POSTER PO06: Poster Session VI

Saturday, May 7, 2016
9:00 AM - 12:00 PM

PO06-01

THE USE OF SMARTPHONE BASED ECG IN THE SCREENING OF QT INTERVALS IN CHILDREN

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Introduction: A 12-lead ECG is a critical component for the screening of long QT syndrome, however besides an electrocardiography machine, trained personnel are also necessary which limits the screening capability of conventional ECGs. The development of smartphone ECG technologies provides a potential alternative platform for ECG screening for selective purposes such as arrhythmias and QT interval abnormalities. The aim of this pilot study was to assess the reliability of a smartphone based ECG device in the measurement of QT intervals in children.
Methods: In all participants, a 10-second smartphone lead I ECG tracing from AliveCor ECG device (AliveCor, Inc, San Francisco, CA) and a standard 12-lead ECG were obtained simultaneously. Two pediatric electrophysiologists performed the measurements of QT intervals in a blinded manner. The results were compared statistically.
Results: A total of 196 healthy children (mean age 9.2±4.9 months) who presented to our clinic between September 2015 and November 2015 were included in the study. The mean QT interval obtained from AliveCor device was 337±47 msec. The mean QT interval obtained from 12-lead ECGs was 343±42 msec. There was significant correlation between the QT intervals of AliveCor and 12-lead ECGs (Pearson's correlation coefficient: 0.77 ($p<0.001$). There was also significant correlation between the heart rate obtained from AliveCor device and 12-lead ECGs (Pearson's correlation coefficient:0.90 ($p<0.001$).
Conclusions: AliveCor ECG can accurately detect QT intervals and can potentially be used for the screening of congenital long QT syndrome in children. Further studies are needed to assess the potential role of smartphone based ECG systems in the screening of QT interval abnormalities and selective arrhythmia substrates.

PO06-02

HOW MANY PATIENTS UNDERGO AN MRI FOLLOWING IMPLANTATION OF A PERMANENT PACEMAKER

Jerome Goldstein, MBBS, Daniel Wright, BSc, Adam Lee, MBBS, FRACP, John Betts, BSc, Oscar Davison, BSc, Simon Townsend, BSc, Haris M. Haqqani, MBBS, PhD and Russell Denman, MBBS, FRACP. The Prince Charles Hospital, Chermside, Australia, The University of Queensland - The Prince Charles Hospital, Brisbane, Queensland, Australia

Introduction: Magnetic Resonance imaging (MRI) is considered an essential imaging modality in the diagnosis and management of many medical conditions. Until recently MRI was considered a contra indication in patients (pts) with a Permanent Pacemaker(PPM). Recently manufacturers have developed MR conditional devices estimating many patients will require an MRI during follow up.
Methods: A retrospective review of all pts from a single institution implanted with an MR conditional device to determine the number of pts who underwent MRI during a 5 yr follow up period.
Results: Between 7/2010 and 12/2015, 292 MRI conditional PPM where implanted, for class I/II indications . The median age was 63yrs (16-92). During a median follow up of 23.7 mths, 27(9.2%) required a clinically indicated MRI. The region imaged was Brain:6 ,Spine:3, Heart:18. The median time to MRI following implant of a PPM was 3.3 mths (0-37). All imaging was performed on a 1.5T magnet with appropriate device reprogramming prior. No device related adverse events occurred during or within 3mths of the MRI. All images obtained were of a reportable standard.
Conclusions: In pts undergoing PPM implantation, nearly 10% will require a clinically indicated MRI within 2 years of follow up. This suggests MR conditional devices should now be considered the standard of care in all pts requiring a PPM.

PO06-03

EXTERNALLY RECORDED CARDIAC ACOUSTIC SIGNALS TO ASSESS RESPONSE TO CARDIAC RESYNCHRONISATION DEVICES

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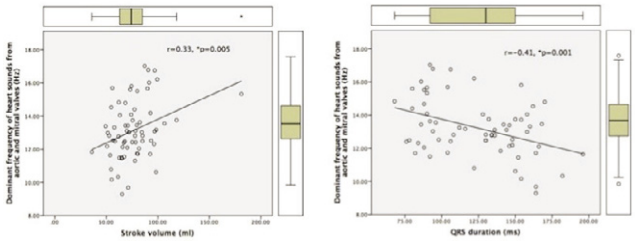
Introduction: Cardiac resynchronization therapy (CRT) improves clinical outcome and reverse remodeling of the left ventricle (LV) in patients with LV failure (LVF). We hypothesize that externally recorded cardiac acoustic signals correspond to mechanical parameters which are altered with CRT in responders.
Methods: 31 subjects with normal LV (group 1) and 50 patients with LVF (group 2) were studied. Patients in group 2 listed for de novo or upgrade to CRT-P/D were assessed at 4 months for response to CRT, defined as improvement in NYHA class, global assessment, 6 minute walk distance (6MWD), Minnesota Living with Heart Failure (MLWHF) score and brain natriuretic peptide (BNP). Heart sounds (HS) recorded externally with an electronic stethoscope, 12-lead ECG, and non-invasive haemodynamics were obtained from the participants. 15 s recording segments of HS were subjected to FFT analysis. The dominant frequencies (DF, the highest peak of the frequency spectrum) of HS from the aortic and mitral valves were compared between groups 1 and 2, and between responders and non-responders to CRT.
Results: Subjects in group 1 had higher DF than in group 2 (13.9±1.7 vs 12.6±1.4 Hz, $p=0.001$). DF correlated positively with stroke volume (SV) ($r=0.33$, $p=0.005$) and cardiac index (CI) ($r=0.37$, $p=0.002$), and inversely with QRS duration (QRSd) (-0.41, $p=0.001$). At 4 months, 17 of 21 patients (81%) responded to CRT. Significant increase in DF compared to baseline was seen in responders to CRT (2.2±2.4 Hz, $p=0.001$) but not in the non-responders (3.0±3.5 Hz, $p=0.276$).
Conclusions: Externally recorded acoustic signals obtained by e-stethoscope offer a novel way to assess response to CRT.

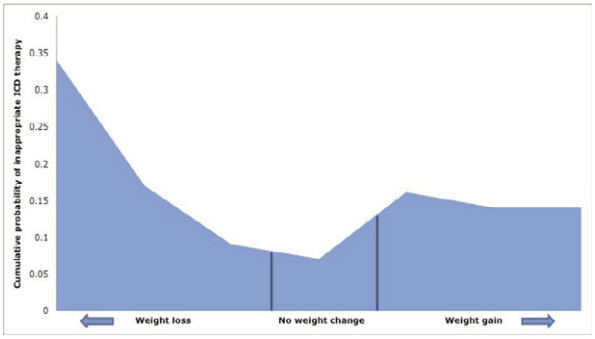


PO06-04

THE EFFECT OF WEIGHT CHANGE ON INAPPROPRIATE IMPLANTABLE CARDIOVERTER DEFIBRILLATOR THERAPY: A MADIT-CRT SUBSTUDY

Usama Daimee, MD, Yitschak Biton, MD, Mehmet K. Aktas, MD, Faiez Zannad, MD, PhD, Barbara Szepietowska, MD, Scott McNitt, MS, Bronislava Polonsky, MS, Paul J. Wang, MD, Wojciech Zareba, MD, PhD, Arthur J. Moss, MD and Valentina Kutyifa, MD, PHD, FHRS. University of Rochester, Rochester, NY, Université de Lorraine, Nancy, France, Stanford University, Stanford, CA

Introduction: The effect of weight change on inappropriate implantable cardioverter defibrillator (ICD) therapy in mild heart failure (HF) patients is not well understood.
Methods: We evaluated the impact of weight change at 1 year on inappropriate ICD therapy among 993 patients receiving cardiac resynchronization therapy with defibrillator (CRT-D) enrolled in MADIT-CRT. Based on quartiles of weight change values, patients were divided into 3 subgroups: weight loss (first quartile, change ≤ -1 kg), no weight change (second quartile, 0 or 1 kg change), and weight gain (third and fourth quartiles with similar risk profile, change ≥ 2 kg). The primary end point was subsequent inappropriate ICD therapy.
Results: Patients with weight loss experienced greater risk of inappropriate ICD therapy when compared to patients with no weight change [hazard ratio (HR)=2.87, 95% confidence interval (CI): 1.48-5.56, p=0.002]. Similarly, weight gain was associated with higher risk of inappropriate ICD therapy (HR=2.33, 95% CI: 1.21-4.51, p=0.012) relative to no weight change. Results were similar for atrial fibrillation/flutter and supraventricular tachycardia. Each kilogram of weight loss was related to increasing risk of inappropriate ICD therapy (HR=1.12, 95% CI: 1.01-1.13, p=0.016), suggesting a linear association. However, any amount of weight gain yielded similar risk of inappropriate ICD therapy (p=0.200) [Figure].
Conclusions: In mild HF patients receiving CRT-D, weight loss and weight gain are both associated with greater risk of inappropriate ICD therapy. Further, increasing weight loss is related to increasing risk of inappropriate ICD therapy, identifying a high-risk cohort.



PO06-05

SAFETY AND EFFICACY OF SUBCUTANEOUS IMPLANTABLE-CARDIOVERTER DEFIBRILLATOR: A REVIEW OF 100 SINGLE CENTER IMPLANTATIONS

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Introduction: Subcutaneous implantable cardioverter defibrillator (S-ICD) is the latest advancement in defibrillation therapy. It is currently approved for patients with indications for ICD implantation, without any pacing indications. Despite initial studies showing safety and efficacy, there are limited data available. We report our single, high-volume academic center experience with S-ICD implantation.
Methods: We retrospectively analyzed inpatient and outpatient records of patients implanted with S-ICD at our center between October 2012 and November 2015.
Results: S-ICD was implanted in 100 patients, with a mean age of 53±14 years (range 18-86). There were 63% males, 56% African-American and 40% Caucasian. 55% were implanted for primary prevention, 40% had ischemic cardiomyopathy, 39% non-ischemic cardiomyopathy, 19% were on dialysis and 17% had prior transvenous device extraction. The mean ejection fraction was 30 ± 17%. Mean procedure time was 59±14 minutes. The mean procedure time per year decreased from 73.66 minutes in 2012 to 44.89 minutes in 2015. Defibrillation threshold testing (DFT) was performed in 87% of patients. Two patients had unsuccessful DFTs. Repeat testing was successful with reversed polarity in one patient and repositioning of the can in the other patient. Median follow-up was 154 days (1-306 days). A three incision approach was used 60% of the time. There was no procedural mortality. Two patients died prior to discharge- 1 from intractable VT due to non-revascularizable triple vessel CAD and 1 from mesenteric ischemia. Four patients died during follow-up (1 from asystolic arrest and 3 from unknown causes). Four patients had pocket infections, 2 required SICD removal. Nineteen patients received shocks- 11 had an appropriate successful shock and 8 had inappropriate shocks (4 from SVT, 2 from noise sensing due to air in the pocket and 2 from T wave oversensing).
Conclusions: Our data show that S-ICD implantation can be performed safely and efficiently to treat life threatening ventricular arrhythmias in a large volume single center.

PO06-06

INDICATIONS AND UTILITY OF TRADITIONAL, INSERTABLE, AND SMARTPHONE-BASED AMBULATORY ECG MONITORING SYSTEMS

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Introduction: Numerous options exist for ambulatory ECG monitoring, including external event recorders (ER) as well as newer insertable loop recorders (ILR) and smartphone-based (SB) ECG monitors. Little is formalized about the indications for and comparative utility of these devices in clinical practice.

Methods: We analyzed the demographics, indications, and diagnostic utility of traditional event recorders, ILRs, and SB ECG monitors among 415 patients (pts) monitored with one of these devices in an outpatient academic electrophysiology practice.
Results: Of the 415 pts monitored, 274 received an ER, 82 received an ILR and 59 received a SB monitor. Patients who received an ER were monitored for 1 month, whereas the ILR patients were monitored for an average of 10.0 months and patients used the SB monitors for an average of 18.2 months. Monitoring for a-fib in cryptogenic stroke was performed by ILR and post-a-fib ablation mostly by SB monitor (Table 1). Changes in management (medication, ablation, or device therapy) resulting from information obtained during monitoring were more commonly achieved by the ILR (18/64, 22%) and the smartphone-based monitors (18/59, 31%) compared to the traditional event recorder (26/274, 9.5%; $p < 0.005$ for both ILR and smartphone-based monitor vs traditional event recorder, $p = 0.34$ for ILR vs smartphone-based monitor).
Conclusions: Newly available devices provide alternative strategies for outpatient ECG monitoring, with potentially enhanced diagnostic yield. Further study is warranted to more fully define the clinical utility of these novel heart rhythm monitoring options.

Table 1 –Indications for and Recorded Arrhythmias during Ambulatory ECG Monitoring by Device

	Traditional Event Recorder	Insertable Loop Recorder	Smartphone-Based Monitor
Indication	N = 274	N = 82	N = 59
Atrial Fibrillation/Flutter	106 (39%)	27 (33%)	40 (68%)
Previous Ablation	1 (0.4%)	12 (15%)	20 (34%)
Cryptogenic Stroke	0	16 (20%)	0
Syncope	38 (14%)	31 (38%)	0
Palpitations	78 (28%)	2 (2%)	8 (14%)
SVT	21 (7%)	4 (5%)	11 (19%)
Other	31 (11%)	2 (2%)	0
Recorded Arrhythmias	N = 26	N = 18	N = 18
Atrial Fibrillation/Flutter	19 (73%)	10 (56%)	13 (72%)
SVT	3 (12%)	3 (16%)	5 (28%)
Bradycardia/Pauses	1 (4%)	6 (33%)	0
Other	3 (12%)	0	0

PO06-07

CIED SAFETY REGARDING MRI IMAGING

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Introduction: Although magnetic resonance imaging (MRI) conditional cardiovascular implantable electronic device (CIED) are available, non- MRI conditional older devices, epicardial and abandoned lead remain a contraindication to MRI studies.
Methods: This is a single tertiary center retrospective study, evaluating the clinical outcomes and device parameter changes in patients with CIED who underwent MRI imaging from June, 1992 to August of 2015. Clinical and device related information was attained by thorough chart review. Device related data included types, modes of the device, manufacturer, generator model, lead model, and lead parameters before and after MRI. MRI related data included anatomical region of MRI, device indwelling time until MRI, and the Tesla of the examined MRI. Patient related data included underlying disease, pacemaker dependency, and any adverse clinical event related to device malfunction after MRI.
Results: Total of 41 patients were ranged in age from 17 to 83 at the time of MRI. Median device indwelling time was 1076 days Elevem devices (including generator and both atrial and ventricular leads)were MRI conditional, while the remaining were non-MRI conditional devices. Among non-MRI conditional cases, 9 were epicardial device and one case of remnant ventricular lead. Brain MRI was the most frequently done (21 cases). 35 patients underwent 1.5 T MRI, and remaining patients underwent 3.0T MRI. 18 patients were implanted CIED due to sick sinus syndrome, 15 patients complete AV block, 2 patients ventricular arrhythmia, and 15 patients were pacemaker dependent after CIED implantation. There was no adverse event during and post MRI in 41 patients. There was no parameter change, nor malfunction of the implanted devices. Even in patients with epicardial leads and remnant lead, there was no clinical event, nor device parameter fluctuation.
Conclusions: The use of MRI in patients with non-MRI conditional CIED, or remnant lead, epicardial leads appears feasible when performed under careful monitoring, with no adverse clinical events. Although the experience is small, MRI did not affect the function of devices and no lead related injury took place.

PO06-08

DO ALL PATIENTS WITH HEART BLOCK POST AORTIC VALVE REPLACEMENT REQUIRE A PERMANENT PACEMAKER?

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Introduction: Heart block (HB) after surgical (SAVR) and trans-catheter aortic valve replacement (TAVR) frequently results in permanent pacemaker (PPM) implantation. However, evidence suggests that some HB may be transient. We sought to investigate whether the timing of HB development predicts conduction recovery in a retrospective analysis.
Methods: Consecutive patients who underwent SAVR or TAVR between January 2010 and December 2014 at our institution were reviewed. All patients who developed high-grade HB post-procedure were included. Patients with pre-existing HB and intra-cardiac devices were excluded. Early HB was defined as that which occurred ≤24 hours post-procedure and late HB as developing >24 hours post-procedure. HB recovery was determined by reviewing pre-discharge ECGs or at PPM interrogation during follow-up.
Results: Records of 543 patients were reviewed. HB developed in 21/143 patients in the TAVR group (early 8 [38%], late 13 [62%]) and in 28/400 patients in the SAVR group (early 17[61%], late 11[39%]). PPMs were implanted in all of the TAVR patients (exclusively with the Medtronic CoreValve®) who developed HB while only 20/28 of SAVR patients required a PPM due to resolution of conduction abnormalities prior to discharge. In the SAVR patients, slightly more patients with early HB recovered (64.7% vs. 72.7%), but this was not statistically significant. In the TAVR patients, those who developed late heart block were more likely to recover (28.5% vs. 75%, p=0.067).
Conclusions: In this study, we saw a trend towards statistical significance for conduction recovery when HB presented late in the TAVR population. This may be due to the later development of tissue edema from continuous radial expansive force of the CoreValve's® self-expanding nitinol frame. In the SAVR population, early HB may be due to tissue edema related to surgery, explaining the transient nature in some patients. A larger study is need to confirm these results.

PO06-09

PREDICTORS OF APPROPRIATE IMPLANTABLE CARDIOVERTER-DEFIBRILLATOR THERAPY IN AN ENTIRE METROPOLITAN AREA: THE SAN FRANCISCO SHOCK STUDY

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Introduction: Implantable cardioverter-defibrillators (ICDs) are the single most effective therapy for prevention of sudden cardiac death (SCD) in high-risk patients in clinical trials, but the benefits of ICDs have not been well studied at the population level. The aim of this study was to determine the real-world rate and predictors of appropriate shocks in an entire metropolitan area.
Methods: We ascertained every San Francisco resident with an active ICD followed in the 5 electrophysiology practices in the city since January 1, 2006 to determine the rate and predictors of appropriate shocks for VF or fast VT. The cumulative incidence estimator of appropriate ICD shocks was determined using survival analysis treating death as a competing event. The significance of predictors of ICD shocks (LVEF, primary or secondary prevention indication, age, coronary artery disease, Brugada syndrome, hypertrophic cardiomyopathy, long QT syndrome, or arrhythmogenic right ventricular cardiomyopathy) were tested using both univariate and multivariate competing-risks regression models with robust standard errors.
Results: 799 San Francisco residents were identified with an active ICD during the study period representing 2532 person-years of follow-up. Mean age was 67.2 ± 14.6 years and median left ventricular ejection fraction was 32.5%. 241 patients received an appropriate shock during the study period. Multivariate predictors of any appropriate therapy included male gender (subhazard ratio 1.54, 95% CI 1.06-2.22, p=0.02), atrial fibrillation or flutter (AF/AFL, subhazard ratio 1.42, 95% CI 1.07-1.88, p=0.02), secondary prevention indication with LVEF >35% (subhazard ratio 1.87, 95% CI 1.37-2.56, p<0.0005) and secondary prevention indication with LVEF ≤ 35% (subhazard ratio 1.65, 95% CI 1.32-2.92, p=0.01). Coronary artery disease was not a significant predictor of shocks (subhazard ratio 1.02, 95% CI 0.75-1.40, p=0.88).
Conclusions: In this real-world study of all ICD recipients in an entire metropolitan area, a secondary prevention indication, AF/AFL, and male gender were independently associated with higher risk of appropriate shocks.

PO06-10

ZERO INFECTION RATE FOR CARDIAC DEVICE IMPLANTATION: NO DIFFERENCE BETWEEN TOPICAL IODINE AND CHLORHEXIDINE

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Introduction: Cardiac implantable device (CID) infections result in high morbidity, mortality and healthcare costs. Device infection rates range between 1.5-20%, stressing the importance of antiseptic technique. Limited data exists comparing chlorhexidine-based preparations to iodine, with potential complications of chlorhexidine including skin hypersensitivity, chemical burns and flammability. This study aimed to compare the efficacy of chlorhexidine over iodine skin antiseptic preparation in the prevention of CID infections.
Methods: This was a three year prospective and retrospective dual centre study. Procedures were performed by an experienced single operator (P.B.S) with patients receiving either skin preparation based on the hospital of implantation. Patients received meticulous surgical site preparation including hair removal and acetone application for removal of superficial adhesives. All patients received intravenous antibiotics (ceftriaxone and vancomycin) pre and post procedure. Follow-up post procedure was at day 1 and 2, at 3 months and at 12-36 months.
Results: CIDs were implanted or replaced in 716 patients across two hospitals. 173 patients received chlorhexidine skin preparation (Group I) and 543 patients received iodine (Group II). Both preparations were left to dry for a minimum of 5 minutes. Across the two groups, 487 (67%) patients had permanent pacemaker procedures (21% replacements), 116 (16%) had implantable cardioverter defibrillators (46% replacements), 102 (14%) had cardiac resynchronisation therapy devices (34% replacements) and 11(2%) had internal loop recorders inserted. All patients completed follow-up. Zero patients developed a device infection, needed device extraction or suffered a Clostridium difficile infection during follow-up.
Conclusions: There were no infections in the chlorhexidine or iodine skin preparation groups, suggesting that iodine is non-inferior. Given the possible complications of chlorhexidine use, iodine is a reasonable alternative in CID implantation.

PO06-11

THE RISK OF STROKE AND ATRIAL FIBRILLATION AFTER BARIATRIC SURGERY IN PATIENTS WITH MORBID OBESITY

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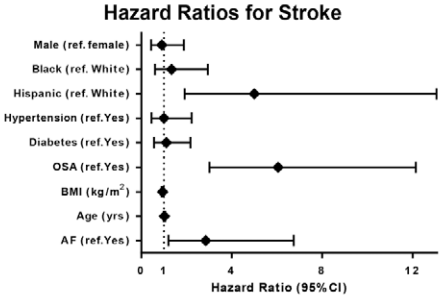
Introduction: Weight loss after bariatric surgery in obese patients reduces stroke risk; however, it is not known if similar benefits are maintained for all patients and whether atrial fibrillation (AF) plays a major role in stroke after weight loss.
Methods: Descriptive statistics were used for category and continuous variables and Cox regression analysis and predictors of stroke events were identified.
Results: Out of 847 morbidly obese patients [body mass index (BMI) ≥35 kg/m2] who underwent laparoscopic adjustable gastric banding (LAGB) and were followed for 11 years (mean age 44±11 years, mean BMI 49±8 kg/m2), incident stroke occurred in

44 (5.2%) patients. AF was present in eight patients (18%) at the time of LAGB who later developed stroke. New onset AF after LAGB developed in 38 (4.5%) patients over a median follow-up of 63.6 months, which was complicated by stroke in 5 patients. Of all patients who developed stroke, AF was documented in 13 patients (30%), while majority had no documented AF (n=31; 70%). On multivariate analysis, obstructive sleep apnea (HR=6.0; 95% CI 3.0- 12.1, p<0.0001), Hispanic (HR=4.9; 95% CI 1.9- 13.0, p<0.001) compared to white and blacks, AF (HR 2.8; CI 1.2-6.7, p<0.01) and baseline BMI (HR 0.94, CI 0.8-0.9, p<0.007) were independent predictors of stroke events, while gender, age, hypertension and diabetes were not.
Conclusions: In patients with morbid obesity who have undergone LAGB both non-AF and AF-related factors were involved in increasing the risk of stroke. Further investigation is warranted to define the relation between stroke with obstructive sleep apnea and Hispanic ethnicity.



PO06-12

RIGHT VENTRICULAR HIGH-SEPTAL PACING VS. RIGHT VENTRICULAR APICAL PACING FOLLOWING ATRIOVENTRICULAR NODE ABLATION: 10 YEARS FOLLOW UP

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Introduction: Right ventricular septal (RVS) pacing is often recommended as a more physiological alternative to right ventricular apical (RVA) pacing. Most comparisons between the two sites have had short follow-up and few trials have assessed different pacing sites following atrioventricular node (AVN) ablation. We analysed the 10 year outcome data for the two pacing sites in patients (pts) 100% V paced following AVN ablation. 22 pts were included mean age 79 (± 21) and 64% were male. The pts had previously been randomised in the Decipher Study (Silberbauer et al. 2012), which showed no significant benefit from septal over apical pacing at 6 month follow-up.
Methods: All hospital notes were retrieved and reviewed. All pacemakers were Biotronic VVIR with active fixation electrodes. All septal leads were placed using the Mond technique. Data for site of the V lead, all hospitalisations and length of each admission, heart failure hospitalisations, change in EF trend over time, QRS width trend over time and all-cause mortality were analysed. Of 22 pts 12 had RVA and 10 had RVS pacing. 10 pts died during long-term follow-up. 60% died from non cardiac causes (spontaneous intracerebral haemorrhage, renal failure, pneumonia, renal carcinoma, alcoholic liver disease) and 40% died of LV failure (75% RVS paced).

Results:

Right Ventricular High-Septal Pacing vs. Right Ventricular Apical Pacing: Results at 10 years		
Endpoint	Mean (95% CI)	P Value
Mortality: Apical; Septal	0.33 (0.0205 to 0.645); 0.6 (0.23 to 0.969)	0.314
HF Admissions: Apical; Septal	1.500 (0.537 to 2.95); 0.300 (-1.83 to 0.78)	0.20
HF Bed Days: Apical; Septal	12.92 (-3.15 to 29.0); 1.300 (-0.67 to 3.27)	0.20
Total Admissions: Apical; Septal	9.833 (5.17 to 14.5); 4.200 (0.388 to 8.01)	0.059
Total Bed Days: Apical; Septal	56.58 (17.432 to 95.73); 16.30 (-0.625 to 33.22)	0.050
Change in EF: Apical; Septal	-2.00 (-18.72 to 14.72); -4.583 (-13.11 to 3.945)	0.731
Change in QRS: Apical; Septal	76.57 (56.76 to 96.38); 38.00 (-46.89 to 122.90)	0.117

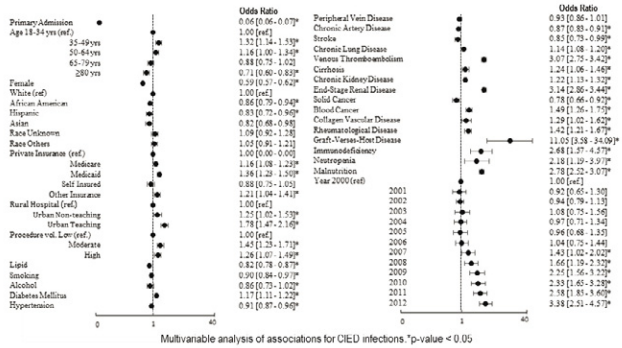
Conclusions: There was no difference in mortality, incidence of heart failure, change in LV function or QRS duration in patients randomised to septal or apical V pacing after 10 year follow-up. This study suggests there is no benefit from RVS pacing with the added complications of displacement risk and increased procedure time.

PO06-13

THE RISK OF CARDIAC IMPLANTABLE ELECTRICAL DEVICE INFECTIONS IS INCREASING

Parijat S. Joy, MD, MPH, Gagan Kumar, MD, Jeanne Poole, MD and Brian Olshansky, MD. University of Iowa, Iowa City, IA, Phoebe Putney Memorial Hospital, Albany, GA, University of Washington, Seattle, WA

Introduction: Infections are a known concern regarding Cardiac Implantable Electrical Devices (CIEDs) but what remains uncertain is whether the incidence has changed with increasing use of these devices. Our purpose was to determine the incidence trend, associated risk factors and outcomes of CIED infections in a large population.
Methods: From the 2000 to 2012 Nationwide Inpatient Sample (NIS) database, we identified ICD-9-CM procedure codes for CIED-related procedures combined with concurrent device-related infections (996.61) or systemic infections or sepsis to estimate the CIED-related infection burden.
Results: Over 12 years, among 3,620,583 initial and 461,157 subsequent hospital admissions for CIED-related procedures, admissions associated with CIED infections were 42,805 and 20,137 respectively. From 2000 to 2012, adjusted odds ratio for CIED infections increased from 0.92 to 3.38. Top 3 independent associations for CIED infections are graft versus host disease (OR: 11.05), end-stage renal disease (OR: 3.14) and venous thromboembolism (OR: 3.07). Admissions for CIED procedures related to infections compared to no infectious complications carry a higher in-hospital mortality of 4.86%, longer median length of stay (9 days {IQR: 5 - 16} vs 4 days {IQR: 2 - 7} P=0.00) and greater median charges ($75360 {IQR: 338161 - 153597} vs $56044 {IQR: 32175 - 99902} P=0.00).
Conclusions: CIED infections have been increasing steadily since 2006. While the cause for this is uncertain and possibly multifactorial, this may be due to a higher comorbidity burden among recipients.



PO06-14

CARDIAC IMPLANTABLE ELECTRONIC DEVICE INFECTION: VARIABILITY IN CLINICAL PRESENTATION AND OUTCOMES IN PATIENTS WITH OR WITHOUT PREVIOUSLY ABANDONED LEADS

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Introduction: Lead abandonment at the time of cardiac implantable electronic device (CIED) system revision or upgrade is widely practiced but remains controversial. We have previously reported on the complexity of extractions in patients with abandoned leads. We sought to assess the clinical profiles and outcomes of CIED infections in patients with or without abandoned leads.
Methods: All consecutive patients undergoing percutaneous extraction of infected CIEDs at our institution (August 1996-September 2012) were enrolled in a prospectively maintained data registry. The clinical profiles and outcomes were compared between patients with (Group 1, n=323) and without (Group 2, n=1063) abandoned leads.
Results: Group 1 patients were older (p=0.04) and more likely to have indications for pacing (p<0.0001). There were otherwise no other significant differences in baseline clinical characteristics between the Groups. Pocket infection was more likely in Group 1 (67.8 vs. 58.0%, p=0.02, endovascular infection 32.2 vs. 42.0%). Nonetheless, Group 1 patients were more likely to have vegetations on trans-esophageal echocardiograms (30.8 vs. 22.3%, p=0.02, vegetations on lead 27.0 vs. 16.9% in Group 2, p=0.002). When present, vegetations were larger in Group 1 (p=0.0003). All leads were targeted with extraction in all patients. The extraction procedures were more complex in Group 1 with longer procedural and fluoroscopy times, higher likelihood of needing rescue femoral workstations (14.9 vs. 2.9%, p<0.0001) and more procedural complications (11.5 vs. 5.6%, p=0.0007). Extracted lead tips grew positive cultures in 73.7% in Group 1 patients (vs. 61.2%, p=0.003). Lead material retention occurred more commonly in Group 1 (11.5 vs. 2.9%, p<0.0001). Retention of lead material was associated with poor clinical outcomes including higher 1-month mortality (7.4 vs. 3.5%), need for open heart surgery to remove lead remnants (16.2%) and long term suppressive antibiotics (41.2%).
Conclusions: Previously abandoned leads complicate the clinical management of CIED infections.

PO06-15

TREATMENT PATTERNS AND RESOURCE UTILIZATION AMONG MEDICARE BENEFICIARIES WITH CARDIAC IMPLANTABLE ELECTRONIC DEVICE INFECTION

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Introduction: Published data regarding healthcare resource utilization (RU) in patients with cardiac implantable electronic device infection (CIED) infection is limited to index hospitalization. In this investigation, we analyzed RU in these patients for 12 months following infection.
Methods: We identified 615,203 Medicare fee-for-service beneficiaries ages 65+ years in the Medicare 100% standard analytic files who underwent implantation or replacement of a CIED (pacemaker, CRT-D, CRT-P, ICD) in the hospital setting between 2010-2012 (first observed CIED procedure defined the index event). Patients were continuously enrolled in Medicare Parts A/B 6 months before index procedure and 12+ months post implantation follow-up (or died). Major device-related infection defined as 1+ hospital stay with ICD-9-CM 996.61 (Infection and inflammatory reaction due to cardiac device, implant, and graft) and/or any subsequent CIED revision, extraction, or replacement.
Results: A total of 5,401 (0.88%) patients experienced an infection within 12 months of index procedure, and 3,800 (0.62%) had a major CIED infection. Patients were classified in 4 groups: [A] 2,109 (55.5%) had their device extracted and replaced; [B] 1,355 (35.7%) had their device extracted without replacement; [C] 173 (4.6%) received lead revisions only; and [D] 163 (4.3%) did not undergo any CIED procedure. Patients with major infection experienced, on average, 0.8 (SD: 1.4) ER visits, 1.7 (SD: 1.9) hospitalizations with 12.9 (SD: 18.9) total hospital days in the year following infection. Overall, 24.6% of patients died. Mean total Medicare payments for facility-based services by Group were: A=$62,638 (SD: $46,830), B=$50,079 (SD: $45,006), C=$27,922 (SD: $33,283), D=$77,397 (SD: $79,130). Group D (no intervention) had the highest rate of comorbidities and mortality. Limitations of analysis included absence of lab, antibiotic utilization and physician office follow-up data.
Conclusions: Management of CIED infection in Medicare beneficiaries is associated with high RU and healthcare expenditures. Additional measures to prevent device infection are needed to reduce high RU in these patients.

PO06-16

PATTERNS OF PHYSICAL ACTIVITY AND SURVIVAL FOLLOWING UPGRADE TO CARDIAC RESYNCHRONIZATION THERAPY: THE ALTITUDE ACTIVITY STUDY

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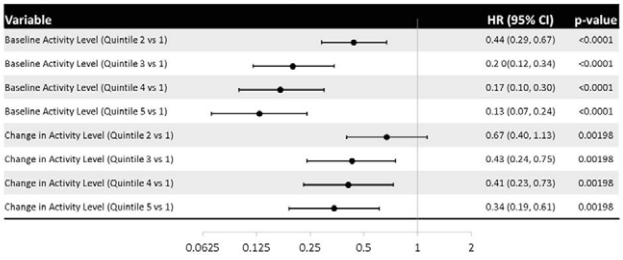
Introduction: CRT is intended to improve the functional status of CHF patients. Patterns of activity changes following upgrades to CRT systems in prior recipients of ICDs, and their relationship to survival, have not been described.
Methods: Patients with single- or dual-chamber ICDs in the Boston Scientific ALTITUDE registry (2008-2012) who received upgrades to CRT-D, and had activity measurements through 6 months, were eligible. Remote monitoring data were used to calculate physical activity differences (mean minutes/day) between pre-upgrade (¬¬30-60d prior to upgrade) and 6 months (180-210 days post upgrade). Factors associated with activity changes were evaluated with linear regression, and the relationship between 0-6 month activity change and survival was modeled using multivariable Cox regression.
Results: Among 932 patients (mean age 70 ± 10, 20% women), mean activity was 100.0 + 60.1 min/day pre-upgrade and 91.9 + 55.1 min/day at 6 months. Mean paired differences between pre-upgrade and 6 month activity was -8.1 min/day and ranged from -67.6 + 49.7 in the lowest quintile to + 42.7 + 29.5 in the highest quintile. In adjusted analyses, mortality was lower for every 30

minute increase in both pre-upgrade activity (HR 0.68, 95% CI 0.6 - 0.77, P <0.0001) and changes in activity at 6 months (HR 0.73, 95% CI 0.62 - 0.86, P=0.0001.) Analyses according to quintile of pre-upgrade and change in activity showed a similar dose-response relationship (Figure).
Conclusions: In patients receiving upgrades to CRT-D systems, overall activity declined slightly at 6 months but ranged widely. Higher pre-upgrade activity and greater improvement in activity at 6 months were associated with improved survival.

Figure: Multivariate analysis of patient characteristics, activity, and mortality. The forest plot demonstrates results of a model adjusted for age and gender evaluating the association with survival of both pre-upgrade and changes in activity according to quintile, using the least active and smallest change quintiles as reference.



PO06-17

CLINICAL USE OF 18-FLUORDEOXYGLUCOSE (FDG) PET FOR THE DIAGNOSIS OF CARDIAC IMPLANTABLE ELECTRONIC DEVICES (CIED): DECREASED FDG UPTAKE ASSOCIATED WITH PUS DRAINAGE

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Introduction: The ability of FDG PET to image the increased glucose metabolism of macrophages/polynuclear cells has made it a helpful diagnostic tool for possible CIED infections, which continues to frequently pose a significant clinical challenge. We hypothesized that spontaneous pus drainage may results in decreased FDG uptake due to decreased presence of inflammatory cells.
Methods: Patients with definite CIED infection referred to a tertiary university hospital for further management were prospectively imaged using a dedicated FDG PET protocol, before device extraction. Blinded nuclear medicine reading, SUVmax (Maximum Standard Uptake Value) and individual enhancement pattern were analyzed.
Results: Out of a total of 38 patients with clinically and/or microbiologically proven CIED infection and FDG PET scans before extraction, 10 (26.3%) had documented pus drainage/ erosion (0.9±0.8 years post device implantation).
Blinded nuclear medicine reading identified increased FDG tracer uptake consistent with infection in 5 of the 10 patients (50%). The distribution of infection was: device pocket (n=3), lead infection (n=1), both pocket and lead (n=1). The remaining 5 patients demonstrated no increased tracer uptake (n=2) or only slightly increased tracer uptake located in the device pocket alone (n=3). SUVmax was 7.1±1.8 vs. 3±1.6 (P=.005) in patients with PET-diagnosed infection vs. non-infection.
Conclusions: Half of the patients with spontaneous pus drainage/erosion demonstrated normal or only slightly increased FDG tracer likely due to decrease inflammatory cells post drainage. This finding will help define the best clinical use of FDG-PET imaging to guide decision making in the difficult entity of CIED infection patients.

PO06-18

PERMANENT HIS BUNDLE PACING IN PATIENTS WITH PROSTHETIC CARDIAC VALVES

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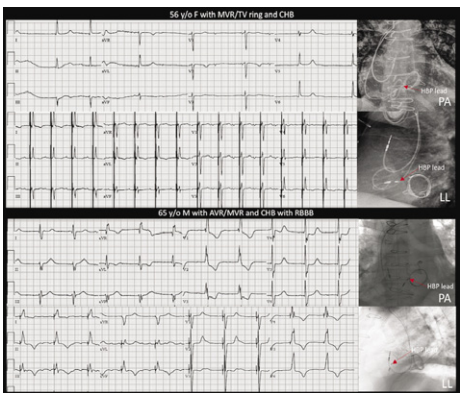
Introduction: Conduction disease is not uncommon after prosthetic valve (PV) surgery. The feasibility of His bundle pacing (HBP) in this patient (pt) population is not well studied. We report our experience with permanent HBP in pts undergoing pacemaker (PM) implantation following PV surgery.
Methods: Permanent HBP was attempted (Medtronic SelectSecure 3830 lead) in pts with significant AV conduction disease post PV surgery referred for PM implantation. Conduction disease was characterized as nodal vs infra-nodal (IN). Feasibility, relationship of HB lead to PVs and HBP characteristics were recorded.
Results: Twenty pts with a mean age 71±14 yrs, men 45%, HTN 100%, CAD 35%, AF 45%, LVEF 52±8%, sinus node dysfunction (SND) 30%, AV disease 100% (IN block 10; RBBB 8, LBBB 3, IVCD 1) underwent attempt at permanent HBP. PVs included AVR in 7 pts (IN block 5 pts); TV ring with MVR in 6 pts (all AVN block), TAVR in 4 pts (IN block 4 pts) and MVR alone in 3 pts. Permanent HBP was successful in 18 (90%) pts (selective HBP 39%). HB recruitment was unsuccessful in 2 pts with TAVR. AVR/TAVR and TV ring served as good anatomic landmarks for localizing the HB (Figure). Successful sites of HBP were posterior and inferior to AVR/TAVR and about 3mm distal to the TV ring. Baseline QRSd improved from 127±35ms to 114±21ms. HBP threshold at implant was 1.5±1.2 V@1ms.
Conclusions: Permanent HBP was feasible in vast majority of pts with PVs. AVR/TAVR pts predominantly developed IN block, compared to AV nodal disease in TVR/MVR pts. Recruitment of the HB may be difficult in TAVR pts due to more extensive and distal conduction disease. Location of PV might serve as a landmark for identifying the site of the HB.



PO06-19

PULMONARY EMBOLISM AND UPPER-EXTREMITY DEEP VENOUS THROMBOSIS IN PATIENTS SUBMITTED TO LEAD EXTRACTION AND UPGRADE PROCEDURES: PROSPECTIVE SINGLE CENTER REGISTRY

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Introduction: Pulmonary embolism (PE) and upper-extremity deep vein thrombosis (UEDVT) are not uncommon after lead replacement or upgrade procedures. Our hypothesis is that the association of these procedures with lead extraction may increase the risk for venous thromboembolism. The purpose of this prospective study was to determine the incidence and possible risk factors of these complications in patients undergoing lead procedures.
Methods: From April/2013 to Nov/2015, we enrolled 80 consecutive patients (51.2% female, 58.7±15.6 years). Patients were submitted to venous ultrasound (VU) examination, computed tomography angiography (CTA) and venography, in the pre and postoperative period. Levels of D-dimer, fibrinogen, factor VIII and antithrombin were determined preoperatively and 10, 30 and 90 days after the procedure. Study outcomes included clinical or radiologic findings of PE and UEDVT. Univariate analysis were used to identify the association between patient-related risk factors for venous thrombosis (obesity, heart failure, atrial fibrillation, number of transvenous leads, presence of ICD leads, surgical technique) and the study endpoints.
Results: Mean time since the initial implantation was 10.8±7.3 years. Of the included patients, 53.7% underwent lead extraction. Venous obstruction was present in 11.7% before the procedure. PE was observed in 9.6% and UEDVT in 33.8%. These endpoints were identified in 59.5% and 24.2% of the patients submitted to lead extraction or not, respectively (P=0.002). There were no significant differences between patients who achieved or not the endpoints regarding the risk factors for venous thrombosis. Lead removal was the only significant predictor of thromboembolic endpoints (P=0.002; OR: 4.6; 95% CI: 1.7- 12.6). Pared-VU and CTA analysis showed significant difference (P=0.002). Mean levels of biomarkers increased significantly postoperatively (P<0.001) and these changes were greater in patients with thromboembolic endpoints (P<0.04).
Conclusions: The incidence of PE and UEDVT after lead replacement and upgrade procedures is high. Lead extraction plays a role in the pathogenesis of these complications by significantly increasing their risk.

PO06-20

OUTCOMES AFTER ASYSTOLE EVENTS DURING WEARABLE CARDIOVERTER DEFIBRILLATOR USE

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Introduction: The wearable cardioverter defibrillator (WCD) records and alarms for both sustained VT/VF and asystole, culminating in a treatment shock for VT/VF while attempting to enlist bystander help for asystole. We hypothesized that WCD alarms for asystole would lead to earlier intervention and better patient (pt) outcomes.
Methods: Asystole events (AE) recorded by the WCD during 2013 were retrospectively analyzed from a database of device and medical records and customer call reports. Events were classified as asystole if the initial presenting arrhythmia was asystole with a ≥ 5 second pause. Survival was defined as arrival to ER alive or not needing to go. Medical care was defined as either in hospital, nursing home, or ambulance. Serious AEs were life-threatening AEs that led to unconsciousness, being taken to the hospital, or death.
Results: Among the 257 pts (74% male, age 68 ± 11), there were 264 AEs. AE survival was 44%. Most AEs were considered "serious" (n=201 events in 201 pts, 76%), with a survival rate of 26%. Location without medical care was associated with better survival of serious AEs. Of pts who survived any AE, 21% later died during WCD use, a median of 4 days post AE. Over half of the 85 pts alive at the end of WCD use received an ICD/ Pacemaker (n=48, 56% of survivors), or improved their condition (n=17, 20% of survivors).
Conclusions: Pts wearing the WCD exhibited 44% overall AE survival, and a 26% survival of serious AEs, significantly better than the 2-5% survival reported in the EMS literature at discharge. Pts under medical care at the time of AE exhibited lower survival, likely due to an already worsened condition prior to the AE.

Table. Univariate logistic regression analysis of potential survival factors associated with serious asystole events

Variables (ALL serious AEs, n=201)	Odds Ratio	95% CI	p-value
Sex, male	0.76	0.38,1.55	0.4572
Age	0.99	0.96,1.02	0.9889
Location, not under medical care	8.53	2.77,24.22	0.0001
Variables (not under medical care, n=112)	**Odds Ratio**	**95% CI**	**p-value**
EMS called	0.91	0.26,3.22	0.8796
Witnessed	1.05	0.26,4.29	0.9467

PO06-21

BENEFIT OF IMPLANTABLE CARDIOVERTER-DEFIBRILLATOR IN PATIENTS WITH IMPROVED LEFT VENTRICULAR SYSTOLIC FUNCTION

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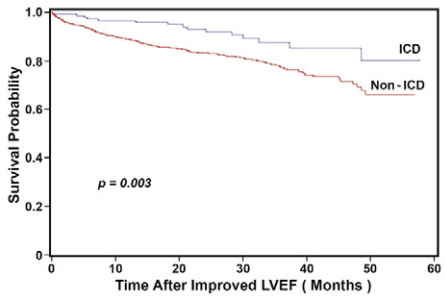
Introduction: About 25% patients with primary prevention implantable cardioverter-defibrillator (ICD) will have improved left ventricular (LV) ejection fraction (EF) on follow-up. Whether ICD benefits this cohort is largely unknown.
Methods: Clinical characteristics and outcomes of patients in the Aurora Health System with transient LV dysfunction (initial LVEF≤35% that improved to ≥40%), during 1/1/2010-12/31/2014, were compared between primary prevention ICD recipients and those without ICD. Patients with cardiac resynchronization therapy, cardiac transplant and LV assist devices were excluded. We used Kaplan-Meier, chi-square and Fisher exact test for analysis.
Results: One thousand three hundred sixty-four patients developed transient LV dysfunction. One hundred forty-eight (10.8%) had ICD implant. ICD recipients (vs. non-ICD patients) were more likely to be male (72% vs. 28.4%, p<0.001), of younger age (62±12 vs. 66±14, p=0.001), with diabetes (49% vs. 39%, p=0.02) and had a prior heart failure admission (95% vs. 82%,p<0.001). History of coronary artery disease, atrial fibrillation, renal insufficiency and myocardial infarction was similar in both groups. All cause mortality was lower in patients with ICD (figure), despite longer EF recovery time (median 325 days (174-640), vs. 131days (73-300), p<0.001) and less improvement in LVEF (46%±7 vs. 49%±8, p<0.001).
Conclusions: ICD is associated with mortality benefit in patients with transient LV dysfunction suggesting continued sudden death protection in patients with LVEF≥40%. This highlights the drawbacks of LVEF as ICD implant criterion.



PO06-22

INCIDENCE AND PREDICTORS OF MRI SCAN UTILIZATION IN PATIENTS RECEIVING MRI-CONDITIONAL PACEMAKERS: A MULTI-CENTER, REAL WORLD EXPERIENCE

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Introduction: Patient and device characteristics, higher device costs, and vendor contracts likely prevent the use of MRI-conditional pacemakers (MPM) in all PM-eligible patients at present. It thus becomes important to identify patient subgroups that benefit the most from MPM. The purpose of this multicenter study was to identify the incidence as well as demographic and clinical predictors of MRI scan utilization in patients with MPM.
Methods: Analysis was performed on 451 patients who received an MRI-conditional dual chamber PM and leads (Medtronic Revo™ or Advisa™) in 4 centers within the Catholic Health Initiatives network. Incidence and details of MRI scans following MPM were collected from hospital records and corroborated with patient phone calls. Multivariate stepwise regression was used to identify predictors of MRI utilization during follow up.
Results: Of 451 patients (Age 71±11 years, 50% male, 88% white), 80% had hypertension, 46% had AF and 17% had atrial tachycardia (AT). MPM was implanted for sick sinus syndrome in 62% and for AV block in 31%. At baseline, 26% had a history of prior MRI and 55% had MRI risk factors (syncope, recurrent falls, neurological disease, severe musculoskeletal/joint disease, malignancy) with 11% having a prior stroke/TIA. During a mean follow up of 18±14 months, 31 patients (7.4%) had an MRI with 84% of these performed for a brain or spine condition. Mean time from implant to MRI was 15±12 months (range 1-41). Multivariate analysis identified baseline MRI risk factor (OR 2.97, 95% CI 1.95-4.53, P<0.0001) and AT (OR 1.83, 95% CI 1.07-3.14, P<0.03) as independent predictors for MRI during follow-up whereas age (OR 0.93 for yearly increment, 95% CI 0.92-0.95, p<0.001) and history of prior MRI (OR 0.62, 95% CI 0.41-0.94, p<0.02) predicted a decreased need.
Conclusions: In this multicenter cohort of MPM, a small proportion of patients required MRI scans during follow-up, mainly for brain and spine conditions. Having an MRI risk factor at baseline strongly predicted the need for MRI scan during follow-up whereas prior MRI did not. These data can help identify patients who can potentially benefit from MRI-conditional pacemakers.

PO06-23

MEDTRONIC CARELINK EXPRESS DEVICE USAGE IN MIDSIZE EMERGENCY DEPARTMENT

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Introduction: Patients with Medtronic devices presenting to emergency department (ED) need interrogation of the device. The manual interrogation via the on-call nurse or the representative may take time. This time will increase the cost per case and the overflow in the ED preventing newcomers to be seen in a timely fashion. CareLink express (CLE) technology allows an automatic interrogation in the ED that will be interpreted instantly electronically. The time and cost using CLE is evaluated in a midsize ED.
Methods: During a 10-month period there were 125 consecutive patients with Medtronic devices (69.5± 20 years old, 61.3% males) who came to ED for interrogation. The cost and length of stay in ED was compared between two groups. The study group includes patients with CLE (46 patients); the control group includes patients without CLE (79 patients). Endpoints measured were length of stay in ED in minutes and estimated cost of stay ($6/min cost factor is used according to National Database of Hospitals 2010).
Results: The demographics of the two groups were similar (67.9±2.48 vs. 70.3±1.83 years old; and 67.4% vs. 57% male). Comorbidities includes coronary artery disease, chronic kidney disease, diabetes, hypertension, dyslipidemia and history of coronary artery bypass grafting were also similar. The primary outcome showed statistically significant shorter length of stay in the CLE group (182.2±9.69 minutes) compared to the control group (229.8±9.19 minutes) (P=0.001). Subsequently, the cost of stay also was less in the CLE group ($1093.4±58.14) vs. the control group ($1378.7±55.16) (P=0.001). There was no difference in the interrogation findings (76.1% vs. 64.6% normal) and defibrillator shocks (10.9% vs. 8.9%). The inpatient admission decision was the same in both groups (43.5% vs. 53.2%). As expected, there was a trend of fewer patients in the CLE group that had reprogramming of the device (2.2% vs. 13.9%) (P = 0.055).
Conclusions: CareLink Express facilitates a shorter length of stay in the ED for patients with Medtronic devices and less cost to the patient without affecting the disposition decision.

PO06-24

GENDER DIFFERENCES IN READMISSION AFTER IMPLANTABLE CARDIOVERTER DEFIBRILLATOR PLACEMENT FOR SECONDARY PREVENTION

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Introduction: Implantable cardioverter defibrillator (ICD) is

the therapy of choice in patients with ventricular tachycardia. Hospital readmission after ICD implantation has a significant impact on patient quality of care and healthcare costs. It is important to understand the rate and reasons of readmission in this patient population to help develop methods of avoiding this costly outcome.
Methods: This was a study of all patients undergoing implantation of ICD for secondary prevention in an integrated healthcare delivery system. Patients who underwent ICD implantation for secondary prevention between 2009 and 2014 were identified and source documents were reviewed to obtain baseline characteristics and readmission data. Readmissions were categorized as device related or cardiac related. Gender differences in readmission were examined.
Results: A total of 1922 subjects underwent ICD placement for secondary prevention during the study period. There were 33 (1.7%) and 48 (2.5%) device related admissions within the first 30 and 90 days after discharge, respectively. There were 527 (27%) and 625 (32.5%) cardiac related admissions within the first 30 and 90 days after discharge, respectively. There was no statistically significant difference in cardiac related admissions between women and men at 30 days (4.55 vs 4.14%, p = 0.69) and 90 days (9.96 vs 9.3%, p = 0.71). Thirty day device related readmission rates trended towards being higher in women (3.25 vs 1.82%, p = 0.09). Ninety day device related readmission rates were twice as high in women compared to men (4.98 vs 2.33%, p = 0.007). Device related readmissions were higher over the full study period in women (10.8 vs 6.8%, p = 0.009) while cardiac readmissions were similar between women and men (29.2 vs 29.8%, p = 0.86). Device related readmissions were driven by lead problems in women compared to men (1.7% vs 0.65%, p = 0.05).
Conclusions: In this large community based cohort of patients undergoing ICD implantation for secondary prevention, women were found to have a significantly higher rate of device related readmissions driven by lead problems.

PO06-25

RIGHT VENTRICULAR NON-APICAL PACING IS ASSOCIATED WITH INCREASED LEAD-RELATED COMPLICATIONS

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Introduction: Right ventricular (RV) apical pacing is associated with left ventricular dysfunction in certain patients. Non-apical lead positions provide an alternative, but are potentially a less stable long-term location. This study explores the rates of lead-related complications associated with RV apical and non-apical lead locations in a large single institution study.
Methods: Patients with a dual chamber pacemaker placed from 2004 through 2013 underwent careful examination of their chest radiographs to determine the lead position. This was classified as apical and non-apical and the latter further subdivided into a septal/RVOT group to attempt to exclude potentially less desirable positions such as the free wall. Complications were assessed by manual medical record review, and rates at 5 years were compared using Kaplan-Meier analysis.
Results: In the study cohort, 2 477 patients were identified to have leads in the apical position and 974 in the non-apical position - including 242 in a septal/RVOT location. A significantly increased rate of lead dislodgement and need for lead revision in the non-apical group was identified (Figure). Lead dislodgement was not found to be higher in the septal/RVOT group than the apical group.
Conclusions: Non-apical pacing is associated with higher rates of lead dislodgement and subsequent revision. This does not appear to be the case for RV septal/RVOT positions, and this approach warrants further investigation.

Comparison of complication rates by right ventricular lead position

Complication	Apical	Non-apical	Septal/RVOT	Apical vs. Non-apical	Apical vs. Septal/RVOT
Lead dislodgement	21 (0.9%)	15 (1.5%)	1 (0.4%)	**p = 0.04**	p = 0.45
Perforation	12 (0.5%)	6 (0.6%)	3 (1.2%)	p = 0.54	p = 0.14
Pericardial effusion	59 (2.4%)	21 (2.2%)	8 (3.3%)	p = 0.81	p = 0.45
Cardiac tamponade	7 (0.2%)	4 (0.4%)	2 (0.8%)	p = 0.45	p = 0.18
Lead revision	60 (2.4%)	38 (3.9%)	11 (4.6%)	**p = 0.004**	p = 0.06
Any complication	150 (6.1%)	69 (7.1)	20 (8.3%)	p = 0.06	p = 0.26

Rates given are Kaplan-Meier probability at 5 years

PO06-26

HIGH DEFIBRILLATION THRESHOLD IN OBESE PATIENTS RECEIVING S-ICD

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Introduction: Average defibrillation threshold (DFT) values with the S-ICD have been reported as 36.6 J. Formal DFT testing is not currently required following S-ICD implantation. Given the S-ICD's extrathoracic position, DFT may be affected by body mass index (BMI) due to increased thoracic size and adipose tissue in obese patient.
Methods: Records of consecutive patients at our institution included in the post-market S-ICD study over the past two years were reviewed. Pertinent clinical risk factors, medications, cardiomyopathy etiology and ICD indications were recorded. Patients underwent full DFT testing and factors associated with elevated DFT were examined.
Results: Twenty-one patients underwent S-ICD implantation. Eighteen patients had attempted VF induction; three were deemed unsafe for DFT testing due to hemodynamic instability. The mean age was 50.7 years with average BMI 31.2kg/m2 and ejection fraction 33%. The average DFT was 50.7J and the average number of shocks during DFT testing was 4.6. Four patients had DFT of 80J or greater and three patients were non-inducible. Higher BMI was positively correlated with higher DFT values (correlation coefficient 0.46, R-square 0.21, p-value 0.08) (Figure 1). There was a trend toward markedly higher DFTs in patients with BMI above 30.
Conclusions: Obese patients (BMI >30) undergoing SICD implant may have DFTs that are higher than published averages. Formal DFT testing should be considered in this population. Further study with large sample size is needed to further characterize risk factors that may predict unacceptably high DFTs.

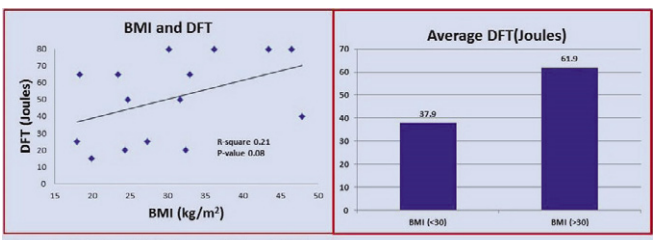

Figure 1. Relationship between BMI and DFT

PO06-27

PREDICTORS OF MORTALITY IN PATIENTS WITH TRANSIENT SEVERE LEFT VENTRICULAR SYSTOLIC DYSFUNCTION

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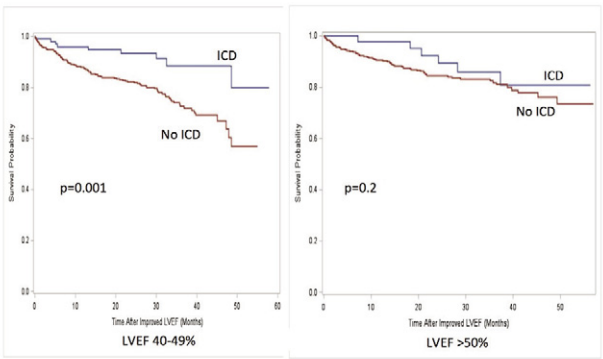
Introduction: About 25% of patients who develop left ventricle (LV) systolic dysfunction will have improvement in LV ejection fraction (EF) overtime. This patient cohort is generally excluded from large sudden death trials and hence under studied.
Methods: Patients who had transient LV systolic dysfunction between 2010-2014 within Aurora Health System who had LVEF improved ≥40%, irrespective of implantable cardioverter-defibrillator (ICD) implant, were studied and predictors of mortality were identified using Cox proportional hazard model. Patients were then divided into groups based on LVEF >50% or <50% to assess for benefit of ICD using Kaplan-Meier estimates.
Results: 1364 patients met inclusion criteria. 58.4% were male and mean BMI was 29+/- 7. Mean age at improved LVEF was 66 years +/- 14, and with each added year the hazard rate increased by 5% [Hazard Ratio (HR) 1.05,p =0.0001]. Several clinical characteristics emerged as predictors of mortality, including smoking (HR 1.8, p=0.0002), chronic renal disease (HR 2.3, p = 0.0001), atrial fibrillation (HR 1.4, p=0.013) and no-ICD (HR 2.1, p=0.012). But with each percentage increase in LVEF hazard rate decreased by 2% (HR 0.97, p=0.007). However, presence of ICD did not significantly improve mortality in the group with LVEF >50% (figure).
Conclusions: Clinical predictors of mortality in patients with transient LV systolic dysfunction may help further risk stratify this cohort of patients. It appears that patients with LVEF 40-49% continue to derive benefit from ICD therapy.



PO06-28

REAL WORLD UTILIZATION AND IMPACT OF THE WEARABLE CARDIOVERTER-DEFIBRILLATOR IN A COMMUNITY SETTING

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Introduction: The wearable cardioverter-defibrillator (WCD) is frequently used in patients at risk for sudden cardiac death (SCD) but not immediate candidates for intracardiac defibrillator (ICD) implantation. Previous studies including the WEARIT/BIROAD study have demonstrated a benefit in detecting and treating ventricular tachyarrhythmias as a bridge to transplantation or ICD. However, the real world utilization of the WCD in a community, predominantly minority population setting has not been published.
Methods: We performed a single center retrospective study of patients prescribed WCD upon hospital discharge over a 13-year period. Clinical characteristics were obtained from the hospital electronic database. Device therapy data was obtained from the Zoll LifeVest database.
Results: A total of 140 patients were identified. The mean age was 58.2 + 15.5 years, 62% were men, and 86% were African-American. Ischemic cardiomyopathy was present in 45 patients (34%) and non-ischemic cardiomyopathy in 64 patients (48%). The mean left ventricular ejection fraction (EF) was 28 + 13%. Median interval between placement and removal of WCD was 72.5 days. Mean use per day was 17.3 + 7.5 hours. There were a total of 6 (4.2%) WCD shocks out of which 2 (1.4%) were appropriate (one for VT, one for VF) and 4 (2.8%) were inappropriate (2 had supraventricular tachycardia, 2 had artifact). The 2 patients who received appropriate shocks were of African-American race with non-ischemic cardiomyopathy (EF<20%), non-sustained VT and wide QRS duration at baseline. Upon termination of WCD use, 45 patients (32.1%) received ICD while EF improved in 35 patients (25%).
Conclusions: In a predominantly minority, community setting, the WCD compliance is high and use is effective in aborting SCD due to ventricular tachyarrhythmias. However, inappropriate shocks do occur. While a large number of WCD were prescribed to prevent a small number of ventricular arrhythmias, a significant proportion of patients did not ultimately require ICD implantation suggesting this may be a cost-effective strategy in patients at concerning risk of SCD.

PO06-29

REASSESSMENT OF LV FUNCTION AT THE TIME OF ICD REPLACEMENT IN A PRIMARY PREVENTION COHORT OF GERMAN PATIENTS

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Introduction: Impaired LV function (LV-EF) is the most important predictor of arrhythmogenic death. It is accepted to implant an ICD in patients (pts) with an LV-EF of ≤35% for primary prevention. Yet, improvement of LV-EF after ICD implantation is common and it may exceed 35% at the time of generator replacement. However, reassessment of LV-EF is often neglected prior to ICD replacement and the implications are still unclear, as reported by data from the US.
Methods: In a retrospective analysis, we sought to investigate whether these findings can be confirmed by data collected in Germany. Pts who received an ICD generator replacement between 2011 and 2015 at 2 German hospitals were screened. Those who had initially been implanted for primary prevention were included in the analysis. LV-EF at ICD implantation and at generator exchange and occurrence of ICD shock was collected from the medical files, the referring cardiologist and by follow-up via telephone.
Results: Out of 232 screened patients, n=51 (age 69±9 years,

n=23 single chamber ICD, n=6 dual chamber ICD, n=22 CRT-D) matched the inclusion criteria. The underlying condition was ischaemic heart disease in 31 pts and dilative cardiomyopathy in 20 pts. The mean LV-EF at implantation was 27±7%. At the time of generator replacement 6±2 years later, the mean LV-EF had increased to 33±12% (p=0.007). An improvement of LV-EF was seen in 12 patients (23%, 6 CRT and 6 ICD). In 21 patients (41%, 10 CRT and 11 ICD) LV-EF remained ≤35% and in 18 (35%, 6 CRT and 12 ICD) it was unknown at the time of ICD replacement. In the groups of pts with an LV-EF of ≤35% or an unknown LV-EF at the time of replacement, 9 (43%) and 2 (11%) respectively had experienced a prior ICD shock. None of the pts with an improved LV-EF had been shocked.
Conclusions: Improvement of LV-EF by the time of ICD replacement in pts with primary prevention indication was common. Patients with improved LV-EF were less likely to have experienced shocks. These data confirm previous findings and emphasize the implications of an LV-EF improvement after ICD implantation and the necessity for reassessment. Albeit, the LV-EF had not been reevaluated in a substantial number of pts.

PO06-30

IMPACT OF INSURANCE STATUS ON ICD IMPLANTATION QUALITY METRICS: INSIGHT FROM THE NCDR ICD REGISTRY

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Introduction: Insurance status can influence healthcare. However whether this factor is associated with ICD implantation quality metrics, including decision to implant cardiac resynchronization therapy (CRT-D) device when indicated,complication rate, and optimal medical therapy, is unknown.
Methods: Among 312,251 patients < 65 years old in the National Cardiovascular Data Registry (NCDR, ICD registry) with de novo ICD implant between 1/1/06 and 12/31/14, 167,064 had private insurance, 38,139 had Medicare, 56,789 had Medicaid and 24,564 were uninsured (25,695 with other insurance were excluded). Inverse probability of treatment weighting (IPTW) was used to control for imbalances between noninsured and other groups. After IPTW, all pairwise standardized differences were < 10%. All statistical tests were corrected for multiple comparisons.
Results: Mean age was 53 years, 29% were female. Uninsured patients were less likely to receive CRT-D when indicated compared to privately insured or Medicare patients although did not differ vs Medicaid (Table 1) . Complication rates were similar. Uninsured patients were more likely to be receiving optimal medical therapy than all other groups.
Conclusions: In propensity-weighted analysis, uninsured patients are less likely to receive CRT when indicated than those with insurance. Use of OMT was higher, perhaps reflecting a higher threshold for implant. Strategies to reduce disparities for the uninsured may improve outcomes given the proven benefit of CRT.

Odds Ratios Versus Uninsured Patients			
	Private Insurance	Medicare	Medicaid
CRT-D implant	1.19(1.09-1.28) P<0.0001	1.11(1.01-1.21) P=0.03	0.99(0.90-1.08) P=0.76
Serious adverse events	0.90(0.80-1.0) P=0.05	1.01(0.89-1.15) P=0.88	1.03(0.91-1.16) P=0.62
Optimal Medical Therapy	0.92(0.88-0.96) P<0.0001	0.82(0.78-0.86) P<0.0001	0.89(0.86-0.93) P<0.0001

PO06-31

ABSENCE OF DIFFERENCES IN PRESENTATION AND OUTCOMES OF CARDIOVASCULAR IMPLANTABLE ELECTRONIC DEVICE INFECTIONS ACCORDING TO DEVICE TYPE

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Introduction: While the clinical features of cardiovascular implantable electronic device (CIED) infections are known, the variations in risk factors, presentation, and outcomes based on CIED type (pacemaker [PM] vs. implantable cardioverter-defibrillator [ICD] vs. biventricular device [BiV]) are less well described.
Methods: The Multicenter Electrophysiologic Device Infection Cohort (MEDIC) registry prospectively enrolled patients with CIED infection at 11 international centers. Clinical data were analyzed by device type.
Results: There were 221 patients with a PM, 129 patients with an ICD, and 84 patients with a BiV (Table). Patients with a PM were younger, more likely to have a prosthetic valve, and presented a longer time since the most recent CIED procedure. Patients with an ICD were more likely to have coronary artery disease. Subjects with a BiV were more likely to be on oral anticoagulation. Both the ICD and BiV groups were more likely to have heart failure, prior myocardial infarction and a vascular graft. There were no differences in the rates of pocket infection, endocarditis, or blood stream infection or microbiology among groups. Removal of leads in those with an ICD or BiV was more likely to require a laser, though there were no differences in the rate of lead extraction complications. In follow-up, there was similar 6-month mortality among groups.
Conclusions: Variations in patient risk factors for CIED infection among different device types are likely related to conditions that lead to indication for initial CIED placement. Despite this, there were no differences in microbiology, pocket or endovascular infection rates, or mortality among groups.

	PM	ICD	BIV	p-value
Patient risk factors				
Age (years)	41 ± 15	45 ± 14	46 ± 12	0.003
Female	25.8%	16.3%	19.0%	0.09
Heart failure	34.4%	76.0%	79.8%	<0.001
Coronary artery disease	38.0%	72.1%	50.0%	<0.001
Prior myocardial infarction	23.1%	45.0%	42.3%	<0.001
Prosthetic valve	21.3%	6.2%	14.3%	<0.001
Vascular graft	5.9%	16.3%	16.7%	0.002
Hemodialysis	8.1%	7.8%	10.7%	0.72
Anticoagulation	31.7%	27.1%	51.2%	<0.001
Presentation of infection				
Time from last CIED-related procedure to diagnosis (years)	2.5 ± 3.4	1.4 ± 1.9	1.4 ± 1.5	<0.001
Pocket infection	59.7%	65.9%	59.5%	0.48
Endocarditis	40.3%	38.0%	42.3%	0.78
Bloodstream infection	55.0%	32.1%	20.9%	0.7
Paravalvular complications	5.8%	0.0%	0.0%	0.003
Organism type				0.13
Coagulase-neg staph	35.4%	33.9%	30.0%	
MRSA	14.9%	17.0%	13.8%	
MSSA	20.0%	25.9%	32.5%	
Other	29.7%	23.2%	23.7%	
Treatment and outcomes				
Removal required laser	41.7%	59.7%	53.6%	0.003
Complication of surgical lead removal	3.2%	1.6%	6.0%	0.21
Complication of percutaneous lead removal	11.8%	16.3%	13.1%	0.49
Mortality at 6-month follow-up	15.4%	14.0%	23.2%	0.19

PO06-32

ADAPTIVE PACING DURING LONG DURATION VENTRICULAR FIBRILLATION

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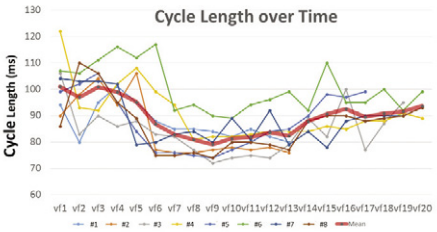
Introduction: Recent data showed that during long duration ventricular fibrillation (> 1 min, LDVF) the wavefronts are relatively organized and propagate mainly from apex to base about 31% of the time. We sought to capture during LDVF with adaptive pacing at the endocardial apex of LV.
Methods: In 8 dogs, a 64-electrode basket and a 10-pole unipolar electrode catheter were inserted into the LV for pacing. The basket was expanded to record the entire LV endocardium in order to construct activation maps from the area captured by pacing. VF was allowed to continue for 30 sec before pacing was begun. Pacing cycle length was timed to the measured VF rate and was delivered in 30 second bursts with 30 seconds of VF in between each episode for up to 20 episodes. Pacing strength was set to 10 times diastolic sinus pacing threshold. The activation interval and organization of VFs between each burst pacing episode were calculated.
Results: Regional capture, defined as control of the myocardium under the electrode at least 10 beats was achieved in 7 out of 8 dogs. The maximum area captured for each pacing episode was about 1/3 endocardial area (18 basket electrodes) with the average of 5 electrodes captured. The VF rhythm before captured pacing beats was significantly more organized than those before non-captured pacing beats. The activation intervals of VF between each pacing episode were significantly shorter (Figure) compared to our previous study without pacing.
Conclusions: Adaptive pacing can capture ventricular myocardium during VF. Pacing delivered during synchronized VF is more likely to capture ventricle. VF activation rate was accelerated by the pacing stimulation.



PO06-33

TRANSVENOUS REMOVAL OF PACING AND ICD LEADS: SINGLE ITALIAN REFERRAL CENTER EXPERIENCE

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Introduction: Device related complications are rising the need of Transvenous Lead Removal (TLR). Transvenous extraction of Pacing (PL) and Defibrillating Leads (DL) is a highly effective technique. Aim of this report is to analyse the longstanding experience performed in a single Italian Referral Center.
Methods: since January 1997 to July 2015, we managed 2331 consecutive patients (1782 men, mean age 65.3 years) with 4261 leads (mean pacing period 72.0 months, range 1-576). PL were 3433 (1626 ventricular, 1436 atrial, 371 coronary sinus leads), DL were 828 (807 ventricular, 6 atrial, 15 superior vena cava leads). Indications to TLR were infection in 81% (systemic 27%, local 54%) of leads. We performed mechanical dilatation using a single polypropylene sheath technique (Cook Vascular - Leechburg PA, USA) and if necessary, other intravascular tools (Catchers and Lassos, Osypka, Grentzig-Whylen, G); an Approach through the Internal Jugular Vein (JA) was performed in case of free-floating leads or failure of the standard approach.
Results: Removal was attempted in 4252 leads because the technique was not applicable in 9 PL. Among these, 4161 leads were completely removed (97.9%), 44 (1.0%) partially removed, 47 (1.1%) not removed. Among 4167 exposed leads, 655 were removed by manual traction (15.7%), 3094 by mechanical dilatation using the venous entry site (74.3%), 35 by femoral approach (FA) (0.8%) and 292 by JA (7.0%). All the free-floating leads were completely removed, 25.8% by FA and 74.2% by JA. Major complications occurred in 15 cases (0.64%): cardiac tamponade (14 cases, 3 deaths), hemotorax (1 death).
Conclusions: our experience shows that in centers with wide experience, TLR using single sheath mechanical dilatation has a high success rate and a very low incidence of serious complications. TLR through the Internal Jugular Vein increases the effectiveness and safety of the procedure also in case of free-floating or challenging leads.

PO06-34

BOLD CLAIMS OF 50% REDUCTION IN FLUOROSCOPY DOSE SUBSTANTIATED? A COMPARISON OF TWO FLUOROSCOPY SYSTEMS

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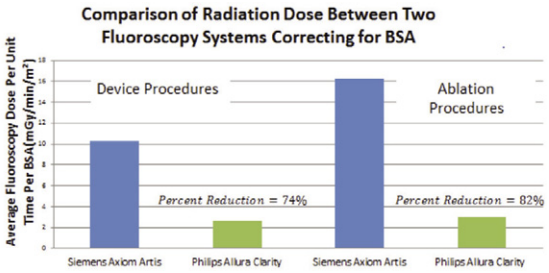
Introduction: Radiation exposure in EP procedures is of paramount importance to patients, operators, and lab staff. To

achieve the lowest reasonable radiation dose, many parameters can be controlled by the operator, such as fluoroscopy time, frame rate, camera angulation, collimation, and table height. Fluoroscopy hardware is another factor, and we sought to compare radiation dose between two of our EP labs with different fluoroscopy systems.
Methods: Radiation dose, fluoro time, procedure type, and patient body surface area (BSA) were retrospectively collected from 200 procedures; 100 performed on a Siemens Axiom Artis (SAA) system and 100 performed on a Phillips AlluraClarity (PAC) system. ALARA principles were used by the operators, who worked interchangeably with the 2 systems, using identical radiation safety practices in each lab.
Results: For SAA and PAC systems: mean procedure fluoro time was 14.2 vs 18.3 min, and mean patient BSA was 1.99 vs 1.97 m2. The radiation dose for device procedures in SAA and PAC systems was 20.5 vs 4.99 mGy/min and 10.32 vs 2.64 mGy/min/m2 (p-value <0.0001), and mean radiation dose for ablation procedures was 32.6 vs 6.09 mGy/min and 16.3 vs 2.98 mGy/min/m2 (p-value<0.0001).
Conclusions: In the setting of identical radiation use practices by the same operators, the Philips AlluraClarity fluoroscopy system was associated with a 74% reduction in radiation dose in device procedures and an 82% reduction in radiation dose in ablation procedures. The dramatic differences in dose/min by fluoroscopy system are an important factor to consider when striving to achieve the lowest possible radiation exposure to patients and health care providers.



PO06-36

MINIMISING RADIATION DOSE IN THE EP LAB USING NEW GENERATION X-RAY TECHNOLOGY AND OPTIMISED EQUIPMENT CONFIGURATION

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Introduction: Electrophysiology (EP) procedures require fluoroscopic guidance, with the associated detrimental effects of ionising radiation. Newer X-ray systems have features that enable greater dose reduction strategies. This study aimed to compare radiation doses between an older fluoroscopy system (Philips Integris 5000) and a modern system (Siemens Artis Q) optimised with dose reduction strategies.
Methods: We retrospectively analysed fluoroscopy times (FT) and radiation doses (dose area product - DAP) for patient procedures performed on the older system compared to the newer system both over a period of 1 year each. Dose optimisation strategies utilised included default low frame rates (4 fps) and detector doses (6 nGy/pulse). 7 categories of procedures were analysed including simple pacemakers/ICDs (Devices), biventricular devices (BiV), diagnostic EP studies (EPS), simple ablations (SVT, CTI, AV node - RFA), ventricular tachycardia ablation (VT), pulmonary vein isolation (PVI) and other complex atrial ablations (CAA).
Results: All procedures performed with optimal dose reduction strategies on the newer system benefited from marked reduction in radiation doses despite no increase in FT (Table 1). FT were shorter for simple devices and diagnostic EP studies, however this did not account for the magnitude of dose reduction. There was no significant difference in rates of procedural success.

Comparison of Radiation Doses Between the New and Old X-ray Systems

Procedure (n = Old/New)	Fluoroscopy Times (mins) [median, IQR]			Radiation Dose (DAP - Gycm2) [median, IQR]			Procedural Success (%)		
	Old	New	p-value	Old	New	p-value	Old	New	p-value
Devices (n = 385/340)	5.3 [3.3 - 8.5]	3.6 [2.4 - 5.9]	<0.001	3.0 [2.0 - 5.0]	0.22 [0.10 - 0.41]	<0.001	100%	100%	1.0
BiV (n = 59/56)	20.3 [14.8 - 36.1]	15.2 [9.9 - 28.0]	0.26	26.0 [13.0-43.0]	4.1 [2.3 - 7.4]	<0.001	100%	100%	1.0
EPS (n = 72/99)	4.2 [2.0 - 7.8]	2.3 [1.3 - 5.4]	0.04	2.0 [1.0 - 4.5]	0.14 [0.05 - 0.41]	<0.001	NA	NA	NA
RFA (n = 150/137)	22.2 [13.2 - 34.4]	17.4 [10.4 - 34.1]	0.26	11.0 [5.0 - 20.0]	1.34 [0.60 - 2.71]	<0.001	99%	94%	0.054
VT (n = 46/52)	39.4 [28.0-48.2]	37.1 [23.5-54.8]	0.54	26.0 [15.0 - 40.0]	4.85 [2.46 - 7.59]	<0.001	89%	83%	0.40
PVI (n = 45/54)	39.7 [34.2 - 52.1]	42.1 [36.2 - 52.0]	0.62	31.0 [22.0 - 43.0]	7.10 [3.83 - 5.78]	<0.001	90%	88%	0.99
CAA (n = 19/23)	45.4 [32.4 - 60.9]	38.7 [29.9 - 53.5]	1.00	25.0 [12.0 - 46.0]	3.76 [2.25 - 7.28]	<0.001	90%	88%	0.99

Conclusions: Newer X-ray systems, optimised for low dose fluoroscopy, delivers markedly reduced exposure to radiation in the EP lab in comparison to predecessor technology and the published literature. Procedural times and success rates are not compromised.

PO06-37

HEPARIN RESISTANCE IN PATIENTS RECEIVING DIRECT FACTOR XA INHIBITORS

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Introduction: Achievement of therapeutic anticoagulation is critical to avoid thromboembolic events during left-sided cardiac radiofrequency ablation (RFA) procedures. Therapeutic intraoperative activated clotting times (ACT) have been generally achieved with relative predictability with unfractionated heparin IV bolus dosing. However, not all patients respond to heparin dosing in the same manner, thus ACT monitoring is necessary. An increasing number of patients undergoing treatment with novel oral anticoagulatants (NOACs) especially direct factor Xa inhibitors present for AF RFA. It is important to understand the implications that these NOACs may play on interpatient variability in ACT response to IV heparin dosing.
Methods: A series of patients undergoing left-sided cardiac RFA were given a standard dose of approximately 140 units/kg of unfractionated IV heparin. At approximately 5 minutes after heparin administration, ACT was measured using Hemochron Signature Elite. If ACT was not greater than 350 seconds, an additional dose of heparin was given at provider's discretion and ACT remeasured to maintain targeted level of anticoagulation. Lab practice is that patients receiving factor Xa inhibitors are to hold the previous day's dose.
Results: We compared initial ACT result for patients who had received chronic Factor Xa inhibitor anticoagulation after heparin bolus doses with those who had no recent NOAC exposure. Patients who have been on chronic anticoagulation tended to demonstrate increased resistance to heparin. Not all patients

on these agents were resistant to heparin. Some patients with no known direct factor Xa exposure were heparin resistant. However, there was a 2.2-fold increased incidence of heparin resistance in patients exposed to direct factor Xa inhibitors, requiring much higher than expected heparin dosing.
Conclusions: Patients with recent factor Xa inhibitor exposure demonstrated an 2.2-fold increased frequency of heparin resistance compared to patients without NOAC exposure. Thus, close ACT monitoring is increasingly indicated as increasing numbers of patients on factor Xa present to the EP lab. Further studies to elucidate mechanism of heparin resistance and implications of findings are indicated.

PO06-38

EFFICACY OF DOFETILIDE IN PATIENTS WHO HAVE FAILED OTHER ANTIARRHYTHMIC DRUGS

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Introduction: Patients who fail one or more antiarrhythmic drugs are often refractory to other antiarrhythmics. The efficacy of dofetilide among patients who have failed other antiarrhythmic medications is unknown.
Methods: We performed a retrospective chart review of patients admitted for dofetilide loading at our institution from 2008-2014. Patients who had failed other antiarrhythmic agents (Group 1) were compared to those had never been tried on other agents (Group 2). Recurrence of AF was defined as any sustained AF (> 30 sec) documented on ECG, cardiac device, or ambulatory monitor.
Results: 248 patients were identified, 134 (54%) who had failed one or more antiarrhythmic drugs, and 114 (46%) who had not been tried on other agents. Prevalence of persistent AF (80 vs 73%), hypertension (82 vs 82%), diabetes (23 vs 22%), and coronary disease (31 vs 34%) were similar in both groups. More CHF was present in Group 1 (35 vs 24%, p=0.05). Group 1 patients had a similar but slightly lower rate of freedom from recurrent AF at 1 year than Group 2 (35 vs 44%, p =0.16). Of patients in Group 1, 41 had failed sotalol; 44 amiodarone; 44 dronedarone; and 29 flecainide or propafenone. Rate of freedom from recurrent AF on dofetilide at 1 year for patients failing sotalol was 27%; amiodarone: 38%; dronedarone 35%; and Class 1C drugs 36%.
Conclusions: Dofetilide maintains efficacy in a significant number of patients who have failed other antiarrhythmic drugs, including those with Class III properties.

PO06-39

EP VERSUS NON-EP CARDIOLOGIST MANAGEMENT OF OUTPATIENT ATRIAL FIBRILLATION PATIENTS: SPECIALISED AF CARE IS ASSOCIATED WITH GREATER GUIDELINE ADHERENCE

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Introduction: Atrial fibrillation (AF) is a complex disease with recent evidence showing that specialized AF clinic was associated with improved guideline adherence and patient outcomes. This study aimed to examine the difference between adherence to guideline recommended care in the EP cardiologist managed arrhythmia clinic (AC) and non-EP cardiologist managed cardiac clinic (CC).
Methods: A retrospective audit was undertaken for AF patients managed in the AC and CC of a large tertiary referral centre from January to December 2014. Four aspects of AF care were evaluated: 1) Appropriate anticoagulation according to the CHA2DS2-VASc score; 2) Appropriate use of anti-arrhythmic medications (not used in those with permanent AF) and appropriate utilization of investigations in the preceding two years: 3) Transthoracic echocardiogram and 4) Thyroid function testing.
Results: A total of 111 AC and 193 CC AF patients were included for analysis (see Table). Patients were age and gender matched, however, the mean CHA2DS2-VASc score was lower and valvular and permanent AF were less prevalent in the arrhythmia clinic group. Appropriate anticoagulation occurred more frequently in those attending the AC as compared with the CC. There was no significant difference in adherence to appropriate use of antiarrhythmic therapy, transthoracic echocardiography and thyroid function testing.
Conclusions: A specialized AF clinic is associated with greater guideline adherence to appropriate anticoagulation that may translate to improved patient outcomes. Further prospective studies are needed to demonstrate the advantages of integrated multidisciplinary AF care with EP input.

Baseline characteristics and guideline adherence in the AC versus the CC

	Arrhythmia Clinic (n=111)	General Cardiac Clinic (n=193)	P value
Mean Age (years)	69.9±12.6	69.2±13	0.71
Female gender (%)	38/111 (34%)	66/193 (34%)	1.0
AF Type (%) -Paroxysmal/Persistent -Chronic	82/111 (74%) 29/111 (26%)	93 (48%) 100 (52%)	<0.001
Mean CHA2DS2-VASc score	2.8±1.7	3.5±1.9	0.001
Valvular AF (%)	7/111 (6%)	57/193 (30%)	<0.001
Appropriate anticoagulation (%)	102/111 (92%)	156/193 (81%)	0.01
Appropriate use of AAD (%)	108/111 (97%)	188/193 (97%)	0.953
Echocardiogram in prior 2 years (%)	93/111 (85%)	161/193 (85%)	0.892
Thyroid function testing in prior 2 years (%)	59/111 (53%)	118/193 (63%)	0.102

PO06-40

ATRIAL FIBRILLATION SELF-MONITORING: PATIENTS VS. ALGORITHMS

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Introduction: Atrial fibrillation (AF) is the most common significant arrhythmia worldwide, with significant morbidity and mortality risks if undetected or untreated. AF recurrence is commonly detected based on symptoms. However, it is well known that AF is frequently asymptomatic, even in patients who do sometimes experience AF symptoms. Patient-facing monitoring devices offer the opportunity for real-time ambulatory AF evaluation with the potential to facilitate drug dosing and other therapeutic approaches without significantly increasing healthcare utilization. We conducted a pilot study to assess the feasibility of a twice-daily self-monitoring protocol with self-assessment of AF vs. sinus rhythm.
Methods: 18 patients with paroxysmal AF and rhythm control management completed a 3-month twice-daily monitoring

program using the commercially-available AliveCor monitor without the automatic AF detection algorithm enabled. Patients were taught to recognize AF, and were instructed to notate "sinus" or "AF" on twice-daily rhythm strips. Patients were instructed to make no therapeutic changes based on monitoring data, but were invited to contact their heart rhythm clinician in the event of AF detection or adverse symptoms.
Results: Mean sensitivity of AF detection = 85% (range 50-100%) and specificity of AF detection = 98% (range 89-100%). Patient detection sensitivity was inferior to the AliveCor AF algorithm reported at 100%, with patient specificity comparable to the AliveCor AF algorithm reported at 97%. Adherence to the twice-daily monitoring protocol was suboptimal and declined each month. Month 1: mean 76%, median 83%, range 21-98%. Month 2: mean 64%, median 63%, range 10-95%. Month 3: mean 56%, median 58%, range 3-97%.
Conclusions: In this pilot study, patients' ability to accurately detect AF was inferior to reported accuracy for the AliveCor AF detection algorithm, suggesting that in clinical settings, patients should be instructed to activate the AF detection algorithm. While a variety of factors impacted patients' adherence to a twice-daily monitoring protocol, further study is needed to assess strategies to improve patient self-monitoring adherence for clinical AF applications using intermittent ambulatory heart rhythm monitors.

PO06-41

MALFUNCTION OF AN MRI CONDITIONAL PACEMAKER FOLLOWING AN MRI

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Introduction: Patients with cardiac implantable electronic devices were historically unable to undergo MRI imaging. In 2011 the FDA approved the first MRI conditional pacemaker, the Medtronic Revo MRI SureScan.
Methods: N/A
Results: A 63 year old man underwent implant of a Revo MRI RVDR01 dual chamber pacemaker on 5/11/2011 at an outside hospital for complete heart block. He was admitted to our institution on 2/25/2015 for a non-cardiac condition. When interrogated on admission, the device reported "Date of Visit" was 08-Apr-1996. The OBSERVATIONS section reported "MRI SureScan On: 16-Jan-1996 MRI SureScan Off 16-Jan-1996. Data was not collected during MRI SureScan." By the device clock, this event was 82 days prior to admission. Device information, including battery and lead measurements, lead trends, histograms and arrhythmia data, were reported between 10/1994 - 4/1996. Sensing, battery and lead impedances, and capture thresholds were within normal limits. Review of outside records revealed that the patient underwent brain MRI 82 days prior to admission. As the patient was pacemaker dependent and the stability of the device could not be guaranteed, the generator was replaced.
Conclusions: We present a pacemaker dependent patient with a Medtronic Revo MR Conditional Pacemaker who underwent MRI which caused a "power on reset" with subsequent malfunction of the device clock per analysis by Medtronic. The "MRI conditional" device behaved unpredictably following exposure to the MRI environment. This behavior has not been observed in non-MRI conditional devices in greater than 5000 reported scans and calls into question the durability of MRI-conditional devices in the MRI environment.

Battery Voltage (RRT=2.81 V)			2.99 V	08-Apr-1996
		Atrial (5086MR)	RV (5086MR)	
Lead Impedance		560 ohms	576 ohms	08-Apr-1996
Programmed Amplitude/Pulse Width		2 V / 0.4 ms	2 V / 0.4 ms	
Measured P/ R Wave		2.2 mV	- - -	08-Apr-1996
Programmed Sensitivity		0.3 mV	0.9 mV	
Parameter Summary				
Mode	DDDR	Lower Rate	40 bpm	Paced AV 160 ms
Mode Switch	Off	Upper Track	150 bpm	Sensed AV 130 ms
		Upper Sensor	150 bpm	
Detection		**Rates**	**Therapies**	
AT/AF	Monitor	>171 bpm	All Rx Off	
VT	Off			

PO06-42

INFLUENCE OF ATRIAL FIBRILLATION ON QUALITATIVE SLEEP PARAMETERS IN STABLE HEART FAILURE PATINETS

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Introduction: Sleep quality is reported to change across the human life span. However, it is little clarified whether cardiac comorbidity such as atrial fibrillation (AF) and chronic heart failure has further effect on qualitative sleep parameters.
Methods: Heart failure patients under stable condition took polysomnography (PSG) between June 2011and 0ctober 2014. Patients with noninvasive positive pressure (NPPV) therapy were excluded. We retrospectively enrolled 89 patients (age 59±14, Male n=68) . The patients were divided into two groups: group A (age≥70 years old) and group B (age< 70 years old). Qualitative sleep parameters were compared between in the patients with or without AF in each group.
Results: In group A, 13 patients had AF. WASO was significantly longer in AF (+) patients than AF (-) patients. In group B, 30 patients had AF. WASO was not different regardless of AF. Other sleep parameters such as apnea hypopnea index, sleep efficacy, total sleep time or stage3+4 (%) sleep were not significantly different between in AF (+) and in AF (-) patients in each group.
Conclusions: AF might affect some qualitative sleep parameters in aged patients with stable heart failure.

PO06-43

IMPACT OF BASELINE HEART RATE ON RESPONSE TO CARDIAC RESYNCHRONIZATION THERAPY: RESULTS FROM THE MULTI-CENTER SMART AV TRIAL

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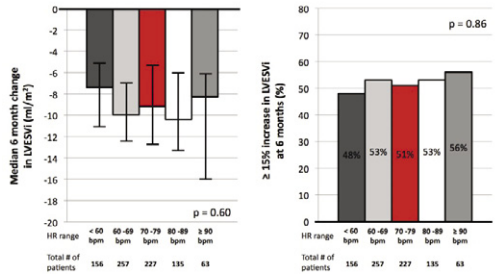
Introduction: Elevated baseline heart rate (BHR) has been associated with adverse outcomes in pts with systolic heart failure and implantable cardioverter-defibrillators. The impact of BHR on outcomes in pts undergoing cardiac resynchronization therapy (CRT) is unknown. We sought to investigate the effects of BHR on reverse left ventricular (LV) remodeling in CRT pts.
Methods: Data from 838 CRT pts from the SMART AV trial were used in this substudy. BHR prior to 1:1:1 randomization to CRT with fixed atrioventricular delay, echocardiography-guided AV optimization (AVO), and electrogram-guided AVO was recorded. Differences between baseline and 6-month LV end systolic volume index (LVESVi) was calculated. Positive CRT response was defined as ≥15% decrease in LVESVi from baseline at 6 months.

Results: Median BHR in study pts was 70 (IQR: 61, 79) bpm. Compared to pts with BHR ≤ 70 bpm, pts with BHR > 70 bpm had lower age and LV ejection fractions, lower incidence of ischemic heart disease and higher incidence of COPD. There were no significant differences in 6 month decrease in LVESVi (range median reduction 7.40 - 10.4 ml/m2 across groups; p =0.60) or positive CRT responder rates (range 48.7 - 55.6% across groups; p = 0.86) among pts with BHR 90 bpm. Higher BHR was not associated with differences in LVESVi reduction or positive CRT response rates by linear or logistic regression analysis, with or without adjustment for beta blocker dose, AVO treatment arm and co-morbidities.
Conclusions: The extent and rates of LV reverse remodeling were similar across all BHR ranges in patients undergoing CRT. Elevated BHR does not appear to mitigate the beneficial effects of CRT.



PO06-44

ELECTRICAL HETEROGENEITY METRICS FROM BODY SURFACE MAPPING VS ROUTINE ECG MEASURES BEFORE AND AFTER CRT

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Introduction: Favorable changes in ventricular activation patterns and electrical heterogeneity may be an important mechanism of CRT response. QRS duration (QRSd) and morphology are the only clinical electrical heterogeneity measures for assessing CRT settings. We developed a body surface mapping methodology using multi-electrode anterior and posterior arrays to better characterize activation patterns and quantify electrical heterogeneity.
Methods: We studied 91 subjects with EF ≤ 40% 1 week after CRT implant. Subjects were LBBB (n = 45), RBBB (n= 6), RV-paced (n=15), and IVCD (n = 25). QRSd was measured using 12-lead EKGs at native conduction (or RV pacing) and the programmed CRT setting. The standard deviation of activation times (SDAT) was measured at the same settings using isochronal maps from a 55-electrode body surface mapping system.
Results: Under native conduction, SDAT correlates modestly with QRSd (r2 = 0.30, p<0.01). However, SDAT shows no significant correlation with QRSd during CRT. Native electrical heterogeneity measured by mean SDAT was significantly greater (p<0.01) in LBBB (40ms) and RV-paced (45ms) than in RBBB (27ms) and IVCD (29ms) patients. In addition, native SDAT was significantly greater (p< 0.01) in patients with QRSd >150ms (39ms) than in patients with QRSd <150ms (30ms). Similar results were seen in native SDAT in non-ischemic and ischemic populations (33 and 39ms, respectively; p = 0.02). Finally, SDAT was significantly reduced (p<0.01) with CRT (-23 ± 30%), but QRSd was not significantly reduced (-2 ± 20%; p = 0.26).
Conclusions: Body surface mapping measurement of electrical dyssynchrony (SDAT) provides information that cannot be obtained using 12-lead ECG. The effects of CRT pacing on electrical activation heterogeneity and, by extension, the potential benefit of particular CRT device settings are more readily detected by SDAT (23% reduction) than QRSd (2% reduction). This body surface mapping methodology may offer insight on electrical activation and help in CRT patient selection, lead placement, and optimization.

PO06-45

LACK OF ASSOCIATION BETWEEN CARDIAC RESYNCHRONIZATION THERAPY AND IMPROVED SURVIVAL IN LEFT VENTRICULAR ASSIST DEVICE PATIENTS

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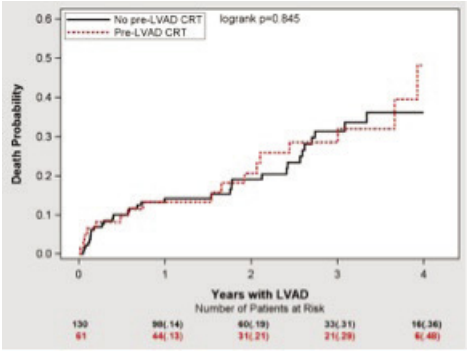
Introduction: In patients with advanced heart failure (HF), left ventricular assist device (LVAD) has been proven to be a life-saving therapy when compared to medical management. However, the impact of cardiac resynchronization therapy (CRT) on clinical outcome in patients with a continuous flow LVAD is currently not well understood.
Methods: We evaluated the effect of CRT on outcome in 191 patients with HeartMate II LVADs implanted between May 2008 and June 2014 at the University of Rochester Medical Center, Rochester NY. The presence of CRT was assessed at the time of LVAD implantation. The primary end point of the study was all-cause mortality.
Results: There were 61 of 191 LVAD patients (32%) implanted with a CRT before LVAD implantation, with a mean age of 58.9 ± 9.7 years, 5 (15%) were female. During the mean follow-up of 25 months, 17 of 61 patients (36%) with implanted CRT died compared to 33 of 130 patients (25%) without an implanted CRT. There was no significant difference in the cumulative probability of all-cause mortality in patients with or without an implanted CRT (Figure, log-rank p=0.845). In the multivariate model after adjustment for age and presence of diabetes at baseline, there was no significant difference in death from any cause in patients implanted with CRT vs. in those not implanted with CRT (HR=0.88, 95% CI: 0.48-1.59, p=0.660). This was consistent in patients across various INTERMACS levels.
Conclusions: In patients with an implanted continuous flow left ventricular assist device, there was a lack of association between CRT and improved survival.



PO06-46

THE ECONOMIC IMPACT OF LONGEVITY OF IMPLANTABLE CARDIOVERTER-DEFIBRILLATOR FOR CARDIAC RESYNCHRONIZATION THERAPY FROM A HEALTHCARE SERVICE PERSPECTIVE

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Introduction: Patients receiving implantable cardioverter-defibrillator for cardiac resynchronization therapy (CRT-D) are likely to undergo one or more device replacements after the first implantation, mainly for battery depletion. We assessed the economic impact of longevity and device replacement from a healthcare service perspective in a real-world cohort of patients.
Methods: We analyzed data on 1,400 patients implanted with a CRT-D between January 2008 and March 2010 in 9 Italian centers, and followed-up until 2014. Probabilities of replacement for battery depletion, stratified by device generation and manufacturer, were calculated up to 6 years. Public tariffs from diagnosis-related groups were used. All costs are expressed in Euro (€) and refer to the fiscal year 2015.
Results: A total of 1,792 implantation/replacement procedures were performed during the observation period. The generators were from 3 manufacturers: Medtronic (973, 54%), Boston Scientific (667, 37%), and St Jude Medical (152, 8%) . The Italian healthcare system spent €34 million for CRT-D therapy in the participating hospitals over the observation period. The initial implant cost was €30,679. The probability of replacement at 6 years was 83% and 68% for earlier- and recent-generation devices (released before and after 2007), respectively. Over 6 years, the cost for replacement per-patient decreased by 30%, from €9,092 for earlier-generation to €6,953 for recent-generation devices, with a decrease of 6% in the overall cost of therapy. Among recent-generation CRT-Ds, the probability of replacement from different manufacturers ranged from 12% to 70%.The cost per-patient for replacement over 6 years ranged from €1,258 to €7,214, a difference of 83%. The difference in the overall cost of therapy was 19%.
Conclusions: This study demonstrated that differences in CRT-D longevity strongly affect the overall cost of therapy and in particular, the cost of therapy decreased with recent-generation devices although significant differences exist among currently available systems.

PO06-47

SAFETY AND EFFICACY OF ENDOCARDIAL LEFT VENTRICULAR PACING FOR CARDIAC RESYNCHRONISATION THERAPY - A META-ANALYSIS

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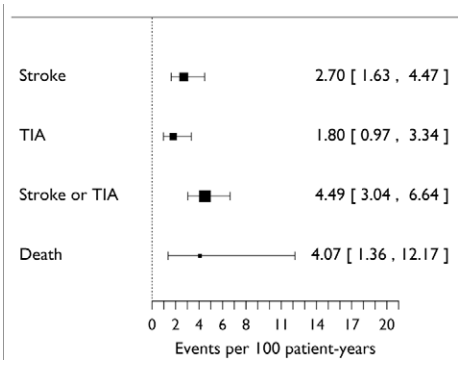
Introduction: Endocardial LV pacing for CRT has been proposed as an alternative to conventional LV lead placement via the coronary sinus. In order to assess the relative benefits and risks of this technique, we have performed a meta-analysis of published reports.
Methods: A systemic search was performed using online databases to identify studies of lead-based endocardial LV pacing published before 6/2015. A random-effects meta-analysis was performed, using a binomial-normal model to analyse the rate of complications and clinical response (defined as≥1 decrease in NYHA class).
Results: 23 studies were selected, including 386 patients (range 1-138 per study). 20 studies used the trans-atrial septal technique, 1 used the trans-ventricular apical technique, and 2 used the trans- ventricular septal technique. Age was 67±10, male 67%, EF 26±3.4%, NYHA class 3.1±0.3. Procedural success rates were over 95% in all studies. 16 studies reported clinical response for 264 patients, giving a response estimate of 91% (95% CI 78-96%) although there was significant heterogeneity and response in the only large study was 60%. Thromboembolic complications were reported by all studies, over 22 ±32 months follow up. 55% of follow up time was from two studies; the rest was distributed between studies. Estimated complication rates are shown in the figure.



Conclusions: LV endocardial pacing appears to be a viable technique when conventional lead placement is not possible. Response rates were heterogeneous but comparable to conventional. There is likely to be a small increase over expected rates of stroke, although included patients were high risk.

PO06-48

TRIPLE SITE PACING IMPROVES HEMODYNAMICS COMPARED TO CONVENTIONAL BIVENTRICULAR PACING

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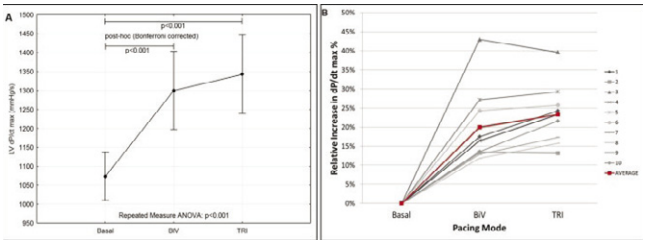
Introduction: Multisite stimulation of the LV has been suggested as an alternative to standard BiV. Aim of the study was to compare the acute hemodynamic response of tri-ventricular pacing (TRIV) with standard BiV pacing in a group of CRT pts.
Methods: Ten pts with chronic AF, 10 male, 76±7 years old, LVEF 34±7%, 5 with ICH, QRS duration 183±30 ms, were selected as candidates for CRT. A right ventricular lead was implanted in the mid septum. Two LV leads were positioned in two different branches of the CS. The first LV pacing lead was positioned based on the criterion of the latest electrically

activated site during intrinsic ventricular activation (Q-LV) and the second lead as remote as possible from the first lead. Acute hemodynamic response was evaluated as variation of LVdP/dtmax by means of a RADI pressure wire within the LV. One-way analysis of variance (ANOVA) with repeated measures and with Bonferroni post-hoc testing was applied to evaluate differences in pacing protocols.
Results: On average, 2.6±0.7 veins and 5.5±2.0 pacing sites were evaluated per patient. During standard BiV pacing LVdP/dtmax from the latest electrically activated LV site was an average 19.98±10% greater than during intrinsic rhythm. A significant further increase in acute hemodynamic response (figure A) was observed when TRIV pacing was enabled (to 23.33±8% above baseline).In Figure B are depicted 10 lines corresponding to the individual response of every single patient at baseline, with RV pacing (RV), BiV pacing and TRIV pacing respectively.
Conclusions: In pts with HF and RV pacing TRIV pacing produces a significant further increase in acute hemodynamic response compared to conventional BiV.



PO06-49

MYELOPEROXIDASE LEVELS CORRELATE INVERS WITH RESPONSE TO CARDIAC RESYNCHRONIZATION THERAPY

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Introduction: Response to cardiac resynchronization therapy (CRT) in patients (pts) with heart failure (HF) and left bundle branch block (LBBB) remains challenging. Inflammation and oxidative stress play a key role in the pathogenesis of HF. Myeloperoxidase (MPO) is an important biomarker with proven prognostic significance in HF. Changes in MPO levels after CRT implantation were investigated to evaluate MPO as a possible predictor of therapy response in CRT pts.
Methods: In 38 pts with ischemic (28pts) and dilative (10pts) cardiomyopathy undergoing CRT implantation, MPO plasma levels were obtained prior to implantation and at 1 and 3 month follow up (FU). Pts were further evaluated by 6-minute walking test (6-MWT), physical capacity (PC) using the BORG-exercise-scale (BES) and NYHA classifications at baseline and at 1- and 3-month FU.
Results: CRT implantation was successful in all 38 pts (LV ejection fraction of 25±6%). Significant changes in MPO levels during FU were observed and 3 groups could be discerned: Early responding (ER) pts with a MPO level decrease within 1 month n=21 (534.8±375.8 to 296.6±356.6ng/ml p=0.02); late responding (LR) pts with a MPO level decrease within 3 months n=3 (1007.8±283.7 to 399.4±213.1ng/ml p=0.03) and non responding (NR) pts with no change in MPO levels n=14 (281.4±326.6 to 363.7±402.2 p=0.5). In pts with an early MPO response also a significant improvement of PC, NYHA and 6-MWT (BES: 6±4 vs. 3±3 p=0.04; NYHA class: 3±0.4 vs. 2±0.8; p=0.003; 6-MWT: 216±204 vs. 387±170m p=0.02) was notable. By trend improvements for these parameters were seen in the LR group but no improvement of clinical parameters was seen in the NR group (NYHA: 3±0.6 vs. 3±0.7; p=0.6; 6-MWT:350±269 vs. 343±261m p=0.8). In correlation with severity of HF and impaired PC early responding pts showed significantly higher MPO levels at baseline than the NR group (534.8±375.8 vs. 281.4±326.6, p=0.03). Even higher baseline MPO levels were seen in LR pts as compared to ER (1007.8±283.7 vs. 534.8±375.8ng/ml, p=0.02) assuming pronounced HF.
Conclusions: Plasma MPO levels at baseline may distinguish CRT responders from non-responders prior to implantation. To determine MPO cut-off values and compare MPO with known clinical predictors of CRT response further studies are required.

PO06-50

RENAL SYMPATHETIC DENERVATION DECREASES SYMPATHETIC NERVE ACTIVITY IN AMBULATORY DOGS WITH MYOCARDIAL INFARCTION

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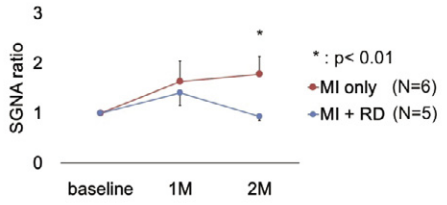
Introduction: Myocardial infarction (MI) is followed by significantly increased sympathetic tone which may contribute to the post-MI arrhythmia and sudden death. We hypothesize that renal sympathetic denervation (RD) can prevent MI-induced elevation of sympathetic tone in ambulatory dogs.
Methods: We recorded left stellate ganglion nerve activity (SGNA), subcutaneous nerve activity (SCNA) and electrocardiogram using implanted radiotransmitters in 11 dogs with MI induced by coronary artery ligation or balloon inflation. Six of 11 dogs underwent catheter based RD one month (1M) after MI (MI+RD group) while the other 5 had MI only. All dogs were monitored for 2 months (2M). The nerve activities were integrated every min to generate 24-hr integrated SGNA and SCNA at baseline, 1M and 2M after MI. The ratios between integrated nerve activity after MI and that of baseline were calculated.
Results: Figure shows increased SGNA ratio after MI in all dogs at 1M. At 2M, the ratio was 1.78 (95% confidence interval, CI, 1.34-2.22) in MI-only group (red), significantly (p=0.004) higher than that of the MI+RD group (blue) (0.94, CI, 0.86-1.02). The ratio between SCNA at 2M and that at baseline was 3.06 (CI, -1.54-7.66) in MI only group, significantly (p=0.009) higher than that for the MI+RD group (0.92, CI, 0.81-1.02). The ratio of RR interval at 2M and RR interval at baseline was significantly (p=0.030) shorter in MI only group (1.14, CI, 0.98-1.29) than MI+RD group (1.31; CI, 1.20-1.43).
Conclusions: There was a significantly increased sympathetic outflow including both SGNA and SCNA 2M after MI in ambulatory dogs. The heightened sympathetic tone can be prevented by bilateral RD.



PO06-51

CATHETER ABLATION FOR MANAGEMENT OF VENTRICULAR TACHYCARDIA IN PATIENTS ON LEFT VENTRICULAR ASSIST DEVICE SUPPORT

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Introduction: Ventricular tachyarrhythmias (VT) are common among the patients(pts) with left ventricular assist devices (LVAD). We report our experience with catheter ablation for the management of VT in LVAD pts.
Methods: All pts with surgically-implanted LVADs (HeartMate II and HeartWare) who underwent VT ablation at our center were included.
Results: A total of 137 pts received LVADs at our center between 10/2012 and 10/2015. Among these pts, 9 (8 males, mean age of 58.2 years, 8 HeartMate II and one HeartWare) underwent an EP study and ablation procedures for VT.The underlying cardiomyopathy pathogenesis were ischemic in 6 and non-ischemic in 3 pts. All pts had previously failed median of 2 (range 1-3) antiarrhythmic medications.The ablation procedures were done after LVAD implant (median 207 days, range 4 days- 4.8 years). Electroanatomic mapping of all pts demonstrated reentrant VT related to intrinsic scar in 4 and the apical inflow cannula site in 5 tachycardias.Immediate catheter ablation success was all the pts (100 %). 2 pts had epicardial focus.The pts had a median follow-up of 6 months. Seven(78%) pts had no recurrence of sustained VTs at one month follow up. Three pts underwent heart transplantation.One patient required total artificial heart placement for severe refractory VT despite ablation.
Conclusions: Catheter-based ablation is an effective treatment option for VT management in LVAD patients. The major complication incidence is low. Although, the myocardial scar is the major factor, the peri-cannula scar is a significant contributor to VT burden in this population.

PO06-52

PERMANENT HIS BUNDLE PACING IMPROVES CLINICAL OUTCOMES IN HEART FAILURE PATIENTS WITH ATRIOVENTRICULAR NODE ABLATION FOR ATRIAL FIBRILLATION

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Introduction: His bundle pacing (HBP) utilizes the intact His-Purkinje system to achieve synchronous ventricular activation. This study evaluated clinical outcomes of permanent HBP in patients who underwent atrioventricular node (AVN) ablation to relieve heart failure symptoms caused by atrial fibrillation (AF).
Methods: The study enrolled 52 consecutive patients with frequent heart failure symptoms and hospitalizations due to persistent/chronic AF that was refractory to pharmacological therapy. All patients underwent AVN ablation and received permanent pacing. Acute HBP was attempted in all 52 patients, of whom 42 patients (80.8%) received permanent HBP with a backup right ventricular pacing lead or backup bi-ventricular pacing leads. The remaining 10 patients did not receive permanent HBP due to implantation failure of HBP or incomplete AVN ablation. Patients' echocardiographic left ventricular end-diastolic dimension (LVEDd) and left ventricular ejection fraction (LVEF), NYHA classification, hospitalizations, and use of diuretics for heart failure were assessed during follow-up visits after permanent HBP. Comparisons were made between baseline (within 1 year prior to HBP) and at 1-year or last follow-up visit.
Results: After permanent HBP in 42 patients with a mean follow-up interval of 19±9 months (median 18), LVEDd decreased to 50.6±4.7 mm from baseline 55.8±8.0 mm (P <0.001) while LVEF increased to 60.1±8.8% from the baseline 44.9±14.4% (P <0.001). NYHA classification reduced to 1.4±0.5 from the baseline 2.8±0.6 (P <0.001). All 42 patients experienced hospitalization for heart failure decompensation 1 year prior to permanent HBP, while only 2 of these 42 patients were hospitalized for heart failure treatment during the follow-up period after permanent HBP. The number of patients who used diuretics for heart failure management decreased from 38 (90.5%) at baseline to 23 (54.8%) after permanent HBP (P <0.01 for the reduction). Of these 23 patients, 18 patients took diuretics at lowered doses.
Conclusions: Permanent HBP was significantly associated with improved clinical and echocardiographic outcomes in heart failure patients who underwent AVN ablation for symptomatic AF.

PO06-53

INCIDENCE OF VENTRICULAR TACHYARRHYTHMIAS IN PATIENTS WITH ISCHEMIC CARDIOMYOPATHY RECEIVING STEM CELL HOMING THERAPY

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Introduction: The recently published STOP-HF trial enrolled patients with symptomatic heart failure due to ischemic cardiomyopathy (LVEF ≤40%) to receive an endocardial injection of a plasmid encoding SDF-1, a factor known to attract stem cells to the myocardium to improve cardiac function. Patients demonstrated a clinically relevant increase in LVEF and decrease in LV end systolic volume in response to high-dose SDF-1. Controversy exists in the stem cell field as to whether poor electro-mechanical coupling of newly recruited stem cells could lead to arrhythmogenesis. We therefore hypothesized that patients in the STOP-HF trial would have no increased arrhythmias compared to placebo.
Methods: STOP HF enrolled 93 patients and randomized them to placebo (n=31); SDF-1 encoding DNA plasmid 15mg (n=32); and 30mg (n=30). All patients had an ICD. For this sub-study, in addition to baseline clinical variables, we collected ECG parameters (PR, QRS, and QTc interval) and arrhythmic events, measured by appropriate ICD-delivered therapy (anti-tachycardia pacing or shock), at baseline, 4 months, and 12 months of follow up.
Results: Baseline mean age was 65±9 years and mean LVEF was 28±7% in the entire population. There was a trend towards

improvement in LVEF at 12 months in the 30 mg cohort. In the placebo group, 7 patients (22%) had an arrhythmic event in follow up, with 2 patients receiving multiple therapies (>2) and with a mean time to an arrhythmia of 248 days. In the SDF-1 15mg group, only 3 patients (9%) had an event and no patient had multiple shocks; the mean time to an arrhythmia was 279 days. In the SDF-1 30 mg group, 8 patients (27%) had an event and 3 patients had multiple shocks; the mean time to an arrhythmia was 145 days. Upon review of the electrocardiograms, there were no significant changes in PR, QRS, and QTc intervals in all three groups at 12 months compared to baseline.
Conclusions: In this sub-study of the STOP-HF trial, we demonstrate that ventricular tachyarrhythmias are not increased in patients receiving therapy that attracts stem cells to the myocardium. Though the LVEF clinically improved, especially in the 30mg cohort, further studies are needed to determine whether improvements in LVEF to >35% will lead to a decrease in arrhythmogenesis.

PO06-54

REFINED HEART FAILURE DETECTION ALGORITHM FOR IMPROVED CLINICAL RELIABILITY OF OPTIVOL ALERTS

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Introduction: The reliability of monitoring intrathoracic impedance (OptiVol) as a marker of worsening heart failure (HF) by implantable cardiac devices are controversial. Despite using additional device-based parameters described in the PARTNERS HF study, such as new onset of atrial or ventricular arrhythmias, abnormal autonomics, biventricular pacing rate or patient activity levels, the number of false positive alerts remains remarkably high.
Methods: From April 2011 to June 2014 we prospectively enrolled all patients who were implanted with an OptiVol capable CRT-D device in this present observational study. In case of remote OptiVol alerts patients were interviewed for the presence of HF symptoms via telephone calls and/or were seen during additional outpatient visits, if necessary. A new device algorithm was derived from the original PARTNERS HF criteria considering also minor changes and change pattern of these above cited parameters.
Results: During an average follow-up period of 38±24 months 722 remote transmissions were received from 42 enrolled patients of which 128 transmissions were with OptiVol alerts (Fluid index ≥ 60 Ohms). From 128 OptiVol alerts, 32 corresponded to true HF events. Upon multivariate discriminant analysis, the parameters of low patient activity, high night heart rate, and low CRT pacing (<90%) proved to be independent predictors of true HF events (all p<0.001). Using these three refined criteria in the new detection algorithm, the diagnostic yield of OptiVol was improved by increasing specificity from 38% to 87%, positive predictive value from 34 to 70% and AUC (ROC) from 0,79 to 0.92, without a relevant loss in sensitivity (97% vs. 94%).
Conclusions: Refined device diagnostic algorithm based on the parameters of low activity level, high night heart rate, and suboptimal biventricular pacing can improve the clinical reliability of OptiVol alerts.

PO06-55

CARDIAC PHENOTYPE AND PROGNOSIS OF PATIENTS WITH MUTATIONS IN NKX2.5 GENE

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Introduction: Mutations in NKx2.5 gene are a cause of familial forms of atrial septal defect (ASD) associated with atrioventricular conduction disturbances and unexplained sudden death (SD) but cardiac phenotype has not been described in a large population of patients with NkX2.5 mutations.
Methods: all successive patients with mutations in NKx2.5 gene diagnosed in France were included.
Results: 48 pts carried NkX2.5 gene mutations (24 men, median 24 yo, 0 to 69) (18 unrelated families, median 3 mutated subjects/family). There was an history of SD in 8 and of pace-maker implantation in 5 families. ASD (ostium secundum) was present in 36 (75%) (surgically corrected in 26 and percutaneously in 3) and ventricular septal defect (VSD) in 10 (21%). Conduction disturbances were observed in 40 (90%). 22 pts developped complete or high degree permanent or paroxysmal AV block. Available ECGs showed a mean heart rate of 78±19 bpm, with a PR interval of 232±55 ms, a QRS duration of 88±15 ms and a QTc of 461±61 ms. Electrophysiological study was erformed in 16 pts (AH interval 182±66 ms, increased AH interval in all but two cases, HV 49±23 ms, 3 patients with HV interval > 55 ms). A pace-maker was implanted in 20 pts (42%) (with ICD in 5) and a loop recorder in one. Sustained or nonsustained ventricular tachycardia were observed in 8 pts. Mean ventricular pacing % was 79±37. Eight pts were dependent of the pace-maker. Three patients deceased over the follow-up (1 SD, 1 meningitis and 1 endocarditis). 12 pts developed paroxysmal or permanent supraventricular arrhythmias (mainly atrial fibrillation). Two pts displayed dilated cardiomyopathy, 4 had left ventricular (LV) hypertrophy and 5 with features of noncompacted LV. LV ejection fraction was normal in 42 pts.
Conclusions: carriers of NkX2.5 gene mutations harbor a rich phenotype associating most of the time ASD and/or VSD together with evolutive AV block leading to pace-maker/ICD implantation in a significant part of them. Associated LV cardiomyopathy is less frequent but ventricular arrhythmias appear common and SD may happen.

PO06-56

EVEN PORE-LOCALIZING, HIGHLY CONSERVED MISSENSE VARIANTS IN KCNQ1-ENCODED KV7.1 CHANNELS MAY BE WILD TYPE VARIANTS RATHER THAN TYPE 1 LONG QT SYNDROME CAUSING MUTATIONS: DO NOT RELY SOLELY ON THE GENETIC TEST COMPANY'S INTERPRETATION

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Introduction: Type 1 long QT syndrome (LQT1) is the most common hereditary form of LQTS and is caused by mutations in the KCNQ1-encoded Kv7.1 potassium channel pore-forming alpha subunit. Mutations localizing to Kv7.1's transmembrane

have > 90% probability of being pathogenic. Here, we characterized functionally a KCNQ1 variant that was interpreted by the genetic test company as a "disease-causing mutation" and was identified in a family with insufficient clinical evidence for LQTS.
Methods: The family sought a second opinion evaluation following the observation of a family member with a "borderline QT interval" and a "positive" genetic test report which identified a "predicted deleterious" rare A300S-KCNQ1 mutation localizing to Kv7.1's S5/pore domain. The A300S-KCNQ1 variant was engineered using site-directed mutagenesis. Whole cell patch clamp technique was used to characterize functionally the KCNQ1 wild type (WT) or mutant channel co-expressed with KCNE1 in TSA201 cell lines.
Results: The proband was a 17-year-old female with only a vasovagal episode of syncope but never a clear LQTS-attributable cardiac event. Her treadmill stress test and epinephrine QT stress test were both normal without any QT reaction to suggest LQT1. Her two A300S-positive sisters were both asymptomatic and without electrocardiographic evidence for LQTS. Both parents also had normal ECGs and the family history is unremarkable. The whole cell patch clamp functional studies revealed no significant difference in current density at +80 mV between KCNQ1-A300S (629.4±135.5 pA/pF, n=14) and KCNQ1-WT channel (608.4±100.3 pA/pF, n=14, p=NS).
Conclusions: Here, in vitro functional studies facilitated the re-classification of a rare, "predicted deleterious mutation" as being a non-pathogenic variant. This finding suggests that even KCNQ1 mutations residing within areas of high probability for pathogenicity (i.e. transmembrane spanning or pore forming regions) or indicated by a genetic test company as "deleterious" should be interpreted with caution especially when there is insufficient clinical evidence to justify the consideration of LQTS in the first place.

PO06-57

SYMPTOMATIC LQT3 PATIENTS REMAIN AT RISK OF SERIOUS EVENTS DESPITE TREATMENT

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Introduction: Type 3 Long QT Syndrome (LQT3) represents 5-10% of genotype positive LQTS. Natural history and risk stratification data are scares in this rare condition.
Methods: Patients from our 2 reference centers with a pathogenic mutation in SCN5A for LQT3 were included and prospectively followed after initial diagnosis. Patients were divided according to the symptomatic status before diagnosis. Treatment was let at the appreciation of the physicians in charge of the follow-up. Documented VT/VF or Torsade de Pointes, aborted cardiac arrest and sudden death were considered as serious events.
Results: Our LQT3 cohort includes 133 patients from 49 families (mean age = 28±21 years, 47% females, 36.8% probands). Median follow-up was 6 years (IQR 9). At the time of diagnosis, 33/133 (24.8%) of patients were symptomatic (mean age = 22±22 years) (syncope n=18, serious events n=12 and atrio-ventricular block n=3). Subsequent treatment consisted in beta blockers in 21cases (63.6%), ICD in 9 cases (27.3%) and a pacemaker in 4 cases (12.1%). During the follow-up (28/33), 25% (7/28) of symptomatic patients experienced serious events (4 deaths and 3 documented ventricular arrhythmias) and 14.3% (4/28) had syncope. Among the 99 asymptomatic patients at diagnosis (mean age 30±21 years, p=0.08 vs. symptomatic patients), beta blockers were initiated in 27.3% and ICD implanted in 4%. During the follow-up, 3 out of 87 asymptomatic patients (3.4%) had events (1 syncope, 2 torsade de pointes). Patients with symptoms before diagnosis had a higher risk of events (OR=17.5 95%CI 4.1; 107.9) and serious events (OR=13.7 95%CI 2.4; 144.7) during follow-up.
Conclusions: Despite treatment, 25% of LQT3 patients with symptoms before diagnosis presented serious events during follow-up. Oppositely, patients without symptoms before diagnosis mainly remained asymptomatic.

PO06-58

SPORTS ORGANIZATION/SCHOOL/UNIVERSITY DETERMINED FATE OF ATHLETES WITH GENETIC HEART DISEASE WHO RECEIVED PHYSICIAN SUPPORT FOR RETURN TO PLAY AFTER THEIR SHARED DECISION MAKING EVALUATION

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Introduction: Since 1995, expert guidelines have recommended disqualification from most competitive sports for athletes with a variety of genetic heart diseases (GHDs). More recently, it was demonstrated that LQTS athletes who remained competitive after shared decision making reported rare cardiac events, prompting more recent guidelines to embrace this approach. As part of the comprehensive sudden death safety net strategy, overt disclosure to the athlete's school/university is required with the understanding that the host institution could deny the athlete's return to play (RTP). Here, we analyze the frequency of and reasons for RTP denials.
Methods: Records of all athletes evaluated at our Genetic Heart Rhythm Clinic from 7/2000 - 12/2015 were reviewed.
Results: Overall, 246 athletes (mean age at evaluation; 18±7

years) were seen including 201 with LQTS and 34 with CPVT. Following their evaluation, 46 (19%) chose to quit sports. Of the 200 remaining athletes, 71 (36%) were competitive pre-high school, and 40 (20%) were high school, 23 (11%) college, and 2 (1%) professional athletes. After establishing their comprehensive treatment program, 4 athletes (2%) had a cardiac event compared to 1 patient among those who ceased athletic activity (2.2%, p=1.0). Of the 25 post-high school competitive athletes, 72% had been disqualified previously and were seeking a reversal in the decision. Following evaluation, all athletes elected to RTP. Despite our support to RTP, 4 athletes (16%; 1 professional/3 collegiate) were disqualified by their team and/or university. Reasons cited for the RTP denial included the Bethesda Conference Guidelines, potential liability, and media exposure concerns.
Conclusions: The majority of athletes with GHDs who receive support for a RTP are indeed able to resume their competitive sport. However, beyond high school, nearly one out of every five athletes is denied return to sport.

PO06-59

TRANSESOPHAGEAL USE OF THE CARTOSOUND® SOUNDSTAR® CATHETER DURING PEDIATRIC ELECTROPHYSIOLOGY STUDIES AND CATHETER ABLATION

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Introduction: Electroanatomic mapping (EAM) during arrhythmia ablation has decreased radiation dose in electrophysiology studies (EPS). Intra-cardiac echocardiography (ICE) probes paired with EAM catheters have expanded the ability to create a comprehensive map of the cardiac anatomy. However, the sheath size required for ICE catheter placement is often prohibitive for young patients. Use of the SOUNDSTAR® ICE catheter via the esophagus is an alternative to the standard transvenous approach. 3D anatomic creation of cardiac geometry using transesophageal echocardiography (TEE) with a SOUNDSTAR® ICE catheter is feasible with low risk of complication.
Methods: Analysis of pediatric patients who underwent TEE utilizing the SOUNDSTAR® ICE catheter prior to the EPS. A 3D anatomic map was created in a single plane view from the TEE images and was used as a guide during EAM and catheter ablation. Patient demographic data and procedural outcomes were recorded including: fluoroscopy time (min), dose area product (DAP; cGy*cm2), ablation success and complications.
Results: Twelve patients were included, median age 2.8 (0.1 to 10) years, BSA 0.59 (0.24 to 1.1) m2. Ten patients had congenital heart disease (6 single ventricle physiology, 3 Ebstein's, 1 AV canal) of which 6 had previous cardiac surgery. One patient was in incessant tachycardia and another was on ECMO at the time of the EPS. Two patients underwent EPS for diagnostic purposes only. Of the 10 patients who underwent catheter ablation, the arrhythmia substrate was AVRT/accessory pathway (n=10), atrial tachycardia (n=3) and twin AV nodal tachycardia (n=2). Radiofrequency ablation was successful 12 of the 15 (80%) arrhythmia substrates. Median fluoroscopy time 1.3 (0 to 7.3) min and median DAP 6.6 (0 to 349) cGy*cm2. Five patients had fluoroless ablations. No complications were noted.
Conclusions: The creation of 3D ultrasound anatomic map by TEE is feasible in pediatric patients where transvenous sheath placement of the ICE catheter would otherwise be ill-advised. Cardiac anatomy can be identified clearly by TEE, which is beneficial in patients with congenital heart disease. Combined use of TEE imaging with EAM in pediatric EPS with catheter ablation is an effective strategy for reducing radiation dose.

PO06-60

ICD PROGRAMMING PARAMETERS AND ASSOCIATIONS WITH SHOCKS IN PEDIATRIC PATIENTS IN 9 PEDIATRIC HEART NETWORK SITES

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Introduction: Shocks are an important source of morbidity for pediatric patients (pts) with ICDs and may result in anxiety and post-traumatic stress disorder, especially in cases of inappropriate therapy. Despite the use of ICDs in children for over 20 years, there are limited studies on programming practices and their association with shocks in this population.
Methods: Pts who were <19 years of age at ICD placement who had an ICD placed after 7/01/08 at one of the 9 core Pediatric Heart Network (PHN) sites. Those with ICD <6 months were excluded. Demographics, ICD device details, programming parameters, and shock event data were collected. Arrhythmia at the time of shock was adjudicated by 2 electrophysiologists. Continuous variables were reported as mean (standard deviation). Analyses included two independent sample t test, Chi-square test, and Fisher's exact test.
Results: A total of 373 pts met inclusion criteria. Mean age at implant was 13.1 ± 3.8 years. In the 105/373 patients who received shocks, 38 (27%) had primary arrhythmia syndromes, 58 (31%) had cardiomyopathy, and 19 (26%) had congenital heart disease. There were 174 shocks over 930 years of total follow up. The mean value for the minimum detection rate for ventricular fibrillation zone was 219.4 ± 16.8, and there was no significant difference between pts who had received shocks and pts who did not.
Conclusions: There were no significant differences in age, indication for ICD, or diagnosis when comparing pts with shocks and without shocks. More data are needed to identify predictors of inappropriate shocks and appropriate shocks.

Patient Characteristics				
	All patients	Patients with shocks	Patients without shocks	p-value
Total number of patients, n (%)	373	105 (28.2)	268 (71.8)	
Age at initial implant, years Mean (SD)	13.1 (3.8)	13.2 (3.7)	13.0 (3.9)	0.72
Indication for ICD n (%) Primary prevention Secondary prevention	227 (60.9) 141 (37.8)	71 (67.6) 35 (33.3)	156 (58.2) 106 (39.6)	0.09 0.27

Number of pts with diagnosis category Primary arrhythmia syndrome Cardiomyopathy Congenital heart disease	140 (37.6) 190 (50.9) 74 (19.8)	38 (36.2) 58 (55.2) 19 (18.1)	102 (38.1) 132 (49.3) 55 (20.5)	0.74 0.30 0.60
Number of patients with arrhythmia diagnosis SVT VT VF	10 (2.7) 160 (42.9) 111 (30)	1 (1.0) 49 (46.7) 35 (33.3)	9 (3.4) 111 (41.4) 76 (28.4)	0.29 0.36 0.34

PO06-61

THE "HIDDEN" LEFT SIDED ACCESSORY PATHWAY: AN UNCOMMON CAUSE OF SVT IN YOUNG PEOPLE

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Introduction: Concealed left sided accessory pathways (CLAP) are a common cause of SVT in the young. Most can be demonstrated and then mapped with RV apical/outflow pacing. Rarely, however, they cannot and alternative means of mapping and ablating these CLAPs is required. We review our combined experience from 3 pediatric EP centers with this rare form of "hidden" CLAP.
Methods: All pts < 21 years undergoing EP study from 2006-2014 from 3 centers who were identified to have a "hidden" CLAP were included. A "hidden" CLAP was defined as an AP for which RV pacing at CL's stable for mapping did not demonstrate eccentric retrograde conduction. Exclusion criteria: pre-excitation. Demographic, procedural, and follow-up data were collected.
Results: 20 pts met inclusion criteria [median age 15.5 yrs (range 7-21), weight 58 kg (range 31-98.6)]. 19 (95%) had prior documented SVT and 1 had AFIB (5%). APs were adenosine-sensitive in 7 patients (35%) and VA conduction was decremental in 4 (20%). Standard RV pacing failed to demonstrate the CLAP in all patients. CLAP conduction was demonstrable with orthodromic reentrant tachycardia in all patients, with RV extrastimulus testing in 7 (35%) and with rapid RV pacing (< CL 300) in 2 (11%). Retrograde LV pacing demonstrated CLAP conduction in all 15 patients in whom the maneuver was used. All 20 pts were acutely successfully ablated via transseptal approach with radiofrequency energy. Specific ablation techniques included: 15 (75%) during LV paced rhythm, 4 (20%) during ORT (3/4 ventricular entrained) and 1 (5%) with brief rapid RV pacing. 3 patients required LV pacing for ablation because the patient was unstable with rapid RV pacing or ORT. All CLAP's were lateral with specific locations including: 12 (60%) straight left lateral, 4 (20%) left anterolateral ("4'o'clock"). There were no ablation related complications. At median follow-up of 18 mo (range 3-96) there was 1 recurrence (5%).
Conclusions: Some CLAPs are more "hidden" than others and maneuvers such as LV pacing, entrained ORT or rapid RV pacing may be required to map them. LV pacing, in particular, facilitated preferential AP conduction, allowing for precise mapping while maintaining stable hemodynamics and catheter position.

PO06-62

PERCUTANEOUS PULMONARY VALVE IMPLANTATION-ASSOCIATED VENTRICULAR TACHYCARDIA IN CONGENITAL HEART DISEASE

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Introduction: Percutaneous pulmonary valve implantation (PPVI) is used to relieve obstruction and/or regurgitation and RV dysfunction in patients with dysfunctional right ventricular outflow tracts (RVOT). PPVI is not known to induce arrhythmias. This study is the first to report on the incidence of ventricular tachycardia (VT) acutely after PPVI.
Methods: This is a single center, retrospective review of all patients undergoing PPVI between 2010 and 2015. All patients were admitted on telemetry post-procedure. Patients with newly detected VT within 24 hours post-PPVI and no prior history of VT were considered to have VT related to PPVI.
Results: In total, 79 patients (mean age 17 ± 9 years, 66% tetralogy of Fallot/pulmonary atresia) had PPVI. New-onset VT was detected in 6 patients (8%) within 24 hours after PPVI. These patients had significantly lower BMI (18 ± 2 vs. 23 ± 7, p = 0.04) compared to non-VT patients. There was no difference between the 2 groups in terms of age, native conduit or percutaneous valve size, or change in the minimum diameter of the RVOT from pre- to post-PPVI. The VT group (n = 6) had a range of 1 to 21 runs of non-sustained, monomorphic VT at rates of 110-170 (average 140 bpm). One patient had a subsequent EP study, which mapped VT to the RVOT. Five patients were started on beta-blockers (BB) and 1 was observed off medication. All 6 patients had subsequent normal Holters. Four of the patients successfully weaned off BB with no recurrence of VT. The median follow-up time for the VT group was 2 years. No patients required surgical removal of the implanted valve. Of the 36 patients with an available Holter prior to PPVI only 4 had documented VT. Of the 79 PPVI patients, 14 were on BB for anti-arrhythmic or remodeling effects prior to PPVI and none of these patients had acute VT post-PPVI. The protective effect of BB on the development of acute VT post-PPVI was not found to be statistically significant (OR 0.32, p = 0.4).
Conclusions: This is the first study to report on the acute occurrence of VT after PPVI. New-onset, non-sustained VT in the immediate post-PPVI period appears to be a transient phenomenon that is not associated with long-term development of VT. Close monitoring for arrhythmias in the post-PPVI period should be considered.

PO06-64

DOES THE INFORMATION PROVIDED FOR PATIENTS PRIOR TO CONSENT FOR DEVICE IMPLANTATION INFORM APPROPRIATELY?

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Introduction: In the UK, the General Medical Council, which regulates medical practice, recommends that patients be given information about the potential benefits, risks and burdens of treatment options verbally, maybe with supporting written information before they consent to treatment. The scope of decisions must be explained if the treatment is provided in stages, with the possibility that changes or adjustments will be needed. Permanent pacemaker (PPM), cardiac resynchronization therapy (CRT) and defibrillator (ICD) implantation are usually lifelong treatments, and are examples

of treatments provided in stages. This study was designed to assess the quality of information leaflets provided to these patients in relation to long term adjustments, which may be required after initial implantation.
Methods: 84 leaflets were identified using an internet search engine: 47 related to PPM, 22 to ICD and 15 to CRT. Information within them relating to risk was assessed.
Results: Overall risk was mentioned in 44/84 (52%), mainly in qualitative terms. 3 PPM leaflets gave a figure: 1, 1-2 and 6%, compared with 7-10 and 12.4% reported in studies; 3 ICD leaflets gave a figure: 1, 7 and 11% compared with 14%, and 1 CRT leaflet quoted 13% compared with 18%. Figures were more often given for individual complications: 10 (32%) PPM, 6 (50%) ICD and 3 (33%) CRT leaflets gave rates for lead displacement. Longer term complications were rarely mentioned. The potential need for generator change was mentioned in 16 (34%) PPM, 13 (59%) ICD and 7 (47%) CRT leaflets. Estimates of generator longevity were given in 31 (37%) and varied between several and 4 - 10 years. 2 additional leaflets specifically related to generator change were identified; risks were described as small and 9%, compared with 6 and 15% (with lead revision) in the Danish Registry.
Conclusions: Only half the patient information leaflets examined mention risk of device implantation. It is quantified in a minority, and probably underestimated. While risks of individual complications are more often mentioned, these are seldom summed to give a numerical overall risk. Longer term risks are rarely mentioned, and the need for generator change was noted in less than half, with no discussion of risk.

PO06-65

REDUCTION OF PRRX1 PREVENTS DEVELOPMENT OF ATRIAL FIBRILLATION

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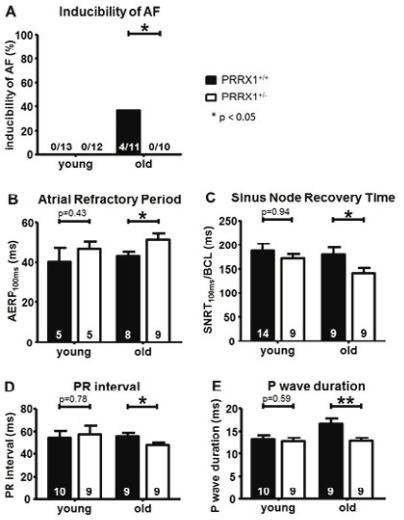
Introduction: Atrial Fibrillation (AF) is the most common arrhythmia worldwide. Genome-wide association studies linked the susceptibility for AF to the PRRX1 locus. To evaluate the functional role of PRRX1 in AF we characterized young (mean age 73±1.9 days) and old (mean age 352±46.8 days) PRRX1 heterozygote knockout mice by echocardiography, ECG, telemetry, and invasive EP studies.
Methods: N/A
Results: In young mice we found no differences between PRRX1 heterozygous (het, +/-) and wildtype (wt, +/+) mice. However, in old wt mice, AF inducibility was significantly increased (4/11 vs. 0/10, p<0.05, fig.1A). Echocardiography did not show any differences. ECG analysis of wt mice revealed a significant prolongation of the P wave duration (16.7±1.1 vs. 12.8±0.7, p<0.01, fig.1D), that is known to develop with age. This finding was also confirmed by telemetry analysis. Het mice showed a significant shortening of the PR interval in the ECG (55.9±3.3 vs. 47.7±2.0, p<0.05, fig.1E) but not during telemetry recordings. Performing invasive EP studies we could identify a significant shortening of the sinus node recovery time (179.4±14.4 vs. 141.4±9.9, p<0.05, fig.1C) and a significant prolongation of the atrial effective refractory period (43.3±2.0 vs. 51.6±3.1, p<0.05, fig.1B), both at a 100 ms cycle length in het mice. No differences were observed in the ventricular ECG or EP study between wt or het mice at different ages.
Conclusions: In summary, a heterozygote KO of PRRX1 prevents age-related changes in electrical conduction properties and reduces the risk for development of AF in mice. PRRX1 may therefore be an important proarrhythmogenic factor in AF pathophysiology.



PO06-66

A FUNCTIONAL ROLE FOR HEART-DERIVED EXTRACELLULAR VESICLES IN HEART FAILURE ASSOCIATED ELECTRICAL REMODELING

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Introduction: Extracellular vesicles (EVs) and their microRNA (miRNA) cargo can function as mediators of intercellular communication. We previously identified miRNAs associated with left ventricular (LV) remodeling in heart failure (HF). We compare characteristics and function of cardiac-enriched EVs in HF patients vs. healthy controls.
Methods: Coronary sinus blood was collected from patients undergoing EP study for SVT (controls) or implantation of CRT for systolic HF. Cell-free plasma was analyzed by small particle flow cytometry (Beckman Coulter MoFlo Astrios EQ) to determine size and scatter properties of EVs. EVs were isolated from plasma by Optiprep density gradient, and the expression of miRNAs associated with LV remodeling assessed by qRT-PCR. The functionality of EVs was tested by addition to human induced-pluripotent stem cells derived cardiomyocytes infected with lentiviral vector carrying ArcLight, a genetically engineered voltage indicator. Action potentials (AP) were obtained through ArcLight fluorescence imaging and analyzed at 80% repolarization.
Results: Controls (n=6) were younger (age 54±5.4 vs. 72±5.1, p=0.03) and had higher LVEF (63±5% vs. 25±3%, p=0.0003) compared to HF patients (n=7). EV profiles in HF patients demonstrated an increase in the geometric mean value of side scatter vs. controls, indicative of increased EV size (SVT, 1.02 ± 0.19 gMFI; HF, 1.39 ± 0.06 gMFI). Addition of EVs from HF to human embryonic stem cell-derived cardiomyocytes produced a 34% increase in APD80 at 24 hrs (p<0.0001), with no

change following addition of control EVs. Increases in miRNAs previously associated with HF were observed in the EV fraction from HF vs. controls, including miR-151a, miR-30d, and miR-660 (2.6, 1.8, and 3.9 fold increase). In silico target prediction (TargetScan, MIRDB) produced several mRNA targets, including KCNJ10, MAPK11, KCNJ12, and KCMB2 that may be involved in electrical remodeling. Suppression of these is a potential mechanism for the observed prolongation of AP within cardiomyocytes.
Conclusions: EV profiles and miRNA contents differ in controls vs. HF patients, whose EVs may mediate cellular electrical remodeling. EVs and their contents may reflect a novel paracrine signaling mechanism and therapeutic target in HF.

PO06-67

CRITICAL ROLE OF STRESS SIGNALING JNK1 ISOFORM IN SUPPRESSING CONNEXIN43 IN THE OBESE HEART

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Introduction: Emerging evidence suggests an important role of stress-activated kinase JNK in modulating gap junction Cx43 (cell-cell communication channel) and action potential propagation. It is known that JNK is crucial in the development of obesity-related insulin resistance (IR). Whether this JNK-Cx43 relationship exists in the obese heart remains unclear.
Methods: We used C57BL/6J mice fed a high-fat diet (60%, 22-27 weeks), which induced obesity (DIO) and IR but normal cardiac function were retained. Functional effects of JNK1 & JNK2 isoforms on Cx43 expression were assessed by qPCR, immunoblotting, enzyme activity assays, and optical mapping in cardiac-specific inducible MKK7D-JNK2KO+/- mice (with robustly activated JNK but JNK2 knocked down) and a lipid-induced IR cellular model induced by palmitate and insulin (PA-Ins, 24hrs) in HL-1 myocytes.
Results: DIO mouse left ventricles (LV) showed enhanced JNK activation (by 70%) along with 30% reduction in Cx43 proteins vs. sham controls, while activation of other MAPKs p38 and ERK1/2 were unchanged. Interestingly, we found that total JNK1 protein was up-regulated by 11%, while JNK2 was reduced by 23% in DIO LV. MKK7D-JNK2KO+/- LV (mimicking the JNK profile of DIO) showed a similar Cx43 reduction as that of DIO LV. Furthermore, PA-Ins-treated myocytes exhibited reduced Cx43 by 41%, ~25% slowed conduction velocity, and ~1.5-fold increase in JNK activities. JNK inhibition using JNK specific inhibitor SP600125 inhibited JNK1 activity and completely rescued Cx43 proteins in PA-Ins-treated myocytes. However, JNK2 specific inhibition with a JNK2 inhibitor (JNK2I-IX) did not affect PA-Ins-enhanced JNK1 activity and Cx43 remained downregulated. These results suggest that JNK1 isoform is responsible for obesity-associated Cx43 suppression. In addition, we discovered that DIO-induced JNK activation also suppressed Cx43 mRNA (by 21%), while the activity of JNK downstream transcription factor AP-1 complex was reduced by 20% assessed by AP-1 luciferase activity in vitro assays.
Conclusions: We discovered specific action of JNK1 isoform in suppressed gap junction Cx43 expression in DIO hearts. Modulation of JNK1 activity could be a novel therapeutic approach to improve cell-cell communication in the obese heart.

PO06-69

DIRECT OBSERVATIONS OF THE MECHANISMS OF AF ROTOR TERMINATION BY ABLATION: BIOLOGICAL PHENOMENA AND COMPUTATIONAL STUDIES

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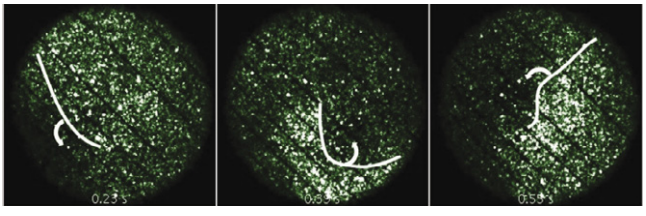
Introduction: Contradictory data exist as to the effectiveness and mechanisms of rotor termination by ablation in atrial fibrillation (AF). We investigated the effects of focal rotor ablation in two systems allowing direct observation of mechanisms: a novel atrial monolayer system exhibiting spontaneous fibrillation, and a computer model of AF.
Methods: The calcium activity of HL1 cardiomyocyte monolayers on multielectrode arrays was recorded. Functional cores of stable rotors were mechanically ablated under continuous visual monitoring. These experiments were replicated in a computational model of cardiac propagation.
Results: The HL1 system recapitulated features of clinical AF including focal activity, stable and wandering rotors, fibrillatory conduction, wavefront collision, and spontaneous termination. Spatially stable rotors were observed spontaneously in 57% of monolayers. Rotors could also be induced by electrical stimulation. Four unique mechanisms of functional rotor elimination were identified: 1) conversion to structural reentry, with longer periodicity allowing overdrive termination by other drivers, 2) block of a critical isthmus separating adjacent rotors of opposite chirality, 3) connection of rotor core to an external boundary, and 4) ectopic induction during ablation. All mechanisms were reproducible in the computational model.
Conclusions: In biologic and computational studies we demonstrated novel mechanisms by which focal ablation can terminate stationary rotors in atrial fibrillation.



PO06-70

REGIONAL ROS PRODUCED BY PARADOXICAL MUSCLE STRETCH INCREASES ARRHYTHMIA SUSCEPTIBILITY IN RAT MYOCARDIUM WITH NONUNIFORM CONTRACTION

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Introduction: Reactive oxygen species (ROS) produced by muscle stretch increases the frequency of Ca2+ sparks. In diseased hearts, impaired muscle is frequently distributed within the hearts and is paradoxically stretched by contractions of the more viable neighboring muscle, thereby representing nonuniform contraction. Using the myocardium with nonuniform

contraction, we investigated whether such paradoxical stretch regionally increases ROS production within the stretched region and increases arrhythmia susceptibility.
Methods: Trabeculae were dissected from rat hearts. Force and intracellular Ca2+ (Cai) were measured. To assess ROS production, 2',7'-dichlorofluorescein (DCF) fluorescence was measured. The difference (ΔDCF) between the DCF fluorescence in the absence and that in the presence of 3 μM diphenyleneiodonium (DPI), a NADPH oxidase inhibitor, was calculated along the long axis of trabeculae. Nonuniform contraction was produced by a jet of 10 μM blebbistatin. Ca2+ waves were induced by stimulation for 7.5 s (2.5 Hz, Cao 2 mM). Arrhythmias were induced by stimulation for 15 s (4 Hz, Cao 2 - 3 mM, 0.2 μM isoproterenol, 24°C).
Results: Global superfusion of trabeculae with 10 μM blebbistatin did not increase ΔDCF after electrical stimulation (4 Hz) for 30 s regardless of a substantial decrease in force ($n=8$, $p<0.01$). Regional superfusion with the jet of blebbistatin caused paradoxical stretch within the jet-exposed region during contraction and increased ΔDCF within the stretched region ($n=6$, $p<0.05$). In the myocardium representing nonuniform contraction, 3 μM DPI decreased the velocity of Ca2+ waves ($n=7$, $p<0.05$) and the number of triggered contractions after electrical stimulation, that is, arrhythmias ($n=5$, $p<0.05$). Conversely, regional superfusion with the jet of 0.2 mM H_2O_2 increased the velocity of Ca2+ waves ($n=6$, $p<0.05$) and the number of triggered contractions after electrical stimulation ($n=7$, $p<0.05$).
Conclusions: In the myocardium with nonuniform contraction, paradoxical muscle stretch during contraction increases ROS production within the stretched region, increases the velocity of Ca2+ waves, and thereby increases arrhythmia susceptibility.

PO06-71

MODELING ATRIAL FIBRILLATION USING HUMAN EMBRYONIC STEM CELLS

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Introduction: Current experimental models of Atrial Fibrillation (AF) have significant limitations which impact on our ability to understand and target its underlying pathophysiology. Human embryonic stem cells (hESCs) have demonstrated their robust ability to model cardiac electrophysiology in vitro, yet there have been a limited number of investigations into tissue based arrhythmias.
Methods: We have generated atrial- and ventricular-like cardiomyocytes (CMs) from hESCs using established differentiation protocols that employ Activin A and BMP4 followed by Wnt inhibition, and retinoic acid signaling for atrial specification.
Results: Differentiation protocols efficiently generated CMs (>80% positive for cardiac troponin). Whole-cell patch-clamp recordings of CMs generated from the atrial protocol revealed high proportions of CMs (>90%) with atrial action potential (AP) morphologies that had shorter AP duration at 30% repolarization (APD30) compared to the ventricular protocol ($p < 0.0001$).
In response to dofetilide, the atrial-like CMs demonstrated significant APD prolongation ($p<0.05$), predominantly affecting late repolarization(APD90). Recordings in voltage clamp revealed dofetilide-sensitive outward tail currents. Confluent cell sheets of atrial-like CMs were then generated and showed synchronized AP propagation. As a model of AF, stable rotors were induced and used for drug testing. Optical mapping was employed to generate activation, APD, and conduction velocity maps. Dofetilide converted the rotor in 10% of cases, while flecainide paradoxically increased the number of rotors in 30%. Dofetilide significantly prolonged the optically measured APD90 ($p < 0.01$) with a more significant effect on APD90 compared to APD30 ($p < 0.01$). Flecainide did not prolong early (APD30) or late (APD90) repolarization in the cell sheets. Flecainide caused a significant slowing of conduction velocity ($p<0.01$), with an average reduction of 40%.
Conclusions: We have employed hESCs to derive atrial-like CMs to generate an in vitro model that recapitulates many of the features of human atrial electrophysiology and human AF. We have tested and characterized the effects of two anti-arrhythmic agents on atrial-like rotors.

PO06-72

CELL- AND TISSUE-LEVEL CHANGES RESULTING FROM FIBROSIS NEED TO BE REPRESENTED IN PERSONALIZED ATRIAL MODELS TO CORRECTLY REPRODUCE CLINICAL OUTCOMES IN AF PATIENTS

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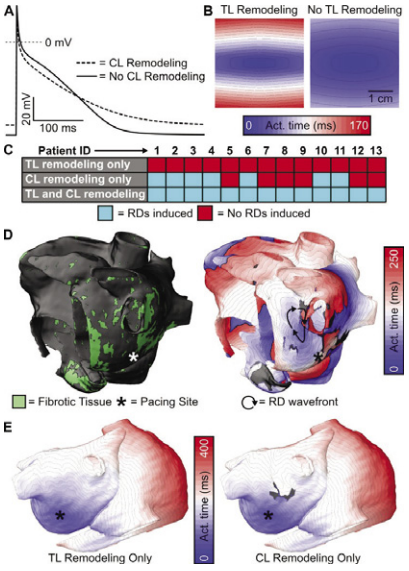
Introduction: Personalized atrial models are currently being used to reveal links between fibrosis distribution and AF reentrant drivers (RDs). However, there is no consensus on the appropriate approach for simulating fibrotic tissue so that models correctly reproduce clinical outcomes in patients. We hypothesized that both cell-level (CL) changes in excitability and refractoriness and tissue-level (TL) changes in conduction must be incorporated in fibrotic regions to appropriately represent the arrhythmogenic propensity of the AF substrate in patients.
Methods: Atrial models were built from LGE-MRI scans of 13 AF patients with clinically observed RDs. In LGE regions, CL remodeling (Fig A) due to elevated TGF-β1 was represented by decreasing key ionic currents (-50% IK1, -50% ICaL, -40% INa); TL remodeling (Fig B) due to replacement fibrosis and collagen deposition was represented by reduced intercellular coupling (-30%) and increased longitudinal-transverse anisotropy (+60%). In each model, pacing from 30 sites probed AF inducibility and RD presence under 3 remodeling conditions: TL only, CL only, and TL+CL.
Results: 1170 simulations were executed (Fig C). With only TL changes, no AF was induced. With CL changes only, AF with RDs was induced in 7 patients; in the remaining 6 patients, no AF was induced. For the case of TL+CL, AF with RDs was induced in all 13 patients. Figs D-E show an example where pacing from a particular site induced an RD in the TL+CL case (D) but no AF in the TL and CL only cases (E).



Conclusions: Personalized models should incorporate both CL and TL changes resulting from fibrosis in order to accurately capture the arrhythmogenic propensity of the AF substrate.

PO06-73

INTERACTIVE MYOCARDIAL SCAR VISUALIZATION ON A HOLOGRAPHIC DISPLAY FOR PLANNING THE DELIVERY OF CARDIAC RESYNCHRONIZATION THERAPY

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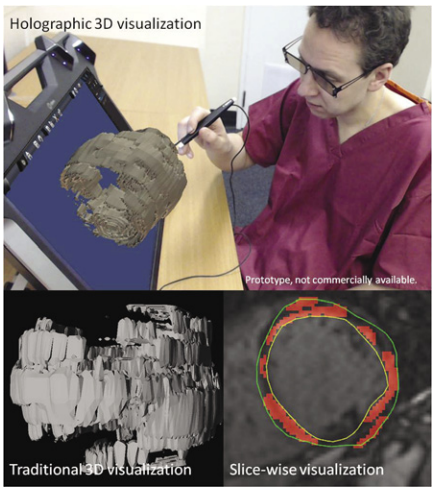
Introduction: LV lead positioning in myocardial scar is associated with poor response to cardiac resynchronization therapy (CRT). Scar distribution and transmurality can be accurately derived from cardiac magnetic resonance images. However, numerical metrics of scar and 2D visualizations have limitations. We propose a novel method for visualizing and manipulating myocardial scar on a 3D holographic display.
Methods: Short axis late gadolinium sequences are segmented to generate a scar mesh which is subdivided into layers, from endocardium to epicardium and visualized on a holographic display. The implanting physician wears specially designed glasses with markers that track head movement and enable the scar tissue to be visualized and manipulated in 3D.
Results: Myocardial scar tissue can be observed layer by layer in 3D and from different orientations by natural head movement. Ideal points of pacing can be defined directly in 3D compared to traditional decision making in 2D or based on AHA Segment plots. Seven physicians were consulted and all of them found 3D visualization more helpful for scar assessment than traditional 2D visualization. Mean 6.86 ± 0.99 (scale 1-10).
Conclusions: Initial results on a first patient indicate that visualizing scar location and transmurality in 3D can complement the traditional 2D slice- or segment-wise transmurality visualization. The proposed method could aid in accurately targeting the LV lead outside of scar in order to improve CRT delivery and in doing so, may lead to improved clinical outcomes.



PO06-74

NOVEL SUB-MILLIMETER RESOLUTION SWINE HEART MODEL REVEALS THE CONTRIBUTION OF INFARCT 3D MICROSTRUCTURE TO THE FORMATION AND MAINTENANCE OF POST-INFARCTION REENTRY

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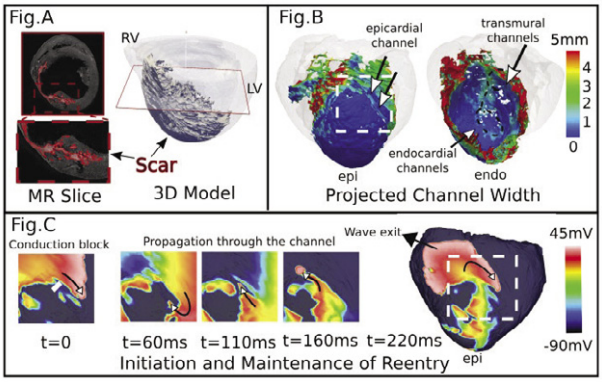
Introduction: The detailed mechanisms of arrhythmogenesis associated with infarction in large animal and human hearts remain incompletely understood, due to lack of high resolution structural data. We present, for the first time, a sub-millimiter resolution imaging data that reveals the microscopic structure of the infarct at the intact heart. We employed this data in simulations to examine the micro-level electrophysiological phenomena that lead to global reentry circuits.
Methods: For 8 swine hearts with chronic MI, infarct geometry and fiber orientation were acquired ex vivo using high resolution LGE MRI (250um isotropic, Fig A) and DTMRI, respectively. Models were created from images and VT was induced by programmed stimulation. The images were analyzed to extract information on the 3D dimension of the viable tissue within the scar border, and reentry activations correlated with structure.
Results: Results from 23 different VT morphologies (CL=196 ± 62 ms) show that reentry pathways traverse complex viable tissues channels at the border of the scar that have mean width of 1.2 ± 0.6 mm (Fig B, C). Reentry initiated by functional block within or at the border of these thin channels. These narrow pathways were most frequently located at the endocardium (52%), in comparison to epicardial (22%) and transmural (26%) channels.
Conclusions: The findings from these novel whole heart models reveal the contribution of infarct 3D microstructures to the initiation and maintenance of reentry at whole heart level. Accurate knowledge of these structures may enhance the understanding of the post-infarction arrhythmia and improve detection of optimal ablation targets.



PO06-75

NOVEL PANORAMIC ENDOCARDIAL OPTICAL MAPPING REVEALS A ROLE OF THE SUPERIOR VENA CAVA IN THE MAINTENANCE OF ATRIAL FIBRILLATION

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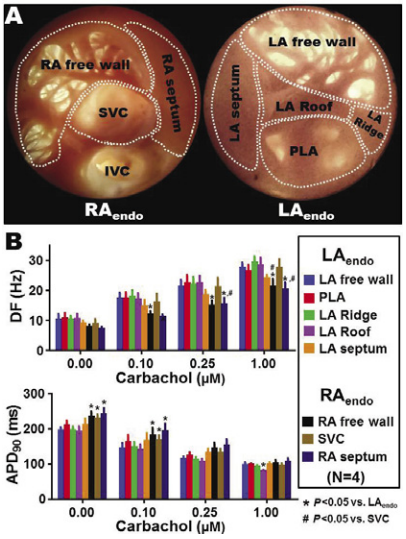
Introduction: The mechanisms that maintain atrial fibrillation (AF) are poorly understood. We used a novel optical mapping approach to visualize simultaneously the entire and intact right and left atrial endocardial (RAendo, LAendo) surface to test the hypothesis that the superior vena cava (SVC) acts not only as initiator/trigger but also as a driver/perpetuator of AF.
Methods: In Langendorff-perfused sheep hearts (N=4), two CCD video cameras were coupled to specialized wide angle lenses attached to rigid borescopes (145° view angle) which were introduced via ventricular incisions and focused on endocardial LA and RA surfaces (Fig A). In the absence or presence of carbachol (CCH: 0.1-1.0 μM), LAendo and RAendo were mapped to determine action potential duration (APD90) during pacing and maximum dominant frequency (DFmax) during AF.
Results: DFmax increased and APD90 decreased in all regions with CCH concentration. However, at 0.25 and 1.0 μM CCH LAendo demonstrated higher excitation frequencies (21.2±1.0 & 27.0±0.9 Hz, P<0.05 respectively) than RAendo (15.0±0.8 & 20.7±1.0 Hz) except for the SVC (19.8±3.2 & 25.6±2.7 Hz; Fig. B). Dose response curve analysis demonstrated that the SVC had lower IC50 for APD90 compared to the RA free wall (0.14±0.02 μM vs 0.22±0.03 μM, P=0.09), whereas the value was similar with LAendo (0.12±0.01 μM).
Conclusions: Novel panoramic optical mapping and dose response curve analysis revealed unique regional responses to CCH. The sensitivity of the SVC to CCH is similar to LAendo but higher than RA free wall, suggesting that the SVC can be a driver of AF, particularly during vagally induced AF.



PO06-76

LOCAL LIGHT EXPOSURE TERMINATES ANATOMICAL REENTRY IN OPTOGENETICALLY MODIFIED TRANSVERSE RAT VENTRICULAR TISSUE SLICES

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Introduction: Anatomical reentry is an important mechanism of VT in patients with structural heart disease. Current approaches for studying and treating VT rely on drugs, devices, and ablation. As a result, electrophysiological properties can only be controlled to some extent in terms of magnitude, time and space, thereby hampering progress. However, optogenetics, based on light-gated ion channel expression and activation, can modulate such properties with unmatched precision in all three ways. Therefore, we studied whether and how optogenetic interventions can influence anatomical reentry.
Methods: Neonatal rat hearts and a vibratome were used to produce 150-µm-thick transverse ventricular tissue slices, which were genetically modified with lentiviral vectors encoding a depolarizing channelrhodopsin (CatCh), or yellow fluorescent protein (eYFP) as control. CatCh activation in these slices was precisely controlled by using a 470-nm LED-based patterned illuminator, while the effects were studied by optical voltage mapping.
Results: CatCh and control groups behaved similarly upon electrical stimulation (n=23 and n=7). However, only in CatCh-group, 10-ms light pulses evoked propagating waves. Stable reentry was induced in both groups by electrical stimulation but only in CatCh-expressing slices it could be terminated by global exposure to 500-ms light (p<0.01). Furthermore, local transmural exposure of the slice over a width of 600 and 300 μm, resulted in 100% and 54% arrhythmia termination, respectively (p<0.01). Mechanistically, arrhythmias were terminated by CatCh activation-induced temporary conduction block leading to reentrant wave extinction allowing normal activation to regain.
Conclusions: This is the first study to show that stable anatomical reentry in ventricular tissue slices can be terminated effectively by creation of a temporary and fully reversible conduction block through local activation of light-gated ion channels. These results can provide novel practical and mechanistic insights into the optogenetic control of arrhythmic activity in ventricular tissue.

PO06-77

GENETIC INVESTIGATION INTO THE PARADOXICAL DIFFERENTIAL RISK OF ATRIAL FIBRILLATION AMONG BLACKS AND WHITES

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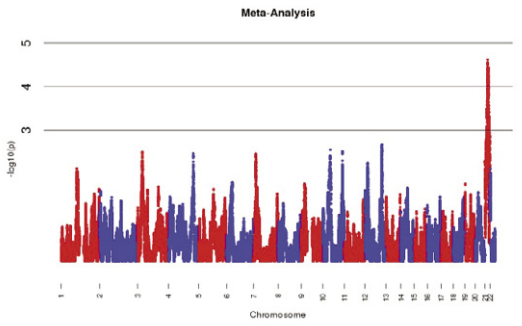
Introduction: Whites have a higher risk of atrial fibrillation (AF) than Blacks, despite a lower prevalence of risk factors. We used an admixture mapping approach to search genome wide for loci that may account for this phenomenon.
Methods: Admixture mapping was performed in Black participants from the Cardiovascular Health Study (CHS), the Atherosclerosis Risk in Communities Study (ARIC), and the Health, Aging, and Body Composition Study (Health ABC). Locus-specific African ancestry across the genome in Blacks was estimated using LAMPLD 1.0 using a 2 population model (African and European). Cox proportional hazards models were used to evaluate associations between locus-specific African ancestry and incident AF. The genome-wide significance threshold was 7x10-6.
Results: Meta-analysis of genome-wide admixture mapping of the 3 cohorts (CHS [n=811], ARIC [n=3,112], and Health ABC [n=1,015]) identified the peak for locus specific ancestry association with AF at rs1977904 (chromosome 21; HR 1.42, 95% CI: 1.20-1.67, p=2.40 x 10-5). Among a pre-specified lone AF subgroup, the strongest locus specific ancestry association was at rs4649274 (chromosome 1; HR: 0.49 95% CI: 0.35-0.69, p=4.44 x 10-5). Neither locus reached the pre-specified statistical threshold for genome-wide significance.
Conclusions: Using genome wide admixture mapping, we were unable to identify any genetic variants that account for a statistically significant proportion of the differential risk of AF by race. This suggests that additional genetic or environmental factors beyond single SNPs in isolation account for racial differences in AF risk.

Figure: Manhattan Plot of Admixture Mapping for Incident Atrial Fibrillation Among Blacks in Meta-Analysis Involving the Cardiovascular Health Study, the Atherosclerosis Research In Communities Study, and the Health, Aging, and Body Composition Study.



PO06-78

SERUM MICRORNA26A LEVELS PROGRESSIVELY DECREASE DURING AF DEVELOPMENT IN CORONARY VEIN BLOOD SAMPLES

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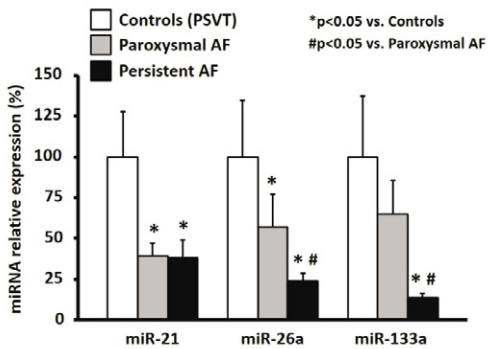
Introduction: AF evolves from a paroxysmal (PAF) to a persistent form (PerAF) with a process attributed to fibrotic remodeling. MicroRNAs (miRs) play a critical role in AF pathophysiology and circulating miRs are potentially utilized as AF biomarkers. However, serum miR levels in the peripheral blood might not reflect cardiac phenomenon since most of miRs are expressed in the multiple organs. We first examined the serum expression of fibrosis-related miRs in the coronary vein blood samples of AF patients, reflecting a cardiac event more specifically.
Methods: In 36 patients with PSVT (n=12, controls), PAF (n=12), and PerAF (n=12) who underwent catheter ablation, serum levels of fibrosis-associated miRs, miR-21/miR-133 (pro-fibrotic signal-related gene regulators), miR-26a (a fibroblast activation-gene regulator), and miR-29b (an extracellular-matrix-gene regulators) were measured with qPCR in the coronary vein blood samples.
Results: In echocardiography, LA diameter increased in PerAF vs. PAF (by 56%*, *p<0.05), suggesting PerAF-induced atrial structural remodeling. Serum miR-21 levels decreased in PAF vs. controls (by 61%*, Figure), but remained unchanged in PerAF (by 1% vs. PAF). MiR-133a was unchanged between controls and PAF, but decreased in PerAF (by 86%* vs. PAF, Figure). MiR-26a decreased in PAF vs. controls (by 44%*) and further decreased in PerAF (by 58%* vs. PAF, Figure). MiR-29b was almost undetectable. In controls, miR-26a was the most abundantly expressed miR among them.
Conclusions: Serum miR-26a is abundantly expressed in the cardiac circulation and progressively decreases during AF development, and thus is a promising candidate for AF remodeling biomarkers.



PO06-79

PHENOTYPIC CHARACTERIZATION AMONG INDIVIDUALS REFERRED WITH SECONDARY CARDIAC GENETIC FINDINGS

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Introduction: The American College of Medical Genetics & Genomics recommends secondary genetic findings in cardiac sarcomeric, desmosomal and ion channel genes be reported and patients further evaluated. We performed cardiac phenotypic characterization in patients with such variants referred for evaluation.
Methods: In this single center retrospective study, disease-specific evaluation included personal and family history, resting and exercise ECG and cardiac imaging. Gene variant factors included lab determination of pathogenicity, population mean allelic frequency (MAF) in ExAC database, prior reports of association with a consistent phenotype including familial segregation and in vitro analysis.
Results: From 5/2014-11/2015, 9 probands, 6 parents and 2 siblings (age 1.5-47 yrs) were assessed. Indications for proband whole exome sequencing (7) or multi gene panels (2) were neurological (4), autism spectrum (3), growth (1), and autoimmune (1) disorders. No patients had cardiac symptoms. Family history was present in 1. Eleven variants were identified in 9 probands - compound (KCNQ1/KCNQ1), digenic (KCNH2/RyR2) or single (KCNH2, SCN5A, CACNA1C, LMNA, SCN1B) missense; truncating (DSP) and synonymous (CACNA1C). MAF was <0.1% in all but 1 variant. 6/11 were reported pathogenic by the testing lab. 9/11 had prior association with cardiac disease, but none with familial segregation. Subtle phenotypic expression was seen in 2 parents with 3 variants all reported as pathogenic; a 30 yr old (KCNQ1 compound heterozygote) with exercise-induced QT prolongation, and a 42 yr old (LMNA) with subtle conduction and RV myocardial changes. None of the patients carrying the 3 variants with prior in vitro changes showed evidence of disease. Lifestyle changes (drug/fever avoidance) were recommended in 3 families and serial evaluation in 5.
Conclusions: In asymptomatic patients referred with secondary variants in cardiac disease-causing genes, only a minority display subtle subclinical phenotype, not always concordant with lab reports of pathogenicity. Larger studies are needed to determine the potential clinical and economic benefit and/or burden of secondary genetic variant reporting and evaluation.

PO06-80

HOW CAN A GAIN-OF-FUNCTION MUTATION IN KCNQ1 LEAD TO ACTION POTENTIAL PROLONGATION?

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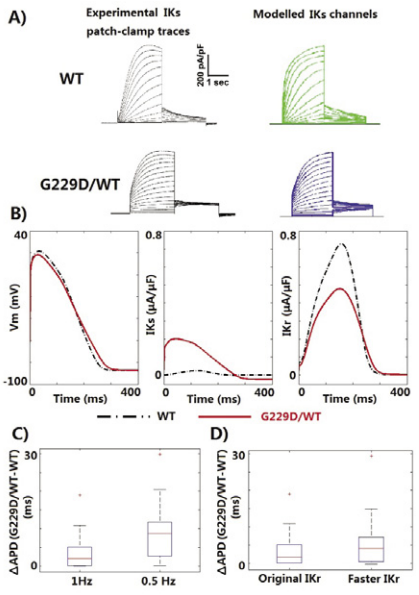
Introduction: Gain-of-function mutations in the KCNQ1 gene are related to the short-QT syndrome and atrial fibrillation, where stronger IKs results in action potential duration (APD) shortening. However, borderline long-QT has also been reported for certain gain-of-function mutation carriers. We perform a combined in vitro/in silico investigation to explore the penetrance of gain-of-function KCNQ1 gene mutations in the long-QT syndrome.
Methods: An in silico model of the IKs current with the KCNQ1 gain-of-function G229D mutation was constructed based on in vitro patch clamp experiments (Fig.A). The mutant IKs model was integrated into a population of 2000 human ventricular electrophysiology models, calibrated against human in vivo recordings, accounting for variability in sarcolemmal currents and Ca2+ handling.
Results: The primary effect of mutant KCNQ1 G229D channels at 1Hz pacing in the human population was APD shortening, whose extent is regulated by the relative densities of ICaL, IKr and IKs currents. However, 17 mutant models showed up to 6.8% APD prolongation, due to the voltage-dependent decrease of IKr caused by the stronger IKs during the plateau phase (Fig.B). Slower pacing (0.5Hz) and faster (two-fold) IKr kinetics increased the extent of APD prolongation (up to 9.1% and 13%, respectively) (Fig.C-D) by dominating the dynamic change of IKr during repolarization.
Conclusions: The subtle interplay between changes in IKr and IKs can lead to APD prolongation in the presence of gain-of-function KCNQ1 G229D mutations. Slower pacing and faster IKr kinetics affect this process by regulating the relative contributing weights of IKr and IKs to the repolarization reserve.



PO06-81

VARIABLE ATRIAL WALL THICKNESS CAN OBSCURE ELECTROGRAM ACTIVATION INFORMATION DURING ATRIAL FIBRILLATION

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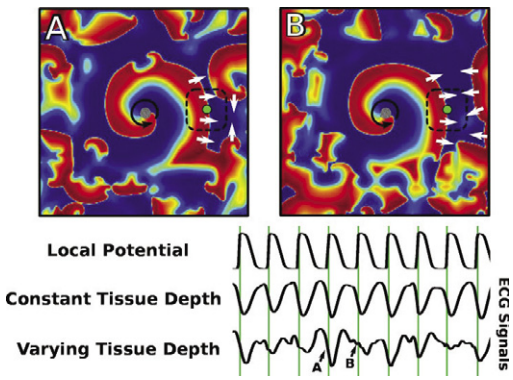
Introduction: Electrograms (EGM) are difficult to interpret in atrial fibrillation (AF). It is unstudied if this may also reflect complex geometry of the atrium, since variations in atrial thickness can significantly alter EGMs that integrate near and far-field regions of tissue. We used computational modeling to test the hypothesis that recorded EGM in AF are influenced more by regions of greater depth than similarly-positioned regions of lesser depth.
Methods: We simulated AF using a standard model comprising a stable anchored rotor and wavebreak outside the coherent spiral wave domain. Virtual EGM were computed 2 mm above uniform tissue domain of 5 mm depth, and compared to a recording where local tissue depth was decreased to 1 mm.
Results: Fig A and B show AF potentials, with the region of reduced thickness inside the dashed line. The virtual electrode (green dot) within this zone is where membrane potential and EGM are computed. At constant tissue depth, EGMs are

organized but when depth varies, EGM can vary substantially. At timepoint A (snapshot A) the EGM was dominated by activation under the electrode. At timepoint B, however, the expected EGM deflection was attenuated by the secondary wavefront traveling in the opposite direction in larger tissue volume.
Conclusions: Variation in atrial wall thickness can obfuscate EGM recordings of underlying electrical activity by assigning greater weight to regions of increased tissue depth. Electrodes positioned over thin tissue are most susceptible to recording spurious deflections or missing activations. Information about the underlying spatio-temporal dynamics of AF inferred from EGM should account for such potential pitfalls.



PO06-82

GALECTIN-3 IN THE HUMAN ATRIA AND SERUM OF PATIENTS WITH ATRIAL FIBRILLATION

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Introduction: Galectin-3 (Gal-3) is a soluble lectin that is expressed in a variety of tissues and appears to be an important mediator of cardiac fibrosis. Gal-3 levels are associated with an increased risk of developing atrial fibrillation (AF) and may be associated with structural atrial remodeling. Therefore, Gal-3 is suggested as a biomarker for AF progression. We investigated the relation of Gal-3 levels in serum and atrial tissue of patients with AF.
Methods: Left atrial appendages (LAAs) were retrieved during thoracoscopic pulmonary vein isolation (TPVI) for treatment of AF. In the same patients, serum was collected at baseline and 6 months after TPVI. Gal-3 levels in serum and in LAAs were measured with ELISA and normalized for total protein concentration.
Results: Ninety-eight consecutive patients (76% man, mean age 60±9 years) underwent TPVI for paroxysmal (n=44) or persistent AF (n=54). No correlation was shown between Gal-3 in tissue and left atrial volume index (p=0.8). Gal-3 levels were not significantly different in paroxysmal AF and persistent AF (14.2±4.1 ug/l versus 14.1±3.6 ug/l respectively, p=0.97 in serum and 93.6±28.6 ug/l versus 91.9±28.4 ug/l, p=0.08 in atrial tissue). There was no correlation between Gal-3 levels in serum and in atrial tissue (p=0.3). Serum Gal-3 was similar in patients with (14.4±3.2 ug/l) and without recurrence of AF (13.9±2.8 ug/l, p=0.5) within one year after the procedure and serum Gal-3 did not significantly change after the procedure, independent of outcome (recurrence p=0.1 and no recurrence p=0.6).
Conclusions: Galectin-3 expression in left atrial tissue is not reflected by circulating concentrations of Galecin-3 in patients with atrial fibrillation. Our data suggest that changes in Galectin-3 may reflect remote processes and are not related to the mechanism of AF progression. Relating Galectin-3 levels with the amount of fibrosis in atrial tissue is necessary to gain further insight in the role of Galectin-3 in structural atrial remodeling.

PO06-83

MYOCARDIAL INFARCTION IN AGED RABBITS: A NOVEL METHOD FOR STUDYING MECHANISMS OF ARRHYTHMOGENESIS

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Introduction: Risk for sudden cardiac death increases over 10-fold by age 65. Our group previously published a minimally invasive model of myocardial infarction (MI) in young rabbits (6-9mo). We employed this methodology in aged rabbits (>4yr) to create a model of arrhythmogenesis relevant to the aging human population.
Methods: Thirty-eight old and 20 young New Zealand White rabbits underwent site-specific micro-coil embolization. Coronary anatomy was determined by angiography and a coil was placed to localize the infarct in the lateral left ventricular wall. With experience, we developed a rubric for vessel occlusion to create a standardized, reproducible infarct. Seven aged hearts underwent high-resolution optical mapping ex-vivo.
Results: Twenty-five (66%) aged rabbits survived the procedure, compared to 17 young (75%) (*not significant). Cause of death was ventricular arrhythmia in 12 of 13 (92%) aged rabbits and only 2 of 5 (40%) young rabbits (p<.05). Optical mapping revealed a wider infarct border zone (7.4 ± 1.4 mm) compared to a previously studied cohort of young rabbits (4.2 ± 1.4 mm). Aged hearts also presented prolonged APD and slowed conduction velocity in the border zone vs. remote zone (Border Zone APD= 180.1 ms vs. Remote Zone APD = 170.3 ms and Border Zone Conduction Velocity=0.34m/s (SE = 0.086) vs. Remote Zone Conduction Velocity=.95m/s (SE = 0.133)). Interestingly, a previously studied cohort of young animals showed a shortened infarct border zone APD (Border Zone APD = 200.1 ms, Remote Zone APD = 217.7 ms, n=14). Prolonged APD and slowed conduction in the infarct border zone of aged hearts was associated with large cardiac alternans and frequent reentry formation.
Conclusions: Minimally invasive MI in aged rabbits is highly arrhythmogenic. This model is a novel, age-appropriate, method for studying mechanisms of sudden cardiac death in the aging population.

PO06-84

GLIBENCLAMIDE PREVENTS APD SHORTENING DURING DEOXYGENATION IN LEFT VENTRICULAR WORKING HEARTS

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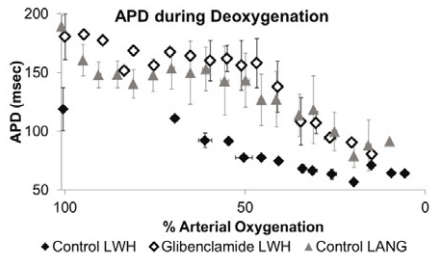
Introduction: Sarcolemmal ATP-sensitive K+ channels (KATP) open in response to low [ATP]/[ADP] to link cardiac energetics and action potential duration (APD). The effect of workload and oxygenation on KATP activation in excised working hearts

is important for arrhythmia mechanisms, yet is unknown. Using novel motion-corrected ratiometric optical mapping, we hypothesized that, due to KATP activation, APD shortening in LV working (LVW) hearts during hypoxia is more severe than in unloaded Langendorff perfused hearts (LANG).
Methods: Epicardial APDs were measured from LVW and LANG rabbit hearts (n=11) using di-4-ANEPPS excitation ratiometry and a motion-tracking algorithm. Circulating perfusate was gradually deoxygenated by bubbling with N2 gas. Perfusate %O2 was measured. In a subset of studies, 10μM glibenclamide (GLIB) was added to identify the level of APD shortening attributed to KATP.
Results: APD dropped more rapidly in LVW than LANG hearts during gradual deoxygenation (Fig 1). Between 75 to 50 %O2, LVW APD dropped at a rate of 1.33±0.84 %O2/msec while LANG APD was constant. LANG APD dropped most rapidly at 50 %O2. GLIB diminished APD shortening in LVW hearts to a rate of 0.61±0.11 %O2/msec until 45 %O2, when APD dropped rapidly (Fig 1). In LVW hearts with GLIB, the APD vs. %O2 curve closely mirrored the LANG curve.
Conclusions: APD shortens severely in LVW hearts during deoxygenation. High workload precipitates a mismatch of O2 supply:demand sooner, and to a greater extent, than in unloaded hearts. GLIB blocks KATP to decouple energetics and electrical activity to align the deoxygenation curves of loaded and unloaded hearts.



PO06-85

ELECTROPHYSIOLOGIC EFFECTS OF THE NOVEL IK1 INHIBITOR PA-6 ARE MODULATED BY EXTRACELLULAR POTASSIUM

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Introduction: Recently, the pentamidine analog PA-6 was developed to study the effects of inhibiting the inward rectifier potassium current (IK1), as established inhibitors either lack specificity or have lethal side effects that prohibit their use in vivo. In cardiac myocytes, PA-6 was previously shown to increase action potential duration (APD). However, the effects of PA-6 in intact tissue, particularly on cardiac conduction velocity (CV), are unknown. Previously we have shown that blockade of IK1 with BaCl2 increases ventricular CV. The aim of the current study was to determine the effects of PA-6 in an intact heart preparation.
Methods: Langendorff-perfused guinea pig hearts were perfused with a modified Tyrode's solution containing 200 nM PA-6 (n=5) or vehicle (dimethyl sulfoxide + pluronic acid; n=5) for 60 minutes. Hearts were optically mapped with the voltage-sensitive dye di-4-ANEPPS (7.5 µM) to quantify traverse CV (CVT) and APD at 90% repolarization (APD90).
Results: APD90 was significantly prolonged in hearts treated with PA-6 (115±2% of baseline values; p<0.05), but not in hearts treated with vehicle (105±2% of baseline). In contrast to previous findings with BaCl2, PA-6 did not significantly change CVT (106±5% of baseline, p=NS). Previously, we found the effects of partial IK1 blockade to be enhanced with hypokalemia (2 mM [K+]o); thus we sought to determine whether hypokalemia modulates the effects of PA-6 . Similar to normokalemic conditions (4.56 mM [K+]o), at 2 mM [K+]o PA-6 prolonged APD90 (107±2% of baseline, p<0.05), although this effect was less pronounced than observed at 4.56 mM [K+]o. Interestingly, lowering [K+]o to 2 mM revealed an effect of PA-6 on conduction, as CVT was significantly faster in hearts treated with PA-6 versus vehicle (24±2 vs 13±3 cm/s, respectively; p<0.05).
Conclusions: Under normokalemic conditions, PA-6 significantly prolonged APD but did not change cardiac conduction. During hypokalemia, PA-6 prolonged APD, although to a lesser degree, and significantly increased conduction velocity. Thus, in intact guinea pig hearts, the electrophysiologic effects of the novel IK1 blocker, PA-6, are [K+]o-dependent.

PO06-86

PROTECTIVE EFFECTS OF LATE INA INHIBITION BY ELECLAZINE AGAINST MYOCARDIAL ISCHEMIA-INDUCED HETEROGENEITY OF REPOLARIZATION

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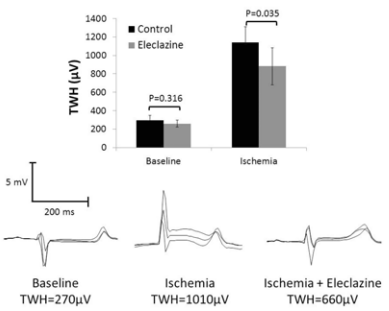
Introduction: The late sodium current has been increasingly implicated in the genesis of ventricular arrhythmias. We examined the effect of the selective inhibitor of this current, eleclazine, which is undergoing clinical evaluation.
Methods: In chloralose-anesthetized, open-chest Yorkshire pigs (N=6), the proximal segment of left circumflex (LCx) coronary artery was occluded to reduce flow by 75%. Electrocatheters were positioned on the left ventricular epicardium to measure T-wave heterogeneity (TWH) and Tpeak-Tend intervals, indicative of transmural dispersion. Effects of ischemia were analyzed prior to and at two hours after eleclazine (0.9 mg/kg, i.v. bolus, over 15 min) during right atrial pacing at 150 bpm.
Results: Eleclazine blunted the myocardial ischemia-induced increase in TWH by 23% (from 1140±171 to 882±202 μV, p=0.035). The drug also reduced Tpeak-Tend interval by 28% (from 54±6 to 39±3 msec, p=0.01) and shortened JT interval by 5% (from 227±5 to 215±5 msec, p=0.003). Eleclazine did not alter contractility as assessed by left ventricular dP/dt.
Conclusions: Selective late INa inhibition with eleclazine exerts a protective effect against ischemia-induced heterogeneity of ventricular repolarization when assessed with clinically relevant markers, specifically, TWH and Tpeak-Tend. These effects were devoid of negative inotropic actions, an inherent advantage over a number of current antifibrillatory drugs.



PO06-87

IN VIVO EP STUDIES IN TRANSGENIC SHORT QT RABBITS REVEAL SHORTENED ATRIAL AND VENTRICULAR REFRACTORY PERIODS AND HIGHER ATRIAL AND VENTRICULAR TACHYARRHYTHMIA INDUCIBILITY

Johannes Steinfurt, MD, Michael Brunner, MD, Gerlind Franke, PhD, Stefanie Perez-Feliz, No Degree, Ilona Bodi, PhD, Naga D. Pantulu, PhD, Corinna N. Lang, MD, David Ziupa, MD, Manfred Zehender, MD, Axel zur Hausen, MD, Genevieve Jolivet, PhD, Christoph Bode, MD and Katja E. Odening, MD. Department of Cardiology and Angiology I, Heart Center Freiburg University, Freiburg, Germany, Department of Pathology, University Hospital Freiburg, Freiburg, Germany, Department of Pathology, Maastricht University Medical Center, Maastricht, Netherlands, INRA, UMR1198 Biologie du Dévelopement et Reproduction, Jouy-en-Josas, France

Introduction: Inherited short QT syndrome (SQTS) is characterized by accelerated repolarization, high incidence of atrial fibrillation (AF), ventricular tachyarrhythmia (VT/VF), and sudden cardiac death (SCD) caused by gain-of-function mutations in K+ channel genes. Patients show shortened atrial and ventricular refractory periods and increased inducibility of AF and VT in electrophysiological (EP) studies. We generated transgenic SQT1 rabbits to study arrhythmogenic mechanisms of this disease.
Methods: Adult transgenic SQT1 (HERG-N588K) rabbits (n=9) and wild type (WT) littermates (n=8) received in vivo ECG and EP studies under ketamine anesthesia. Atrial and ventricular effective refractory periods (ERPs) were determined using an S1-S2 and S1-S2-S3 stimulation protocol. Inducibility of AF was tested by atrial burst.
Results: We previously reported an increased rate of SCD, shorter QT intervals in vivo, and shortened ventricular action potential duration and increased rates of VF ex vivo.
During in vivo EP studies, we now demonstrated shortened QT intervals in SQT1 compared to WT rabbits (QT, ms, SQT1, 168.0±3.5 vs. WT, 215.0±10.2, p<0.001). All other ECG features (PQ, QRS) did not differ between groups. SQT1 had shorter atrial ERPs than WT rabbits (AERP, ms, SQT1, 118.9±9.5 vs. WT, 147.5±7.0, p<0.05). Compared to WT, SQT1 rabbits also had shorter ventricular ERPs at all pacing CL (VERP, ms, SQT1 vs. WT, CL 240 ms, 135.0±5.3 vs. 172.5±10.8, CL 200 ms, 137.5±7.3 vs. 162.5±8.6; p<0.05) and greater additional shortening after double extrastimuli (VERP S3, ms, CL 200 ms, SQT1, 123.8±5.7 vs. WT, 152.5±10.5, p<0.05). Inducibility of non-sustained AF and VT tended to be higher in SQT1 than in WT rabbits (4/9 SQT1 vs. 1/8 WT, p=0.15).
Conclusions: These first transgenic SQT1 HERG-N588K rabbits mimic the human phenotype with shorter QT duration, shortened atrial and ventricular ERPs and a (trend towards) higher inducibility of atrial and ventricular tachyarrhythmia. These models are thus a useful tool to investigate arrhythmogenic mechanisms in SQTS on the ventricular and atrial level.

PO06-88

THE MUTUAL REGULATION OF EXTRINSIC CARDIAC NERVE SUPPRESSES ATRIAL FIBRILLATION VULNERABILITY

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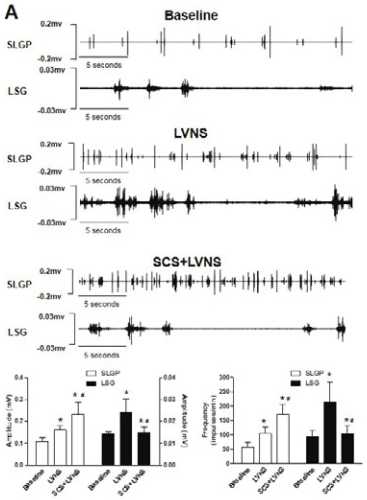
Introduction: This study aimed to investigate the effect of the mutual regulation of extrinsic cardiac nerve on atrial electrophysiology and atrial fibrillation (AF) vulnerability.
Methods: Sixteen dogs (12-15 kg) were randomly divided into 2 groups: spinal cord stimulation (SCS) group (n=8) and spinal cord block group (SCB, n=8). SCS was performed by 90% voltage of the threshold stimulating T1-T2 spinal level, while SCB was performed by injecting 2% lidocaine into epidural space at T2-3 level. Effective refractory period (ERP), ERP dispersion, AF inducibility and extrinsic cardiac nerve activity were measured during atrial pacing combine different extrinsic cardiac nerve stimulation.
Results: ERPs were decreased and ERP dispersion was increased at left/right atrium and four pulmonary veins during left cervical vagus nerve stimulation (LVNS) and left stellate ganglion stimulation (LSGS) at baseline. ERPs were lower and ERP dispersion was higher during SCS combine LVNS than during LVNS, while ERPs were higher during SCS combine LSGS than during LSGS. SCS increased the induced AF episodes and AF duration during LVNS, while SCS decreased the induced AF episodes and AF duration during LSGS. ERPs were lower and ERP dispersion was higher during SCB combine LSGS than during LSGS. SCB increased the induced AF episodes and AF duration during LSGS. SCS enhanced the activity of left cervical vagus nerve, but attenuated the left stellate ganglion activity.
Conclusions: The spinal cord nerve, as the “integration center”, modulates the extrinsic cardiac nerve between vagus nerve and stellate ganglion. SCS facilitates the effect of LVNS and attenuates the effect of LSGS in AF inducibility.



PO06-89

CATHETER ABLATION OF VENTRICULAR TACHYCARDIA IN PATIENTS WITH STRUCTURAL HEART DISEASE - TRIAL SEQUENTIAL DESIGN META-ANALYSIS

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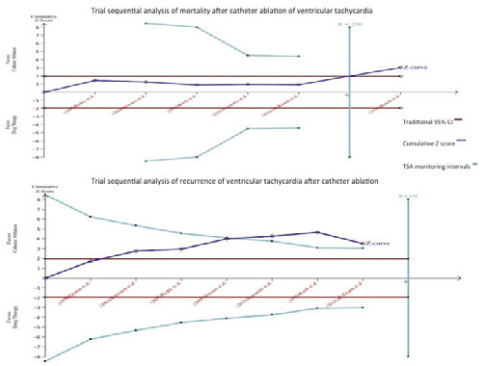
Introduction: Drug therapy (DT) for ventricular tachycardia (VT) is not very effective and is fraught with pro-arrhythmic and other

adverse effects. Catheter ablation (CA) of VT is considered an effective alternative to DT.
Methods: PubMed, EBSCO and Ovid databases were searched to identify studies comparing CA and DT for the management of VT in structural heart disease only. Outcomes of recurrence of VT and mortality were extracted and risk ratio (RR) with 95% confidence intervals (CI) were calculated. Trial Sequential Analysis (TSA) was performed using predetermined 25% relative risk reduction model.
Results: A total of 8 studies (5 randomized studies) met our inclusion criteria and included 1256 patients, 379 in the CA group and 877 in the DT group. The overall RR of recurrence of VT was 0.67 (95% CI 0.51 - 0.89) in favor of the CA group. Subgroup analysis including only randomized studies also had similar results (RR 0.72, 95% CI 0.52 - 0.99). In the TSA, the cumulative z-curve exceeded the traditional and trial sequential monitoring boundary for 25% relative risk reduction. Mortality was reported in 6 studies and the overall risk of mortality was significantly lower in the CA group (RR 0.63, 95% CI 0.47 - 0.85). In the TSA, the cumulative z-curve crossed both the traditional boundary (P=0.05) and the trial sequential monitoring boundary, indicating firm evidence for a 25% reduction in mortality with the use of CA.
Conclusions: The results of this meta-analysis suggest that the risk of VT recurrence and mortality are decreased by 33% and 37% respectively with CA of VT compared to DT. TSA confirms that there is at least 25% reduction in recurrence of VT and mortality with CA.



PO06-90

EFFICACY OF ABLATION TO TREAT PREMATURE VENTRICULAR COMPLEXES ORIGINATING FROM THE CORONARY CUSPS

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Introduction: Idiopathic premature ventricular complexes (PVCs) can arise from many locations and are often successfully managed with ablation. Outcomes in patients undergoing ablation of idiopathic PVCs from the coronary cusps (CC) are not well detailed. This study describes characteristics and outcomes in patients presenting for ablation of PVCs originating from the CC compared to a control group of patients ablated for PVCs from other sites of origin.
Methods: 48 patients with idiopathic PVCs originating from the CC and a control group of 292 patients with idiopathic PVCs originating from other sites presenting for ablation were compared. Acute procedural success was defined as elimination of PVCs at the termination of the ablation. Long-term success at follow-up was defined as an 80% decrease in PVC burden verified by Holter monitor while off antiarrhythmic drugs.
Results: The average pre-ablation PVC burdens were similar in the CC and control groups (20.2% and 19.6%, respectively). Acute procedural success was greater in the CC group as compared to the control group (94% vs. 82%, p=0.04) but recurrence rates among those successfully ablated were significantly higher in the CC group (20% vs. 9%, p=0.03). Long-term success off antiarrhythmic drugs was similar between the CC and control group (75% vs. 74%, p=0.92). Procedure and fluoroscopy times were similar in both groups (312 min and 47 min in the CC group, 295 min and 47 min in the control group). Radiofrequency duration times were shorter in the CC group compared to the control group (17 vs. 23 min, p=0.03). More patients in the CC group were symptomatic as compared to the control group (96% vs. 85%, p=0.04), while fewer patients in the CC group had cardiomyopathy vs. the control group (19% vs. 28%, p=0.19). One (2.1%) major complication (femoral pseudoaneurysm) was observed in the CC group. Rate of major complications was 1.8% in the control group.
Conclusions: Ablation of PVCs from the coronary cusps is an effective and relatively safe procedure. Acute success was higher when ablating PVCs of coronary cusp origin compared to PVCs from other locations; however, ablation of cusp PVCs was associated with a higher recurrence rate. This may be related to anatomic challenges and less aggressive ablation in the coronary cusps.

PO06-91

THE IMPACT OF COUPLING INTERVAL AND MORPHOLOGY VARIABILITY ON CATHETER ABLATION OF VENTRICULAR ARRHYTHMIA ORIGINATING FROM OUTFLOW TRACT

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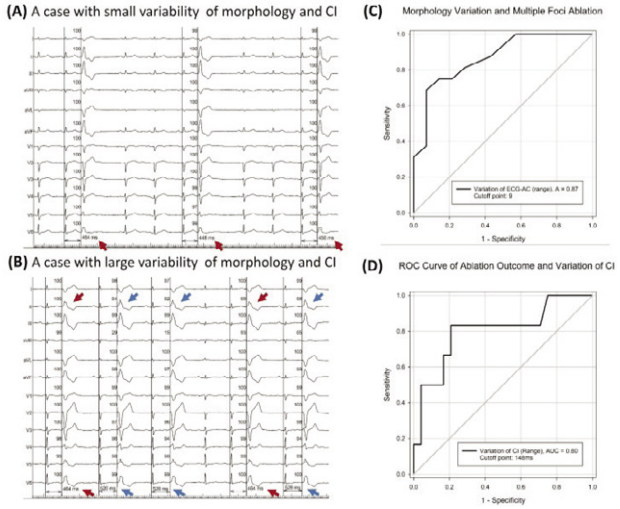
Introduction: Ventricular arrhythmia (VA) originating from right ventricular outflow tract (RVOT), aortic sinus cusp (ASC) and other sites were characterized by different electrophysiological characteristics. Preferential conduction from ASC to RVOT and multiple exits of VA originating from outflow tract were reported. We hypothesized that morphology alternation and coupling interval (CI) variability could affect the outcome of catheter ablation.
Methods: Patients, who received catheter ablation for VA originating from outflow tract area, were enrolled. A 20-minute ECG segment before procedure were recorded for analysis. The interval between preceding sinus beat to the beginning of PVC were measure as CI. Morphology alternation was objectively evaluated by using average correlation of ECG leads (ECG-AC, based on correlation coefficient) and comparison with first beat of spontaneous VPC (Figure).
Results: Total 30 patients without difference in baseline comorbidities were enrolled. There were 10 patients required RF attempts targeting multiple sites and characterized with the greater variation of morphology (multiple sites vs. single site, range of ECG-AC: 13.3±8.3 vs 7.3±5.9, p=0.028). In a mean 11.2-month follow up, 7 patients suffered from VA recurrence. The greater variation of CI were found to associated with recurrence (success vs. recurrence, range of CI: 186±77ms vs 117±58ms, p=0.021) ROC curve suggested these 2 indices could well predict the procedure outcome.

Conclusions: The variation of morphology and coupling interval may predict the requirement of multiple sites ablation and recurrence after catheter ablation.



Characteristics	Patients with Successful Ablation (n = 23)	Patients with Unsuccessful Ablation (n = 18)	p-value
Age	57.9 ± 18.1	65.3 ± 10.7	0.28
Body mass index	28.2 ± 5.9	30.7 ± 6.1	0.15
Hypertension	12	9	0.90
Dyslipidemia	9	10	0.31
Diabetes	5	3	0.70
Coronary artery disease	8	7	0.80
Sleep apnea	6	2	0.24
LVEF (%)	47.9 ± 14.0	42.9 ± 17.8	0.46
LVEDD (cm)	5.56 ± 0.98	5.89 ± 1.02	0.49
LVESD (cm)	4.18 ± 1.25	4.69 ± 1.29	0.27
ECG Data			
RR interval (msec)	907 ± 156	910 ± 170	0.95
PR (msec)	216 ± 168	186 ± 57	1.00
QRS (msec)	120 ± 45	135 ± 32	0.06
QT (msec)	434 ± 60	460 ± 74	0.14
VT cycle length (msec)	338 ± 88	410 ± 125	0.09
Ablation Parameters			
Count	16.7 ± 16.4	20.9 ± 13.9	0.17
Power	59.1 ± 22.8	58.6 ± 14.8	0.41
Temperature	50.0 ± 7.6	51.3 ± 7.6	0.49
Biomarkers			
BNP (ng/dL)	125 ± 40	365 ± 120	**0.044**
Creatinine (mg/dL)	0.96 ± 0.04	1.16 ± 0.09	**0.041**

PO06-92

BIOMARKERS IDENTIFY PATIENTS AT GREATER RISK FOR VT RECURRENCE FOLLOWING ABLATION

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Introduction: Biomarkers provide unique physiologic data regarding ventricular loading and end-organ dysfunction. We hypothesized that biomarkers would yield additional insight into the probability of procedural success in patients undergoing ventricular tachycardia (VT) ablation.
Methods: We studied patients undergoing VT ablation at a tertiary medical center. We defined ablation success as the absence of recurrent, sustained VT requiring repeat ablation or the absence of appropriate ICD shocks at 6 months. We recorded pre-ablation BNP and serum creatinine, and analyzed whether elevated levels of these biomarkers identified patients at risk for VT recurrence.
Results: In 41 patients (age 61±16 years, LVEF 46±16%), single procedure VT ablation success was 56%, similar to prior work. In this cohort, procedural success was not associated with age, baseline LVEF, BMI, common cardiovascular comorbidities, or procedural characteristics such as ablation count (see table; p≥0.05 for all). However, patients with VT recurrence had significantly higher baseline BNP (365±120 ng/dL) and serum creatinine (1.16±0.09 mg/dL) than patients with successful ablation (125±40 ng/dL, p=0.44 and 0.96±0.04 mg/dL, p=0.41, respectively).
Conclusions: Serum BNP and creatinine identify patients at greater risk for VT recurrence following ablation. Future studies should examine the precise mechanisms of arrhythmia recurrence in such patients and whether additional procedural steps, such as more extensive ablation, may improve ablation success.

PO06-93

PREDICTIVE VALUE OF ENDOCARDIAL UNIPOLAR VOLTAGE MAPPING TO DETECT EPICARDIAL SCAR IN PATIENTS WITH STRUCTURAL HEART DISEASE UNDERGOING VENTRICULAR TACHYCARDIA ABLATION

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Introduction: Bipolar voltage mapping detects areas of scar and guides ablation of VT. The role of unipolar voltage mapping is still not well defined. We therefore sought to determine whether areas of endocardial unipolar low voltage predict the presence and location of an epicardial scar.
Methods: Data from 26 consecutive patients with structural heart disease (SHD) (12 ischemic cardiomyopathy (ICM), 6 non-ischemic cardiomyopathy, 3 hypertrophic cardiomyopathy, 3 arrhythmogenic right ventricular cardiomyopathy, 1 myocarditis, 1 Brugada) with a detailed combined endocardial-epicardial substrate mapping were retrospectively reviewed. Maps were obtained using an electro-anatomical 3D mapping system (CARTO 3), with the following parameters for normal thresholds: ≥ 1.5 mV for bipolar voltage, and ≥ 5.5 (RV) or ≥ 8.3 mV (LV) for unipolar voltage.
Results: 27 maps were obtained: LV in 18 patients, RV in 7 patients, both in 1 patient. Mean points per map were 198 (76 in those with normal bipolar mapping, 328 in those with scar). An endocardial unipolar low voltage area was found in 23/27 maps. In 12/23 maps there was no corresponding epicardial scar, while in 3/4 cases an epicardial scar was detected despite a negative unipolar map (positive predictive value (PPV)=48%, negative predictive value (NPV)=25%, P=NS). When considering patients with ICM, an endocardial low voltage area had PPV and NPV for epicardial scar of 70% and 50% respectively, compared to 31% and 50% in patients without ICM. These results were consistent also when considering patients with low (< 100 points) vs high-density (≥100 points) mapping. In the 11 cases with both positive endocardial unipolar and epicardial bipolar maps, the epicardial scar was found in the corresponding ventricular region

of the endocardial low-voltage area, although unipolar area misestimated the area of the epicardial scar (r = 0.07, Pearson's P = NS).
Conclusions: In this series of patients with SHD, analysis of unipolar voltage maps could not reliably predict the epicardial arrhythmogenic substrate. There is only a modest correlation between areas of endocardial unipolar low voltage and epicardial scars. Moreover, an epicardial substrate cannot be safely excluded based on a normal unipolar endocardial map.

PO06-94

ELECTROPHYSIOLOGICAL CHARACTERISTICS OF MYOCARDIAL SLEEVES IN THE RIGHT VENTRICULAR OUTFLOW TRACT - A HIGH-RESOLUTION EPICARDIAL MAPPING STUDY

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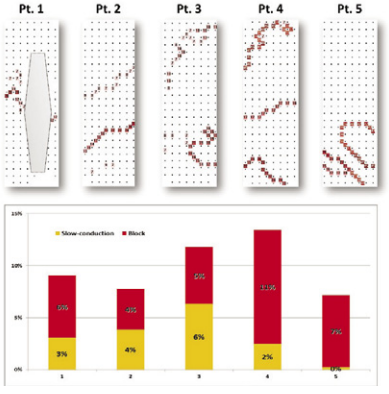
Introduction: Idiopathic PVC or VT often originates from the right ventricle outflow tract (RVOT). Recent case reports have described the origin of such arrhythmias above the pulmonary valve, suggesting extension of myocardial tissue in the pulmonary artery (myocardial sleeves). The electrophysiological relevance of these sleeves is unknown.
This study aimed to quantify the electrical characteristics of the RVOT and proximal pulmonary artery (PPA) region using high-resolution epicardial mapping (HREM).
Methods: HREM was performed in five patients without a history of RVOT ectopy. During coronary artery bypass grafting, a 192 electrode array (ø 0.065mm, inter-electrode spacing 2mm) was used to map the RVOT-PPA region. Conduction-slowing (velocity <28cm/s) and -block (velocity <18cm/s) were analyzed using custom-made software.
Results: An average of 8 sinus beats were measured and analyzed per patient. The average number of conduction times was 2577±1389 (range 1195 and 4474). Slow conduction occurred in all patients, and ranged between 0.23 to 6.32%. Continuous lines of block, however, were more prominent with an average of 6.54% (range 3.87-10.92%). In patient 1, an electrically silent region was present (Figure 1, gray area).
Conclusions: HREM identified electrical connectivity between the RVOT and PPA. Heterogeneity in conduction (slowing and block) was observed in this region. These observations are highly suggestive for the presence of myocardial sleeves. Validation of these findings in a larger patient group is needed to increase our knowledge about this relatively unknown anatomical entity, and clarify its role as arrhythmogenic substrate.

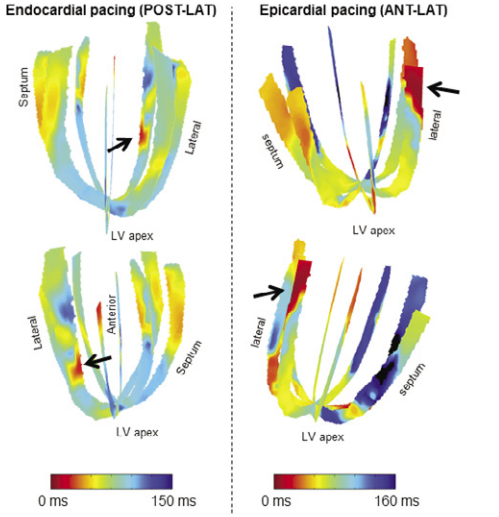


PO06-95

ELECTROMECHANICAL WAVE IMAGING OF VT FOR THE NON-INVASIVE DETECTION AND DIFFERENTIATION OF ENDOCARDIAL FROM EPICARDIAL SOURCES IN A PACED ANIMAL MODEL

Alexandre Costet, MSc, Elaine Wan, MD, Lea Melki, MS, Ethan Bunting, MS, Julien Grondin, PhD, Hasan Garan, MD and Elisa Konofagou, PhD. Columbia University, Department of Biomedical Engineering, New York, NY, Columbia University Medical Center, Department of Medicine-Cardiology, New York, NY

Introduction: VT can originate from a trigger on either surface of the ventricle. Currently, there are no non-invasive methods to detect the origin of VT and differentiate between endocardial or epicardial trigger. Electromechanical Wave Imaging (EWI) is a direct ultrasound imaging technique that can map the transmural electromechanical activation in the heart in vivo. In this study, we show EWI potential in characterizing VT and in differentiating between epicardial and endocardial origins in the LV.
Methods: EWI was performed in five dogs (N= 5) while pacing from six (n=6) endocardial and epicardial locations in the LV using St. Jude Medical EP-4 Stimulator (Secaucus, NJ). A Verasonics ultrasound system (Redmond, WA) with a 2.5 MHz phased array and an unfocused beam sequence at 2000 frames/s in the standard apical views was used, and electromechanical strains and activation maps were estimated using high-precision, RF based speckle tracking.
Results: Activation maps from endocardial pacing showed early regions of activation in the endocardium, whereas maps from epicardial pacing showed early regions of activation on the epicardium. Transmural activation was 60 ± 5 ms for endocardial pacing (n=3) and 65 ± 25 ms for epicardial pacing (n=3).
Conclusions: EWI was capable of differentiating endocardial from epicardial pacing locations in the LV in an animal model. These results demonstrate that EWI can be a valuable pre-treatment planning tool that could significantly reduce risk and RF ablation procedure duration by non-invasively characterizing epicardial or endocardial origin of VT.



Examples of Electromechanical Wave Imaging (EWI) maps of the electromechanical activation during endocardial and epicardial pacing. Pseudo 3D views are presented from the anterior (top row) and posterior (bottom row) side. The earliest region of activation (arrows) is seen in the endocardium during endocardial pacing and on the epicardium during epicardial pacing.

PO06-96

ASSOCIATION OF LEFT ATRIAL LOW-VOLTAGE AREA AND THROMBOEMBOLIC RISK IN PATIENTS WITH ATRIAL FIBRILLATION

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Introduction: Atrial fibrillation (AF) is associated with an increased risk of thromboembolism. The CHA2DS2-VASc score, including clinical parameters and comorbidities, is recommended for thromboembolic risk stratification in AF patients. The purpose of this study was to test the hypothesis if left atrial low-voltage area (LVA) is associated with magnetic resonance imaging (MRI) detected silent cerebral ischemia (SCI) and previous stroke in patients with AF.
Methods: Two-hundred patients (64±10.5 years, 37.5% women) with symptomatic paroxysmal (n=88, 44%) or persistent AF undergoing AF ablation were prospectively enrolled. Left atrial LVA (a voltage cutoff 300 points) during sinus rhythm. Cerebral delayed-enhancement MRI was performed 1 to 2 days after procedure for detection of pre-existing SCI. SCI were defined as focal, sharply demarcated, regularly or irregularly shaped areas that are hyperintense on T2-weighted fluid-attenuated inversion recovery (FLAIR) images or isointense on T1-weighted images.
Results: Over all, 17 patients (8.5%) experienced previous stroke. Pre-existing SCI were detected in 135 patients (67.5%). The mean CHA2DS2-VASc score was 2.3±1.4. Patients with previous stroke (4.0±1.5 vs 2.1±1.3, p<0.0001) and SCI (2.7±1.3 vs 1.5±1.4, p<0.0001) had a significantly higher CHA2DS2-VASc score. Left atrial LVA was significantly higher in patients with previous stroke (12.5±8.5% vs 3.4±5.4%, p<0.0001) as well as SCI (5.8±6.9% vs 0.8±1.7%, p<0.0001). Multivariate logistic regression analysis revealed that the left atrial LVA was independently associated with SCI (HR per 1% LVA 1.13 [1.06-1.22], p=0.0003) and previous stroke (HR per 1% LVA 1.36 [1.19-1.60], p<0.0001) after adjustment of CHA2DS2-VASc score.
Conclusions: Left atrial remodeling, estimated by left atrial LVA, has significant relationship to cerebral thromboembolism in patients with AF. Thus, atrial substrate may be utilized as an index for thromboembolic risk stratification and to guide individual anticoagulation therapy.

PO06-97

SIMULTANEOUS AMPLITUDE FREQUENCY ELECTROGRAM TRANSFORMATION (SAFE-T) MAPPING TO IDENTIFY THE SUBSTRATE FOR VENTRICULAR ARRHYTHMIA IN ARRHYTHOGENIC RIGHT VENTRICULAR CARDIOMYOPATHY PATIENTS

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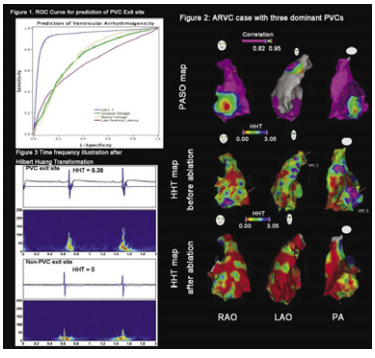
Introduction: Abnormal potential indicates abnormal ventricular substrate. We hypothesized the signals high frequency component beneath the low frequency QRS-T wave can be decomposed using temporal frequency analysis, which may be helpful to quantify the sinus rhythm electrograms in patients with ARVC.
Methods: High-density ventricular mapping with Carto MEN version UDM module was performed in 18 normal heart controls and 46ARVC patients. In VT, isthmus sites were characterized using entrainment responses. In non-sustained VT/PVC, exit sites were characterized using pacemapping and activation mapping. Sinus rhythm electrograms underwent HHT analysis and were displayed as 3D SAFE-T maps. Abnormal potentials and their relation to the VT isthmus, NSVT/PVC exit sites were studied.
Results: Abnormal potentials were defined by a cutoff value of 3.08 Hz-mV using normal heart controls. ROCs showed that ventricular arrhythmogenic sites were best identified using SAFE-T mapping (p<0.001) as compared to bipolar and unipolar scar and late potential mapping with an optimal cutoff value of 3.09 Hz-mV, allowing identification of 100% of the 5 mapped VT isthmuses, and 100% of exit site of NSVT/PVCs. There was no significant difference between SR and paced SAFE-T values.
Conclusions: Automated electrogram analysis using 3D SAFE-T mapping could detect VT isthmuses and/or exit site of NSVT/PVCs in ARVC. The results suggest that SAFE-T mapping is good alternative strategy in identifying ventricular arrhythmogenic sites and might reduced procedure time in making activation map and pacemapping.



PO06-98

THE ROLE OF RIGHT VENTRICULAR SEPTAL UNIPOLAR MAPPING IN IDENTIFICATION OF ABNORMAL LEFT VENTRICULAR SEPTAL SCAR WITH CONSIDERATION OF WALL THICKNESS

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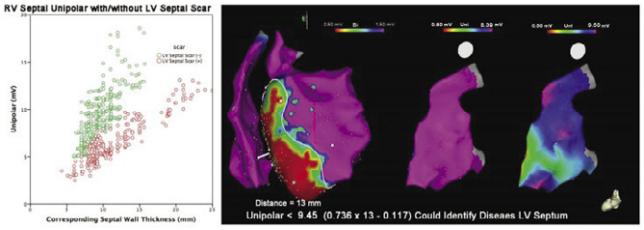
Introduction: The application of RV septal unipolar voltage in prediction of LV septal scar regarding different septal wall thickness remains to be elucidated.
Methods: From 2013 to 2015, consecutive 28 patients (mean age: 53 ± 16 years, 19 male [67.9%]) receiving bi-ventricular substrate mapping with and without LV septal scar were enrolled. Patients with RV septal scar were excluded. The septal thickness was measured point by point with the use of CARTO software. Fisher's linear discriminant formulas (LDFs) based on combined examinations (Uni/Thickness LDF) were developed. We used the Mahalanobis distance to evaluate the unipolar voltage and corresponding wall thickness between two groups.
Results: A total of 514 points were collected for ventricular substrate, 323 points in 12 patients without LV septal scar

and 218 points in 16 patients with LV septal scar. The unipolar voltage and corresponding wall thickness were significantly different between two groups ($p < 0.001$). LDFs provided better sensitivities and specificities as compare with Unipolar LDF (Sensitivity: 0.96 vs. 0.68; Specificity: 0.91 vs. 0.80). We developed a formula to predict opposite LV septal scar as follows: unipolar voltage of RV septal wall -0.736 * wall thickness + 0.117. A minus value could best predict opposite LV septal scar with a predictive rate of 0.94. The net reclassification for septal scar discrimination could be improved by 23.2%in comparison with traditional cut-off value of unipolar in right ventricle ($p < 0.001$).
Conclusions: Analysis of RV septal unipolar voltage by using Fisher's linear discriminant formulas provided higher accuracy in recognition of LV septal scar.



PO06-99

RIPPLE MAPPING THE POST-INFARCT VENTRICULAR SCAR - A NOVEL APPROACH TO SUBSTRATE BASED ABLATION

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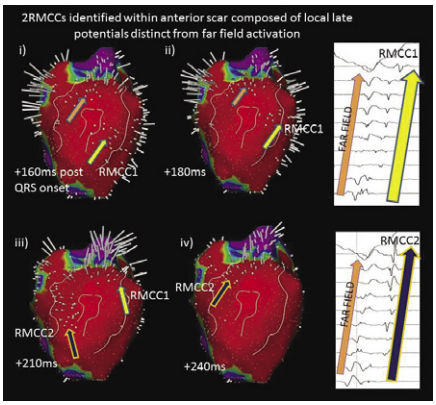
Introduction: Post-infarct Ventricular Tachycardia (VT) is dependent upon channels of surviving myocardium within scar associated with fractionated and late potentials during sinus rhythm. Substrate mapping is dependent upon precise annotation of the smaller local signal within scar from far-field in surrounding healthy tissue. Ripple Mapping (RM) displays every deflection of an electrogram as dynamic bars moving over a bipolar voltage map. This allows local activation to be followed through the scar without annotation. We prospectively used RM to ablate conducting channels (RM-CCs) of local activation.
Methods: High density bipolar LV endocardial electrograms were collected using CARTO3v4™ in sinus rhythm or ventricular pacing and reviewed for RMCC identification.
Results: 15 consecutive patients (median age 68yrs, LVEF 30%) were studied (6month pre-procedural ICD therapies: median 19 ATP events (IQR=4-93) and 1 shock (IQR=0-3)). "Scar" (<1.5mV) occupied a median 29% of the total surface area (median 523 points collected within scar). A median of 2 RMCCs were seen within each scar (length 60mm; far field amplitude 0.43mV; local 0.19mV; conduction 53cm/s). Ablation was performed along all RMCCs (median 19 lesions (IQR=10-23)) and non-connected late or fractionated ripple activation (median 6 lesions (IQR=2-12). VT was non-inducible in 85% post ablation and 71% remain free of VT recurrence at 6 month median follow up.
Conclusions: Ripple mapping identifies channels of local activation within the post-infarct scar without annotation or tagging to guide substrate ablation.



PO06-100

VT ISTHMUS CHARACTERISTICS AND CONDUCTION VELOCITIES: INSIGHT FROM HIGH DENSITY MAPPING

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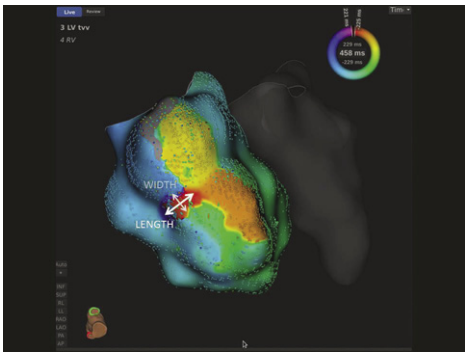
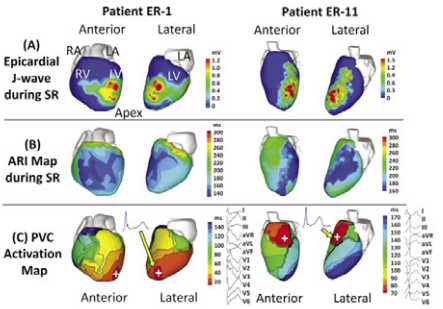
Introduction: We aimed to describe VT isthmii characteristics mapped with a high density mapping catheter and an original algorithm to reconstruct activation (Orion catheter, Rythmia, Boston Scientific).
Methods: All cases of patients with VT ablation performed with Rythmia (Boston Scientific) in 3 tertiary centers were reviewed. In this population all patients with at least one VT mapped during the procedure were included. Isthmii were identified at the area of shortest path width. Measures are depicted in the figure. Mean conduction velocity was measured between the entrance within the isthmus and the exit. Slowest conduction velocity was measured throughout the isthmus.
Results: Fifty-seven patients had VT ablation performed with the Rythmia system. Of those, 16 (15 M; 60 ±19 yo) had a VT mapped. Ischemic CMP was the main substrate (75%) and mean LVEF was 45 ±15%. Mean VTCL was 462 ±110ms. A total of 16 VT have been mapped, one was septal without isthmus identified. On the remaining 15, mean isthmus length, width and conduction velocity were 24.8 ±16.3 mm, 6.9 ±1.6 mm and 0.18± 0.13 m/s. The slowest conduction velocity throughout the circuit was 0.03 ±0.02 m/s. Of note the slowest conduction velocity was at one of the extremity of the isthmus (entrance or exit) in 14 VT.
Conclusions: This new high density mapping system allows for accurate mapping with better understanding of activation within the critical part of the circuit.





The electrophysiological substrate in relation to premature ventricular contractions (PVCs). The PVC initiation sites are indicated by plus signs "+". An EP substrate with abnormal EGMs, shortened ARIs and steep ARI gradients correlated with the PVC site of origin in both cases.

PO06-101

THE ELECTROPHYSIOLOGICAL SUBSTRATE OF HUMAN EARLY REPOLARIZATION SYNDROME: NONINVASIVE MAPPING WITH ECGI

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Introduction: The early repolarization (ER) pattern is a common ECG finding. Recent studies established a definitive clinical association between ER and fatal ventricular arrhythmias. However, the arrhythmogenic substrate of ER in the intact human heart has not been characterized.
Methods: Using noninvasive Electrocardiographic Imaging (ECGI), we studied 29 ER syndrome patients to characterize the electrophysiological (EP) substrate. Seven normal subjects provided control data.
Results: The abnormal EP substrate in ER syndrome patients has the following properties: (1) Abnormal epicardial EGMs characterized by presence of J-waves; (2) Marked abbreviation of ventricular repolarization in areas with epicardial J-waves. The action potential duration (APD) was significantly shorter than normal (196±19 vs. 235±21 ms, $p<0.05$). Shortening of APD occurred heterogeneously, leading to steep repolarization gradients compared to normal control (45±17 vs.7±5 ms/cm, $p<0.05$). (3) Conduction abnormalities were not observed in any of the patients. Premature ventricular contractions (PVCs) were recorded in 2 patients. The PVC sites of origin were closely related to the abnormal EP substrate with J-waves and steep repolarization gradients.
Conclusions: ECGI identified regions with steep repolarization gradients caused by localized shortening of APD in ER syndrome patients. It also showed close association of PVC initiation sites with the abnormal EP substrate. Conduction abnormalities were not observed.

PO06-102

ROSCOVITINE, A SELECTIVE INHIBITOR OF THE LATE L-TYPE CALCIUM CURRENT SUPPRESSES EARLY AFTERDEPOLARIZATION-MEDIATED TRIGGERED VENTRICULAR FIBRILLATION. A NEW CLASS OF ANTIARRHYTHMIC DRUG ACTION

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Introduction: We have shown that oxidative stress with H2O2 or hypokalemia (HypoK) enhance the late L-type Ca current (ICa-L) promoting early afterdepolarizations (EADs) in ventricular myocytes. Dynamic clamp showed that these EADs are potently suppressed by the selective inhibition of the late ICa-L and by roscovitine (R), an anticancer that selectively inhibits the late but not the peak ICa-L in iPS cells from patients with Timothy syndrome. Here we hypothesized that R suppresses EAD-mediated triggered VT/VF in intact hearts.
Methods: Male aged Fisher344 (22-25 months; N = 6) and young/adult (3-4 months; N = 5) rat hearts were studied in the isolated-perfused Langendorff setting with Tyrode's solution (37ºC, pH=7.4). The LV epicardial activation pattern was optically mapped using voltage-sensitive fluorescent dye (RH-237) along with single cell action potential (AP) recordings with microelectrode and pseud-ECG. Suppressant effect of R (10-100 μM) on H2O2 (0.1 mM) or HypoK (2 mM) induced VF was tested.
Results: Spontaneous VT/VF arising abruptly during sinus rhythm by EAD-mediated triggered activity was shown by microelectrode recordings in 100% of hearts exposed to H2O2 or HypoK. Activation map showed that the VF was initiated by focal activity on the LV epicardium and maintained by mixed focal and irregularly wandering wavelets. R suppressed VF within 8-35 min in 5 out of 6 hearts exposed to H2O2 and in 4 out of 5 hearts perfused with HypoK ($P<0.05$, for both comparisons, two-tailed Exact Fisher test). In an additional 6 adult hearts roscovitine caused significant ($P<0.05$) concentration-dependent shortening of the action potential duration (APD) and flattening of the slope of the dynamic APD restitution curve. R had no effect on the PR interval or sinus cycle length. Effects of R were partially reversible upon 20 min of washout.
Conclusions: This is the first demonstration of VT/VF suppression in intact hearts by roscovitine, a drug that selectively blocks the late ICa-L but not the peak ICa-L providing a new antiarrhythmic drug class action not considered in previous classifications. Roscovitine or its analogs can be tested for antiarrhythmic efficacy in human clinical trials since this agent passed drug safety testing for cancer treatment.

PO06-103

THE FEASIBILITY OF DETECTING TRUE CRITICAL ISTHMUS SITES OF VENTRICULAR TACHYCARDIA BY UTILIZING FAST-FOURIER TRANSFORM ANALYSIS WITH VOLTAGE LIMIT ADJUSTMENT

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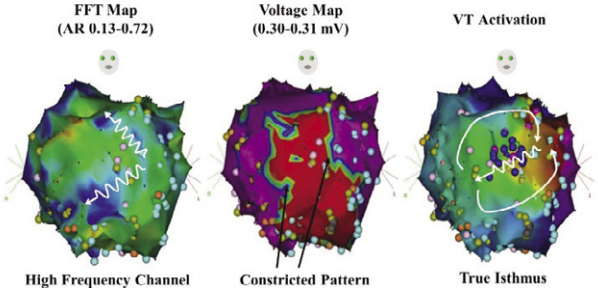
Introduction: Conducting channels in the circuit of ventricular tachycardia (VT) can be identified by voltage limit adjustment (VLA) of substrate mapping. However, they might include bystander channels, and endocardial substrate mapping may not be sufficient for intramural circuit.
Methods: Fast-Fourier transform (FFT) analyses and VLA of the local ventricular bipolar electrograms were performed during sinus rhythm in 9 postinfarction patients with 12 monomorphic VTs. The relatively high AR areas between the low AR areas on a 3-dimensional map were regarded as high frequency channels (HFC). The relatively high voltage areas between the low voltage areas were defined as high voltage channels (HVC).
Results: Eight VT isthmuses were included in 15 HVC, consisting of 9 HVC identical to HFC and 6 HVC not identical to HFC. Seven VT isthmuses were found in the 9 HVC (+)/HFC (+) sites, while only 1 true VT isthmus was found in the 6 HVC (+)/HFC (-) sites. To 4 true VT isthmuses which were not revealed by VLA, FFT analysis in the low-voltage area was performed first. Ten HFC were detected, and 6 of the 10 HFC were identical to a constricted pattern (CP) of the low voltage area. Four VT isthmuses were found in the 6 HFC (+)/CP (+) sites, while no VT isthmus were found in the 4 HFC (+)/CP (-) sites. The combined use of FFT analysis and VLA predicted true VT isthmuses with a sensitivity of 92 % and specificity of 69 %.
Conclusions: Combined use of FFT analysis and VLA may be useful to detect true VT isthmuses.



PO06-104

COMPARISON OF THE RELATIVE RADIATION REDUCTION OF COLLIMATION AND RADIATION PADS USED IN THE ELECTROPHYSIOLOGY LAB AS ASSESSED BY DOSIMETRY

Scott J. Pollak, MD, George Monir, MD, Julie Pepe, PhD, Barry Egolf, RN, Melissa Leonard, RN, MBA and Melissa Pequeno, No Degree. Florida Hospital, Orlando, FL

Introduction: Use of x-ray is still prevalent although there is recognition that any radiation may be associated with cancer risk. Recent new technology allows real-time assessment of radiation dose exposure at a given location. The purpose of this study was to assess the relative value of two different radiation reduction methods in the EP lab (collimation and radiation pads) compared to an open configuration using real-time radiation dose monitoring.
Methods: A phantom acrylic model was used in order to allow serial measurements using the same parameters with the x-ray system. Radiation real-time detectors (RaySafe™) were used to measure radiation dose around the phantom in three different configurations (open, collimation, and radiation pads) with three different camera angulations. The open configuration consisted of x-ray exposures without radiation reduction methods. Collimation tests were conducted by moving collimators to the border of the saline/contrast phantom. The radiation pad configuration used radiation pads placed along the operator side of the table extending from the acrylic block at the heart level to the block at groin level.
Results: The parameters analyzed for radiation dose were measured in millirem by real-time radiation detectors. The parameters obtained from the x-ray system labeled patient measurements were total mGy and cGy-cm². Collimation resulted in this phantom simulation in a significant decrease ($p<0.01$) of approximately 50% in radiation exposure for the operator compared to the open configuration for all locations. A non-significant radiation reduction (6-11%) was observed for radiation pads compared to the open configuration. Collimation resulted in a significant reduction ($p<0.01$) of 23-31% in the exit dose of radiation from the phantom, but a significant increase ($p<0.01$) of 54% of the air kerma (AK) measured in mGy for all locations compared to the open configuration.
Conclusions: This study showed a significant benefit of collimation compared to an open configuration or radiation pads to reduce radiation exposure. Despite the fact the AK measurement increases significantly with collimation compared to an open configuration, the radiation dose actually decreases as assessed by the dosimetry exit dose from the phantom.

PO06-105

NON INVASIVE IMAGING CORRELATES OF ABNORMAL ELECTROANATOMIC SUBSTRATE IN CARDIAC SARCOIDOSIS

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Introduction: In patients (pts) with cardiac sarcoidosis (CS) and ventricular tachycardia (VT), the relationship between electroanatomic (EAM) substrate abnormalities and non-invasive imaging correlates of scar and active inflammation has not been previously investigated.
Methods: We studied 23 pts (age 54±11 years) with CS based on HRS diagnostic criteria and VT who underwent pre-procedural MRI and PET, and high-density EAM as part of VT ablation procedures. Abnormal EGMs were defined as multicomponent fractionated, isolated, late and split EGMs according to standard criteria. The presence and distribution of abnormal EGMs (at least 3 contiguous in an area ≥1cm²) was correlated with regions of LGE at MRI and increased FDG uptake at PET according to a standard 16-segment LV model.
Results: A total of 14044 bipolar and unipolar EGMs were

acquired in the left ventricle (LV) endocardium (21 pts, 4300 EGMs), right ventricle (RV) endocardium (18 pts, 3749 EGMs) and epicardium (EPI, 11 pts, 5995 EGMs). Abnormal EGMs represented 47% of the total acquired EGMs and were present in all pts. The mean bipolar and unipolar voltage subtending areas of abnormal EGMs was 1.2±1.1 mV and 4.9±3.3 mV, respectively. At pre-procedural MRI/PET, LGE was present in 21 (91%) patients while abnormal FDG uptake in 15 (65%) cases. Segmental analysis comparing areas with abnormal EGMs with regions of LGE at MRI and increased uptake at PET showed a concordance in 271 (74%) segments for MRI ($p<0.0001$) and in 251 (68%) segments for PET ($p=0.024$). Abnormal EGMs appeared more strongly associated with LGE at MRI than increased FDG uptake at PET (abnormal EGMs present in 39% of LGE positive/PET negative segment vs. 27% of LGE negative/PET positive segments, $P = 0.001$). Pre-procedural MRI and PET missed a total of 41 (11%) and 44 (12%) segments with abnormal EGMs, respectively. In addition, EAM showed completely normal EGMs in 57 (15%) MRI segments with positive LGE and in 72 (20%) PET segments with increased FDG uptake.
Conclusions: Pre-procedural imaging with MRI and PET can be useful in detecting EAM abnormalities that are potential target for substrate ablation. However, a significant discordance between EAM results and non-invasive imaging correlates of scar and active inflammation was found in up to 20% of cases.

PO06-106

SPATIALLY DISCORDANT APD ALTERNANS FRACTIONATES ELECTROTONIC SYNCHRONY AND TRIGGERS ARRHYTHMOGENESIS IN FIBROTIC RAT VENTRICULAR MYOCARDIA

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Introduction: Two key features of ventricular remodeling are fibrosis and reduced gap junctional coupling. These are associated with abnormalities in electrical impulse generation and propagation, which predispose to reentrant tachyarrhythmias. In the absence of structural remodeling, high-frequency impulse generation can also induce such arrhythmias, via the development of dynamic electrical instabilities. However, owing to the complex and stochastic nature of arrhythmias, the combined mechanistic influences of structural and dynamical perturbations on arrhythmogenesis remain incompletely understood.
Methods: Arrhythmogenesis was studied using in vitro and in silico monolayer models of neonatal rat ventricular tissue with 30% randomly distributed cardiac myofibroblasts and systematically lowered intercellular coupling achieved in vitro through graded knockdown of connexin43 expression.
Results: Arrhythmia incidence and complexity (i.e., number of phase singularities) increased with decreasing intercellular coupling efficiency, at pacing frequencies > 3Hz. This coincided with the onset of a specialized type of spatially discordant action potential duration (APD) alternans characterized by island-like areas of opposite alternans phase (APIs). The degree of electrotonic dyssynchrony (number of APIs) correlated positively with the degree of Cx43 knockdown and arrhythmia complexity. At higher myofibroblast densities, more APIs were formed and reentrant arrhythmias were more easily induced.
Conclusions: Downregulation of intercellular coupling and presence of myofibroblasts give rise to spatially-discordant APD alternans in simulated and cultured monolayers of rat ventricular cells. This study reveals islands of oppositely phased APD alternans to be important determinants of reentrant tachyarrhythmia initiation and complexity.

PO06-107

THE CIPS-VECTOR: A NEW METHOD TO LOCALIZE SPATIALLY PREMATURE VENTRICULAR CONTRACTIONS FROM PAPILLARY MUSCLES

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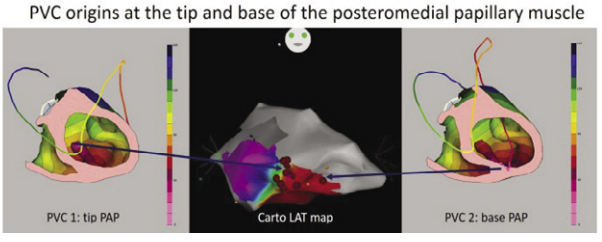
Introduction: Prior to ablation, the precise localization of the site of origin of a PVC can facilitate the planning and execution of the electrophysiological procedure. Using only the standard 12 lead ECG, the localization of PVCs originating from the papillary muscles frequently fails. Electrocardiographic imaging (ECGI) techniques should localize these PVCs to the endocardial papillary muscles. However, current ECGI methods use complex body surface mapping, and frequently only localize the PVC to the epicardium. We hypothesize that the new Cardiac Isochrone positioning system (CIPS)-Vector can localize the PVC origin from the endocardial papillary muscles.
Methods: CIPS-Vector uses three components to accurately model the relation between the source -the heart- and the sensors - ECG electrodes: a) torso and endocardial and epicardial cardiac anatomy from MRI, b) the patient specific electrode positions from 3D image registered to the MRI model, and c) the 12 lead ECG. CIPS-Vector localizes the PVC origin by matching the anatomical isochrone vector with the 12 lead ECG derived vector. The CIPS-Vector localized PVC origin was compared to the site of successful ablation or stimulation.
Results: In 3 patients, CIPS-Vector localized the PVC origin to the anterolateral-superior (n=1) and posteromedial-inferior (n=2) papillary muscle and spatially to the parts: tip, mid, and base.
Conclusions: This novel vector-based CIPS method, using only the standard 12-lead, makes evident that the CIPS-Vector method is capable of localizing the PVC to parts of the papillary muscles. CIPS-Vector demonstrates the importance of spatial-3D patient specific data to localize PVC accurately.



PO06-108

THE BASIS OF A WAVEFRONT METHOD TO MAP VENTRICULAR TACHYCARDIA IN HUMANS: OMNIPOLAR MAPPING

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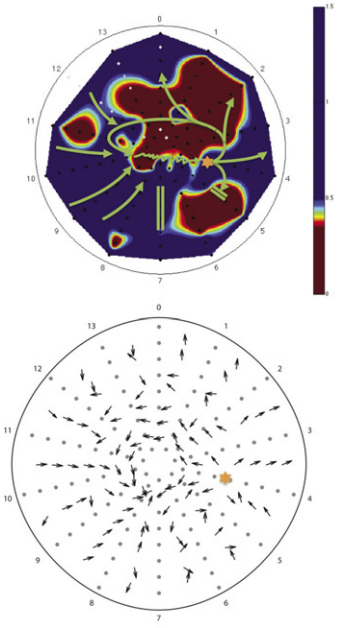
Introduction: Activation mapping requires point-by-point acquisition of local activation time to recreate the VT circuit.

The hemodynamic instability of VT makes this long process precarious. The biophysical properties of electrical wavefronts can be transformed into a vector field that represents direction of the activity (Omnipolar Mapping (OM)). We hypothesized that beat to beat directional analysis of this vector field can be used to identify exit&entrance of the VT circuit.
Methods: We used OM on previously acquired intraoperative maps to test it for locating entrance&exit regions of the VT circuit (top). Thirteen VTs from 9 patients were analyzed and vector fields were generated (bottom). Three blinded operators used these maps to a) identify healthy versus pathological myocardium; b) locate exit (half-starburst pattern surrounded by uniform vectors towards a healthy area(* in bottom)) and c) locate entrance of the VT circuit (uniform vectors converging near scar). Results were compared with intraoperative activation and substrate maps (top).
Results: Analysis of maps located exit sites reliably within 1 cm in 11/13 (85%) VTs compared to traditional ischronal based mapping, while entrance sites were localized within 1 cm in 6/13 (46%) VTs. Additionally,disarray in wavefront vectors identified with OM matched diseased myocardium in voltage mapping in all VTs studied.
Conclusions: Omnipolar wavefront analysis may aid in rapid navigation of mapping tool to the region of interest of the VT circuit using a novel drag-and-map strategy. Available high-resolution catheters combined with an electroanatomic mapping system and OM may provide for a novel activation mapping strategy.



PO06-109

ROBUST VOLTAGE CUTOFF VALUES FOR RIGHT VENTRICULAR SCAR: A COMBINED MRI AND CONTACT FORCE MAPPING STUDY IN PATIENTS WITH TETRALOGY OF FALLOT

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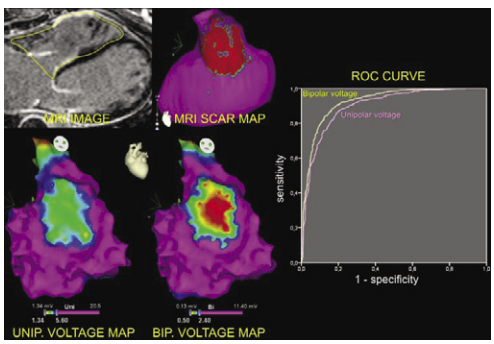
Introduction: Voltage criteria for ventricular mapping have been obtained from small series of patients, and prioritizing high specificity. Using tetralogy of Fallot as a model of transmural RV scar and MRI as reference, we aimed to define robust voltage cutoff values for RV scar, taking into account the influence of contact force.
Methods: 8 patients (age 35±18 years, 3 female) with repaired tetralogy of Fallot underwent late gadolinium enhanced (LGE) MRI at high spatial resolution (1.25x1.25x2.5 mm) using a free breathing method initially developed for atrial imaging. Scar, defined as pixels with intensity >50% maximum, was mapped over the RV geometry, and merged within the CARTO system to RV endocardial voltage maps acquired at high-density using a 4-mm ablation catheter with contact force sensor (SmartTouch®, Biosense Webster).
Results: A total of 1416 points were analyzed, of which 770 were within scar and 646 in healthy tissue. In healthy tissue, contact force correlated to unipolar (R=0.155, P<0.001) and bipolar voltage (R=0.182, P<0.001). Points obtained with very low contact force (1-3 g) showed lower voltage than those obtained with 4 g or higher (unipolar 6.6±4.1 vs. 9.1±4.3, P<0.001; bipolar 2.7±2.0 vs, 5.0±2.7, P<0.001). Receiver Operating Characteristics curve analysis (excluding points with very low contact force) identified optimal voltage cutoffs of 5.6 mV for unipolar voltage and 2.4 mV for bipolar voltage, associated with sensitivities/specificities of 0.82/0.84 and 0.86/0.86, respectively.
Conclusions: Provided good contact force is applied, we propose unipolar and bipolar voltage cutoffs of 5.6 and 2.4 mV to identify RV scar on endocardial mapping.



PO06-110

UTILITY OF IMPEDANCE MAPPING IN LOCALIZING THE ORIGIN OF OUTFLOW TRACT PREMATURE VENTRICULAR CONTRACTIONS

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Introduction: We previously reported that contact tissue impedance mapping (CTIM) can differentiate focal atrial tachycardia (AT) from atrial flutter and focal firing AT from micro-reentrant AT by identifying a contiguous low impedance area (CLIA) during tachycardia. We hypothesized that the CLIA reflected a region of triggered activity. As the mechanism of outflow tract (OT) PVCs is known to result from triggered activity, we further investigated this hypothesis in a cohort of OT PVCs patients.
Methods: We studied 24 patients with OT PVCs using local activation time (LAT) mapping and CTIM to detect CLIAs and their proximity to the ablation site. Mapping was performed with the CARTO 3 and XP systems utilizing a 4-mm tip ablation catheter. Tissue impedance (Z) data was obtained

retrospectively. The presence of CLIA, its surface area and distance to ablation site were measured. Low Z was defined as ≤ Zmin + 10% (Zmax-Zmin). Normal Z was defined as ≥ Zmin + 20% (Zmax-Zmin).
Results: Of the 24 patients undergoing PVC ablation, 13 were right ventricular OT PVCs, 11 were left ventricular OT origin. Mean age was 58.7 ± 15 years, 62% were men. Mean left ventricular ejection fraction was 44 ± 12%. CTIM showed presence of CLIA in 22 patients (92%). The mean CLIA surface area was 5.9 ± 3.8 cm². The CLIA contained the successful ablation site in 16 patients (73%). In the remaining 6 patients, CLIA was at a mean distance of 1.8 ± 1 cm from the ablation site. Unlike the CLIA patients whose ablation site had sharp, short duration, large amplitude electrograms, the non-CLIA patients had long duration (≥ 120 msec) fractionated electrograms at the ablation site, suggesting micro-reentry as a possible mechanism.
Conclusions: Generally, CTIM in outflow tract PVCs is characterized by the presence of CLIA, correlating with their triggered activity mechanism. The CLIAs are adjacent to or contained in the focal ablation site. CTIM and its ability to detect CLIAs may be a useful tool to identify focal firing caused by triggered activity.

PO06-111

OPEN CHEST EPICARDIAL VOLTAGE MAPPING DURING LEFT VENTRICULAR ASSIST DEVICE IMPLANT IN PATIENTS WITH END-STAGE HEART FAILURE

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Introduction: Strategies to predict and prevent ventricular arrhythmias (VA) in patients undergoing left ventricular assist device (LVAD) implant for end-stage heart failure are critical to improving long-term outcomes.
Methods: Patients undergoing LVAD implant were evaluated intra-operatively. Prior to incision, 3 pairs of orthogonal skin patches were placed for impedance-based electroanatomical mapping. After sternotomy and adequate exposure, a multielectrode catheter was swept across the epicardial surface to generate 3-D bipolar voltage and activation maps. Fractionated electrograms <0.5mV were considered to represent dense scar, and >1.5 mV normal (see figure). VA burden post-LVAD implant was determined via ICD interrogation and chart review.
Results: 13 consecutive patients undergoing LVAD implant were included (12 non-ischemic cardiomyopathy, 1 ischemic). Complete 3-D voltage maps were obtained in 11 (median mapping time 9.0 min). Scar and border zone affected >20% of the epicardial surface in 1 patient, 5-20% in 5 patients, and <5% in 5 patients. Abdominal patch location yielded optimal mapping accuracy without significant alteration in surgical preparation. There were no VA events documented after LVAD implant for any patient with <5% scar burden.
Conclusions: Open chest epicardial voltage mapping can be performed quickly and safely in patients undergoing LVAD implant. In this cohort, low epicardial scar burden is associated with absence of early post-implant VA. Information gathered using our novel epicardial mapping protocol may help guide both intra-operative and post-operative management of VA.

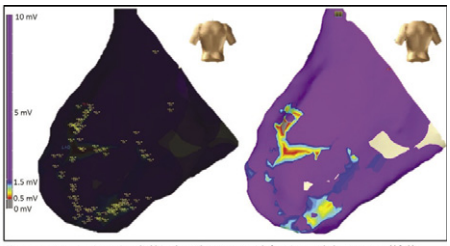

Figure: Representative epicardial bipolar voltage map with fractionated electrograms (*fx*) corresponding to scar (<0.5mV) and border zone (0.5 – 1.5 mV).

PO06-112

THE USE OF LATE GADOLINIUM-ENHANCED CARDIAC MAGNETIC RESONANCE AT HIGH SPATIAL RESOLUTION TO IDENTIFY ARVC SUBSTRATE

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Introduction: Free-breathing late gadolinium-enhanced imaging (FB-LGE) was recently introduced to improve spatial resolution and depict atrial fibrosis. We evaluated the accuracy of FB-LGE in assessing the ARVC substrate, as compared to conventional breath-holded LGE (BH-LGE) and to cine imaging.
Methods: Consecutive patients with definite ARVC according to Task Force criteria (TFC) underwent CMR before an electrophysiological study. Cine imaging was performed in 2 stacks of slices encompassing the whole ventricles in 2 orientations. BH-LGE was performed 10 min after contrast in 3 stacks of slices encompassing the whole ventricles in 3 orientations (pixel size 1.6x1.6x6mm). FB-LGE was initiated 15 min after contrast to acquire a whole heart volume at higher spatial resolution (pixel size 1.25x1.25x2.5mm). Wall motion abnormalities (WMA) and LGE were assessed and distributed over a biventricular 16-segment model. All patients underwent electrophysiological contact mapping during sinus rhythm on RV endocardium and RV and LV epicardium. Low bipolar voltage and local abnormal ventricular activity (LAVA) were distributed over the same segments.
Results: 23 pts were included (age 45±14yrs, 5 women). MRI was positive for a major TFC in 14/23(61%), for a minor TFC in 3/23(13%), and it was negative in 6/23 pts (26%). RVEF and RVEDV were 38±9% and 111±24mL/m2. LVEF and LVEDV were 57±11% and 82±18mL/m2. On the RV, low voltage and/or LAVA were found at contact mapping in all pts, WMA in 22/23(96%), FB-LGE in 20/23(87%), and BH-LGE in 16/23(70%). On regional analysis, WMA and FB-LGE showed higher agreement with contact mapping than BH-LGE (k=0.72 and k=0.70 vs. k=0.55, respectively). On the LV, low voltage and/or LAVA were found at contact mapping in 13/23(57%) pts, WMA in 7/23(30%), FB-LGE in 13/23(57%) and BH-LGE in 13/23(57%). On regional analysis, FB- and BH-LGE showed higher agreement with contact mapping than WMA (k=0.77 and 0.77 vs. k=0.32).
Conclusions: The use of FB-LGE imaging at higher spatial resolution improves the performance of CMR for the detection of ARVC substrate on the thin RV wall.

PO06-113

RELATION BETWEEN LEFT VENTRICULAR TISSUE CHARACTERISTICS AND ELECTRICAL HETEROGENEITY

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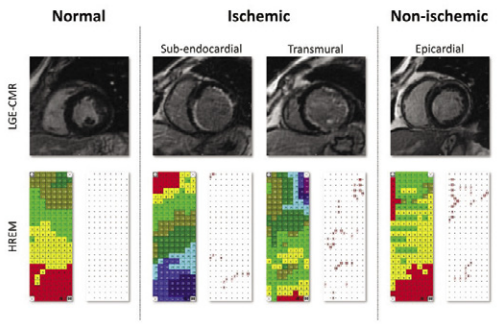
Introduction: Myocardial fibrosis may give rise to lethal tachyarrhythmias, due to heterogeneity in conduction. Detailed assessment of this substrate requires integration of tissue characteristics and electrical properties.
Left ventricular heterogeneity in myocardial fibrosis and conduction were studied using late gadolinium enhanced cardiac magnetic resonance (LGE-CMR) and high resolution epicardial mapping (HREM).
Methods: Five patients scheduled for coronary artery bypass grafting (CABG, n=4) or aortic-valve replacement (AVR, n=1) underwent LGE-CMR to assess fibrosis. Intra-operative, multi-site HREM was performed using a 192 electrode array (ø 0.065mm, inter-electrode spacing 2mm). Total activation time (TAT), conduction-slowing (velocity <28cm/s) and -block (velocity <18cm/s) were determined and correlated with the LGE-CMR images.
Results: An average of 6±1 sinus beats were acquired and analyzed per recording site. The AVR patient had no focal fibrosis (normal LGE-CMR) and no conduction disorders (TAT 21ms). Patients with sub-endocardial fibrosis had multiple areas of slow conduction (TAT 39ms). In the patient with transmural enhancement, continuous lines of block were present (TAT 48ms). The patient with epicardial enhancement had a short TAT (18ms) with instantaneous depolarization in three different large regions, separated by multiple lines of conduction slowing and block.
Conclusions: HREM identified conduction slowing and block in patients with myocardial fibrosis, as detected on LGE-CMR. Slowing of conduction and block were related to the location, extent and transmurality of fibrosis.



PO06-114

MAPPING LOCAL ABNORMAL VENTRICULAR ACTIVITIES (LAVA) PROBABILITY WITHIN THE ENSITE PRECISION™ SYSTEM

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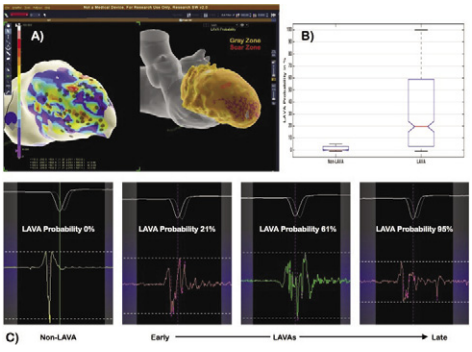
Introduction: Surviving fibers in the scar can be detected as high frequency signals occurring any time during or after the far-field electrogram (LAVAs). LAVA elimination has been demonstrated to provide a good clinical outcome for Ventricular Tachycardia (VT) patients. In an effort to simplify and facilitate LAVA mapping, an automatic LAVA detection algorithm has been developed in a research version of the EnSite Precision™ v.2 Software (St. Jude Medical, MN, USA) to compute a LAVA probability map.
Methods: 20 VT patients underwent mapping with the system. All signals within the proximity of 5mm were collected and the LAVA Probability map was computed. The physician manually tagged all LAVAs and their agreement with the LAVA probability map was assessed.
Results: 7200 points were collected with 1080 as LAVAs. LAVAs were observed to have higher probability values of 19.5[3-59]%, whereas non-LAVAs had 1.03[0-3]% (Fig B). Mostly Late or Mid-Diastolic potentials were observed at 75% probability or higher, whereas early LAVAs had relatively less probability (Fig C). Also a good visual agreement was observed with the LAVA probability map having higher values (red[100%] vs purple[0%]) around the LAVA manual tags (brown lesions) and where the physician ablated (Fig A).
Conclusions: LAVA Probability map is useful and has a robust automatic LAVA detection algorithm. The probability value does grade the range of early to late LAVAs observed during the studies. Early LAVAs with probability less than 50% should be confirmed by pacing, whereas late LAVAs greater than 50% are directly selected for ablation.



PO06-115

ENDOCARDIAL UNIPOLAR VOLTAGE MAP OF THE LEFT VENTRICLE TO DETECT EPICARDIAL SCAR IN PATIENTS WITH CHAGASIC CARDIOMYOPATHY

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Introduction: Chagasic Cardiomyopathy (ChCM), unlike ischemic cardiomyopathy, is characterized by significant midmyocardial and epicardial involvement, which is the

substrate for reentrant VT in these patients. Prior studies have demonstrated the utility of unipolar endocardial voltage maps to predict the location and extent of epicardial scar in patients with non ischemic cardiomyopathy (NICM); however these studies have not included patients with ChCM.
Methods: Nineteen patients with ChCM underwent catheter ablation using the Carto 3 mapping system. Endocardial and Epicardial point by point maps were obtained. Endocardial and epicardial points were correlated using the Spearman correlation coefficient and ROC curves were used to define the endocardial unipolar voltage cutoff values for identification of epicardial scar.
Results: A total of 8494 epicardial and 6331 endocardial voltage points were obtained. There was a statistically significant difference between the unipolar voltage amplitude of a given endocardial point when compared to its epicardial bipolar adjacent site (6.9 versus 2.6 mV, P <0.001). Mutivariate logistic regression analysis showed that unipolar endocardial voltage amplitude was independently associated with epicardial bipolar voltages below 1mV (OR 0.8, 95%CI 0.71-0.89, p<0.001). ROC for endocardial unipolar amplitude showed a cutoff value of 4mV for the identification of epicardial scar (AUC 0.8; 95% CI 0.76-0.85, sens 71%, spec 75%). The low voltage area on endocardial unipolar voltage map using cut off between 4.0mV to 6.5mV and epicardial scar show no significant differences. The percentage of confluence of low voltage area between endocardial unipolar and epicardial bipolar voltage map was not significantly different.
Conclusions: In patients with ChCM, endocardial unipolar voltage values below 4 mV are useful to define location and extent of epicardial scar burden. This information is valuable to define substrate for epicardial ablation in these patients.

PO06-116

NOVEL FUNCTIONAL SUBSTRATES DURING PROGRAMMED STIMULATION ARE THE MOST SIGNIFICANT PREDICTOR OF TIME TO VENTRICULAR ARRHYTHMIA RECURRENCE

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Introduction: Ventricular tachycardia (VT) recurrence is common following ablation procedures, suggesting current ablation strategies could be further optimized.
Methods: WIn 25 consecutive patients at VT/PVC ablation, we inserted 64-electrode catheters into left and right ventricles during PVS (IRB approved). Ventricular fibrillation (VF), if induced, was defibrillated. Offline, we studied biventricular activation for regional conduction slowing or onset of reentry and used computational phase analysis to identify sustained sites if VF was seen. After VT ablation, patients were followed for 1 year. Cox-proportional hazards analysis was used to determine predictors of arrhythmia recurrence among variables including history of CHF, AF, number of VTs, inducible VT after ablation, and rotor stability.
Results: VF was induced in n=19 (defibrillated at 11±3 s) and showed localized reentry in scar (82.4%) and non-scar tissue. Only 25% of singularities lay at routine ablation targets. On ROC analysis, >14.5 spiral wave rotations optimized sensitivity (85%) and specificity (87%) for arrhythmia recurrence. Rotor stability was associated with recurrence (86% vs. 11%, p = 0.01; Table 1) but other clinical factors were not. Cox proportional hazards showed that rotor stability was the only significant predictor of arrhythmia recurrence (p = 0.024), which provided a hazard ratio of 11.8 (1.4, 100).
Conclusions: Functional substrate, including VF rotor stability, predicts arrhythmia recurrence with a hazard ratio 12 times those without such substrate. Work is required to define whether such substrate is a marker of risk or participates in ventricular arrhythmia recurrence.

	Recurrence	No Recurrence	p-value
n	7	9	-
Age (years)	68.9 ± 7.9	66.9 ± 4.4	0.53
Atrial fibrillation	4 (57)	2 (22)	0.30
CHF	4 (57)	5 (56)	1
Prior MI	4 (57)	2 (22)	0.30
Post-procedure VT	3 (43)	3 (33)	1
Arrhythmia type (VT)	4 (57)	3 (33)	0.61
VTs, n	1.3 ± 0.5	1 ± 0	0.10
Ejection Fraction, %	36.1 ± 16.0	42.3 ± 12.6	0.40
Rotor stability >14.5	6 (86)	1 (11)	**0.01**

PO06-117

RADIOFREQUENCY CATHETER ABLATION OF VENTRICULAR ARRHYTHMIAS ORIGINATED FROM THE CARDIAC CRUX IN THE PATIENTS WITH STRUCTURAL HEART DISEASES : CHARACTERISTICS, ELECTROPHYSIOLOGICAL PROPERTIES, AND MAPPING

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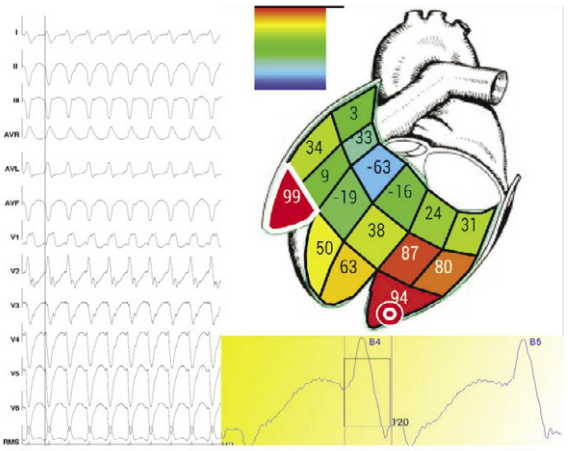
Introduction: There are reports describing idiopathic ventricular arrhythmias (VAs) from the cardiac crux. We aim to investigate a distinct clinical syndrome of focal VAs from the endocardium at the crux of the heart in patients with structural heart diseases (SHD).
Methods: From 2014/3 to 2015/11, we had 349 patients with clinical documented VAs , including 145 patients with SHD. 15 patients (mean age: 58 ± 15 years old, 12 men) with VAs from cardiac crux all had underlying SHD (15/145=10.3%) (Table). We compared the electrophysiologic characteristics of the endocardial RV and LV crux, and identified the whether the dominant origin, by pace, entrainment or activation mapping. Results: Five patients had the dominant origin from the endocardium of RV crux, and 10 from LV. Nine cases had studies in both RV and LV. For the 9 cases, the points of endocardial cardiac crux in dominant chambers had lower bipolar voltages (1.3 ± 1.1 mv v.s 3.1± 2.6mv, P<0.0001), lower unipolar voltages (3.9± 2.8 mv v.s 5.7 ± 2.9mv, P<0.0001) and longer electrogram (EGM) lateness (defined as the interval from onset of QRS complex to end of local EGM, 160.2 ± 48.2 mv v.s 140.3 ± 52.5mv, P=0.0001). Combining all 15 patients, there were also lower bipolar voltages (1.2 ± 1.0 mv v.s 3.1 ± 2.6mv, P<0.0001), lower unipolar voltages (4.0 ± 1.9 mv v.s 5.7 ± 2.9mv, P<0.0001), and longer EGM lateness (157.6 ± 47.9 mv v.s 140.3 ± 52.5mv, P=0.0001) in the dominant chambers.
Conclusions: All of our patients with VAs from cardiac crux have SHD. The lower unipolar, bipolar voltage mapping and longer EGM lateness are able to identify the abnormal substrate in the endocardium in the crux VAs patients and helpful to predict the dominant chamber in SHD patients.

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11	Case 12	Case 13	Case 14	Case 15
Underly-ing disease	ARVD	ARVD	CPVT	AR post AVR	CAD	ARVD	CAD	CAD	Myocar-ditis	CAD	Heart failure	CAD	CAD	CAD	TR post TVR
VT Morpho-logy	LBBB	LBBB	LBBB	LBBB	LBBB	LBBB	LBBB	LBBB	RBBB	LBBB	RBBB	LBBB	RBBB	RBBB	RBBB
VT- axis	Supe-rior	Supe-rior	Supe-rior	Supe-rior	Supe-rior	Supe-rior	Supe-rior	Supe-rior	Supe-rior	Supe-rior	Supe-rior	Supe-rior	Supe-rior	Supe-rior	Supe-rior
VTQRS dura-tion (ms)	172	220	184	140	188	130	141	262	204	168	162	128	236	132	220
VT CL (ms)	0*	308	456	542	516	388	417	298	292	270	561	328	252	174	488
VT-MDI	0.44	0.36	0.34	0.32	0.48	0.5	0.57	0.49	0.39	0.44	0.22	0.46	0.50	0.46	0.4
VT-PdW (ms)	75	80	0	24	0	32	48	92	0	0	0	0	0	59	76
Epicar-dial ablation	No	Yes	No	No	No	Yes	No	No	No	No	No	No	No	Yes	No
Other VAs origin	(1)RV OT free wall, (2)RV basal lat. wall	(1)RV OT free wall, (2)RV ant.free wall,(3) RV bottom.	(1)RV bottom, (2)Inf. TV-(3)Left posteri or papillar y muscle	(1)RV OT mid inf.free wall (2)LV post. papillar y muscle	No	(1)RV basal to mid inferior free wall (2) low anterior RVOT free wall	No	No	LV lateral basal wall	LV post Fasci-cle	RV basal septum	LV Mid septum	LV apex	LV apex	No

*=only VPCs

ARVD=Arrhythmogenic right ventricular dysplasia. CPVT=Catecholaminergic Polymorphic Ventricular Tachycardia. AR=Aortic regurgitation. AVR=Aortic valve replacement. CAD=Coronary artery disease. TR=Tricuspid regurgitation. TVR=Tricuspid valve replacement.



VT was induced; the site of earliest ventricular activation at the inferior left ventricular apex was correctly identified in real-time by the algorithm (bullseye).

PO06-118

VALIDATION OF AN ALGORITHM FOR AUTOMATED REAL-TIME LOCALIZATION OF LEFT VENTRICULAR ACTIVATION SITES DURING CATHETER ABLATION OF VENTRICULAR TACHYCARDIA

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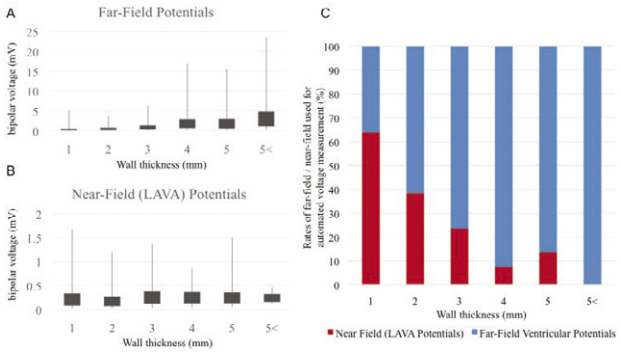
Introduction: Ablation of scar-mediated VT may use several techniques, including arrhythmia induction to target culprit substrate. This can require rapid ECG interpretation and cataloging of all induced VTs. A computerized method to identify early sites of activation could facilitate this. We report the prospective validation of automated real-time localization of ventricular activation using the 12-Lead ECG.
Methods: During VT/PVC ablation of consenting patients, paced ECGs were collected and electroanatomic maps used to register pacing sites to one of 238 triangles within a 16-segment model LV endocardium. Equations relating ECG parameters (QRS integrals of 8 leads) to 3D coordinates of the LV model were obtained by least-square solution to the linear regression problem; they were derived using data from 8 pts (356 sites) and validated in 12 pts (461 sites).
Results: Derivation and validation cohorts had similar characteristics (respectively: age 66 ± 12 vs 69 ± 9; male 88 vs 100%; structural heart disease 100 vs 92%, ejection fraction 41.6 vs 35.3%) although antiarrhythmic use was greater in the validation group (50 vs 92%; p=0.03). Localization error was 10.6 ± 6.4 mm for the derivation set and 14.0 ± 9.9 mm for the validation set. Bootstrap method with replacement for the entire sample (n = 817) had a localization error of 12.2 ± 8.1 mm.
Conclusions: Real-time computerized localization of sites of ventricular activation during ablation of VT is feasible, reproducible and may facilitate rapid identification of culprit sites.

PO06-119

RELATIONSHIP BETWEEN BIPOLAR VOLTAGE AND WALL THICKNESS HETEROGENEITY IN CHRONIC HEALED MYOCARDIAL INFARCTION

Masateru Takigawa, MD, Ghassen Cheniti, MD, Arnaud Chaumei, MD, Frederic Sacher, MD, PhD, Jatin Relan, PhD, Yuki Komatsu, MD, Antonio Frontera, MD, Nathaniel Thompson, MD, PhD, Elvis Teijeira. Fernández, MD, PhD, Claudia Camaioni, MD, Sana Amraoui, MD, Jean-Yves Wielandts, MD, Nora AL Jefairi, MD, Grégoire Massoullié, MD, Arnaud Denis, MD, Nicolas Derval, MD, Meleze Hocini, MD, Michel Haissaguerre, MD, PhD, Pierre Jais, MD, PhD and Hubert Cochet Cochet, MD, PhD. CHU Bordeaux, Hôpital du Haut-Lévêque, Bordeaux, France, St. Jude Medical. Inc, St. Paul, MN

Introduction: Contrast-enhanced multidetector computed tomography (MDCT) can assess myocardial wall thickness (WT) with up to 300μm resolution. We assessed the relationship between wall thickness heterogeneity and bipolar voltage in chronic infarction.
Methods: 12 consecutive ischemic VT patients (age 66±16 yrs, all men) underwent MDCT before ablation. Wall thickness was computed from endo and epicardial segmentations and registered to bipolar endocardial voltage maps acquired at high-density during sinus rhythm within Carto (N=7) or NavX (N=5). All electrograms in scar area were reviewed to look for local abnormal ventricular activities (LAVA). In case of LAVA, amplitudes were measured on both the far-field and near-field components, and the component from which the system automatically measured voltage was assessed.
Results: Out of a total of 1349 points reviewed in the scar area, 659 showed LAVA. The amplitude of the far-field component related closely to WT (R2=0.24, P5mm to 64% in areas with WT<1mm (figure panel C). As a result, automated voltage mapping within the infarcts consisted of composite amplitude measurements from far-field and near-field signals.
Conclusions: In chronic infarcts, the amplitude of the far-field signal on contact mapping reflects WT heterogeneity, whereas the amplitude of near-field signals does not. Alternate signal processing methods should be developed to enable voltage mapping from far-field only.

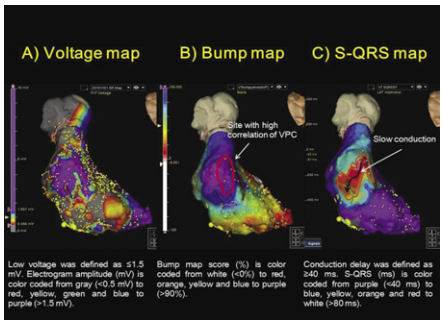


PO06-120

BUMP MAP AND S-QRS MAP: SIMPLE AND NOVEL AUTOMATIC ALGORITHM TO IDENTIFY CRITICAL SLOW CONDUCTION IN SUBSTRATE VENTRICULAR TACHYCARDIA

Shinya Yamada, MD, Yenn-Jiang Lin, MD, Fa-Po Chung, MD, Shih-Lin Chang, MD, Li-Wei Lo, MD, Yu-Feng Hu, MD, Da–chuan duan, MD, Tze-Fan Chao, MD, Jo-Nan Liao, MD, AbigaiL Louise D. Te, MD, Hung Yuan, MD, Yao-Ting Chang, MD, Chong-Hsin Lin, MD, Chin-Yu Lin, MD and Shih-Ann Chen, MD. Taipei Veterans General Hospital, Taipei, Taiwan

Introduction: Pace mapping and analyses of the QRS morphology and the S-QRS delay interval are well-established strategies for substrate mapping in VT. We aimed to develop a simple and novel automatic algorithm (bump map and S-QRS map, obtained from mechanical VPCs during SR substrate mapping) to facilitate identification of VT origin in substrate VT.
Methods: We analyzed 10 patients (age 53 ± 22 years) with scar-related VT (6 ischemic CM, 2 ARVC, and 2 non-ischemic CM) using St. Jude Velocity™ Precision 2.0 Automap™ software. During 3D EAM, collected points (1628 ± 610 points) were sorted into 3 maps using Automap™. The sinus beats were used for (1) substrate voltage map (Figure A). The mechanical VPC beats were automatically reassigned to (2) pace mapping (correlation to documented VT as bump map as Figure B) and (3) S-QRS map (S-QRS interval measured from the onset of intracardiac bipolar recording to the earliest surface QRS, figure C). Score threshold, which quantifies the similarity between the real-time cardiac rhythm and template cardiac rhythm, was set at 80% for all maps.
Results: Voltage map (Figure A, 1413 ± 566 points, 86%) showed low voltage zone in all patients (91 ± 13 cm²). Meanwhile, the bump map and S-QRS map (Figure B and C, 215 ± 43 points, 14%) exhibited a mean similarity score of 92 ± 6% and mean S-QRS interval of 65 ± 8 ms, respectively, which were compatible with the VT origin for all patients (100%).
Conclusions: Bump map and S-QRS map can be simultaneously generated from mechanical VPCs during 3D EAM mapping using automatic algorithm of Precision system which can facilitate the determination and/or localization of critical slow conduction in substrate VT.



PO06-121

ENHANCED RADIOFREQUENCY ABLATION WITH MAGNETICALLY DIRECTED METALLIC NANOPARTICLES

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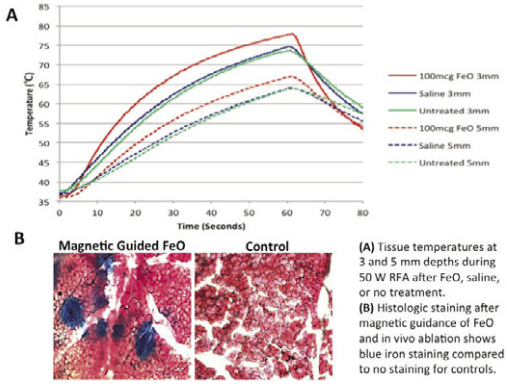
Introduction: Remote heating of metal located near a radiofrequency (RF) ablation source has been previously demonstrated. Therefore, ablation of cardiac tissue treated with metallic nanoparticles (NPs) may improve local radiofrequency (RF) heating and lead to larger ablation lesions. We sought to evaluate the feasibility of magnetic guidance and the effect of metallic NPs on tissue sensitivity to RF energy.
Methods: Ablation was performed using an ablation catheter positioned with 10 grams of force over prepared ex vivo specimens. Tissue temperatures were measured and lesion volumes were acquired. An in vivo porcine thigh model was used to study systemically delivered, magnetically guided iron oxide (FeO) NPs during RF application. Histologic staining of ablated tissue was performed.
Results: Ablation of ex vivo myocardial tissue treated with metallic NPs resulted in significantly larger lesions with greater impedance changes and increased thermal conductivity (Figure). Magnet-guided localization of metallic FeO NPs within thigh preps was demonstrated by iron staining (Figure). Irrigated ablation in regions with greater FeO, after FeO infusion and magnetic guidance, created larger lesions without a greater incidence of steam pops.
Conclusions: Metal NP infiltration resulted in significantly larger ablation lesions with altered electrical and thermal conductivity. In vivo magnetic guidance of FeO NPs allowed for facilitated RF ablation without direct infiltration into the targeted tissue. Further research is needed to assess the clinical applicability of this ablation strategy using metallic NPs for the treatment of cardiac arrhythmias.



PO06-122

WALL THICKNESS HETEROGENEITY WITHIN CHRONIC MYOCARDIAL INFARCTION RELATES TO THE ELECTROPHYSIOLOGICAL SUBSTRATE OF POST-INFARCTION VENTRICULAR TACHYCARDIA

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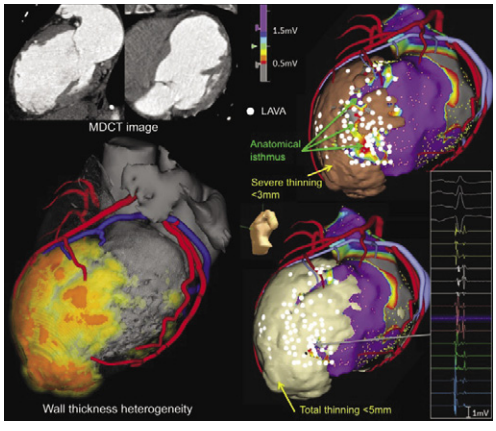
Introduction: MDCT can assess wall thickness (WT) within myocardial infarction with up to 300μm resolution. We hypothesized that slow conduction leading to circuit reentry would likely occur in scar areas with relatively preserved WT.
Methods: 10 patients with post-infarction ventricular tachycardia underwent MDCT before catheter ablation. WT was automatically computed from endocardial and epicardial segmentations. In all patients, anatomical channels were defined as areas between mild and severe wall thinning. Mild wall thinning was consistently defined as WT<5mm, and a patient-specific threshold was used to define severe thinning, i.e WT threshold covering 50% of total wall thinning area. WT maps were registered to electroanatomical maps acquired at high density during sinus rhythm. All electrograms in the substrate area were reviewed to look for local abnormal ventricular activities (LAVA). The distribution of LAVA with respect to WT and anatomical channels was analyzed.
Results: A total of 1444 points evenly distributed over the scar area were reviewed, of which 685 (47%) exhibited LAVA. On imaging the severe wall thinning threshold that was associated with optimal anatomical channel delineation was 2mm in 8 patients and 3mm in 2. Among all LAVA, 526 (77%) projected in an anatomical channel, 151 (22%) in severe thinning areas, and 8 (1%) in non-thinned areas. In the scar area, the rate of LAVA was twice higher inside than outside anatomical channels (60±19 vs 25±24% of all points, P=0.001).
Conclusions: Anatomical channels of relatively preserved WT within severely thinned areas are a common substrate for slow conduction in patients with post-infarction VT.



PO06-123

BENEFICIAL EFFECTS OF REPEAT CATHETER ABLATION IN PATIENTS WITH MULTIPLE MORPHOLOGY OF PREMATURE VENTRICULAR CONTRACTIONS

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Introduction: In patients with high burden multiple morphology premature ventricular contractions (PVCs) catheter ablation represent a viable therapeutic option. Whether the elimination of all these PVCs affect the long term left ventricular ejection fraction is unknown.
Methods: Seventy three patients (56 ±16 years) with frequent multiple PVCs (defined as patients with at least two PVCs morphology) and with a high burden (26 ± 13%) were included in this study. In all patients all PVCs morphology were targeted for ablation at index procedure. Holter monitoring and clinical evaluations were utilized to determine success at follow up.Two-dimensional echocardiography was performed at baseline and follow-up. LVEF were calculated by Simpson's rule.
Results: With a single procedure, successful ablation of all PVC morphologies occurred in 33 (44%) patients. The baseline EF in the population was 52% (52.4 ± 4.7) with 6 patients with reduced EF at around 45%. In the 40 patients with PVCs recurrences a repeat procedure was offered. Twenty two patients underwent a repeat procedure. In 20 cases (91%) the ablation was successful and no recurrence occurred at the 3 years follow up. In patients successfully treated at the index procedure, the 3 years follow up EF was 56 ± 4.9%. Instead, in the patients with failed procedure over three years the EF dropped from 50.1 ± 4.3% to 40.3 ± 7.4%.
Conclusions: Patients with multiple PVCs morphology undergoing ablation have a lower success rate with a single procedure. However, ablation of all PVCs morphology with repeat procedures increased the long term success and is advisable to avoid cardiac function deterioration at the long term follow up.

PO06-124

ANATOMICAL BASED PREDICTION OF LEFT VS RIGHT OUTFLOW TRACT ORIGIN OF PREMATURE VENTRICULAR CONTRACTIONS

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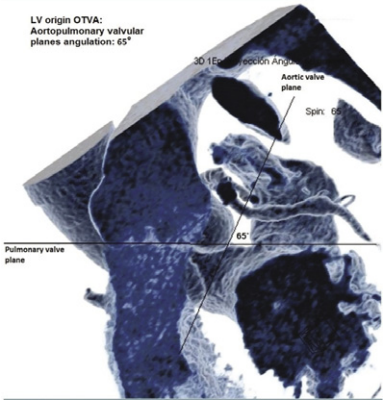
Introduction: Left ventricle outflow tract ventricular arrhythmias (LVOT-VA) are associated with hypertension, older age and left ventricular (LV) dysfunction, suggesting that LV overload plays a role in the etiopathogenesis. We hypothesized that anatomical modifications of LVOT, aortic root and the aortopulmonary valvular angulation (APVA) due to chronic LV overload could predict left vs right site of origin of OTVA.
Methods: Fifty-three (29 men, 52.4±17.9 years) consecutive patients referred for OTVA ablation were included. A contrast enhanced CT scan was obtained before ablation. Anatomical characteristics of the aortic root and APVA were analysed blinded to the site of origin of OTVA.
Results: Patients with LVOT site of origin (n=29; 55%) were more frequently male (76% vs 24% , p<0.001), older (56.3±17.6 vs 47.6±17.5 years, p=0.07) and more likely to suffer from hypertension (55% vs 20%, p=0.013) and LV dysfunction (LVEF 45.8±15.1% vs 54±11.4%, p<0.03) as compared with RVOT-VA patients. Aortopulmonary valvular angulation was higher in LVOT group (68±6 vs 54±8 degrees, p<0.001). Absolute increase of all aortic root diameters (aortic ring, sinuses of Valsalva, sinotubular junction, ascending aorta) was associated with LVOT origin. However, after indexing by body surface area, only sinotubular junction diameter increase maintained this association (p=0.04). In the multivariable analysis, APVA was the only independent predictor of LVOT origin. An APVA ≥62 degrees reached 82% sensitivity and 88% specificity for predicting LVOT origin.
Conclusions: The measurement of aortopulmonary valvular planes angulation is useful for the prediction of LVOT vs RVOT origin of OTVA.



PO06-125

IMPROVEMENT OF SYMPTOMS AND QUALITY OF LIFE AFTER RADIOFREQUENCY CATHETER ABLATION OF VENTRICULAR ARRHYTHMIAS IN PATIENTS WITH STRUCTURALLY NORMAL HEART

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Introduction: Radiofrequency ablation (RFA) for ventricular arrhythmias (VA) is commonly performed for symptomatic patients with significant arrhythmia burden. We aim to evaluate if RFA improves VA burden, associated symptoms and quality of life (QOL) in patients with structurally normal heart.
Methods: Patients with structurally normal hearts and VA (PVCs/VT) who underwent RFA between Jan/2013 and May/2015 at Mayo Clinic, completing comprehensive symptom and SF 36 QOL inventories at baseline and 3 month follow up were included. Demographics, procedure details, VA burden, symptoms and SF36 QOL data were obtained.
Results: A total of 54 patients were identified. Mean age was 55.3±15 with 52% men and mean LVEF was 56±11. Sustained VT was documented in 35% of the patients. Proportion of patients with palpitations, dizziness and dyspnea was 86, 82 and 69% respectively. RFA resulted in acute success in 98.1% patients; During follow-up, a significant reduction of PVC burden (18% ±16 vs 3.2±7.5, p<0.0001) with no recurrence of VT noted. Complete elimination was noted in 48.1%. Forty percent patients did not need B-blockers at follow-up (p=0.006). A significant improvement in severity of palpitations (1.5±0.8 vs.0.8±0.9, p<0.001), dizziness (2.5±1.0 vs.1.6±0.8, p<0.001), dyspnea (1.0±0.8 vs.0.3±0.5, p<0.001), physical health (63.8±18.7 vs.80.2±14.8, p<0.001), mental health (68.2±17.6 vs.80.6±14.4, p<0.001), occurred at 3 months.
Conclusions: RFA in patients with structurally normal hearts and VA is effective in reducing the arrhythmia burden and is associated with significant improvement in symptoms and QOL. This provides previously unavailable justification for intervention.

	Baseline	Follow up	Significance
B-blocker/calcium channel blocker usage	38(70.4%)	23(42.6%)	p=0.006
Antiarrhythmic usage	11(20.3%)	9 (16.6%)	P=0.3
LVEF %	55.7% ±17.3	54% ±10.8	P=0.52
PVC burden	18% ± 15.7	3.2% ± 7.5	p<0.0001
Presence of sustained VT	19 (35.2%)	0	p<0.001
Severity of palpations scale	1.6 ± 0.9	0.8 ± 0.9	<0.001
Dizziness scale	2.6 ± 1.0	1.7 ± 0.8	<0.001
Dyspnea scale	0.96 ± 0.82	0.3 ±0.52	<0.001
Physical Health Score	63.8 ± 18.7	80.2 ± 14.8	p<0.001
Mental Health Score	68.2 ± 17.6	80.6 ± 14.4	p<0.001

PO06-126

ABLATION OF VENTRICULAR ARRHYTHMIA ORIGINATING AT THE PAPILLARY MUSCLE USING AN AUTOMATIC PACE-MAPPING MODULE

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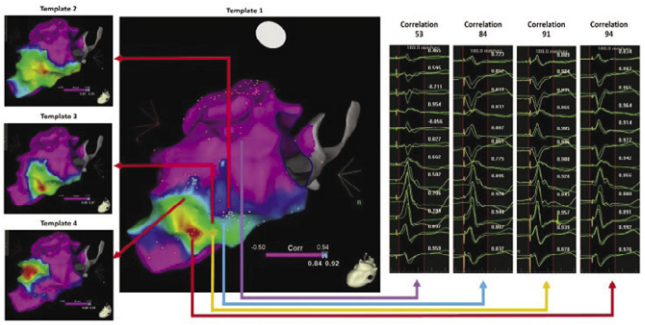
Introduction: Ventricular arrhythmia (VA) originating from the papillary muscle (VA-PM)is characterized by multiple exits and morphological alternations during catheter ablation. The conventional ablation strategy relies on activation mapping, results of which can be suboptimal. Here a novel pacemapping strategy aimed at multiple exits using highoutput software is proposed as an alternative approach.
Methods: A consecutive 13 patients with VA-PM were enrolled in the present study.Novel pacemapping based on an automatic matching algorithm and integrated electroanatomical mapping was used in this cohort. We used the novel pacemapping correlation index to quantify the morphology variation in these patients, and identify the potential exits of VA-PM.
Results: Twelve of thirteen (92%) patients experienced morphological alternation and a total of 34 morphologies were detected (2.6±1.0 per patient). Exits with a high pacemapping correlation index of a corresponding morphology could be mapped, and preferential exits could be identified. Acute success rate was 100%. During a mean follow-up of 12.2± 6.9 months, only 1 case recurred with ventricular tachycardia. Three cases recurred with different VPC morphologies. The VPC burden in recurrent cases reduced from 16.3 ± 8.8% to 2.6 ± 1.7 %.
Conclusions: Consistent high pacemapping-correlation sites and multiple morphological alternations were found in patients with VA-PM, which suggested the presence of multiple preferential exits. The novel pacemapping strategy effectively eliminated multiple exits and resulted in optimal outcome.



PO06-127

PRIMARY ENDOCARDIAL ABLATION OF IDIOPATHIC VENTRICULAR ARRHYTHMIAS ARISING FROM THE LEFT VENTRICULAR SUMMIT: "MAP EPI, ABLATE ENDO"

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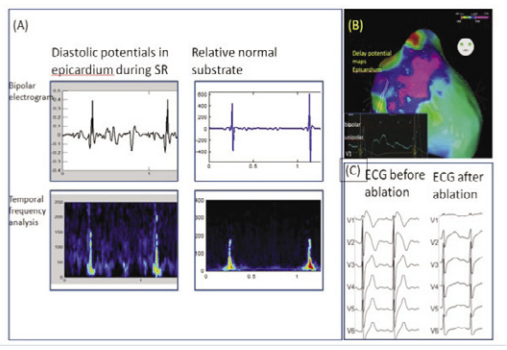
Introduction: The LV summit (LVS) is a known site of origin for idiopathic ventricular arrhythmias (VA's). Those are typically mapped and targeted with ablation via epicardial coronary veins, which can be challenging. Reported success rates after a single procedure are approximately 50%, the lowest for any idiopathic VA.
Methods: We report a series of twelve patients, from two major academic centers, with idiopathic VA originating from the LVS. All patients underwent careful mapping of the coronary veins, left coronary cusp, and the endocardial aspect of the LV summit.
Results: All patients had high PVC burden (mean 27±7%). The maximum deflection index was 0.55± 0.06. The earliest presystolic activation was recorded in the proximal anterior interventricular vein (AIV) or AIV/great cardiac vein junction (30±8 msec pre-QRS), followed by the endocardial LV summit (11±10 msec pre-QRS). Pacemapping at the site of earliest epicardial activation yielded pacemaps that were 11/12 match or better in all patients, while endocardial sites yielded poor pacemaps (< 6/6). The ratio of Q wave in aVL/Q wave in aVR was 1.3± 0.3 mV. Primary endocardial ablation to the endocardium of the LV summit, opposite the site with the earliest epicardial activation, eliminated VA's in all patients with mean follow up of 9 ± 8 months. The total endocardial radiofrequency ablation time was 11.5 ± 8.4 minutes. The distance between the epicardial site with earliest activation and the site of successful endocardial ablation was 10.6 ± 5.6 mm. There were no complications.
Conclusions: Epicardial venous ablation of LV summit VA's is typically hindered by proximity to major coronary arteries, high impedance, risk of perforation, and the distance separating the coronary veins from the site of origin (SOO). Preferential conduction can result in relatively late endocardial activation despite proximity to the SOO. Targeting the epicardial or intramural SOO with transmural ablation from the endocardium is safe and feasible after careful epicardial mapping. Larger studies are needed to further assess the safety and efficacy of this approach.

PO06-128

FEASIBILITY OF USING TEMPORAL FREQUENCY ANALYSIS TO IDENTIFY THE ABNORMAL SUBSTRATE IN PATIENTS WITH BRUGADA SYNDROME WITH FATAL ARRHYTHMIAS

Abigail Louise D. Te, MD, Yenn-Jiang Lin, MD, PhD, Men-Tzung Lo, PhD, Shih-Lin Chang, MD, PhD, Li-Wei Lo, MD, Yu-Feng Hu, MD, Fa-Po Chung, MD, Da-Chuan Duan, MD, Tze-Fan Chao, MD, Jo-Nan Liao, MD, Chin-Yu Lin, MD, Yao-Ting Chang, MD, Chung-Hsing Lin, MD, Rohit Walia, MD, Shinya Yamada, MD, Yuan Hung, MD and Shih-Ann Chen, MD. Taipei Veterans General Hospital, Taipei City, Taiwan

Introduction: We hypothesized that in Brugada syndrome (BrS) patients with electric storm, the critical substrate could be identified by advanced signal analysis and serve as a target for ablation.
Methods: We studied 12 symptomatic type 1 BrS patients (all men, ages 38-43 yrs) who had VF and electric storm (3-27 episodes/month) with ICD. Electroanatomic mapping of endocardial and epicardial RV was performed during SR. Exits of sustained VT/VF were determined by pacemapping. SR electrograms (EGM) were analyzed using SAFE-T (defined as the product of temporal frequency and the corresponding amplitude derived from Hilbert Huang Transform decomposition). Abnormal potentials were quantified as LAVA density and displayed in 3D geometry (Fig A). The region of LAVA and their relationship to the exit of VT were determined.
Results: All patients had inducible VT/VF. Unique prolonged late potentials extending over the diastolic intervals, which revealed LAVAs in SR by presence of high frequency fraction in time-frequency representation (Fig B) mostly located at the anterior RV epicardium and in the boundaries of the LVZ. Ablation in the high density LAVA location with prolonged EGM rendered VT non-inducible with normalization of BrS ECG pattern in 6 of 12 patients (Fig C).
Conclusions: Ablation at the abnormal area resulted in normalization of BrS ECG pattern and prevented VT/VF. Temporal frequency analysis was feasible in identifying the exits of localized reentry of fatal VA in a real-time analysis.



PO06-129

RECOGNITION OF AORTIC VALVE CLOSURE ARTIFACT DURING OUTFLOW TRACT MAPPING AND ABLATION: CORRELATION WITH HEMODYNAMICS

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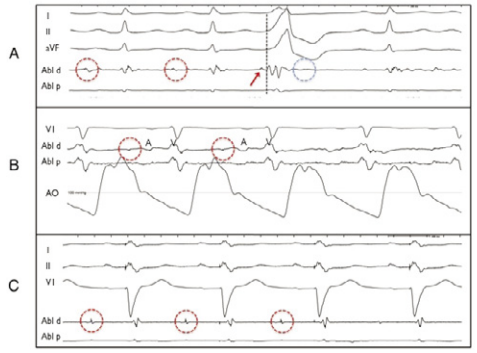
Introduction: The optimal site for ablation of LVOT PVCs may be challenging due to proximity of the involved structures. Physical valve motion artifacts may be recorded during mapping and may confound clinical interpretation.
Methods: Twenty-eight consecutive patients with clinical and symptomatic LVOT PVCs undergoing ablation were analyzed. Abnormal signals recorded on the ablation catheter not coincident with atrial, ventricular depolarization, or T wave were marked and analyzed. Correlation with invasive hemodynamic aortic and femoral pressure tracings was performed.
Results: Out of the 28 patients (73% male, 51 ± 10 years, LVEF 51% ± 10%), 11 (39%) were found to have an aortic valve artifact while mapping in the coronary cusps. This artifact was consistently seen surrounding the terminal portion to the T wave. The average interval between the end of the T wave and the aortic valve artifact was 19 ms ± 37 ms. The duration of the aortic valve artifact was in average 39 ms ± 8 ms and the amplitude fluctuated between 0.06 and 0.36 mV with an average of 0.12 mV ± 0.07 mV (panel A). In four patients (36%) this artifact was coupled just before onset of the PVC, obscuring activation measurements (panel A). When mapping below the valve, artifact was observed in five patients (45%). Timing of the artifact always fallowed the aortic dicrotic notch (panel B). In three patients with mechanical aortic valve, a higher amplitude and higher frequency artifact was seen (panel C).
Conclusions: In patients referred for LVOT PVC ablation, artifact due to aortic valve closure is frequently seen. Recognition of this phenomenon is important to avoid misinterpretation of early sites when performing activation mapping of PVCs.



PO06-130

ANALYSIS OF COMPLICATIONS: ANTERIOR VERSUS INFERIOR ACCESS TO THE PERICARDIAL SPACE IN PATIENTS WITH EPICARDIAL VENTRICULAR TACHYCARDIA

Shibu Mathew, MD, Christine Lemes, MD, Bruno Reissmann, MD, Christian H. Heeger, MD, Ardan M. Saguner, MD, Kentaro Hayashi, MD, Christian Sohns, MD, Andreas Metzner, MD, Karl-Heinz Kuck, MD, FHRS and Feifan Ouyang, MD. St. George Asklepios Klinik, Hamburg, Germany, AK St Georg, Hamburg, Germany, Asklepios Klinik St. Georg Hamburg, Hamburg, Germany, AK St. Georg, Hamburg, Germany, University Hospital Zurich, Zurich, Switzerland, Kokura Memorial Hospital, Kitakyusyu, Japan, Asklepios St. Georg, Hamburg, Germany, Ak-St.Georg, Hamburg, Germany, Asklepios Klinik St. Georg, Hamburg, Germany, Asklepios Klinik St. Georg, II Med Abteilung, Hamburg, Germany

Introduction: Epicardial- VT Ablations are increasingly performed, but there are still limited information about its safety and complications. The question whether an anterior epicardial puncture compared to an inferior epicardial punctue may reduce potential complications has not been systematically analysed so far.
Methods: N/A
Results: Complications associated to the epicardial puncture were analysed in 146 patients (51±16.7yrs, 126 male) and in 171 epicardial procedures. In 35/ 171 (20,47%) procedures an anterior approach and in 136/171(79,53%) procedures an inferior approach to the pericardial space was performed. In brief access to the pericardial space was gained from a subxiphoid puncture and access was performed under fluroscopic guidance and additional injection of 2 to 5 ml contrast media to verfiy correct position. The inferior approach was performed via fluroscopically guidance in an antererior-posterior view, whereas the anterior epicardial puncture was performed by an anterior-posterior and additional LAO 90° view in order to avoid abdominal organ perforations. Due to the inferior epicardial puncture in one patient (0.7%) a perforation of the right coronary artery (RCA) was seen. In two pts (1,47%) a perforation of the liver and in another patient (0,7%) a perforation of the colon was observed. In these three patients the epicardial sheath was inserted via the liver or colon to the epicardial space. No organ perforations were observed due to an anterior epicardial puncture.
Conclusions: The risk of potential severe complications in epicardial-VT Ablations is high. But an anterior epicardial approach may reduce potential complciations.

PO06-131

MITRAL VALVE PROLAPSE - SUBSTRATE FOR PAPILLARY MUSCLE VENTRICULAR ARRHYTHMIAS?

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Introduction: The LV papillary muscles (PM) are a unique intra-cavitary site of origin of idiopathic ventricular arrhythmias (VA) or premature ventricular complexes (PVCs). We aim to review the characteristics of pts undergoing ablation of VAs arising from the LV PMs from our centre.
Methods: All patients referred for PVC ablation from 2011 until 2015 were retrospectively reviewed. Those who underwent ablation of either the anterolateral or posteromedial LV PMs were identified and compared to a control group of pts who underwent ablation of PVCs from other sites over the same period.
Results: PM ablation was performed in 14 pts, whilst 78 patients underwent ablation at other sites. In the PM group, VA arose from the posteromedial PM in 7/14 (50%), the anterolateral PM in 2/14 (14%) and both 5/14 (36%). Mitral valve prolapse (MVP) occurred in 7/14 (50%) of the PM group compared to none in the controls ($p < 0.001$). PM ablation was successful in 4/7 (57%) pts with MVP and in 7/7 (100%) pts without MVP. Pts undergoing PM ablation required longer procedural times and more RF lesions, though less fluoroscopy time. Intracardiac echocardiography (ICE) with image integration was used in all PM cases. There was 1 complication in the PM group (small femoral AV fistula) and 2 in the control group (tamponade during pericardial access and a femoral artery fistula).

Characteristics of Patients Referred for PM vs Other PVC Ablation			
	PM PVC Ablation (n = 14)	Other PVC Ablation (n = 78)	P-value
Age (years)	50.2 ± 18.3	52.6 ± 15.1	0.60
Pre-ablation LVEF (%)	48.5 ± 10.7	52.9 ± 14.0	0.31
Pre-ablation Holter PVC burden (%)	26.0 ± 13.5	25.1 ± 22.5	0.95
Mitral valve prolapse	7/14 (50%)	0/78 (0%)	< 0.001

Acute Success	11/14 (79%)	62/78 (79%)	0.94
Use of ICE	14/14 (100%)	20/78 (26%)	< 0.001
Procedure Duration (mins)	260.7 ± 78.8	209.6 ± 54.9	0.04
Fluoroscopy Time (mins)	19.1 ± 11.4	31.9 ± 17.4	0.01
RF Lesions	27.2 ± 15.7	11.9 ± 9.1	< 0.001

Conclusions: There is a strong association between MVP and PM VAs. This association may be due to mechanical PM stretch and requires further study. Compared to other sites of PVCs, PM ablation requires longer procedure time, use of ICE and more RF lesions. Acute success rates are excellent.

PO06-132

DYNAMIC GADOLINIUM CONTRAST-ENHANCED VISUALIZATION OF RADIOFREQUENCY ABLATION SHOWING ACUTE AREA OF REVERSIBLE EDEMA AND PREDICTING CHRONIC LESION SIZE

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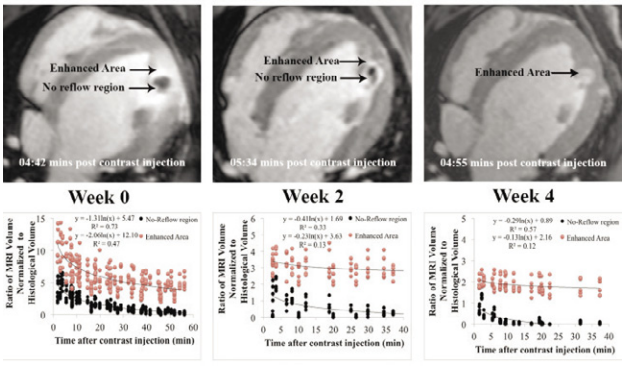
Introduction: Late Gadolinium Enhancement (LGE) MRI is a widely used technique to visualize ablation lesions. However, lesion appearance changes drastically with time after ablation and contrast injection. Here we characterize areas of enhancement and the micro-vasculature obstruction (MVO) or the no-reflow region acutely after lesion creation and over a 4 week period with the goal of identifying areas of reversible edema and predicting chronic scar formation.
Methods: After ablation in the ventricles in a chronic canine model (n=7), the animals underwent an LGE-MRI 0, 2, and 4 weeks after ablation with image acquisition at multiple time points after contrast injection. The volumes of enhancement and the MVO in MRI were quantified. The volume of chronic lesion was determined from excised heart and the MRI volumes were normalized by histological volume. Volumes were compared over the 4 week post ablation period.
Results: The number of analyzed lesions were 36, 11 and 20 at week 0, 2 and 4 respectively. Histological volume was 99±52 mm3. The average normalized volumes of enhancement for the initial MRI acquired five minutes post contrast injection were 8.78± 3.64 at week 0, 3.26±0.49 at week 2, and 1.95±0.37 at week 4. Part of this overestimation came from edema, which was resolved by week 2. After ablation, the acute MVO volume at 30.33 mins predicted chronic lesion size. One month after ablation, the MVO volume was negligible and the area of enhancement was on average 1.63 times the chronic lesion.
Conclusions: LGE-MRI done after ablation can be used to identify areas of reversible edema and predict chronic lesion size depending on the delay between contrast injection and image acquisition.



PO06-133

CATHETER TIP ORIENTATION AND VARIABLE CATHETER TIPS CAN AFFECT ABLATION LESION SIZE DURING BIPOLAR RADIOFREQUENCY ABLATION

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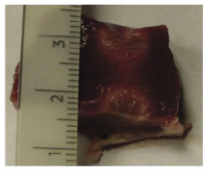
Introduction: Bipolar radiofrequency ablation (RFA) has been used to create larger ablation lesions and to treat deep septal and midmyocardial arrhythmia circuits that may be refractory to standard unipolar RFA. However, little is known about optimal bipolar RFA conditions. We sought to evaluate various bipolar RFA conditions, including active and ground catheter tip orientation and the use of variable active and ground catheters during bipolar RFA.
Methods: Viable bovine myocardium was placed in a circulating saline bath in an ex vivo model. Two ablation catheters, one active and one ground, were oriented across from each other, with myocardium in between. The catheters' tips were placed in various combinations of either perpendicular or parallel to the myocardium. The active catheter was either a 3.5 mm irrigated or 8 mm tip, and the ground catheter was either a 4 mm or 8 mm. Ablations were performed at 50W (irrigated and 8 mm) and 70 W (8 mm) for 60 seconds, and ablation lesions were analyzed.
Results: For active irrigated tips, the largest lesions were achieved with both active and ground tips perpendicular to the myocardium. For 8 mm active and ground tips, the largest lesions were created with both catheters parallel to the myocardium. The largest overall lesions were produced using 8 mm active and ground tips, parallel to the myocardium, with 70W (Figure).
Conclusions: Catheter tip orientation and the type of catheter tip, for both active and ground tips, are important determinants of lesion sizes during bipolar RFA. Using an 8 mm tip, compared to an irrigated tip, as both active and ground can increase lesion sizes, since higher powers can be delivered.

A



B

Sample#	Active Position	Ground Position	Total Volume (ml)	Watts
n=30	**Irrigated Perpendicular**	**4mm Perpendicular**	**454.4 ± 73.2**	**50**
n=30	Irrigated Parallel	4mm Perpendicular	335.2±44.7	50
n=30	Irrigated Perpendicular	4mm Parallel	352.5±38.3	50
n=30	Irrigated Parallel	4mm Parallel	254.3±28.1	50
Sample#	Active Position	Ground Position	Total Volume	Watts
n=30	8mm Parallel	4mm Perpendicular	370.9±43.5	50
n=30	8 mm Perpendicular	4mm Perpendicular	169.1±23.5	50
Sample#	Active Position	Ground Position	Total Volume	Watts
n=30	8mm Parallel	8mm Parallel	406.9±40.6	50
n=30	**8mm Parallel**	**8mm Parallel**	**558.8±61.0**	**70**

(A) Example of bipolar ablation on ex vivo tissue with irrigated (active) and 4 mm (ground) perpendicular to myocardium. **(B)** Table of various configurations for catheter tip type and orientations. The largest lesions were created using 8 mm active and ground tips parallel to the myocardium, with powers at 70W (bolded last line).

PO06-134

OUTCOME OF VT ABLATION PROCEDURES USING CONTACT FORCE SENSING CATHETERS

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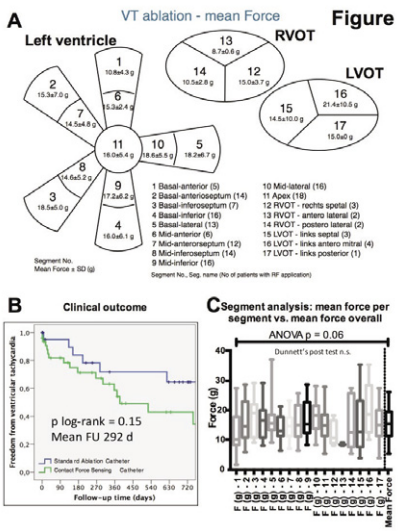
Christoph Schuhmann, MD, Sebastian Clauss, MD, Moritz F. Sinner, MD, MPH, Stefan Kaab, MD, PhD, Stephanie Fichtner, MD, Heidi L. Estner, MD and Reza Wakili, MD. Medizinische Klinik I, Klinikum Grosshadern, Munich, Germany

Introduction: In this study we evaluated patients (pts), who underwent ventricular tachycardia ablation (VTA) with respect to the potential role of Contact force (CF) catheters.
Methods: We analyzed 74 pts with ischemic cardiomyopathy (n=40) and non-ICM (n=34) undergoing VTA. We performed regular retrograde approach via the aortic valve. Pts were divided into 2 groups: (1) n = 50, ablation performed with CF sensing SMARTtouch catheter© aiming for a CF > 10 g/lesion, and (2) n = 24, patients undergoing VTA with a conventional non-CF sensing standard ablation catheter (SAC). Efficacy endpoint was clinical outcome (freedom from VT recurrence). All patients were equipped with an ICD and follow-up (FU) was performed on regularly basis in 3-6 months terms. In addition, CF values were evaluated with respect to different anatomical segments (figure 1A).
Results: Procedural analysis revealed just a trend towards lower Radiation time dose in the CF, while number of RF applications were indistinguishable. Clinical outcome did not differ between the groups during a mean FU of 292 days (figure 1B). CF analysis showed a relatively homogenous distribution of CF values with mean CF > 14g throughout most segments (figure 1A + C). Statistical analysis just missed significance (p=0.06) but showed a strong trend towards low CF values in the right lateral region of the RVOT (segment 13 +14) and LV basal-anterior (segment 1) (figure 1C).
Conclusions: CF catheters failed to show a benefit on procedural parameters or clinical outcome in VTA. However, analysis suggests generation of sufficient CF in most LV segments with exception of the anterior-basal segment and the RVOT.

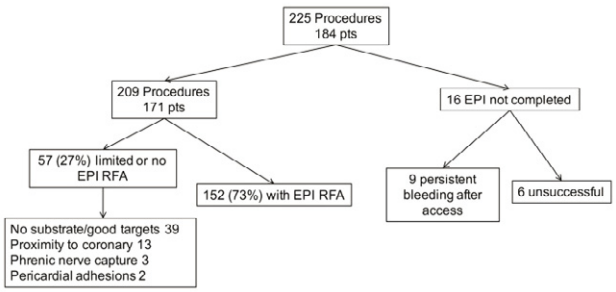


PO06-135

PREVALENCE AND REASONS FOR NOT PERFORMING EPICARDIAL ABLATION IN PATIENTS WITH NONISCHEMIC CARDIOMYOPATHY FOLLOWING ATTEMPTED OR SUCCESSFUL ACCESS

Pasquale Santangeli, MD, Erica S. Zado, PA, Daniele Muser, MD, David S. Frankel, MD, FHRS, Gregory Supple, MD, Robert Schaller, DO, Fermin C. Garcia, MD, Mathew D. Hutchinson, MD, FHRS, David Lin, MD, Michael P. Riley, MD, PhD, Sanjay Dixit, MD, FHRS, David J. Callans, MD and Francis E. Marchlinski, MD, FHRS. Hospital of the University of Pennsylvania, Philadelphia, PA, Hospital of the University of Pennsylvania - Cardiovascular Div., Philadelphia, PA, University of Pennsylvania, Philadelphia, PA, Hospital of Univ of Pennsylvania, Cardiology, Philadelphia, PA, Hospital Of The University of Pennsylvania, Philadelphia, PA, Hosp of The University of Pennsylvania, Philadelphia, PA, University of Pennsylvania Health System, Philadelphia, PA

Introduction: Patients with nonischemic cardiomyopathy (NICM) have a high prevalence of epicardial (EPI) substrates, and EPI catheter ablation has been associated with improved VT-free survival in this population. However, in some cases EPI ablation is limited or not possible. We report the prevalence and reasons for failed EPI ablation in patients with NICM.
Methods: We included 184 patients (age 58±13 years, 83% males, mean ejection fraction 34±15%) with NICM and VT undergoing a total of 225 EPI procedures. After EPI substrate mapping, all critical sites for the clinical or induced VT(s), identified by activation, entrainment or pace-mapping, together with late, split and fractionated potentials were targeted with focal and/or linear ablation. Ablation was not performed at sites within 5 mm of major coronary arteries or in case of persistent phrenic nerve capture.
Results: A total of 16 (7%) EPI procedures could not be completed because of either unsuccessful attempts at obtaining access (6/16, 38%) or periprocedural complications (10/16, 63%). The latter included 9 patients with persistent bleeding. Out of the remaining 209 procedures, 57 (27%) received no EPI ablation because of lack of abnormal substrate or good EPI targets (68%), proximity to a major coronary artery (23%), phrenic nerve capture (5%) and significant pericardial adhesions limiting mapping (4%) (Figure).
Conclusions: In patients with NICM EPI ablation is limited or impossible in up to one third of cases because of lack of EPI abnormal substrate/good ablation targets, safety concerns, inability to obtain access or periprocedural complications related to access.



PO06-136

LONG TERM OUTCOMES AFTER CATHETER ABLATION OF RECURRENT VT IN PATIENTS WITH CARDIAC SARCOIDOSIS

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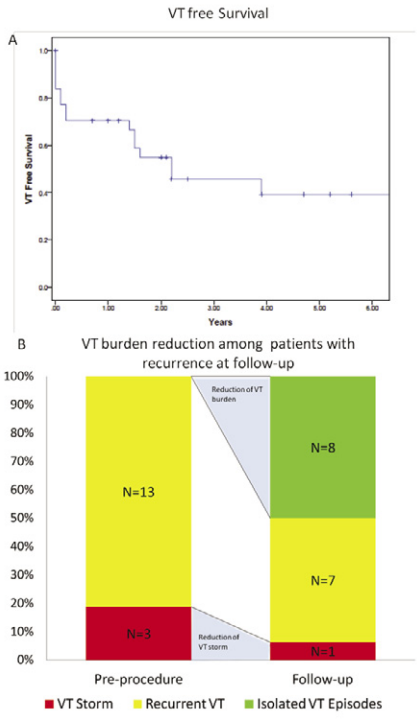
Introduction: Catheter ablation (CA) VT in patients (pts) with cardiac sarcoidosis (CS) is challenging due to the complex underlying substrate. We evaluated outcomes at the long-term follow-up of CA of VT in pts with CS.

Methods: We enrolled 31 pts (55 ± 10 years, 71% males) with recurrent VT related to CS who underwent CA. Diagnosis of CS was established according to HRS criteria. CA was guided by activation/entrainment mapping for tolerated VT and pacemapping/targeting of abnormal substrate for unmappable VT. Recurrent VT over follow-up was defined as any sustained VT at ICD interrogation.
Results: The mean LVEF was 42±15% (14 pts with LVEF≤35%), with 6 (19%) pts presenting significant biventricular involvement. CA was performed endocardially in all pts. Epicardial mapping was performed in 13 (42%) pts and ablation in 8 (26%) cases. In 11 (36%) cases more than one procedure (max 3 procedures) was necessary to achieve the long-term results. At the end of the last procedure, noninducibility for any VT at programmed stimulation was achieved in 21 (68%) of pts. After a median follow-up of 2.5 years (1.3 to 5.2 years), 1 (3%) pt died and 4 (13%) underwent heart transplant. Overall VT-free survival was 40% at 6-years follow-up. Among the 16 (52%) pts with VT recurrences, CA still resulted in a significant reduction of VT burden with 8/16 (50%) having only isolated (≤3 over 0.5 to 47 months, mean 11±1 months) VT episodes and a single pt with recurrent VT storm.
Conclusions: In pts with CS and VT, CA is effective in achieving long-term VT freedom in 40% of cases with a substantial improvement in VT burden in many of the remaining pts. In more than one third of pts multiple procedures are needed to achieve long-term VT control.



PO06-137

FASCICULAR VENTRICULAR TACHYCARDIA ORIGINATING FROM PAPILLARY MUSCLES: PURKINJE-NETWORK INVOLVEMENT IN THE REENTRANT CIRCUIT

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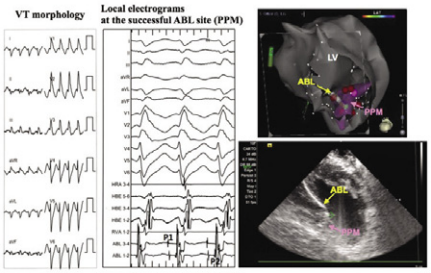
Introduction: Verapamil-sensitive left fascicular ventricular tachycardia (FVT) has been demonstrated to be reentrant mechanism using Purkinje network as a part of its reentrant circuit. Although the papillary muscles (PMs) are implicated in arrhythmogenic structure, reentrant fascicular ventricular tachycardia (FVT) originating from the PMs has not been well-defined.
Methods: N/A
Results: We studied 10 cases (38±18 years, 8 men) in which sustained FVT was successfully eliminated by ablation at the posterior (n=6; PPM-FVT) and anterior PMs (n=4; APM-FVT). Intravenous administration of verapamil (5mg) failed to terminate VT in 5 patients. Eight patients had undergone previous ablation of FVT originating from the left posterior or anterior fascicular regions. The APM-FVT exhibited right bundle branch block (RBBB) configuration and right axis deviation with deep S wave in lead I, V5 and V6. The PPM-FVT exhibited RBBB and horizontal axis or northwest axis deviation. In all patients, FVT was reproducibly induced by programmed ventricular stimulation. His-ventricular interval during FVT was shorter than that during sinus rhythm. Both diastolic and pre-systolic Purkinje potentials (P1 and P2) were sequentially recorded during VT at the PMs, where ablation successfully eliminated the tachycardia. All patients have been free from recurrent VT after ablation.
Conclusions: Reentrant circuit of FVT can involve Purkinje network lying around the papillary muscles. This subtype of reentrant FVT mostly appears after common type FVT ablation and is characterized by poor sensitivity to verapamil administration and distinctive electrocardiographic characteristics.



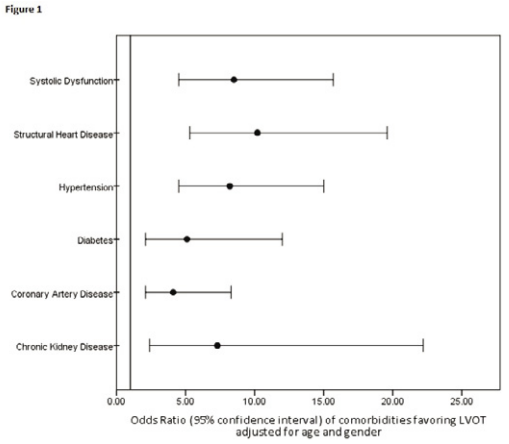
PO06-138

LEFT AND RIGHT VENTRICULAR OUTFLOW TRACT PVCS: DISTINCT CLINICAL ENTITIES? A TWO-CENTER STUDY

Felix Bourier, MD, Tilko Reents, MD, Carola Gianni, MD, Sanghamitra Mohanty, MD, FHRS, Chintan Trivedi, MSc, Amin Al-Ahmad, MD, FHRS, Andrea Natale, MD, FHRS, Gabriele Hessling, MD, FHRS and Isabel Deisenhofer, MD, FHRS. Deutsches Herzzentrum, München, Germany, Texas Cardiac Arrhythmia Institute, Austin, TX

Introduction: Premature ventricular contractions (PVCs) from ventricular outflow tracts (OT) are considered benign with a good long-term prognosis, and they are assumed to be variants of the same clinical entity. We hypothesized that there might be clinical differences between LVOT and RVOT/coronary cusps (CC) PVCs and analyzed a large group of patients undergoing RF catheter ablation for their elimination.
Methods: From 2010 to 2015, patients with OT PVCs who underwent catheter ablation were included in the study. Patients were categorized into LVOT and RVOT/CC and compared for clinical characteristics. Odds ratios (OR) were calculated for comorbidities favoring LVOT by adjusting it for age and gender.

Results: A total of 325 patients were included in the study (LVOT group, n=122, RVOT/CC group, N=223). The patients with arrhythmias originating from the LVOT were older than compared to RVOT/CC group (64.2 ± 12.5 vs. 49.3 ± 16.1, p<0.001). There were more male patients in the LVOT group [88 (72.1) vs. 102 (45.7), p<0.001]. There was an higher incidence rate of structural heart disease [69 (56.6) vs. 17 (7.6), p<0.001], hypertension [98 (80.3) vs. 48 (21.5), p<0.001], coronary artery disease [51 (41.8) vs. 15 (6.7), p<0.001], systolic dysfunction [67 (54.9) vs. 16 (7.7), p <0.001] and diabetes [29 (23.8) vs. 8 (3.6) , p<0.001] in LVOT group. Figure 1 shows the odds ratio for comorbidities adjusted for age and gender.
Conclusions: Patients with LVOT and RVOT/CC arrhythmias presenting for catheter ablation have significant differences in baseline and clinical characteristics. LVOT arrhythmias might be regarded as a distinct clinical entity pointing towards a more severe underlying disease.

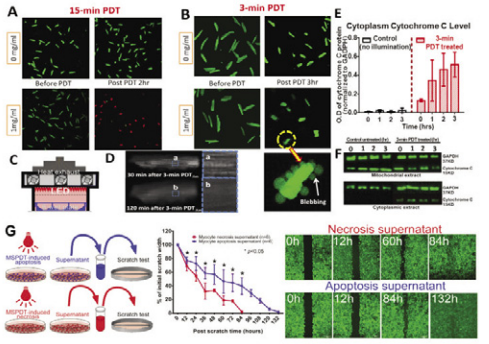


PO06-139

LOW LIGHT DOSE PHOTODYNAMIC-INDUCED CARDIOMYOCYTE ABLATION LEADS TO CELL APOPTOSIS AND MINIMAL MYOFIBROBLAST PROLIFERATION

Uma Mahesh R. Avula, MD, Chang H. Lee, PhD, Hyung KI Yoon, PhD, Kuljeet Kaur, PhD, Fred Morady, MD, Raoul Kopelman, PhD and Jerome Kalifa, MD, PhD. University of Michigan, Ann Arbor, MI

Introduction: We have previously demonstrated that photodynamic therapy (PDT) may be used for cell-specific cardiomyocyte ablation. Here, we evaluated whether PDT photo-ablation of cardiomyocytes may lead to cell apoptosis rather than necrosis.
Methods: We implemented a 671nm LED chamber (6-well dish, Fig. C) and compared a 3-min vs. a 15-min PDT treatment of freshly dissociated rat ventricular myocytes pre-incubated with a photosensitizing nanoparticle, the methylene blue-8-arm-polyethylene glycol. The experiments were conducted in the presence of a live cell indicator, calcein AM, and of a cell necrosis indicator, propidium iodide (PI).
Results: After a 15-min PDT treatment, nearly all myocytes went into necrosis but after a 3-min PDT treatment myocytes exhibited changes compatible with cell apoptosis. Cells shrunk and formed blebs without that any of them exhibited PI uptake (Fig. A, B). Also, cytosolic and mitochondrial cytochrome C protein was progressively released from the cardiomyocyte mitochondrial compartment to their cytoplasm (Fig. E, F). Finally, the MitoTracker orange staining pattern changed gradually from bright punctate to a diffuse cytoplasmic staining aspect, indicating that most mitochondria became porous (Fig. D).
We then compared fibroblast proliferation and migration after incubation with a necrotic vs. apoptotic PDT photo-ablation supernatant (in-vitro scratch assay, Fig. G). The PDT photo-ablation supernatant yielded a significantly reduced fibroblast proliferation and migration.
Conclusions: At the appropriate light dose, PDT photo-ablation of cardiomyocytes leads to cell apoptosis and to minimal fibroblast proliferation.

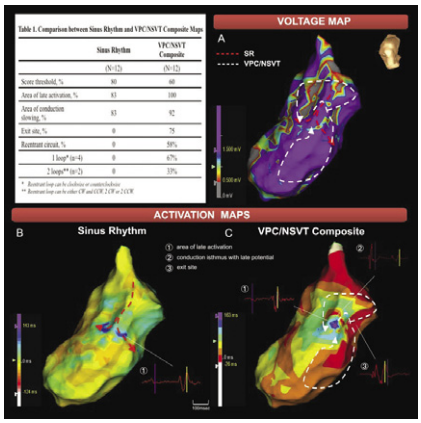


PO06-140

FEASIBILITY OF IDENTIFYING RELEVANT CONDUCTION ISTHMUSES USING COMPOSITE MAPS OF VENTRICULAR PREMATURE COMPLEX/NONSUSTAINED VENTRICULAR TACHYCARDIA DURING CATHETER ABLATION OF SCAR-RELATED VENTRICULAR TACHYCARDIA

Abigail Louise D. Te, MD, Yenn-Jiang Lin, MD, PhD, Shih-Lin Chang, MD, PhD, Li-Wei Lo, MD, Yu-Feng Hu, MD, Fa-Po Chung, MD, Da-Chuan Duan, MD, Tze-Fan Chao, MD, Jo-Nan Liao, MD, Yao-Ting Chang, MD, Chin-Yu Lin, MD, Shinya Yamada, MD, Yuan Hung, MD, Rohit Walia, MD and Shih-Ann Chen, MD. Taipei Veterans General Hospital, Taipei City, Taiwan

Introduction: Electroanatomic mapping using SR and VPC/NSVT composite maps may provide advantage to identify critical substrates in scar-related VT and predict relevant conduction isthmuses during ventricular arrhythmia (VA).
Methods: This study analyzed 12 patients with scar-related VT (6 ischemic CM, 3 ARVC, and 3 non-ischemic CM). The SR and VPC/NSVT composite maps (2±1 maps) were generated based on pre-specified ECG criteria using St. Jude Velocity Precision 2.0 AutomapTM software. The score threshold, which quantifies the similarity between real time and template cardiac rhythm, was set at 80%. The common wavefront propagation pattern was analyzed in each map and compared the SR map with the abnormal substrate during the VA.
Results: The SR and VPC/NSVT composite activation maps showed common regions of slow conduction propagating into the latest activation zone (Table 1, Fig A-C). The VPC/NSVT composite maps demonstrated reentrant circuits with 1 loop (67%) and 2 loops (33%) rotating around a protected isthmus bounded by 2 conduction barriers that could not be identified during SR. These were compatible with the slow conducting zones, exit sites and reentrant circuits identified by entrainment in 80% of VAs during tachycardia. 67% of these reentrant circuits were also localized at the scar border (0.5-1.5mV).
Conclusions: The VPC/NSVT composite map may be able to identify the dynamic waveform propagation patterns near abnormal substrate and localize reentrant circuits that are important for the VA, and were amenable for RF ablation. This could be a novel substrate mapping from the baseline SR and may be advantageous in unmappable VAs.



PO06-141

IMPACT OF PRE-PROCEDURAL MRI AND PET IMAGING FINDINGS ON OUTCOMES OF CATHETER ABLATION OF VT IN CARDIAC SARCOIDOSIS

Daniele Muser, MD, Pasquale Santangeli, MD, Rajeev Pathak, MD, PhD, Silvia Magnani, MD, Simon A. Castro, MD, Jackson Liang, MD, Fermin C. Garcia, MD, Benoit Desjardins, MD, Mathew Hutchinson, MD, Gregory Supple, MD, David Frankel, MD, Michael Riley, MD, PhD, David Lin, MD, Robert Schaller, MD, Sanjay Dixit, MD, David Callans, MD, Erica Zado, PA and Francis E. Marchlinski, MD. Hospital of the University of Pennsylvania, Philadelphia, PA, Ospedali Riuniti di Trieste, Trieste, Italy

Introduction: Catheter ablation (CA) has been successful in select patients with cardiac sarcoidosis (CS) and recurrent ventricular tachycardia (VT). The impact of pre-procedural imaging with MRI and PET in predicting RFCA procedural outcomes has not been investigated.
Methods: 23 patients (age 54±11 years, 78% males) with a diagnosis of CS based upon HRS criteria underwent RFCA for recurrent drug-refractory VT. All patients had recurrent VT despite attempts at VT suppression with 1.7±0.8 antiarrhythmic drugs, with 17 (74%) patients on immunosuppressive therapy at the time of the procedure. In all patients cardiac, MRI and PET evaluation were performed before the procedure. Patients were followed for VT recurrence, death and heart transplant.
Results: Pre-procedure MRI detected LGE in 21 (91%) patients whereas abnormal FDG uptake was found in 15 (65%). In 14 of the 15 patients with positive PET at baseline, PET was repeated after a mean 6.1±3.7 months follow-up. FDG uptake decreased in 7 (50%) and increased or remained unchanged in 8. A total of 35 procedures were performed during the study period (mean 1.5±0.7 procedures per patient). During a median follow-up of 2.2 years (interquartile range 1.5 to 4.7 years), one (4.3%) patient died, 2 (9%) underwent heart transplantation, and 12 (52%) had recurrent VT. Cumulative VT free survival was 44% at 6 years, and was worse in those with positive baseline PET compared to those with negative baseline PET (11% vs. 65% , respectively, Log-Rank P = 0.028). VT free survival was also worse in those without PET improvement compared to those in whom PET improved (0% vs. 43%, respectively, Log-Rank=0.026). Cumulative death/transplant free survival was 86% at 6 years with a trend towards better survival for patients with negative baseline PET (100% vs. 73%, respectively, Log-rank=0.104) and those with PET improvement during follow-up (100% vs. , Log-rank=0.280). Presence of LGE at MRI was not predictive of post-procedural outcomes.
Conclusions: In patients with CS and VT undergoing CA, pre-procedural imaging with PET is useful to identify patients at higher risk of VT recurrence during follow-up. In particular, a positive PET scan at baseline or lack of improvement at follow-up PET predicts worse arrhythmia-free survival.

PO06-142

PREDICTION OF REENTRANT VENTRICULAR TACHYCARDIA CIRCUITS USING SINUS RHYTHM SCAR PROPAGATION PATTERNS: NEW TARGETS FOR ABLATION AND IMPLICATIONS FOR PHYSIOLOGIC ENDPOINTS

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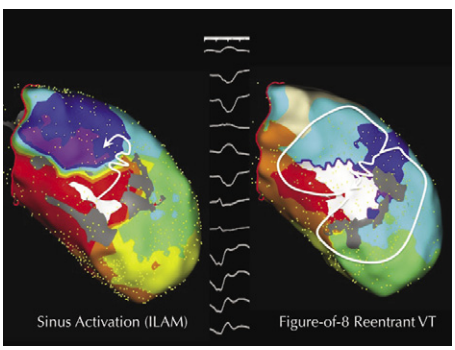
Introduction: The relationship of complete circuit mapping during VT and sinus rhythm scar propagation has not been systematically studied in humans.
Methods: Ultra high-density mapping (NAVX, St. Jude, Minneapolis, MN) was performed using a multipolar duodecapolar catheter (LiveWire, St. Jude Medical) during normal sinus rhythm and displayed as isochronal late activation maps exhibiting the ventricular activation window over eight isochrones. In patients with hemodynamically tolerated VT, detailed comprehensive mapping of the entire reentrant circuit was performed with combined endocardial-epicardial mapping and isthmus sites were prospectively correlated with regions with isochronal crowding during sinus rhythm.
Results: 11 patients (ARVC=5, NICM=5, ICM=1) underwent mapping during hemodynamically stable monomorphic VT. Termination of VT was achieved at sites that were mid or late diastolic within the first two radiofrequency applications. During sinus rhythm, these sites correlated with localized regions of isochronal crowding (>3 isochrones within 1 cm) outside the latest isochrone. Figure of eight reentry was observed in 75% of cases during VT mapping.
Conclusions: In patients with hemodynamically tolerated VT, sinus scar propagation patterns demonstrate localized regions of fixed conduction slowing which correlated with isthmus locations within the reentrant circuit. This data suggests that regions of abnormal local ventricular electrograms with isochronal crowding may predict the highest yield region for substrate modification.



PO06-143

STEP WISE APPROACH FOR VENTRICULAR FIBRILLATION ABLATION IN BRUGADA SYNDROME: EVIDENCE FROM ENDOCARDIAL MAPPING

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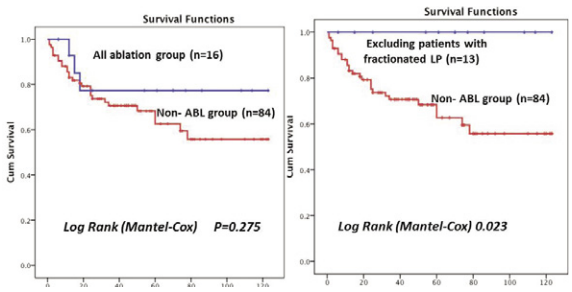
Introduction: Despite effectiveness of both , endocardial catheter ablation(CA)of ventricular fibrillation (VF)-triggering premature ventricular contractions(PVCs)and substrate modification of the right ventricular outflow tract (RVOT) epicarduim in Brugada syndrome(BrS),it is unclear which should be practiced and which case responds to which approach.
Methods: Among 100 BrS patients presented with syncope/VF, CA was performed in 16. Detailed endocardial mapping revealed heterogeneous electrophysiological substrate characteristics, namely; 56% of the cases did not exhibit endocardial late potentials (LP) or low voltage areas, 25 % exhibited non-fractionated LPs and 19%, who experienced more than 20 VF episodes, had fractionated LPs. CA of VF-trigger PVCs followed by additional consolidation radiofrequency applications around the PVC origin and LP sites was performed in the RVOT-free wall in 77% of the cases and in the RV itself in the rest of the cases, which rendered VF non-inducible in 7 patients with normalization of Brugada-type ECG in 2 patients.
Results: During 54 ±43 (6-123)-month follow up,VF recurrence was observed in all patients with fractionated LPs despite occurrence of triggering PVCs and normalization of Brugada pattern ECG in 2. Epicardial approach completely prevented VF recurrence in these 3 patients (Table).
Conclusions: VF-trigger elemination followed by substrate modification around the site of origin has excellent long-term outcome while presence of endocardial fractionated delayed potentials, in patient with the most frequent VF episodes, indicates inadequacy of endocardial ablation and epicardial approach is necessary.



PO06-144

OUTCOMES OF CATHETER ABLATION OF OUTFLOW TRACT VENTRICULAR ARRHYTHMIAS WITH AN R WAVE PATTERN BREAK IN LEAD V2: A DISTINCT CLINICAL ENTITY

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Introduction: In patients with outflow tract ventricular arrhythmias (OT-VAs), the presence of an R wave pattern break in lead V2 (PBV2) suggests an origin close to the anterior interventricular sulcus (anatomically opposite to lead V2), and inaccessible for direct ablation due to the presence of major coronary vessels and fat (LV summit). We studied the prevalence and outcome of catheter ablation of OT-VAs with a PBV2.
Methods: Out of 48 consecutive patients (age 50±15 years, 30 females) with OT-VAs and a precordial transition in V3, 8 (17%) had PBV2, defined as net QRS amplitude in lead V2 being less positive or having a smaller R wave than in both lead V1 and V3.
Results: Compared to the control population, patients with a PBV2 had a smaller R amplitude in lead I (0.054mv vs 0.27mv P=0.0058), higher III/II R amplitude ratio and greater Q-wave ratio in aVL/aVR (1.09mv vs 0.94mv P=0.014, 1.44 vs 0.95 P=0.0018 respectively). Mapping was performed in the RVOT in all patients, in the LVOT and coronary cusp region in 7, in the coronary venous system in 4, and in the epicardium via a subxiphoid access in 3 cases. The earliest activation was recorded in the RVOT in 3 patients (21±4 ms pre-QRS), in the coronary cusp (left coronary cusp (LCC)) in 1 patient (31 ms pre-QRS), in the anterior interventricular vein (AIV) in 3 patients (42±13 ms pre-QRS), and in the epicardium in 1 patient (28 ms pre-QRS). Acute success was achieved in 4 patients with the earliest activation site in the RVOT or in the coronary cusp (LCC)). In the remaining 4 patients (all with earliest activation in the AIV or epicardium) ablation was aborted due to proximity to the left anterior descending (LAD) coronary artery. After a mean follow-up of 1094±494 days, VA free survival was 38%, with 1 patient having VA recurrence before hospital discharge. Success rate was significantly lower compared to the reference population with transition in V3 without pattern break (38% vs 80% P=0.02).
Conclusions: Catheter ablation of OT-VAs with a PBV2 remains challenging. In half of these patients ablation at the earliest site could not be performed secondary to proximity to the LAD. In the remaining patients, ablation was delivered from the RVOT or coronary cusp region, but was successful in achieving long-term VA suppression in only one third of cases.

PO06-145

ISCHEMIC VT ABLATION: IMPACT OF ONGOING AMIODARONE ON OUTCOMES AT FOLLOW UP

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Introduction: Catheter ablation of scar related ventricular arrhythmias is a valid therapeutic option in patients with ischemic cardiomyopathy. Whether ongoing Amiodarone therapy may affect the procedural outcome is unknown.
Methods: One hundred and-four consecutive patients (78% male, age 64 ±10years) with ischemic cardiomyopathy undergoing VA catheter ablation were included in this study. Patients were sorted by Amiodarone therapy before ablation. In all patients a substrate based ablation in sinus rhythm abolishing all "abnormal" electrograms within the scar was performed with the endpoint of VT non inducibility. Following ablation, Amiodarone was discontinued. All patients had an ICD and recurrences were analyzed through the device interrogation.
Results: In 66 patients the ablation was performed "on"Amiodarone while the remaining 38 were "off" Amiodarone. Patients on and off Amiodarone were comparable in their baseline characteristics. The mean scar size was 145 ± 58cm2 vs 142 ± 60 cm2 (p=0.8). The density of the substrate map was comparable between groups (543±102 vs 538±106 p=0.8).
In the "off" Amiodarone group more radiofrequency time was necessary to achieve non inducibility when compared to the "on" Amiodarone group (67±17vs 52±16, P < 0.001). In addition in the "off" Amiodarone group, due to persistent VT inducibility, a higher number of patients required epicardial access and ablation when compared to the "on" Amiodarone group (4/66, 6% vs 10/38 pts 26% p=0.003). During a mean follow-up of 24±8 months, the recurrence of any ventricular tachycardia off AADs was 42% (28 pts/66) in the "on" Amiodarone group and 21%, 8/38 in the "off" Amiodarone group (p=0.027).
Conclusions: Our study demonstrates that ongoing Amiodarone may limit the extent of ablation required during scar related VT to achieve non inducibility. However, this is associated with higher VT recurrence at follow up.

PO06-146

THE ABSOLUTE EARLY ACTIVATION DISCREPANCY AND EARLIEST ACTIVATION DISTANCE: A NEW ELECTROPHYSIOLOGICAL CRITERIA FOR STRATEGY OF ABLATION IN SEPTAL VENTRICULAR OUTFLOW TRACT TACHYCARDIA

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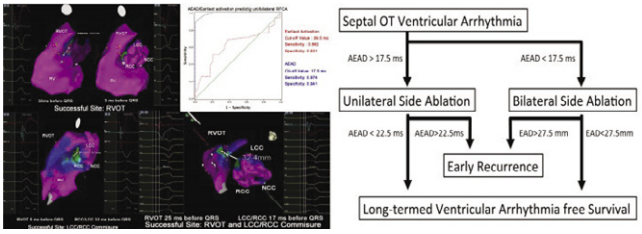
Introduction: Several electrocardiographic and electrophysiological criteria have been proposed for differentiating left from outflow tract ventricular arrhythmia (OT-VA) origin. Septal OT-VA remains a challenge and the requirement for bilateral ablation is not uncommon. We sought to develop electrophysiological criteria for ablation strategy of decision-making in patients with idiopathic septal OT-VA.
Methods: We retrospectively analyzed the surface ECG patterns and electrophysiological parameter from 67 patients (mean age 48±15 years, 39 female) with idiopathic septal OTVA. ECG parameter and electrophysiological parameters were compared.
Results: The absolute early activation time discrepancy (AEAD, earliest activation time before QRS in RVOT - earliest activation time before QRS in LVOT) could predict the failure of single side ablation and requirement of bilateral ablation with excellent sensitivity and specificity, which is superior to earliest activation site in single OT mapping. The long-termed recurrence was associated with small AEAD in unilateral ablation and longer EAD (earliest activation site distance) in bilateral ablation.
Conclusions: The absolute early activation time discrepancy is a novel electrophysiological measurement that reliably predicts the requirement of bilateral ablation to achieve acute success and long-termed recurrence in septal OT-VA.



PO06-147

INFLUENCE OF SEDATION DEPTH AND PROPOFOL ON THE OCCURRENCE OF PREMATURE VENTRICULAR CONTRACTIONS

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Introduction: Deep anesthesia may suppress premature PVCs thus complicating CA. PVCs are affected by sympathetic stimulation or sedative drugs. We sought to investigate the influence of PFL sedation on the number of PVCs in patients undergoing ablation of PVCs.
Methods: 14 patients (pts) (mean age 58±12 years, 42.9% male, BMI 27.7±4.3 kg/m², LVEF 51.3±9.6) undergoing ablation of PVCs were prospectively included. Deep sedation with PFL was achieved by target controlled infusion (TCI) (Schnider model, effect site control) using a stepwise protocol (0.5 μg/ml (sedation level, SL 1), 1.5 μg/ml (SL 2), 2.5 μg/ml (SL 3), individual TCI dose to reach deep sedation (SL 4, mean TCI effect dose 4.38±1.02 μg/ml)). Number of PVCs and bispectral index (BIS) values (0 complete cortical EEG suppression, 100 awake) were obtained at every defined SL and prior to sedation. If PVCs disappeared prior to ablation TCI dose and BIS index was documented.
Results: Prior to ablation 7.14% of pts were on class I antiarrhythmic drug (AAD) medication, no pt was on class III AAD and 64.29% were on beta blocker therapy. Prior to administration of PFL 23.1±11.1 PVCs per minute were present, with 1.0 (0-2) morphologies per pt. No pharmacological or physical provocation was performed to induce PVCs.
With higher PFL TCI target doses, BIS indices decreased significantly (r = -0.79, p<0.001), number of PVCs was significantly correlated to PFL TCI doses (r= -0.46, p<0.001), as well as PVCs to BIS index (r=0.50, p<000.1). In 50% of pts PVCs disappeared prior to ablation, at a mean BIS index of 41.8±20.31, and TCI effect dose of 4.3±1.03. At time of first RFC number of PVCs was significantly lower than at baseline

(6.7±9.3 versus 22.6±2.6, p<0.001).
Conclusions: PVCs are influenced by sedation with PFL leading to a significant reduction. In half of the pts PVCs dissolved before ablation. The effect of PFL on PVCs is dose dependent and correlates well with sedation depth. TCI and BIS index monitoring may lead better mapping conditions.

PO06-148

EARLY (BLANKING PERIOD) RECURRENCES AFTER AF CRYOABLATION: REAL INCIDENCE AND PROGNOSTIC IMPACT

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Introduction: Early recurrences within 3 months (blanking period) are common after AF ablation by pulmonary veins isolation (PVI), and are regarded as irrelevant for the long-term prognosis. The procedural success rate is often over-estimated for the occurrence of asymptomatic episodes.
We aimed at assessing the incidence and the prognostic impact of recurrences during the blanking period after cryoablation of paroxysmal and persistent/long term persistent (LTP) AF, and evaluating the efficacy of using implantable devices for the continuous monitoring of the cardiac rhythm (ILR) in the follow-up of such patients.
Methods: Ninety-eight consecutive PVI procedures for paroxysmal and persistent/LSP AF were performed at one Italian EP Centre. Patients were monitored for 12 months. Sixty-one patients agreed to ILR implant. In such patients, recurrence was defined as at least one AF/atrial tachycardia (AT) episode lasting ≥5 min. In patients without ILR, recurrence was defined as the detection, in monitoring ECG or ECG-Holter, of an episode of AF/AT lasting ≥30 seconds, or as a tachyarrhythmic symptomatic episode requiring medical assistance.
Results: Out of 61 patients with ILR, 16 (26.23%) experienced at least one recurrence in the blanking period. At multivariable Cox analysis, variables associated with recurrences during the blanking were procedural time (HR 1.023; 95% CI 1.001-1.046; P = 0.044) and presence of AF at the time of the procedure (HR 2.346; 95% CI 1.002-5.543 P = 0.05). Total freedom from AF/AT recurrences at 12 months occurred in 34 (55.7%) patients. Recurrence in the blanking was the strongest predictor of long-term failure after PVI (HR 5.903; 95% CI 2.599-13.411; P <0.001), together with history of non-paroxysmal AF (HR 1.936; 95% CI 1.008-3.720; P = 0.047). The rate of recurrences in ILR patients was 17.3% higher than in those who had not consented to implantation (P = 0.123), despite comparable baseline characteristics.
Conclusions: Recurrences during the blanking period occur in ≈ 25% of patients after cryo-PVI and are strongly associated with subsequent procedural failure at 12-month follow-up. The use of ILRs allows a more accurate detection of post-ablation recurrences. Among ILR patients, 55.7% were completely AF-free at 12-month follow-up.

PO06-149

EFFECTIVENESS OF CRYOABLATION ON PAPILLARY MUSCLE PVCS AND VT AFTER RADIOFREQUENCY ABLATION HAS FAILED

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Introduction: Cryoablation has been used to improve the safety of ablation for arrhythmias such as AV nodal reentrant tachycardia, but experience with cryoablation of ventricular arrhythmias is limited. Although cryoablation lesion formation is slower than with radiofrequency (RF) and therefore may not be as effective for ablation of larger substrates, the ability of the catheter to adhere to tissue results in improved catheter stability, which may be effective for focal ventricular arrhythmias on highly mobile structures such as papillary muscles.
Methods: A series of 12 patients undergoing PVC or VT ablation from the LV or RV papillary muscles were evaluated. If RF ablation was unsuccessful due to poor catheter stability and contact, then, during the same procedure, cryoablation was used to ablate the arrhythmia. Successful ablation was defined as achieving acute elimination of the arrhythmia.
Results: Successful cryoablation was achieved in 92% of patients (11 of 12). In patients with longer term follow-up, 100% (5 of 5) had durable PVC suppression. Real-time imaging with intracardiac echo (ICE) was critical in demonstrating when the cryoablation catheter adhered to the site of interest during energy application, and it showed both improved catheter tip contact and stability throughout the cardiac cycle when compared with RF ablation. In the one patient out of twelve in whom ablation was unsuccessful, cryoablation was not performed due to aortic dissection while attempting to advance the catheter into the LV via retroaortic approach.
Conclusions: When RF catheter ablation of focal arrhythmias from the papillary muscles fails, cryoablation can be considered as an alternative ablation strategy, especially if catheter stability is felt to be a significant limitation. Caution should be used advancing the catheter in a retroaortic fashion, and the use of long sheaths to reach the LV may improve the safety of this approach. Further comparative investigation can be conducted to evaluate whether cryoablation is an effective initial ablation strategy.

PO06-150

OUTCOME OF CATHETER ABLATION FOR VENTRICULAR ACHYCARDIA IN PATIENTS WITH NONISCHEMIC CARDIOMYOPATHY: A SINGLE CENTER STUDY

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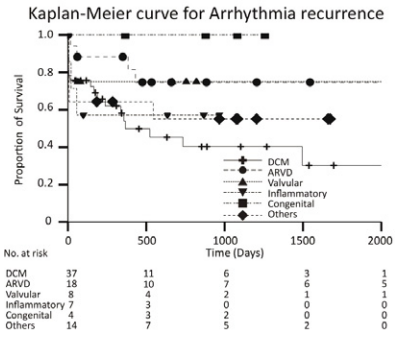
Introduction: Catheter ablation (CA) is an established treatment for patients with ventricular tachycardia (VT) and structural heart disease, especially in the setting of electric storm. However, the less favorable outcome is reported for patients with nonischemic cardiomyopathies (NICM). The aim of this study was to investigate a long term, single center results of CA of VT in patients with NICM.
Methods: A total of 148 consecutive VT ablation procedures in 88 patients with NICM (56 ± 16 years; 80% male) were included into the analysis.
Results: The underlying heart diseases were dilated cardiomyopathy (DCM) in 37, arrhythmogenic cardiomyopathy in 18, valvular cardiomyopathy in 9, inflammatory cardiomyopathy in 7, grown-up congential heart disease in 4 and other in 14. In 22 patients (22%), the ablation was indicated for electrical storm. Epicardial ablation was performed in 19 patients (22%). The mean follow up period from the initial procedure was 1056 ± 828

days. There were 35 arrhythmic and 29 death events after the last procedure (Figure). Comparing DCM and non-DCM patients, DCM patients had more events during the follow-up period for both arrhythmic (P = 0.028) and death events (P = 0.001). There were no procedure related deaths.
Conclusions: Patients with NICM undergoing VT ablation represent a heterogeneous population with the least favorable outcome observed in DCM. In these subjects, the outcome appears to be related to severity of underlying disease.



PO06-151

ABLATION OF VENTRICULAR TACHYCARDIA WITH EXTRACORPOREAL MEMBRANE OXYGENATION HEMODYNAMIC SUPPORT

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Introduction: Catheter Ablation (CA) of unstable Ventricular Tachycardia (VT) in the setting of advanced heart disease requires circulatory support. We report the experience in a cohort of consecutive patients receiving ExtraCorporeal Membrane Oxygenation (ECMO) during VT ablation at our Centre.
Methods: From Jan 2010 to Aug 2014 ECMO was initiated in high risk patients with unstable VTs. Procedural endpoints were activation-mapping-guided VT termination, Late Potentials (LP) abolition and non inducibility at Programmed Ventricular Stimulation (PVS). Follow up (FU) visits were scheduled at-3 and 6 months.
Results: Out of 264 high risk patients, 57 patients (Left Ventricular Ejection Fraction 27±9%) / 66 procedures underwent ECMO supported VT CA. Termination of VT was achieved in 51/61 (84%) of baseline inducible procedures (in 24 absence of targetable substrate). Non inducibilty was achieved in 48 procedures (72%). Seven patients had in-hospital VT recurrence (9%) treated with a second successful CA. Acute heart failure (HF) occurred periprocedurally in 5 patients (9%), leading to in hospital death in 1 (2%). All other patients were discharged alive after 16 (13-28) days. After a mean FU time of 16 months (6-68), 17 patients (30%) suffered from VT recurrence (2/24 VT terminated and LPs abolition (8%); 4/19 (21%) VT terminated, but no LP abolition, and 11/14 (78%) no VT termination (p <0.001). VT recurred in 7/41 non inducible patients (17%), 3/7 patients (42%) in whom non clinical VT and in 3/4 (75%) in whom clinical VT were inducible after CA and in 4/5 (80%) in whom inducibility was not tested (p <0.001). Overall mortality was 6 (10%), (1 HF related, 1 VT related, 4 non cardiac). ECMO was the bridge to HF destination therapy in 11 patients (19%), (5 heart transplantations, 6 LVADs).
Conclusions: Ablation of unstable VTs in high risk patients can be safely and effectively supported by ECMO and may be the bridge to end stage heart failure treatments. Ablation endpoint of VT termination guided by activation mapping should be completed with the abolition of LPs to achieve better long term outcomes.

PO06-152

ANTERIOR PERICARDIAL ACCESS FOR VENTRICULAR TACHYCARDIA ABLATION: A SINGLE CENTER EXPERIENCE

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Introduction: While success rates for percutaneous epicardial access have improved, complication rates remain 4-10%. Epicardial access is commonly obtained via a posterior approach. Herein, we report our experience using an anterior approach combined with pre-procedural contrast-enhanced high-resolution cardiac CT imaging.
Methods: In 86 consecutive patients referred for epicardial VT ablation (2011-2015), thoracic and cardiac anatomy were evaluated by CT scan. Subxiphoid epicardial access was obtained with a Tuohy needle and an anterior approach under fluoroscopic guidance. Intrapericardial methylprednisolone 125 mg was injected after the procedure. We documented all outcomes, including successful epicardial access and complications, e.g., major (>300 mL) pericardial bleeding, inadvertent RV puncture.
Results: Patient diagnoses were ARVD (75%), ischemic (2%) and non-ischemic (18%) cardiomyopathy, and sarcoid (5%). No one had prior sternotomy. Epicardial access was deferred in 3 patients based on CT evidence of a dilated transverse colon, massively enlarged liver and long xiphoid process (FIGURE 1). Epicardial access was successfully obtained in the rest (N=83). All patients had mild self-limiting pericarditis. There were no complications or deaths. Overnight pericardial drain was placed in 1 patient. Mean and median hospital stay was 1±0.5 [range 1-5] days and 90% of the patients were discharged after overnight stay.
Conclusions: In a single center experience we found that epicardial access via an anterior approach is a safe and efficacious method for facilitating VT ablation. A pre-procedural cardiac CT may be helpful in avoiding complications in select patients.

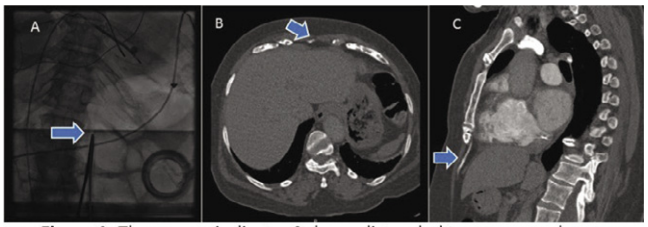

Figure 1. The arrows indicate: **A.** large distended transverse colon; **B.** enlarged left lobe of liver below xiphoid; **C.** long xiphoid process.

PO06-153

ABLATION OF OUTFLOW TRACT VENTRICULAR ARRHYTHMIAS IN PATIENTS WITH PRIOR FAILED ABLATION

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Introduction: Ablation (RFA) of ventricular arrhythmias (VAs) arising from outflow tracts (OT) is estimated to have a high success rate. However, in patients with prior failed RFA, they may be referred for redo RFA or consideration for epicardial

RFA. Understanding reasons for failure of initial RFA may help improve mapping techniques, success rates of initial RFA, and pre-operative counseling prior to redo RFA regarding procedural expectations.
Methods: Patients referred for redo RFA between 2013-2015 for redo RFA of presumed OT PVCs were included. Patients had detailed summaries of initial RFA procedure, inferiorly directed PVCs with tall, monophasic R waves in leads II, III, aVF, and otherwise structurally normal hearts.
Results: 55 patients were included (67% male; age 62+15 years). All patients had prior failed RFA. In reports, 10% had 6/55 (11%) had only right ventricular OT (RVOT) mapping, 45/55 (82%) had comprehensive mapping of left (LV) and right OTs and coronary sinus (CS), and the remainder had LV and RVOT mapping but no CS mapping. 50/55 (91%) patients had acute success after redo RFA, with 47/55 (85%) with long-term success at 3 month follow-up. No patients had epicardial puncture performed. Of 5 acute failures, 3 were due to proximity to coronary arteries with no RFA delivered, and 2 were due to proximity to the His bundle and concern for heart block. In 3 recurrences, 2 had recurrence of PVCs of different morphology but also arising from the OT (wider QRS, larger maximum deflection index [MDI], and earlier transition than initial VA), 1 had recurrence of the same VA. Average procedural time was 45+29 minutes. The most common site of successful RFA was at the endocardial aspect of the LV summit (15/50, 30%), LV aspect just beneath the left/right (L/R) junction of the aortic cusps or right cusp (15/50, 30%), endocardial aorto-mitral continuity (10/50, 20%), coronary sinus (5/50, 10%), and supravalvar pulmonary artery (5/50, 10%).
Conclusions: Redo RFA for OT VAs is common and success rates are high. After initial failed RFA, patients rarely require epicardial puncture and traditional endocardial mapping at less common sites (endocardial LV summit, L/R cusp junction, supravalvar pulmonary artery) may be useful.

PO06-154

EPICARDIAL SUBSTRATE AS A TARGET FOR RADIOFREQUENCY ABLATION IN AN EXPERIMENTAL MODEL OF EARLY REPOLARIZATION SYNDROME

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Introduction: ERS is an inherited cardiac arrhythmia syndrome associated with sudden cardiac death. The arrhythmogenic substrate is thought to develop as a result of early repolarization of left ventricle (LV) epicardium, particularly in the region of the inferior wall. Approaches to therapy are currently very limited. The present study assesses the ability of bipolar epicardial electrograms (EGs) to identify regions of abnormal repolarization and the ability of radiofrequency ablation (RFA) to suppress the development of ventricular tachycardia (VT) / ventricular fibrillation (VF) in early repolarization syndrome (ERS).
Methods: Action potentials (APs), bipolar EGs and transmural pseudo-electrocardiogram (ECG) were simultaneously recorded from coronary-perfused canine LV wedge preparations (n = 9). The Ito agonist NS5806 (7-10 μM) and calcium channel blocker verapamil (3 μM) were used to pharmacologically mimic ERS genotypes. RFA was performed in an attempt to abolish the arrhythmogenic substrate.
Results: The provocative agents induced prominent J waves in the ECG secondary to accentuation of the AP notch in epicardium but not endocardium. Bipolar recordings displayed low-voltage fractionated potentials in epicardium due to temporal and spatial variability in appearance of the AP dome. Concealed phase-2-reentry (P2R) developed when AP dome was lost at some epicardial sites but not others, appearing in the bipolar EG as discrete high-frequency spikes. Successful propagation of the P2R beat recipitated VT/VF. RFA of the epicardium suppressed the J waves, destroyed the cells displaying abnormal repolarization, and thus suppressed the development of VT/VF in 6/6 preparations. Ablation of endocardium did not suppress the arrhythmogenic substrate.
Conclusions: Our findings suggest that low-voltage fractionated potential and high-frequency spike recorded from the epicardial surface of the LV can identify the substrate responsible for VT/VF in ERS and that RFA of these regions of LV epicardium can suppress the vulnerability to development of VT/VF by destroying regions of early repolarization.

PO06-155

REAL-TIME VISUALIZATION OF TEMPERATURE DISTRIBUTION IN THE MYOCARDIUM DURING RADIOFREQUENCY ABLATION BY MAGNETIC RESONANCE (MR) THERMOMETRY

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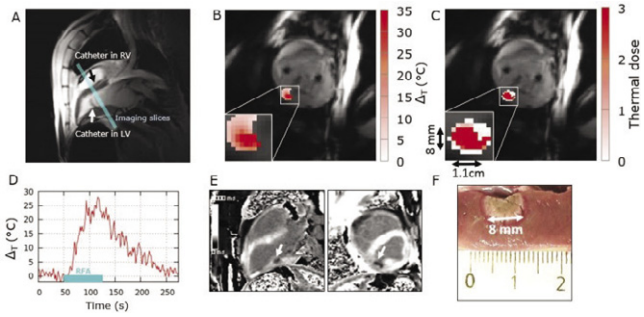
Introduction: Magnetic Resonance (MR) Thermometry has the potential to provide real-time visualization of temperature distribution in the myocardium during radiofrequency ablation (RFA) to improve safety and assessment of the therapy outcome. In this study, we investigated the feasibility of a full automated MR Thermometry method operating at 1.5T. This approach was evaluated during free-breathing on 5 healthy volunteers and during RFA in the left ventricle (LV) of a sheep.
Methods: An Echo Planar Imaging sequence was combined with parallel imaging to achieve a 1.6x1.6x3 mm spatial resolution. Five slices in short-axis orientation were continuously acquired at each RR-cycle with ECG triggering. A navigator was located on the diaphragm to adjust the slice position in real-time and compensate through-plane respiratory motion. RFA was performed in a sheep with two MR-compatible catheters inserted under fluoroscopic guidance (A). One catheter was located into the LV for ablation and one catheter was positioned into the right ventricle for heart pacing (140 bpm). RFA was run for 85s at 40W.
Results: On each volunteer and on the sheep, a temperature precision below 2°C on LV was achieved. Irrigated RFA was successfully performed in the sheep with simultaneous MR thermometry. Quantitative temperature elevation (B-D) was observed in real-time (update rate 1s). Thermal dose mapping (C) was consistent with lesion dimensions observed on T1 mapping (E) and with gross dissection (F).
Conclusions: This study demonstrated the feasibility of monitoring temperature and ablation extent within the targeted tissue. This could be a major step in the improvement of safety and efficacy of catheter ablation.



PO06-156

USE OF CARDIOPLEGIA TO GUIDE ALCOHOL ABLATION FOR INCESSANT VENTRICULAR TACHYCARDIA

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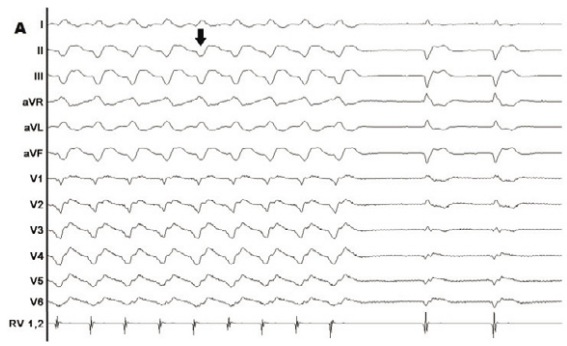
Introduction: Selective transcoronary alcohol ablation (TCAA) is a recognized alternative for incessant scar related re-entrant ventricular tachycardia (VT) not amenable to emergent radiofequency (RF) catheter ablation. We report the use of cardioplegia for identification of the critical VT isthmus to guide efficient TCAA.
Methods: 77 year old male was admitted for symptomatic persistent scar related re-entrant VT despite maximal antiarrhythmic therapy. The VT showed a single ventricular origin with inferior-mid to apical LV exit. Given multiple comorbidities, patient was deemed a poor candidate for RF catheter ablation and underwent TCAA. The distal left anterior descending (LAD) was identified as a suitable target vessel for TCAA. To confirm the implication of this vessel in VT maintenance, the vessel was occluded and injected with radiocontrast which failed to terminate the VT. Subsequently, 0.5 cc of cardioplegic solution (Buckberg solution, Central Admixture Pharmacy Service) was injected which resulted in immediate VT termination (Figure A).
Results: Alcohol was then injected into the distal LAD and the VT was no longer inducible. The procedure lasted a total of 52 min (5.9 minutes of fluoroscopy). No sustained VT recurrence was noted during the 180-day follow up.
Conclusions: A major limitation of TCAA is the accurate identification of the vessel supplying the culprit VT myocardium before irreversible myocardial damage with alcohol injection. By transiently reproducing the effects of alcohol and its immediate potential complications, the use of cardioplegia may improve sub-selection of target coronary vessel and prevent unnecessary myocardial destruction in TCAA.



PO06-157

AN EMERGING NON-THERMAL ABLATION TOOL: ELECTROPORATION EFFECTIVELY ABOLISHES PURKINJE FIBER POTENTIALS WITHOUT TRANSMURAL MYOCARDIAL ABLATION

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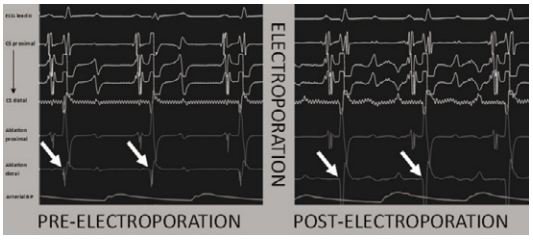
Introduction: Radiofrequency ablation is associated with high arrhythmia recurrence rate and complications related to heating. Electroporation (EPN) consists of short high-energy pulses of DC ablation that lead to non-thermal cell death by formation of pores within the membrane. We explored its effect on Purkinje fibers, ectopy from which are believed to underlie some cases of ventricular fibrillation (VF).
Methods: Purkinje fiber mapping and ablation was performed via a 4 or 8 mm Blazer II catheter (Boston Scientific, MA) with a novel connection to the NanoKnife (Angiodynamics, NY). EPN (gated to ECG) delivery protocol consisted of 500-3000V in 20-100 pulses of 20-100μs duration. Changes in electrogram (EGM) were recorded.
Results: In 3 acute canine studies (27-30 kg), 21 EPN therapies (average 738±256V) were delivered. Loss of Purkinje signal occurred in all cases (figure). Reversibility was checked in 4 locations; in 2 with 500V therapy, recovery occurred within 2 minutes; in 2 with 1000V therapy, no recovery was noted after 40 minutes suggesting the threshold for irreversible Purkinje EPN may be around 1000V. Decreased amplitude and fragmentation of the ventricular EGM occurred to a variable extent with no evidence of transmural myocardial ablation. Transient atrial fibrillation occurred in 5 deliveries. VF requiring cardioversion occurred in 4 deliveries all ≤1000V (secondary to fascicular ectopy [N=1] or improper gating [N=3]). At necropsy, no gross lesions were identified.
Conclusions: Electroporation effectively ablates Purkinje potentials. Chronic studies to determine the threshold for selective and permanent Purkinje ablation and further evaluate safety are needed.



PO06-158

CONSISTENCY OF HIGH FREQUENT COMPONENT IDENTIFIED BY SIMULTANEOUS AMPLITUDE FREQUENCY ELECTROGRAM TRANSFORMATION (SAFE-T) IN VENTRICULAR SUBSTRATE DURING SINUS RHYTHM AND PREMATURE VENTRICULAR COMPLEX

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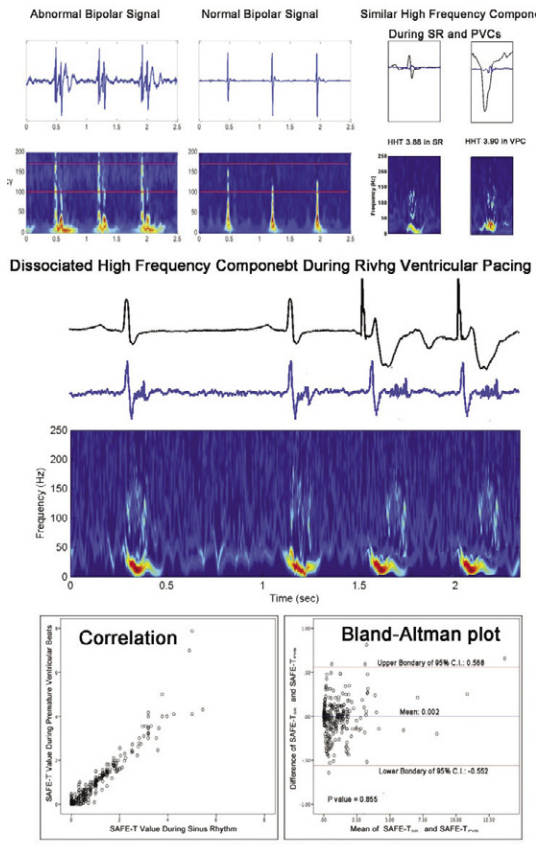
Introduction: We propose an automated method, Simultaneous Amplitude Frequency Electrogram Transformation (SAFE-T) by Hilbert-Huang Transform (HHT), may recognize abnormal high frequency potentials (APs) beneath the QRS electrogram during sinus rhythm. This study was to evaluate the high frequency components within the local abnormal ventricular activity (LAVA) during different activation rhythm in patients with substrate VT.
Methods: We retrospectively investigated the intracardiac bipolar recordings in 13 patients (Age=55±14 years, 9 NICM and 4 ICM) who underwent successful radiofrequency ablation guided by 3D mapping (Carto MEM with UDM module) and Navistar catheter (Biosense Webster). The time-domain ECG of LAVAs was decomposed to time-frequency analysis. The product of temporal frequency and the corresponding amplitude derived from HHT SAFE-T during sinus rhythm and PVC of the same recording sites within 2 mm (mean 0.51±0.42) were compared.
Results: There were corresponding 631 points collected for SAFE-T value assessment during SR and PVC. The LAVA assessed by SAFE-T value was independent of the rhythm (Cronbach's Alpha value =0.897, intra-class correlation coefficient: 0.914 [0.753-0.973]). The agreement test of LAVA by Bland-Altman plot was reached with 97% points within 2 x CI (confidence interval).
Conclusions: The LAVA of substrate VT could be decomposed and quantified by a novel temporal frequency analysis, SAFE-T. The high frequency component of LAVA relative to the QRS far fields could be consistently identified, irrespective of the rhythms.



PO06-159

UTILITY OF IMPEDANCE MAPPING IN LOCALIZING THE ORIGIN OF NON-OUTFLOW TRACT PREMATURE VENTRICULAR CONTRACTIONS

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Introduction: Contact tissue impedance mapping (CTIM) can differentiate focal atrial tachycardia (AT) from macro-reentry e.g. atrial flutter, and localized reentry e.g. AVNRT, by identifying a contiguous low impedance area (CLIA) only in AT. We hypothesized that the CLIA reflected a region of triggered activity due to after-depolarizations. This was in part confirmed by identification of CLIAs in triggered activity AT patients and not in the micro-reentrant ATs when a new cohort of focal AT patients had CTIM. To further characterize the utility of CTIM to differentiate arrhythmia mechanisms, we evaluated CTIM in patients with non-outflow tract (NOT) PVCs that are thought to be caused by triggered activity.
Methods: Sixteen consecutive patients with 21 different NOT PVCs were mapped via local activation time and CTIM utilizing the Carto 3 and XP mapping systems, and a 4-mm tip ablation catheter. Maps were created by moving the catheter to 100 - 200 points in the ventricle. Pace mapping was used adjunctively to select the ablation site. Low impedance (Z) was defined as ≤ Z min + 10%(Zmax- Zmin). Normal Z was defined as ≥ Zmin + 20%(Zmax-Zmin).
Results: The origin of the 21 PVCs were: mitral annulus in 5, LV apex in 4, LV papillary muscles in 4, LV lateral wall in 3, tricuspid annulus in 3 and RV septum in 2. Nineteen (90%) of the 21 PVCs had a CLIA. In 13 of the 19 PVCs (68%) the CLIA contained the ablation site and in 6 PVCs (32%) the CLIA were within 1.33 ± 0.69 cm of the ablation site. The average surface area of the CLIA was 7.65 ± 2.71 cm². In the 2 patients with more than 1 PVC focus, each focus had its own adjacent CLIA. One patient with LV apical PVC and another with inferior mitral annular PVC had no CLIA, but both had highly fractionated long duration (97-145 ms) electrograms at the ablation site.
Conclusions: Most NOT PVCs have associated CLIAs in the CTIM without fractionated long duration electrograms, and the CLIAs either contain the successful ablation site or are in close proximity to it. A small percentage of NOT PVCs have highly fractionated long duration electrograms and no CLIA compatible with micro-reentry. It appears that the CLIA phenomenon seen in focal ATs is also seen in ventricular arrhythmias related to triggered activity.

PO06-160

ELECLAZINE: A NOVEL LATE SODIUM CURRENT INHIBITOR SHORTENS THE QT INTERVALS IN LQT3 PATIENTS ACROSS WIDE RANGE OF HEART RATES

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Introduction: Enhanced late sodium current (INaL) is a consequence of mutations in the SCN5A gene in LQT3 patients, in whom events usually occur at night and during bradycardia. Eleclazine is a selective inhibitor of INaL currently being investigated as a new medication to shorten repolarization duration. The aim of this study was to evaluate the effects of Eleclazine on the QT interval across different heart rates during day and night hours in LQT3 patients.

Methods: Five LQT3 patients (age 24-54 years, 4 females) with QTc>480 ms participated in the study. They received multiple doses of Eleclzine (50 mg on Day 1, 10 mg on Days 2 to 3, and 20 mg on Days 4 to 7). Beat-to-beat QT intervals were measured automatically from 24-hour Holters. Eleclazine-induced changes in QT interval were studied using the RR bin method using beat-to-beat QT intervals evaluated in a series of 8 RR bins: 550-649 to 1250-1349 ms; any RR bins with fewer than 100 beats were excluded from the analysis. Average QT values in each bin were computed and differences (ΔQT) between matched periods before Eleclazine administration and on Day 7 were compared for the entire 24-hour recording (24h), for the first 6 hours after drug administration during day hours (Day), and from 12 AM to 6 AM for night hours (Night).
Results: Eleclazine caused significant shortening of QT for all RR bins ($p<0.001$ for all ΔQT values in Table below) across both day and night hours for a wide range of heart rates.
Conclusions: Eleclazine caused significant shortening of repolarization duration in LQT3 patients across different heart rates during day and night hours.

Changes in QT by RR bins

RR bin (ms)	QT_24h (ms)	ΔQT_24h (ms)	QT_Day (ms)	ΔdQT_Day (ms)	QT_Night (ms)	ΔdQT_Night (ms)
550-649	472	-31	483	-22	474	insufficient number of beats
650-749	481	-38	479	-25	488	-54
750-849	492	-33	493	-41	509	-40
850-949	501	-24	503	-29	529	-35
950-1049	524	-25	516	-25	548	-32
1050-1149	561	-31	534	-31	574	-35
1150-1249	586	-39	567	-51	595	-36
1250-1349	602	-47	587	-79	611	-30

PO06-161

HOSPITAL VARIATION AND OUTCOMES OF VENTRICULAR TACHYCARDIA ABLATION

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Introduction: Ventricular tachycardia (VT) ablation is an option for the management of drug refractory ventricular arrhythmia in the setting of coronary artery disease. There is paucity of data in the literature regarding impact of annual hospital volume on outcomes of VT ablation.
Methods: We used the 2002-2012 Nationwide Inpatient Sample (NIS) database to identify all patients ≥18 years of age with a primary diagnosis of VT (International Classification of Diseases, Ninth Edition, Clinical Modification [ICD-9-CM] code 427.1) and who also had a secondary diagnosis of prior history of myocardial infarction (ICD-9-CM 412) undergoing catheter ablation were identified using ICD-9-CM procedure code 37.34. We investigated common complications including pericardial complications (hemopericardium, cardiac tamponade, or pericardiocentesis), pneumothorax, stroke, vascular complications (consisting of hemorrhage/hematoma, incidents requiring surgical repair, and accidental arterial puncture), and in-hospital deaths described with VT ablation. We divided hospital volume as less than 10, 10-20 and more than 20.
Results: We identified 5,507 VT ablation procedures. majority were in men (84.2%), age between 50-64 years (42.9%), whites (67%) with Medicare as primary payer. Most of these procedures were performed in hospitals with large bed size, academic, urban setting, teaching hospitals and in southern states. 40.71% procedures were done at hospitals with hospital volume <10. In hospital mortality rates were similar (hospital volume:20), (1.33% vs 1.88% vs 1.78%, p 0.34) amongst all hospital volume strata. Higher hospital volume was associated with decrease in overall complications (15.43% vs. 10.54% vs. 11.59%, p20: 0.63, 0.40-0.99, p 0.04) as compare to hospital volume < 10.
Conclusions: Higher annual hospital volumes are significantly predictive of reduced post procedural mortality, complications, after VT ablation.

PO06-162

NON-CLINICAL, FAST VENTRICULAR TACHYCARDIA INDUCIBLE AFTER ABLATION IN PATIENTS WITH STRUCTURAL HEART DISEASE: DEFINITION AND CLINICAL IMPLICATIONS

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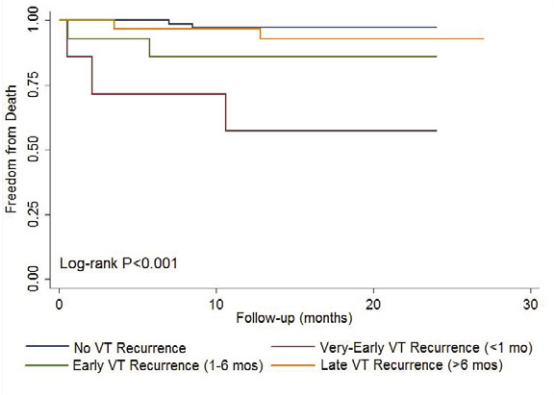
Introduction: Non-inducibility of ventricular tachycardia (VT) with similar or longer cycle length (CL) than clinically documented VTs (C-VTs) is used as endpoint of radiofrequency catheter ablation (RFCA) in pts with structural heart disease (SHD). Since their clinical relevance remains unclear, fast non-clinical VTs (NC-VTs) are often not targeted. However, an accepted definition for fast VT is lacking. The shortest possible CL of a re-entry VT is determined by the ventricular refractory period (VRP). We therefore propose a definition for fast VT based on individual VRP and assess the prognostic value of persistent inducibility of fast NC-VTs based on this definition.
Methods: From 191 pts with SHD who underwent RFCA, 71 pts (63 men, 63±13 years, 63% post-MI, EF 35±12%) with partial procedural success, defined as elimination of C-VTs but persistent inducibility of NC-VTs were included. VRP was assessed with a basic drive CL of 400ms. Fast NC-VT was defined as VT with CL ≤ VRP + 30ms, slow NC-VT as VT with CL > VRP + 30ms. Pts were followed for VT recurrence.
Results: VRP at 400ms was 230±25ms. After RFCA, 41 pts (58%) were inducible for slow NC-VT (CL 326 ± 56ms) and 30 (42%) only for fast NC-VT (CL 231 ± 25ms). Pts with remaining slow NC-VT had lower EF (P=0.01), slower C-VTs (P=0.001), were more often on amiodarone (P<0.001) and were inducible for a higher number of VTs (P=0.01). During follow-up of 31 (IQR 17-37) months, 37 pts (52%) had VT recurrence. Pts with only fast NC-VTs after RFCA had a 3-year VT recurrence-free survival of 63% (CI 95%, 47-79%) compared to 21% (CI 95%, 3-38%) for pts with slow NC-VT (P= 0.009). On multivariate analysis, inducibility of only fast NC-VT was independently associated with lower VT recurrence (HR 0.47: CI 95% 0.21-0.99; P=0.047). Of interest, only 1/36 pts in whom any fast NC-VT remained inducible (6 had also slow NC-VTs) recurred with a fast VT based on our definition.
Conclusions: Inducibility of only fast NC-VTs with a CL close to VRP after RFCA is associated with low VT recurrence. Of importance, fast NC-VTs according to our proposed definition rarely occur spontaneously during follow-up without the need to be targeted by RFCA.

PO06-163

IMPACT OF TIMING OF RECURRENCE FOLLOWING CATHETER ABLATION OF SCAR-RELATED VT ON SUBSEQUENT MORTALITY

Todd B. Mendelson, MD, Joe Fahed, MD, Daniele Muser, MD, Jeffrey P. Gordon, MD, Matthew Hyman, MD, PhD, Erica S. Zado, PA, Sanjay Dixit, MD, FHRS, Mathew D. Hutchinson, MD, FHRS, Robert Schaller, DO, David S. Frankel, MD, FHRS, Michael P. Riley, MD, PhD, David Lin, MD, Fermin C. Garcia, MD, Gregory Supple, MD, David J. Callans, MD, Pasquale Santangeli, MD and Francis E. Marchlinski, MD, FHRS. Hospital of the University of Pennsylvania, Philadelphia, PA, Hosp of The University of Pennsylvania, Philadelphia, PA, University of Pennsylvania, Philadelphia, PA, Hospital Of The University of Pennsylvania, Philadelphia, PA, Hospital of Univ of Pennsylvania, Cardiology, Philadelphia, PA, Hospital of the University of Pennsylvania - Cardiovascular Div., Philadelphia, PA, Hospital of The University of Pennsylvania, Philadelphia, PA, University of Pennsylvania Health System, Philadelphia, PA

Introduction: Radiofrequency catheter ablation (RFCA) has an established therapeutic role in managing recurrent scar-related ventricular tachycardia (VT), but the risk of recurrent arrhythmia is still substantial and the appropriate intensity of post-ablation monitoring unknown. The clinical implication of timing of post-ablation VT recurrence has not been adequately investigated.
Methods: We studied 120 consecutive patients with scar-related VT (age 60±15 years, mean left ventricular ejection fraction [EF] 39±16%, 52% ischemic etiology) with at least 6 months of post-ablation arrhythmia monitoring. Timing of VT recurrence was classified as very-early (<1 month), early (1-6 months) or late (>6 months).
Results: Over a mean follow-up of 23 ± 5 months, 53 (44%) patients had recurrent VT. Out of these 53 patients, 8 (15%) had very-early recurrence, 17 (32%) early recurrence, and 28 (53%) late recurrence. At 2 years, mortality rates were significantly higher in patients with very-early VT recurrence (43%) compared to those with early (14%), late (7%) and no (3%) recurrences (P<0.001 for comparison) (Figure).
Conclusions: Timing of VT recurrence following catheter ablation of scar-related VT has a strong impact on subsequent risk of mortality. Patients experiencing VT recurrence within 1-6 months from the procedure are at particularly high risk. These data support the importance of intense post-ablation monitoring for at least 6 months after the procedure to identify patients with early VT recurrence who may benefit from additional therapeutic interventions to improve survival.



PO06-164

THE EFFECT OF SHOCK BURDEN ON HEART FAILURE AND MORTALITY

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Introduction: Prior studies have associated implantable cardioverter defibrillator (ICD) shocks with mortality risk within the context of clinical trials. We examined the relationship between appropriate shocks, death and heart failure in a large cohort with prolonged follow-up.
Methods: A single referral centre prospective ICD registry with excellent follow-up was interrogated. All patients with a minimum of one year follow-up were included (primary and secondary prophylaxis). Patients with ion channelopathies, inherited cardiomyopathies and idiopathic VF were excluded. All delivered ICD therapies were adjudicated by two electrophysiologists with a third reviewer for disagreements. This included anti-tachycardia pacing (ATP) and ICD shocks. Through linkage with the Cardiovascular Health Nova Scotia (CVHNS) database, heart failure hospitalization data was obtained.
Results: Of the 776 patients (mean age of 64.8 years) included in the study, 37% received any appropriate therapy. Compared with patients receiving no ICD shocks, there was no significant difference in mortality associated with a single ICD shock (HR 1.16; CI 0.79-1.69; p=0.447) whereas there was a significant increase in mortality associated with receiving 2 or more ICD shocks (HR 3.22; CI 2.04-5.08; p<0.0001). Compared with patients receiving no ICD shocks, there was a significant increase in heart failure hospitalization associated with receiving a single ICD shock (HR 2.03; CI 1.45-2.85; P<0.0001). There was a further increase in heart failure hospitalization seen in patients receiving 2 or more ICD shocks (HR 4.34; CI 2.52-7.48; P < 0.0001). Compared to patients with no ICD therapy, patients receiving ATP alone had improved survival (HR 0.52; CI 0.34-0.8; P=0.0027) and no difference in heart failure hospitalization (HR 0.99; CI 0.66-1.47; p=0.947).
Conclusions: ICD shocks are associated with an increased risk of both mortality and heart failure hospitalization whereas inappropriate shocks and ATP alone do not increase the risk of death or heart failure hospitalization. Reduction of ventricular arrhythmia requiring shocks may alter the progression of both heart failure and mortality.

PO06-165

IN-HOSPITAL COST AND QUALITY MEASURE OUTCOMES ASSOCIATED WITH HEMODYNAMIC SUPPORT DURING CATHETER ABLATION OF VENTRICULAR TACHYCARDIA USING PERCUTANEOUS VENTRICULAR ASSIST DEVICE VERSUS INTRA-AORTIC BALLOON PUMP

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Introduction: The rate of utilization of percutaneous

ventricular assist devices (PVADs) during catheter ablation of hemodynamically-unstable ventricular tachycardia (VT) has steadily risen in the last few years. However, there is a paucity of data in support of a potential benefit associated with this approach. This study investigated several benchmark in-hospital measures of quality and cost associated with the use of mechanical support with PVAD Vs intra-aortic balloon pump (IABP) during catheter ablation of VT, retrieved from the Medicare Provider Analysis and Review (MEDPAR) database.
Methods: We performed a comprehensive analysis on several acute, in-hospital metrics including: (1) the hospital length of stay (LOS), (2) overall cost, (3) patient disposition at hospital discharge, and (4) in-hospital mortality among all pts who underwent catheter ablation of VT using either PVAD Vs IABP between 2010 and 2014, captured by the MEDPAR database. Index cases were identified using the principal diagnosis of VT (code: 427.1) treated by catheter ablation (procedure code: 37.34), supported by either PVAD (procedure code: 37.68) or IABP (procedure code: 37.61).
Results: Altogether, data from 663 consecutive pts (IABP=238 pts, PVAD=425 pts) were examined. Of note, the hospital LOS was significantly shorter with PVAD (7.1 ± 10.2) Vs IABP (12.0 ± 18.8); p<0.001. Despite the higher upfront cost associated with PVAD, the overall hospital cost did not differ between PVAD ($75,779 ± $56,095) Vs IABP ($96,072 ± $134,112); p=0.269. That is, the latter was ultimately offset by the longer LOS associated with IABP. On the other hand, the rate of hospital discharge to home/self-care was greater with PVAD (64.6%) Vs IABP (47.8%); p<0.001. Moreover, in-hospital mortality was substantially lower with PVAD (10.8%) Vs IABP (25.2%); p<0.001.
Conclusions: Among the cases captured by the Medicare database, catheter ablation of VT with hemodynamic support using PVAD was associated with shorter hospital LOS, a higher rate of hospital discharge to home/self-care, reduced in-hospital mortality, but no difference in the overall cost, when compared to IABP. As such, these findings support the perceived advantage of using PVAD over IABP in VT ablation cases that may require mechanical support.

PO06-166

DRUG FAILURES BEFORE VT ABLATION: EVIDENCE THAT PATIENTS WITH NON-ISCHEMIC CARDIOMYOPATHY STAND TO BENEFIT MOST FROM EARLY REFERRAL

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Introduction: Failure to control ventricular tachycardia (VT) with anti-arrhythmic drugs (AADs) prompts referral for catheter ablation. Earlier referral may be associated with improved outcomes. We sought to examine if the type of underlying structural heart disease influences the potential benefit from early referral (before multidrug failure) for VT ablation.
Methods: 721 pts with VT referred for a first episode of catheter ablation were included. Patients were classified according to the number of failed class I/III AADs prior to referral to VT ablation as Group A (failure of ≤1 AAD, n=303), Group B (failed 2-3 AADs, n=364) or Group C (failed >3 AADs, n=54). Acute success, VT-free survival, overall mortality and need for transplant were compared between the Group A-C stratified according to underlying disease type (no structural heart disease [no SHD] 102 pts, ischemic [ICM] 394 pts, and non-ischemic [NICM] cardiomyopathy 236 pts).
Results: Within each disease group, baseline characteristics were similar between Groups A-C except for LVEF (highest in Group A among ICM and NICM pts) and VT storm (least common in the Group A in all types of heart disease). Amongst NICM pts, rate of major complications (A 2.8%, B 5.5%, C 20%, P=0.02), 1 yr VT-free survival (A 52%, B 46%, C=35%, P=0.08), and 1 yr overall survival (A 96%, B 78%, C 60%, P<0.001) all favored Group A. Amongst ICM pts, rate of major complications (A 4%, 8%, 9%, P=0.34), 1 yr VT-free survival (A 59%, B 56%, C 55%, P=0.5) was similar between the groups, however a non-significant trend in survival favored Group A and B (A 89%, B 89%, C 74%, P=0.08). In the no SHD group there was no difference in outcomes between Groups A-C. Number of failed AADs prior to referral remained an independent predictor of mortality in NICM (hazard ratio 2.1 for Group C vs. A, P=0.001).
Conclusions: Multidrug failure is associated with worse outcome in NICM pts suggesting that they may stand to benefit the most from early referral for VT ablation, before multiple drug failures.

PO06-167

DOES USE OF CONTACT-FORCE SENSING CATHETERS IMPROVE THE OUTCOME OF ABLATION OF VENTRICULAR TACHYCARDIA?

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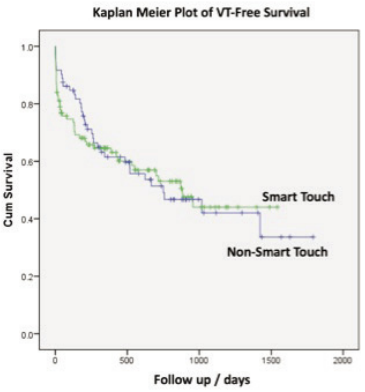
Introduction: Contact force sensing (CF) catheters have improved acute outcomes and medium-term recurrence rates following AF ablation, however data supporting the use of CF in ventricular tachycardia (VT) ablation is limited. To evaluate outcome following VT ablation with and without CF at a large tertiary referral hospital in London, UK.
Methods: Retrospective review of all VT ablations performed between 1/1/2010 and 31/12/2014. Data collection included: demographics, VT etiology and presentation, procedural complications, follow-up. Failure of VT ablation was adjudicated based on VT recurrence, re-do VT ablation and appropriate ICD therapies. (A priori, all congenital VT was excluded as most were performed using remote magnetic navigation at our institution.)
Results: 220 consecutive cases were identified (median age 65yrs, range 15-90; 76% male), classified as ischemic in 122 (55.5%), cardiomyopathy in 86 (39%) and occurring in structurally normal hearts in 12 (5.5%). Presentation was VT storm in 54 (23%). There were 15 (6.8%) procedural complications. There was no significant difference in any of these variables between CF and non-CF groups. Follow up data was available in 173 (78%) (mean duration 1.3 yrs, range 0.2-5 yrs). There were 79 events. Kaplan-Meier curves (Figure 1) were statistically identical between CF and non-CF groups (log-rank p=0.91).

Conclusions: There was no improvement in VT ablation outcomes using CF catheters compared to non-CF catheter in a large, single center study. Prospective studies to evaluate further are needed.



PO06-168

A RAPIDLY APPLICABLE RISK SCORE ALLOWS IDENTIFICATION OF PATIENTS AT RISK FOR EARLY MORTALITY AFTER CATHETER ABLATION FOR VENTRICULAR TACHYCARDIA

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Introduction: Catheter ablation (CA) is an important therapy for reducing episodes of ventricular tachycardia (VT). However, in some patients VT is the harbinger of inexorable decline. We sought to identify predictors of early mortality within the 2 weeks following CA to aid in appropriate procedural patient selection.
Methods: We assessed early mortality and its risk factors in consecutive patients with structural heart disease undergoing CA for VT at our center from 1999 to 2015 and developed a risk score. Tested variables were: age, sex, BMI, LVEF, NYHA-class, diabetes, chronic obstructive lung disease (COPD), renal insufficiency (glomerular filtration rate <30mL/min/1.73 m2), VT-storm, number of prior VT ablations, and need for hemodynamic support. Variables with p-values <0.2 in univariate logistic regression models were added to a multivariate model to identified independent, significant predictors ($p<0.05$) for early mortality. Rounded hazard ratios were used to construct score weights. Model discrimination was determined by calculating the area under the receiver operator curve (ROC).
Results: A total of 1057 patients underwent CA. From 522 patients complete information on all variables was available and 28 of these patients (5.4%) had early mortality. The following score showed the best performance with an area under the ROC of 0.84: 2 × NYHA-class + 6 (for renal insufficiency) + 4 (for COPD) + 3 (for VT-storm). A score of ≤5 defined low risk, 6-10 intermediate risk, 11-15 high risk and >15 was defined as very high risk. The incidence of early mortality was 0.7% in the low risk group, 5.6 % in the intermediate risk group, 23.9% in the high-risk group, and 57.1% in the very high risk group.
Conclusions: Readily available clinical variables can be aggregated into a risk score that allows stratification of patients with a dramatic difference in mortality risk within 14 days after CA for VT. This risk score will require future validation but could have critical implication on patient selection as well as patient and family counseling for CA.

PO06-169

UTILIZATION AND COMPLICATIONS OF ISCHEMIC VENTRICULAR TACHYCARDIA ABLATION

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Introduction: Ventricular tachycardia (VT) ablation is an option for the management of drug refractory ventricular arrhythmia in the setting of coronary artery disease. However, data on VT ablation outcomes is generally limited to high volume centers and few data exist regarding trends in utilization and adverse outcomes more broadly. The aim of our study was to examine utilization patterns, frequency of adverse events related to VT ablation in patients with CAD.
Methods: We used the 2002-2012 Nationwide Inpatient Sample (NIS) database to identify all patients ≥18 years of age with a primary diagnosis of VT (International Classification of Diseases, Ninth Edition, Clinical Modification [ICD-9-CM] code 427.1) and who also had a secondary diagnosis of prior history of myocardial infarction (ICD-9-CM 412) undergoing catheter ablation were identified using ICD-9-CM procedure code 37.34. We investigated common complications including pericardial complications (hemopericardium, cardiac tamponade, or pericardiocentesis), pneumothorax, stroke, vascular complications (consisting of hemorrhage/hematoma, incidents requiring surgical repair, and accidental arterial puncture), and in-hospital deaths described with VT ablation.
Results: We identified 5,507 VT ablation procedures and observed an increase in the number of ablations over the study period (311 in 2002 to 770in 2012). Majority were in men (83.2.2%), age between 65-79 years (47.6%), whites (70.9%) with Medicare as primary payer. The majority of these procedures were performed in hospitals with large bed size, academic, urban setting, teaching hospitals and in southern states. In total, 12.8% (708) of all ablation were associated with at least one complication. Frequent complications included vascular (9.2%), hemorrhage (5.35), respiratory complications (3%), and stroke (0.46%). The overall complication rate has increased over the observational period (p for trend <0.001), however, the in-hospital mortality, 1.5%, remained stable over the study period.
Conclusions: The utilization rate of catheter ablation for post infarct VT has increased over the past decade. With increase utilization, there has been a steady increase in complication rates.

PO06-170

ESOPHAGO-PLEURAL FISTULA FOLLOWING EPICARDIAL VT ABLATION

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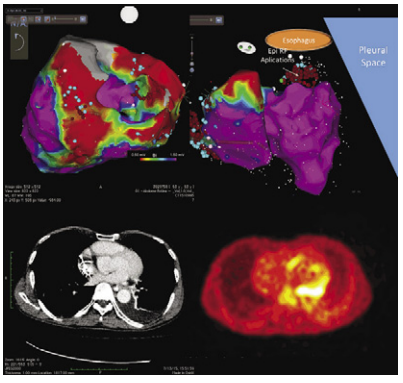
Introduction: The esophagus has an intimal relation with the heart, especially with the LA posterior wall, being a concern for AF ablation. Although, for VT ablation there is no worry about esophageal lesions.
Methods: N/A
Results: A 63-yo male patient with Chagas disease and syncope due to sustained VT was referred for ablation. The EF was 35% and CMR epicardium LGE. The procedure was performed using CARTO and irrigated tip catheter with contact sensor. During the ablation 4 morphologies of VT has been induced and voltage map showed epicardial RV and epicardial infero-latero-basal scar on the LV. Ablation was performed using irrigated tip catheter (40W 17ml/min). After substrate modification no VT was induced. It was planned ICD implantation, but one week following ablation the patient presented fever and pleural effusion, CRP levels increased, being started antibiotics. Torax CT showed left pleural effusion, but as the fever remained a Pet-CT was performed showing inflammation on the left mediatinum. The patient also presented abdominal symptoms, so an endoscopy was performed showing an orifice on the lateral wall of esophagus 35cm after dental arch. A Torax CT with oral iodated contrast showed spilling of contrast on pleural space confirming esophago-pleural fistula. Patient was maintained in fast state, with antibiotics and a nasogastric tube was maintained for 2 months without orifice closure, then orifice was closed using OTSC System (Ovesco). Patient was discharged without ICD implantation, in 3 months' follow-up the patient had no VT and fistula recurrence and has normal oral feeding.
Conclusions: Esophago pleural fistula is a rare but possible complication of epicardial VT ablation.



PO06-171

TIME COURSE OF MYOCARDIAL INJURY AND ACUTE RESULTS OF CRYOABLATION OF PAROXYSMAL ATRIAL FIBRILLATION: A COMPARISON TO STANDARD RADIOFREQUENCY ABLATION

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Introduction: Cryoablation of paroxysmal atrial fibrillation (PAF) is a new technology that may have similar results to radiofrequency ablation. However, little is known about the characteristics of myocardial injury following cryoablation.
Methods: In 42 patients with drug-refractory PAF (16 women; 65±12 years), pulmonary vein (PV) isolation was performed with either cryo-energy (n=28; CB-group) or radiofrequency (RF) energy (n=14; RF-group). The peripheral plasma troponin T (TnT) and CK-MB levels before, 12 hours, and 1 day after the ablation procedure were measured. The changes in the troponin T (ΔTnT) and CK-MB (ΔCK-MB) levels between that before and 1 day after ablation and the acute results were also evaluated.
Results: No significant difference was found in TnT level 12 hours (CB-group, 1.91±0.86; RF-group, 1.94±0.33 [ng/dl], p=0.94) or 1 day (CB-group, 2.08±0.68; RF-group, 2.02±0.55 [ng/dl], p=0.95) after the ablation procedure between the 2 groups. The ΔTnT did not differ between the 2 groups (p=0.96), either. However, the CK-MB levels 12 hours and 1 day after the ablation procedure were both greater in the CB-group than in the RF-group (12hrs: 64.4±31.7 vs. 15.3±5.03 [IU/L]; 1 day: 42.9±21.8 vs. 13.0±2.64 [IU/L], both for p<0.05). The ΔCK-MB was also greater in the CB-group than RF-group (37.9±20.0 vs. 8.33±3.21 [IU/L]; p<0.05). There was no difference in the fluoroscopy time (p=0.10), procedure time (p=0.06), or number of cardioversion during the procedure (p=0.41) between the 2 groups. However, the total ablation time was shorter in the CB-group than in the RF-group (p<0.01). The prevalence of ATP induced-PV reconnections was less in the CB-group than in RF-group (p<0.05). Complete PV isolation was achieved in all patients without any complications. The freedom from PAF/atrial flutter/tachycardia at 10 months following a single procedure without antiarrhythmic therapy was comparable between the 2 groups (p=1.00).
Conclusions: The difference in the TnT and CK-MB levels between the 2 groups indicated a distinct difference between the myocardial injury by cryo-energy and that by RF-energy. Compared to RF-energy, satisfactory myocardial injury could be obtained by cryo-energy with a shorter ablation time.

PO06-172

HIGH DENSITY MAPPING CHALLENGING CONVENTIONAL CRITERIA OF CTI BLOCK

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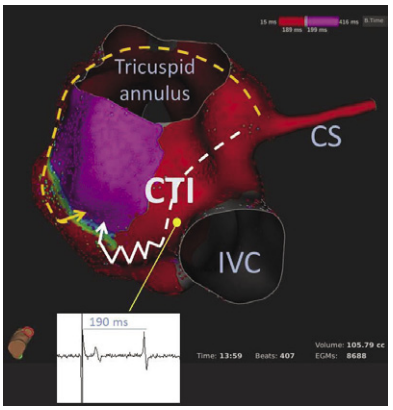
Introduction: Criteria of CTI block have been well established and the use of a mapping system is not deemed necessary for most cases of CTI-dependent flutter.
Methods: N/A
Results: A 75-year old patient with hypertrophic cardiomyopathy and previous myectomy + surgical atrial fibrillation ablation underwent an EPS with an initial left sided slightly irregular arrhythmia. A high density map of the left atrium was created with the Rhythmia® system (Boston Scientific). After ablation around the left pulmonary veins, the tachycardia became regular. A new left atrial activation map identified the septum as the earliest region, the diagnosis was typical atrial flutter and the CTI was ablated conventionally without the help of the mapping system. Criteria of bidirectional CTI block were confirmed. Widely split double potentials (>100 ms, 190 ms from the stimulus while pacing from the other side of the line) were identified on the line of previous CTI ablation. A high-to-low activation sequence was found on the lateral wall while pacing at the CS ostium, and differential pacing was also consistent with CTI block. During the waiting period, the mapping system was used to create a voltage map and an activation map of the RA during CS ostium pacing. Surprisingly, a gap was found at

the posterior portion of the CTI line. The presence of previous scarred tissue and the slow conduction velocity through the gap allowed for the fast propagation of the impulse around the tricuspid annulus before the arrival of the front from the CTI, resulting in the misleading presence of criteria of CTI block.
Conclusions: High density mapping may help to identify a gap even when standard pacing maneuvers are in favor of complete block.



PO06-173

COMBINED LASER AND FEMORAL APPROACH TO REMOVE A PREVIOUS FAILURE OF RIATA LEAD EXTRACTION

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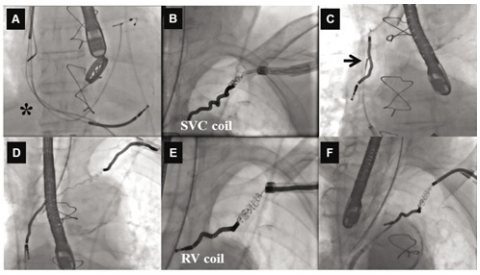
Introduction: Transvenous lead extraction (TLE) is a high-risk procedure especially in low volume centers and with non-skilled operators. The main issue of Riata is the conductor cables externalization through an eroded silicone outer insulation. In the case hereby reported, the patient was scheduled for TLE due to device pocket decubitus and presence of vegetation. Although LASER-powered sheath has been proven to be effective to perform Riata lead extraction, removal of a failed lead with conductors externalization can cause procedure complications including rupture and remnant lead caused by incomplete removal.
Methods: N/A.
Results: The Bulldog Lead Extender was used to secure the lumenless leads. The pace-sense RV, atrial and LV leads were successfully extracted using a 16Fr LASER sheath. Differently, the Riata was unsuccessfully removed due to the massive conductors externalization at the proximal edge of the SVC coil. The externalization created a “knot” which made impossible to retrieve the catheter inside the LASER sheath lumen. Thus, via right femoral vein, a snare was inserted through a deflectable long sheath to straighten the tangle created by the conductors. After this maneuver the SVC coil was retracted inside the lumen of the LASER sheath. The same issue was observed proximally to the RV coil and the operation was repeated to straighten the conductors.
Conclusions: Riata TLE could be a challenging procedure due to insulation failure and conductor cables externalization. A combined LASER and femoral approach was necessary due to the massive conductors externalization and the inability to complete the extraction from the subclavian vein.



PO06-174

REDUCTION IN ELECTROCARDIOGRAPHIC LATERAL PRECORDIAL VOLTAGE AFTER SUBCUTANEOUS IMPLANTABLE CARDIOVERTER-DEFIBRILLATOR IMPLANTATION

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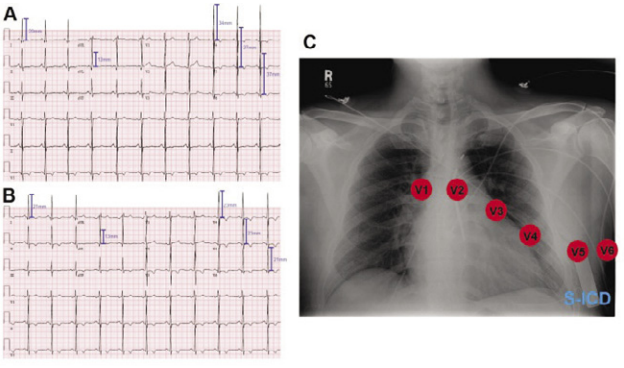
Introduction: Decreased voltage across the precordial leads may occur in the setting of increased impedance between the heart and the surface electrodes. ECG changes may occur after implantation of a subcutaneous ICD (S-ICD) when surface ECG electrodes are placed over the implant site.
Methods: N/A
Results: A 31-year old man was diagnosed with apical hypertrophic cardiomyopathy (HCM) on echocardiogram after a syncopal episode. Cardiac MRI demonstrated delayed enhancement in the inferior septal wall. He was referred for evaluation of a primary prevention ICD. After discussion, it was decided to implant a S-ICD (Boston Scientific). Pre-implant ECG (Figure, A) demonstrated left ventricular hypertrophy (LVH). R-wave amplitude in the lateral precordial leads were consistent with apical HCM. The S-ICD was implanted successfully in the left upper abdomen. Repeat ECG after device implant (Figure, B) demonstrated only minimal criteria for LVH. The R-wave amplitudes in the lateral precordial leads V4-V6 were lower than the pre-implant ECG, while R-wave amplitudes in the lateral limb leads were unchanged.
Conclusions: Reduction of precordial voltage on ECG most commonly results from the presence of pericardial/pleural fluid or subcutaneous fat. In patients undergoing implantation of a left-sided S-ICD, it is important to recognize that the placement of the lateral precordial leads over the device may result in reduced voltages on the corresponding leads recorded on the surface ECG (Figure, C).



PO06-175

CRYOBALLOON ABLATION FOR ATRIAL FIBRILLATION. IS CRYOENERGY APPLIED ONLY TO THE PULMONARY VEIN OSTIUM?

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Introduction: Cryoballoon ablation for atrial fibrillation (AF) has become a accepted, effective and safe technique for the treatment of this arrhythmia. However, in some patients, the lesions are created more distally in the pulmonary veins (PV) than using radio-frequency technique. In many instances cryoballoon has to be pushed quite firmly into the PV ostium in order to obtain good contact with atrial tissue.
Methods: N/A
Results: We describe a case of a 58 year old male with paroxysmal AF who underwent the PV isolation (PVI) using cryoballoon ablation. In order to assess the cryoenergy-induced acute changes inside the PV, an intravascular ultrasound probe (IVUS) for peripheral vessel wall imaging was introduced inside the PV before and after the PVI. The computed tomography image of the PV showed a common left trunk with the measurement of 42x24 mm, whereas size of LSPV (left superior pulmonary vein) was 22x11 mm. During the procedure all four PV were isolated with the maximal negative temperature of -47° C in the LSPV, 2 cryoapplications with cumulative time 480 sec. Isolation was confirmed using Achieve catheter. The IVUS visualisation showed a striking narrowing of the PV lumen after cryoablation as distal as 2.5 cm from the PV ostium where cryoballoon was placed during energy delivery. The mean time from PVI to IVUS post-ablation imaging ranged from 10 min for right inferior pulmonary vein to 45 min for LSPV. The in-hospital period was uneventful. During the next 3 months he had no symptoms of AF and a 14-day telemetric ECG showed no recurrences of AF. A control CT was performed 3 months after the ablation showed no narrowing of any of PV. However, in right lung, new focal site of fibrosis was found that was not seen on pre-procedural CT.
Conclusions: This case report shows that cryoablation may cause deeper lesions as expected, probably due to too distal positioning of balloon in some veins and well-known freezing effects on blood close to the tip of the balloon which may extend to few centimeters. These lesions may represent oedema or true narrowing of PV lumen. In addition cryoenergy may be transmitted to surrounding tissue not only because of its close proximity but also by conductibility of blood with low temperature to more distal part of lung tissue casing “silent” complication.

PO06-176

CARDIAC RESYNCHRONIZATION THERAPY IN A TRANSPLANTED HEART: A CASE REPORT

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Introduction: Ventricular dyssynchrony is a major contributor to morbidity in advanced heart failure (HF). Cardiac resynchronization therapy has been shown to improve HF symptoms, ventricular contractile function, and left ventricular ejection fraction (LVEF) in appropriately selected heart failure patients. Whether this applies to a transplanted heart is unknown. We report a case of successful cardiac resynchronization therapy in a patient with a transplanted heart who developed CHF. To the best of our knowledge, this has not been previously reported.
Methods: NA
Results: A 73 year old man, 13-year post cardiac transplant, developed sinus node dysfunction and required a right ventricular pacemaker 11 years afterwards. One year later, He developed 3rd degree AV block with pacemaker dependence. He presented for a follow up visit and had worsening HF symptoms (NYHA class III). His echocardiogram was significant for a left ventricular thrombus with a reduced LVEF of 30-35%. A previous echo 5 months prior to this visit showed a preserved LVEF of 50-55%. His EKG showed a paced rhythm with the expected LBBB pattern and QRS width of 160 ms. His medications regimen included Lisinopril 40 mg daily, Metoprolol succinate 25 mg daily, and diuretics. Given his clinical picture, and based on extrapolation of the current evidence to patients with transplanted hearts, we upgraded his pacemaker to a Bi-ventricular ICD. We noted gradual recovery of LVEF, reaching 45-50% after 1 year. This was paralleled by progressive clinical improvement, that reached NYHA class I one year after the upgrade. His immunosuppressive regimen was not changed.
Conclusions: The exact etiology of this patient’s HF was uncertain, but may have been partially attributable to ventricular dyssynchrony, which in turn could have been induced by the chronic right ventricular pacing. This suggests that the pathophysiology behind his cardiac dysfunction was mechanical and similar to that in non-transplanted hearts.
It has been reported that 50% of heart transplant patients develop sinus node dysfunction, and that 16% will need a pacemaker. If pacing is undertaken in these patients, avoidance of ventricular pacing is prudent. If it cannot be avoided, biventricular pacing should be considered.

PO06-177

RIGHT VENTRICULAR OUTFLOW TRACT VENTRICULAR TACHYCARDIA CAUSED BY ESOPHAGASTRIC COMPRESSION

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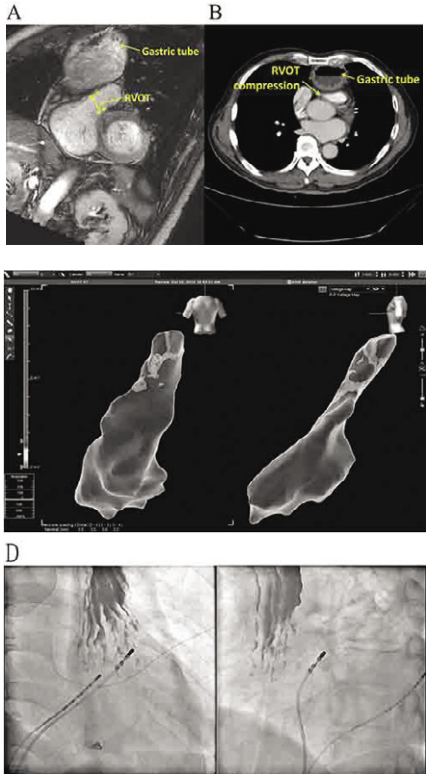
Introduction: A 66-year-old man was sent to our ER due to ventricular tachycardia (VT). He has a history of squamous cell carcinoma of esophagus, stage I underwent subtotal esophagectomy and gastric tube reconstruction. MRI disclosed no evidence of fat or focal dyskinesia in both ventricles, however, the right ventricular outflow tract (RVOT) was adjacent to a huge retrosternal gastric tube (Figure A). CT demonstrated that RVOT was compressed by a retrosternal gastric tubing with reduced volume of lumen (Figure B). During EP study, VT was induced with the morphology of inferior axis, LBBB pattern, and V3-4 transition. The earliest activation site during VT was located at anteroseptum of RVOT. Voltage map showed small area of lower voltage at this area (Figure C). Ablation was performed successfully at anteroseptal RVOT rendering noniducibility of VT (Figure D). During 3-years’ follow-up, no recurrence of VT was found.
Methods: N/A
Results: N/A
Conclusions: This is a first report demonstrating an esophagastric compression induced VT. RVOT compressed by the retrosternal gastric tubing may cause structural and electrical remodeling.

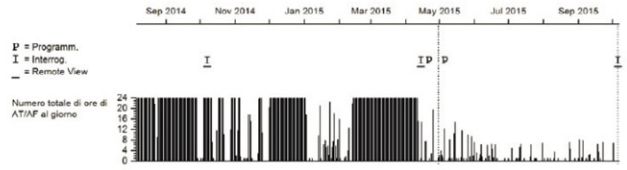


PO06-178

REACTIVE ANTITACHYCARDIA PACING TRANSFORMS A LONG-LASTING PERSISTENT ATRIAL FLUTTER IN AN UN-FREQUENT PAROXYSMAL ARRHYTHMIA

Maria Stella Baccillieri, MD, Pietro Turrini, MD, Giuseppe Boriani, MD, Luigi Padeletti, MD and Roberto Verlato, MD. Cardiovascular Division Camposampiero Hospital, Camposampiero, Italy, Cardiology Dept. Policlinico di Modena, University of Modena and Reggio Emilia, Modena, Italy, a) University of Firenze; b) IRCCS Multimedica Sesto San Giovanni (MI) LP, Firenze, Italy

Introduction: Heart failure (HF) and atrial fibrillation (AF) frequently coexist in the same patient and are associated with increased mortality, morbidity and quality of life impairment. The prompt treatment of AF in HF patients may significantly improve outcome. The MINERVA trial has recently shown the impact of new generation Reactive atrial antitachycardia pacing (ATP) in sinus node disease patients. Whether Reactive ATP may be effective in other patient cohorts, such as HF patients with implanted pacemakers or defibrillators or with cardiac resynchronization therapy (CRT), remains as an important unanswered question.
Methods: NA
Results: We report a case of a 83-year-old man, with a history of first degree AV block, hypertension, idiopathic dilatative HF, and symptomatic atrial flutter. On December 2011 he received a biventricular pacemaker and was then treated by elective AV node ablation. Pharmacological treatment, comprising warfarin, doxazosin mesylate, perindropil/indapamide, ezetimibe/simvastatina and remained unchanged for all the observation period. From August 2012 till April 2015 the patient was characterized by a long-lasting form of persistent atrial arrhythmia. On April 30 2015 Reactive ATP was enabled and the atrial arrhythmia had an immediate transition from a long-lasting persistent form to an un-frequent paroxysmal form with low daily AT/AF burden. Patient activity improved. The Trend of atrial arrhythmias is show on figure 1.
Conclusions: This is the first case report showing that Reactive ATP may have a clinical impact in reversing the natural history of atrial disease progression in a HF patient wearing a CRT pacemaker.



PO06-179

INTRATHORACIC IMPEDENCE MEASUREMENT ABNORMALITY AS A CONSEQUENCE OF ICD POCKET ABSCESS: A NEW DIFFERENTIAL DIAGNOSIS

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Introduction: Intrathoracic impedence monitoring is used to guide management of congestive heart failure(CHF). We describe finding of marked shift in intrathoracic impedance due to pocket abscess.
Methods: N/A
Results: A 69yo man with active pectoral Medtronic ICD and abandoned 23 year old abdominal ICD systems, and a tunneled transvenous lead from the abdomen through the ipsilateral subclavian vein contiguous with both devices presented with frank abdominal ICD infection and epicardial patch infection to outside hospital. Abdominal system and epicardial leads were removed through abdominal incision and sternotomy, and the aforementioned transvenous lead was cut below and left to retract into the pectoral pocket. He was treated with course of antibiotics and discharged. 4 months later he presented with persistent swelling and drainage from his pectoral ICD pocket. Patient underwent explant of device and extraction of existing 3 transvenous leads, with discovery of frank pus and abscess cavity in the device pocket. Device interrogation showed abrupt and persistent decrease in the intrathoracic impedance (Optivol, MEDTRONIC) since around the time of abdominal device removal. There were no signs or evidence of CHF. All other impedance measurements (RV, RV HV, SVC HV) were unchanged. Given that the intrathoracic impedance is measured between the ICD generator and the RV coil and can be impacted by fluid in the device pocket, we hypothesize that the finding of decreased intrathoracic impedance was a consequence of pocket abscess. This measure presumably signaled an early indication of developing pocket abscess since the impedance changed shortly after the infected lead retracted into the pectoral pocket. We considered that the change could have been a result of the sternotomy but dismissed this due to the absence of any other changes in lead impedance measurements.
Conclusions: While intrathoracic impedance is typically used for monitoring of heart failure, pocket abscess should be considered in the differential diagnosis in setting of device infection and associated symptoms.

PO06-180

INAPPROPRIATE ICD SHOCK DURING SURGERY: DOES THE HRS/ASA EXPERT CONSENSUS STATEMENT ON PERIOPERATIVE MANAGEMENT OF ICDS REQUIRE REVISION?

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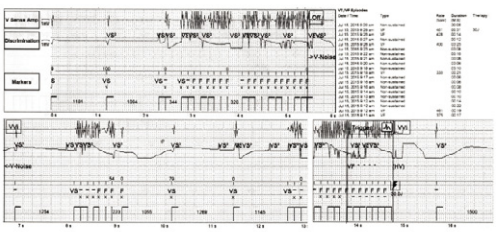
Introduction: Current HRS/ASA guidelines do not recommend specific intraoperative intervention for surgical procedures below the umbilicus for managing electromagnetic interference (EMI) in ICD patients.
Methods: N/A
Results: A 60 year old man with a single chamber VVI ICD for secondary prevention (St. Jude Medical [SJM] Fortify Assura™, SJM Durata 7122, ICD detection zones: VT 200bpm and VF 230bpm), underwent a right total hip arthroplasty. Perioperative risk assessment concluded that no specific ICD intervention was required based on the location of the surgery in accordance with the 2011 HRS/ASA Expert Consensus Statement. The procedure was completed without any incidents. During a routine post-procedure EP device clinic follow-up visit, multiple episodes of VF and an ICD shock therapy were noted, correlating with the time of the surgery (Figure). Intraoperative logbook events indicated that the use of electrocautery correlated with the device-detected VT and VF episodes. The tachycardia episodes were due to oversensing of EMI as VF. The inappropriate ICD therapy was not recognized during surgery.
Conclusions: Monopolar electrosurgery even below the umbilicus may cause inappropriate ICD detection and result in serious adverse events. Spurious tachycardia detection in ICDs and inhibition of pacing should be considered regardless of the procedure site if EMI interference is suspected.



PO06-181

BROAD COMPLEX TACHYCARDIA DUE TO A MANIFEST NODOVENTRICULAR PATHWAY, WITH CURATIVE ABLATION IN THE SLOW PATHWAY REGION

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Introduction: We present a case of a broad-complex tachycardia that was demonstrated to be an antidromic nodoventricular reciprocating tachycardia, terminated with ablation in the anatomic slow pathway region.
Methods: N/A
Results: A 55 year old with palpitations was brought to the EP lab. ECG showed sinus rhythm with no pre-excitation. Pacing from CSp revealed A-H decrement, with an abrupt increase coincident with development of pre-excitation and the H-V interval becoming markedly negative. A sustained wide-complex tachycardia was induced with atrial extra-stimuli. There was a 1:1 V-A relationship with inverted p-waves in the inferior leads, an atypical LBBB morphology with a V5 transition, and a left superior axis. Earliest atrial activation was at CSp. Variability in the tachycardia cycle length was associated with delay in the V-H interval that prolonged the V-A interval. The earliest recorded ventricular electrogram was at the right ventricular (RV) summit, earlier than any recorded at the tricuspid annulus (TA). With the septal atrium committed, sensed atrial extra-stimuli from the lateral TA or from CSp failed to advance the subsequent ventricular activation. VOD pacing from the summit of the septum at a cycle length 30ms shorter than the TCL demonstrated manifest QRS fusion, with tachycardia resetting following the first fused complex. Cessation of pacing after tachycardia entrainment revealed a V-H-A-V sequence, and a PPI minus TCL of 30ms. Cessation of entrainment from CSp revealed an A-V-H-A response and a PPI - TCL of 40ms. A diagnosis of a manifest nodoventricular pathway sustaining an antidromic nodoventricular reciprocating tachycardia was made. Given the findings of entrainment from CSp, ablation in the slow pathway location was performed anatomically, immediately superior to the ostium of the CS and with no evidence of a pathway potential. No pre-excitation or tachycardia could subsequently be induced.
Conclusions: Whilst rare, the presence of a manifest nodoventricular pathway should be considered in the evaluation of an atypical broad complex tachycardia. This case highlights the utility of curative ablation in the slow pathway region.

PO06-182

FALLING INTO PACE: FALL PREVENTION WITH PACING IN ICTAL ASYSTOLE

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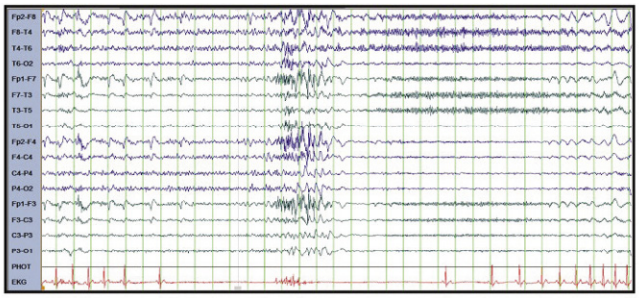
Introduction: Ictal asystole is an uncommon manifestation of epilepsy most commonly associated with complex partial seizures of temporal lobe origin with a prevalence of <0.4%. Centrally mediated vagal storm has been implicated as a potential mechanism, and cardiac pacing is usually reserved for when antiepileptic drug (AED) therapies fail to prevent ictal bradycardia. We present a case of ictal asystole captured on continuous EEG monitoring requiring pacemaker implantation in a patient refractory to AEDs.
Methods: N/A
Results: A 56 year old male with an 11 year history of medically intractable right temporal lobe partial complex seizures due to resection of a cavernous hemangioma was admitted for continuous video EEG monitoring. Seizures were characterized by olfactory aura, staring spells, loss of consciousness (LOC) and multiple falls with injury, without any observed convulsions. During the monitoring period, he had 2 seizures manifested as staring spells followed by LOC. EEG and cardiac rhythm recordings of a representative episode (Fig. 1) showed a 16 second period of asystole 32 seconds after the onset of seizure.

The patient underwent permanent pacemaker implantation. At 7 month follow-up, despite AEDs, he continued to have seizures with appropriate backup atrial pacing for ictal asystole, but reported the “best seizure control since 2008” and no falls.
Conclusions: We present a rare case of medically intractable seizures with significant ictal asystole, necessitating cardiac pacemaker implantation. Pacemaker implantation in these cases may mitigate potential morbidity from falls and injury if AEDs fail to prevent ictal bradyarrhythmias.



Ictal asystole. After onset of clinical seizure, rhythmic theta activity was observed over the right fronto-temporal region consistent with an epileptic focus (onset not shown). Thirty-two seconds into the seizure a sixteen second asystolic period was recorded on the rhythm strip. EEG ictal activity was interrupted by generalized rhythmic delta activity during asystole. Sinus rhythm resumed and EEG was remarkable for generalized attenuation. Time scale: 10 mm/s, Low filter: 1Hz, High filter: 50 Hz, Notch filter: Off, Sensitivity: 10 µm/mm, Time line interval: 1.0 seconds.

PO06-183

TERMINATION OF PERSISTENT ATRIAL FIBRILLATION AT A STABLE AF ROTOR IDENTIFIED ONE HOUR EARLIER

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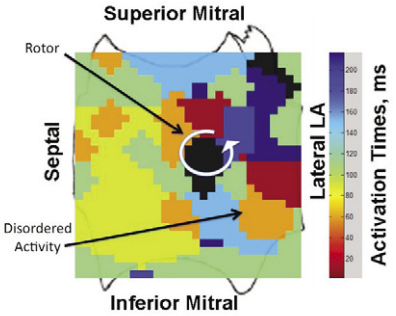
Introduction: Many clinical studies now reveal sources for atrial fibrillation (AF), yet one major debate is whether these sites are stable. This has mechanistic and technical implications for ablation. We report a man with persistent AF in whom basket mapping identified a left atrial rotor before the basket was removed. One hour later, guided only by visual recall, ablation at this site terminated persistent AF to sinus rhythm before complete PV isolation.
Methods: N/A
Results: This is a 67 year-old man with persistent AF despite 3 prior cardioversions and antiarrhythmic drugs including Amiodarone (discontinued before ablation). The patient presented in sinus rhythm and was easily induced into AF that was sustained for >2.5 hours. A basket (FIRMap, Abbott EP) was inserted into the right atrium (RA), where a rotor was ablated and eliminated on a repeat map. After trans-septal puncture, an anatomic map of the LA was created (CARTO, Biosense-Webster). LA basket maps identified one index rotor (and no other clear sites) at the LA roof near the appendage (figure 1). The basket was removed for sheath management, without marking the rotor site(s) on the shell. One hour later, ablation guided only by operator recall of the LA rotor abruptly terminated AF to sinus rhythm (5 min ablation). The PVs were not isolated at this point. The case was concluded by PV isolation.
Conclusions: This is a unique case where a rotor proven to drive persistent AF was spatially and temporally stable and where ablation acutely terminated AF to sinus rhythm. These results have mechanistic implications, and rotor stability may also help to improve the workflow for AF rotor mapping and ablation.



PO06-186

ATRIAL ARRHYTHMIAS AND CLINICAL OUTCOMES IN PATIENTS WITH LEFT VENTRICULAR ASSIST DEVICES

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Introduction: In patients who require left ventricular assist devices (LVAD), the incidence and predictors of atrial arrhythmias and their relation with ventricular arrhythmias and survival are not known. We hypothesized that atrial arrhythmia burden would be affected by LVAD implantation and have a negative impact on survival and incidence of ventricular arrhythmias.
Methods: All patients who underwent LVAD implantation from 2008 to 2015 were included. Medical records, electrocardiograms and cardiac electrical device interrogations were reviewed to determine arrhythmia incidence and clinical outcome. The association of arrhythmias with survival was evaluated using Kaplan-Meier and Cox proportional hazards analyses.
Results: A total of 331 consecutive patients (23% female) were followed for an average of 484 days (Range: 0-2306). At implant, mean age was 57.8±12.7 years, 140 (42.2%) were implanted as bridge to transplant, and 124 (37.5%) had ischemic cardiomyopathy. Atrial arrhythmias were highly prevalent before LVAD implantation: atrial fibrillation (AF) in 152 (45.9%), atrial flutter (AFL) in 46 (13.9%), atrial tachycardia (AT) in 23(6.9%) and atrioventricular nodal reentrant tachycardia (AVNRT) in 4 (1.2%). After LVAD, new onset atrial arrhythmias were also frequent: AF in 49(27%), AFL in 31 (10.8%), AT in 40(13%) and AVNRT in 4(1.2%). New onset AF was more common among women (32% vs 25%). Increasing age and ischemic cardiomyopathy were predictors of AF post-LVAD in multivariate analyses. AF was associated with decreased survival following LVAD. After adjusting for age, gender, ischemic cardiomyopathy, and implant date, persistent AF preceding LVAD was an independent predictor for mortality in Cox proportional hazards analysis ($p<0.05$). Also, the incidence of ventricular arrhythmias after LVAD was significantly higher in patients with persistent AF preceding LVAD ($p<0.05$, 44% vs. 25.2%).
Conclusions: Patients who require LVAD have an increased incidence and prevalence of atrial arrhythmias, particularly AF. In this population, AF is associated with increased ventricular arrhythmias and reduced survival. Thus, maintenance of sinus rhythm may be critical for better outcomes in patients with LVAD.

PO06-187

INCREASED RISK OF VENTRICULAR TACHYCARDIA IS ASSOCIATED WITH SARCOIDOSIS DURING A VERY LONG TERM FOLLOW-UP : A NATIONAL REPRESENTATIVE COHORT

Yun-Yu Chen, MPH, Yenn-Jiang Lin, MD and Shih-Ann Chen, MD. Taipei Veterans General Hospital, Taipei, Taiwan, Taipei Veterans General Hospital/National Yang-Ming University, Taipei, Taiwan

Introduction: Sarcoidosis is an important diagnostic consideration in patients with ventricular tachycardia (VT) of unknown origin. The clinical course of patients with ventricular tachyarrhythmias as a primary presentation during long-term follow-up in patients with sarcoidosis is mostly unknown.
Methods: We analyzed the epidemiological feature of sacroidosis in Taiwan (N=4474) using the National Health Insurance Research Database from 2000-2004. Patients of sarcoidosis were identified. Healthy controls without prior history of structural heart disease were matched with propensity-score 1:1 matching for sarcoidosis group. We investigated the incidence of life-threatening VT and mortality by the history of sarcroidosis during long-term follow-up.
Results: A total of 4474 cases with sacroidosis were enrolled as the same number of healthy controls, the baseline characteristics between the two groups were similar. After a mean follow-up of 11.4±2.15 years (IQR: 12, 11.3-12), the incidence of VT in sarcoidosis group was higher as compared with healthy controls (0.94% [85 per 100,000 person-year] in sarcoidosis group, and 0.09% [8 per 100,000 person-year] in healthy controls; adjusted hazard ratio [HR]: 12.7 (95% confidence interval [CI]: 2.82-56.9); P<0.001). The cumulative incidence of defibrillators implantation for secondary prevention, cardiovascular death, and total mortality were equivalent between two groups after multivariate adjustment including the sex, age, underlying disease as hypertension, diabetes mellitus, and other comorbidities.
Conclusions: Sarcoidosis may increase the predisposition to ventricular arrhythmia with cumulative incidence of 0.94%, but may not relate to the increased cardiovascular mortality during long-term follow-up.

PO06-188

LONG TERM USE OF IVABRADINE: IS SLOWING THE HEART RATE WORTH IT?

Gabriel Vanerio, MD and Maria Jose. Arocena, MD. British Hospital-CASMU, Montevideo, Uruguay

Introduction: Assess safety and efficacy of ivabradine in patients with sinus tachycardia and diverse comorbidities.
Methods: We studied 35 (45% female) patients with several comorbidities; 25% had stable coronary heart disease and a heart rate >80 bpm despite optimal medical therapy. Other patients had inappropriate sinus tachycardia, COPD, long term diabetes and other conditions (heart rate >90 bpm). Ivabradine was used as a solely agent or as an add-on therapy to the maximally tolerated b-blocker till a target dose of 10-15 mg/day. During follow-up (555 ± 384 days, min-max 102-1460 days) safety, patient tolerance and efficacy of ivabradine were assessed. All patients underwent regular 12-lead resting electrocardiography during follow-up. Statistical analysis was accomplished using paired t-test and Chi-square tests.
Results: Mean age was 64 ± 17 years. We observed a persistent and significant reduction in resting heart rate in all patients by a mean of 20.9 ± 9.4%, without significant changes of blood pressure. No changes on PR, QTc or QRS durations were detected. There was a significant correlation between resting heart rate and NYHA. One patient developed visual disturbance that was resolved by drug discontinuation. One patient died of stroke unrelated to ivabradine.
Conclusions: Long term use of ivabradine is safe and effective. It significantly decreases resting heart rate, improves NYHA functional class without significant adverse effects.

PO06-189

INFEROLATERAL T-WAVE INVERSIONS AMONG NON-ISCHEMIC SUDDEN CARDIAC DEATH VICTIMS

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Introduction: T-wave inversion in leads other than V1-3 have been associated with increased risk for sudden cardiac death (SCD) in general population and among coronary artery disease patients. The association of inferolateral T-wave inversions and non-ischemic SCD has not been studied.
Methods: We have collected autopsy information from 4,032 SCD subjects since 1998 in the Fingesture study. Non-ischemic etiology was the cause of SCD in 951 subjects. We were able to collect pre-mortem ECGs from 275 subjects with non-ischemic SCD (mean age 57±12, male 75%). The control population consisted of general population cohort of 10,864 subjects (mean age 44 ± 8 years, male 52%). T-wave inversions in inferior or lateral location were defined as inverted T waves in more than one lead in the area.
Results: Cardiac hypertrophy related to hypertension (HTA) (25%), unexplained cardiomegaly (CMCMP) (23%), alcohol related cardiomyopathy (ACMP) (24%) and idiopathic myocardial fibrosis (IMF) (15%) were the most common causes of SCD in the non-ischemic population with ECGs. Structurally normal heart was seen in only 1.5% (n=4). No subject with arrhythmogenic right ventricular dysplasia was found among subjects with pre-mortem ECG. The prevalence of inferolateral T wave inversions was 37% (inferior 10%; lateral 18%; both 9%) among patients with non-ischemic SCD compared to 0.7% in the general population (p< 0.001). The prevalence of T-wave inversions was highest in CMCMP group (48%), followed by HTA (29%), ACMP (29%) and IMF group (25%), respectively. Prevalence in SCD victims with structurally normal heart was one out of four subjects. The history of prior diagnosis of cardiac disease was higher among subjects with inferolateral T-wave inversions (72%) than those without (47%, p< 0.001).
Conclusions: Pre-mortem inferolateral T-wave inversions in 12-lead ECG are common in non-ischemic cardiac disease leading to SCD.

PO06-190

SUDDEN CARDIAC DEATH WITH PRESERVED VS. REMODELED HEART: A POST-MORTEM EVALUATION

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Introduction: The majority of sudden cardiac deaths (SCD) occur in patients with preserved left ventricular function, but mechanisms are not well understood. We therefore performed detailed comparisons of cardiac autopsy findings in SCD patients with structurally preserved vs. dilated left ventricles.
Methods: From an established, dedicated cardiac pathology

database in the eastern US, we compared 64 consecutive SCD patients with structurally preserved LV, to 77 with dilated LV (2005-2010). Preserved hearts were defined by heart wt. ≤450g and LV cavity ≤35mm; dilated hearts were heart wt. >450g and LV cavity >35mm. Detailed clinical and autopsy data including cardiac and coronary gross and histopathology findings were compared.
Results: Age was similar in preserved vs. dilated groups (58.9 ± 13.5 yr vs. 58.5 ± 16.9 yr; p = 0.89) and females were more likely to have a preserved heart (72% vs. 28%; p < 0.01). There were no significant differences in cardiovascular risk factors such as hypertension and diabetes mellitus. The prevalence of severe coronary artery disease (> 75% stenosis in any major coronary artery) was higher in preserved hearts (50% vs. 36.3%; p=0.03), but proportion with acute coronary thrombosis was not different (preserved 25%, dilated 22%; p=0.1). However, preserved hearts were more likely to have coronary plaque erosion (14% vs 1.2%; p<0.01). There were no significant differences in the prevalence of plaque rupture (10.9% vs 16.8%; p=0.31) or calcified nodule (0 vs 3.9%; p=0.11). Myocardial replacement fibrosis was equivalent (preserved 34.3% vs dilated 42.8; p=0.3). However preserved hearts were less likely to have right ventricular scar (preserved 1.5% vs dilated 16.8%; p<0.01) and transmural scar in the LV inferior wall (Preserved 9.3% vs Dilated 22%; p=0.04). We observed significant interstitial fibrosis in both groups, higher in dilated hearts (57.9% vs. 48%, p=0.045).
Conclusions: Patients with SCD and preserved LV have a higher prevalence of severe coronary lesions with distinct coronary plaque characteristics, as well as higher than anticipated burden of myocardial interstitial fibrosis. These findings suggest greater involvement of acute coronary syndromes and diastolic heart disease in SCD with preserved LV.

PO06-191

CHOICE OF AF TREATMENT IN THE ELDERLY POPULATION - A RETROSPECTIVE, SINGLE-CENTER ANALYSIS

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Introduction: Most randomized controlled AF trials exclude patients with age > 70 years (a). In perspective of the aging population there is clear need for data in elderly patients. Aim of this study was to investigate the preferred choice and type of AF treatment (rate control, RAC; rhythm control, RYC) in elderly patients.
Methods: We performed a retrospective analysis of n=551 patients (>70a) and n=80 patients (≤ 70a), which were admitted to our hospital with AF from 2012 to 2014. We analyzed type of treatment at discharge, drug type, ablation (ABL), anticoagulation (OAC), and hospitalization rate. We analyzed 3 age groups: A: ≤ 70a, B: 71-74a and C: ≥75a.
Results: Our analysis revealed an inverse relationship with age, incremental rise of RAC and decremental choice of RYC (Figure 1B). OAC differed mainly in group B (figure 1C). ABL was decremental with age (group A>B>C; figure 1D). Hospitalizations (HOS) showed a trend for more HOS in RYC vs. RAC overall, while heart failure (HF)-related HOS were less frequent in RYC vs. RAC (figure 1E). RYC therapy within the RYC cohort (n=247) showed decremental use of class-Ic AADs and ABL with age (group A>B>C; figure 1F). Analysis of HOS in within the RYC cohort revealed lower HOS rates in the patients with ABL vs. w/o ABL especially for non-AF related HOS and HF-related HOS (figure 1G).
Conclusions: Our analysis of AF treatment in the elderly revealed less frequent RYC in older patients. However, HF-related HOS were less frequent in RYC treated patients. In addition, patients treated with ABL for RYC showed significantly lower HOS compared to AAD treated patients. These results provide first insights into a potential benefit of ABL in older patients assigned to a RYC therapy.

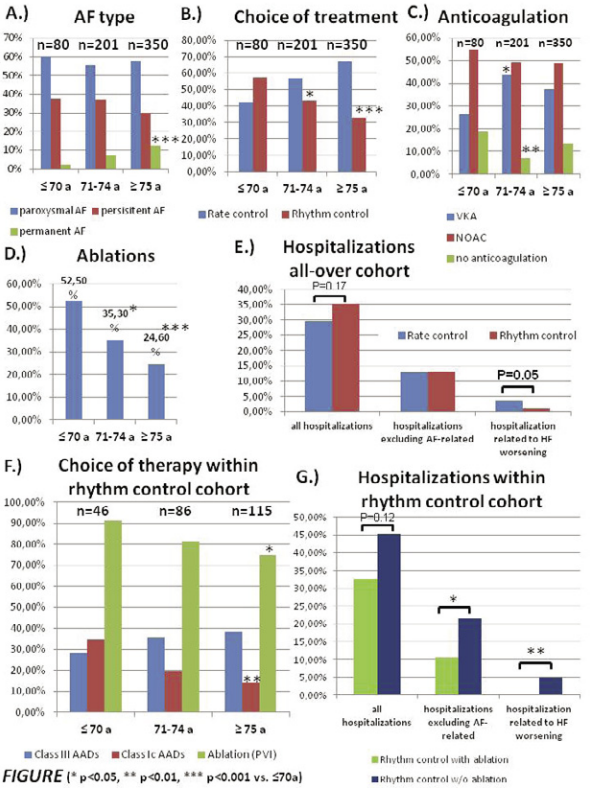

FIGURE (* p<0.05, ** p<0.01, *** p<0.001 vs. ≤70a)

PO06-192

CYCLIC VARIATION OF HEART RATE AS A MARKER OF THERAPEUTIC EFFECTS IN PATIENTS WITH SLEEP APNEA

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Introduction: Sleep apnea (SA) is an important risk factor for cardiovascular morbidity and mortality and its treatment improves prognosis. To maintain effective SA treatment, however, repeated polysomnographic (PSG) examinations are necessary, which require substantial time and cost. In patients with SA, apnea-hypopnea episodes are accompanied by characteristic ECG pattern known as cyclic variation of heart rate (CVHR), which has been proposed as a marker of moderate-to-sever SA. We examined if CVHR can be used as a maker of therapeutic effect in patients with SA.
Methods: We studied 142 patients with SA (median age [IQR],

51 [39-60] yr, 12 female) who underwent PSG studies baseline and after treatment. The number of CVHR per hour was measured from ECG during the PSG studies by an automated algorithm of autocorrelated wave detection with adaptive threshold.
Results: Among 142 patients, 123 (87%) of them were treated by continuous positive airway pressure, 9 (6%) by oral appliances, 4 by surgical operation, and 5 by lifestyle modifications. Median (IQR) of apnea-hypopnea index (AHI) reduced from 41 (27-55) at baseline to 4 (2-10) after the treatment. The changes in AHI (ΔAHI) estimated by CVHR adjusted for individual AHI-to-CVHR ratio at baseline correlated closely with actual ΔAHI (r = 0.93). Patients with post-treatment residual AHI ≥15 (n = 23 [16%]) were detected by CVHR at 87% sensitivity and 76% specificity (area under the receiver-operating characteristic curve [AUC], 0.87 [95%CI, 0.81-0.92]) and those with AHI ≥30 (n = 8 [5%])) at 100% sensitivity and 96% specificity (AUC, 0.98 [0.94-1.00]).
Conclusions: The changes in CVHR with SA treatments reflect therapeutic effects on AHI. The ECG analysis of CVHR may be used as a screening tool for patients with residual SA episodes after treatment.

PO06-193

RISK FOR CARDIAC EVENT IN ARVC PATIENTS IN ASSOCIATION WITH T-WAVE MORPHOLOGY MEASURED FROM HOLTER RECORDINGS

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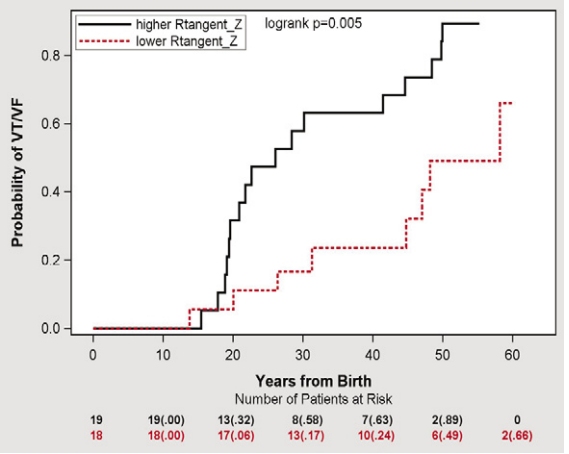
Introduction: Predicting episodes of ventricular tachyarrhythmia (VT/VF) events in arrhythmogenic right ventricular cardiomyopathy (ARVC) patients is a challenge. This study investigates ventricular repolarization parameters and their value in predicting VT/VF events in patients with ARVC.
Methods: We studied 37 probands, diagnosed with ARVC according to the 2010 Task Force criteria. Three orthogonal (X,Y, and Z) lead ECG from Digital Holter were acquired at enrollment. The QRS duration, QTc, QTpc (QT peak corrected), TpTe (Tpeak-Tend), T-wave amplitude (Tamp) and right (Rtangent) and left tangent (Ltangent) of the T-wave were automatically quantified using custom-made algorithms. Median value was considered as a prespecified cut-off values for all parameters.
Results: Of 37 patients with available recordings, 26 had VT/VF events. Lower median Rtangent and higher Ltangent (in lead Z) identified subject at higher risk for VT. Patients stratify by median Rtangent differ with respect to assessment of right ventricle function. Kaplan-Meier curve showed significantly lower risk of VT/VF in subject with lower T wave tangent (logrank p=0.005); after adjustment for age of enrolment, gender and T wave in II, III and AVF: (HR: 6.0 CI: 1.9-19, p<0.01). Additionally, TpTe and Tamp both on lead Z were borderline predictive (HR:1.66, CI: 1.1-1.6, p <0.05 and HR:2.4 , CI: 1.4-4.4, p<0.01) respectively.
Conclusions: T-wave morphology was the strongest repolarization parameter predicting events in patients with ARVC.



PO06-194

THE APPLICATION OF SIGNAL-AVERAGE ECG (SAECG) IN PREDICTION OF RECURRENCES AFTER CATHETER ABLATION OF VENTRICULAR TACHYARRHYTHMIAS IN ARRHYTHMOGENIC RIGHT VENTRICULAR DYSPLASIA/ CARDIOMYOPATHY

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Introduction: The clinical implication of signal averaged ECG (SAECG) in patients with arrhythmogenic right ventricular dysplasia/cardiomyopathy (ARVD/C) undergoing radiofrequency catheter ablation (RFCA) of ventricular arrhythmias (VAs) remain to be elucidated.
Methods: N/A
Results: From 2010 to 2013, a total of 70 patients (mean age 46.2±14.1, 37 males) with ARVD/C undergoing successful endocardial and epicardial RFCA for ventricular tachyarrhythmias were consecutively enrolled. Baseline characteristics, noninvasive examinations and SAECG were performed for all patients before and after RFCA (3 months). Patients were categorized into 3 groups according to the changes before and after RFCA, including electrical regression (group 1), no electrical changes (group 2), and electrical progression (group 3). Changing of electrical parameters were found in 39 patients (55.7%). After successful RFCA, 28 patients (40%) are categorized into group 1, and 31 into group 2, and 11 into group 3. Comparing with group 3, there was higher incidence of positive SAECG in group 1 and group 2 (P<0.001; Table 1 and 2). During a mean follow-up period of 17.8±10.7 months, 23 patients (32.9%) had VA recurrences, including 4 in group 1, 12 in group 2, and 7 in group 3. Comparing with group 2 and 3, group 1 had a significant survival free from VA recurrences (P=0.019, figure 1), and VAs recurrences were similar between group 2 and 3. After multivariable Cox regression analysis, electrical regression after RFCA was associated with lower VAs recurrences. (P=0.02, OR: 0.28, 95% CI: 0.10~0.83).
Conclusions: Electrical regression of SAECG after RFCA in ARVD/C was associated with less VA recurrences.

Table 1. Baseline characteristics of patients with ARVD/C (N=70)

Syncope	36 (51.4%)
Palpitation	61 (87.1%)
Diabetes mellitus	3 (4.3%)
Hypertension	15 (21.4%)
Dyspnea	3 (4.3%)
Structural abnormalities*	28 (40.0%)
Fibro-fatty replacement*	21 (30.0%)
Depolarization changes*	59 (84.3%)
Repolarization change*	20 (28.6%)
Family history*	21 (30.0%)
RFCA	
Epicardial approaches	21 (30.0%)

*According to the 2010 Revised Task Force Criteria.
ARVD/C: arrhythmogenic right ventricular dysplasia/cardiomyopathy; RFCA: radiofrequency catheter ablation.

Table 3. Changing of SAECG parameters before and after RFCA in ARVD/C

	Before RFCA	After RFCA	P value
Group 1 (N=28)			
Filtered QRS duration	120.0±12.3	111.8±9.5	<0.001
Duration of terminal QRS<40μV (ms)	46.7±9.9	35.0±8.3	<0.001
Root-mean-square voltage of terminal 40 ms (μV)	16.1±7.1	29.8±18.0	0.001
Group 2 (N=31)			
Filtered QRS duration	126.0±24.7	128.3±30.0	0.20
Duration of terminal QRS<40μV (ms)	48.3±19.6	49.3±22.4	0.65
Root-mean-square voltage of terminal 40 ms (μV)	17.9±10.6	17.2±10.9	0.61
Group 3 (N=11)			
Filtered QRS duration	109.8±11.3	112.7±8.8	0.1
Duration of terminal QRS<40μV (ms)	33.9±9.5	38.3±7.2	0.04
Root-mean-square voltage of terminal 40 ms (μV)	39.0±21.4	27.4±16.4	0.03

ARVD/C: arrhythmogenic right ventricular dysplasia/cardiomyopathy; RFCA: radiofrequency catheter ablation; SAECG: signal averaged ECG

Table 2. Comparison of baseline characteristics in each group

	Group 1 (N=28)	Group 2 (N=31)	Group 3 (N=11)	P value
Age	47.2±15.4	47.4±13.7	40.0±10.8	0.29
Gender	16 (57.1%)	16 (51.6%)	5 (45.5%)	0.79
Structural abnormalities*	12 (42.9%)	9 (29.0%)	7 (63.6%)	0.12
Fibro-fatty replacement*	7 (25.5%)	11 (35.5%)	3 (27.3%)	0.67
Depolarization changes*	28 (100.0%)	28 (90.3%)	3 (27.3%)	<0.001
Repolarization change*	6 (21.4%)	13 (41.9%)	1 (9.1%)	0.07
Family history*	12 (42.9%)	7 (22.6%)	1 (9.1%)	0.07
SAECG parameters				
Filtered QRS duration	120.0±24.7	126.0±24.7	109.8±11.3	0.05
Duration of terminal QRS<40μV (ms)	46.7±9.9	48.3±19.6	33.9±9.5	0.03
Root-mean-square voltage of terminal 40 ms (μV)	16.1±7.1	17.9±10.6	39.0±21.4	<0.001

*According to the 2010 Revised Task Force Criteria16.
ARVD/C: arrhythmogenic right ventricular dysplasia/cardiomyopathy; RFCA: radiofrequency catheter ablation.

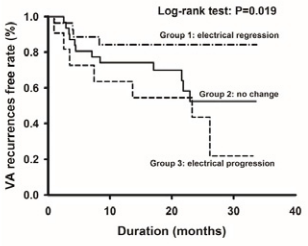

Figure 1. Kaplan-Meier curve demonstrated patients with electrical regression by SAECG had less VA recurrences than those without electrical changes or with electrical progression.

PO06-195

AGE AND BLOOD UREA NITROGEN PREDICT RISKS OF DEATH AND VENTRICULAR TACHYARRHYTHMIAS FOLLOWING ELECTIVE IMPLANTABLE CARDIOVERTER DEFIBRILLATOR GENERATOR REPLACEMENT

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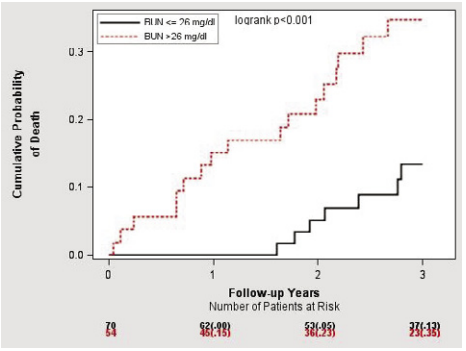
Introduction: Patients with implantable cardioverter defibrillator (ICD) may require multiple elective generator replacements. Data is limited on predicting the risks of ventricular tachyarrhythmias (VTA) and death following generator replacement.
Methods: This is a retrospective study of patients that presented for elective primary prevention ICD generator replacement from 1996 to 2009 at the University of Rochester Medical Center. Clinical variables at ICD implant and generator replacement were examined. Primary outcomes were death and VTA requiring ICD therapy following generator replacement. Predictors of outcomes were determined using multivariate Cox proportional hazards regression models.
Results: 238 patients who underwent elective primary prevention ICD generator replacement were followed. Mean time to generator replacement was 4.61±1.87 years. During mean follow-up of 2.42 ± 2 .14 years, 62 deaths and 20 episodes of VTA requiring ICD therapy occurred. Mean age was 70±12 years and mean BUN was 29±21mg/dl. Parameters were analyzed in study population quartiles. Age > 80 years and BUN > 26mg/dl were significant predictors of death with HR 1.89, 95%CI 1.03-3.45 (p 0.037) and HR 2.55, 95%CI 1.27-5.15 (p 0.008) respectively. Age >70 years had less risk of VTA (HR 0.31, 95 CI0.11-0.86, p 0.024).
Conclusions: In patients presenting for elective primary prevention ICD generator replacement, age > 80 years and elevated BUN are associated with an increase risk of death but patients <70 years are at higher risk for VTA.



PO06-196

RED CELL DISTRIBUTION WIDTH AS A PREDICTOR FOR THE INTENSITY OF ANTICOAGULATION IN PATIENTS WITH ATRIAL FIBRILLATION

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Introduction: Elevated red cell distribution width (RDW) has been shown to be associated with adverse long-term events in patients with cardiovascular diseases. Also, it was associated with new-onset stroke and mortality in patients with atrial fibrillation (AF). We hypothesized that RDW value might influence the intensity of anticoagulation, resulting in higher incidence of adverse events in patients with AF taking warfarin.
Methods: We analyzed 657 patients with non-valuvular AF who took warfarin. INR value and clinical outcomes were assessed during 2-yr follow-up. Intensity of anticoagulation was assessed as mean time in the therapeutic range (TTR) and defined TTR ≥60% as an optimal intensity. Primary end-point was the composite of new-onset stroke and major bleeding. Secondary end-point was the composite of new-onset stroke, major bleeding and death. The relationship of RDW with TTR and clinical outcomes was assessed using categorical variables as quartiles or dichotomous variables as best RDW cut-off value 13.7%.
Results: TTR was significantly co-related with RDW (r= -0.192, p<0.001), and decreased in a stepwise manner as an increment of RDW (45.2% vs. 44.7% vs. 40.8% vs. 35.2%, p<0.001). CHA2DS2-VASc score was increased according to an increment of RDW (2.7±1.6 vs. 2.8±1.6 vs. 2.9±1.7 vs. 3.2±1.6, p=0.040). Primary and secondary end-points were significantly decreased when TTR was more than 60% and RDW was less than 13.7%. Patients with optimal anticoagulation were significantly decreased as an increment of RDW (28.7% vs. 23.1% vs. 15.8% vs. 10.7%, p<0.001). Patients with RDW <13.7% were significantly increased as a quintile increment of TTR (43.1% vs. 44.5% vs. 46.1% vs. 62.1% vs. 67.2%, p<0.001). RDW <13.7% was a significant predictor for optimal anticoagulation (adjusted Odds ratio [OR] 2.39, 95% confidence interval [CI] 1.56-3.66, p<0.001), primary (adjusted OR 0.51, 95% CI 0.27-0.96, p=0.037) and secondary end-point (adjusted OR 0.37, 95% CI 0.20-0.69, p=0.002) even after CHA2DS2-VASc score adjustment.

Conclusions: RDW was negatively associated with TTR in patients with AF. RDW might be a useful marker for the prediction of anticoagulation response and clinical outcomes in patients with AF.

PO06-197

UTILITY OF THE ROMHILT-ESTES ECG SCORE FOR PREDICTION OF SUDDEN CARDIAC ARREST

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Introduction: The Romhilt-Estes point score system (RE) is an established ECG criterion for diagnosing left ventricular hypertrophy (LVH), a condition that is independently associated with SCA. In this study, we assessed for the first time, whether RE and its components are predictive of SCA.
Methods: SCA cases occurring between 2002 and 2014 in a Northwestern US metro region (catchment area approx. 1 million) were compared to geographic controls. ECGs and echocardiograms prior to the SCA and those of controls were acquired from the medical records and evaluated for the ECG criteria established in the RE point-score system and for LV mass.
Results: 272 SCA cases (age 68.7 ± 14.6, male 63.6%) and 351 controls (age 67.6 ± 11.4, male 63.3%) were included in the analysis. RE scores were greater in cases than controls (2.88 ± 2.40 vs. 2.01 ± 1.83, p <0.001), and SCA cases were more likely to meet diagnostic LVH criteria with RE scores ≥ 5 (23.5% vs. 10.3%, p <0.001). We evaluated each component of the RE score and noted 6 of the 9 ECG criteria to be associated with SCA (R/S wave in limb leads ≥ 20 mm, SV1,2 ≥30 mm, LV strain pattern with or without use of Digoxin, left atrial abnormality, and delayed intrinsicoid deflection ≥0.05s). In a multivariate model including echocardiographic LVH, RE score ≥ 5 remained independently predictive of SCA (OR 1.86, 95% CI 1.13-3.05, p=0.014). The model was replicated with the individual ECG criteria, and only SV1.2 ≥30 mm (OR 3.05, 95% CI 1.26-7.39, p=0.013) and delayed intrinsicoid deflection (OR 1.69, 95% CI 1.10-2.59, p=0.016) remained significant predictors of SCA.
Conclusions: LVH as defined by the RE point score system is associated with SCA independent of echocardiographic LVH, and 2 individual components remained significant predictors of SCA in multivariate analysis. These results support the concept that electrical and anatomic remodeling in LVH are partly distinct entities with independent effects on SCA risk.

PO06-198

PREDICTION OF RECURRENT VENTRICULAR ARRHYTHMIA AFTER CATHETER ABLATION OF ARRHYTHMOGENIC RIGHT VENTRICULAR CARDIOMYOPATHY BY MICRORNAS

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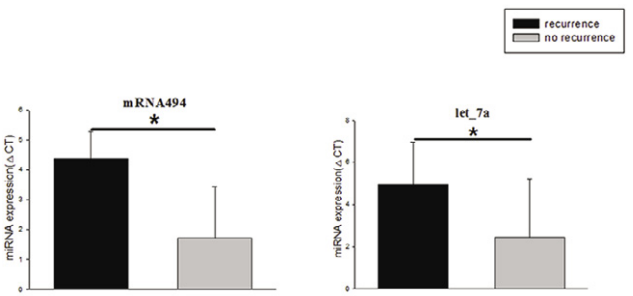
Introduction: The aim of study was to screen the circulating miRNAs in patients with arrhythmogenic right ventricular cardiomyopathy (ARVC) and correlate it with the electrophysiological characteristics and outcome of catheter ablation.
Methods: This study included 62 patients with ventricular tachyarrhythmia (VT). Of them, 28 patients had definite ARVC, 11 patients had borderline ARVC, and 23 patients had idiopathic VT. 61 patients received radiofrequency ablation procedure for VT. 33 healthy subjects were enrolled as normal control.
Results: Cardiac related miRNAs were detected in the 13 definite ARVC and 13 normal subjects by microarray analyses of miRNA. The blood levels of 11 miRNAs were found to be upregulated and 6 miRNAs were found to be downregulated in patients with definite ARVC. To validate the result of miRNA array, we selected the miRNAs whose blood level was 4 times higher (has-let-7e, miR-122-5p, 144-3p, 145-5p, 185-5p, 195-5p and 494) or lower (miR-107, 142-3p, 150-5p, 378a-3p) than that in normal subjects for further analysis. The results of real time PCR in circulating miRNA level were proportioned to the result from the PCR array. There was no significant correlation between miRNA and patient characteristics, such as age, sex, HTN, DM, cardiovascular disease, LVEF, cardiac chamber size in either definite ARVC group or all VT group. The definite ARVC patients with recurrent VT after catheter ablation had a higher circulating has-let-7e and miR-494 compared to those without recurrence (Figure).
Conclusions: Higher circulating has-let-7e and miR-494 might predict the recurrent VT after catheter ablation in patients with ARVC.



PO06-199

SUCCESSFUL SITE OF ABLATION OF NODOVENTRICULAR TRACT: DISTAL VS PROXIMAL INSERTION

Nitish Badhwar, MD, FHRS, Colleen J. Johnson, MD, Jonathan M. Kalman, MBBS, PhD, William G. Stevenson, MD, FHRS, Patrick J. Tchou, MD, Davendra Mehta, MD, PhD, Elizabeth V. Saarel, MD, Parvin C. Dorostkar, MD, Raed Abu Sham'a, MD, David H. Birnie, MD, Mark E. Josephson, MD and Melvin M. Scheinman, MD, FHRS. University of California - San Francisco, San Francisco, CA, Tulane, New Orleans, LA, Royal Melbourne Hospital, Melbourne, Australia, Brigham and Women's Hospital, Boston, MA, Cleveland Clinic, Cleveland, OH, Mount Sinai Hospital, New York, NY, University of Utah, Salt Lake City, UT, University of Minnesota, Minneapolis, MN, University of Ottawa Heart Institute, Ottawa, ON, University of Ottawa Heart Institute, Ottawa, ON, Canada, Beth Israel Deaconess Medical Center, Boston, MA, University of California San Francisco, San Francisco, CA

Introduction: Concealed and manifest nodoventricular tachycardia (NVT) is a rare cause of supraventricular tachycardia (SVT) that involves the AVN- His axis and NV tract (retrograde in concealed and antegrade in manifest). Catheter ablation of the NV fiber can be performed in the proximal insertion at the AV node or distal insertion in the ventricle. We describe the

successful ablation sites in 15 patients with NVT.
Methods: We describe the electrophysiological features and successful ablation site in 15 patients (pts) with NVT with special emphasis on 3 pts in whom the CS formed a critical part of the circuit.
Results: The study population included 15 pts with a mean age of 52 years. 2 pts had manifest NVT and 13 pts had concealed NVT. All patients showed episodes of spontaneous AV block or AV dissociation with ventricular pacing during SVT, which excluded the involvement of an extranodal AV accessory pathway. In all patients a critically timed PVC delivered during SVT when the His bundle was refractory reproducibly either advanced or delayed the next His or ventricular complex or terminated the SVT. Ventricular fusion with VOD or PVC during tachycardia proved diagnosis of concealed NV tract. VOD during tachycardia showed long PPI from RV apex arguing insertion away from RVA. 3 patients showed a discrete potential in the CS between the atrial (A) and the ventricular (V) electrograms during sinus rhythm that was recorded 3-4 cm in the CS. In one patient this potential was mapped back to the proximal CS along the roof of the CS. Catheter ablation was successful at the site in the CS showing the largest potential. Mapping and ablation at distal insertion site in 2 patients with manifest NVT was not successful. Successful ablation sites in the other pts were the slow pathway region (10 pts) and fast pathway region (2 pt). Junctional rhythm was noted at proximal insertion site in the AV node.
Conclusions: We describe 15 pts with SVT involving AVN-His axis and NV tract . The successful ablation site for NVT included proximal insertion at the slow (majority) and fast AV nodal pathways as well as within the CS where a distinct potential was recorded between the A and V in sinus rhythm.

PO06-200

12-LEAD ELECTROCARDIOGRAM CHARACTERISTICS IN PATIENTS WITH SLOW/FAST ATRIOVENTRICULAR NODAL REENTRANT TACHYCARDIA WITH AND WITHOUT DRUG-INDUCED TYPE 1 BRUGADA PATTERN

Can Hasdemir, MD, Hatice Sahin, RN, Gulten Duran, RN, Onur Akhan, MD, Umut Kocabas, MD, Serdar Payzin, MD, Mehmet Aydin, MD and Charles Antzelevitch, PHD, FHRS. Ege University School of Medicine, Bornova, Izmir, Turkey, Tepecik Teaching and Research Hospital, Izmir, Turkey, Lankenau Institute for Medical Research, Wynnewood, PA

Introduction: Spontaneous, clinical atrioventricular nodal reentrant tachycardia (AVNRT) and drug-induced type 1 Brugada ECG pattern (BrPdi) co-occur in ~ 25% of patients. The present study was designed to determine the ECG characteristics at baseline and during AVNRT in patients with spontaneous AVNRT with and without type 1 BrPdi.
Methods: Study population consisted of 218 consecutive patients, undergoing EPS and catheter ablation for symptomatic, drug-resistant AVNRT from 7/2011 to 4/2015. Thirty-nine patients were excluded due to: presence of structural heart disease (n=17), AVNRT with functional/fixed bundle branch block (n=12), slow/slow (n=8), fast/slow (n=1) and left variant AVNRT (n=1). The remaining 179 patients (127F/52M, 45±15 years of age, range 18-84) with slow/fast AVNRT formed the patient population. All patients were in normal sinus rhythm. All patients underwent ajmaline challenge test.
Results: Type 1 BrPdi was present in 49 (27.3%) patients. Mean age (44±13 vs 45±15 y/o, p=0.521) and frequency of female gender (71.4% vs 70.8%, p=0.931) were similar between patients with and without type 1 BrPdi, respectively. No patients had type 1 BrP at baseline. Type 2/3 BrP at baseline was present in 24.5% of patients with type 1 BrPdi and 4.2% of patients without type 1 BrPdi (p<0.001). Baseline heart rate, PR interval, P-wave duration/amplitude, QRS duration, prevalence of inferior/lateral/V1-V3 QRS fragmentation and early repolarization, P and T-wave axis, prevalence of low QRS voltage were similar in patients with and without type 1 BrPdi. Patients with type 1 BrPdi had shorter baseline QTc intervals (402±15 ms vs 409±16 ms, p=0.034) and a leftward shift of mean frontal plane QRS axis (18±31.9° vs 32.6±33.2°, p=0.011) compared to patients without type 1 BrPdi, respectively. Type 1 BrPdi patients had higher prevalence of type 2/3 BrP in V1-2 (64.6% vs 43.9%, p=0.017) and pseudo-r' deflection in lead V1 (93.8% vs 71%, p=0.002) and lower prevalence of P-in-QRS pattern (6.2% vs 18.7%, p=0.044) during AVNRT compared to patients without type 1 BrPdi. AVNRT cycle length, prevalence of pseudo-S wave and QRS alternans were not different between groups.
Conclusions: Certain 12-lead ECG parameters at baseline and during AVNRT may help in predicting type 1 BrPdi.

PO06-201

PLASMA LEVEL OF ANTI-PARVOVIRUS B19 IGG IS ASSOCIATED WITH THE OCCURRENCE OF ATRIAL FIBRILLATION

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Introduction: Viral and postviral myocarditis have emerged as the major causes of cardiac arrhythmia, including atrial fibrillation (AF). The high prevalence of parvovirus B19 in patients with chronic dilated cardiomyopathy strongly suggests that chronic cardiac disease develops from previous parvovirus B19-associated myocarditis. However, although the close correlation between AF and cardiomyopathy has been well recognized, the role of HSV infection in the development of AF is unknown.
Methods: A total of 2,220 consecutive AF patients from 20 hospitals were screened for structural heart diseases and known risk factors for AF and the resultant 48 patients (35 with paroxysmal and 13 with persistent AF) without these commodities and risk factors were included for data collection. Their baseline demographic and clinical characteristics, as well as plasma levels of anti-viral IgG antibody against parvovirus B19 were compared with those of 48 control subjects matched for age, gender and commodity.
Results: AF patients had significantly higher level of anti- parvovirus B19 IgG as compared to control subjects (163.83±21.92 vs 102.07±23.5 μg/ml, P < 0.001). In logistic regression analysis, anti- parvovirus B19 was associated with AF occurrence (OR: 1.29, 95% CI: 1.041-1.599, P = 0.02). The optimal cut-off point of anti-parvovirus B19 (131.09 μg/ml) predicted AF occurrence with a 95.8% sensitivity and 89.6% specificity, respectively.
Conclusions: Plasma anti-parvovirus B19 is elevated in AF patients and independently associated with AF occurrence/development.

PO06-202

VITAMIN D DEFICIENCY AND RISK OF ATRIAL FIBRILLATION: A META-ANALYSIS OF OBSERVATIONAL STUDIES

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Introduction: There are accumulating studies investigating the association between vitamin D status and the risk of atrial fibrillation (AF). However, the results in these studies were inconsistent in regards to the role of vitamin D deficiency in predicting the development of AF.The aim of this meta-analysis was to evaluate the potential relationship between vitamin D status and risk of AF.
Methods: Using PubMed and Embase databases, we searched for records published through June 2015. Additionally, a manual search was conducted using all review articles on this topic. Of the 404 initially identified records, 6 studies with a total of 139,076 patients were finally analyzed.
Results: In the categorical variable analysis, vitamin D deficiency was demonstrated to be a predictor of AF [odds ratio (OR): 1.32, 95% confidence interval (CI): 1.08 to 1.61, p = 0.008], this effect was consistently seen in both cohort studies that were conducted without seasonal restriction (OR: 1.18, 95% CI: 1.01 to 1.29, P = 0.03) and case-control studies that were performed during winter or spring season (OR: 1.83, 95% CI: 1.35 to 2.48, P < 0.0001). Continuous variable analysis also suggested that increased vitamin D levels protect against the development of AF (OR: 0.91, 95% CI: 0.83 to 1.00, P = 0.05).
Conclusions: This meta-analysis demonstrated that vitamin D deficiency increases the risk of AF. Further studies are needed to determine when there is a direct causal link between vitamin D and AF and whether vitamin D replacement will prevent new-onset AF.

PO06-203

IMPACT OF STRUCTURAL REMODELING ON REPOLARIZATION DYNAMICS MAY EXPLAIN WHY PERSISTENT ATRIAL FIBRILLATION IS LESS DEPENDENT ON TRIGGERS

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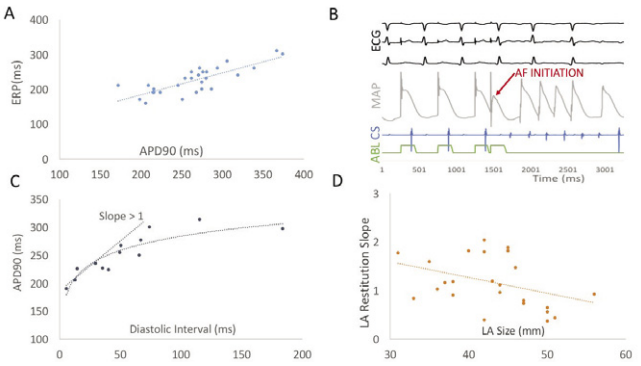
Introduction: Persistent atrial fibrillation (AF) is less trigger-dependent than paroxysmal AF, with lower success of pulmonary vein (PV) isolation, for unclear reasons. We hypothesized that structural remodelling in persistent AF patients may flatten left atrial APD restitution, reducing the ability of a trigger to cause APD oscillations and AF, that can be tracked by dynamic effective refractory period (ERP) in such patients.
Methods: 47 patients (61±9 years, LA 44±6mm, 52% persistent AF) had left atrial pacing with monophasic AP recordings near PV antra. We plotted cycle length (CL) dependence of APD90, i.e. the time from monophasic action potential (MAP) upstroke to 90% repolarization, as a restitution curve, and calculated its maximum slope. ERP was defined routinely. Both indexes were related to echocardiographic structural remodelling.
Results: Dynamic ERP tracked APD in remodelled human LA (Fig A; p<0.05). Fig B shows an AF trigger engaging steep APD restitution (C) to initiate AF. Fig D shows that APD restitution slope was negatively correlated to LA diameter (p<0.05). Compared to patients with paroxysmal AF, those with persistent AF (remodelled atria) had shorter APD90 (236±35 vs 284±46ms, p<0.01), flatter APD restitution (0.67±0.2 vs 1.5±0.4, p<0.001) and shorter ERP (204±28 vs 241±38ms, p=0.01).
Conclusions: The impact of atrial structural remodelling on repolarization dynamics may explain why patients with persistent AF are less dependent upon triggers. These results have clinical and mechanistic implications.



PO06-204

ATRIAL TACHYCARDIA DURING ABLATION FOR ATRIAL FIBRILLATION MAY NOT BE IATROGENIC BUT REFLECT INTRINSIC ATRIAL SUBSTRATES

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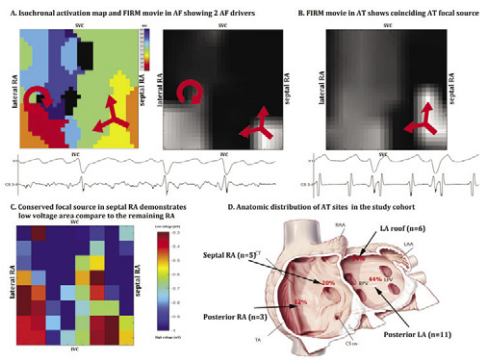
Introduction: It is unknown if atrial flutter or tachycardia (AFL/AT) during atrial fibrillation (AF) ablation is related to ablation lesions,or reflects intrinsic substrates. We hypothesised that AFL/AT during AF ablation is not iatrogenic, from prior anatomic or linear lesion,but instead reflect critical AF maintaining regions.
Methods: We enrolled 26 patients with AFL/AT during AF ablation. AF was mapped with baskets and custom software to identify potential drivers. AFL/AT sites were mapped using activation and entrainment,and compared to sites of AF drivers,anatomical regions (e.g. PVs,LAA) low voltage areas <0.2 mV,and prior lesions.



Results: Patients had LA size 42±6 mm,LVEF 58±13 %,and 38% had persistent AF. AFL/AT arose in RA (9/26; 1 typical AFL) or LA,and were reentrant (17/26) or focal. AF mapping showed 3.7±1.7 drivers in LA/RA. NavX shells (St Jude, Sylmar, USA) showed that 92% AFL/AT were at AF drivers not anatomical ablation,and 29% occurred before any ablation. AFL/AT sites had lower voltage (0.36±0.2 vs 0.49±0.2 mV p=0.03),supporting intrinsic substrates. Fig A shows 2 AF drivers in a patient with paroxysmal AF. The focal AT (Fig B) localized to the AF focal source. Fig C shows voltage across the entire atrium, measured in 64 individual electrodes, showing lower voltage at the AF-AT

shared site. Fig D shows the anatomic distribution of AT sources.
Conclusions: AFL/AT in patients at AF ablation is often not iatrogenic but may arise at intrinsic substrates indicated by diminished voltage and at sites that maintain human AF. Future studies should characterize substrates for AF and AT functionally and using MRI.

PO06-205

CAROTID INTIMA-MEDIA THICKNESS AND RISK OF SUDDEN CARDIAC DEATH IN OLDER ADULTS: THE CARDIOVASCULAR HEALTH STUDY (CHS)

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Introduction: Sudden cardiac death (SCD) is a leading cause of mortality in the U.S. and frequently occurs in the setting of underlying atherosclerosis. Carotid intima-media thickness (C-IMT) is a known surrogate marker for atherosclerosis. Whether C-IMT is associated with risk of SCD is unknown.
Methods: We investigated the associations of C-IMT with SCD among 5,555 blacks and whites in the CHS Study, a population-based study of older adults. The maximum internal and common C-IMT was measured by echocardiogram at baseline and defined as the mean of the maximal internal and common C-IMT of the near and far wall on both of the left and right sides. Presence of plaque was evaluated by percent stenosis, lesion surface, morphology, and density of the internal carotid artery. Cox regression models were used to estimate hazard ratios (HRs) of C-IMT quartiles and presence of plaque with SCD after the adjustment for potential cofounders.
Results: Over a median of 13.1 years, 302 participants developed SCD (4.64 per 1000 person-years). Higher C-IMT was associated with risk of SCD after adjustment for traditional risk factors: HRs for 4th quartile was 1.93 [95% CI 1.35-2.77] and 1.50 [1.06-2.14] for maximum internal and common C-IMT, respectively. Presence of plaque was associated risk of SCD (HR 1.42 [1.12-1.80]). Maximum internal C-IMT and presence of plaque remained significant after further adjustment by incident coronary heart disease and heart failure as time-dependent variables (Table).
Conclusions: C-IMT was associated with risk of SCD in older adults in the community. These results may suggest the importance of subclinical atherosclerosis in SCD risk stratification and prevention.

		1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
Maximum Internal C-IMT	Range (mm)	0.57-0.99	0.99-1.31	1.31-1.77	1.77-4.26
	Model 1	Reference	1.33 (0.92-1.93)	1.61 (1.12-2.31)	2.51 (1.77-3.56)
	Model 2	Reference	1.26 (0.87-1.83)	1.39 (0.96-2.00)	1.93 (1.35-2.77)
	Model 3	Reference	1.20 (0.83-1.74)	1.28 (0.89-1.85)	1.75 (1.22-2.51)
Maximum Common C-IMT	Range (mm)	0.61-0.92	0.92-1.03	1.03-1.16	1.16-2.59
	Model 1	Reference	1.16 (0.81-1.67)	1.40 (0.98-1.99)	1.93 (1.37-2.72)
	Model 2	Reference	1.10 (0.76-1.58)	1.23 (0.86-1.75)	1.50 (1.06-2.14)
	Model 3	Reference	1.05 (0.73-1.51)	1.15 (0.81-1.64)	1.36 (0.95-1.93)
Presence of Plaque		Absent	Present		
	Model 1	Reference	1.67 (1.32-2.11)		
	Model 2	Reference	1.42 (1.12-1.80)		
	Model 3	Reference	1.32 (1.04-1.68)		

Model 1: adjusted for age, sex, race, and field center
Model 2: Model 1 plus education, hypertension, diabetes mellitus, Cornell voltage, CHD, HF, BMI, HDL and LDL cholesterols, current drinking, and current smoking
Model 3: Model 2 plus incident CHD and HF as time-varying covariates

PO06-206

IMPACT ON OUTCOMES OF CHANGING TREATMENT GUIDELINE RECOMMENDATIONS FOR STROKE PREVENTION IN ATRIAL FIBRILLATION

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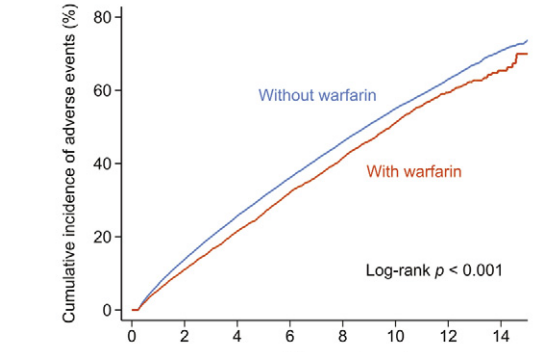
Introduction: The 2014 ACC/AHA/HRS guidelines for atrial fibrillation (AF) recommends use of CHA2DS2-VASc score instead of the older CHADS2 score for stroke risk stratification, leading to more AF patients to receive oral anticoagulants (OACs) for stroke prevention. We investigated the impact on outcomes of changing treatment guideline recommendations by comparing the proportion of AF patients recommended for OAC under the 2011 and 2014 guidelines. Second, we studied the prognosis of these patients with or without OAC use.
Methods: We used the "National Health Insurance Research Database" in Taiwan which included 354,649 AF patients. Patients with a CHADS2 score of ≥ 2 and a CHA2DS2-VASc score of ≥ 2 were considered to have a definitive indication for receiving OACs according to the 2011 and 2014 guidelines, respectively.
Results: The percentages of AF patients recommended for OACs increased from 69.3% under the 2011 guideline to 86.7% by using the new 2014 guidelines, an increment of 17.5% (95%CI 17.4-17.6). Most AF females (94.1%) and patients older than 65 years (97.2%) would receive OACs based on the 2014 guidelines. Among patients previously not being recommended for OACs in older guidelines, OAC use under the new guidelines was associated with a lower risk of adverse outcomes (ischemic stroke or intra-cranial hemorrhage or mortality; adjusted hazard ratio of 0.87 (95% CI 0.83-0.90)(Figure).
Conclusions: In this nationwide cohort study, use of the 2014 guidelines led more AF patients to receive OACs for stroke prevention, and this increased OAC use was associated with better outcomes. Better efforts to implement guidelines would lead to improved outcomes for patients with AF.



PO06-207

SPATIO-TEMPORAL STABILITY INDEX OF AF ELECTROGRAM CHARACTERISTICS: A NOVEL MARKER FOR ARRHYTHMIA STABILITY AND TERMINATION

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Introduction: Sequentially mapped complex fractionated atrial electrograms (CFAE) and dominant frequency (DF) sites have been targeted during catheter ablation for atrial fibrillation (AF). However, these strategies have yielded variable success and have not been consistently shown to correlate with AF dynamics. Whether the spatio-temporal stability of CFAE and DF may be better markers of AF sustenance and termination remains unknown.

Methods: Eighteen sheep with 12 weeks of 'one- kidney, one-clip' hypertension underwent open-chest studies. A total of 42 self-terminating (28-100s) and 6 sustained (>15min) AF episodes were mapped using custom epicardial plaque and analysed in 4-second epochs for: CFAE (NavX CFE-m) and DF (Fast Fourier Transform). Spatio-temporal stability index (STSI) was calculated using intra-class correlation coefficient of consecutive AF epochs.

Results: A total of 67,733 AF epochs were analysed. (Table) During AF initiation, mean CFE-m and STSI of CFE-m/DF were similar between sustained and self-terminating episodes although median DF was higher in sustained AF. During AF maintenance of sustained episodes, STSI of CFE-m increased significantly whereas mean CFE-m, median DF and STSI of DF remained unchanged. Prior to AF termination, STSI of CFE-m was significantly lower with a 'non-physiologically significant' 4% decrease in median DF (-0.3Hz) and no significant changes in mean CFE-m or STSI of DF.

Conclusions: Spatio-temporal stabilization of CFAE breeds AF sustenance and its de-stabilization heralds AF termination. STSI of CFE-m is more representative of AF dynamics than STSI of DF, sequential mean CFE-m or median DF.

Electrogram Characteristics during Different Phases of AF

	CFE-m	DF
AF Initiation (First 16s of AF: Self terminating vs. Sustained)		
Conventional	↔	↑23%***
Spatio-temporal stability index	↔	↔
AF Maintenance (0-2 min vs. 13-15 min in Sustained episodes)		
Conventional	↔	↔
Spatio-temporal stability index	↑22%**	↔
AF Termination (Change in terminal 4-sec epoch in Self terminating episodes)		
Conventional	↔	↑4%**
Spatio-temporal stability index	↓13%***	↔

** p<0.05; *** denotes p≤0.001;
↔ denotes equivalent; ↓denotes lower; ↑ denotes higher