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Topic: Health Services Research and Outcome

001542

Effects of artificially-induced iPEEP and post-inspiratory pause on dead space and slope of capnographic phase III in acute respiratory failure

C. Zilianti[1], A. Kyriakoudi[2], E. Potamianou[2], C. Karakatsanis[2], K. Pontikis[2], A. Koutsoukou[2], M. Pecchiari[1]
[1]Department of Pathophysiology and Transplantation, University of Milan, Milano, Italy, [2]ICU, 1st Department of Respiratory Medicine, National and Kapodistrian University of Athens, Sotiria Thoracic Diseases Hospital of Athens, Athina, Greece
Correspondence: C. Zilianti
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Introduction: According to a previous report (Brandolese et al., 1993), artificially induced intrinsic positive end-expiratory pressure (iPEEP) causes a deterioration of gas exchange in mechanically ventilated patients with acute respiratory failure, presumably because of a less homogeneous distribution of inspired gas.
Objectives: This hypothesis was investigated indirectly by measuring the slope of phase III, anatomic and physiologic dead space using volumetric capnography.
Methods: Measurements were obtained in 11 sedated, mechanically ventilated paralyzed acute respiratory failure patients with iPEEP < 3 cmH2O assessed at zero end-expiratory pressure, and without a known diagnosis of chronic obstructive pulmonary disease. In all experimental conditions, respiratory rate, ventilation and total PEEP (PEEPtot) were the same, but the same PEEPtot was obtained either by applying external PEEP (ePEEP condition) or by shortening the duration of expiration to produce iPEEP. iPEEP was induced either by reducing the inspiratory flow (Fins) and increasing the duration of the inflation (TI) (iPEEP with long TI, iPEEPlongTI condition), or by keeping constant Fins and TI, and introducing a long post-inspiratory pause (pIp) (iPEEP with a long pause, iPEEPlongP condition).
Results: PEEPtot was not significantly different in the three experimental conditions (6.6 ± 1.3, 6.4 ± 1.5 and 6.4 ± 1.2 cmH2O, $P = 0.474$, for ePEEP, iPEEPlongTI and iPEEPlongP, respectively), as was the corresponding end-expiratory volume above equilibrium volume, measured during deflation to ZEEP ($P = 0.158$). iPEEP was not different between iPEEPlongTI and iPEEPlongP (4.9 ± 1.1 and 5.1 ± 0.9 cmH2O, $P = 0.453$, respectively), but substantially greater than in the ePEEP condition (0.6 ± 0.3 cmH2O, $P < 0.001$). PaO2 was not significantly different among the three conditions ($P = 0.262$), while PaCO2 was lower at iPEEPlongP (35.2 ± 4.7 mmHg) than at ePEEP (38.4 ± 5.2 mmHg, $P < 0.001$) and iPEEPlongTI (38.3 ± 4.2 mmHg, $P = 0.019$). Relative to ePEEP, slope of phase III, anatomic, physiologic and alveolar dead space were not different at iPEEPlongTI (Δ − 0.7 ± 1.8%CO2/L, $P = 0.655$; 1 ± 7 ml, $P = 1.000$, 2 ± 22, $P = 1.000$ and 1 ± 17 ml, $P = 1.000$, respectively). In contrast, the same parameters were significantly lower at iPEEPlongP (Δ − 1.6 ± 1.1%CO2/L, $P < 0.002$, − 18 ± 9 ml, $P < 0.001$, − 32 ± 19 ml, $P < 0.001$, and − 14 ± 13 ml, $P = 0.017$, respectively).
Conclusions: In these patients, no difference in slope of phase III, anatomic and physiologic dead space were detected between ePEEP and iPEEPlongTI, suggesting that during iPEEPlongTI the effect of iPEEP-induced alterations of ventilation distribution, if any, were completely compensated by the increase of inspiratory duration (Åström et al., 2008). In contrast, the prolongation of pIp led to a significant reduction of heterogeneity as indexed by the slope of phase III in the iPEEPlongP condition, despite the presence of iPEEP.

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Topic: Acute respiratory failure and mechanical ventilation

001543

Diagnostic efficacy of cerebrospinal fluid lactate and procalcitonin in Healthcare-associated ventriculitis or meningitis: a single-center prospective study

M. Sileli[1], G. Katsikaki[1], G. Gkogkos[1], E. Kerezidou[1], D. Ntantos[1], G. Rempelakos[1], A. Athanasiadou[1], E. Koletsou[1], C. Iasonidou[1]
[1]B ICU, General Hospital "G. Papanikolaou", Thessaloniki, Greece
Correspondence: M. Sileli
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Introduction: Healthcare-associated ventriculitis or meningitis (HCVM) is a difficult-to-distinguish infection in neurocritical care. Conventional cerebrospinal fluid (CSF) parameters and classical microbiology are the mainstay for establishing diagnosis, while various factors decrease their diagnostic value. Recent guidelines propose using CSF lactate and procalcitonin (PCT), but their diagnostic value remains controversial.
Objectives: To evaluate and compare the performance of lactate and PCT in HCVM diagnosis.
Methods: This prospective observational study was conducted from January 2019 to March 2024. We enrolled all consecutive adult patients with suspected HCVM after neurosurgical procedures. We excluded patients with recent intracranial infection, immunocompromised, and pregnant women. The diagnosis of HCVM was based on the definition of the IDSA guidelines 2017. Demographics, indications for neurosurgical procedures, and the following blood and CSF parameters for each patient were recorded: white blood cell count (WBC), protein content, glucose, lactate, and PCT as well. Blood and CSF samples collected from an EVD were analyzed at the same time. Patients were allocated into two groups (group 1 = HCVM/group 2 = non-HCVM). Chi-square, Student's t, and Mann-Witney U test were used as appropriate. The p-value was set at 0.05. ROC curves were constructed, and the best cut-off points were determined. Statistical analyses were performed using R statistical software.
Results: A total of 60 patients were included, predominantly males (55%), with a median age of 60 (IQR:50–67). The main reasons for ICU admission were ruptured aneurysm and intracerebral hemorrhage (43,3%). HCVM was diagnosed in twenty patients (33,3%), with the majority of pathogens being Gram-negative bacteria (Acinetobacter baumannii 47,6%, Klebsiella pneumoniae 33,3%, Enterobacter aerogenes 4,8%). Age and gender did not significantly differ between the two groups ($p > 0.05$). The differences in CSF glucose, CSF/Serum glucose, CSF PCT, CSF lactate, CSF/Serum Lactate, CSF WBC, and CSF albumin between the groups were statistically significant ($p < 0.05$). There was no association between CSF/Serum PCT and HCVM in our cohort ($p = 0.113$). Based on the ROC curves, the CSF lactate measurement had the best diagnostic accuracy for HCVM (AUC: 0,936, 95%CI: 0.841 to 0.983) with a cut-off point > 4.4. The AUC values for CSF glucose, CSF/Serum glucose, CSF/Serum lactate, CSF PCT, CSF WBC, and CSF albumin were 0,786, 0,819, 0,809, 0,834, 0,769, and 0,715, respectively. Hence, CSF lactate is classified as an excellent test, CSF/Serum lactate, CSF/Serum glucose, and CSF PCT as a good test, while CSF glucose, CSF WBC, and CSF albumin are classified as fair tests.
Conclusions: Based on our findings, all parameters measured except CSF/Serum PCT showed a significant correlation with the HCVM diagnosis. Among the assessed biomarkers, CSF lactate had the best predictive performance. Our results extend knowledge and shed light upon the diagnostic dilemma of HCVM.