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Letter to the Editor

Do different mechanical compressors provide equivalent hemodynamic support during cardiopulmonary resuscitation?

High-quality chest compression is crucial during cardiopulmonary resuscitation (CPR) to maintain adequate tissue perfusion, ultimately leading to return of spontaneous circulation (ROSC) and favorable neurological outcomes.[1–3] Mechanical compression devices offer a viable alternative to manual resuscitation, especially in prolonged CPR and/or during transport.[4,5] However, the diverse designs and compression techniques of available devices can impact CPR outcomes.[4–6] A recent retrospective analysis of 2146 out-of-hospital cardiac arrests (OHCA) treated with three different mechanical compressors, i.e. LUCAS® (Stryker), Autopulse® (ZOLL Medical), and EasyPulse® (Schiller), revealed significant differences in ROSC and survival.[6] Nevertheless, comparative studies on the devices' performance in terms of hemodynamic support generated, are lacking.

The aim of this study was to compare the hemodynamic efficacy of two mechanical compressors, LUCAS® and EasyPulse®, by assessing end-tidal CO2 (EtCO2) as a surrogate marker[3,7,8] in the OHCAs occurring in Lombardy, Italy, during 2021. More specifically, all available defibrillator records (stored in the Regional database) from patients who underwent mechanical CPR and advanced airway management with continuous EtCO2 monitoring, were included. The first 20 min of CPR were analyzed. The study was approved by the "Milano Area 2" Ethical Committee (no. 653_2022bis), and informed consent was waived due to the retrospective observational design. Categorical variables were compared by $\chi 2$ test, while continuous ones were analyzed with a 2-way ANOVA. A $p < 0.05$ was considered as statistically significant.

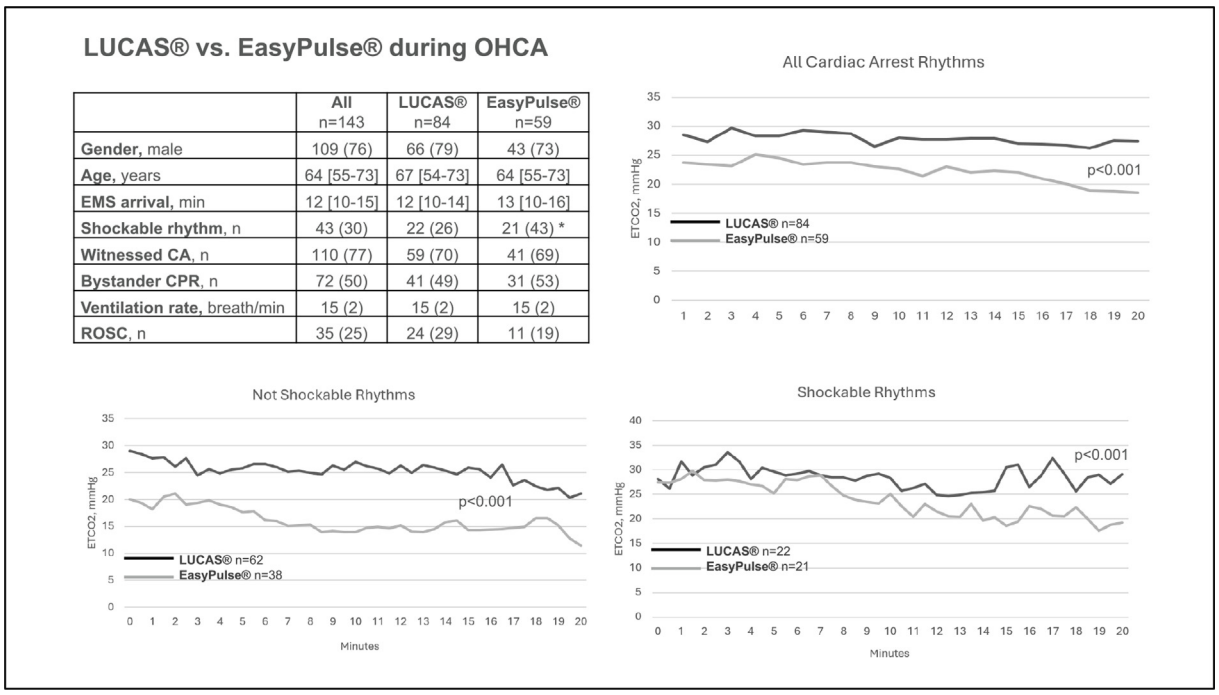
Data from 143 OHCAs were analyzed, with 84 cases using LUCAS® and 59 using EasyPulse® (Fig. 1). No significant differences were found in population and CPR characteristics (including ventilation rate), except for a higher incidence of shockable cardiac arrests in the EasyPulse® group compared to the LUCAS® one ($p < 0.05$). Patients compressed with LUCAS® exhibited consistently higher EtCO2 levels compared to those compressed with EasyPulse® ($p < 0.001$, Fig. 1). This difference was present in both shockable and non-shockable arrests (Fig. 1). A trend towards higher sustained ROSC rate was observed in the LUCAS® group compared to the EasyPulse® one.

Acknowledging the limitations inherent in a retrospective study with a small sample of defibrillator records available, our findings suggest that LUCAS® may be more effective than EasyPulse® in generating hemodynamic support and perfusion during CPR. These results highlight the potential impact of different mechanical compression techniques, such as piston (LUCAS®) vs. a combination of piston and band type (EasyPulse®), on cardiac output, as evidenced by the large difference in EtCO2.[5] This discrepancy in hemodynamic performance, likely related to a different way of exploiting the cardiac and/or the thoracic pump theory behind CPR physiology, may ultimately lead to the divergent ROSC and survival rates earlier reported.[6]

To fully understand the pathophysiology underlying the varying performance of different compression devices, further larger prospective clinical trials are needed. These studies should focus on direct measures of perfusion, including blood pressure, EtCO2, and cardiac output, or other perfusion assessments. Addressing this knowledge gap is crucial for optimizing resuscitation outcomes, as the increasing availability of diverse mechanical compressors needs a clear understanding of their relative effectiveness in generating blood flow during CPR.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: No relationship exists between any of the authors and any commercial entity or product mentioned in this manuscript that might represent a conflict of interest. No inducements have been made by any commercial entity to submit the manuscript for publication. GR is the European Resuscitation Council Director Congresses and Board member of Resuscitation Plus. All the other authors declared no COI.



	All n=143	LUCAS® n=84	EasyPulse® n=59
Gender, male	109 (76)	66 (79)	43 (73)
Age, years	64 [55-73]	67 [54-73]	64 [55-73]
EMS arrival, min	12 [10-15]	12 [10-14]	13 [10-16]
Shockable rhythm, n	43 (30)	22 (26)	21 (43) *
Witnessed CA, n	110 (77)	59 (70)	41 (69)
Bystander CPR, n	72 (50)	41 (49)	31 (53)
Ventilation rate, breath/min	15 (2)	15 (2)	15 (2)
ROSC, n	35 (25)	24 (29)	11 (19)

Fig. 1 – Population characteristics and end-tidal CO2 (ETCO2) during out-of-hospital cardiac arrest (OHCA) in the whole population and in shockable and not-shockable cardiac arrests (CA). CA, cardiac arrest; CPR, cardiopulmonary resuscitation; EMS, Emergency Medical system; ROSC, return of spontaneous circulation. Data in table are reported as n (%) or median [IQR]. Data in graphs are reported as mean over time (minutes of CPR). * p < 0.05 vs. LUCAS®.

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Ivan Silvestri [1]

Department of Pathophysiology and Transplantation, University of Milan, Italy
Department of Anaesthesiology, Intensive Care and Emergency, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy

Giuseppe Stirparo [2]

Agenzia Regionale Emergenza Urgenza (AREU), Milan, Italy

Claudia Bonetti

Department of Pathophysiology and Transplantation, University of Milan, Italy
Department of Anaesthesiology, Intensive Care and Emergency, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy

Beatrice Guerra Maria

Department of Pathophysiology and Transplantation, University of Milan, Italy
Department of Anaesthesiology, Intensive Care and Emergency, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy

Serena Ruberti

Agenzia Regionale Emergenza Urgenza (AREU), Milan, Italy
ASST Papa Giovanni XXIII, Bergamo, Italy

Anna Coppo

Agenzia Regionale Emergenza Urgenza (AREU), Milan, Italy

Maurizio Migliari

Agenzia Regionale Emergenza Urgenza (AREU), Milan, Italy

Giuseppe Ristagno *

Department of Pathophysiology and Transplantation, University of Milan, Italy
Department of Anaesthesiology, Intensive Care and Emergency, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy

* Corresponding author at: Department of Pathophysiology and Transplantation, University of Milan, Department of Anesthesiology, Intensive Care and Emergency, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Via Francesco Sforza 35, 20122 Milan, Italy.

E-mail address: gristag@gmail.com.

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[1] Author I.S. played equal roles.
[2] Authors G.S. played equal roles.