Passive ventilation generated by mechanical chest compressions (LUCAS 3) during cardiopulmonary resuscitation

Pauline Tomassen[1], Maxim Vanwulpen[2], Brecht Rombaut[2], Saïd Hachimi-Idrissi[2,3]
1 AZ Sint-Jan Brugge, Departement of Anaesthesiology and Critical Care
2 Ghent University Hospital, Departement of Emergency medicine
3 Free University Brussels, Faculty of Medicine and Pharmacy

Introduction

Goal of this study was to evaluate whether the LUCAS 3 mechanical chest compression device generates passive ventilation during cardiopulmonary resuscitation. High-quality chest compressions are crucial to improve the chance of survival following cardiac arrest. In recent years, mechanical chest compression devices have become available. The LUCAS 3 uses a suction cup placed on the chest to compress and decompress the thorax, ensuring the thorax returns to its neutral position.

Figure 1: LUCAS 3

Methodology

A convenience sample of adult, intubated cardiac arrest patients receiving mechanical chest compressions (Stryker LUCAS 3) was recruited at the Ghent University Hospital. A flowsensor (Sensirion SFM3200) measured airflow through the endotracheal tube. Inspiratory and expiratory volumes generated by the first 20 compressions (without simultaneous manual ventilation) after connection were calculated. Patient data was collected from the medical report. Ethical approval was obtained.

Results

10 patients were recruited, two were male. Median age was 62 years (IQR 59–75). Mechanical chest compressions were observed to generate variable, rapidly changing airflows (Figure 2). Initially, expiratory flow occurs (median volume 22mL, IQR 7-27). After reaching maximal compression, a short period of inspiratory flow is detected (median volume 2mL, IQR 1-4). Hereafter, expiratory flow resumes (median volume 6mL, IQR 1-12). When the thorax is released, inspiratory flow occurs (median volume 23mL, IQR 5-29). After the LUCAS has reached its neutral position, a brief period of expiratory flow is registered (median volume 2mL, IQR 1-3). Hereafter, inspiratory flow resumes (median volume 4mL, IQR 1-10).

Conclusion

The LUCAS 3 chest compression system generates rapidly changing airflows. Six phases of flow are observed. Associated volumes are small, not exceeding anatomical deadspace. The oscillatory character of the generated flow possibly causes some ventilation, which warrants further study.

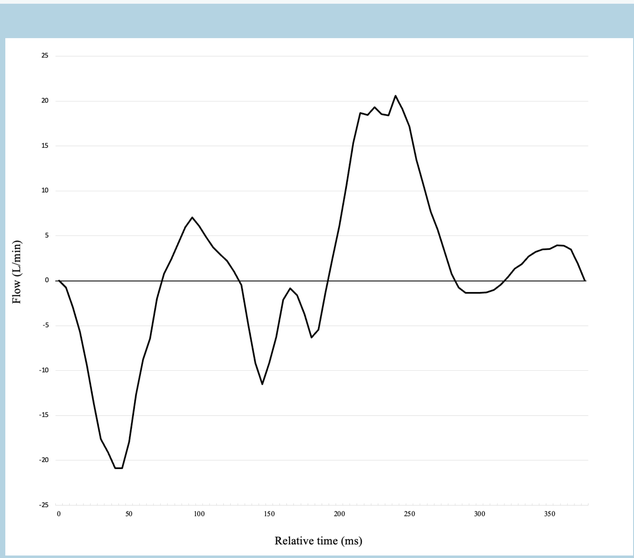

Figure 2: passive ventilation generated by a single mechanical chest compression

AZ Sint-Jan Brugge
UZ Gent
VUB Vrije Universiteit Brussel
BSICM Belgian Society of Intensive Care Medicine