Clinical Summary

Safety of mechanical chest compression devices: AutoPulse® and LUCAS® chest compression system vs. manual CPR

Rudolph W. Koster, Ludo F. Beenen, Esther B. van der Boom, et al. Safety of mechanical chest compression devices AutoPulse and LUCAS in cardiac arrest: a randomized clinical trial for non-inferiority. *European Heart Journal*. 2017;38:3006-3013.

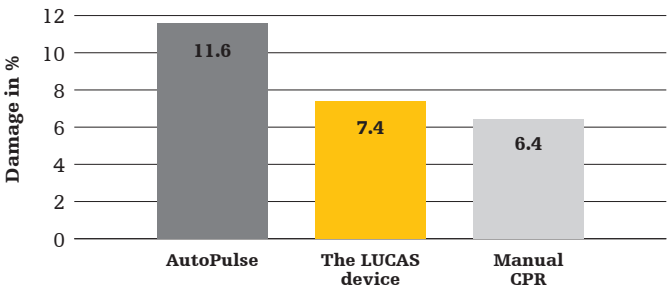
Summary

This randomised controlled non-inferiority safety study looked at the safety of two different mechanical chest compression devices; Stryker's LUCAS 2 chest compression system and the ZOLL® AutoPulse Resuscitation System. The aim was to demonstrate that mechanical chest compression devices do not cause an excess of severe or lethal visceral damage such as pneumothorax, intracranial air emboli or hepatic injury compared with good quality manual chest compressions. 337 patients experiencing in-hospital or out-of-hospital cardiac arrest arriving with manual CPR at the Emergency Department were randomised to the LUCAS device, the AutoPulse device or continued manual chest compressions. Patients randomised to manual CPR received quality manual chest compressions with an accelerometer-based chest compression feedback device.

The results showed that the use of mechanical chest compressions with the LUCAS device did not cause more severe or life-threatening visceral damage than good quality manual chest compressions. The authors could not exclude that more severe or life-threatening damage was caused with the AutoPulse device compared with good quality manual chest compressions.

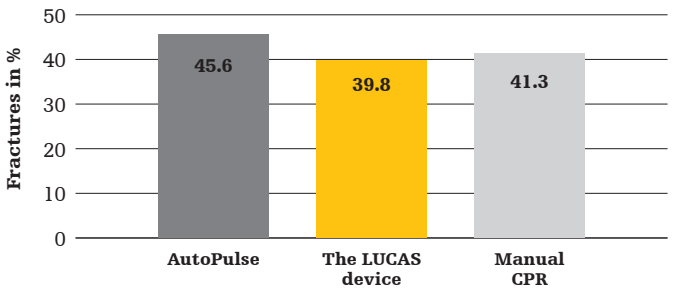
- Serious or life-threatening visceral resuscitation-related damage was seen in 11.6 percent of the AutoPulse device patients, 7.4 percent of LUCAS device patients and 6.4 percent in the manual group.

Life-threatening visceral resuscitation-related damage



- The secondary outcome (severe rib and/or sternum fractures) was observed in 45.6 percent of the AutoPulse device patients, 39.8 percent of LUCAS device patients and 41.3 percent in the manual group.

Severe rib and/or sternum fractures



- During the study, there were no LUCAS device failures. AutoPulse device experienced a 16 percent failure rate caused by battery failure or a broken belt that resulted in imbalance in active treatment. However, this did not affect the interpretation of the outcome.
- Mean compression depth in the manual control group was 4.8 cm/1.9 inches and the provided rate was 110 compressions per minute. This is the first randomised safety study where the quality of manual chest compressions was measured with a feedback device. Measuring the quality of manual CPR is important because low quality, shallow chest compressions will result in fewer injuries, but decreased perfusion and circulation.

Key points

- Rib fractures and other injuries are common, but acceptable consequences of CPR given the alternative of death from cardiac arrest.[1]
- This study shows that the LUCAS device does not cause more severe or life-threatening visceral damage than good quality manual chest compressions.
- The findings are in line with the results of the large randomised controlled LINC trial where the LUCAS device was found to be as safe and effective as manual CPR.[2]
- This study is the only randomised controlled study between mechanical CPR devices and quality-controlled manual CPR. This study design constitutes the highest level of evidence.

What is a randomised controlled trial?

The Koster study is a randomised controlled trial. This is a type of scientific experiment which aims to reduce bias when testing a new treatment. The participants of the trial are randomly allocated to either the group receiving the treatment under investigation or to a group receiving standard treatment (or placebo treatment) as the control.

Prospective randomised controlled study
Advantages
• Highest quality of evidence available[3]
• Low potential of bias
• One treatment is directly compared to another

References

1. 2005 International Concencus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations. *Resuscitation*. 2005;67:195.
2. Rubertsson S, Lindgren E, Smekal D, et al. Mechanical chest compressions and simultaneous defibrillation vs conventional cardiopulmonary resuscitation in out-of-hospital cardiac arrest: The LINC Randomized Trial. *JAMA*. 2014;311:53-6.
3. Morrison L, Gent L, Lang E, et al. Part 2: Evidence Evaluation and Management of Conflicts of Interest 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2015;132[suppl 2]:S368–S382.

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CE Class IIb (2460)
Jolife AB
Scheelevägen 17
Ideon Science Park
SE-223 70 Lund
Sweden

Stryker European
Operations B.V.
Herikerbergweg 110
1101 CM Amsterdam
Netherlands
Tel +31 (0)43 3620008
Fax +31 (0)43 3632001