CPR-Related Injuries

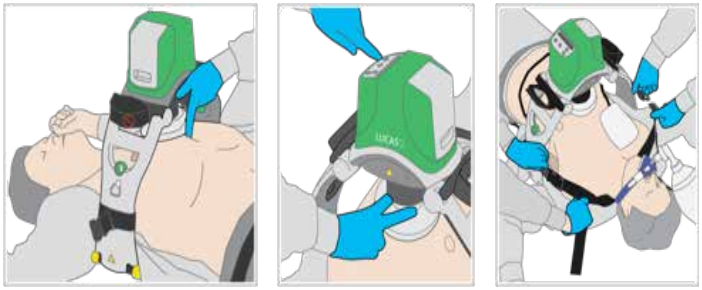
Chest compressions should be given at a rate of 100-120 compressions per minute and a depth of at least 5cm (2 in) to be effective.[1] Ever since chest compressions were introduced back in the 1960s, we know effective CPR often comes at the cost of rib and sternum fractures.[2] Quality and duration of CPR, as well as individual patient parameters such as age, sex and other health conditions influence the risk of CPR-related injuries.

It is important to remember that the value of chest compressions is not determined by the avoidance of chest injuries but by its ability to maintain adequate circulation to vital organs like the brain and heart.

"Rib fractures and other injuries are considered common but acceptable consequences of CPR given the alternative of death from cardiac arrest."

"After resuscitation, all patients should be reassessed and re-evaluated for resuscitation related injuries."

International Liaison Committee on Resucitation Consensus
Resuscitation. 2005;67:195.



Bruising and soreness of the chest are common during the use of the LUCAS chest compression system.

As for all CPR, users should continuously monitor the patient and make sure chest compressions are done in the correct position. Always monitor to ensure that the LUCAS device stays in the correct position and angle on the patient's chest according to the Instructions For Use.

The LUCAS device has been evaluated for safety and efficacy in a large randomized controlled clinical study as well as several safety/autopsy studies

The LUCAS® chest compression system has a solid base in CPR science and has been evaluated for safety and efficacy in clinical and experimental studies since its launch in 2003. The LUCAS device has been shown to increase hands-on times as well as blood flow to the heart and brain in addition to being a helpful tool to the rescue teams.

The highest level of evidence for the LUCAS device is the large randomized controlled LINC trial.[3] It showed the device is safe and effective and contributed to good neurological outcomes in 99% of the pre-hospital cardiac arrest survivors at 6-month follow up. The study, including 2,589 patients (1,300 in the LUCAS group and 1,289 in the manual CPR group), was monitored carefully for adverse events and there were no device safety concerns. Overall the LUCAS device worked reliably in over 99% of its uses, with very few interruptions to compressions.[4]

Several studies have compared patient injuries after LUCAS CPR to standard manual CPR. They have shown the LUCAS device is safe for the patient, with similar and no difference in serious or life-threatening injuries compared to manual CPR. The frequency of rib or sternum fractures after the LUCAS device was used compared to manual CPR has been reported to be lower, similar or higher, possibly a result of variability in the quality of manual CPR as manual CPR has not been controlled for depth and rate in the majority of these studies. To our knowledge, the only study that has compared the LUCAS device versus manual CPR with corrective depth and rate feedback from a sternal transducer is the randomized, controlled study by Koster, et al[5] (summarized on the right).

Koster R, et al. 2014[5]

This publication contains results from two parallel prospective, randomized controlled studies looking at autopsy, CT and x-ray findings in both in-hospital and pre-hospital patients after mechanical and manual chest compressions. The patients were randomized to either the LUCAS device or manual CPR, and in the parallel study to either the ZOLL® AutoPulse® or manual CPR. Rate and depth feedback was given in the manual groups, using a sternal transducer. 122 LUCAS cases were compared to 131 manual cases, and 116 AutoPulse cases to 132 manual cases.

"Conclusion: LUCAS does not cause significantly more serious of life-threatening visceral damage than manual CPR. For AutoPulse the non-inferiority hypothesis was not accepted and significantly more serious or life-threatening visceral damage than manual CC cannot be excluded."

Summary of studies evaluating safety of the LUCAS Chest Compression System

Kralj E, et al. 2015[6]

A retrospective analysis of results from routinely performed autopsies of non-survivors of out-of-hospital cardiac arrest. 134 LUCAS cases, 2,014 manual CPR cases.

"We found no significant difference in the incidence of skeletal chest injuries between patients who received manual-only resuscitation and those who underwent manual-LUCAS resuscitation, which is in accordance with the finding of Smekal, et al".
[…]
"We found no adverse effects of LUCAS."

Boland L, et al 2015[7]

A retrospective analysis of pre- and in-hospital reports and records of injuries of 235 consecutive out-of-hospital cardiac arrest patients; 117 survived to discharge; 118 died during hospitalization. 104 LUCAS cases, 131 manual CPR cases.

"Our results do not suggest the device used by providers in the current setting is unduly associated with compression-related trauma in OHCA patients who survive to hospital admission."

Lardi C, et al. 2015[8]

A retrospective, consecutive autopsy reports of 26 LUCAS cases and 32 manual CPR cases. LUCAS resuscitations were 52 min on average and manual 29 min.

"LUCAS 2-CPR is associated with more rib fractures than standard CPR. Typical round concentric skin lesions were observed in cases of mechanical reanimation. No life-threatening injuries were reported."

Smekal D, et al. 2014[9]

A prospective, multicenter, autopsy study of non-survivors after out-of-hospital cardiac arrest. 139 LUCAS cases and 83 manual CPR cases.

"In patients with unsuccessful CPR after out-of-hospital cardiac arrest, rib fractures were more frequent after mechanical CPR but there was no difference in the incidence of sternal fractures. No injury was deemed fatal by the pathologist."

Oberladstaetter D, et al, 2012[10]

A prospective study analyzing injuries after LUCAS compressions on 13 female cadavers using CT as well as autopsy.

"All fractures were classified as minor and nondislocated. No inner organ injuries were detected with autopsy or CT."
[…]
"Another reason for the absence of severe injuries with LUCAS may be a refined technique (compression, active decompression only up to the base level) compared to older active chest compression–decompression devices."

Menzies D, et al, 2010[11]

A retrospective study of in- and pre-hospital cardiac arrest patients comparing records and post-mortem findings for post-CPR-related trauma from one hospital using LUCAS with another hospital not using LUCAS in the ED. 40 LUCAS cases and 39 manual CPR cases.

"We did not identify a significant variation in trauma with the use of the LUCAS device compared to manual CPR."

Smekal D, et al, 2009[12]

A prospective autopsy study of non-survivors after out-of-hospital cardiac arrest. 38 LUCAS cases and 47 manual CPR cases.

"Mechanical chest compressions with the LUCAS device appear to be associated with the same variety and incidence of injuries as manual chest compressions."

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