Letter to the Editor

Technical factors weaken the clinical relevance of manikin measurements of mechanical chest compression depth

Sir,

The recent study by Blomberg et al.\(^1\) used measurements from a CPR training manikin to compare the timing and depth of chest compressions during CPR delivered manually and with a mechanical compression device. The study showed the LUCAS™2 Chest Compression System was applied quickly, without delaying the first defibrillation, and without increasing interruption in compressions compared to manual CPR. However, compressions delivered by LUCAS were reported to be too shallow. Important technical factors must be considered when evaluating whether these depth measurements are clinically relevant.

Most importantly, the manikin’s back is flat and, when it rests on the curve of the LUCAS back plate, it leaves a gap of over 12 mm between the back of the manikin and the back plate (Fig. 1a). When LUCAS presses down on the manikin chest, the manikin back flexes downwards and some of the piston displacement goes to closing the gap instead of compressing the manikin. Measuring this in a rigid setup using calibrated tools reveals that the manikin’s back deflects 5–6 mm when the piston depresses the chest 50 mm. This deflection results in the manikin reporting 5–6 mm less compression depth than that actually delivered. Since human backs are not as flat as the manikin’s, no analogous situation occurs when LUCAS compresses a human thorax (Fig. 1b). The manual CPR in the study was performed with the manikin on a flat surface, so this error in depth measurement occurred only during mechanical compressions.

The manikin used in this study is a Laerdal CPR training manikin provided by Jolife to help enable a study with two primary variables: (i) time to first defibrillation and (ii) no-flow time before the first defibrillation. This manikin had been modified by Jolife but it was not calibrated for depth measurements on the curved back plate of LUCAS.

Further careful measurements of the manikin used in this study reveals it underestimates the depth by an additional 3–6 mm compared to calibrated measurement tools. This is in line with the manufacturer’s instructions for the manikin which state a depth tolerance of ±15%. This inaccuracy is valid for both the manual group and the LUCAS group.

One cause for shallow compressions identified by Blomberg et al. was sliding of the LUCAS device relative to the manikin. The light weight and flat plastic back of the manikin make sliding of the device more common during manikin CPR than in real clinical use.

In summary, the gap between the manikin’s back and LUCAS, the measurement inaccuracy of the manikin, and the sliding of the manikin relative to LUCAS have combined to result in substantial underestimation of LUCAS compression depth in this manikin study. We therefore believe the depth measurement findings of the study are inaccurate and not relevant to clinical use of LUCAS.

Conflict of interest statements

The authors are employed by Physio-Control Inc., a division of Medtronic. Jolife AB is a part of Physio-Control Inc., and Jolife is the manufacturer and developer of the LUCAS device.

Reference


Anders Nilsson*  
Jolife AB Physio-Control CPR Products, Ideon Science Park, SE-223 70 Lund, Sweden

Fred W. Chapman  
Physio-Control Inc., 11811 Willows Rd. NE, PO Box 97006, Redmond, WA, USA

* Corresponding author. Tel.: +46 46 286 50 00; fax: +46 46 286 50 10.  
E-mail address: anders.nilsson@medtronic.com (A. Nilsson)

6 October 2011

---

Fig. 1. (a) Manikin on LUCAS back plate. (b) Patient on LUCAS back plate.