

# Survival and Neurological Function with a Novel Trapezoidal Compression-Decompression CPR Waveform during Automated Head-Up CPR in a Porcine Model of Cardiac Arrest

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## Background

- Automated head-up cardiopulmonary resuscitation (AHUP-CPR), the combination of automated head and thorax elevation, active compression-decompression (ACD) CPR, and an impedance threshold device (ITD), is associated with improved clinical outcomes.<sup>1,2</sup> A recent animal study showed 3 cm of active decompression plus an ITD resulted in significantly improved hemodynamics and stroke volume vs 1 cm.<sup>3</sup>
- The amount of active lift during AHUP-CPR needed to optimize survival is unknown.

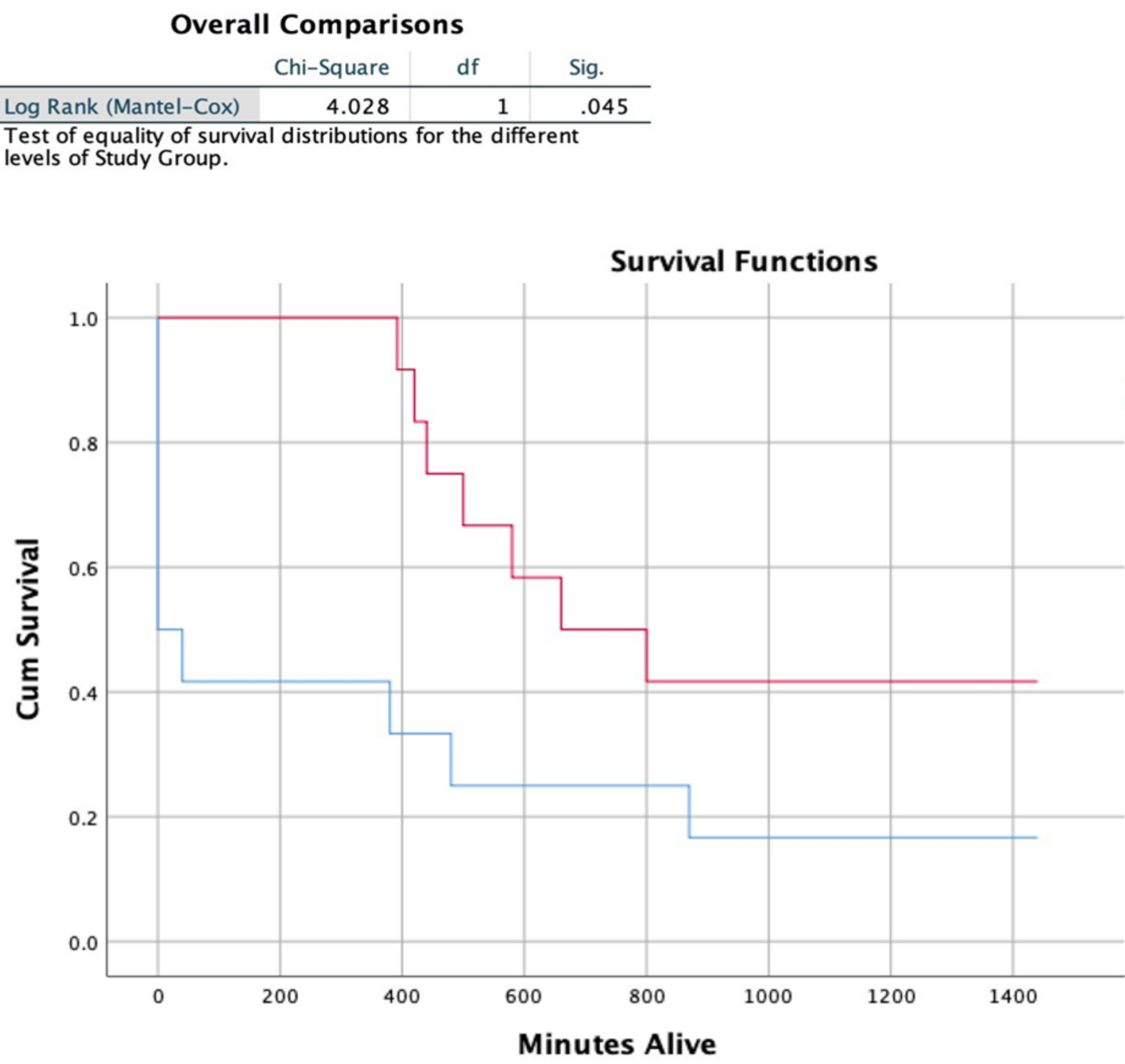
1. Moore et al, 2020 2. Bachista et al., 2024 3. Pourzand et al, 2024

## Hypothesis

Survival will be higher with a trapezoidal ACD-CPR waveform with 3 cm of active chest wall lift (TWF-3cm) versus a rectilinear ACD waveform with 1 cm of active lift (RWF-1cm). Hemodynamics and neurological outcomes were compared secondarily.

## Methods

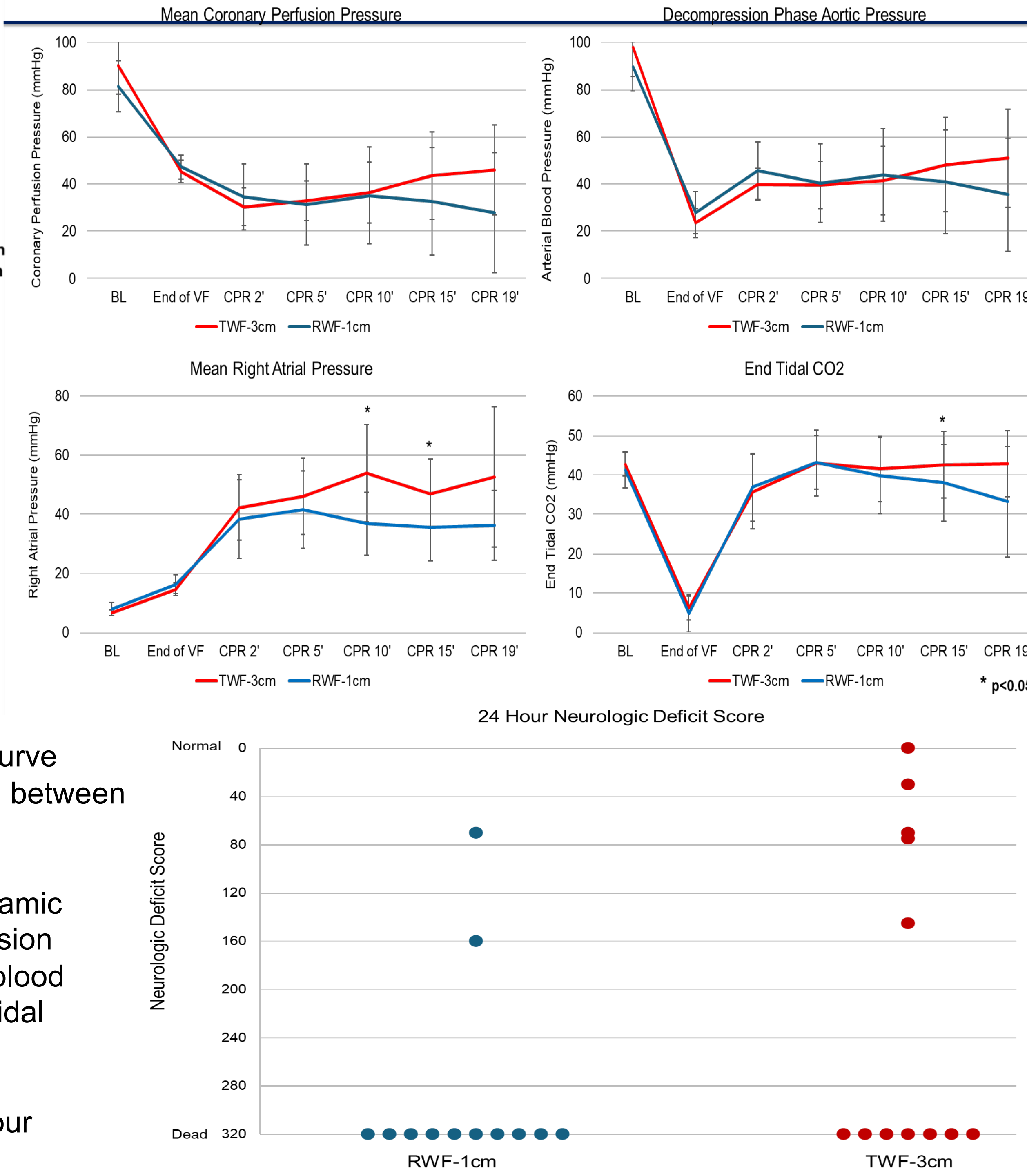
- 24 Female and male swine (~40 kg) were sedated, intubated, and anesthetized.
- Bilateral femoral arterial access was obtained for continuous measurement of central arterial and venous pressures.
- Placement of arterial and venous pressure catheters was confirmed via fluoroscopy.
- Ventricular Fibrillation (VF) was induced and left untreated for 10 minutes, during which they were randomized to receive either (RWF-1cm) or (TWF-3cm).
- Animals were then treated with 2 minutes of conventional CPR before 18 minutes of AHUP-CPR treatment with RWF-1cm or TWF-3cm. They were then treated with epinephrine (0.5mg), amiodarone (30mg) and defibrillation (up to 3 360-j shocks).
- If ROSC was achieved, animals were monitored for up to 6 hours before weaning from isoflurane anesthesia and, if stable, allowed to recover for 24 hours.
- 24 hours post-ROSC, a neurologic assessment was performed by a Veterinarian blinded to the treatment
- Student’s T-test, Fisher’s exact, log-rank, and Mann-Whitney t-tests were used for statistical comparison of the groups.



**ABOVE LEFT:** Figure 1. Kaplan-Meier curve showing the average duration of survival between treatment groups

**ABOVE RIGHT:** Figure 2. Key hemodynamic parameters during CPR, Coronary perfusion pressure, decompression phase, aortic blood pressure, right atrial pressure, and end tidal carbon dioxide

**RIGHT:** Figure 3. Histogram of the 24-hour Neurologic deficit scores of all animals



## Results

- ROSC was achieved in 6/12 pigs treated with RWF-1cm vs 12/12 with TWF-3cm (p<0.01).
- 24-hour survival rates were 16.7% vs 41.7%, respectively (p=0.045).
- ETCO2 after 15 minutes of CPR  $38.0 \pm 9.7$  with RWF-1cm and  $42.6 \pm 8.5$  with TWF-3cm. (p=0.025)
- Neurological deficit scores were  $285 \pm 79$  with RWF-1cm vs  $213 \pm 130$  with TWF-3cm (p=0.12)

## Conclusions

- AHUP-CPR treatment with with 3 cm of active lift resulted in higher ETCO2 values during CPR and improved 24-hr survival rates compared with 1 cm of lift using a rectilinear ACD-CPR waveform.**
- These findings emphasize the importance of the amount of active lift during automated AHUP-CPR.**