

# Feedback during CPR: judging chest compressions

G.J. Noordergraaf, MD<sup>1</sup>; P. Van Berkomp, RN<sup>2</sup>; A. Venema, RN<sup>3</sup>;

Dept. of <sup>1</sup>Anesthesiology, <sup>2</sup>Intensive Care or <sup>3</sup>Emergency Med, & Dept. for Edu and Research, CPRLab. St Elisabeth Hospital, Tilburg

GJ Scheffer, MD, PhD. Dept of Anesthesiology, University Medical Center Nijmegen

A. Noordergraaf, PhD. University of Pennsylvania, Philadelphia PA (USA)



## Introduction:

Adequate chest compressions are described as 3.8 to 5.1 cm (1.5 to 2 inches) deep, by Kouwenhoven et al. in 1960.<sup>1</sup>

However, a multitude of (manikin) studies have described a) rapid loss of skills, b) rapid tiring with loss of depth but not frequency, c) thresholds for effect on output and d) lack of frequency as well as compression depth recognition.<sup>2</sup>

Our QRT (Quick Response Team) responds to 100-150 calls year<sup>-1</sup>, with consultant-level anesthesiology supervision. Individual response frequency for a resident is low (0 - 6 year<sup>-1</sup>). The resident at the patient's head 'coaches' the nurse performing the compressions. Interest into the actual quality of chest compressions and into its mechanisms<sup>3</sup> suggests the need to focus on the capability of advanced life support caregivers, including senior medical staff, to judge whether compressions are in fact adequate (within guidelines).<sup>3,4</sup>

**Focus:** This poster focuses on the ability of physicians and nurses to judge the adequacy of chest compressions.

## Procedure:

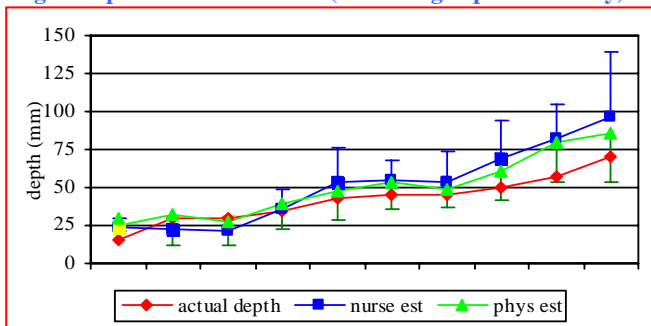
Using a random/convenience sample, in a crossover design, with blinding of the candidate, 30 physicians and nurses were sought. Each candidate received a standardized briefing but no practice. A Resusci Anne SIM4000™ (Laerdal, Stavanger N) was placed on a hospital bed. An investigator compressed the chest in a predetermined series of depths, either with or without the CPREzy (Health Affairs, London UK). The SIM indicates depth of compression, allowing standardization. The compressions were interrupted at the end of each series to minimize direct comparisons.

The candidate a) determined if the compressions were adequate (3.8 - 5.1 cm) or not (too deep or too shallow) and b) estimated actual depth (mm). After each depth the compressions were interrupted briefly to avoid direct comparison. The crossover was performed one day later.

The CPREzy™ is a small device of 240g, which is placed between the hands and the sternum and uses a 9V battery to indicate compression force in relationship to patient weight.

**Statistics:** For normal distributed data, mean ( $\pm$  SD) is presented. For time and depth criteria, a GLM with repeated measures was performed.  $P < 0.05$  was taken as significant.

**Fig 1: Depth without feedback (increasing depth for clarity)**



## Results:

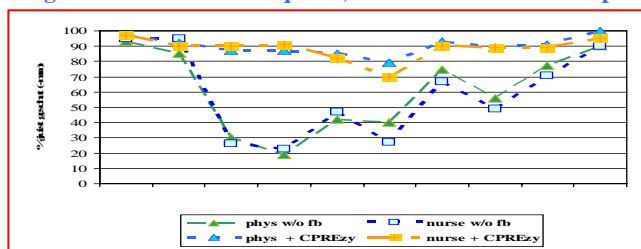
15 physicians and 15 nurses participated in the study, recruited from the Dept of Anesthesia, Cardiology, Intensive care, and the Emergency Dept.

Without feedback only three (1 physician, 2 nurses) were able to estimate depth both in terms of adequacy and in actual impression depth.

Of the candidates 40% was able to recognize 4-5 cm (3.8 - 5.1) as the general goal or to note that an acceptable equivalent is 20% of the AP distance. None were able to estimate the AP diameter of the manikin. The estimations in the depths surrounding the 4-5 cm were especially difficult. 63 % (n=19) of candidates estimated depths as too great in all steps of the procedure. Repetition of depth was not recognized (fig 1), and incorrect conclusions were drawn from external factors (such as a red face). Extremely deep as well as extreme lack of depth was recognized, but starting at 2.5 cm impression depth, the estimation of adequacy was incorrect in ca. 80% of cases.

With feedback estimations (n=19) improve across the board, both in general judgement ( $p = 0.0001$ ,  $n = 16$ ) as well as in terms of millimeters ( $p = 0.01$ ,  $n=7$ ) The 20% correct increased to ca. 89%.

**Fig 2: Estimation as 'adequate', 'too shallow' or 'too deep'**



## Discussion:

Different studies have suggested that (basic) caregiver's CPR may improve using a feedback device<sup>2,4,6</sup>, but we are unaware of any studies approaching this issue from the 'coaching' point of view.

Many studies have reported improved outcome if chest compressions were started early and some even comment on their adequacy, but how 'adequacy' was determined is not defined. Recognizing the adequacy of compressions is a skill not, as yet, taught during typical CPR courses or designated as a task for ACLS team members. Persistent poor outcome may, in part, be due to lack of recognition of poor compressions. While these manikin results have their limitations, one may expect even less in patients with different chest sizes and compliances.

## Conclusions:

Neither physicians nor nurses consistently recognize impression depths without the help of a feedback device. Ability improves with feedback, e.g the CPREzy ( $p < 0.0001$ ) External factors such as the suggestion of "work being done" by the caregiver directly influences the perception of depth.

## References:

<sup>1</sup>Kouwenhoven et al. JAMA 1960; <sup>2</sup>Noordergraaf c.s. Resuscitation, 2006, IN PRESS; <sup>3</sup>Maier et al. Circulation 1984; <sup>4</sup>Noordergraaf et al. Int J Sci & Med. 2005; <sup>5</sup>Wik et al.. JAMA 2005; <sup>6</sup>Boyle et al. Resuscitation 2002;