PS D1

Cardioversion by precordial thump: differences in UK and US clinical experience

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Mechanical cardioversion in man has been studied since at least 1920, when Schott reported successful application of precordial thumps (PTs) to initiate competent ventricular contractions in a patient during Stokes-Adams syndrome-caused cardiac arrest (Schott, 1920). At present, PT is the first prescribed procedure of the AHA Advanced Cardiac Life Support Algorithm for witnessed cardiac arrest (Guidelines, 2000). However, since the initial publication of guidelines in 1976, the resuscitative utility of PT has been progressively de-emphasised, as its effectiveness is uncertain (reported cardioversion rates range from 6 % to 93 % (Miller, 1984; Pennington, 1970). Published reports do not contain quantitative descriptions of PT application, which makes it difficult to relate and compare findings. Also, there are no teaching guides or training tools for PT, so the procedure will be performed in different ways, which may contribute to the observed diversity in success rates. The present study aimed (i) to obtain an overview of the current use of PT in the UK and USA, and (ii) to relate any differences in clinical utility of PT to the particulars of its application, as assessed from verbal descriptions and subsequent biometric studies.

A letter stating the aims of the investigation and a questionnaire relating to 'personal experience with PT' was sent to 567 healthcare professionals (UK: 279, USA: 288). By May 2003, 95 replies were received (UK: 52, USA: 43), with a reported total of over 1700 incidents of PT (UK: 813, USA: 927). 'Speed of delivery' was ranked by 92.5 % of the participants as the most important reason for using PT, while 'perceived inefficiency' (60.2 %), 'other established procedures' (45.9 %), and 'unawareness of technique' (37.8 %) were reported to preclude more frequent use of PT. Only 54.3 % of professionals were taught PT as part of their curriculum, and no established tools for training or assessment were identified. There was a pronounced difference in opinions on appropriateness of PT application in ventricular fibrillation (VF) and tachycardia (VT). UK participants ranked 'onset of VF' as the prime indication for PT (89.5 %, with VT at 35.1 %), while the trend in the USA was opposite (VT: 62.8 %, 'onset of VF': 58.1 %). This correlated with a significantly higher success rate of US healthcare professionals, who reported 'at least temporary cardioversion to normal sinus node rhythm' in 27.7 % of PT cases, compared to 13.3 % in the UK ($P < 0.05$, ANOVA). Adverse side effects were rare and seen in 0.5 % of cases only (UK: 0.8 %, USA: 0.2 %).

To determine PT mechanics, we developed a 'thump-o-meter' (Fig. 1). The pilot device contains four miniature force-transducers under a cushioned target pad, and two light barriers to measure pre-impact fist speed. Data output to a portable computer is via an AD/DA interface card (DAQ-6062E, National Instruments, USA), and signal processing is handled in real-time, using a LabVIEW-based data analysis system.

Healthcare professionals in both countries (UK: 22, USA: 22) performed three mock PTs each. Inter-individual differences in pre-impact fist speed ranged from 0.42 to 8.14 m s^{-1}. Participants with fist speeds of < 2.25 m s^{-1} reported successful cardioversion in 18 ± 3 % of PT cases, compared to 36 ± 2 % for those who performed faster impacts ($P < 0.01$, means ± S.D., ANOVA). The national distribution of pre-impact fist speeds showed a significantly higher average among US participants (UK: 1.55 ± 0.68 m s^{-1}, USA: 4.17 ± 1.68 m s^{-1}; $P < 0.01$, means ± S.D., ANOVA). Force recordings were found to require a larger sensor array and greater dynamic range of individual sensors, and a second stage design for quantification of PT deceleration characteristics is under development.

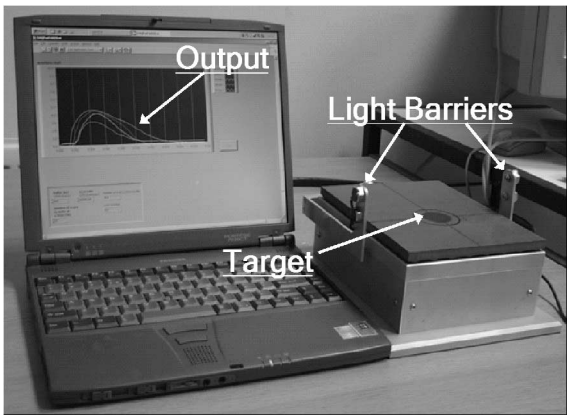

Figure 1. The 'thump-o-meter' used in this study.

Thus, PT success rates are more than two times higher in the USA, compared to the UK. This may be related to differences in either/both arrhythmia targeted and mechanics of PT. A minimum severity of impact appears to be required to achieve high mechanical cardioversion rates, which highlights the need for better procedural instructions and training aids, such as a simple modified version of the thump-o-meter.

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