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Respiration and the Airway

Surgicric 2: A comparative bench study with two established emergency cricothyroidotomy techniques in a porcine model

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Abstract

Background: 'Can't Intubate, Can't Oxygenate' is a rare but life threatening event. Anaesthetists must be trained and have appropriate equipment available for this. The ideal equipment is a topic of ongoing debate. To date cricothyroidotomy training for anaesthetists has concentrated on cannula techniques. However cases reported to the NAP4 audit illustrated that they were associated with a high failure rate. A recent editorial by Kristensen and colleagues suggested all anaesthetists must master a surgical technique. The surgical technique for cricothyroidotomy has been endorsed as the primary technique by the recent Difficult Airway Society 2015 guidelines.

Methods: We conducted a bench study comparing the updated Surgicric 2 device with a scalpel-bougie-tube surgical technique, and the Melker seldinger technique, using a porcine model. Twenty six senior anaesthetists (ST5+) participated. The primary outcome was insertion time. Secondary outcomes included success rate, ease of use, device preference and tracheal trauma.

Results: There was a significant difference ($P<0.001$) in the overall comparisons of the insertion times. The surgical technique had the fastest median time of 62 s. The surgical and Surgicric techniques were significantly faster to perform than the Melker (both $P<0.001$). The surgical technique had a success rate of 85% at first attempt, and 100% within two attempts, whereas the others had failed attempts. The surgical technique was ranked first by 50% participants and had the lowest grade of posterior tracheal wall trauma, significantly less than the Surgicric 2 ($P=0.002$).

Conclusions: This study supports training in and the use of surgical cricothyroidotomy by anaesthetists.

Key words: airway management; intubation, intratracheal; trachea, tracheostomy

'Can't Intubate, Can't Oxygenate' (CICO) is a rare (1:50000[1]) but life threatening event. All anaesthetists must therefore be trained and have appropriate equipment available for such an eventuality.

We know that in two studies comparing the Melker technique with other cricothyroidotomy devices and surgical techniques,[2 3] the Melker technique was rated highest by anaesthetists[2] and had a higher success rate than a surgical technique.[3] However, in cases reported to NAP4, cannula techniques were associated with a worryingly high failure rate.[4] In contrast, a more recent study[5] and a meta-analysis[6] have found surgical techniques to

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Editor's key points

- Insertion time was compared between the Melker Seldinger technique emergency cricothyrodotomy set, the VBM Surgicric 2 set and a scalpel-bougie-tube surgical technique, using a porcine model.
- Insertion time was significantly faster with surgical and Surgicric techniques than the Seldinger technique, and the incidence of posterior tracheal wall trauma was significantly less with surgical than with Surgicric 2.
- In case of a "Can't Intubate, Can't Oxygenate" scenario, surgical cricothyrodotomy may be better than the other methods.

have a high success rate. This was also demonstrated when surgical techniques were used as a rescue technique in morbidly obese manikins.[7] As highlighted by these opposing findings, it remains unclear as to which cricothyroidotomy technique is superior. This is further supported by a systematic review by Langvad and colleagues[8] which showed no clear advantage of any device and no significant difference in success rates. The recent Difficult Airway Society guidelines[9] have advocated a surgical technique as the default technique for cricothyroidotomy.

The aim of this study was to compare the insertion time and success rate of the new updated Surgicric 2 (VBM Medical, Germany)[10] system, to other well established techniques for achieving successful emergency tracheal access. The Surgicric 2 device comprises a pre-assembled surgical cricothyroidotomy kit, which aims to bridge the divide between cannula cricothyroidotomy techniques and a surgical technique. It has not been formally evaluated in any previous trial.

Methods

The protocol was reviewed and approved by the local Research and Development Department. Written informed consent was obtained from all participants.

We performed a randomized crossover bench study, comparing three cricothyroidotomy techniques on a porcine model.

The recruitment of participants took place in a single location during a one day study period. We recruited 26 senior anaesthetists; trainees (ST5+), Non-Consultant Career Grades and Consultant Anaesthetists. All anaesthetists volunteering to take part, first completed a questionnaire to determine their grade, experience of cricothyroidotomy procedures, and how recently they had received training in these techniques.

Participants were asked to watch three short, standardized videos, demonstrating the three different cricothyroidotomy techniques. After this, participants had the opportunity to practice one insertion with each technique on a part-task neck manikin (Crico trainer Frova, VBM, Germany), consisting of a plastic trachea covered by artificial skin.

The techniques compared were the Melker seldinger technique emergency cricothyroidotomy set, the VBM Surgicric 2 set and a scalpel-bougie-tube surgical technique. We used the seldinger side of the Melker emergency cricothyroidotomy catheter set universal tray (COOK Medical), with a 5.0 mm cuffed tube. The Surgicric 2 set contains a pre-assembled dilator and 6.0 mm cuffed tracheal tube, size 11 scalpel, tracheal hook, blunt scissors, a dilating speculum, 10 ml syringe, neck tape and extension tubing. The video supplied by VBM demonstrated the following technique: a vertical skin incision was made using the scalpel, the dilating speculum was used to separate subcutaneous tissues, a horizontal incision through the cricothyroid membrane with the scalpel, then insertion of the preassembled Surgicric 2 device into the trachea with the aid of the dilating speculum. For the surgical technique we supplied a size 11 scalpel, a bougie and a 6.0 mm cuffed tracheal tube, and the technique depicted involved an initial vertical skin incision, digital palpation followed by a horizontal incision through the cricothyroid membrane, insertion of the bougie and railroading of the tracheal tube (Fig. 1).

The porcine model consisted of a pig larynx with a long length of trachea held by pins within a purpose built crico trainer (VBM Germany). This was covered with a tightly stretched artificial skin, which was unable to move and allowed palpation of the underlying laryngeal anatomy. A tight fitting balloon was stretched over the caudal end of the trachea of each pig larynx, to demonstrate effective ventilation.

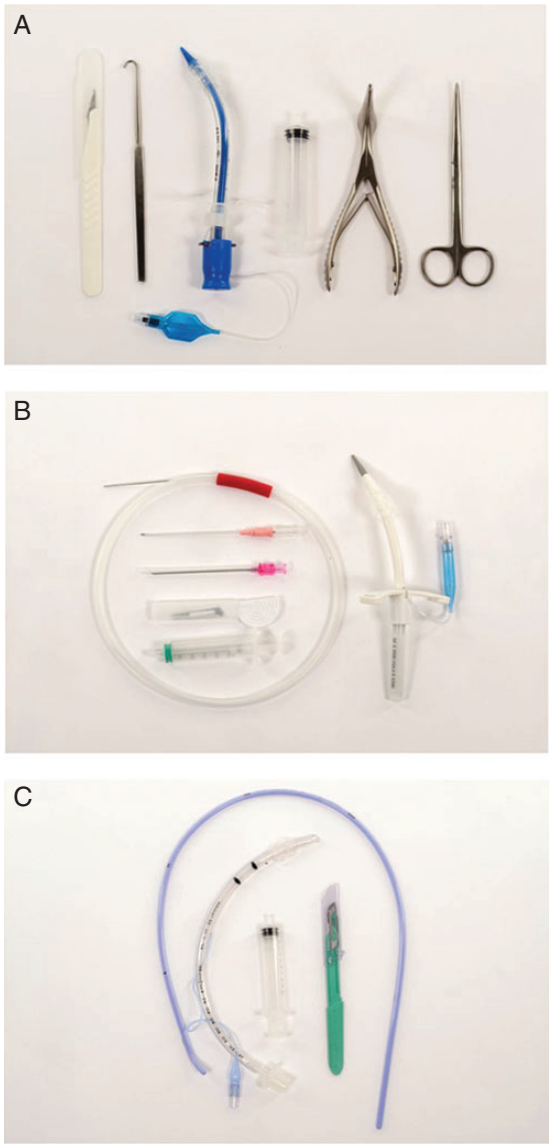

Fig 1 VBM Surgicric 2 set (A), Melker seldinger cricothyroidotomy set (B), surgical cricothyroidotomy equipment supplied (C).