

## Cricothyroidotomy: Do Not Compare Small Apples to Big Oranges

*To the Editor:*—Schaumann *et al.*<sup>1</sup> are to be congratulated for a nice study regarding cricothyroidotomy. The duration and complications of cricothyroidotomy performed by emergency physicians in cadavers was evaluated. They specifically compared a surgical technique and the Arndt cricothyroidotomy set. As in a previous study from the same institution, the assessment of the cutaneous-tracheal tract by a pathologist is a valuable methodologic aspect. However, we have to disagree with their conclusions because of several methodologic problems.

The most important methodologic issue, which should be obvious to someone familiar with tracheostomy,<sup>2</sup> is that a cuffed tracheostomy tube was used in the surgical group, whereas the canula in the Arndt cricothyroidotomy set is without a cuff. A cuffed canula, although much better for ventilation, is much more difficult to insert. In addition, the canula provided in the Arndt set is of a smaller diameter, an ID of 3 mm *versus* 5 mm for the Mallinckrodt tracheostomy tube. It is easier to insert a smaller, smooth object into tissues, and I doubt that many anesthesiologists will find the ventilation through a 3-mm tube to be equivalent to that through a 5-mm tube!

A second related question is the additional 70% of time spent for the connection of the ventilation equipment (10.1 s in the Seldinger technique group and 17.4 s in the surgical technique group) because in both cases the tracheal tubes used ended with a connection piece specifically made to fit standard ventilation equipment, our unique potential explanation is that time is taken to inflate the cuff. The authors do not discuss this difference in the text, and a thorough explanation seems necessary.

Probably the most bothersome aspect of this study is the way the authors interpret the failures of the trials. In the Seldinger group, there were seven cases that were classified unsuccessful, to which should be added four cases where the tube was found by the pathologist in the subcutaneous tissues. To our knowledge, placing the tube in front of the trachea can hardly be considered as a successful placement allowing ventilation. Therefore, the failures in this group amount to 11.8% (11 of 93), which should be compared with a failure rate of 6.4% (6 of 94) in the open cricothyroidotomy group. A simple statistical test shows this difference to be highly significant. Contrary to what might be argued by the authors, the injury of vessels is rare in the area of the

cricothyroid membrane and is far less important than the misplacement of the canula.

Another point of lesser importance is the use of the “Viennese tracheal dilator” in the surgical cricothyroidotomy. We doubt that most of the readers of *ANESTHESIOLOGY* are familiar with this tool, and without any further description, it is unclear why such a dilator would provide any advantage over classic surgical tracheal-laryngeal hooks for spreading of the tissue. What it certainly does is increase the time spent for the insertion of the endotracheal tube and ventilation, the two main outcomes the authors chose to evaluate.

Finally, it is surprising that in a randomized study, the cadavers were significantly heavier and with larger necks in the surgical group. Stating that “the differences in weight and circumference of the neck were not clinically relevant” is either frivolous or represent a misunderstanding of the risk factors for this operation.

In conclusion, this study, which seems exemplary at first glance, suffers from major methodologic flaws. Doubling of the failure rates should be an obvious reason to prefer a procedure, especially when a failure for cricothyroidotomy means a probable death for the patient. Overlooking these data and basing the conclusion on the duration of the procedure seems bewildering. Furthermore, these delays (time to tube insertion and time to first ventilation), although seeming objective, are somewhat subjective because they were performed by an unblinded and hopefully unbiased observer.

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### *Surgical Cricothyroidotomy Technique*

*To the Editor:*—Schaumann *et al.* are to be congratulated on their large and detailed study on cricothyroidotomy techniques.<sup>1</sup> However, the suggestion that their results favor the Seldinger technique as a method of inserting a surgical airway is misleading. The control technique used was inappropriate; the airways used were not comparable, and uncuffed narrow bore tubes may not be suitable as emergency airways. The clinical applicability of the study is therefore limited. The authors did not discuss these deficiencies in their article.

The results do not necessarily support the use of a Seldinger technique but rather demonstrate that their standard technique of cricothyroidotomy is more time consuming. Their standard technique is more complex than that originally described for elective situations:<sup>2</sup> It involves, in addition, both vertical and horizontal incisions and also use of both dilation and a tracheal hook. Other techniques have been developed for emergency situations. These include that of the Advanced Trauma Life Support course<sup>3</sup> and the rapid four-step technique.<sup>4</sup> Expert reviewers have recommended such techniques.<sup>5</sup> It may be possible to secure an airway in 32 s,<sup>4</sup> as opposed to 109 s with the Arndt airway<sup>1</sup> or 137 s<sup>1</sup> or 114 s<sup>4</sup> for a standard technique. Although these techniques may have their own problems,<sup>4,6</sup> they have been

shown to work in clinical practice.<sup>7-10</sup> Comparison of a Seldinger airway for emergency use with one of these techniques would have been more valid. Elective techniques have previously been used as a control in studies of a new emergency technique,<sup>5,11</sup> and this has been criticized.<sup>12,13</sup>

The study assessed only the Arndt airway. The Seldinger technique is used with other airway devices. The Arndt airway is an uncuffed device of 3 mm ID. Subjective ease and objective speed of insertion of the Arndt airway may be a consequence of its narrower diameter when compared with the control airway: 5 mm ID plus a cuff. This may also account for the differences in injuries to the larynx. It has been shown that larger airways require an increased force for insertion.<sup>14</sup> It would have been more appropriate to have used a Seldinger cricothyroidotomy airway with a diameter comparable to that of the tracheostomy tube used. When the Cook Melker airway was compared with a standard elective technique, there was no difference in time of insertion.<sup>15</sup>

Reoxygenation and ventilation of the patient must also be considered in the assessment of a novel airway device. Clearly, this is a limitation of cadaver studies. It is likely that the performance of uncuffed narrow bore tubes depends on the degree of upper airway obstruction.<sup>16</sup> Their use as emergency airways has been criticized.<sup>17-19</sup>

It would be have been more appropriate for the study to have compared the cuffed Cook Melker airway to a cuffed tracheostomy tube inserted with the rapid four-step technique.

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*In Reply:*—We appreciate the great interest in our article.<sup>1</sup> In response to Drs. Dulguerov and Gysin, referring to the question of an uncuffed *versus* a cuffed canula, although it seems obvious that it is easier to insert a smaller canula, the difference is not as great as expected. However, our aim was to compare two different recognized methods of cricothyroidotomy and not a cuffed *versus* an uncuffed canula. Although ventilation is not comparable between a 3- and a 5-mm tube, oxygenation may be sufficient during the first few minutes. Neither method is assumed to serve as a long-time device.

Referring to the authors' second question, we do not fully understand the "additional 70%": The few seconds (10-17) spent were necessary to inflate the cuff, to connect the valve of the breathing bag, and to deliver the first squeeze of the bag. Although one assumes that everything goes faster, we often need more time in the real world—at least in this study.

Regarding the failures (page 9, paragraphs 3 and 4), there is confusion of Drs. Dulguerov and Gysin between accurate placement and injuries: There was a failure rate of 11.8% in group 1 (including the four misplacements) and a failure rate of 16% in group 2. The punctures of the thyroid vessels in group 2 are not listed as failures but as injuries and did not necessarily prevent insertion of the canula.

The "Viennese tracheal dilator" is a piece of our standard equipment. We agree that the authors can use the hook or other device they are familiar with.

We are concerned about the authors' use of the aggressive terms of "frivolous" and "misunderstanding." Having performed more than 500 cricothyroidotomies in corpses ourselves, we are sure that a mean difference of 1.6 cm in neck circumference is not clinically relevant. If someone has performed more cricothyroidotomies in corpses, we are ready for discussion.

In response to Dr. Price, we could not find a major time difference whether a vertical and horizontal incision was used or only horizontal incisions. The reason for a vertical incision is that in wide necks, it is easier to find the cricothyroid membrane.

With regard to time, Holmes *et al.*<sup>2</sup> state,

A surgical airway was established in 28 of 32 attempts with the use of the rapid four-step technique (88%); the average time elapsed

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before tube placement was 43 s. Thirty of 32 attempts involving the standard technique (94%) were successful; the average time to tube placement was 134 s (95% confidence interval for a difference of 91 s, 63 to 119;  $P < 0.001$ ). Complications were identified in 12 attempts involving the standard technique (38%; 1 considered major) and in 12 involving the rapid four-step technique (38%; 3 considered major).

The time varies between 4 and 134 s. Furthermore, this study did not include first ventilation. In addition, major complications occurred very often in this study (38% in both groups). So, the fastest time was accompanied by severe complications.

As stated above, we wanted to compare a standard technique to another commercially available kit. Of course, other methods may be similarly useful. We agree that a device with a larger cuff may require more time; however, if it is possible to shorten the time, allowing adequate oxygenation, even without adequate ventilation, may be valuable for patients in the first few minutes.

We thank Dr. Price for the idea of comparing the cuffed Cook Melker airway with a cuffed tracheostomy tube with the rapid four-step technique. If our time allows, we will investigate these devices in the future.

Again, we thank both readers for their valuable comments and helpful criticism. However, we cannot agree that the clinical applicability of our study is limited.

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