**CORRESPONDENCE**

**Royal Perth Hospital solution for managing the ‘can’t intubate, can’t ventilate’ crisis**

Editor—We commend the Royal College of Anaesthetists and Difficult Airway Society (DAS) in producing the Fourth National Audit Project ‘Major complications of airway management’. Practicing anaesthetists should be alarmed at how ineffective traditional techniques are in managing the ‘can’t intubate, can’t ventilate’ (CICV) crisis. More than 65% (16 of 25) cricothyroidotomy attempts by anaesthetists failed to secure the airway.

The authors estimate that anaesthetists in the UK are likely to experience a CICV scenario once every 6 yr. Poor management was thought to be an aetiological factor in the majority of airway-related deaths in their series prompting the authors to conclude ‘research is needed to identify equipment and techniques most likely to be successful for direct tracheal access’.

We would like to draw attention to excellent work that addresses a number of these questions. The Royal Perth Hospital has published a CICV algorithm, the result of a number of years of airway crisis simulation and training using anaesthetized sheep. The authors identified that in a CICV situation, the DAS Difficult Intubation algorithm leaves one at a difficult junction: should you perform a cannula or a surgical cricothyroidotomy? What if you fail with your first choice? What if you cannot clearly identify the midline structures? Without a clear management plan, this incredibly stressful situation becomes even more challenging.

The Royal Perth algorithm outlines a logical progression of techniques from the least invasive through to the most successful, but most invasive. The algorithm emphasizes rapid oxygenation and favours the skill complement of the anaesthetist, who may be more reluctant than a surgeon to reach for a scalpel.

The algorithm initially recommends attempting cannula cricothyroidotomy or tracheotomy. If successful, jet oxygenation can stabilize the patient. The algorithm next suggests either waking the patient, considering further upper airway techniques, or placing a COOK Melker Seldin- ger guided 5.0 tube. If the initial cannulation fails, the next step depends on having palpable neck anatomy. If palpable, then a ‘scalpel bougie’ technique is recommended. The COOK Frova Bougie has a lumen to facilitate jet ventilation. This is introduced into the trachea through a surgical incision and guided into the trachea against the scalpel blade. This allows jet ventilation to oxygenate and stabilize, before railroading a 6.0 tube. If the ‘scalpel bougie’ technique fails or the airway anatomy is not palpable at the outset, the Royal Perth algorithm recommends a 6 cm longitudinal scalpel incision and finger dissection until the neck anatomy is palpable. A cannula tracheotomy then allows jet oxygenation.

Crisis algorithms successfully facilitate logical task progression in a stressful environment. The current DAS algorithm is excellent until arriving at the CICV scenario. We believe that the Royal Perth CICV guideline complements the current DAS algorithm and importantly provides guidance at the CICV juncture.

At our institution, we have initiated anaesthetic CICV training adopting this algorithm and technique. The YouTube videos produced by the authors greatly facilitated this process. The algorithm was easily learned and understood. The practical techniques were quickly mastered using manikin and pig specimens. We are now better prepared for a CICV crisis.

**Conflict of interest**

None declared.

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3 Heard AMB, Green RJ, Eakins P. The formulation and introduction of a ‘can’t intubate, can’t ventilate’ algorithm into clinical practice. Anaesthesia 2009; 64: 601–8

doi:10.1093/bja/aer282

**Reply from the authors**

Editor—We thank Dr Massey and colleagues for their interest in the NAP4 publications. NAP4 showed a high failure rate for anaesthetist-performed needle cricothyroidotomy and this raises many issues about training in the management of the cannot intubate, cannot ventilate (CICV) situation, the best equipment to use and the best technique.

We are aware of the excellent work done by Heard and colleagues in the ‘wet lab’ at Royal Perth Hospital, Western...
Australia. The set-up in that hospital is perhaps unique and we are certainly not aware of a similar set-up in the UK. In the article cited by Dr Massey, the authors describe a number of techniques they report to have found effective in training a large cohort of anaesthetists and present their institutional algorithm which is based on their local experience and also analysis of the literature. There is a considerable amount to learn from the paper and it is well worth reading.

NAP4 has already led to considerable discussion about the present recommendations that are embedded in the DAS guidelines for failed intubation and failed ventilation. Since the publication of NAP4, at meetings presenting the results, it has been common for audience members to suggest that anaesthetists should abandon cannula cricothyroidotomy in favour of a surgical approach. In the NAP4 report, we intentionally stopped short of this recommendation. NAP4 highlighted a high failure rate for cannula cricothyroidotomy. The reasons were numerous and included poor technique, poor choice of equipment, equipment failure, and failures of both cannula insertion and of safe and effective ventilation. There are no useful data from NAP4 on the success rate of anaesthetists with a surgical technique, but it is perhaps relevant of itself that anaesthetists did not use this technique, which suggests that it is currently not popular with anaesthetists. Although the success rates for surgeons using a surgical technique to rescue the airway was almost 100%, it should be noted that many of these occurred while the anaesthetist maintained a clear or adequate airway and oxygenation; in contrast, cannula cricothyroidotomies were typically performed in extremis and with the anaesthetist having to abandon any attempt at oxygenation while attempting the procedure. They are therefore not directly comparable. As a final piece to the jigsaw, we have very little idea how anaesthetists perform with a scalpel, or indeed whether they are even willing to do so. NAP4 does not answer all the questions. It has identified a high failure rate of cannula cricothyroidotomy but does not reveal whether better equipment choices and better training would improve this, nor whether surgical techniques are more appropriate for us.

Our recommendations regarding CICV include the following:

- All anaesthetists must be trained in emergency cricothyroidotomy and keep their skills up to date.
- Surgical cricothyroidotomy should be taught alongside cannula cricothyroidotomy, including to anaesthetists.
- Further research focused at identifying the success rates and optimal techniques of cannula cricothyroidotomy is required.
- Anaesthetists should understand that the decision to perform an emergency surgical airway is commonly inappropriately delayed.
- The importance of early, clear decision-making should be highlighted during training in cricothyroidotomy.

The Perth algorithm has much to recommend it. It describes an initially minimally invasive technique of small cannula over needle insertion, progressing as needed to a larger cannula inserted with a Seldinger technique and thence as indicated to a scalpel bougie or more surgical technique. Some aspects of the described techniques require examination. The algorithm advocates the use of a standard i.v. cannula for tracheal access during the surgical technique rather than a device such as the Ravussin cannula which is designed for this role. 'Jet ventilation' (high-pressure source ventilation) via a hollow bougie is also advocated to re-oxygenate before completing a surgical airway. The depth to which the bougie is inserted is not stated. Several case reports (we are aware of at least four cases) have reported significant barotrauma, including death, from high-pressure source ventilation, oxygen insufflation, and even lower pressure ventilation via a blindly inserted narrow-bore airway exchange catheter or bougie. We suggest that, in all but the most exceptional circumstances, the priority after establishing the airway with a narrow-bore exchange device should be to complete the exchange to a larger tube and then ventilate conventionally.

We are pleased that NAP4 has initiated considerable discussion on the management of CICV. We believe there needs to be more discussion by the anaesthetic community, further review of the literature and of recent innovations (e.g. the Ventrain device which claims to enable active exhalation via a narrow cannula), and possibly further research. This might then lead to development of updated national guidelines on the management of CICV.

As a final point, we suggest that these guidelines might usefully explore the human factors associated with CICV that lead many anaesthetists to delay when action is required. Rescue techniques need to be technically appropriate, reliable, and effective but also need to be deployed in a timely manner when needed.

**Conflict of interest**

None declared.

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and colleagues' studies creating a unit-of-analysis error. This could have been avoided by either splitting the shared group resulting in a smaller sample size and including two or more comparisons, by combining groups to create pairwise comparisons, or by undertaking a multiple treatment analysis.

Conflict of interest
None declared.

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4 Sinatra RS, Jahr JS, Reynolds LW, Viscusi ER, Groudine SB, Payen-Champenois C. Efficacy and safety of single and repeated administration of 1 gram intravenous acetaminophen injection (paracetamol) for pain management after major orthopedic surgery. Anesthesiology 2005; 102: 822–31

do:i:10.1093/bja/aer284

Reply from the authors

Editor—We thank Dr Sahgal and colleagues for their interest and scrutiny of our manuscript and statistical approach, highlighting what is undoubtedly a complex analysis. Their reasoning is valid and we have been aware of these points, explored them, and had performed sensitivity analyses. We did not discuss these issues in detail in our manuscript, both for the sake of brevity and readability, and because they had little impact on our main findings. First, we referred to the heterogeneity of pain models in our discussion, both by listing it as a potential weakness of the review, and by performing a post hoc sensitivity analysis, where dental studies were removed. Although numbers needed to treat (NNTs) were lower in dental studies, they were similar to those derived from the more invasive surgery, and statistical significance was not affected. Our findings are in agreement with evidence that, despite expected differences in pain intensity and duration, analgesic response and derived NNTs are similar when comparing dental and other postsurgical models, and that it is legitimate to extrapolate efficacy from one pain context to another. There were insufficient data to perform a further subanalysis by surgical specialty.

Single-dose intravenous paracetamol or propacetamol for prevention or treatment of postoperative pain

Editor—We read with interest the article ‘single-dose intravenous paracetamol or propacetamol for prevention or treatment of postoperative pain’ and would like to highlight some concerns about the study.

In Figure 2, in the propacetamol vs placebo, and paracetamol vs placebo analyses, the authors have combined different procedures such as major vascular, orthopaedic, and dental surgery as part of their subgroup analysis. Postoperative pain and analgesic requirement after major vascular surgery such as abdominal aortic aneurysm repair would be different from that following orthopaedic and dental surgery. Hence, a separate subgroup analysis depending on the surgical specialties may have been more beneficial.

Secondly, due to the different types of surgery being included in this study, a random effect model rather than a fixed effect model may have been more useful, as results obtained from the latter model may be viewed as a ‘typical intervention effect’ from the included studies. In contrast, a random effect model involves an assumption that the estimated effects in the different studies are not identical but follow some distribution.

Finally, the number of patients in the placebo groups and colleagues’ studies creating a unit-of-analysis error. This could have been avoided by either splitting the shared group resulting in a smaller sample size and including two or more comparisons, by combining groups to create pairwise comparisons, or by undertaking a multiple treatment analysis.

Conflict of interest
None declared.

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4 Sinatra RS, Jahr JS, Reynolds LW, Viscusi ER, Groudine SB, Payen-Champenois C. Efficacy and safety of single and repeated administration of 1 gram intravenous acetaminophen injection (paracetamol) for pain management after major orthopedic surgery. Anesthesiology 2005; 102: 822–31

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