Correspondence

Airway management in angiotensin converting enzyme inhibitor related angioedema

To the Editor:

In their review of the anaesthetic implications of angiotensin converting enzyme inhibitors (ACEI) and angioedema,¹ Sarkar *et al.* review a limited variety of airway management techniques. Rai *et al.* describe five patients with ACEI related angioedema, all requiring emergency airway control.² Four patients had a tracheostomy, and three of these were performed following awake fibreoptic intubation.

Tracheal intubation in these cases may be difficult. In one series, two of 14 cases required emergency cricothyroidotomy following failed endotracheal intubation. The authors produced an airway management algorithm, which suggested fibreoptic intubation with emergency cricothyroidotomy or tracheostomy if trans-oral intubation fails.³

Our own experience of three patients with ACEI angioedema suggests that early pre-emptive cannula cricothyroidotomy is useful in this setting. We use the Ravussin cannula-over-needle technique (VBM, Sulz, Germany). Pre-emptive, precautionary cricothyroidotomy has been shown to be an effective "insurance policy" in a variety of airway pathologies.⁴ This allows immediate oxygenation and ventilation if the airway becomes further compromised, and provides an effective bridge to definitive management. If the patient can be oxygenated via a cannula cricothyroidotomy, then the airway can be secured by either an awake fibreoptic technique, direct laryngoscopy under general anaesthesia, or by tracheostomy depending on the operator's expertise.

Once the airway has been secured, however, there is little to be gained in performing a tracheostomy, as airway edema from ACEI usually resolves within 48 hr.³

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Reply:

Thank you for the opportunity of replying to the letter of Dr. Kapoor and colleagues.

Dr. Kapoor and colleagues comment that we have reviewed a limited number of airway management techniques in patients with angiotensin converting enzyme inhibitors (ACEI) related angioedema and suggest that early pre-emptive cannula cricothyroidotomy may be useful. This is based on their own experience of three patients in three years.¹ It would be helpful if Dr. Kapoor and colleagues included some clinical details about their patients including presenting signs and symptoms as well as rapidity of diagnosis.

The purpose of our review was not to discuss emergency airway management techniques, but to increase awareness amongst clinicians of the risk of angioedema in patients on ACEI drugs. We again emphasize that initial diagnosis of the condition is most important. Securing the airway is the mainstay of successful management and this may indeed require a tracheostomy. Cannula cricothyroidotomy is a well recognized useful technique in the short term, but is not an effective substitute for securing a definitive airway.

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International variances in carbon dioxide absorbent colour indicators

To the Editor:

We recently provided general anesthesia to 16 children undergoing patent ductus arteriosus repair at the Angkor Wat Hospital for Children in Siem Reap, Cambodia. Prior to the first surgery, a thorough machine check was conducted, which demonstrated proper functioning of all elements, including the CO₂ absorbent, which was uniformly white in colour. Midway through the first case, it was noted that in spite of adequate minute ventilation with a tidal volume of 10 mL·kg⁻¹, that the PETCO₂ ranged from 50–55 mmHg, and that during inspiration the PETCO₂ decreased to only 12 mmHg. We suspected incomplete CO₂ absorption.

Upon investigation, and much to our surprise, we learned that the fresh Spherasorb CO₂ absorbent (Intersurgical Ltd., Wokingham, UK) was pink in colour and turned white with exhaustion. After the CO₂ canister was filled with fresh soda lime, the patient's hypercapnia resolved. The confusion originated from our assumption that fresh CO₂ absorbent is always white, which is the case at our home institution, in San Diego, California. In fact, Spherasorb has two types of indicators: one that changes from white to violet, and one that changes from pink to white. In contrast, Baralyme (Chemtron Medical Division, Allied Healthcare Products, St. Louis, MO, USA) has a single formulation that turns the crystals from white to violet with exhaustion.

It appears that the two colour schemes (pink to white, and white to violet), developed independently of each other many decades ago, as different pH sensitive dyes were used as markers for exhausted absorbent. While the American and European manufacturers chose the white to violet route (using ethyl violet dye), in the United Kingdom the pink to white option is employed (using titan yellow dye).¹

According to Intersurgical Ltd., countries that use soda lime with a pink to white colour change include: the United Kingdom, much of Australia, New Zealand, India, Pakistan, Bangladesh, Hong Kong (which influenced China), Indonesia, Malaysia, and Sri Lanka. (all countries with a British colonial link.) Most other

countries use soda lime that turns from white to violet with absorbent depletion. An additional factor to consider is that the pH and the resulting strength of colour depends on the moisture content of the exhausted soda lime. Higher exhaustion moisture content, as seen with low flows and large absorbers, results in a higher pH and weaker colour change.^{2,3} In addition, if the soda lime remains in the absorber for 10–48 hr, some of the NaOH regenerates and the pH increases, changing the colour of the soda lime back to its “fresh” appearing colour. This is often mistaken for a regeneration of CO₂ absorbing potential. Also, desiccated baralyme may turn a yellow colour,⁴ further complicating the use of colour as a visual reference to the adequacy of absorbent capacity. Thankfully, the use of capnography allowed us to search for, and solve the problem. The experience highlighted the importance for anesthesiologists undertaking work overseas, to recognize international variances in CO₂ colour indicators and the need to identify the indicator as part of the routine preoperative machine check.

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Fast-track ambulatory anesthesia: impact on nursing workload when analgesia and antiemetic prophylaxis are near-optimal

To the Editor:

We were very interested in reading the excellent publications of Dr. Song *et al.*¹ and Dr. Awad *et al.*² from Dr. Chung's research group addressing bypass of the postanesthesia care unit (PACU bypass) after