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## Critical airways, critical language

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The contribution of human factors to adverse outcomes during emergency airway management is well established.<sup>1</sup> Effective communication is a core non-technical skill that contributes to minimizing such error.<sup>2</sup> The language used must aid rather than hinder communication.

The term ‘critical language’ refers to standardized communication in which specific terms or phrases have a clear, mutually agreed meaning.<sup>3–4</sup> It is employed in healthcare and other high reliability industries to avoid ambiguity, flatten hierarchies and improve team situation awareness.<sup>3–6</sup> Its use has typically involved phrases invoking a halt to activity and a mandate to consider any party’s concerns,<sup>3–5</sup> but the concept can be extended to include any standardized language that improves clarity of communication and reduces teamwork errors by facilitating a shared mental model. Critical language used in emergency settings should be precisely defined, consistently used, memorable, easy to articulate and readily understood by all team members. Ideally it should not only improve clarity of communication but also trigger cognitive links to key priorities and actions required. Phrases including ‘cardiac arrest’, ‘no output’, ‘shockable rhythm’ and ‘stand clear’ are examples of de facto critical language that are embedded in cardiac arrest management and familiar to most clinicians. In contrast, such consistent clear vocabulary has not developed in emergency airway management, which is encumbered with multiple terms and a lack of definitions for many essential concepts, devices and procedures. This creates the preconditions for confusion and misunderstanding between team members with the potential to impair performance, particularly in a crisis setting. Here, we describe specific areas of concern and discuss the need to consolidate these terms to create a universally accepted lexicon for airway management.

### Communicating ‘can’t intubate, can’t oxygenate’

The can’t intubate, can’t oxygenate (CICO) situation occurs when ‘oxygenation’ cannot be achieved using the anatomical conduits of the upper airway. The shift to CICO from the previous ‘can’t intubate, can’t ventilate (CICV) terminology, initiated by Heard,<sup>7</sup> has been applauded for creating a focus on the priority of

maintaining patient oxygenation. The expectation is that this could diminish fixation on tracheal intubation and attempting to establish normal minute ventilation, which is known to have jeopardized oxygen delivery and contributed to adverse airway outcomes.<sup>1–8</sup> Adoption of the term CICO has not been universal, however, and it is conceivable that the co-existence of the similar terms CICV and CICO to describe the same situation could lead some clinicians to wrongly conclude that they are intended to distinguish between slightly different circumstances. If a declaration of CICV is not understood to be synonymous with one of CICO, this could compromise team situation awareness that the trigger for abandoning attempts at the upper airway techniques of face mask, supraglottic airway and tracheal intubation has been reached. The move from ‘ventilate’ to ‘oxygenate’ has also introduced some issues that affect the potential utility of the new term as a form of critical language for emergency airway management.

Firstly, it has impacted on the abbreviated forms, converting the initialism CICV (which must be spelt out when verbalized) into the acronym CICO (which can be spoken as a word). This alteration is a double-edged sword: on one hand, the CICO acronym creates a distinct term that can be easily verbalized during a crisis. In addition to facilitating team situation awareness, this has the potential to generate a ‘brand’ that not only helps promote CICO itself, but link it to related concepts such as CICO training, CICO kit, CICO pathway,<sup>9</sup> CICO status<sup>10</sup> and CICO rescue.<sup>10</sup> On the other hand, however, the acronym converts the descriptive phrase ‘can’t intubate, can’t oxygenate’ into an incomprehensible neologism. This creates the potentially dangerous situation of having a term that may not be understood by all clinicians in a team. This risk is likely to vary with geography, institution and discipline, according to the cultural tendency to use the abbreviated form—indeed we have observed differences between Australia (where the spoken abbreviation is commonplace) and the UK (where voicing the abbreviation is not the norm). Even in environments where the abbreviated form is in common use, a lack of consistency in how it is verbalized may still lead to confusion. Variations include ky-koh, kic-koh, see-koh, cheek-koh, sic-koh, psy-koh and spelling out C-I-C-O. While this diversity may seem comical, the lack of standardization in a

key term for emergency management is concerning. It is foreseeable, particularly under stress, that one pronunciation may not be recognized and understood by unfamiliar team members, producing a critical failure in communication. Heard,<sup>7</sup> who coined the CICO acronym, has endorsed ky-koh (a common variation in Australia) as the pronunciation (A.M.B. Heard, personal communication, 2016), so it seems reasonable that this should be adopted as the standard.

A less obvious but potentially more serious deficit with CICO is the lack of consensus on what is meant by 'oxygenation' and consequently what 'can't oxygenate' means. Oxygenation could refer to oxygen delivery to the alveoli, blood or tissues, with an inability to achieve each of these being, respectively, identified by absence of an end-tidal carbon dioxide trace, oxygen desaturation and bradycardia/arrhythmia. Even the term 'alveolar oxygenation' could imply either the physiological state of maintained high oxygen concentration in the alveoli (which following preoxygenation does not require ongoing airway patency) or the process of delivering fresh oxygen to the alveoli (which demands a patent airway). Depending on the interpretation of 'oxygenation' adopted, significant disparities in the trigger for declaring CICO are possible (and logical) and could result in differences of several minutes before rescue techniques are initiated. While a discussion of which of the above triggers is most appropriate is beyond the scope of this article, this sort of discrepancy is undesirable in a time-critical situation, such as insurmountable upper airway obstruction, where only a few minutes may separate complete recovery from permanent neurological injury.

In a situation that is already psychologically and technically challenging, an ill-defined trigger potentially adds a cognitive barrier to initiating rescue interventions. The corollary of the above is potential confusion over when a 'can oxygenate' situation exists, with a resultant failure to properly exploit the opportunities this presents. To ensure consistent understanding of what constitutes a CICO situation and when to institute rescue procedures, consensus must be reached on the precise meaning of the term oxygenation and thus how to determine whether this is being achieved. The Vortex Approach<sup>10</sup> attempts to address these ambiguities by encouraging a declaration of whether the situation is 'in the Green Zone' (i.e. there is 'confirmation of adequate alveolar oxygen delivery') or 'in the Vortex' (i.e. where this fails), enabling clinicians to concisely articulate to their team a clear dichotomous relationship between two contexts with distinct priorities and opportunities. Whether these terms can become widely accepted 'critical language' remains to be seen.

## Terminology for airway rescue

Declaration of a CICO event represents the trigger for initiating urgent restoration of airway patency by creating a passage for oxygen delivery between the anterior neck and the trachea. However, each of the major guidelines and other authors have tended to adopt varied and often idiosyncratic terms for this procedure.<sup>7 10-18</sup> This lack of consistent terminology is another potential impediment to prompt management of CICO events. Consider the situation in which a stressed clinician, having recognized and declared a CICO situation, requests the 'emergency surgical airway' kit as the patient's oxygen saturations decrease. Their assistant searches for, but cannot identify, the required equipment, which is labelled 'invasive airway access' or 'front of neck access' or 'percutaneous emergency oxygenation' or 'cric' or 'tracheostomy', etc. Under

extreme psychological pressure, the connection between these divergent terms, which might seem obvious to the unstressed clinician, may not be made. The authors (Chrimmes & Cook) are aware of CICO emergencies in which discrepancies between the terminology understood by different clinicians in a team vs that used to label equipment and storage locations have caused confusion and delays in management.

Table 1 provides a (non-exhaustive) sample of terms used to describe the rescue interventions required during a CICO event. The merits and disadvantages of each of these as terms for use in an emergency situation are best understood by considering some of the desirable features of such a term.

1. Simple. The term should be simple enough to be recalled and articulated by stressed clinicians and understood by those assisting. Polysyllabic, complex or highly technical terms are undesirable. Many of the terms in Table 1 are burdened by this issue as medical terminology has tended towards technical vocabulary without considering the impact of this on communication and teamwork in an emergency.
2. Intuitive. The term should ideally be able to be understood by all clinicians including those without prior exposure. This is facilitated by terms that are familiar, descriptive and accurate. As discussed above, this element may be compromised by the reduction of some otherwise descriptive terms to unfamiliar acronyms.
3. Precise. The term should be specific to techniques for emergency restoration of alveolar oxygen delivery during a CICO situation. This includes ensuring the term is distinct both from non-airway interventions and from non-emergent surgical tracheostomy, which is inappropriately time-consuming during CICO situations. Such ambiguity is known to have contributed to adverse outcomes during airway emergencies, particularly when surgical colleagues have been invited to perform airway rescue via the front of the neck during CICO situations.<sup>16</sup> Adding the prefix 'emergency' to non-emergent techniques (e.g. emergency surgical airway) effectively distinguishes them from one another but this distinction risks being lost if the prefix is dropped to enable concise communication in a crisis. Although technical terminology is typically precise, this advantage is offset by a negative impact on simplicity and the intuitive nature of the term, as not all technical terms are understood equally by all healthcare professionals. For example, the term 'infraglottic' rescue<sup>14</sup> (Table 1) is technically precise but is unlikely to be widely recognized. The challenge is achieving precision while preserving clarity and conciseness.
4. Inclusive. The term should be inclusive of all techniques appropriate to a CICO emergency, irrespective of the equipment used (cannula or scalpel) or anatomical site (cricothyroid membrane or trachea).
5. Non-intimidating. The term itself should not pose a psychological barrier to action. Again, technical terms have the potential to be intimidating by implying the requirement for highly specialized (e.g. 'surgical') skills.
6. Established. Ideally terminology in common clinical use should be used. Coining of new terms should only be undertaken where the existing terminology has significant deficits and the benefits of addressing them outweighs the downsides of introducing another term. Unfortunately, the commonly used term 'surgical airway' is undesirable according to several of the above criteria for being imprecise, non-inclusive, intimidating and perhaps not intuitive.

Table 1. Comparative merits of terms used to describe the rescue interventions required in a CICO event. ECMO, Extracorporeal membrane oxygenation; Green, ideal; Yellow, flawed; Red, undesirable

TERM	Simple		Intuitive	Precise	Inclusive		Non-intimidating		Established
	Concise	Terminology			Anatomy	Technique			
Emergency surgical airway	Nine syllables May be abbreviated to the initialism 'ESA' but this impacts negatively on intuitive aspect	Lay	Yes	May be confused with elective tracheotomy if 'emergency' omitted	Yes	Potentially excludes cannula techniques as 'surgical' is inconsistently used to refer exclusively to scalpel techniques <sup>1-10-13 17 18</sup>	'Surgical' may contribute to a psychological barrier to performance among non-surgeons	Yes	
Cricothyroidotomy <sup>18</sup> (or cricothyrotomy)	Seven (or six) syllables May be abbreviated to 'cric' but this is imprecise and easily misunderstood	Technical	Yes	No. May be confused with non-emergent techniques	No, anatomically specific, excludes techniques on the trachea	Yes	Technical terminology potentially intimidating	Yes	
Tracheostomy (or tracheotomy)	Five syllables	Technical	Yes	No. No mechanism to distinguish emergent from non-emergent techniques	No, anatomically specific, excludes techniques on the cricothyroid membrane	Yes	Technical terminology potentially intimidating	Yes	
Cut the neck	Three syllables	Lay	Yes	No. May be confused with non-emergent techniques Not necessarily specific to airway (though commonly used colloquially in this regard)	Yes	No, implies scalpel technique	'Cut' potentially intimidating	Yes	
Invasive airway access <sup>11</sup>	Seven syllables	Lay	No	No. Potential ambiguity as intubation/supraglottic airway may be perceived as 'invasive' vs face mask ventilation	Yes	Yes	Yes	No	
Infraglottic rescue <sup>13</sup>	Six syllables	Hybrid technical/lay terminology	No	Potential to interpret tracheal intubation as being an infraglottic technique (as oxygen is delivered below the glottis) although it is more correctly described as transglottic by this classification Yes	Yes	Yes	Yes	No	
Emergency subglottic transtracheal access <sup>12</sup>				Descriptive and technically accurate but complex. May not be readily understood by the uninitiated	Yes	Yes	Potentially intimidating	No	
Emergency front-of-neck access <sup>10</sup>	Nine syllables May be abbreviated to the acronym 'emergency FONA' but this impacts negatively on intuitive aspect	Lay	No	No. Not specific to airway Access could refer to central vascular access. Potential confusion with non-emergent procedures if 'emergency' omitted	Yes	Yes	Yes	Recently introduced	

Continued



The authors propose that '(Emergency) Front-of-Neck Airway' [which one author (T.M.C.) has adapted from Front-of-Neck access]<sup>16 19</sup> and 'CICO Rescue'<sup>10</sup> are two more recent terms warranting further consideration as solutions to this problem. Their relative merits are outlined in Table 1.

## Preventing and recognizing CICO

Limiting the number of attempts at tracheal intubation and other upper airway techniques is a core principle of emergency airway guidelines. The intention is both to avoid precipitating CICO events by unnecessary airway instrumentation and to promote timely progression to alternate rescue techniques. Such recommendations are meaningless, however, without a clear definition of what constitutes 'an attempt'. The 2015 Difficult Airway Society Guidelines have provided a useful definition of an attempt at tracheal intubation.<sup>11</sup> The Vortex Approach provides additional definitions for attempts at ventilation via face mask and supraglottic airway.<sup>20</sup> By assigning a precise meaning to the term 'attempt', these definitions could make an important contribution to team situation awareness and effective decision-making during airway crises. This impact would be maximized if there was widespread consensus on these definitions.

The endpoint of attempts at a given upper airway technique is typically framed in terms of declaring 'failure'<sup>11-13</sup> but acknowledging failure may represent a psychological barrier that fosters task fixation and delays progression to alternatives. There may be merit in encouraging more positive critical language such as the phrase 'completed best effort' employed by the Vortex Approach.<sup>10 20</sup> Accompanied by prompts to promote recognition of when this has been achieved, this provides a clear trigger for abandoning further attempts at each mode of upper airway rescue that avoids the negative connotations of 'failure'.

## A way forward

The anaesthetic airway management community has been among the first to acknowledge the importance of incorporating human factors strategies into crisis management.<sup>12</sup> As part of that process, we believe attention must be given to establishing critical language to facilitate effective communication. This can be done at a local level but a universal approach is preferable given the multiple specialties involved in airway management, the propensity of clinicians to work across multiple sites and the increasing globalization of their interaction via the internet. This will no doubt be a challenge. Perhaps more important than identifying the perfect terms is finding ones that will be universally accepted and ensuring a consistent, precise understanding of their definitions. Although 'cardiac arrest' does not literally describe this emergency accurately, as the heart may still be beating vigorously and blood circulating, this term is universally associated with the concept of circulatory compromise to the point that the pulse becomes absent and the patient unresponsive and where life-saving action must be initiated. Similarly, while for clarity it might seem preferable to avoid all use of abbreviations, it is doubtful that most clinicians are declaring the need for cardiopulmonary resuscitation (CPR), electrocardiogram (ECG) and extracorporeal membrane oxygenation (ECMO) using the expanded forms. Sufficient familiarity with abbreviations can be achieved to exploit the concise, unique terms they create without compromising the clarity of communication. Thus, no single approach is clearly superior.

The Core Outcome Measures for Effectiveness Trials (COMET)<sup>21</sup> initiative aims to promote and facilitate

standardization of terms for the purposes of defining study outcomes in trials. Within anaesthesia the Core Outcome Measures in Perioperative and Anaesthetic Care (COMPAC) group is one limb of COMET and has combined with the Standardizing End points in Perioperative medicine (StEP) group to form COMPAC-StEP with the aim of reaching an agreed set of definitions for outcomes used in perioperative medicine trials.<sup>22</sup> The method includes a systematic review to identify terms in use and a Delphi consensus process performed by relevant experts to agree terms and definitions.

The numerous national and international airway special interest groups and societies could use a COMPAC-StEP-type approach to achieve consensus on the language used during an airway emergency, with the potential for clinical and research benefits. Until then, emergency airway management is left with a high-stakes, time-critical situation for which we are unable to define the trigger, articulate the name or agree on what the rescue procedure is called. As the evidence<sup>18</sup> tells us that a delay in acting when CICO occurs is at least as much of a problem as the technical challenges of rescue procedures, this is more than an academic concern.

## Declaration of interest

None declared.

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## Engaging in risky business: is it time to rethink risk tolerance in anaesthesia?

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In this issue of the *British Journal of Anaesthesia*, Greig and colleagues<sup>1</sup> describe a new study examining risk tolerance amongst a large and diverse group of anaesthetists from across a single National Health Service Trust. Using a validated electronic questionnaire, the authors presented a group of anaesthetists with 11 risky situations and queried respondents as to whether they would proceed with the procedure or not (a go/no-go decision). Importantly, all of the scenarios were drawn from previous instances where a critical incident had occurred and been reported. Among their key findings, the authors reported that a consultant was significantly more likely to proceed with a given scenario than a trainee. Perhaps even more striking was the finding that in no one scenario was there absolute agreement over whether to proceed or not. Even in situations where national guidelines clearly suggest a procedure should be cancelled (i.e. a faulty gas analyser), several individuals responded that they would proceed. Overall, the authors found wide variability in what anaesthetists consider either acceptable or professional behaviour. One might expect that if the study were expanded to include other trusts, or even anaesthetists from other countries, this variability would be likely to persist.

This study and its findings represent an important call for our specialty to rethink that which we do every day: engage in risky business. As a specialty, we have made tremendous advances.

The mortality attributed to what we do was of the order of 1:1000 a few decades ago.<sup>2</sup> Now it is almost unmeasurable at an individual level. But this impressive safety record does not mean that it is acceptable to allow safety decisions to be made without regard to established standards. It is, in fact, those very standards that have brought our safety record to where we are today.

It is well established that clinical practices vary, and this can be either appropriate or inappropriate.<sup>3</sup> Appropriate variation can be thought of as responding to individual patient differences. Conversely, inappropriate variation reflects practice differences among individual practitioners resulting in the same patient receiving differential treatment not explained by their condition.

In addition to the 11 scenarios presented in the study, we too have each witnessed situations in facilities where we have either worked or trained where questionable decisions to go ahead with a procedure were made. Sometimes these decisions were rationalized as being for convenience of the patient. At other times, those decisions were for the convenience of the providers. Sometimes these decisions were transparent and involved the patients; in other instances, they were not. Almost every anaesthetist we know can recount a situation in which they continued to work while either too ill or too tired, often because of financial