Managing airway trauma: applying logic and structure to the anaesthetic decision-making process

ADAM REHAK, MBBS FANZCA

Consultant Anaesthetist, Department of Anaesthesia, Royal North Shore Hospital, NSW

After completing vocational anaesthesia training at Monash Medical Centre, Melbourne and Guy's & St Thomas' hospitals in London, Dr Rehak took a combined clinical and simulation position at Royal North Shore Hospital in Sydney. His interests include simulation-based education, human factors in airway management and multi-disciplinary team performance. He is a co-opted member of the Airway SIG executive, a member of the ANZCA EMAC course subcommittee, and a director of the Safe Airway Society – a newly formed multidisciplinary trans-Tasman airway society

INTRODUCTION

Traumatic airway injuries (TAIs), like other "threatened airway" presentations, are rare. Despite accounting for only 1% of all trauma presentations the mortality rate amongst these patients is estimated to be well over 20%.[1,2] Exact mortality rates are difficult to gauge as a significant proportion of these patients die at the scene.

Existing guidelines on airway management are (mostly) designed for use in situations of unanticipated difficulty during routine airway management[3,4], and are thus intended to be applied where anaesthesia has already been induced. As such, they are not directly applicable to the situation of a patient presenting with a TAI. Moreover, several authors have emphasised that adhering to these guidelines in the presence of a TAI may be unhelpful[5] or even harmful.[6]

There have been a large number of reviews focusing on airway trauma.[1,5-11] These articles comprehensively describe the incidence, aetiology, and common presentations of these injuries, and catalogue the diagnostic investigations and management options available. With a few exceptions, however, these reviews either fail to provide a framework to guide decision-making around airway management or focus specifically on the decisions pertaining to surgical management. The few reviews that do provide a framework or algorithm for anaesthetic decision-making fail to address how extrinsic (non-patient) factors such as equipment available in the emergency department (ED) compared with that in the operating theatres (OT) and the distance from ED to OT impact choices around airway management.

This article attempts to provide a decision-support matrix for the management of TAIs that incorporates both the intrinsic considerations such as patient and airway factors, and the extrinsic considerations such as the situational factors described above and team factors. These factors are then applied in a sequential decision-making process which addresses when and where the airway should be managed, the team composition, and the primary and contingency airway management plans.

Components of the presented decision-support matrix are derived or borrowed from the Vortex Approach.[12] [See The Vortex Approach to Airway Management (N. Chrimes) in this edition of Australasian Anaesthesia]. Specifically, the table of considerations presented later is a modification of that presented in the Green Zone planning tool, and the contingency plan options are presented as either those available "in the vortex" or those available "in the green zone".

TAIs are comprised of a heterogenous collection of injuries including maxillofacial trauma, blunt and penetrating neck trauma, and inhalational injuries. Tracheobronchial injuries can also result from blunt chest trauma, but due to low survival-to-hospital rates these won't be addressed here. An overview of the presenting features of the various types of TAIs is presented below.

Maxillofacial trauma

Maxillofacial trauma may involve the mandibular/maxillary structures or the mid-face region. These injuries are characterised by copious bleeding which may threaten the airway via aspiration and hypoxia and may complicate airway management. Patients often present sitting erect and spitting out blood in order to avoid choking and asphyxia. Rarely mandibular condylar impaction can restrict mouth opening. Bilateral mandibular fractures may cause the tongue to migrate posteriorly, obstructing the airway. These patients will also present in an erect position. Mid-face fractures are associated with airway disruption along the nasopharynx and with cervical spine injuries.[13]

Blunt neck trauma

These injuries are often part of a wider multi-trauma picture, such that urgent airway management may be required due to deterioration secondary to other injuries. The cricoid cartilage and cricothyroid membrane are involved in 50% of blunt airway trauma where the airway is compromised. Thyrohyoid membrane, thyroid cartilage and upper tracheal injuries accounting for the remainder.[14,15] Laryngo-tracheal disruption is a feature in more than half of these patients[1] and complete separation may occur, usually between the cricothyroid membrane and the fourth tracheal ring. Patients with blunt neck trauma may present with cough, dyspnoea, aphonia, stridor, subcutaneous emphysema or haemoptysis but

symptoms don't correlate well with location of injury or severity.[16,17] Airway obstruction can be secondary to oedema, haematoma, subcutaneous emphysema, tissue deformity from cartilage fracture, or a combination of these.

Penetrating injuries

Injuries include airway laceration and disruption, cartilage fracture and vocal cord damage, blood vessel damage, pneumothorax and oesophageal perforation. They cause airway compromise through aspiration of blood, oedema, subcutaneous emphysema, haematoma, and pneumothorax. Large penetrating injuries may allow establishment of a definitive airway by direct placement through the wound. Cervical spine injuries are frequently associated with gunshot wounds but less so with other causes of penetrating neck trauma.[18]

Airway burns

Thermal injury to the airway is typically seen in patients trapped in an enclosed space for a prolonged period. The main concern is airway obstruction secondary to oedema. Swelling may be immediate or delayed and can be exacerbated by fluid resuscitation. Inhalational injury is a significant cause of mortality in burns patients.[19] Difficulty with airway management and specifically intubation increases with time.[20] Nasendoscopy has been used to predict need for intubation, and can be used serially to assess increasing oedema.[21,22]

GOALS OF AIRWAY MANAGEMENT IN TAI

In patients presenting with a TAI the airway may be compromised or complicated by a broad range of pathological processes. Despite this, the goals of airway management in all cases remains the same.

1. To identify which patients with TAIs need their airways secured.
2. To place a cuffed tracheal tube into the lumen of the airway distal to the location of injury while avoiding hypoxia
3. To avoid exacerbating a potential or actual airway disruption and/or migrating an endotracheal tube (ETT) outside the airway
4. To avoid creating or exacerbating subcutaneous emphysema

INTRODUCING A FRAMEWORK TO GUIDE DECISION-MAKING IN THE MANAGEMENT OF TAIs

With reference to the goals of airway management in the presence of a TAI, as described above, it is understandable why awake airway management techniques such as flexible bronchoscopic intubation (FBI) or performance of a front of neck airway (FONA) under local anaesthetic have been promoted by some as the "gold standard" for the management of

patients with TAIs. In reality, performance of awake techniques, especially those involving specialised equipment and/or specific technical skills is only a realistic option under certain circumstances. Hence, over-emphasis on an aspirational ideal is unhelpful. It may even promote dangerous practices whereby clinicians ignore or avoid intuitively safer options in favour of pursuing techniques inappropriate in the given context or attempt dangerous transfers of unstable patients to the operating theatres.

Prior to deciding how the airway is to be managed, it must first be determined when and where the airway can and should be managed. Most, if not all patients presenting with a symptomatic TAI will arrive first to the ED. There they will be assessed and managed by a multi-disciplinary team that in Australia and New Zealand will (almost) always include an anaesthetist or anaesthetic trainee. The decision to stay in ED or move to theatre will impact the options available for airway management. Another decision that should precede, and will ultimately impact, the selection of how the airway is to be managed is that of who can and should be involved in the management of the airway. Once a decision has been made on how the airway is to be managed, the final aspect of management to be considered is what are the contingency plans in the event of failure.

They key questions to be addressed are listed below:-

1. **Where** and **when** should the airway be managed?
2. **Who** should be involved?
3. **How** should the airway be managed?
4. **What** is the plan if that plan fails?

In order to guide the key questions outlined above, a broad array of factors need to be considered. These are outlined in **Table 1**.

Where and when should the airway be managed?

The decision-making process begins with an airway triage to decide whether the option to move the patient out of the ED and into the operating theatre (OT) is realistic and safe. While the presenting state of the patient will impact this decision-making, important situational factors will also come into play. Many of these factors will be specific to the facility within which that case is taking place and may even vary with time of the day or day of the week. The importance of taking local circumstances such as the distance from the ED to the OT was emphasised in the NAP4 report, where several cases where identified where a transfer between the two locations led to a prolonged period of hypoxia.[23] In smaller hospitals theatre staff may not be immediately available after-hours or on weekends and the consequences of any delay required to have theatres ready to receive a patient with a TAI need to be carefully considered.

Table 1. Key considerations in patients with TAIs

Situation Factors	**Urgency**
	Complexity
	Environment/Location
Airway Factors	**Stability**
	O_2 Saturation
	Viable options
	Pathology
Patient Factors	**Aspiration risk**
	Feasibility of waking
	Compliance
Team Factors	**Experience**
	Skillset

In 2016 Mercer and colleagues presented a systematic review of traumatic airway injury management and suggested dividing patients into three groups: no time, some time, and adequate time to allow airway assessment, investigation and intervention.[6] The advantage of this taxonomy is that it utilises the clinical picture at presentation along with an understanding of the pathophysiology and its likely progression to help decide how urgently the airway needs to be managed. It does, however, fail to account for the aforementioned situational factors. There is limited value in advocating a decision-support model that utilises a time-based classification system if the included categories have different management implications across different hospitals, days of the week or times of the day. In fairness to the authors, they were presenting an institution-specific protocol.

For the purposes of developing a transferable, universally applicable approach, an airway triage system is proposed that accounts for both intrinsic and extrinsic factors impacting when and where the airway should be managed. This is shown in **figure 1.**

Figure 1. Airway triage categories

Triage category 1: "CRACK ON"

Patients triaged to this category are those *in extremis,* where the risks of delaying airway management outweigh any advantages gained by waiting for additional personnel or equipment. These are patients obviously too unstable to undergo extensive airway assessment or investigation, let alone be transferred to the OT. It should be noted that the self-selecting nature of these injuries will dictate that relatively few patients will arrive at a trauma department in this state as a direct result of their TAI – most will have either died at the scene or have had their airways managed in-transit.[1]

Table 2. Absolute and conditional indications for immediate airway management

Absolute indications for immediate airway management	Indications for immediate airway management when associated with actual or expected deterioration
Severe hypoxia	Stridor
Airway obstruction from blood or secretions	Respiratory distress
Decreased conscious state	Subcutaneous emphysema
Profound shock	Expanding neck haematoma
Cardiac arrest	Inability to lie flat

It is hard to identify a definitive list of signs or symptoms which indicate a patient should be triaged to the "Crack on" category. Some, such those listed in the left hand column of table 1 are incontrovertible. Others, such as those listed in the right hand column of table need to be interpreted within the context of the presentation. It can logically be argued that the presence of one or more from the list in the right hand column of the table, without evidence of progression, may not necessitate immediate airway management. For example, if a patient

with a TAI is recorded as having stridor and a respiratory rate of 32 at the scene of the accident, and then arrives in the ED with her clinical state unchanged, the potential benefits of waiting for additional resources may outweigh the risk of the airway deteriorating further. This example highlights the fact that the process of differentiating patients within the "Crack on" category from those in the "Stay & play" category requires consideration of both the significance of the presenting sign or symptom and the rate of progression of the underlying pathology.

Triage category 2: "STAY & PLAY"

Patients triaged to this category are those where the risks of transferring the patient are deemed to outweigh the advantages inferred by being in the OT environment. These patients are, however, stable enough to permit delaying definitive airway management in order to maximise the likelihood of success. This may involve gathering of personnel and equipment, and performing limited investigations of the airway. Transfer for CT scan is unlikely to be feasible in this cohort of patients but nasendoscopy along with radiographs and ultrasound of the neck are quick to perform and are likely to influence decision-making. In some centres, patients with major airway injuries excluded on nasendoscopy are managed conservatively, despite the presence of voice changes and/or subcutaneous emphysema.[8,24]

In the presence of a TAI, a patient would be triaged to the "Stay and play" category if displaying signs and symptoms suggestive of major airway injury but without evidence of the rapid progression or deterioration that would demand immediate definitive airway management. Specifically, these are patients with with stridor, dyspnoea, subcutaneous emphysema, neck swelling or intolerance of the supine position.

Other injuries may prevent a patient with an otherwise stable TAI from being transferred to the OT. Examples are major haemorrhage or head injury in a multi-trauma patient, and smoke inhalation in burns patients. The signs and symptoms associated with TAIs have been noted to have poor predictive value[16,17], and as such the pathophysiology or mechanism of the injury and/or the impact of patient specific-factors may suggest the need to "stay and play". For example, the underlying airway oedema in patients with symptomatic inhalational thermal injuries is likely to rapidly progress[20]. As mentioned, factors such as distance to theatres, availability of theatres or theatre staff, and equipment available in the ED need also be considered when deciding whether to transfer or not.[5,9]

Triage category 3: "HEAD FOR HOME"

This category comprises those patients with TAIs who require definitive airway management but are stable enough to permit transfer to the OT prior to airway being secured. As with

those in the “stay and play” category, these patients should undergo a comprehensive airway assessment including nasendoscopy, chest and neck radiographs and possibly neck ultrasound. Unlike the “stay and play” patients, these patients should be considered for CT scan. The decision to surgically explore or repair a TAI secondary to blunt laryngeal trauma is largely based on the criteria outlined in the Schaefer classification system[25] or one of its many derivations.[14,26] These criteria include a combination of presenting signs and symptoms, nasendoscopy findings and features on the CT scan. Essentially all symptomatic patients with severe oedema, significant mucosal disruption, vocal cord immobility or displaced laryngeal fractures will require surgical intervention.

Who should be involved with airway management?

Pausing to consider who should be involved prior to commencing airway management in the presence of a TAI is about ensuring both that personnel with the correct skillset and experience are in attendance, and also that roles are clearly allocated and defined. The most senior anaesthetic help available should be deployed for these cases along with a surgeon with tracheostomy and/or cricothyroidotomy skills.

In the “crack on” group of patients, the ability to get additional senior help and an ear, nose and throat (ENT) surgeon or similar, may be restricted to presentations where the presence of airway pathology is recognised and communicated at the time of trauma team activation.

Taking time to consider who should be involved is likely to infer the greatest benefit in the patients falling within the “stay and play” triage category. NAP4 identified several cases with poor outcomes involving non-urgent but complex airway injuries or pathology where the airway was managed in the ED by anaesthetic trainees while senior help had been available.[23] In situations where time is available but the patient is considered too unstable for transfer to the OT, the presence of a senior anaesthetist and an ENT surgeon should be requested. Consideration should also be given to having a capable anaesthetic nurse or technician from OT attend the ED.

Patients in the “head for home” category will be managed in the OT, and the process of explicitly considering who should be involved can be used to overcome the complacency that can arise with the familiarity of the environment and the relative stability of these patients. The anaesthetist should ensure that all team members are present in OT at the outset of airway management, and that all roles are allocated including a “hands-off” team leader.

How should the airway be managed?

There is no consensus on how TAIs should be managed and in many cases authors appear determined to identify and advocate a single best way to manage all presentations, rather than considering the pertinent factors in a structured way to guide decision-making. This is particularly evident with laryngotracheal trauma, where historically awake tracheostomy was advocated by many for all patients requiring definitive airway management.[26,27] Others advocated rapid sequence induction with direct laryngoscopy despite the risk of exacerbating a tracheal tear.[14] More recently some have proposed awake FBI as the method of choice[24] while others suggest any of the aforementioned techniques may have place in the management of TAIs.[6,9,10] The impracticality of a "one size fits all" approach has already been explained. Instead a method for deciding which options are feasible and appropriate in different circumstances should be employed.

In the Vortex Approach patients are considered to be in one of two states based on whether alveolar oxygen delivery is occurring: either "in the vortex" or "in the green zone".[12] A Green Zone (GZ) tool is provided to guide decision-making in the circumstance where alveolar oxygen delivery has been restored. This tool is discussed later in this paper.

The situation of the threatened airway lends itself to a modified version of this model. Any patient presenting with a threatened airway such as a TAI who is able to maintain their own airway would be considered to be "in the green zone". Assuming that the patient requires definitive airway management, a primary airway plan that addresses the goals of airway management in the presence of a TAI would be selected from within following three broad categories:-

1. **AWAKE** - securing the airway awake – patient remains within the green zone
2. **SV** - securing the airway asleep but with maintenance of spontaneous ventilation – patient remains within the green zone
3. **RSI** - securing the airway asleep and apnoeic with rapid sequence induction – patient enters into the vortex

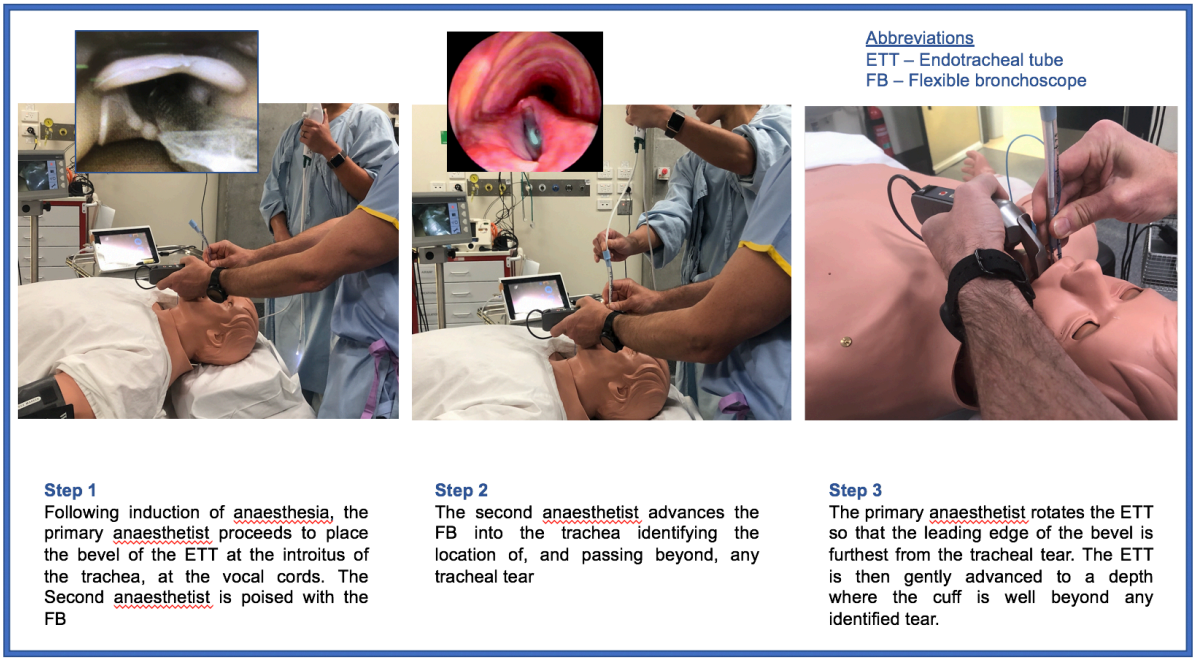
In other, non-trauma, presentations of threatened airways the use of 'holding measures' such as continuous positive airway pressure, high-flow nasal oxygen and heliox (helium-oxygen mixture) have been advocated.[28] While these may intuitively seem worthy of consideration in TAIs where stridor and obstruction feature prominently, the possibility that these may exacerbate surgical emphysema should mandate careful patient selection.

Primary plan options in patients in the "Crack-on" triage category

In the patients that have been triaged to the "Crack On" category the time-limitations render awake and spontaneous ventilation techniques impractical. In these situations the primary airway plan will constitute a modified RSI with or without manual in-line stabilisation.

Recognising that blind passage of an ETT during RSI can exacerbate airway disruptions and lead to migration of the ETT outside the trachea[14], measures to mitigate this risk should be employed. Mercer and colleagues recommend a modification of RSI whereby the concurrent use of videolaryngoscopy (VL) and an flexible bronchoscope (FB) allows negotiation of any airway disruption under direct vision.[6] The steps involved with this technique are explained in Box 1.

Box 1. Steps involved in an FB-assisted RSI



It should be noted that FBs are not immediately available in the emergency departments of most Australian and New Zealand hospitals. The FB-assisted RSI described above will only be possible in the few hospitals where these are stocked in ED or where a portable FB is mobilised to the ED at the time of the trauma team activation. In the absence of an FB, a smaller than usual ETT should be utilised. Cricoid pressure should be avoided in the presence of a laryngeal injury, as should high flow nasal oxygen delivery which generates a degree of positive airway pressure. Simple apnoeic oxygenation delivered at 10-15 litres per minute via standard nasal cannulae can significantly prolong time to desaturation[29] and should be utilised in these patients.

Regardless of the exact technique used to perform an RSI in these situations, a second clinician should have the equipment ready for, and be poised to, perform an emergency front of neck airway (eFONA); the only viable contingency plan in this situation. This has been described as a “double set-up”.[7]

Occasionally with patients in the “crack on” triage category it will be determined that the extent and severity of the airway and facial pathology equate to a very low probability of success with direct or video laryngoscopy during RSI. In these cases immediate eFONA following induction may constitute the primary plan with the highest likelihood of success.

Primary plan options for TAI patients in the “Stay & Play” triage category

In these patients where some time is available, but management necessarily must occur in the ED, options from within each of the Awake, SV and RSI categories become viable. The patient factor having the greatest impact on choice of technique in these patients is compliance. An awake technique is only tenable in situations where a patient is cooperative, while an SV or RSI techniques will be required in a non-compliant patient.

In a compliant patient where a surgeon is available, and factors such as blood in the airway or a lack of equipment or skills make awake FBI less viable, awake FONA should be the technique of choice. The location of the injury will determine whether cricothyroidotomy or tracheostomy is indicated. It should again be emphasised that neither FBs nor the equipment used for topicalization are commonly available in Australian and New Zealand EDs. Awake FBI will rarely be a viable option for patients in this triage category and should only be considered where time and/or availability permits its use and the pathology strongly indicates the need for this technique.

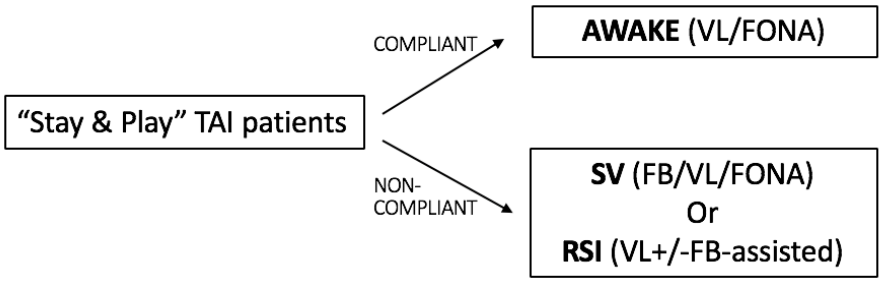
In situations such as severe maxillofacial injury or a penetrating injury to the pharynx or hypopharynx, blood will be a prominent feature but subglottic structures are likely to be intact. In such cases, awake VL or awake surgical airway are the primary plan options with the highest likelihood of success. The skillset and experience of the team should be used to guide which is selected.

In confused or combative patients in this triage category the choice of a SV or RSI technique will be guided by the estimated risk of aspiration (blood or stomach contents) and the anticipated ability of the patient to maintain a patent airway while anaesthetised.

The pharmacological options for inducing anaesthesia while maintaining spontaneous ventilation are limited in the ED. The use of Ketamine is advocated by some authors for this situation[7] and has been used extensively to gain control in combative patients prior to RSI.[30] Topicalisation is not required for performance of FBI after induction with ketamine. This technique should, therefore, be considered in the minority of EDs where these devices are available, or where a disposable scope has been mobilised from OT early in the process.

If an RSI technique is utilised, the same modications and precautions described earlier should be adopted. A summary of the options for the primary airway plan in patients in the stay and play category is presented in figure ?.

Figure 2. Primary plan options in patients in the "Stay & play triage category.



FB, filexible bronchoscope. VL, videolaryngoscope. FONA, front of neck airway.
SV, spontaneous ventilation. RSI, rapid sequence induction

Primary plan options in TAI patients in the "Head for home" triage category

Options from all three of the management categories; awake, SV, and RSI are available to the anaesthetist. The same considerations as those described above for patients in the "Stay & play" triage category apply to these patients. Additionally, information from a CT scan may determine the need for a surgical procedure that itself requires specific airway management such as a tubeless field accross the larynx.

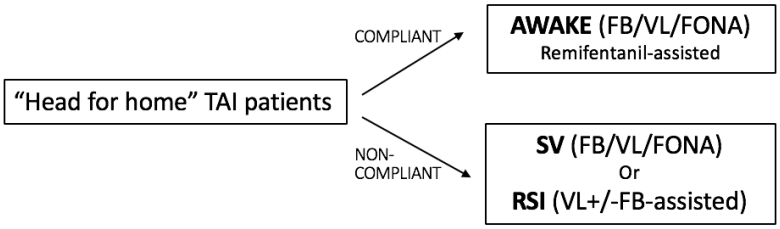
As with patients in the "Stay & play" triage category, compliance will again be the factor having the greatest impact on choice of anaesthetic technique for the primary airway plan. Amongst cooperative patients the choice of awake FONA, awake FBI or awake VL will largely be determined by airway factors, with equipment availability and team skillset less likely to play a role than with the cohort of patients in the "Stay & play" triage category. The availability of target-controlled infusion pumps for the delivery of remifentanil in the OT environment is likely to enhance performance of awake techniques.[31]

The small group of combative patients that do make it to theatre, and those that refuse an awake technique, will require either an SV or RSI technique. Aspiration risk and likelihood of the airway remaining patent after induction will again determine this choice. A small proportion of patients may be appropriate for rigid laryngoscopy and bronchoscopy, but concurrent cervical spine injury is common in TAIs, and would be contraindication to these.

The utility of SV techniques using volatile inhalational agents in threatened airway presentations has been questioned[28] and was associated with frequent failure in cases reported in NAP4.[32] An SV technique utilising intravenous anaesthesia has theoretical advantages[28] and target-controlled infusions of propofol have been successfully used to

maintain SV in patients requiring airway surgery for subglottic stenosis.[33] The primary plan options in the "Stay and play" patient cohort are summarised in **Figure 3**

Figure 3. Primary plan options in patients in the "Head for home" triage category



FB, flexible bronchoscope. VL, videolaryngoscope. FONA, front of neck airway.
SV, spontaneous ventilation. RSI, rapid sequence induction

What is the plan if that plan fails?

One of the themes that emerged from NAP4 was the frequency with which airway management was embarked upon with only a primary airway plan rather than a strategy comprising both a primary plan and contingency plans to be enacted in the event of the primary plan failing.[32] Even the existence of a viable airway strategy is of limited value unless it is shared with members of the team such that a shared understanding of the steps within the strategy exists.

A useful way to ensure that likely contingencies and the appropriate responses to these are considered is to always ask "What is the plan if that plan fails?". A second, and equally important component to contingency planning in the setting of TAIs, is to also ask the question "what is the plan if the airway is lost now?" This is particularly pertinent in patients triaged to the "Stay & play" and "Head for home" categories, where a delay to permit optimisation of the environment or a transfer to OT is planned. There are numerous case reports of patients with initially stable TAIs deteriorating suddenly necessitating immediate airway management.[34-36]

The options available as contingency plans are usefully delineated by the Vortex Approach.[37] if alveolar oxygen delivery is not occurring due to airway obstruction or the patient becoming apnoeic, the only options available are the three upper airway lifelines of facemask ventilation (FMV), supraglottic airway rescue (SGA) and intubation (ETT), or the last resort of eFONA. If alveolar oxygen delivery is still possible, or is restored via one of the three upper airway lifelines then the options are to either i) maintain oxygenation with the current airway and wake the patient or proceed with surgery, ii) convert the current airway

while maintaining alveolar oxygen delivery, or iii) abandon the current airway and move to another modality to achieve definitive airway management. The Vortex approach cognitive tools designed to prompt recall of these options are presented in the accompanying article by Nicholas Chrimes in this publication.

It must be emphasised that the cognitive tools are prompting recall of ALL the options available, and it is the responsibility of the team to decide which options should be considered as viable and appropriate contingency plans. Clearly some of these options are unlikely to be successful and in fact may make further attempts at securing the airway more difficult. For example, positive pressure ventilation via FMV or LMA is likely to cause or exacerbate subcutaneous emphysema in the presence of an airway disruption. Similarly, performance of eFONA at the cricothyroid membrane may be at or above the level of the injury and therefore unlikely to achieve the goals of airway management in the presence of a TAI.

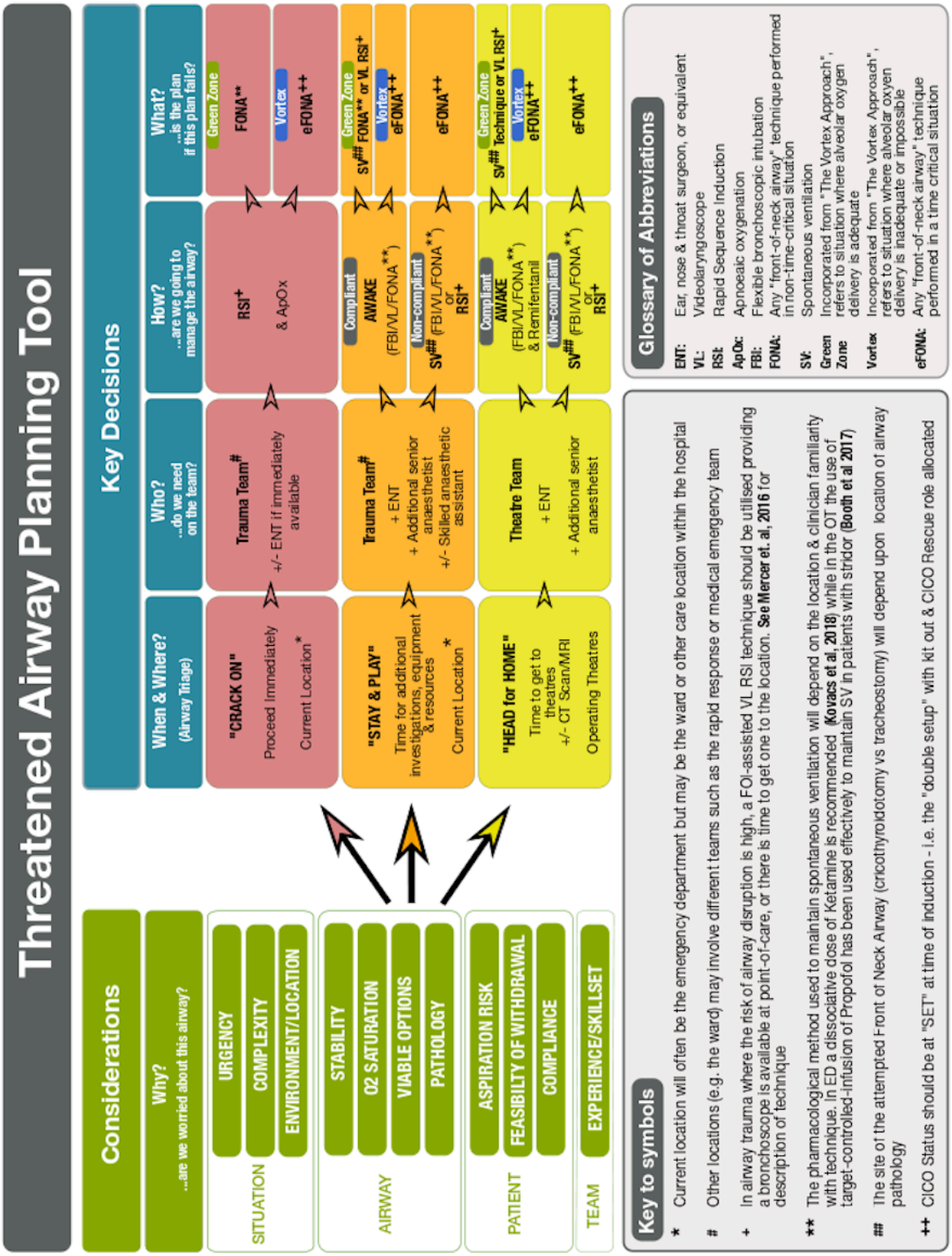
In some circumstances FMV or LMA may appropriately be incorporated into contingency planning for management of patients with TAIs, but at best these are likely to buy time for the performance of FONA. For this reason the approach being advocated here for all symptomatic TAIs involves immediate mobilisation of personnel and equipment for FONA and an escalation of preparedness such that the procedure can be immediately performed in the event of sudden deterioration or the failure of the primary plan. This is the “double set-up” described earlier, which is analogous to the a CICO status of “set” using the Vortex Approach.[38]

Where the decision to perform FONA is made while alveolar oxygen delivery is still possible a more precise FONA approach may be adopted. If oxygen delivery has failed, however, akin to a “can’t intubate, can’t oxygenate” (CICO) situation, a technique that can secure the airway within minutes must employed – eFONA. This distinction needs to be clearly communicated to, and understood by, the team member allocated to this task.

PUTTING IT ALL TOGETHER

A composite decision-support tool for management of patients presenting with a “threatened airway” is presented in Figure 4. A high-resolution version is available for download via this link. The tool prompts consideration of the key patient, airway, situational and team factors that impact decision-making. It then guides clinicians through the process of answering the four key questions explained above. The tool is designed to provide appropriate guidance for not only patients presenting with TAIs, but also other pathologies that include the heterogenous group of patients that present with imminent airway obstruction: infection, haematoma, tumour and foreign body.

Figure 4. The Threatened Airway Planning Tool - A composite decision support tool for management of the threatened airway.



Like all cognitive aids, the “Threatened airway planning tool” requires prior knowledge of its content and an understanding of the concepts and techniques included in the tool. It is designed to both support the decision-making of the individual anaesthetist and promote

effective team performance. Clinical performance is likely to be optimised by rehearsal with immersive simulation which utilises the same tools, resources and personnel that will be available in the clinical setting.

The tool is relatively complex and information-dense. As such, it is likely to be of most use in situations where some time is available - patients presenting in the “Stay & play” or “Head for home” triage categories. It is incumbent on the individual practitioners and teams managing emergent patients to have a clear idea of how patients presenting in-extremis – those in the “Crack on” triage category, should be managed without needing to refer to a cognitive aid.

CONCLUSION

TAI’s, and other presentations involving ‘threatened airways’ are rare events requiring complex anaesthetic decision-making to optimise outcomes and avoid potential complications. The impact of extrinsic factors such as location, distance to theatre, and team skillset on the available options are often ignored but in fact need to be integrated into the decision-making process. Hopefully the step-wise approach outlined here, along with the accompanying decision-support matrix in the Threatened Airway Planning Tool provide logical, structured approach to these challenging situations.

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