PG56(A)BP Guideline on equipment to manage difficult airways Background Paper 2021

Short title: Difficult airway equipment BP

1. Introduction

In 2012 ANZCA released *PG56(A) Guideline on equipment to manage difficult airways* based on recommendations from an expert panel established in 2008. This was in response to concerns raised in an audit of airway management equipment in a metropolitan region published in 2007[1]. The guideline was accompanied by a background paper that was published in Anaesthesia and Intensive Care in 2011 and which remained the most viewed article in that journal for more than five years, proving the importance of this subject to anaesthesia practice[2]. While the fundamental principles of PG56(A); namely standardisation, redundancy and a culture of safety still apply, major changes have occurred during the intervening years. These changes have impacted on the contemporaneousness of the guideline. Several devices mentioned in PG56(A) promulgated in 2010 have been withdrawn and new technology has been introduced. The approach to procurement of airway equipment, and the airway management for patients with a difficult airway has changed since 2010. One weakness of any guideline is its susceptibility to time and the risk of becoming outdated[3].

2. Aim

The aim of updating PG56(A) is to provide an objective, informed, transparent and evidence-based review of equipment to manage difficult airways[4] with a view to standardising the equipment throughout operating suites and areas beyond, including emergency departments and intensive care units (ICUs).

It is intended that these recommendations reflect current Australian and New Zealand difficult airway practice. Standardisation of equipment aims to enhance familiarity and skill sets of clinicians with a broad range of clinical experience. However, it is recognised that some equipment requires specific training or may have applicability in particular situations.

Equipment is sub-classified into two groups, “essential” and “non-essential”, to accommodate the diversity of areas where airway management occurs. The review encompassed adult, paediatric and obstetric difficult airway management practice requirements. In addition, both public and private environments including small stand-alone single procedural rooms were considered. Finally, the review process considered the diverse range of requirements encountered from tertiary through to very remote areas (https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Community_Affairs/Completed_inquiries/2010-13/rurhlth/report/c05: RA1 – Major cities, RA2 – Inner regional, RA3 – Outer regional, RA4 – remote, RA5 – very remote). Regardless of the site, it is paramount that patient safety overrides consideration of convenience or economy, and therefore, the highest standard of care and equipment should be provided wherever airway management takes place.

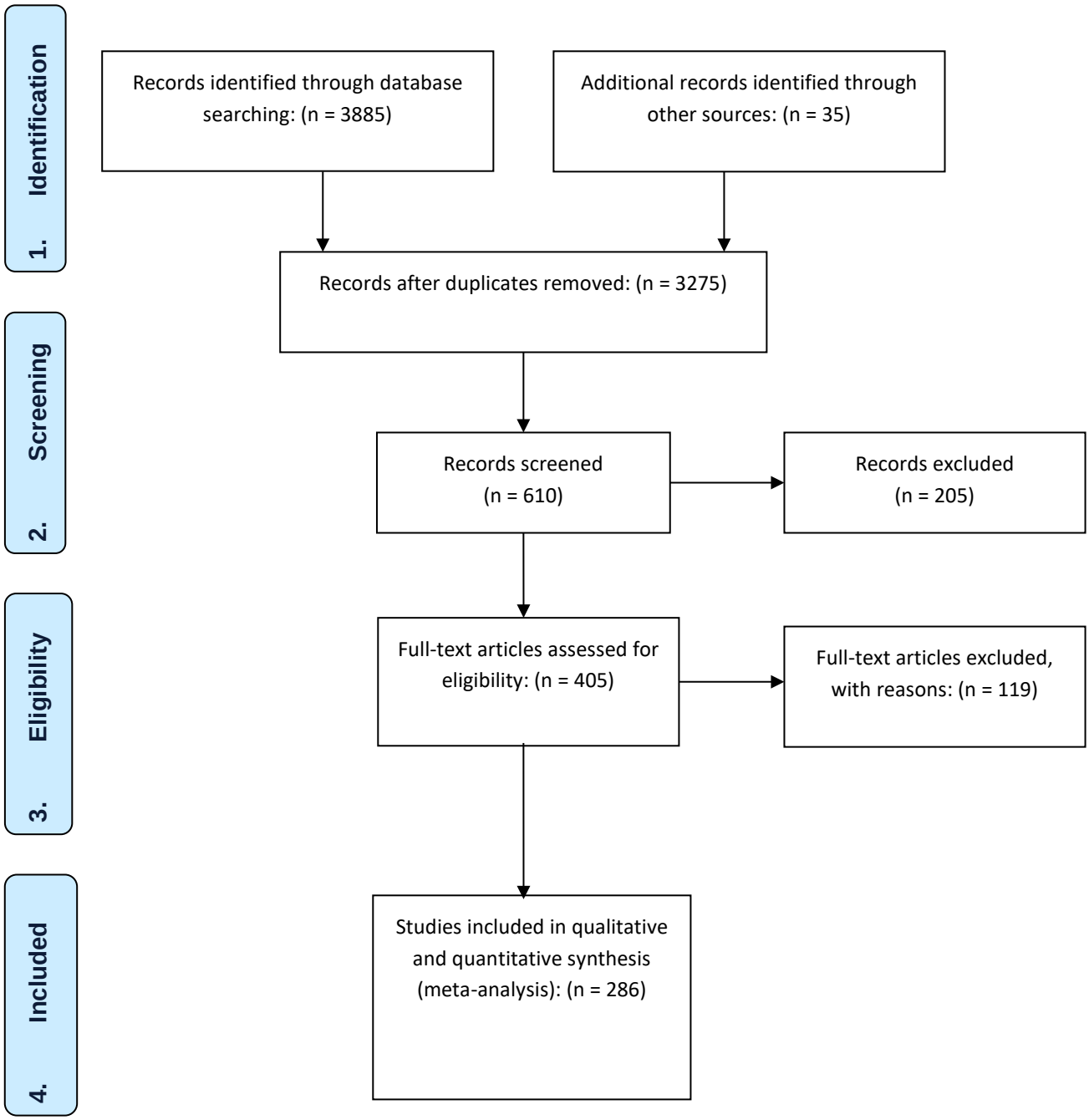
3. Methods

An initial literature search was conducted from 1st January 2009 to 30th June 2019 using databases (Medline Ovid, Cochrane Database of Systematic Reviews) and a search engine (Google Scholar). The websites of the Difficult Airway Society (UK - https://das.uk.com/), Society of Airway Management (https://samhq.com/), European Airway Management Society (http://eamshq.net/index.php) were searched for equipment used in difficult airway management. In addition, the following websites were searched for additional information: American Society of Anesthesiologists (http://www.asahq.org), Australian and New Zealand College of Anaesthetists (http://www.anzca.edu.au), European Society of Anaesthesiology and Intensive Care (ESAIC) (formerly named European Society of Anaesthesiologists' https://www.esaic.org/), Canadian Anesthesiologists' Society (http://www.cas.ca), and the Scandinavian Society of Anaesthesiology and Intensive Care Medicine (http://ssai.info/guidelines/).

4. Results

The literature search results were screened for relevance before allocation to the subgroups (Figure 1). ANZCA *PG61(A) Guideline for the management of evolving airway obstruction: transition to the Can't Intubate Can't Oxygenate airway emergency*[5], continuing professional development resources and previous work developing PG56(A) formed the basis of the review. National and international guidelines and recommendations were considered during this process. An extensive review of the evidence was undertaken, and recommendations were based on the level of evidence whilst also ensuring applicability in all clinical applications from rural to tertiary level health institutions. Special areas of focus included obstetric, paediatric, intensive care and emergency medicine. The Document Development Group (DDG) assessed all previous recommendations as well as new proposals to ensure recommendations were up-to-date and suitable until the next review process in five years.

Figure 1: Results of literature searches
(Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram)



5. Discussion

The founding principles of PG56(A) concern the availability and use of equipment to safely manage any patient with a difficult airway. The application of standards and recommendations to uphold these principles were considered as below.

5.1 General recommendations

5.1.1 Equipment for Difficult Airway Trolleys (DATs) should be fit for purpose.

The fundamental purpose of the accompanying guideline is to ensure that all DATs throughout Australia and New Zealand are fit for purpose. New equipment should be supported by a minimum standard of evidence to justify its purchase. This principle is detailed in the Airway Device Evaluation Project Team (ADEPT) article[6]. In the Difficult Airway Society ADEPT Guidance, the minimum standard is Level 3b (i.e. Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence - single case-control or historical control study)[7]. Chosen equipment should comply with known international standards and recommendations[8, 9]. It is also recommended that before purchase and introduction into clinical service, new equipment should be scrutinised by the Hospital Airway Committee and trialled by medical staff according to committee standards. Ideally, this process would be overseen by the hospital Airway lead (***Strong recommendation for, level of evidence low quality***).

5.1.2 Essential equipment for DATs should be standardised throughout all critical care areas.

This facilitates familiarity with carefully selected equipment, which can then be recognised across all clinical areas where airway management is conducted. Familiarity and confidence with any chosen equipment are key factors contributing to successful outcomes[10]. The “5S” principles (i.e. sort, set in order, sweep, standardise, and sustain) provide the framework to remove unneeded equipment, have logical equipment placement, and maintain improvements resulting in substantial reductions in equipment, cost and set-up time[11]. Changes to their contents should be evidence based, or at least guided by expert advice[12] (***Strong recommendation for, level of evidence low quality***).

5.1.3 Essential equipment for DATs should allow for redundancy and a culture of safety.

Redundancy provides backup when first line ventilation or intubation equipment fails. It is important to recognise that every device and technique is associated with a failure rate, and therefore backup plans and equipment are essential. Redundancy also applies to an immediate alternative to malfunctioning equipment.

Equipment stored in DATs can reflect local preference as well as compliance with any minimum requirements defined in PG56(A). Urgency of use may reflect priority for inclusion. Many facilities store emergency front-of-neck access (eFONA) equipment in each operating site, ready for immediate use. Equipment required for use ideally within 1 minute can be stored within DATs. Other specialised equipment should be sourced within 5 minutes[2] (***Strong recommendation for, level of evidence low quality***).

A culture of safety is a crucial component of *PG56(A) Guideline on equipment to manage difficult airways*. Patient safety overrides considerations of convenience or economy.

The contents of DATs should be checked for absence, malfunction, damage, contamination, expiry and misplacement of equipment and resources. This should be performed and recorded at least weekly according to a check list, which should be permanently attached to the trolleys. An additional check should occur whenever any DAT has been used. Particular areas of concern are laryngoscopes, where light

emission should comply with international standards[9] (***Strong recommendation for, level of evidence moderate quality***).

Removal of airway equipment from airway containers is very common. In a study of 22 DATs, 14 had content lists, but only 50% had contents corresponding with the check lists[1]. Therefore, there needs to be a system of checking and signing the content list. Checklists and template use with cognitive aids can reduce variation in equipment location within the container and errors of omission[13] (***Strong recommendation for, level of evidence moderate quality***).

5.1.4 Equipment within the DAT should meet recognised infection control standards.

Some infection control units recommend single use laryngoscope blades so as to reduce surface contamination and patient infection. However, this initiative is offset by the spiralling cost of disposable items. Environmental impact and laryngoscope cost is minimised when high level disinfection is applied to reusable stainless-steel laryngoscopes[14]. Equipment within DATs must comply with industry recommendations for handling and also national standards[8, 9]. Sterilisation of endoscopes should comply with following ANZCA Professional Documents:

- PG28(A) Guideline on infection control in anaesthesia (2015)
- PS55(A) Position statement on minimum facilities for safe administration of anaesthesia in operating suites and other anaesthetising locations (2021)

5.1.5 Effective and timely training prior to patient contact to avoid morbidity and mortality is recommended for all equipment in any DAT.

Previous adult and paediatric surveys have shown a lack of confidence with DATs because of missing or faulty equipment or lack of confidence using the equipment[1, 12]. Morbidity and mortality have been reported due to practitioners using equipment without adequate training[15]. Examples of this problem include the use of video-laryngoscopes, airway exchange catheters and jet ventilators[16-18]. Formal training and recent use of the equipment are directly correlated with confidence using that equipment[10].

It is recommended that regular in-service education is conducted to teach practitioners about the proper use of airway management equipment. Familiarity with equipment that is used only occasionally in an emergency is particularly important. In an emergency, any staff member may be required to retrieve the DAT and assist by locating equipment within it. DATs and grab-bags require clear labelling and a logical layout to assist efficient use[19, 20] (***Strong recommendation for, level of evidence low quality***).

5.1.6 Capnography should be immediately accessible wherever emergency airway management occurs. This is particularly relevant for the safe management of the difficult airway.

The importance of capnography was emphasised in the previously published version of ANZCA PG56(A) in Anaesthesia and Intensive Care[2]. It was also recommended in the 4th National Audit Project of the Royal College of Anaesthetists and Difficult Airway Society 2011 where it is stated “Capnography should be used during all intubations, irrespective of the location”[21] (***Strong recommendation for, level of evidence moderate quality***).

The Australian and New Zealand College of Anaesthetists *PG18(A) Guideline on monitoring during anaesthesia*[22] recommends the routine use of capnography during anaesthesia. In addition, it states “a monitor of the carbon dioxide level in inhaled and exhaled gases should be immediately available for any patient undergoing sedation”. The background document includes the following: “For sedation techniques that do not require airway instrumentation capnography is optional and should be determined by the patient’s clinical requirement and depth of sedation, and not the availability (or lack thereof) of suitable equipment”[23]. There are currently no guidelines for the use of capnography during emergency airway management outside the operating theatre

including post-anaesthesia care units (PACU) and sedation in off-site health care institutions, including stand-alone gastroenterology units.

In contrast, the following groups recommend the routine use of capnography during sedation:

- The Association of Anaesthetists of Great Britain & Ireland (AAGBI) Standards of Monitoring require an "end-tidal carbon dioxide monitor if the patient is sedated" in locations outside the operating theatre[24]. The AAGBI Safety Statement for the use of capnography outside the operating theatre states "Continuous capnography should be used for all patients undergoing moderate or deep sedation"[25].
- The American Society of Anesthesiologists Standards for Basic Anesthetic Monitoring include the following "During moderate or deep sedation the adequacy of ventilation shall be evaluated by continual observation of qualitative clinical signs and monitoring for the presence of exhaled carbon dioxide unless precluded or invalidated by the nature of the patient, procedure, or equipment"[26].
- Guidelines to the Practice of Anesthesia prepared by the Canadian Anesthesiologists' Society (CAS) require "capnography… to assess the adequacy of ventilation for moderate or deep procedural sedation"[27].

Based on the recommendations of these international authorities, it is recommended that wave-form capnography should be used during emergency airway management (including emergency tracheal intubation and eFONA) outside the operating theatre including in PACU and off-site health care institutions such as stand-alone gastroenterology units (***Strong recommendation for, level of evidence strong quality***).

The use of colorimetric CO_2 detection is recommended for emergency airway management in areas, such as in the hospital ward, where wave-form capnography may not be available. It should be noted that colorimetric CO_2 is very sensitive to low CO_2 values. It may detect CO_2 in the oesophagus and falsely indicate correct endotracheal intubation[28, 29]. Therefore, results from a colorimetric CO_2 detector should be checked as soon as possible. However, it has a role in the grab bag for clinical scenarios where wave-form capnography is not available (***Strong recommendation for, level of evidence strong quality***).

5.2 Difficult airway trolley design

Equipment required for difficult airway management should be stored and organised in such a way that it is immediately recognisable and accessible to all clinicians involved in managing airways or assisting in airway management. Difficult airway trolleys are containers for storage of resources to manage difficult airways. Whilst modern difficult airway trolleys should be comprehensive in their contents, it is important that obsolete equipment does not clutter the space and impede access to commonly used and proven aids[30]. Familiarity with standardised difficult airway trolleys will expedite management of difficult airways in all clinical areas. Additional equipment may form part of these trolleys when clinicians are skilled in its use.

5.2.1 Definitions:

- Difficult airway trolley (DAT) - a container for storage of resources to manage expected and unexpected difficult airways.
- Grab-bag - a container for rapid deployment to areas not readily serviced by the comprehensive container.
- Essential equipment – equipment and devices, found on DATs, that are considered essential for the management of difficult airways in any location.
- Non-essential equipment – equipment and devices that may be added to DATs if operators have been trained in their use and have an ongoing volume of practice.

5.2.2 General features

The 4th National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society (NAP4) audits[21, 31] highlighted the need for significant changes to airway management. To that end, this revision of PG56(A) has examined all aspects related to DATs and simplified as well as standardised their contents where possible[30, 32]. Consideration has been given to equipment and devices that are considered essential for the management of difficult airways in any location.

DATs have evolved from heavy steel constructed sets of drawers confined to operating theatres to modern equivalent, light weight, highly manoeuvrable containers present in all critical care areas. The overall design of DATs should keep pace with the demands of modern difficult airway management. The "footprint" of modern DATs has increased, as more bulky equipment is required. Inclusion of large items such as flexible bronchoscopes, videolaryngoscopy screens, ultrasound for front-of-neck access and a variety of airway exchange catheters mentioned for use in difficult airway management guidelines, have made rapid transit of DATs problematic. This review includes an assessment of design features that enhance mobility and rapid transfer.

5.2.3 Application of occupational ergonomics to DAT design

Human factor and ergonomics (HFE) design is an important feature of modern DATs as large equipment is added over time. Integral to current DAT design is consideration of how to store bulky components such as monitors for videolaryngoscopy, flexible bronchoscopy and ultrasound as well as high flow nasal oxygen. While there may be a natural tendency to centralise this equipment by directly mounting them to DATs, the potential for weight maldistribution and excessive size is likely to significantly impact manoeuvrability. In addition, mounting monitors onto DATs may prevent optimal placement of monitors at the point-of-care.

Siting of monitors in relation to the operator and patient is rarely addressed in anaesthesia but is frequently considered by other medical specialties such as laparoscopic surgeons and gastroenterologists. These specialists often place their monitors in line with their hand movements and visual field. It has been shown that task performance improves when monitors are placed in front of the operator, at a level below the head and close to the hands[33]. Therefore, it is recommended that visual interface design features of DAT monitors and other large difficult airway equipment should be considered during planning. This includes using videolaryngoscopy monitors attached to articulating arms, which allow optimal placement of monitors over patients' chests and facilitate the associated four step technique (mouth-screen-mouth-screen) (***Strong recommendation for, level of evidence low quality***).

5.2.4 Signage

DATs should be easily recognisable as well as being suitably labelled to ensure efficient deployment of DAT equipment. There should also be signs attached to them to ensure ease of identification by all personnel. Critical care areas should have signs indicating the location of the nearest DAT. In the event that any DAT is moved, there should be a card system or sign-out board indicating the location to where it has been moved as well as the location of any alternative DATs should more than one difficult airway management scenario occur (***Strong recommendation for, level of evidence low quality***).

5.2.5 Labelling of drawers

It is recommended that the contents of each drawer be labelled to facilitate rapid and accurate access. This labelling system should be both printed and pictorial. It is not recommended that educational guidance to any difficult airway algorithms (including "Plan A", "Plan B" etc.) should be used when labelling drawers. Such guides are part of difficult airway algorithms and so should be attached to the outside of DATs in the form of "flash card" style guides.

5.2.5.1 Printed labels

There is no medical research on the typography to be used specially for difficult airways. The following are recommendations based on information from Standards Australia[34] and suggestions for NASA flight-deck typography[35].

Printed labels should be concise and easy to read at a distance. Lettering should have the following features:

- Clean and simple font such as Modern Sans-Serif including Arial, Calibri and Gill Sans and Gill San MT.
- Avoid documenting entire inventory on front of drawer – preference for device groups only with further labelling inside drawer as required.
- Avoid using all capitals – capital for first letter then lower case to assist with reading (lower case characters are more legible than when using all upper case).
- No underline or italics but bold font may have some advantage.
- Size of font and spacing of words should be maximal to fit drawer front.

Recommendation for labelling DATs (see Appendix: Recommended labels for DAT drawers):

- Font - Gill San MT.
- Font size - 80 Bold (approximately 2.75cm height and stroke width > 0.3cm). (these sizes are used so that viewing from over one metre away is possible in variable illumination conditions)
    - Facemask: Black font on White background
    - Supraglottic approaches: Dark blue font on White background
    - Direct laryngoscopy and videolaryngoscopy: Dark green font on White background
    - Front-of-neck airway: Black font on Yellow background (in the military pilot setting, this is associated with caution)

(***Strong recommendation for, level of evidence low quality***).

5.2.5.2 Pictorial representation

Semiotics is the study of signs and symbols (visual and linguistic) and their use. There are no icons (i.e. a sign whose form suggests its meaning) in airway management, which are universally accepted or recognisable for labelling. In contrast, pictographs are pictures, which resemble what they signify and are therefore, more likely to be recognised by staff members who are required to locate and deliver DATs to an airway management crisis. These pictographs should be simple and easily recognisable as stand-alone features. Pictographs should be near the printed label to assist in identification of the required drawer (***Strong recommendation for, level of evidence low quality***).

5.3 Access to DATs

Wherever airway management is or may be required, essential equipment for the institution, restoration and maintenance of oxygenation must be available and ready to use. This “point-of-care” equipment includes an oxygen supply, suction, and essential airway management devices (see *PS55(A) Position statement on minimum facilities for safe administration of anaesthesia in operating suites and other anaesthetising locations*).

However, timely access to DATs is also required as oxygenation may be difficult with basic essential airway equipment or where restoration of oxygenation alone may be inadequate for ongoing care of patients with difficult airways. The additional DAT equipment aims to assist in the rapid return and maintenance of oxygenation. Duplication of certain equipment items is essential as an important backup for life saving equipment that may malfunction or be absent and consequently, likely to threaten patient safety.

In a crisis, time is critical and includes the time taken to make a decision that a DAT is required, time to access and deliver the DAT to the point of care, and finally time to effectively restore oxygenation and secure the patient's airway[36].

Farmery and colleagues[37] proposed a model to describe the time course of oxyhaemoglobin desaturation during apnoea which incorporates various pathophysiological abnormalities such as obesity, age and postoperative conditions. Benumof[38] used Farmery's model to calculate times for significant life threatening haemoglobin desaturation ($SaO_2 \leq 80\%$) with initial $FAO_2 = 0.87$ during complete obstructive apnoea for various patients receiving 1 $mg.kg^{-1}$ of intravenous suxamethonium in the CICO situation.

- a healthy 70kg adult - 8.7 minutes
- the moderately ill 70kg adult - 5.5 minutes
- a healthy 10kg child - 3.7 minutes
- an obese 127kg adult - 3.1 minutes

Benumof's calculations are based largely on a mathematical model of haemoglobin desaturation during apnoea[37], duration of succinylcholine effect derived from other articles[39, 40] and what constitutes functional neuromuscular recovery to ensure adequate ventilation. Despite these weaknesses, these calculations provide a reasonable framework for managing difficult airways[36].

The time taken for recognising that a DAT is required and for securing the patient's airway should be as short as possible to optimise the chance of a good outcome. Therefore, it is recommended that essential equipment should be portable and rapidly available within the operating room, operating room suite or off-the-floor site, ideally within 60 seconds. Supplementary equipment should be available within five minutes (***Strong recommendation for, level of evidence low quality***).

- **Availability of DATs**

  The number of DATs required is dependent on the number of anaesthetising locations, acuity of difficult airway likely to be managed, patient co-morbidities and the level of anaesthesia training and experience of treating personnel. For example, difficult airway management training involving head and neck surgical procedures in several operating theatres are more likely to require multiple DATs than lower acuity procedures. It is recommended that Airway leads have a significant role in deciding the number and location of DATs (***Strong recommendation for, level of evidence low quality***).

  Note: If any anaesthetising areas are more than one minute away from the closest DAT, they will require a dedicated DAT independent of the number of anaesthetising areas.

5.4 Documents recommended to be attached to DAT

5.4.1 Guidelines

ANZCA recommends consideration of the following:

- Australian and New Zealand College of Anaesthetists *PG61(A) Guideline for the management of evolving airway obstruction: transition to the Can't Intubate Can't Oxygenate airway emergency*[5] for CICO management.
- Difficult Airway Society's (DAS) guidelines for the management of the difficult airway. The choice of these guidelines is dependent on the critical area serviced by the DAT:
  Anaesthesia[41]:
  https://das.uk.com/guidelines/das_intubation_guidelines
  Intensive Care[42]:
  https://das.uk.com/files/2017/page/DAS_ICU_guidelines.pdf
  Obstetric[43]:
  https://das.uk.com/files/01-15%20DAS-algorithms-web-PRINT20092015.pdf
  Extubation[44]:
  https://das.uk.com/guidelines/das-extubation-guidelines1

  Other guidelines are available and include:

- Canadian[45, 46]: (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3825644/pdf/12630_2013_Article_19.pdf) (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3825645/pdf/12630_2013_Article_20.pdf)
- United States of America[47]: (https://anesthesiology.pubs.asahq.org/article.aspx?articleid=1918684)

Orientation, education and regular interdisciplinary training based on chosen guidelines should be attached to DATs along with ANZCA PG61(A) (***Strong recommendation for, level of evidence low quality***).

5.4.2 Cognitive aids

Further research is required to determine whether cognitive aids are associated with any improvement in team behaviour during airway emergencies[48], although there is some evidence that cognitive aids may improve non-technical skills[49].

There are many cognitive aids and checklists available for use prior to and during airway management crises. Below is a list of some of these aids. Until further research is performed, it is recommended that their suitability be assessed by specialist medical practitioners. Where applicable, any relevant cognitive aids should be introduced through local peer-review, and attached to their DATs (***Strong recommendation for, level of evidence low quality***).

Suggested cognitive aids include:

- PG61(A) Guideline for the management of evolving airway obstruction: transition to the Can't Intubate Can't Oxygenate airway emergency
- DAS: https://das.uk.com/content/dat_labels
- Vortex approach[50]: http://vortexapproach.org/downloads
- PACU: https://www.baets.org.uk/management-of-post-operative-haemorrhage/
- Paediatrics: https://www.rch.org.au/clinicalguide/guideline_index/Emergency_airway_management/
- DAS – ICU checklist: https://das.uk.com/guidelines/icu_guidelines2017

In addition, several generic cognitive aids may assist in triggering action during airway management crises. Two cognitive aids suggested for use prior to embarking on airway management are shown in figure 2 and 3.

5.4.3 Audit lists

DAT contents should be audited on a regular basis. This should include checking expiry dates of all contents and capabilities of batteries to hold suitable charge.
A list of contents with dates of audit should be attached.

5.4.4 Emergency contact telephone numbers

Emergency contact numbers for rapid response team members should be attached to DATs. These may include senior anaesthetists, intensive care medicine physicians, and surgeons including Ear, Nose and Throat (ENT) surgeons. Alternatively, a single emergency switch telephone number may replace these numbers.

5.4.5 Difficult airway alert letters

Difficult airway alert letters should be readily available on or closely associated with DATs for use after any crisis has been successfully managed. Specialists are encouraged to complete alerts and provide them to their patients as soon as practicable after the crisis along with a full debrief and emphasising the importance of the airway alert notification.

- www.difficultintubationapp.com
- https://clinicalexcellence.qld.gov.au/priority-areas/clinician-engagement/statewide-clinical-networks/anaesthesia-and-perioperative-1

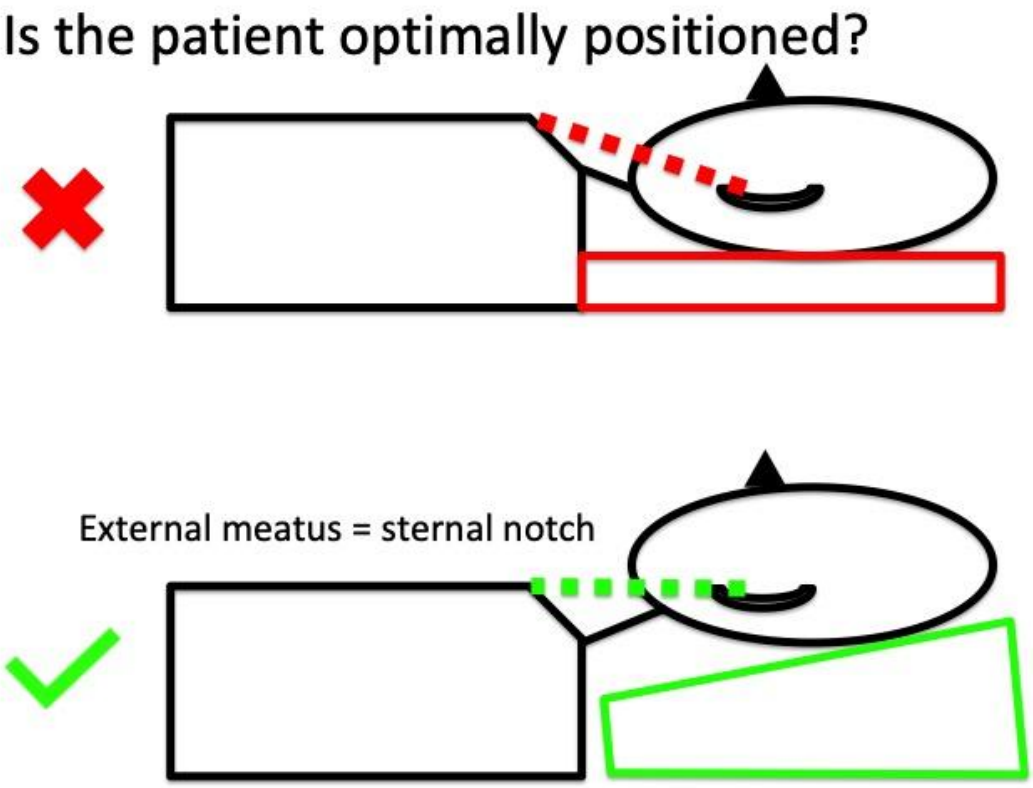


Figure 2: Cognitive aid to check correct head and neck positioning for airway management.

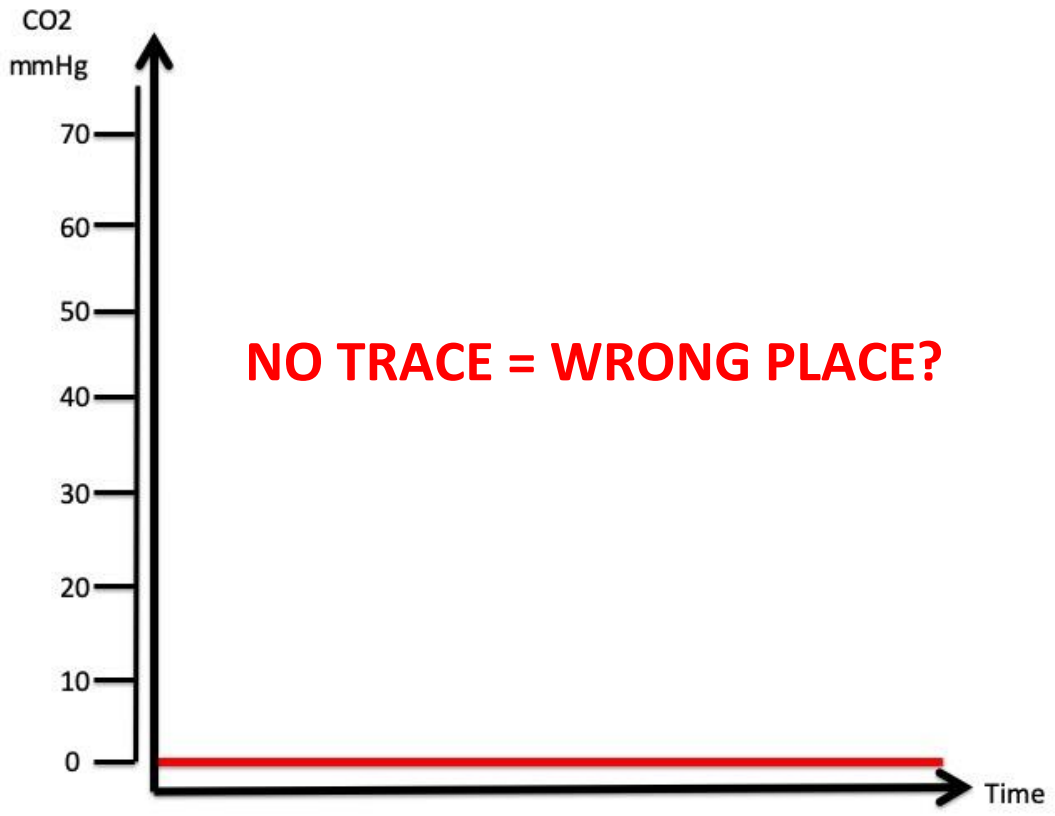


Figure 3: "No trace = Wrong place?" cognitive aid reminding the operator that no capnograph tracing requires immediate removal of airway device and ongoing management.

5.5 Sugammadex (Bridion®; Schering Plough, Kenilworth, NJ, USA)

There have been reported cases of both successful[51-53] and unsuccessful[54, 55] use of sugammadex to reverse susceptible neuromuscular blockade and avoid can't intubate, can't oxygenate (CICO) scenarios. Two simulations[56, 57] have shown that sugammadex is not a reliable agent for avoiding CICO scenarios.

Preventive management of CICO scenarios should focus on airway assessment, and availability of equipment to restore and maintain airway patency and oxygenation. While neuromuscular reversal by sugammadex may successfully avert a CICO scenario, it is not a reliable rescue plan and consequently, is not recommended as an essential item to be stored in DATs. Nevertheless, sugammadex should be available for difficult airway management in a secure but easily accessible (unlocked) location (***Weak recommendation for, level of evidence low quality***).

5.6 A portable emergency airway management kit ("Grab Bag")

A grab-bag is a generic term for a portable emergency container that contains recommended difficult airway management equipment for rapid deployment to clinical areas not readily serviced by the comprehensive container, that is, areas that are more than four minutes from the nearest DAT. If airway management is routinely undertaken in an area more than eight minutes from any DAT, then a DAT should be pre-arranged specifically for the site prior to commencing airway management. Grab-bags are not a replacement for DATs in areas where routine airway management is regularly conducted.

The contents of any grab bag should reflect the patient population. Two types of grab-bags are described: one for adults and adolescents, and another for paediatric patients.
It is recommended that Airway leads should have an active role is ensuring the equipment reflects the needs of their clinical area. Airway leads should run emergency airway management crisis simulations to ensure that equipment is packed in such a way that there is minimal disruption to other equipment in the bag.

Design for quality control includes breakable seals, checklists, moulded compartments and compliance with sterility requirements (refer to *PG28(A) Guideline on infection control in anaesthesia* and *PS55(A) Position statement on minimum facilities for safe administration of anaesthesia in operating suites and other anaesthetising locations*).

5.7 Contents of DATs

5.7.1 Facemasks

- **Adult**

  The incidence of difficult facemask ventilation has been described as 1 in 100[58-61]. However, the basic design of facemasks has not changed in 100 years[62]. Ideally, a good seal should be achievable with minimum leak, and minimal dead space, while being transparent, lightweight and low cost.

  The traditional black silicon rubber mask was antistatic, heavier than plastic disposable face masks and not transparent. These contoured masks perform well in clinical practice[63-66]. However, for daily practice, most institutions are equipped with transparent, single use, plastic facemasks[63-66], which vary in quality, design and efficacy. Designs include facemasks with inflatable air cushions (with or without inflation valves) and those that mould to the face.

  Studies comparing facemasks have shown a significant variation in the functionality of single use and reusable facemasks to provide oxygenation and ventilation[65]. Various designs, materials and sizes are commercially available. A variety of conditions are associated with difficult bag-mask ventilation[59] and the selection of good quality face masks is important. The departmental Airway lead has an important role in evaluation and acquisition of facemasks to be stocked in DATs.

  Note: paediatric facemasks and laryngeal masks may provide an excellent seal over adult tracheostomy stomas. If applicable, Airway leads may consider storing this equipment in adult DATs.

  The use of single use airway management equipment has increased significantly over the years[67] and anaesthesia facemasks are among the most commonly used single use airway devices. Future aims should include reducing plastic waste for environmental reasons. Health practitioners and administrators should ensure that the impact on global climatic conditions and water scarcity become a major consideration in the choice of equipment[68, 69].

- **Paediatric**

  A range of paediatric facemasks is commercially available. The Rendell-Baker-Soucek style mask is made of either malleable rubber or silicone. It has a small dead space and provides an excellent seal due to its contoured shape. Other facemasks are made of rubber or plastic with either a flexible lip or air-filled cushion. Airway leads or any Airway Management Special Interest Group (SIG) executive committee member should be consulted when choosing paediatric facemasks for DATs.

5.7.2 Adult and paediatric self-inflating resuscitation bags

These bags do not need a gas source to operate but their main disadvantage is the lack of operator “feel” when there are changes in respiratory compliance and/or resistance. Several studies indicated that there was a high tendency for hyperventilation with

currently used adult self-inflating bags and a recommendation was made to use paediatric-sized bags instead[70, 71].

It is essential that self-inflating resuscitation bags can be connected to all airway devices including masks, supraglottic airway devices (SADs), and ETTs. The ability to achieve this requires that any attached airway device can be readily detached.

These should be available at the point-of-care where airway management occurs (including general anaesthesia, sedation as well as intensive care and emergency medicine departments). Self-inflating resuscitation bags may be considered for inclusion in DATs in case point-of-care equipment malfunction. In addition, inclusion of a self-inflating resuscitation bag is recommended as part of the "Grab Bag" (***Strong recommendation for, level of evidence moderate quality***).

5.7.3 Laryngoscope blades

When tracheal intubation by direct laryngoscopy has been declared unsuccessful, ANZCA PG61(A)[5] recommends varying the type and size of laryngoscope, or converting to videolaryngoscopy and in some circumstances bronchoscope-guided intubation via a supraglottic airway device. Similarly, the Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults[41] state that the first and second choice of laryngoscope will be determined by the anaesthetist's experience and training.

The choice of videolaryngoscopes and optical stylets is discussed elsewhere in this document.

The two common types of Macintosh blade designs are the English and the Standard (or American)[72]. Compared with the Standard blade, the English blade is longer, its curve is more continuous across the entire length of the blade, the height of the blade flange is shorter, and it continues to the tip. These design features have been shown to be advantageous in difficult airway scenarios[73]. ANZCA recommends that DATs for adult use store 3 and 4 size English style Macintosh blades with handles (***Strong recommendation for, level of evidence moderate quality***).

- **Straight laryngoscope blades**

  These may be considered for patients with anterior column problems including prominent maxillary incisors, retrognathia, large tongue and large floppy epiglottis[74]. The Miller straight blade with its low profile produces a higher pressure on the submandibular tissues with the same force (pressure = force/area), and can be used to lift the epiglottis directly[75] to facilitate intubation. There is evidence to support better success rates with straight blades as a rescue device when the Macintosh blade has failed[76, 77]. However, comparative studies of straight blades and videolaryngoscopy are lacking. As the paraglossal technique for straight laryngoscope blades is different from Macintosh blades, training and ongoing volume of practice is recommended for optimal use. It should be recognised that while straight blades provide better laryngoscopic views, the incidence of difficult intubation due to the narrower field of vision is increased[78].

- **Corazelli, London, McCoy (CLM) laryngoscope blades**

  When "McCoy" laryngoscope blades are in their flexed position, they apply pressure at the base of the tongue lifting the epiglottis anteriorly and are therefore, suitable for posterior column problems (e.g. manual inline stabilisation of head and neck[79, 80]) where the mandible and submandibular tissues are normal. However, the effect of this levering action of McCoy blades has not been shown to consistently improve laryngeal view[81, 82]. When compared to Glidescope™ videolaryngoscopes, McCoy laryngoscope blades resulted in longer tracheal intubation times in bariatric patients[83].

  - **Recommendations concerning Straight and McCoy laryngoscope blades**

Advanced equipment, such as videolaryngoscopy and the common availability of flexible bronchoscopes and intubation guides/bougies, may prove to be better alternatives to difficult airway management. While evidence is currently lacking, it is recommended that Straight and McCoy laryngoscope blades are not required in DATs unless operators have been trained in their use and have ongoing volume of practice (***Weak recommendation for, level of evidence moderate quality***).

- **Obstetric laryngoscope blades and short handle laryngoscopes**

  Obstetric (Kessel's) laryngoscope blades[84] and short handle laryngoscopes have been suggested for direct laryngoscopy of pregnant patients. These devices may also be beneficial for direct laryngoscopy of patients with obesity, kyphosis, severe barrel chest deformity and restricted movements of the neck. However, there is a growing use of videolaryngoscopy as either a first-line device for these conditions or as a rescue airway management device.

  - **Recommendations for obstetric laryngoscope blades and short handle laryngoscopes**

    It is recommended that obstetric laryngoscope blades should not be included in DATs unless operators have been trained in their use and have ongoing volume of practice (***Weak recommendation for, level of evidence moderate quality***). Currently there are no videolaryngoscopes with short handles commercially available. However, short handle laryngoscopes may be useful for managing patients with large antero-posterior chest diameter (e.g. "barrel" chest and bariatric patients with large breasts). It is therefore recommended that a short handle laryngoscope should be included in DATs (***Weak recommendation for, level of evidence moderate quality***).

- **Paediatric laryngoscope blades**

  Given that the size of paediatric patients in the adolescent age group can approach that of adults, it is recommended that Macintosh blades sizes 1, 2, 3, and 4 and straight blades, such as Miller blades, sizes 0, 1, 2 should be included in paediatric DATs (***Strong recommendation for, level of evidence moderate quality***).

5.7.4 Tracheal tube Introducers, guides and catheters

- **Tracheal tube introducers**

  Uses for tracheal tube introducers include difficult intubation, difficult extubation, placement of second-generation laryngeal mask airways and cricothyroidotomy[85]. In some the distal tip is angled at approximately 35 degrees (Frova®). Others are malleable whilst newer devices may have a flexible/steerable tip. Success rates for various Eschmann-style tracheal tube introducers vary[86, 87] and there is a lack of comparative studies examining their performance[6].

  The peak force exerted by some intubating introducers is higher than that by others[86]. This has led to concerns that some introducers may be responsible for airway trauma especially when "hold ups" and "clicks" are elicited[88-90]. Underreporting of airway trauma is likely and further research into this area is required[85]. Until then, devices such as "traffic light" introducers[91] and identifying these risks during training sessions may lower the incidence of these complications.

  There are studies showing shearing of the introducer tip especially when railroading double lumen tubes[92-94]. Operators should be aware of which Intubating Introducers are intended for use with double-lumen tubes.

  Airway leads have an important role in managing procurement and use of tracheal tube introducers at the point-of-care and in DATs. It is recommended that tracheal tube introducers with a 35 degrees Coudé tip should be stored in the DAT. Ideally,

tracheal tube introducers should be stored in a straight position and not folded (***Strong recommendation for, level of evidence moderate quality***).

- **Airway exchange catheters**

  Airway exchange catheters can be used as a safety adjunct when exchanging tracheal tubes or as part of an extubation technique[95, 96]. However, it is recommended that hollow exchange catheters are not used for oxygenation due to the significant risk of barotrauma[15, 18, 97-100]. For any patients in extremis and where oxygenation is critical for survival, then administration of low flow oxygen at 1 to 2 L/min via the lumen of the airway exchange catheter may be considered[99]. However, it should be noted that this has been not substantiated by clinical trials and clinicians must weigh any potential benefit against the risk of volume and baro-trauma, especially in the absence of an exhalatory pathway. Storage of catheters 11Fr and 14Fr in DATs is recommended, and ideally, they should not be stored folded (***Strong recommendation for, level of evidence moderate quality***).

- **Paediatric exchange catheters and tracheal introducers**

  The following are suggested sizes to be included in DATs[101]:
  - Tracheal tube introducers sizes 5Fr and 10Fr
  - Malleable stylets (size 2Fr and 5Fr)
  - Exchange catheters and minimal internal diameter of corresponding tracheal tube:
    7Fr: ≥ 2.5 mm; 8Fr: ≥ 3.0 mm; 11Fr: ≥ 4.0 mm; 14Fr: ≥ 5.5 mm; 19Fr: ≥ 7.0 mm

- **Intubating catheters**

  The most widely available of these is the Aintree Intubating Catheter ™, which is a hollow catheter 56cm long, 6.5mm outer diameter and 4.7mm inner diameter. It is used over flexible bronchoscopes (preferably 4 mm or less) and in association with supraglottic devices for difficult tracheal intubation[102]. The smallest tracheal tube that can be easily railroaded over Aintree intubating catheters has an internal diameter of 7mm. It is recommended that Aintree Intubating Catheters ™ are included in DATs. Ideally, these catheters should not be stored folded (***Strong recommendation for, level of evidence moderate quality***).

- **Tracheal extubation**

  Airway exchange catheters have been used to allow airway access after extubation and re-intubation if needed. Most studies have examined 11Fr and 14Fr size catheters[95, 103] and showed they are well tolerated by patients. The largest catheter (19Fr) is suitable for only 50% of patients[95].

  Staged extubation strategies include inserting a wire for continuous airway access and a staged reintubation catheter to railroad over the wire and facilitate reintubation. The guidewire is generally well tolerated by patients in ICU[104-106]. However, a simulation study showed a failed reintubation rate of 8.3% and significant technical difficulties in another 17.3% of intubation sequences. Staged extubation may be inferior to using an airway exchange catheter for reintubation[107]. Further research is required to clarify its place in a strategic extubation plans and whether it should be stored in DATs.

5.7.5 Tracheal tubes

Microlaryngeal tracheal tubes (MLT) are particularly useful for managing narrowed airways. The Parker Flex-Tip™ tube and the laryngeal mask airway LMA-Fastrach™ silicone tracheal tube [108, 109] have higher success rates when railroaded over a flexible bronchoscope.

5.7.6 Rigid indirect laryngoscopy devices (including videolaryngoscopes)

These devices are often classified by the method of image transmission back to the viewfinder. McGuire and Younger[110] have proposed a new classification based on the method of passing the tracheal tube through the glottis.

Research comparing videolaryngoscopy with direct laryngoscopy is heterogenic with variable outcomes and often affected by operator expertise, degree and type of difficult airway studied, and type of videolaryngoscope used. Videolaryngoscopy has been shown to reduce the number of failed intubations (particularly among patients presenting with a difficult airway), improve glottic view and reduce airway trauma[111]. Currently, there is no evidence that videolaryngoscopy reduces the number of intubation attempts, incidence of hypoxia, respiratory complications[112, 113], or time required for intubation[114, 115]. This may also apply to difficult airways[116-118] in the paediatric cohort but further research is required[101].

Use of videolaryngoscopy has been suggested as a first line laryngoscopy device during elective anaesthesia[119]. This argument is supported by the challenging task for all specialties to reliably predict airway difficulties and the need to be prepared for unexpected difficulties[120]. However, operators need a thorough understanding of how these devices function and their limitations[121].

Videolaryngoscopy has been suggested as first line laryngoscopy device in specific clinical areas such as obstetric anaesthesia[122-124], bariatric anaesthesia[125], intensive care[42, 113, 126] and emergency medicine[126-130]. In routine anaesthesia, however, it may be argued that videolaryngoscopy should be considered as a rescue airway device due to the low incidence of anatomical, physiological and psychological (or situational) difficult airways as well as anaesthetists having a greater volume of practice in both normal and difficult airway management.

Evidence to support any particular type of videolaryngoscope design for specific difficult airway scenarios is lacking. It is therefore, recommended that both Macintosh style and hyperangulated blades are available on all DATs so that a wide range of difficult airways may be successfully managed. Tracheal tube introducers suitable for each type of videolaryngoscopy blade should also be available.

This includes the following:

- Macintosh style videolaryngoscopy: tracheal tube malleable stylet and tracheal tube introducer with a Coudé tip of 35 degrees.
- Hyperangulated blade videolaryngoscopy: tracheal tube malleable stylet and tracheal tube introducer shaped in a similar manner to the hyperangulated blade shape or an intubating bougie/guide with a flexible/steerable tip.

There is a wide range of designs and costs for videolaryngoscopes on the current market[131, 132]. The choice of any particular device depends on individual case scenario, local resources, operator familiarity, and dexterity with the device[133]. It is recommended that Airway leads, or any Airway Management SIG committee member should be consulted prior to procurement of a videolaryngoscope to ensure it meets the needs of local specialties performing airway management.

Laryngoscope blades may be single-use or reusable. Single-use blade devices include those with sheaths that fit over an articulating arm or low-cost metallic blades[134]. However, disposable sheaths have a larger profile than metallic blades. This larger profile may lead to difficulty manipulating the videolaryngoscopy blade, tracheal tube, and introducer in a narrow airway[135] in high acuity difficult airway scenarios. Low profile videolaryngoscopes with high resolution monitors, are suitable alternatives for managing high acuity difficult airways. Unfortunately, these devices are costly and may be considered as a backup in clinical areas using multiple lower cost videolaryngoscopes.

It is recommended that Macintosh style and hyperangulated videolaryngoscopy blades should be readily available in DATs. They may be stored in the “laryngoscopy” drawer along with Macintosh blades or attached to the bedside videolaryngoscopy monitor. In

situations where videolaryngoscopy is used as the first line laryngoscopy device, this backup videolaryngoscopy should be available in DATs in case of device failure at the point-of-care. As videolaryngoscopy becomes more commonly available, it is important that videolaryngoscopes on DATs are used solely for emergency difficult airway management (***Strong recommendation for, level of evidence moderate quality***).

5.7.7 Guided devices

These have a rapid learning curve, and are easier to use than a Macintosh blade for direct laryngoscopy[136-140] but there is a similar decline in intubating skills as with the Macintosh blade over time[141]. Guided devices appear to be superior devices for novice personnel to perform tracheal intubation on patients with limited cervical mobility, pregnant women, and obese patients[142]. They are recommended for inclusion in DATs when more versatile videolaryngoscopy devices are not available and when operators have suitable training and ongoing volume of practice (see Table 2) (***Weak recommendation for, level of evidence moderate quality***).

5.7.8 Optical stylets

Literature shows a high success rate for laryngoscopy and intubation using these devices[143-146]. This does not always translate into higher intubation success rates or faster intubation time, especially when performed by less experienced operators[147-151]. In addition, there is a general lack of studies examining the use of optical stylets in clinical practice. Most of the data comes from small studies and frequently involves patients with normal airways[152]. Similarly, there is limited research in the use of optical stylets in the paediatric population[153-155].

There are economic issues with the provision of these items which have a high initial capital cost and ongoing maintenance[110] cost as well. The current evidence does not indicate a strong case for these devices unless they are used on a regular basis in both normal and difficult airway scenarios[152]. Optical stylets are not recommended for inclusion in DATs unless operators have been trained in their use and have ongoing volume of practice (see Table 2) (***Weak recommendation for, level of evidence moderate quality***).

5.7.9 Rigid fibreoptic laryngoscopes

These devices have fibreoptic channels integrated into a rigid scope. Intubation times seem to be longer[156, 157] and may be due to unfamiliarity and significant learning curves. ANZCA does not recommend rigid fibreoptic laryngoscopes when more intuitive devices such as videolaryngoscopy are available (***Strong recommendation against, level of evidence low quality***).

5.7.10 Supraglottic Airway Devices (SADs)

SADs are an essential component of any DAT. In taking a pragmatic approach to considering which SADs should be included on DATs it is important to consider which devices are readily available in Australian and New Zealand Hospitals. Therefore, the focus is on devices used in their everyday practice and with which they have expertise. The cost and space taken up by items to be placed in DATs also need to be considered[11]. Although there is a large amount of research on SADs, many studies have limitations including small numbers, use of manikins only, consideration of minor outcomes (such as small differences in cuff seal pressures) or are performed on patients with normal airways[158].

At the present time, single use SADs have taken the place of reusable devices in many of hospitals. Recommendations on which SADs to include in DATs are made in light of current practices. However, when environmental impacts are considered, this trend may be reversed[67].

The range of sizes to be stocked on DATs will depend on the population being served by individual hospitals.

- **First generation SADs**

  These generally have a proven track record of reliably seating in airways and providing ventilation in a large number of clinical scenarios. Nevertheless, for routine clinical use it is increasingly recognised that second-generation devices have advantages as described below.

  For DATs the particular scenario of airway difficulty rather than routine clinical use should be the consideration. In this setting ventilation is paramount and classic design LMAs (cLMAs) with their low profile and lack of preformed curve have several advantages. They may be easier to place in common difficult airway scenarios such as reduced mouth opening, limited neck extension and reduced space in the anterior column[159, 160]. Despite not being able to intubate directly through cLMAs, flexible intubation with the use of an intubating catheter remains a robust solution to the conversion of this device to a tracheal tube[92]. The aperture bars in the bowl of the device offer little resistance to passage of bronchoscopes loaded with the Aintree Intubation catheter[102].

  Although a recent Swedish review of DATs suggests that cLMAs should be replaced with two choices of second-generation devices[19], the classic design offers some advantages in management of difficult airways and should continue to be included on DATs (***Strong recommendation for, level of evidence moderate quality***).

- **Second generation SADs**

  Second-generation devices offer higher seal pressures, a gastric access channel and most have a wider airway channel with the result that positive pressure ventilation is improved, the risk of aspiration is reduced, and there is an easier conduit for flexible bronchoscopic intubation[41]. Second generation devices generally also have an inbuilt bite block protecting patients from airway obstruction[161].

  When considering which second generation device to include, expertise with use will be a large factor in influencing choice[41]. Devices on any DAT need to be those available in regular clinical practice as increased operator experience will increase the chance of successful insertion particularly in a stressful situation[19, 67].

  All second generation SADs offer higher airway seal pressures than first generation devices[41, 161-163]. Various comparisons have been made on the basis of difference of seal pressures. Small differences, sometimes with statistical significance, can be found but these small differences are unlikely to be of clinical significance[162, 164-167]. Seal pressures are used as a surrogate measure of protection from aspiration. Given aspiration is a relatively rare outcome it is not possible to definitively know which SADs offer the best safeguard against this complication[158].

  Aside from ease of ventilation, insertion and protection from aspiration another consideration in the difficult airway setting is how easily flexible intubation can be achieved through these devices.

- **Consideration of the glottic view and ease of intubation through SADs**

  Accurate positioning of SADs in the pharynx is not essential for adequate ventilation. Correct positioning does however become relevant when these devices are used for tracheal intubation. The use of flexible scopes for intubation via SADs is supported by the relatively high rate of suboptimal positioning of devices within the pharynx[168]. Direct passage of endotracheal tubes is possible with some SADs[163].

  Multiple head to head comparisons have been made regarding the ease of flexible intubation through SADs[168-171]. Metterlien and workers assessed the fibreoptic view of the glottis via SADs sited in patients. Inclusion into DATS of a second-generation

SAD that can serve as a conduit for easy flexible bronchoscope guided intubation is recommended (***Strong recommendation for, level of evidence moderate quality***).

Inclusion of intubating LMAs on DATs is not recommended.

A range of sizes for classic design first generation SADs should be available. In addition, a second-generation device through which flexible bronchoscope guided intubation can be easily achieved with a standard sized adult tracheal tube should be included. There may be a place for a backup second generation device depending on local preference, but careful consideration should be given to space and the superior outcomes of a unified approach requiring less decision making in an airway crisis (***Strong recommendation against, level of evidence weak***).

5.7.11 Flexible, fibreoptic and video bronchoscopes

Flexible, fibreoptic and video bronchoscopes provide a pivotal role in tracheal intubation and extubation, evaluation of upper and lower airways, examination of supraglottic airways as well as tracheal tubes and tracheostomy tubes[172-175]. They are also useful tools for lower airway suctioning, foreign body retrieval and obtaining specimens[176].

Flexible bronchoscopes for the adult population range from 3.8mm to 6.0mm external diameter. Smaller sizes should be available for paediatrics (2.2mm to 3.1 mm), supraglottic airway conversion with an Intubation Catheter (less than 4.2mmm external diameter) and thoracic cases. Smaller diameter bronchoscopes may lack a working channel. Reusable and single use bronchoscopes are available. Single use scopes may be cost-effective for centres with low usage (fewer than approximately 20-22 per month) as costs of repairs and maintenance of reusable bronchoscopes may be prohibitive[177-180] in their setting, in addition to which there are some logistical advantages in set up time[181]. However, reusable bronchoscopes may be more suitable for critical airway management should any single use bronchoscope malfunction[182].

Flexible bronchoscopes should be readily available for all areas performing advanced airway management. The actual types and sizes chosen for any anaesthetising locations will depend ultimately on the case mix, volume of patients and their physical status. This large scope of clinical situations in which flexible bronchoscopy may be required is acknowledged. When considering procurement of any flexible bronchoscope, areas outside the operating theatre suites and ICUs should consider both cost-benefit as well as any need for training and on-going volume of practice. Alternative solutions, such as rapid access to flexible bronchoscopy and skilled personnel from the operating theatres and/or ICUs, may be reasonable alternatives in low demand departments. In addition, low-cost single use flexible bronchoscopes may provide a realistic alternative for clinical environments where there is low usage but adequate staff training and experience. It is therefore, recommended that Airway leads have a significant role in deciding the number and location of flexible bronchoscopes (***Strong recommendation for, level of evidence moderate quality***).

Flexible bronchoscopes should be stored according to manufacturer's instructions to avoid damage, malformation and infection. Storage should be dry, clean, well ventilated and at normal temperature. This precludes storage of endoscopes curled up in portable containers. Ideally flexible bronchoscopes should be hung straight.

There is a wide range of ancillary equipment that is required to supplement flexible bronchoscopes. Equipment to perform these procedures depend on the technique employed. Airway leads should be involved in deciding what equipment and drugs should be stored in DATs to facilitate the performance of awake and asleep flexible bronchoscopy (***Strong recommendation for, level of evidence moderate quality***).

Tracheal tubes (TT) such as the Parker Flex-Tip™ [183-185] , Intubating Laryngeal Mask Airway™ (iLMA or LMA-Fastrach™) reinforced tracheal tube[186] ,reinforced TT and nasal Ring-Adair-Elwyn (RAE) TT may be better tubes to use than conventional polyvinylchloride (PVC) tracheal tubes for bronchoscope-assisted intubations either in

terms of positioning, reduced epistaxis risk or avoiding hang up on the vocal cord or arytenoids[187].

Nasopharyngeal airways can be used in topicalisation of nasal passages and to help determine the optimal size tracheal tube for nasal intubation.

5.8 Front-of-neck access (FONA)

Front-of-neck access (FONA) procedures in anaesthesia include trans-tracheal or cricothyroid injection of local anaesthetic in preparation for awake intubation, pre-emptive cannula cricothyroidotomy or tracheotomy prior to induction of anaesthesia, retrograde intubation, awake surgical cricothyroidotomy and awake tracheostomy[188-190]. However, FONA is more commonly associated with percutaneous and surgical techniques associated with the "Can't Intubate, Can't Oxygenate" (CICO scenario).

There are many cognitive aids and algorithms available for use prior to and during eFONA[5, 42, 50, 191]. There is some evidence that cognitive aids may improve non-technical skills during airway emergencies[49]. Further research is required to determine whether such aids are associated with an improvement in team behaviour during an airway emergency[48]. How these cognitive aids are presented to the team requires further research.

5.8.1 Access time for eFONA (see section on General features page 7)

Due to the importance of immediate access to eFONA equipment, it is recommended that it should be available at the point of care and duplicated on DATs (***Strong recommendation for, level of evidence moderate quality***).

5.8.2 Surgical time for eFONA

Short-term severe hypoxia without ischaemia does not cause elevated extracellular glutamate levels[192] or pathological changes[193]. However, clinical scenarios progressing from airway obstruction with low oxygen delivery (i.e. hypoxic brain injury) to hypoxic cardiac arrest (i.e. hypoxic-ischaemic brain injury) have escalating patient morbidity and mortality[194]. Based on these studies, it can be postulated that in the presence of hypoxia and ischaemia, eFONA should be performed within approximately three to four minutes[195].

It is recommended that a method of time keeping is incorporated into future DAT designs to ensure this important part of eFONA and difficult airway management is managed optimally (***Strong recommendation for, level of evidence moderate quality***).

5.8.3 Landmark identification

Palpation, ultrasound or pre-incision may be used to identify the cricothyroid membrane (CTM) or trachea. Inability to identify anatomical landmarks particularly as a result of surgery or scarring, haematoma or infection, obesity, radiotherapy and tumours (SHORT) makes clinical identification unreliable especially under stress[196]. Ultrasound may be useful in the elective setting for identification of the CTM and trachea. However, its use in CICO scenarios is not universally recommended[197]. It is recommended that in any CICO crisis, ultrasound be used only by personnel with currency of training and ongoing volume of practice (***Strong recommendation for, level of evidence moderate quality***).

5.8.4 Equipment

- **Choice of cannula**

  The cannula should be simple to use for the purpose of eFONA. Note:
  - The guide wire in the Melker™ kit does not pass down an 18G cannula.
  - Certain safety cannulae do not allow aspiration via a syringe and therefore are not recommended for eFONA.

- **Syringe and fluid**

  A slip tip (non-luer lock tip) 5mL syringe is preferred for its length and volume. Absence of recoil on releasing the plunger following its brisk withdrawal to the full length of the barrel signals correct placement of the cannula. The use of 2mL 0.9% saline in the 5mL syringe provides a positive endpoint of bubbles when aspirating air from within the airway.

- **Tracheal tube introducer with a Coudé tip of 35 degrees**

  A hollow intubating introducer enables rapid oxygenation. Oxygenation may be achieved using a 15mm adapter attached to a self-inflating bag or anaesthetic circuit. The risk of barotrauma is greatly reduced when using a low-pressure circuit compared with jet oxygenation via a luer lock connector.

- **Size 6.0mm ID cuffed tracheal tube**

  The size 6.0mm cuffed tracheal tube passes easily over the tracheal tube introducer with a Coudé tip of 35 degrees. The tube dimensions ensure that it will pass through both the stab incision (to the width of the size 10 blade) as well as through the cricothyroid membrane in patients aged 12 years and older.

- **Size 10 scalpel blade**

  This has a maximum width at a shallow depth required for the stab incision and successful performance of the scalpel-bougie technique.

- **Other instruments** required for eFONA may include a tracheal hook, a Trousseau dilator or tracheal tube introducer[198].

- **Paediatrics**

  The incidence of CICO in otherwise healthy children is exceedingly rare[199, 200]. Clinicians managing paediatric airways need to be familiar with eFONA techniques in the event of CICO. Most recommendations are based on adult guidelines or animal literature although consideration needs to be given to significant anatomical differences in children of different ages[2, 46, 201-204]. Surgical rescue will be extremely challenging even for the experienced Ear, Nose and Throat (ENT) surgeon. If equipment and the expertise of an ENT surgeon are available, then surgical tracheostomy may be the best option in most instances[205].

  - Children less than 1 year of age
    In neonates and infants, the cricothyroid space is underdeveloped. The narrow gap between the cricoid and the thyroid cartilage does not enable the passage of a size 2.0mm ID tracheal tube without significantly damaging the laryngeal cartilages[206]. Needle, cannula or surgical tracheotomy below the level of the cricoid ring represent the best options for eFONA in this age group (Association of Paediatric Anaesthetists of Great Britain and Ireland (APAGBI) Paediatric Airway Guidelines)[207].

  - Children Aged 1 – 8 years
    The combined APA and DAS Guidelines for CICO in paralysed, paediatric patients aged 1-8 years recommend cannula tracheotomy as first choice technique in the absence of an ENT Surgeon[208]. If unsuccessful the clinician is encouraged to rapidly progress to a scalpel technique[208]. Cricothyroidotomy sets, are too large and potentially traumatic to laryngeal structures in children under the age of 5 years and are not recommended[101, 209]. In children over 8 to 10 years of age their cricothyroid dimensions allow for many of the commercially available percutaneous cricothyroidotomy devices to be used.

- **Percutaneous cricothyroidotomy kits**

These devices are designed to provide a large bore airway (> 4mm ID) capable of enabling ventilation at low pressures. Devices may be cuffed or uncuffed and inserted through the cricothyroid membrane or trachea. Devices may be inserted using a Seldinger technique or inserted percutaneously directly into the airway. As children desaturate rapidly, the Seldinger technique offers the potential advantage of early oxygenation down the cannula prior to insertion of the definitive airway[201, 204].

These devices have a significant failure rate due to kinking or misplacement of the wire and inability to advance the dilator[88, 210]. Devices with large diameters require considerable force to insert thereby increasing the likelihood of complications[211, 212]. They may also be time consuming to insert and may take considerably longer than simpler devices or surgical cricothyroidotomy[213].

These devices have been recently reviewed for eFONA in children[204]. There are no published reports of these devices being used clinically in paediatric patients. There are many devices available on the market. Some require complicated steps for insertion making them less desirable for emergency use. There is a steep learning curve with proficiency developed after approximately ten placements[214]. Hence, they may be of value in the management of older children by clinicians experienced in their use. The numerous kits available make familiarity with each difficult to achieve. Each institution should have local protocols and procedures in place supporting a limited number of devices with regular training in their use.

- **Oxygenation equipment**

  Oxygenation through narrow bore cannulae or catheters requires a high-pressure oxygen source and should be considered extremely hazardous especially in the presence of upper airway obstruction. Oxygenation, not ventilation, is the priority. There are significant risks associated with jet ventilation especially in the setting of CICO[17]. Adequate time must be allowed for expiration which may be difficult to assess in a crisis[215].

  The highest flow marking on most wall mounted oxygen flow meters is 15L.min^{-1}. Most flowmeters are accurate at the setting of 15L.min^{-1} [216]. However, excessive flows may be obtained if the oxygen valve is opened beyond this level[216]. Flow meters do not regulate pressure i.e. the pressure remains undiminished at 4 bar regardless of flow rate.

  Oxygenation devices require a pressurised oxygen source and flow meter. They are flow-regulated, T-piece variants, which are compact, lightweight, disposable, portable, affordable, intuitive to use in an emergency, require minimal time to setup, allow for expiration and provide auditory and tactile feedback in relation to oxygen delivery.

  When attached to an oxygen flowmeter set at 15L.min^{-1} they deliver oxygen at flows of 250mL.sec^{-1}. However, flow rates above 15L.min^{-1} are discouraged.

  The Advanced Paediatric Life Support guidelines recommend setting the oxygen flow rate at 1L.min^{-1}.year^{-1}. This provides for an experimentally validated tidal volume of 7mL.kg^{-1} [217]. Although an oxygen flow rate of 1L.min^{-1}.year^{-1} plus 4L.min^{-1} has also been recommended[217]. An I:E ratio of 1:4 is advised with a respiratory rate of 12 bpm. There are no published case series or reports using these devices in neonates or infants.

- **Pressure regulated jet ventilation devices**

  Device settings are recommended by age:
  Baby 0 to 1 bar / 14.5 psi or 100kPa
  Infant 1 to 2.5 bar 36.3 psi / 250 kPa
  Adult 2.5 to 4 bar / 58 psi / 400 kPa

(1 kPa is equivalent to 10 cmH_2O)

At a setting of 0.5-1 bar flow rates are delivered in the region of 250-300mL.sec^{-1}. Flow rates of more than 600mL.sec $^{-1}$ have been reported through 14G cannulae with driving pressure set at 2.5 bar and more than 500mL.sec^{-1} through 16G cannulae at 4 bar[217-219]. Flows of over 1000mL.sec^{-1}have been recorded through 14G cannulae at 4 bar. For this reason, extreme caution should be used at these high settings. Unfamiliarity with these device makes titration of low flows and pressures difficult to achieve.

Extreme caution should be used in the presence of upper airway obstruction[220]. There is also no tactile or visual feedback in terms of oxygen delivery. There is no route for expiratory flow or pressure relief via these devices during expiration when connected directly to a cannula[221] (***Strong recommendation against, level of evidence weak***).

Some devices marketed for emergency jet ventilation are manually operated, flow-controlled ejector ventilators employing the Bernouli principle to generate suction to facilitate exhalation and may theoretically achieve physiological minute ventilation through a fine bore cannula[222]. It is crucial that operators meticulously observe the chest and adjust the Inspiratory to Expiratory (I:E) ratio to avoid lung injury[222, 223].

Such devices have been used to ensure oxygenation, ventilation and maintain haemodynamic stability in a live, anaesthetised porcine model with open, partly and totally obstructed upper airways[223]. They have also been used to provide rescue oxygenation and ventilation in the failed paediatric airway[224].

- **Three-way tap**

  The use of oxygen tubing, three-way taps and other self-made devices is not recommended. Self-made devices waste critical time to assemble and when using three-way taps, flows greater than 6L.min^{-1} prevent the exhalation of gases via the side port predisposing to volutrauma and barotrauma[225, 226]. It is recommended that three-way tap devices should not be used (***Strong recommendation against, level of evidence weak***).

5.9 ANZCA recognised emergency algorithms

- Standards for Can't Intubate Can't Oxygenate (CICO) education sessions http://www.anzca.edu.au/documents/appendix_12_cico_standard_131210

The following background resources and accompanying algorithms are suitable for use in front-of-neck airway.

- ANZCA Airway Management Working Group. Transition from supraglottic to infraglottic rescue in the "can't intubate can't oxygenate" (CICO) scenario [Internet]. 2014. From: https://www.anzca.edu.au/resources/incident-reporting-docs/airway-docs/report-from-the-anzca-airway-management-working-gr Accessed March 4 2019.

  Within this document the following algorithms can be found:
  - Figure 1: American Society of Anesthesiologists (ASA) Difficult Airway Algorithm (page 51)
  - Figure 2: Difficult Airway Society (DAS) – Overview (page 52)
  - Figure 3: Canadian Airway Group Difficult Airway Algorithm (page 53)
  - Figure 4: Dr Andrew Heard's algorithm for percutaneous emergency oxygenation (page 53)
  - Figure 5: Vortex™ Model (page 54)
  - Figure 6: CriCon2 (page 54)
  - Figure 7 & 8: Rural Health Continuing Education Critically Obstructed Airway Course Working Group (page 55)

- Appendix 1: ANZCA Cognitive Aid and User Guide for Transition to CICO (page 58)

- Australian and New Zealand College of Anaesthetists. Available from: *PG61(A) Guideline for the management of evolving airway obstruction: transition to the Can't Intubate Can't Oxygenate airway emergency* [Internet]. 2017. Accessed 30 September 2019.
- Australian and New Zealand College of Anaesthetists. Available from: *PG61(A)BP Guideline for the management of evolving airway obstruction: transition to the Can't Intubate Can't Oxygenate airway emergency: Background Paper* [Internet]. 2017. Accessed 30 September 2019.
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5.10 High flow nasal oxygen

There is increasing evidence that high flow nasal oxygen (HFNO) can provide a safe, convenient, well-tolerated and effective adjunct to difficult airway management. This technique provides oxygen flow rates that will match or exceed a patient's inspiratory flow rate and allows titration of warmed humidified inspired oxygen concentration up to 95-100%[227].This contrasts with standard low flow nasal oxygenation, which may be limited by patient discomfort to much lower rates of around 4L.min^{-1}. These low flow rates are well below the resting adult spontaneously breathing inspiratory flow rates (20 to 40L.min^{-1}) and will result in air entrainment and a variable FiO_2 of 0.2-0.5[228, 229].

Alongside the ability to provide a titratable high FiO_2, other physiological benefits of HFNO have been described[230]. These include the following:

- Reduced anatomical dead space
- Decreased airway resistance
- Increased functional residual capacity
- Improved respiratory mechanics
- Reduced alveolar de-recruitment
- Flow rate related positive end-expiratory pressure (PEEP), only while closed mouth breathing

Clinical applications relevant to the management of the difficult airway include:

- Alternatives to conventional facemask pre-oxygenation[231-233].
- The ability to increase the apnoeic oxygenation time following induction of anaesthesia, thus allowing a less time-pressured intubation attempt[234].
- As an adjunct to providing oxygenation during awake tracheal intubation (ATI) and awake fibreoptic intubation[235].
- As a means of providing ongoing oxygenation during 'shared airway' procedures for both spontaneously breathing[236] and apnoeic[237] patients.

There are several cautions concerning the use of HFNO:

- A patent upper airway is a prerequisite for effective HFNO management.
- A tight-fitting mask attached to a closed breathing circuit should not be applied to a patient's face when HFNO is being applied. This "semi-closed circuit" is likely to lead to high airway pressures, barotrauma and possible gastric insufflation.
- There have been reports of airway fires when HFNO has been used during laser airway surgery or in combination with an ignition source such as diathermy[238]. Several institutions, which use this technique have modified the equipment to include an air blender that can reduce the FiO_2 to 0.3 during this phase of the procedure. Of note, the manufacturers of one of the more commonly used products providing HFNO do not recommend its use in this type of 'shared airway' surgery.
- The use of alcohol-based skin preparation, as well as covering the patients' head with drapes allowing an oxygen reservoir to accumulate below the drapes, are also risk factors for in-theatre fires[239-241]. The latter may be a significant risk should eFONA be required and alcohol-based skin preparation and diathermy are used.
- The degree of CO_2 washout using HFNO in apnoeic patients has not been fully validated yet[242]. Precautions must be taken in high-risk patient population susceptible to respiratory acidosis[242].
- Other contraindications may include complete nasal obstruction, the presence of a base of skull fracture/cerebrospinal fluid (CSF) leak, midfacial fractures and untreated pneumothorax.

HFNO has recently transformed modern-day anaesthetic practice, providing enhanced oxygenation and is used in a variety of settings. However, at the time of writing this document, HFNO is still a novel clinical device and an evolving area of practice in anaesthesia.

ANZCA recommends that HFNO may be considered for difficult airway management and be kept in a secure but easily accessible (unlocked) location close to, but not necessarily attached to DATs (**Strong recommendation for, level of evidence low quality**). It is recommended that Airway Leads should have an active role in ensuring that HFNO equipment availability reflects the needs of the clinical area. Airway leads should arrange emergency airway management crisis simulations to promote the necessary skills in HFNO use and ensure that it is used safely and effectively.

5.11 Difficult airway equipment for paediatric anaesthesia

The same principles concerning quality and safety that apply to adult airway management equipment also applies to paediatric equipment. Standardisation, redundancy and a culture of safety are equally applicable. DATs need to be regularly checked for equipment absence, malfunction, damage, contamination, expiry and misplacement. Regular training should also occur. Similarly, relevant national and international standards should be upheld[10].

The specific details of equipment will depend on the scope of services provided ranging from tertiary paediatric referral centres to general rural clinics. The following recommendations could be adapted to meet local needs.

- Ideally, equipment to manage difficult paediatric airways should be stored in a dedicated paediatric difficult airway trolley (PaedDAT).
- Equipment supplied in PaedDATs should be suitable for the range of ages and sizes of patients undergoing care in the facility and may range from neonatal to large adult size patients. To avoid over-stocking, it may be reasonable to design two trolleys. One PaedDAT for children up to 8 years and an adult DAT for older larger children.

The following is a review of airway equipment for difficult paediatric airways.
SADs are recognised as essential tools for management of difficult paediatric airways functioning as primary ventilation airways, conduits for tracheal intubation and recue ventilation devices[243]. Several devices have been compared, achieving satisfactory results for these purposes.

The incidence of hypoxaemia is lower when continuous ventilation occurs through supraglottic airways during flexible bronchoscope guided intubation. In a multi-centre study, this technique

achieved higher first attempt success than videolaryngoscopy in infants with difficult airways, but equivalent results in older children[244].

Results from the Pediatric Difficult Intubation (PeDI) registry suggest a 2% difficult intubation rate. The best success on first attempt was with flexible bronchoscopes and complications were associated with more than two intubation attempts, weight less than 10kg, short thyromental distance and more than three direct laryngoscopy attempts before resorting to any indirect technique[245].

EFONA should be provided to suit the full spectrum of ages from premature neonates up to morbidly obese adolescents. Paediatric practice guidelines do not consider infants or neonates[208]. An institutional approach and literature review provide recommendations for paediatric eFONA[201]. A recent systematic review of the emergency paediatric surgical airway was able to include only five papers, all involving animal studies[246]. The analysis of mean time for placement of a definitive airway showed “catheter over needle” was the most rapid but with a high failure rate; “wire-guided” technique had a high success rate but high complication rate; “cannula” technique, fewer complications but high failure rate; “scalpel-bougie” technique had a high success rate but longer procedural time. The authors noted that data was limited, heterogeneous and there was a need for more studies. The other important issue after eFONA relates to oxygenation techniques. Very little clinical or laboratory evidence exists to confirm the efficacy or safety of most recommended techniques.

5.12 Difficult airway equipment for obstetric anaesthesia

Equipment to manage difficult airways in obstetric patients does not need to be different from that recommended in the remainder of the accompanying guideline[43, 247]. The guiding principles are simplicity and familiarity. Use of videolaryngoscopes should be first line given the higher baseline risk of difficult airways and the emergent nature of many obstetric intubations[43, 122, 248, 249]. Suggesting first line use of videolaryngoscopy is based on translated evidence from the non-pregnant adult population and expert opinion[123]. There are no large-scale studies in obstetrics regarding the use of videolaryngoscopy and no evidence-based guidance as to the best device[122, 250]. However, there are multiple reports of successful use and one unit reported no failed intubations following the introduction of videolaryngoscopy to their DAT[250]. A standard laryngoscope with a stubby or short handle should be available. At present, no videolaryngoscopes fulfil this requirement.

Second generation SADs are beneficial in obstetrics providing a higher seal pressure facilitating ventilation and a gastric drainage port[249]. As recommended for adults, a first generation device needs to be available in DATs in the event of problems with intubation, facemask ventilation, or seating of any second generation supraglottic device. All SADs should allow easy transition to intubation, without the need to remove the airway, which may be required during general anaesthesia for Caesarean section[251].

Aside from a ready supply of pillows for routine ramping, no new or alternative equipment is required for DATs in the obstetric difficult airways setting[252] (***Strong recommendation for, level of evidence moderate quality***).

5.13 Difficult airway equipment in intensive care medicine

The NAP4[31] highlighted deficiencies in airway management and higher rates of adverse patient outcomes in ICU in the UK. How these results reflect Intensive Care medicine in Australia and New Zealand is debatable. Nevertheless, the ICU environment poses unique challenges that may encompass various combinations of anatomical, physiological[253, 254] and psychological[255, 256] difficult airway factors.

Airway management in ICU often involves a team being called to manage time-critical airway management in deteriorating patients with multiple co-morbidities. While no specific equipment exists for ICU difficult airways, the rationale for choice or how it is presented often reveals important differences from operating theatre environments[42, 257].

Patients with limited physiological reserve are unlikely to tolerate slow airway management, and waking up patients when difficulty is encountered is rarely an option. In general, patients are often not fully conscious and cooperative and therefore, rapid sequence or modified rapid sequence is commonly selected. This in turn has direct implications on the type of rescue device and techniques used.

Equipment stored on DATs provides an important "infrastructure" for any airway management team. These devices should have high success rates, be "user-friendly" and intuitive to use. While a variety of airway management devices are commercially available, stocking a large variety of different devices should be avoided[30]. Recommended devices include a range of second generation SADs, Macintosh-style and hyperangulated videolaryngoscope blades as well as equipment for a surgical airway. In addition, the need for specialised tracheal extubation equipment should be considered[258] (see tracheal extubation section above).

Videolaryngoscopy issues pertaining to ICU usage:

Currently there is a wide range of commercially available videolaryngoscopes and therefore, their selection should reflect important nuances of the intensive care environment. These include the following:

- Selection of videolaryngoscope monitors that –
  - Are easily manoeuvrable to avoid reflected lighting from nearby windows on the video image.
  - Are large enough for the entire team to view the image.
  - provide high resolution images that are viewable at angles allowing assistants an adequate view of the image.
- Videolaryngoscope blades should be low profile and thereby allow sufficient space for manipulating tracheal tubes and/or adjuncts, especially in narrow upper airways. Some disposable videolaryngoscope blades have been found to be bulky and may be difficult to manoeuvre in a narrowed airway[135, 259]. The procurement process should assess videolaryngoscope performance in both normal and a variety of difficult airway scenarios.

The needle and narrow bore cannula for eFONA may be inadequate to provide effective ventilation or oxygenation in patients with profound abnormalities of pulmonary compliance or gas exchange. Therefore, the choice of equipment available for eFONA should include a cuffed tube positioned by either a scalpel-bougie technique or a wire-guided percutaneous dilational technique (the Seldinger technique).

The lack of experienced assistants makes labelling of intensive care DATs an important issue. Clear labelling with both printed labels and pictographs is important.

Disposable flexible bronchoscopes and video laryngoscopes are frequently available, are commonly used and are familiar to the ICU team. The larger bronchoscopes frequently used in intensive care are often too large for an Aintree Intubation Catheter™. If this catheter is required for difficult airway management, staff should be aware that it requires a smaller diameter bronchoscope more frequently found in operating theatre DATs.

"Quality improvement bundles"[260] and high-fidelity simulation programmes[261] have been shown to improve patient care. DATs may be considered an integral part of these programmes. Familiarisation and regular training using DAT equipment should be encouraged.

5.14 Difficult airway equipment in emergency medicine

Airway management in Emergency Departments (ED), as with other areas outside of the operating theatre environment, carries significantly increased risks and can be technically challenging[31, 42, 262]. Patients requiring intubation in EDs often have severe physiological derangement, have had limited pre-intubation airway assessment, and may require expedient intubation. It is well-recognised that there is a higher incidence of difficult airways in EDs, many of which will be unpredicted[263, 264]. It is therefore, recommended that for all intubations in emergency departments DATs are available within the time frames specified in this document.

Given the variations in patient volume and acuity, staffing and skill mix in emergency departments throughout Australia and New Zealand, the specific configuration of DATs in individual EDs will largely be determined by local factors. It should, however, be consistent with the underlying principles and recommendations contained elsewhere in this document. Specifically, equipment should be fit for purpose, there should be redundancy, and all clinicians who will potentially use equipment stored in DATs should be familiar with their layout and the use of individual items of equipment in the trolleys[30].

ED DATs should be configured in a standardised manner consistent with other DATs in the institution. Equipment should meet the minimum recommended requirements described elsewhere in this document. Specific considerations regarding videolaryngoscopes, eFONA equipment and flexible bronchoscopes are outlined below. For all airway equipment there is a considerable range of options available, however excessive stocking of a wide variety of each option is not recommended[30].

A recent multi-centre study of intubations in 43 emergency departments in Australia and New Zealand highlighted that videolaryngoscopes were used in the first attempt in over half of the intubations[265]. With this and other studies demonstrating higher first pass success rates with video laryngoscopy over direct laryngoscopy, even in expert hands, this proportion is likely to significantly increase in coming years[111]. For emergency departments that use videolaryngoscopes for the first intubation attempt, it is recommended that a second videolaryngoscope is available on the difficult airway trolley.

Cricothyroidotomy in Australasian EDs is a rare event with rates around 0.3%[265, 266]. However, all clinicians should be familiar with the eFONA equipment on their DATs and regular simulated and/or cadaveric practice is strongly encouraged.

No data is currently available regarding the use of flexible bronchoscopes in emergency departments in Australia and New Zealand. A large US registry study reported low rates of utilisation in EDs[267], which is likely to be reflective of Australian and New Zealand practice. It may, therefore, be neither feasible nor desirable for every ED to procure a flexible bronchoscope. Alternative solutions, such as rapid access to both flexible bronchoscopy and skilled personnel from the operating theatres or ICUs may be reasonable alternatives in low demand emergency departments.

5.15 Limitations of review

This review focused on English language publications and therefore may have omitted important articles in other languages. The level of airway management research is often moderate or low quality. Therefore, the strength of the recommendations will generally reflect these levels.

6. Conclusion

Standardisation of difficult airway equipment commonly used by anaesthesia, intensive care and emergency medicine in DATs is seen as a vital and fundamental step towards improving patient safety and a collaborative multidisciplinary approach to airway management. While each clinical environment may require variants of these recommendations, the provision of core airway management equipment in all DATs throughout Australia and New Zealand is a fundamental focus of this review.

All aspects of airway management for general anaesthesia and sedation were considered as well as the various clinical scenarios ranging from stand-alone gastroenterology units providing sedation to tertiary level hospitals providing care to high acuity patients with airway problems. It is expected that close adherence to these guidelines will provide an infrastructure of suitable airway equipment to operators managing difficult airway scenarios.

The review has been extensive and comprehensive, as evidenced by the length of this background paper, to ensure that it is contemporary and reflects the range of opinions when making any recommendations. It is strongly recommended that Airway leads are consulted in implementing the recommendations in the accompanying guideline.

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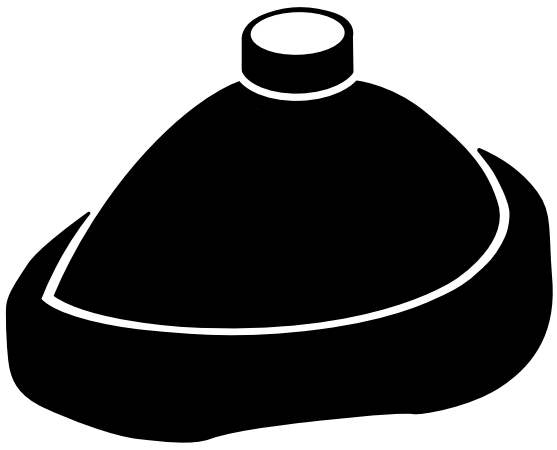
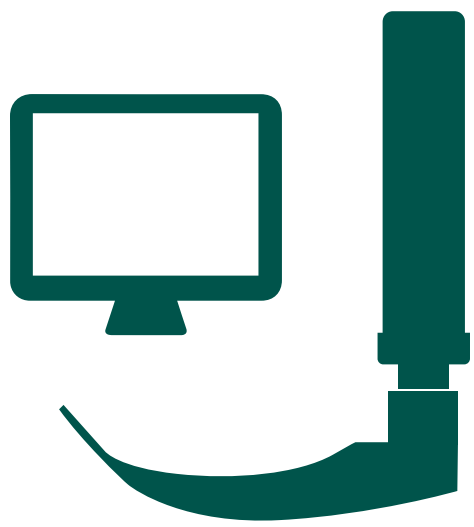
Face Mask



Supraglottic Airways

Laryngoscopy



Front Of Neck Airway