Guidelines 1 (AIDAA)

All India Difficult Airway Association 2016 guidelines for the management of unanticipated difficult tracheal intubation in adults

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ABSTRACT

The All India Difficult Airway Association (AIDAA) guidelines for management of the unanticipated difficult airway in adults provide a structured, stepwise approach to manage unanticipated difficulty during tracheal intubation in adults. They have been developed based on the available evidence; wherever robust evidence was lacking, or to suit the needs and situation in India, recommendations were arrived at by consensus opinion of airway experts, incorporating the responses to a questionnaire sent to members of the AIDAA and the Indian Society of Anaesthesiologists. We recommend optimum pre-oxygenation and nasal insufflation of 15 L/min oxygen during apnoea in all patients, and calling for help if the initial attempt at intubation is unsuccessful. Transnasal humidified rapid insufflations of oxygen at 70 L/min (transnasal humidified rapid insufflation ventilatory exchange) should be used when available. We recommend no more than three attempts at tracheal intubation and two attempts at supraglottic airway device (SAD) insertion if intubation fails, provided oxygen saturation remains ≥ 95%. Intubation should be confirmed by capnography. Blind tracheal intubation through the SAD is not recommended. If SAD insertion fails, one final attempt at mask ventilation should be tried after ensuring neuromuscular blockade using the optimal technique for mask ventilation. Failure to intubate the trachea as well as an inability to ventilate the lungs by face mask and SAD constitutes 'complete ventilation failure', and emergency cricothyroidotomy should be performed. Patient counselling, documentation and standard reporting of the airway difficulty using a 'difficult airway alert form' must be done. In addition, the AIDAA provides suggestions for the contents of a difficult airway cart.

Key words: Complete ventilation failure, emergency cricothyroidotomy, pre-oxygenation, supraglottic airway devices, unanticipated difficult intubation

DISCLAIMER

These guidelines have been developed to help clinicians manage unanticipated difficult intubations in patients using evidence-based recommendations. Consensus opinion from airway experts, members of

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the All India Difficult Airway Association (AIDAA) and Indian Society of Anaesthesiologists (ISA) has been taken, wherever robust evidence is lacking or to suit the needs and situation in the region. These guidelines do not represent the minimum standard of practice, nor are they a substitution for good clinical judgment.

INTRODUCTION

Airway management is a vital skill that is relevant to the practice of all medical specialities, especially anaesthesiology, critical care, emergency medicine and surgery. Inappropriate airway management may result in adverse outcomes. An unanticipated difficult airway tests both the technical and non-technical skills of the provider, during a potentially life-threatening clinical situation. These guidelines have been developed by the All India Difficult Airway Association (AIDAA) taking into account the recent developments and current practices in airway management. The aim is to provide a structured stepwise approach to manage unanticipated difficulty during tracheal intubation in adults and children. In addition, guidelines for special situations such as difficult intubation in obstetrics, in the Intensive Care Unit patients and a strategy for extubation of the difficult airway have been addressed. The AIDAA has also made recommendations for the equipment required in the difficult airway cart (DAC) and proposed a standard format for reporting a difficult airway.

METHODS

A guidelines' working group of 14 airway experts inclusive of a chairman was constituted from among the AIDAA members. This committee was further divided into five subcommittees to draft each of the five guidelines.

A list of airway-related search terms [Supplemental Content 1] was formulated. A literature search for English language publications was conducted from August 2006 to August 2016 using PubMed, EMBASE, MEDLINE, Ovid, Google Scholar Databases and search engines. Additional articles were retrieved by cross-referencing and hand searching. A total of 14,957 abstracts were reviewed for relevance and this was narrowed down to 766 articles. Articles specifically related to the individual guidelines were broadly divided into five categories and circulated to the individual groups. Each article was reviewed by at least two members of the working group. In addition, airway management guidelines of various societies [1-5] were reviewed.

The working group had three meetings and several e-meetings. The five draft guidelines were presented at the national meeting of the AIDAA in September 2016. This was attended by 585 anaesthesiologists, and the live telecast was watched online at 233 centres in India and abroad. Verbal, written and online feedback was received during this presentation. A questionnaire based on the key elements of each algorithm addressing certain inconclusive areas where evidence was lacking was circulated during the meeting, made available on the AIDAA website and circulated by e-mail to all the AIDAA and Indian Society of Anaesthesiologists (ISA) members. The responses of 1027 respondents to the questionnaire were analysed. Where evidence was lacking, recommendations were made by consensus, following extensive discussion among the committee members and considering the results of the questionnaire.

PRE-OPERATIVE AIRWAY ASSESSMENT AND PREPARATION

We recommend pre-operative airway assessment to be routinely performed to identify factors leading to difficult facemask ventilation, supraglottic airway device (SAD) insertion, tracheal intubation and emergency surgical access. This may help identify potential problems before surgery leading to proper planning and preparation to reduce the risk of complications. However, it is very important to keep in mind that none of the available tests are completely reliable, and thus one should be prepared for a difficult airway at all times.[6]

Reduction of the gastric volume and increase in pH should be done before surgery by adequate fasting and pharmacological means. It is necessary to identify patients at a risk of aspiration. In conditions with delayed gastric emptying or intestinal obstruction, mechanical drainage using a nasogastric tube should be considered.[7]

Pre-operative sedation should be used with caution in patients with an anticipated difficult airway. In patients with a compromised airway (both anatomically and physiologically), sedation is best avoided.

OPTIMISING ENDOTRACHEAL INTUBATION

Pre-oxygenation and peri-intubation oxygenation techniques

Optimal pre-oxygenation increases non-hypoxic apnoea time and provides a safety margin before desaturation occurs. Pre-oxygenation and face mask

ventilation are considered the primary methods and essential components to preserve oxygenation until the airway is secured after neuromuscular blockade.[8]

We recommend the following techniques for pre-oxygenation and peri-intubation oxygenation.

Head-up position

Pre-oxygenation should be given using 20° head-up position unless contraindicated.[9] This position is more comfortable for a patient to take full breaths. In the flat position, the posterior portions of the lung become prone to atelectasis and collapse, thereby reducing the oxygen reserves and shortening the safe apnoea time.

Mask fit

Ensure a proper face mask fit.

Method, duration and endpoints of pre-oxygenation

Pre-oxygenation should be performed for a minimum of 3 min with tidal volume breathing[8,10] and should be prolonged for 5 min if a mask leak is present.[11] Nasal cannula oxygen supplementation can improve the efficacy of pre-oxygenation if there is a mask leak.[12] Pre-oxygenation with eight vital capacity breaths for 60 s is an alternative method that is more effective. Pre-oxygenation following forced exhalation followed by tidal breathing is also more effective. Target an end-tidal oxygen >90% and end-tidal nitrogen <4%.[8,10]

Oxygen flow rate

Delivery of at least 10 L/min of oxygen with an open circuit is mandatory during pre-oxygenation. When closed circuit is used, pre-oxygenation should be done with a pre-filled oxygen circuit using minimum oxygen flow rate of 10 L/min.

Continuous positive airway pressure

Application of continuous positive airway pressure (CPAP) of 5–10 cm H_2O during pre-oxygenation is recommended, if not contraindicated.[8,10,13]

Pressure support ventilation

Pressure support ventilation of 5–15 cm H_2O should be applied if possible. Non-invasive ventilation improves the effectiveness of pre-oxygenation.[8,10,14]

Apnoeic oxygenation using a nasal cannula

Insufflation of continuous oxygen at 10–15 L into pharynx through nasal cannula, airway or catheter can extend the duration of safe apnoea time after muscle relaxants are used.[15,16] Oxygen delivered through a nasal cannula at 15 L/min is an easy and effective means of providing apnoeic oxygenation during tracheal intubations.[17] Ensure optimal pre-oxygenation and airway patency while using this technique. The nasal cannula can be placed under a facemask during pre-oxygenation, and then it can be used to administer nasal oxygen during tracheal intubation. We strongly recommend the use of this technique, not only in anticipated difficult airway but also during all intubations.

Transnasal humidified rapid insufflation ventilatory Exchange (THRIVE)

While using transnasal humidified rapid insufflation ventilatory exchange (THRIVE),[18] oxygen (100%) at a flow rate of 70 L/min is used for pre-oxygenation and continued during induction and after giving neuromuscular blockade to provide apnoeic oxygenation, until a definitive airway is secured. The upper airway should be kept patent. This requires dedicated equipment with oxygen humidification unit, nasal oxygen cannula and tubing connecting standard oxygen regulator to the transnasal oxygen cannula. This technique provides CPAP during pre-oxygenation and apnoeic oxygenation with gas exchange by flow-dependent flushing of the dead space. This method significantly prolongs the safe apnoea time, thus allowing securing a definitive airway during a difficult intubation or failed intubation to be done in an unhurried manner. THRIVE should be used when available, especially when a difficult airway is anticipated.

Oxygenation during face mask ventilation

Mask ventilation should be given with 100% oxygen, soon after induction and also between attempts at intubation. Inadequate chest rise during mask ventilation may be either due to an obstructed airway or an air leak around the mask. Inadequate depth of anaesthesia or inadequate neuromuscular block can also make mask ventilation more difficult.[19,20]

When difficulty is encountered during mask ventilation, consider changing to a mask with a better fit. Optimise position, and use airway manoeuvres such as head tilt, chin lift or jaw thrust or two-handed mask holding. Consider using adequately-sized oropharyngeal or nasopharyngeal airways. Increasing the depth of anaesthesia and ensuring neuromuscular blockade may help.

Failure of oxygenation must be identified and alternative methods of oxygenation should be

implemented without any delay. In case of predicted difficult airway and in case of failure of mask ventilation, insertion of an SAD can be used as the primary technique for maintaining oxygenation.[20]

Induction agent and neuromuscular blockade

The choice of the induction agent will depend on the clinical situation and the condition of the patient. Propofol suppresses the laryngeal reflexes, providing better intubating conditions as compared to other agents and it is the most commonly used induction agent. One must ensure adequate depth of anaesthesia during repeated attempts at intubation to prevent awareness.

Neuromuscular block results in apnoea, abolishes the laryngeal reflexes, improves chest wall compliance[21,22] and thus can improve the chances of successful airway management when face mask ventilation is difficult.[23] During rapid sequence induction, either rocuronium or succinylcholine may be used unless contraindicated. When rocuronium is used at a dose of ≥1.2 mg/kg, intubating conditions equivalent to those of succinylcholine are achieved within 60 s.[24]

Proper positioning before intubation

In most patients, the best position for direct laryngoscopy is achieved by using flexion at the neck and extension at the atlanto-occipital joint (the classic 'sniffing' position). This position can be achieved by keeping a pillow of 10 cm thickness under the head of the patient. This position is contraindicated in patients with suspected cervical spine injury. In some obese patients, 'sniffing position' can be achieved by placing blankets or towels below the scapula, shoulder, nape of the neck and head until the external auditory meatus and sternum, are in a horizontal line ('ramped' position, also known as HELP – head elevated laryngoscopic position). Although advantage of this over simple neck extension has been questioned in the last decade, the current literature supports the use of 'sniffing' position.[25]

Laryngoscopy and endotracheal intubation

We strongly recommend continuation of nasal oxygenation using oxygen flow at 15 L/min[17] or THRIVE[18] to maintain oxygenation during apnoea. An attempt at laryngoscopy is defined as the insertion of a laryngoscope into the oral cavity. Repeated attempts can result in airway trauma and increase the risk of progressing to a 'cannot ventilate' situation. Thus, attempts should be limited to the minimum and repeated only if the oxygen saturation is ≥95%.

Either conventional laryngoscopy or videolaryngoscopy may be used for intubation depending on the experience and comfort level of the operator. Videolaryngoscopy offers a superior view compared to conventional direct laryngoscopy.[26,27] There is a definite learning curve for the successful use of a videolaryngoscope.[28] Anaesthesiologists should have access to a videolaryngoscope and must be trained to use it.

If the first attempt at intubation is difficult, one should change the plan during subsequent attempts to improve the chance of success, rather than repeatedly performing the manoeuvres that have failed. This may involve changing the position, intubating device and using additional tools or manoeuvres. Optimal external laryngeal manipulation applied by an assistant may improve the laryngoscopic view.[29,30] A pre-shaped stylet or gum-elastic bougie may be used to facilitate tracheal intubation in Cook's modification of Cormack and Lehane Grade 2b and 3a laryngeal view.[31,32] However, blind insertion in Grade 3b or 4 direct laryngoscopic view is not recommended as it can lead to trauma.[33]

Sometimes, the endotracheal (ET) tube may get held up at the arytenoids leading to difficulty in the passage of the tube,[34,35] especially while railroading the ET tube over a bougie, stylet or bronchoscope. This may be overcome by rotating the ET tube anticlockwise to change the direction of the bevel, keeping the bevel facing posteriorly while pre-loading the tube or by reducing the space between the bronchoscope and the ET tube.[34-36]

Confirmation of endotracheal intubation

Following ET intubation, correct placement of the tube within the trachea must be confirmed. This must include visual confirmation of the ET tube between the vocal cords, bilateral chest expansion, 5-point auscultation and capnography. A continuous sine waveform capnogram is the gold standard for confirming the proper placement of ET tube by the presence of six consistent capnograph traces without any decline in the detected carbon dioxide (CO_2) levels.

Role of supraglottic airway devices as a rescue device during a difficult airway

When ET intubation fails, placement of a SAD helps in maintaining oxygenation and gives us time to think about a further management plan. The

second-generation SADs with the higher sealing pressures and tube for gastric drainage should be preferred due to their increased safety and efficacy as compared to the first-generation devices.[37-45] If initial insertion of the SAD fails, changing over to another type of SAD has been shown to be successful.[46] Cricoid pressure interferes with SAD insertion by reducing the hypopharyngeal space, and therefore it should be removed.[47-49] Repeated attempts at SAD insertion may result in trauma and will further delay the use of other measures to maintain oxygenation. Goldman *et al*.[50] showed that only 4.2% of devices were inserted successfully at the third attempt. We recommend a maximum of two attempts at SAD insertion.

Intubation through SAD should only be performed under vision, using a flexible fibre-optic bronchoscope only,[51-53] provided the patient is stable, oxygenation is possible through the SAD and the operator is familiar with the technique. The intubating laryngeal mask airway (ILMA) has been used for blind tracheal intubation with a high success rate. However, we recommend that blind intubation should never be attempted when an SAD (including the ILMA) has been inserted as a rescue device, in the interest of patient safety. The use of an Aintree Intubation Catheter™ (Cook Medical, Bloomington, USA) over a bronchoscope facilitates guided intubation through a SAD where direct fibre-optic-guided intubation is not possible.[53,54] Blind intubation has a very low first attempt success rate, with a potential of complete loss of an established airway and serious adverse events.[55-56]

COMPLETE VENTILATION FAILURE

Previously, the situation where tracheal intubation, face mask and SAD failed was labelled as 'Cannot Intubate, Cannot Ventilate' (CICV)[1,4] or 'Cannot Intubate, Cannot oxygenate'. We define complete ventilation failure (CVF) as a situation where intubation, ventilation using SAD and face mask have all failed after giving the best attempt, even if oxygenation may be maintained. We recommend proceeding to emergency cricothyroidotomy when there is CVF, while oxygenation is maintained and not only when hypoxaemia sets in. During these events, nasal oxygen insufflation should continue. Before declaring CVF, a final attempt at mask ventilation should be made after ensuring complete muscle relaxation. This will give us the best chance for optimising mask ventilation and also create good operating conditions for cricothyroidotomy, the logical next step.

CALLING FOR HELP

Calling for help should be done at the earliest when the first difficulty in airway management is encountered. In case help has not arrived, one should continue to call for help. While any additional help will be useful during a difficult airway, one should try to get expert help, if available. The AIDAA recommends calling for additional help when the final attempt at rescue mask ventilation fails and emergency cricothyroidotomy is planned. An additional person who has not been part of the process until then may be able to think more rationally and perform better in this situation, in addition to being an extra helping hand.

EMERGENCY CRICOTHYROIDOTOMY

Emergency cricothyroidotomy is deemed necessary when there is CVF, when intubation, ventilation using SAD and face mask have also failed after giving the best attempt, even though oxygenation may be maintained. In spite of its importance, performance of emergency cricothyroidotomy is often hampered by delayed decision, inappropriate skill and knowledge with regard to equipment or its unavailability.[7,57] Repeated multiple attempts at conventional tracheal intubation may convert a 'can-intubate, can-ventilate' situation into a CVF situation.[58] It is thus prudent to expedite the decision to perform emergency cricothyroidotomy. Proper planning, preparation and skill training in cricothyroidotomy will lead to reduced airway-related morbidity.[1,57]

Anatomical landmarks for cricothyroidotomy

The boundaries of the cricothyroid membrane are formed by thyroid cartilage superiorly, the cricoid cartilage inferiorly and the cricothyroideus muscles laterally.[57] The membrane is approximately 10 mm in height, 22 mm in width and is made up of dense fibro-elastic tissue. The cricothyroid membrane is a superficial, easily felt, less mobile structure held steadily in place. It has a relatively avascular structure and placed away from thyroid gland, anterior jugular veins and laryngeal nerves. Cricothyroidotomy is thus easier and faster to perform than tracheostomy and the chances of bleeding are also less.

This membrane can be easily identified using the 'laryngeal handshake' described by Levitan[59] which gives a better three-dimensional orientation of the laryngeal anatomy [Figure 1].

First, the hyoid and thyroid laminae are identified using the non-dominant hand. Then, larynx is identified and stabilised between the thumb and the middle finger, and then the neck should be moved down to palpate the cricothyroid membrane with the index finger. Ultrasound may be used to identify these landmarks, but it should not delay airway access.[60]

Patient positioning and preparation

Patient is positioned supine with the neck extended. This can be provided using a pillow under the shoulders or dropping the head over the operating table. Use aseptic techniques and universal precautions. It may be useful to identify and mark the cricothyroid membrane before induction of anaesthesia in patients with an anticipated difficult airway.

Techniques for cricothyroidotomy

Cricothyroidotomy can be performed by a surgical incision (surgical cricothyroidotomy) or puncture of the cricothyroid membrane (non-surgical/needle cricothyroidotomy). The cricothyroidotomy puncture is achieved by a narrow-bore (usually an internal diameter of ≤4 mm) cannula-over-needle technique, a wide-bore (usually internal diameter ≥4 mm) cannula-over-trocar or a wire-guided technique (Seldinger).

Surgical cricothyroidotomy

It is primarily an incision through the cricothyroid membrane and insertion of tracheostomy tube or ET tube.[1,4,57] Among the various techniques, one of the useful techniques uses 'stab, twist, bougie, tube' steps sequentially.[1] Only a scalpel with number 10 blade, a gum-elastic bougie with angled tip and a cuffed ET tube of size 6 mm are required.

Nasal oxygenation at 15 L/min flow rate and attempts to ventilate by face mask are continued. Keeping the blade perpendicular to the skin, perform a transverse stab incision through the skin and cricothyroid membrane (lower half of the membrane). After stabbing, rotate the blade by 90° with sharp edge of the blade facing caudally. Stabilise the blade with left hand, provide gentle traction towards the operator and insert the bougie 10–15 cm into the trachea. The blade must be removed, cuffed ET tube should be railroaded over the bougie and the bougie must be withdrawn gently. Inflate the cuff and confirm tube position using capnography.

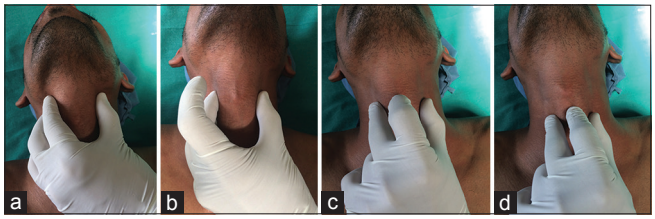

Figure 1: The laryngeal handshake. (a) Palpation of the greater cornu of the hyoid bone with the index finger and thumb. (b) Roll the larynx from side to side. (c) The fingers and thumb slide down over the thyroid lamina. (d) Keep the middle finger and thumb on the cricoid cartilage and move the index finger down to palpate the cricothyroid membrane

In cases, where cricothyroid membrane is not palpable or the initial failure occurs, alternate scalpel–finger–bougie technique may be attempted.[57] A vertical midline skin incision of around 8–10 cm is made and enlarged with blunt dissection using the finger (scalpel handle, forceps or dilator may also be used). Rest of the steps remain as mentioned above.

Cannula cricothyroidotomy

Narrow-bore cannula technique

A 14-/16-gauge cannula with its needle *in situ* attached to saline-filled 10 ml syringe is inserted through cricothyroid membrane in the caudad direction at an angle of 30–50°. Correct placement is confirmed by aspirating air. Push the catheter over the needle into the trachea and remove the needle. Correct placement is reconfirmed using a saline-filled syringe. Start pressure-regulated jet ventilation.

Efficacy of the narrow-bore cricothyrotomy is limited by the fact that it requires jet ventilation using a high-pressure ventilation source and associated breath stacking, barotrauma (pneumothorax, pneumomediastinum), catheter kinking, malposition or dislodgement. In addition to not being a definitive airway, the risk of aspiration is present.[4,57,59] Further, this technique requires a patent upper airway for exhalation.

Wide-bore cannula technique

This technique includes several commercially available kits. The wide-bore cannula allows exhalation, some sets have a cuff as well and thus protects the airway. It can be used with standard ventilator and breathing circuits.[57] This is less invasive than a surgical cricothyroidotomy and avoids the need for jet ventilation. Various devices require Seldinger technique/wide-bore cannula-over-trocar technique or other techniques which rely on a dilational step with or without wire guidance. Wide-bore cannula-over-trocar devices may carry the risk of perforation of the trachea, due to force required to insert it, leading to distortion of trachea. A cricothyroidotomy should be converted

to a tracheostomy at the earliest to avoid tracheal stenosis.

Cricothyroidotomy – which technique?

The ideal technique is one that can be accomplished rapidly, is easy to learn and perform and have a high success with minimal complications.[57] There is no ideal technique that guarantees 100% success with no associated complications.[60,61] Recently, the National Audit Project 4 (UK) reported a success rate of 37% with narrow-bore cannula-over-needle cricothyroidotomy, 57% with wide-bore cannula and 100% with surgical cricothyroidotomy.[7] We recommend performance of any cricothyroidotomy technique based on the familiarity of the anaesthesiologist and the availability of equipment.

Jet ventilation

With needle or narrow-bore (<4 mm) cannula cricothyroidotomy, high-pressure jet ventilation is needed for oxygen to overcome resistance offered by small lumen of catheter. We recommend the use of pressure-regulated jet ventilation. It has manually controlled trigger to control the respiratory rate and adjust the pressure. It is connected to a high-pressure (50 psi) oxygen supply. A high-pressure tubing with a Luer–lock connector is used to connect it to the cannula.

Upper airway obstruction must be relieved to allow adequate egress of air during exhalation. Proper rise of the chest during inspiration, and also equally important i.e., fall during expiration, must be monitored with each breath to avoid barotrauma. Effective ventilation becomes inferior with a narrow-bore cannula technique and hence CO_2 accumulates. Some devices can provide active expiration for CO_2 removal. Jet ventilation provides a short window for oxygenation, during which tracheostomy should be performed at the earliest.

Complication rates of cricothyroidotomy and ventilation vary from 0% to 52%.[57,62] The immediate complications include hypoxia, emphysema, pneumothorax, vocal cord injury needle dislodgement or kinking, bleeding and perforation (trachea, oesophageal and mediastinum).[57,62] However, one must outweigh the risk of these complications against failure to further oxygenate if cricothyroidotomy is not performed.

HUMAN FACTORS IN AIRWAY MANAGEMENT

A proactive healthcare system that lays emphasis on safe airway management should ensure that a variety of airway equipment is available at all anaesthetising or intensive care locations to cover all, or possibly all, airway emergencies. Though such an investment will not produce immediate financial returns, the safety it will ensure to all patients passing through these areas of the hospital, as well as the confidence it will provide to treating physicians, will more than justify the expense in the long run. Real-life experience and training in the management of difficult airways and the CICV situation for all trainees and practitioners is next to impossible, given the infrequent and unpredictable occurrence of such events. Periodic simulation-based training and team practice in the safe environments of a simulation centre can make physicians and other supportive staff competent and confident in managing the common airway emergencies when they occur.[63]

Human factors that can influence outcome from any adverse airway event often starts with an error of judgement.[64] One must remember that there is no tolerance for cutting corners in healthcare. Senior practitioners may at times be lulled into complacency because of overconfidence. Another common factor in a critical incident is a fixation error.[65] Experience often helps one get past sticky issues but overdependence on one's luck or a single skill to bail one out of trouble every time can at times spell disaster. Good communication skills and strong leadership are central to a good outcome in any critical incident.[66] Once a difficult airway has been identified, every team member should then have a clear idea of the role they would be expected to play during the management of the difficult airway. A post-event debrief is crucial to identify not only what went right during the management but also more importantly, what went wrong as this will have a positive impact on preventing any such future event. Team members should accept their mistakes irrespective of their position in the team hierarchy. Ego should not cloud one's readiness to accept one's shortcomings when things have gone wrong. In addition, another crucial requirement is a culture of 'no-blame'. Every adverse event should be seen as an opportunity to improve, correct system faults and enhance safe practices. This can never happen if there is a culture of blaming, naming and shaming.

Airway-related mishaps can also grossly undermine the confidence of the physician involved. Careful planning with attention to details and execution of a well thought-out airway plan can not only ensure patient safety but can also be a rewarding clinical

experience to the physician. Sadly, physicians are also human, and it only takes a split second of inattention to precipitate a life-threatening critical airway incident. Remember, every airway is difficult until one has safely secured it!

DIFFICULT AIRWAY CART

There is no consensus on exactly which devices should be included in the DAC. However, the available equipment should be familiar to the user and standardised according to the local protocols. We recommend a permanent movable storage space with at least 5–6 drawers or compartments. This may be a cart, trolley or even a bag and may be in addition to an emergency drug trolley. Considering the diversity in Indian healthcare facilities, we recommend a list of both mandatory and desirable equipment for the DAC [Table 1]. In addition, we have proposed a simple systematic plan for the arrangement of the airway equipment within each drawer of the DAC [Table 2]. Individual variations maybe made according to the local requirements or hospital policy. Contents of the DAC must be checked at least once a day and following every use. The side of trolley should have a list of contents for daily check and the AIDAA Airway Management Guidelines as laminated charts. The DAC equipment is in addition to equipment for suctioning, pressure-regulated jet ventilation, capnography and other monitoring facilities.

Table 1: List of mandatory and desirable equipment for the difficult airway cart

Mandatory	Desirable
Working laryngoscopes with Macintosh blades	McCoy laryngoscope blades
Face masks	Videolaryngoscope
ETTs	Flexible fibre-optic bronchoscope
Magill forceps	Aintree™ exchange catheter
Stylet	Equipment for high-flow nasal oxygenation (e.g., THRIVE)
Bougie	
Oropharyngeal airway and nasopharyngeal airway	
Manual self-inflating bag with non-rebreathing valve with an oxygen port, tubing and reservoir bag port (with or without a PEEP valve)	
Cannula or catheter or any other device to supplement high-flow nasal oxygen during attempts at intubation	
SADs (preferably second generation)/intubating SAD	
Nasogastric tube	
Airway exchange catheter	
Cricothyroidotomy device-wide bore cannula 12-14 gauge/ scalpel, bougie and size 6 mm ID ETT or any commercially available cricothyroidotomy kit	

Items should be available in all age-appropriate sizes, wherever applicable. ETT – Endotracheal tube; PEEP – Positive end-expiratory pressure; THRIVE – Transnasal humidified rapid insufflation ventilatory exchange; SAD – Supraglottic airway device

STANDARD REPORTING OF AN UNANTICIPATED DIFFICULT AIRWAY

We recommend that whenever an unanticipated difficult airway is encountered, complete details of the nature of difficulty, the airway management plan and complications, if any, should be documented in a standard format. A copy of this should be available in the case notes and should be given to the patient or his/her surrogate (in case the patient is a minor or is incompetent) for future reference.

We propose a standard difficult airway alert form [Figure 2]. This may be modified to suit the requirements of the workplace of the practitioner. The patient or his/her surrogate should be informed that the form contains information about the difficulties encountered during the patient's recent anaesthetic and that this information may be useful to the doctor treating him/her in future. They should be advised to keep the form carefully and show it to the doctor treating them in future and to the anaesthesiologist, if they require a surgery or procedure to be performed.

Table 2: Suggested plan for the arrangement of airway equipment within each drawer of the difficult airway cart

Drawer	Airway management plan	Equipment
Drawer 1	Laryngoscopy	Laryngoscopes, videolaryngoscope*, face masks, ETT, Magill forceps, stylet, bougie
Drawer 2	Mask ventilation and alternate intubation plan	Oropharyngeal airway, nasopharyngeal airway, devices for high-flow nasal oxygenation, McCoy blade, flexible fibreoptic brochoscope*
Drawer 3	Equipment for rescue ventilation and tube exchange	SAD (preferably second generation), manual self-inflating bag (with or without a PEEP valve), airway exchange catheter, Aintree™ exchange catheter, nasogastric tube
Drawer 4	Equipment for emergency cricothyroidotomy to deal with complete ventilation failure	Cricothyroidotomy device-wide bore cannula 12-14-gauge/scalpel, bougie and size 6 mm ETT/any commercially available cricothyroidotomy kit

*This equipment may be kept in close vicinity for ready use depending on the institutional policy. ETT – Endotracheal tube; PEEP – Positive end-expiratory pressure; SAD – Supraglottic airway device

STEPWISE APPROACH TO THE MANAGEMENT OF UNANTICIPATED DIFFICULT TRACHEAL INTUBATION IN ADULTS

The algorithm follows a step wise approach in the management of unanticipated difficult airway in adults [Figure 3]. It is important to remember that while following any step in the algorithm, if the oxygen saturation is not maintained or starts rapidly falling or bradycardia develops, one can bypass any step and even consider skipping some steps and even straightaway proceeding to emergency cricothyrotomy.

Step 1: Laryngoscopy and tracheal intubation

When intubation fails, two more attempts may be made provided the SpO_2 ≥95%. Call for help at the earliest. Subsequent attempts should be performed by a more experienced operator, if available. Nasal oxygenation administration should continue at 15 L/min, and the depth of anaesthesia should be maintained throughout the technique. One should change the plan during repeated attempts to improve the chance of success, rather than repeatedly doing the same things. This may involve changing the position, intubating device such as a videolaryngoscope, technique, using external laryngeal manipulation, releasing cricoid pressure or

Figure 2: AIDAA 2016 difficult airway alert form

AIDAA 2016
Difficult airway alert form

Details of hospital where the airway difficulty was encountered	
Name of hospital: _____	
Contact details: _____	
Details of doctor who encountered the airway difficulty	
Name of the doctor: _____	Qualification: _____
Contact details: _____	
Details of patient	
Name of patient: _____Date of birth: _____	
Co-morbidities: _____	
Contact details: _____	
Details of airway management procedure	
Date of airway event: _____Location: (e.g., OT/ICU/ER)	
Name of procedure/surgery if applicable	
1. Pre-operative difficult airway anticipated	Yes/no
2. Difficult mask ventilation	Yes/no
3. Difficult direct laryngoscopy	Yes/no
4. Difficult tracheal intubation	Yes/no
5. Difficult supraglottic airway device insertion	Yes/no
6. Airway complication following extubation	Yes/no
7. Emergency cricothyroidotomy/tracheostomy required	Yes/no
Complete details of nature of difficulty encountered in any of items 1-7 above (include number of attempts at laryngoscopy/SGA insertion and laryngoscopy grade if applicable)	
Additional equipment used to overcome the difficulty	
Details of associated complications if any	Desaturation/bradycardia/ hypotension/cardiac arrest/aspiration/ other
Any additional information (please use the reverse of the page if required)	
Awake intubation recommended in future	Yes/no
Post-procedure checklist (check only after entering details above and procedures below)	
Patient/surrogate has been counselled	Yes/no
Details have been documented in case notes	Yes/no
Form attached to case notes/department record	Yes/no
Copy of form given to patient/surrogate	Yes/no
Signature: _____	Date: _____
Name of Doctor: _____	Place: _____

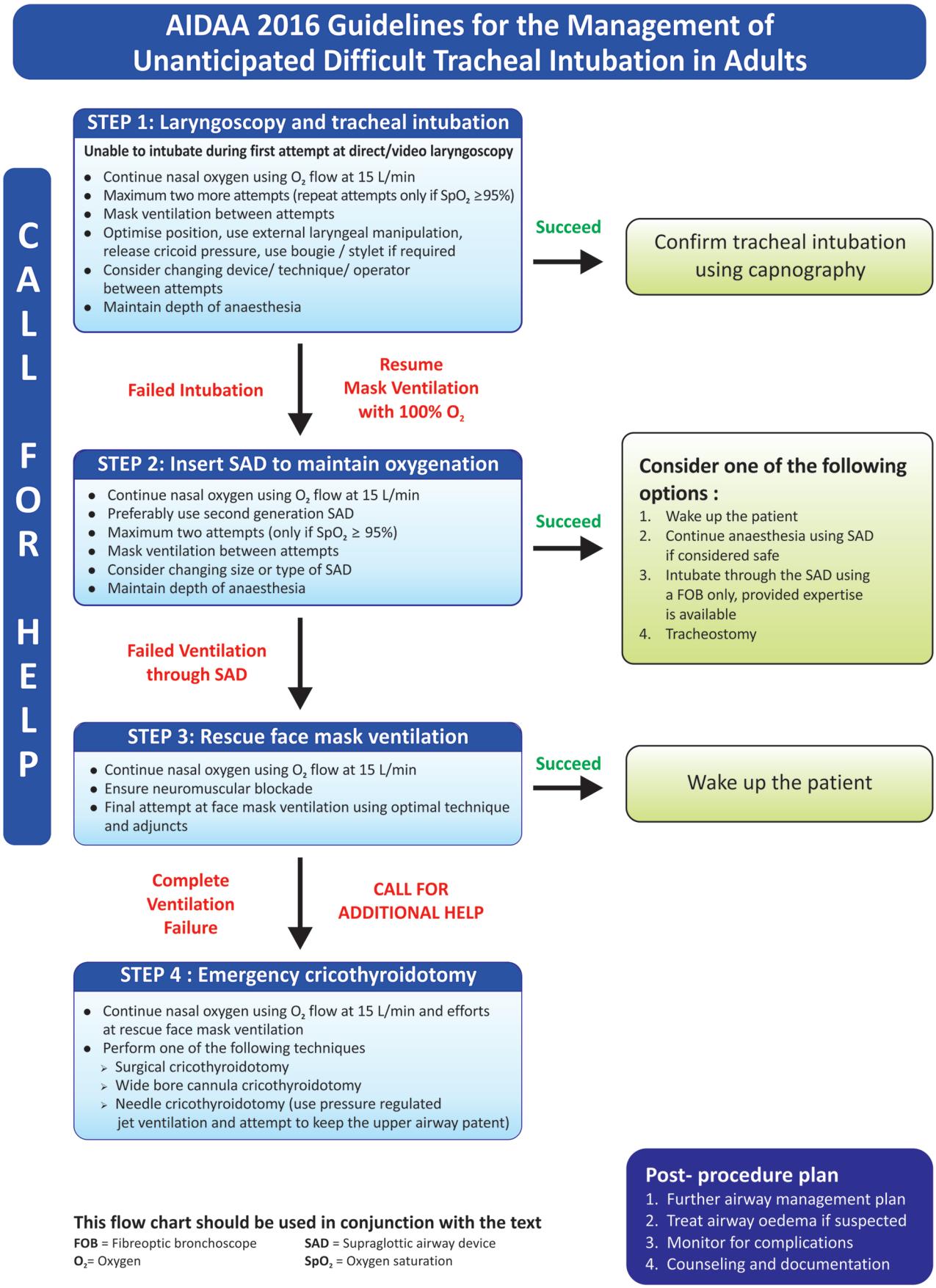

Figure 3: The All India Diffcult Airway Association 2016 algorithm for the management of unanticipated difficult tracheal intubation in adults

using additional tools such as a bougie or stylet. If a Grade 3 and above laryngoscopic view is encountered, one should abandon intubation attempts and continue mask ventilation until a definite airway management plan is made and experienced help is available. If three attempts at intubation fail, resume mask ventilation using 100% oxygen.

Step 2: Insert a supraglottic airway device to maintaining oxygenation

When intubation fails, insert a second-generation SAD to maintain oxygenation. Maximum two attempts at SAD insertion with mask ventilation using 100% oxygen in between can be made. Consider using an alternate type of SAD. Continue nasal oxygenation using oxygen flow at 15 L/min and maintain the depth of anaesthesia. Once SAD has been successfully inserted, effective ventilation and oxygenation will be maintained. This will give us time to think about a further airway management plan. The safest option will be to wake up the patient if the surgery is not an emergency. If it is an emergency procedure or continuation of the procedure is considered safe using SAD, one may proceed keeping in mind that this is a high-risk option. One must remember that this patient had a failed intubation, and any trauma during attempts may produce airway oedema which may worsen during the course of the surgery. If the procedure is unsafe to be continued using an SAD, one should consider intubation through the SAD using a flexible bronchoscope if the expertise is available. In very rare situations, a tracheostomy may be necessary despite successful ventilation using the SAD.

Step 3: Rescue face mask ventilation

When SAD insertion fails, one final attempt at mask ventilation should be tried using the optimal technique and adjuncts, if required, ensuring complete neuromuscular blockade, before proceeding to emergency cricothyroidotomy. If mask ventilation is successful, the patient should be woken up after antagonism of residual neuromuscular blockade. Continue nasal oxygenation using oxygen flow at 15 L/min. When there is CVF, call for additional help and proceed to perform emergency cricothyroidotomy before the patient desaturates.

Step 4: Emergency cricothyroidotomy

Perform either needle or surgical cricothyroidotomy based on familiarity and availability of equipment. If needle cricothyroidotomy is performed, maintain oxygenation using pressure-regulated jet ventilation until tracheostomy is done. If a wide-bore cannula cricothyroidotomy set has been used or an ET tube has been passed from the front of the neck, ventilate manually or using a ventilator circuit.

Post-procedural care

Once oxygenation has been established, a definitive airway plan should be formulated to ensure patient safety. If airway oedema is suspected, it should be treated using steroids and nebulised adrenaline, if feasible. It is necessary to follow up these patients for any immediate or late complication and treat them accordingly. A complete airway examination may be required to evaluate airway injury. A cricothyroidotomy should be converted to a tracheostomy at the earliest to minimise the risk of tracheal stenosis.

Counselling of the patient and the family after the event and documentation in the case notes of the airway difficulty faced are important. In addition, a 'difficult airway alert form' should be filled by the attending physician and a copy must be given to the patient/surrogate for future reference and a copy maintained in the department.

Failed intubations, emergency cricothyroidotomy or any airway-related morbidity or mortality should be discussed in the department or among colleagues to improve performance and prevent adverse events in future.

SUMMARY

The AIDAA stepwise approach to the management of unanticipated difficult tracheal intubation in adults emphasises the importance of adequate pre-oxygenation, insufflation of oxygen at 15 L/min throughout the period of apnoea, limiting the number of attempts at intubation to three and maintaining an SpO_2 >94%. THRIVE may significantly increase the safe duration of apnoea and must be considered when available. Tracheal placement of the ET tube should be confirmed by capnography. SADs have an important role in difficult airway management, and cricothyroidotomy should be the procedure of choice when there is CVF. We believe that the AIDAA guidelines will help anaesthesiologists in the safe management of an unanticipated difficult intubation.

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Conflicts of interest

There are no conflicts of interest.

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SUPPLEMENTAL CONTENT

Supplemental Content 1: List of search terms

'Aintree exchange catheter', 'airway alert form', airway exchange catheter', 'Airtraq', 'airway', 'airway device', 'airway emergency', 'airway management', 'apnoeic oxygenation', 'awake intubation', 'airway oedema', 'backward upward rightward pressure', 'Bonfils', 'bougie', 'bronchoscopy', 'BURP manoeuvre', 'can't intubate can't ventilate', 'can't intubate can't oxygenate', 'capnography', 'C-Mac', 'Cook Melkar', 'cricoid pressure', 'cricothyroidotomy', 'cricothyrotomy', 'difficult airway', 'difficult intubation', 'difficult laryngoscopy', 'difficult mask ventilation', 'difficult ventilation', 'difficult extubation', 'endotracheal intubation', 'esophageal intubation', 'Eschmann stylet', 'extubation', 'extubation failure', 'emergency intubation', 'failed intubation', 'Fastrach', 'fiber-optic scope', 'fibreoptic intubation', 'fiberoptic scope', 'fibreoptic stylet', 'fibrescope', 'Frova catheter', 'Glidescope', 'gum elastic bougie', 'hypoxia', 'human factor', 'airway in ICU', 'i-gel', 'illuminating stylet', 'intubation bundle', 'jet ventilation catheter', 'King Vision', 'laryngeal mask', 'laryngeal mask airway Supreme', 'laryngeal anatomy', 'laryngoscopy', 'lighted stylet', 'light wand', 'LMA Supreme', 'Manujet', 'McCoy', 'McGrath', 'Miller', 'Macintosh', 'nasotracheal intubation', 'obesity', obstetric airway', 'oesophageal detector device', 'oesophageal intubation', 'paediatric airway', 'Pentax airway scope', 'Pentax AWS', 'preoxygenation', 'ProSeal LMA', 'Quicktrach', 'ramping', 'rapid sequence induction', 'Ravussin cannula', 'Sanders injector', 'Sellick maneuver', 'sniffing position', 'sugammadex', 'supraglottic airway', 'suxamethonium', 'surgical airway', 'tracheal introducer', 'tracheal intubation', 'tracheostomy', 'videolaryngoscope' and 'videolaryngoscopy'.