**NALHN EMET AIRWAY SKILLS WORKSHOP 2023**

**MURRAY BRIDGE**

**PRE-LEARNING AND OTHER USEFUL RESOURCES TO HELP GET READY FOR THE WORKSHOP**

**SECTION 1**

**HUMAN FACTORS AND ERGONOMICS (HFE) IN AIRWAY MANAGEMENT**

**Before we go into HFE – I would like you to see the video below titled "Just a routine operation". Hopefully after this, a lot of the subsequent discussion will make more sense and drive home the critical importance of human factors and ergonomics in airway management, especially when facing unexpected difficulty.**

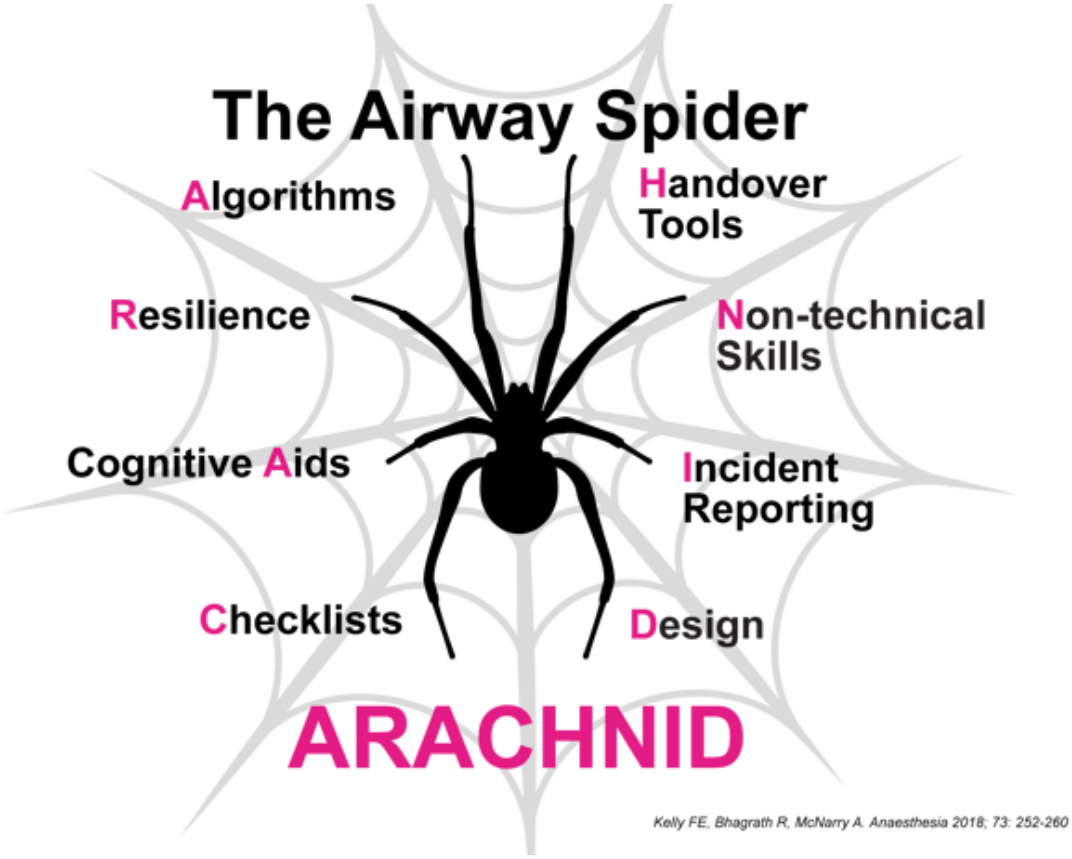
**https://vimeo.com/86978963 (Just a Routine Operation) – to see video, please Ctrl + Click on the link.**

**So, what do you think HFE is really?**

Humans, by their very nature, will inevitably make mistakes however well trained, diligent and conscientious they are.

HFE aims to "design out" the chances of mistakes happening in the first place. If an error does occur, it aims to put barriers in place to prevent that error progressing to patient harm.

**THE AIRWAY SPIDER**



Many aspects of HFE are relevant to airway management and these can be easily described using the airway spider as shown above, each letter of the spider representing one letter of the mnemonic ARACHNID.

**D – DESIGN**

The most important aspect of safe systems and safe working practices. Things like placing airway trolley next to the airway assistant as well as airway operator in an unobstructed, easily seen and accessible spot or placing the screen of the video-laryngoscope to the opposite side of the bed as the airway assistant so that all members of the team can see it easily. Or having the end-tidal and saturation monitoring screens directly in front of the airway operators/assistants so they have a constant unobstructed view of it are simple but extremely useful design aspects during airway management situations.

Standardization of equipment is also important, for example in airway management, being airway trolleys being arranged in the same format throughout the organization and ideally throughout the whole state if not the whole country!

**A – ALGORITHMS**

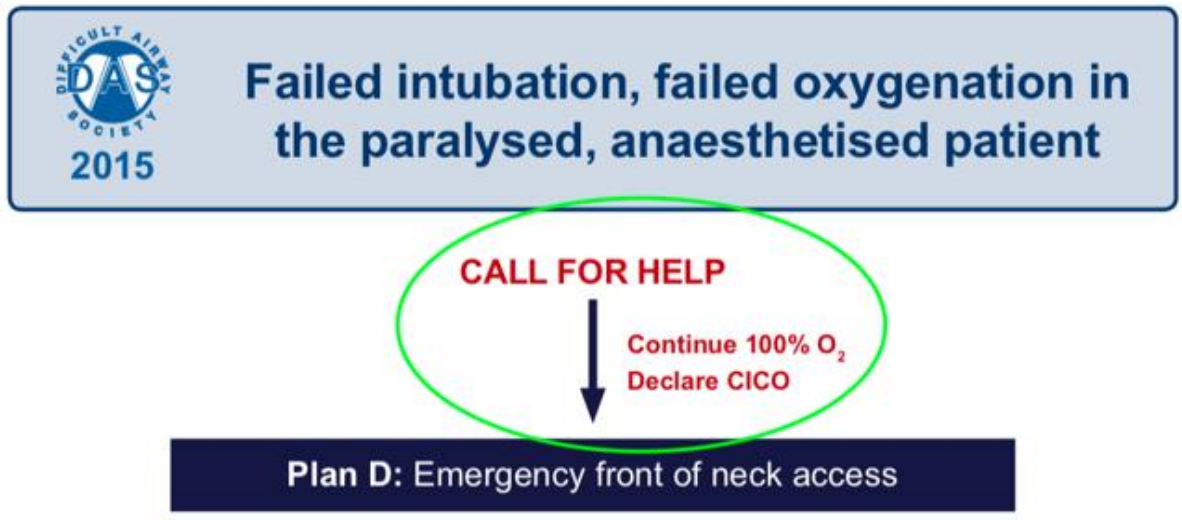
Both designing algorithms using HFE expertise as well as printing algorithms out in colour and having them available in ALL areas where airway management occurs, so that they can be referred to in an emergency if needed is useful. An example of well-designed algorithms in airway management is the

DAS 2015 difficult intubation guidelines which have prompts for the team to “call for help”, “declare a failed intubation”, “stop and think” and “invite ideas from the team”.

**Ctrl + Click** on the following link to access these guidelines.

https://das.uk.com/guidelines/das_intubation_guidelines

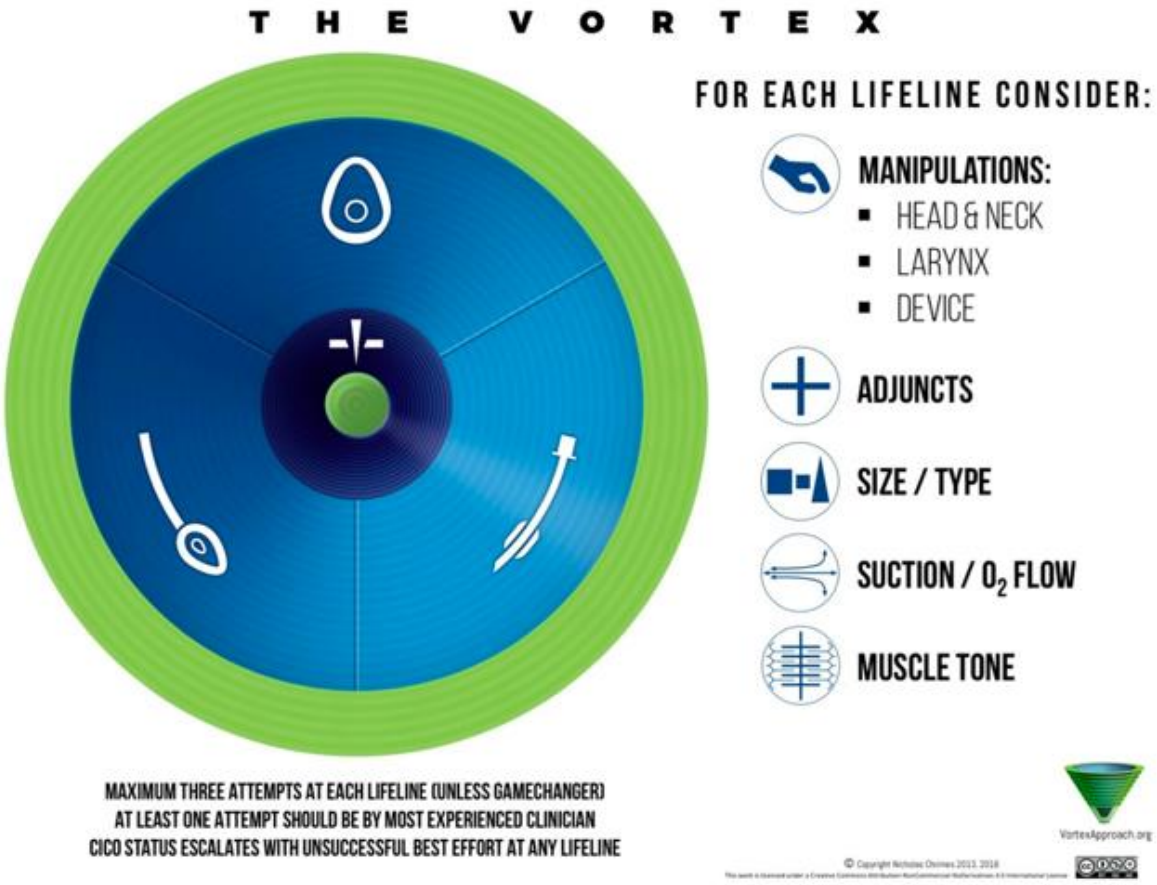
Also see the below flow chart for failed intubation and failed oxygenation situation as per the DAS guidelines.




**RESILIENCE** – The ability to bounce back from difficulty. Must have strategies at state, organizational and departmental level as well as have your own personal strategies. For further reading on resilience, read the article in the below link (Ctrl + Click on the link)

https://onlinelibrary.wiley.com/doi/abs/10.1111/anae.14911

**C – COGNITIVE AIDS** – These are educational materials designed to improve management of an emergency. An example of this would be the VORTEX strategy for management of a Can’t intubate, Can’t oxygenate” situation. (See below).




**CHECKLISTS** – Checklists are proven to improve adherence to an algorithm, for example the intubation checklist for a predicted difficult intubation in the critically unwell patient, from the Difficult Airway Society (DAS). See the link below.

https://das.uk.com/guidelines/icu_guidelines2017

**Intubation Checklist : critically ill adults – to be done with whole team present.**

**Prepare the patient**

- ❑ **Reliable IV / IO access**
- ❑ **Optimise position**
  - ❑ Sit-up?
  - ❑ Mattress hard
- ❑ **Airway assessment**
  - ❑ Identify cricothyroid membrane
  - ❑ Awake intubation option?
- ❑ **Optimal preoxygenation**
  - ❑ 3 mins or $ETO_2$ > 85%
  - ❑ Consider CPAP / NIV
  - ❑ Nasal $O_2$
- ❑ **Optimise patient state**
  - ❑ Fluid / pressor/ inotrope
  - ❑ Aspirate NG tube
  - ❑ Delayed sequence induction
- ❑ **Allergies?**
  - ❑ ↑ Potassium risk?
    - avoid suxamethonium

**Prepare the equipment**

- ❑ **Apply monitors**
  - ❑ $SpO_2$ / waveform $ETCO_2$ / ECG / BP
- ❑ **Check equipment**
  - ❑ Tracheal tubes x 2
    - cuffs checked
  - ❑ Direct laryngoscopes x 2
  - ❑ Videolaryngoscope
  - ❑ Bougie / stylet
  - ❑ Working suction
  - ❑ Supraglottic airways
  - ❑ Guedel / nasal airways
  - ❑ Flexible scope / Aintree
  - ❑ FONA set
- ❑ **Check drugs**
  - ❑ Consider ketamine
  - ❑ Relaxant
  - ❑ Pressor / inotrope
  - ❑ Maintenance sedation

**Prepare the team**

- ❑ **Allocate roles**

One person may have more than one role.

- ❑ Team Leader
- ❑ 1st Intubator
- ❑ 2nd Intubator
- ❑ Cricoid force
- ❑ Intubator's assistant
- ❑ Drugs
- ❑ Monitoring patient
- ❑ Runner
- ❑ MILS (if indicated)
- ❑ Who will perform FONA?

- ❑ **Who do we call for help?**
- ❑ **Who is noting the time?**

**Prepare for difficulty**

- ❑ **Can we wake the patient if intubation fails?**
- ❑ **Verbalise** "Airway Plan is:"
  - ❑ **Plan A:**
    Drugs & laryngoscopy
  - ❑ **Plan B/C:**
    Supraglottic airway
    Face-mask
    Fibreoptic intubation via supraglottic airway
  - ❑ **Plan D:**
    FONA
    Scalpel-bougie-tube
- ❑ **Does anyone have questions or concerns?**

**H – HANDOVER TOOLS** – handover tools improve the clarity of transfer of information within members of a team or from one team to another.

Examples include:

ISBAR – Identification, Situation, Background, Assessment, Recommendation.

Traffic Light Handover Tool – Red emergencies, Amber assists, Green queries

SNAPPI – Stop, Notify, Assess, Plan, Prioritise, Invite ideas.

**N – NON-TECHNICAL SKILLS**

These include Teamwork and Communication, Situational Awareness, Task Management and Decision Making. Flattening the hierarchy and reducing the authority gradient are other important aspects of this. Staff need to be empowered to speak up if they feel patient safety is being compromised. Leadership and followership, delegation and prioritization and coping with distractions are other very pertinent aspects of this.

INCIDENT REPORTING AND INVESTIGATION –We must accept the fact that sometimes things will go wrong. And when things do go wrong, it is a natural reaction for people to look for someone to blame. However, blaming someone does not help help them be better or learn. Helping someone to learn to be better after a mistake is a special skill.

Sometimes, things will go wrong during airway management. It sometimes does not go as well as it could. It happens to all of us – young staff, trainees, juniors and even professors!

The most important thing is to look after the patient as best as you can on that day. The next best thing is to learn from what happened. That will mean that things will go wrong less often.

For us to learn from something that went wrong, four things need to happen:

1. We need to **tell our colleagues** when things have not gone as well as they could.
2. Our colleagues(peers) need to **help us understand why** it happened.
3. We need to work out **what we can change** so things will work better in future.
4. We need to **make that change**!

Good teachers do not tell us off because we do not know something. They help us to understand, and they help us to remember. Good teachers do not tell us off when we can't do something. They show us how to do it and help us to become better. Working out why the best clinicians sometimes make mistakes is difficult. The best teachers and investigators work out why this happens and help us make it better.

So, that's a summary of HFE as relevant to airway management. Putting it together and looking at the role HFE might play in an airway emergency, it is useful to look at ERROR CHAINS.

**ERROR CHAINS**:

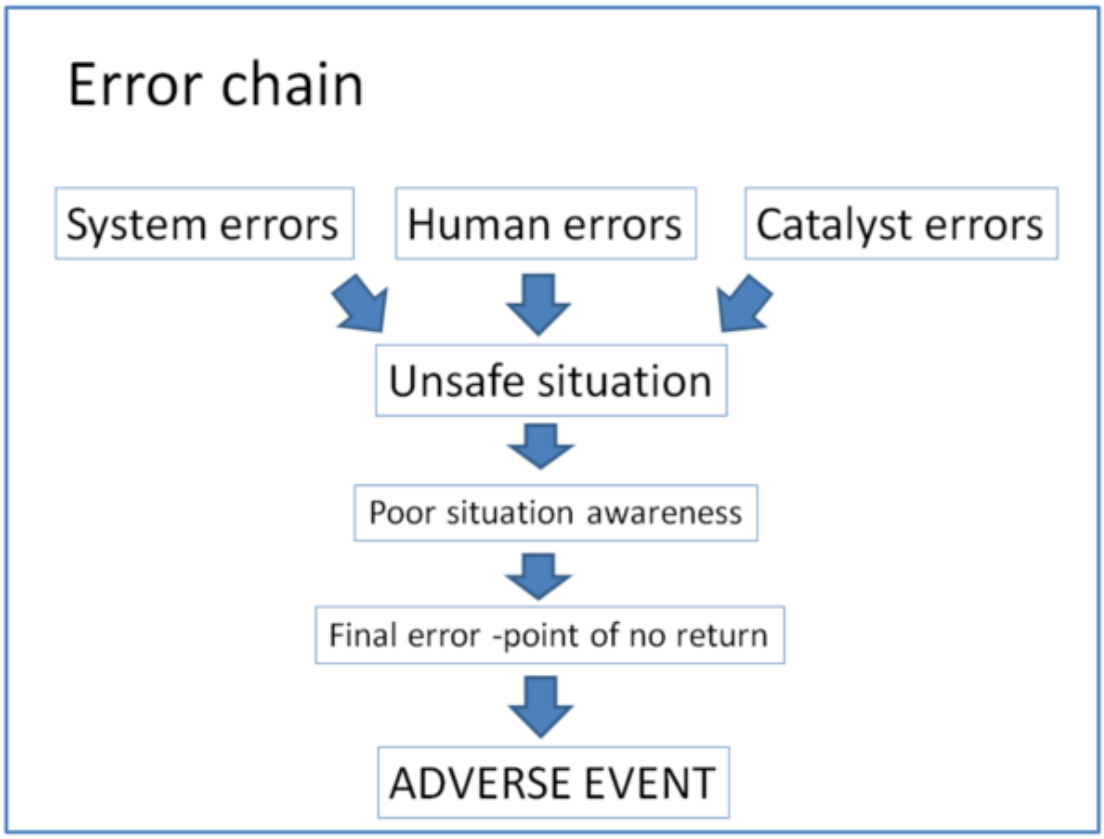
In an emergency, there are multiple things happening all at once and events don't follow each other in a linear fashion as an error chain might suggest. However, error chains can help to understand the concepts well and how the various aspects of HFE play a role in improving safety during airway emergencies.

Looking at the error chain, there are three types of errors at the top:

System errors – also known as latent errors.

Human errors – also known as active failures.

Catalytic events – also known as co-incidental events.

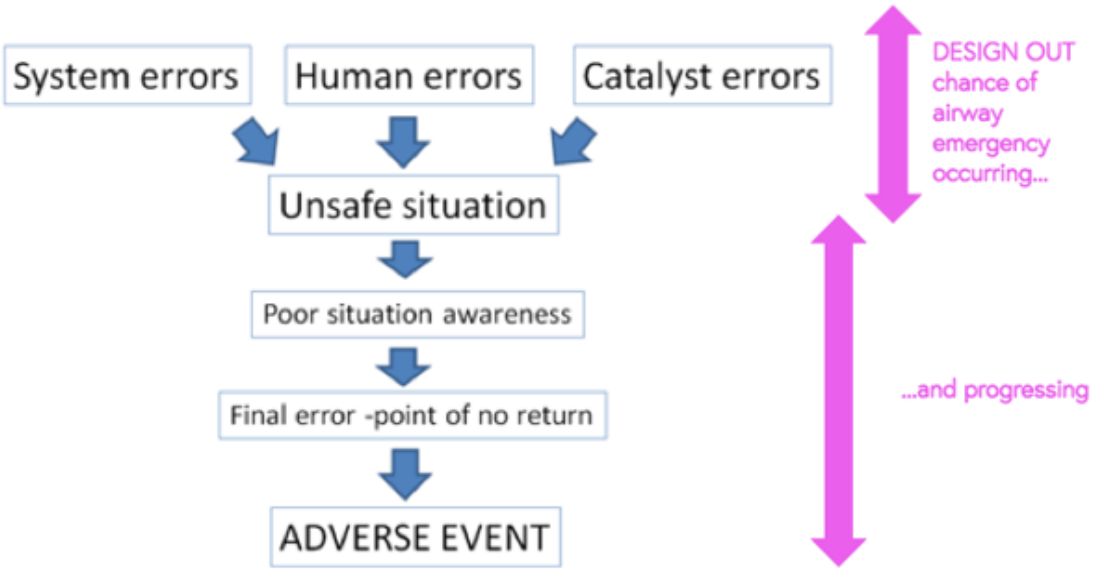



If 2 of the 3 errors are present at the same time, then an unsafe situation is created. If this is then combined with poor non-technical skills and poor situational awareness within the team, then a point of no return is quickly reached and an adverse even, such as an airway adverse incident occurs.

Much team training is carried out with the aim of improving non-technical skills but if the team is then placed back into an imperfect system with system errors and catalytic errors still present, then the chance of the same error occurring again is high.

Many would say that the healthcare system today is reliant on incredibly high levels of personal performance every day to maintain patient safety and that incorporating HFE expertise in our day to day working has the potential for us to be less reliant on such high levels of personal performance and improve patient safety.

## Error chain




## Error chain

**SECTION 2**

AIRWAY ASSESSMENT AND EQUIPMENT

Airway assessment is the cornerstone of good airway management and should be carried out in all patients requiring sedation, induction, airway support and intervention.

Worldwide literature suggests that up to a quarter of patients whose airway was managed had no prior recorded airway assessment. It is also worth noting that that serious adverse events have occurred even when no problem with airway management had been anticipated on assessment, This emphasizes the need for vigilance and a prepared airway management strategy EVERYTIME.

The aim of airway assessment is to predict if the patient's anatomy might make Bag-Mask-Ventilation (BMV) Supra-glottic Airway Device (SAD) placement or laryngoscopy and intubation difficult.

Although unanticipated difficulties may still arise, a good airway assessment reduces the likelihood of airway management difficulties.

Although there are a number of bedside tests available to assess airway, no single test is completely reliable.

Predicted difficulty in airway management should allow appropriate preparation, planning and strategies to be implemented, including avoiding, delaying the procedure, escalating to

senior/experts, using fibre-optic and video assisted techniques or securing the airway with an awake intubation technique.

Key aspects of predicted airway difficulty

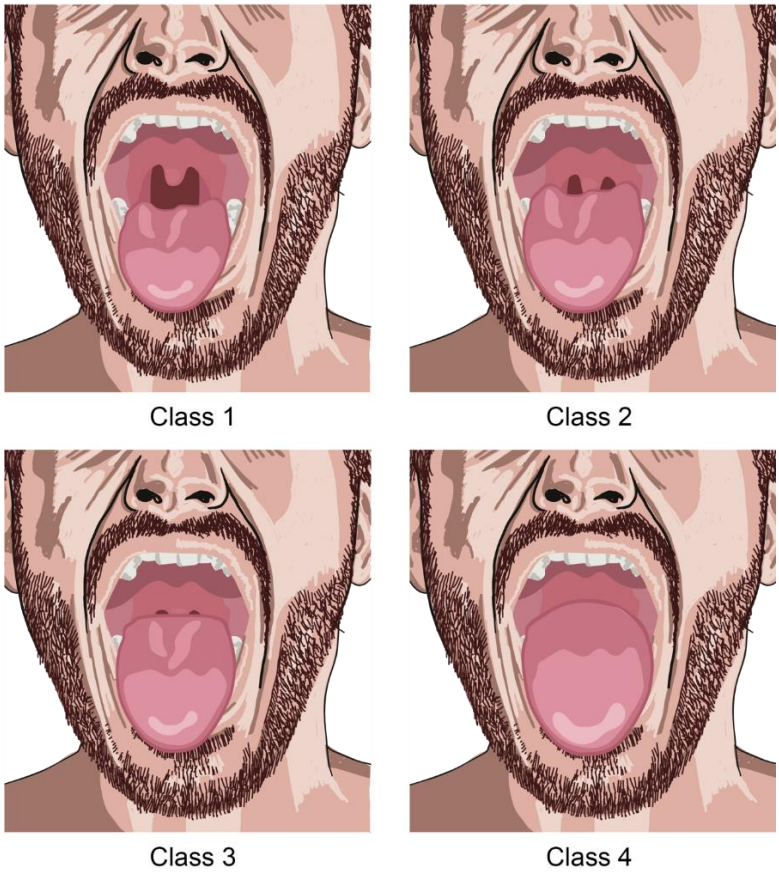
**On history**:

- Current symptoms including dyspnea, dysphagia and dysphonia (difficulty or discomfort on speaking)
- Symptoms of OSA (obstructive sleep apnea).
- Previous surgery or radiotherapy to the neck.
- Previous known/documented difficulty in airway management.
- Chronic medical problems and conditions including diabetes, ankylosing spondylitis and rheumatoid arthritis.

On Examination:

- Obese, increased neck circumference, short neck
- Beard
- Face and neck scarring, burns, contractures or other anatomical distortion
- Dentition – prominent incisors, mobile teeth, gaps
- Jaw subluxation, restricted mouth opening
- Neck movement restrictions, most importantly atlanto-occipital extension
- Neck swellings, masses, scars, radiotherapy

MODIFIED MALLAPMATTI SCORE:




Ask patient to open their mouth and stick out their tongue.

Class 1: Able to see soft palate, uvula, fauces and tonsillar pillars easily.

Class 2: Soft palate, uvula, fauces

Class 3: Soft palate and base of uvula

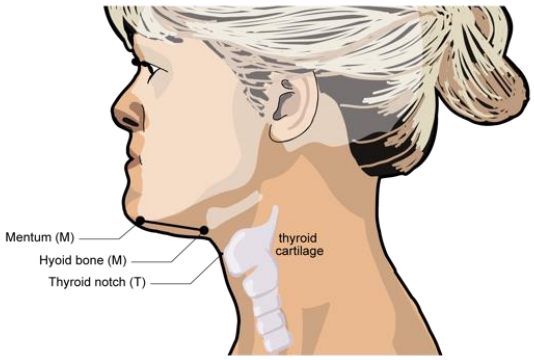
Class 4: Soft palate not visible.

Measurement of distances:

A thyromental distance of < 7cm and a sterno-mental distance of <12.5cm is suggestive of potential airway management difficulty.

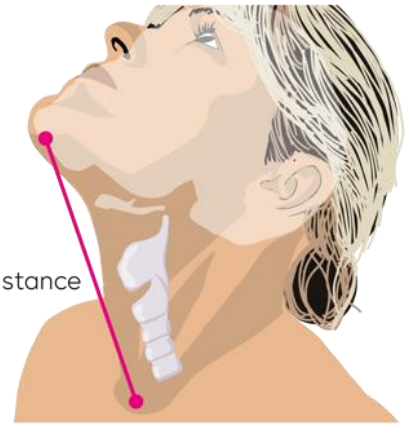
A gap of at least 2cm between the upper and lower incisors is required to be able to insert a direct or a video-laryngoscopy blade.

Palpation of the front of the neck is important to assess for the position of trachea, presence of any masses, the cricothyroid membrane/fossa and any induration/scarring.




Hyomental Distance

Thyromental Distance



Sternomental Distance

THE LARYNGEAL HANDSHAKE

Described by Dr Richard Levitan, the laryngeal handshake promotes confidence in recognition of 3 dimensional anatomy of the laryngeal structures. With the non-dominant hand, identify the hyoid bone and the thyroid cartilage, stabilizing the larynx between the thumb and the middle finger and moving down the neck to palpate the cricothyroid membrane with the index finger.

## SECTION 3

**AIRWAY EQUIPMET – STANDARD AND DIFFICULT AIRWAY**

**The airway trolley in your ED**

The importance of a well organized and suitably stocked standard airway trolley in your department cannot be overemphasized. The National Audit Project 4 (NHS UK) highlighted the importance of a well-organized DIFFICULT airway trolley in safe and standardized difficult airway management.

However, it is my belief and opinion that EVERY airway trolley should be set up as a potential difficult airway trolley and ideally be standardized throughout the department and hospital. This has been discussed above in the Human Factors and Ergonomics section and needless to say, will enable practitioners to know exactly where to find each piece of equipment when quickly and reliably.

Each department/hospital wil have their own standardized airway trolley set up and contents.

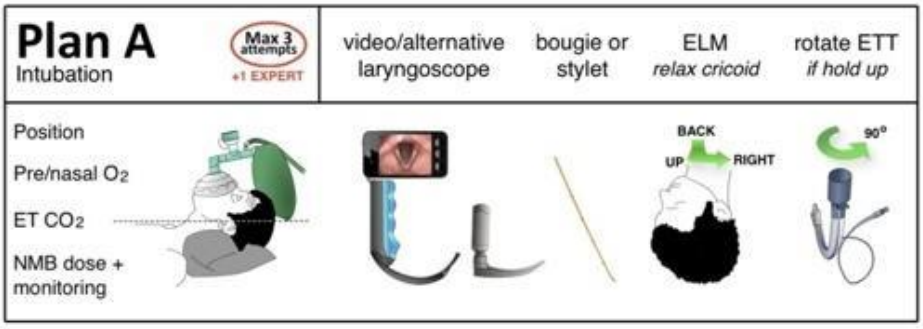
**You would, hopefully, all be aware of and familiar with the airway trolley set up in your department. Is it also set up like a potential difficult airway trolley? How easily can you find the right piece of equipment and how often is it checked and who monitors and restocks it? These are important considerations and questions for any department that manages airways.**

For reference, the Difficult Airway Society (DAS) recommends a **5-drawer airway trolley** with recommended content which would be a good recommendation to follow. It conforms to the DAS **Difficult Intubation Guidelines (2015) with Plan A-B-C-D in mind.**

The standard 5 drawer trolley is labelled as drawers A to D with stickers and written recommended content in each drawer.

Top Drawer is used to keep consumables like lubricants, gauze, ribbons and eye tapes, airway atomisers etc. It is very important that this drawer does not become cluttered with sundries as it provides focus for anticipated airway management plan for each patient.

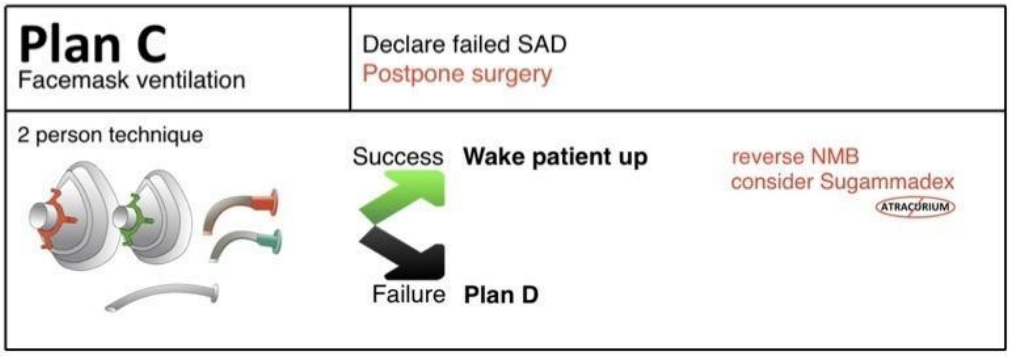
DRAWER A – contains small range of sizes of tracheal tubes making it easier to identify in an emergency situation. It will also have a bougie or stylet, equipment for pre-oxygenation, airway adjuncts and MacIntosh laryngoscope blades. PLAN A sticker is applied to the Drawer A:



DRAWER B contains Supra-glottic Airway Devices with limited choice of sizes – one of each size. It will facilitate moving onto plan B of airway management and is labelled as such.


DRAWER C – contains size 3, 4 and 5 face masks for BMV along with adjuncts to face mask ventilation. This includes a choice of size 2, 3 and 4 oropharyngeal airway and size 6 and 7 naso pharyngeal airway.

This drawer should allow quick access to BMV via face mask to allow emergent oxygenation. ALWAYS REMEMBER – BMV is a 2-person task. One person places, holds and seals the mask appropriately over the patient's face while the other person squeezes the bag.



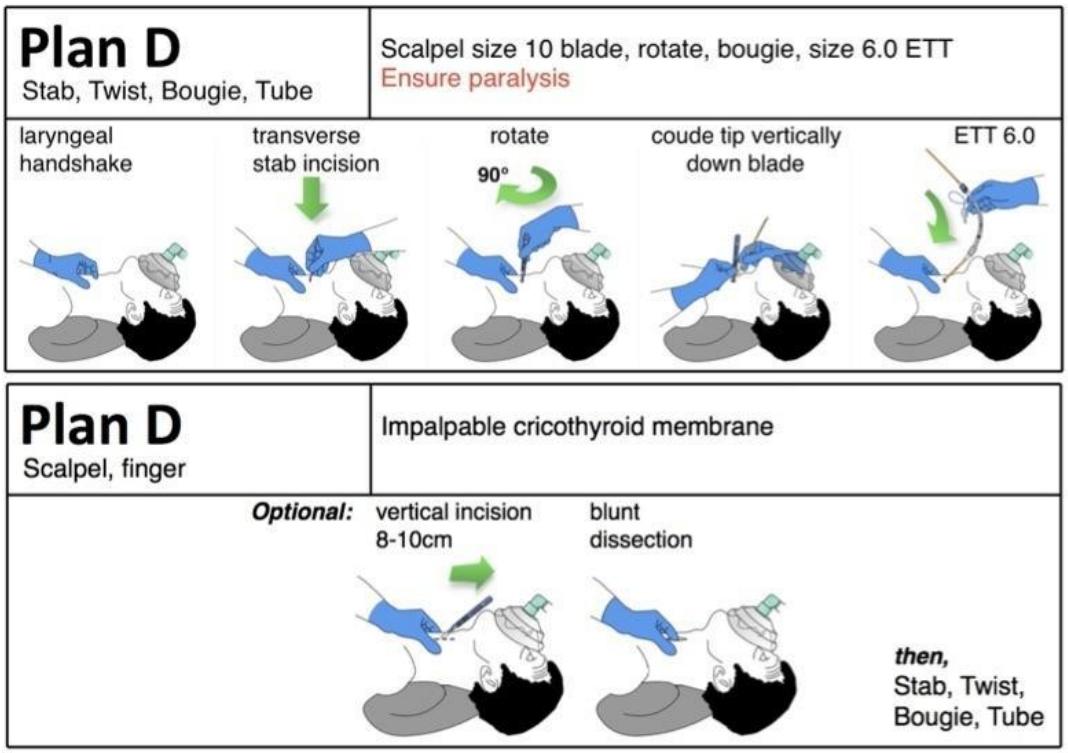

**Please note:**

**As per the DAS guidelines (written with controlled OR environment and anaesthetics department settings in mind, the PLAN C advises taking or planning for one of two options: either waking the patient up or moving to plan D if the first option fails. However, as you all would agree, *waking the patient up is generally not an option when doing an RSI and intubation in the emergency department* settings as the patients most likely are already critically unwell and in need of urgent airway management.**

**Therefore, in ED settings - if BMV fails to oxygenate the patient as per plan C – one needs to be prepared for and quickly move to PLAN D which is establishing emergency front of neck access (eFONA).**

Also, how many of you know about Sugammadex?

DRAWER D – The contents of this drawer should obviously provide easy access to the surgical airway kit and all related adjuncts.




Please Ctr+Click the following link to watch a very useful video by Scott Weingart on surgical airway. This technique of scalpel – finger – bougie – tube is useful and simple.

https://www.youtube.com/watch?v=Q0RVlgwC9rs

There is another brilliant video on the creation of eFONA below, courtesy of DAS via FutureLearn Airway Course. Please Ctr+Click on the below link to watch the video. This technique is useful if the cricothyroid membrane is easily palpable.

https://www.futurelearn.com/courses/airway-matters/6/steps/1344114

Please note that it is extremely important to ensure there is appropriate and regular training and teaching of all staff in your department regarding the layout and planning of airway equipment according to the DAS guidelines. Staff should regularly be taught about the use of and the rationale behind such an approach and layout. A weekly airway training session should be aimed at.

Please Ctr+Click on the following link for more examples and details on Airway Rescue Trolley set-up.

https://www.futurelearn.com/links/l/gl09qp9kp2s796lqa75f3tuvcmxkqnd

To access an infographic on Supraglottic airway devices (commonly known as LMAs), please Ctr+Click on the below link.

https://www.futurelearn.com/links/f/23lkngzmegfjkxoe79bf8ws34s8es9o

To access an infographic on airway opening maneuvers, adjuncts, face masks – please Ctr+Click on the below link.

https://www.futurelearn.com/links/f/kl047vxgmnj2ld6rk4ewyvugv8ej50w

**SECTION 4**

**THE DECISION TO INTUBATE**

Timely, effective airway management in an emergency can mean the difference between life and death or between ability and disability. As such, airway management is the single most important skill of emergency clinicians.

Regardless of specialty or locus of care, all airway practitioners must maintain the cognitive base and technical skills set required for swift, decisive airway management without warning and even in suboptimal circumstances.

The emergence of new technologies, especially the various methods of video laryngoscopy is changing the fundamental approach to airway decision making particularly with respect to difficult airways.

Nevertheless, emergency airway management whether in the ED or elsewhere in the hospital still comprises a series of complex actions:

- Rapidly assess the patient's need for intubation and the urgency of the situation.
- Determine the best method of airway management.
- Decide whether pharmacological agents are indicated, which ones to use, in what order and in what doses.
- Construct a plan in the event that the primary method is un successful, recognize when the planned airway intervention has failed and quickly and effectively execute the alternative (rescue) technique.

The entire repertoire of airway skills must be mastered, including optimal positioning, bag-mask ventilation, use of airway adjuncts, conventional and video laryngoscopy, flexible endposcopy, the

use of extra-glottic airway devices (also known as supra-glottic airway devices), use of stylets and gum-elastic bougies and surgical airway techniques.

**Indications for intubation:**

The decision to intubate is based on three fundamental clinical assessments:

1. Is there a failure of airway maintenance or protection?
2. Is there a failure of ventilation or oxygenation?
3. What is the anticipated clinical course?

The results of these three evaluations will lead to a correct decision to intubate or not to intubate in virtually all conceivable cases.

**THE DIFFICULT AIRWAY VERSUS THE FAILED AIRWAY.**

These two concepts are distinct and the response to each is different.

A difficult airway is one in which a pre-intubation examination identifies attributes that are likely to make laryngoscopy, intubation, BMV, use of an extra-glottic device or even a surgical airway difficult.

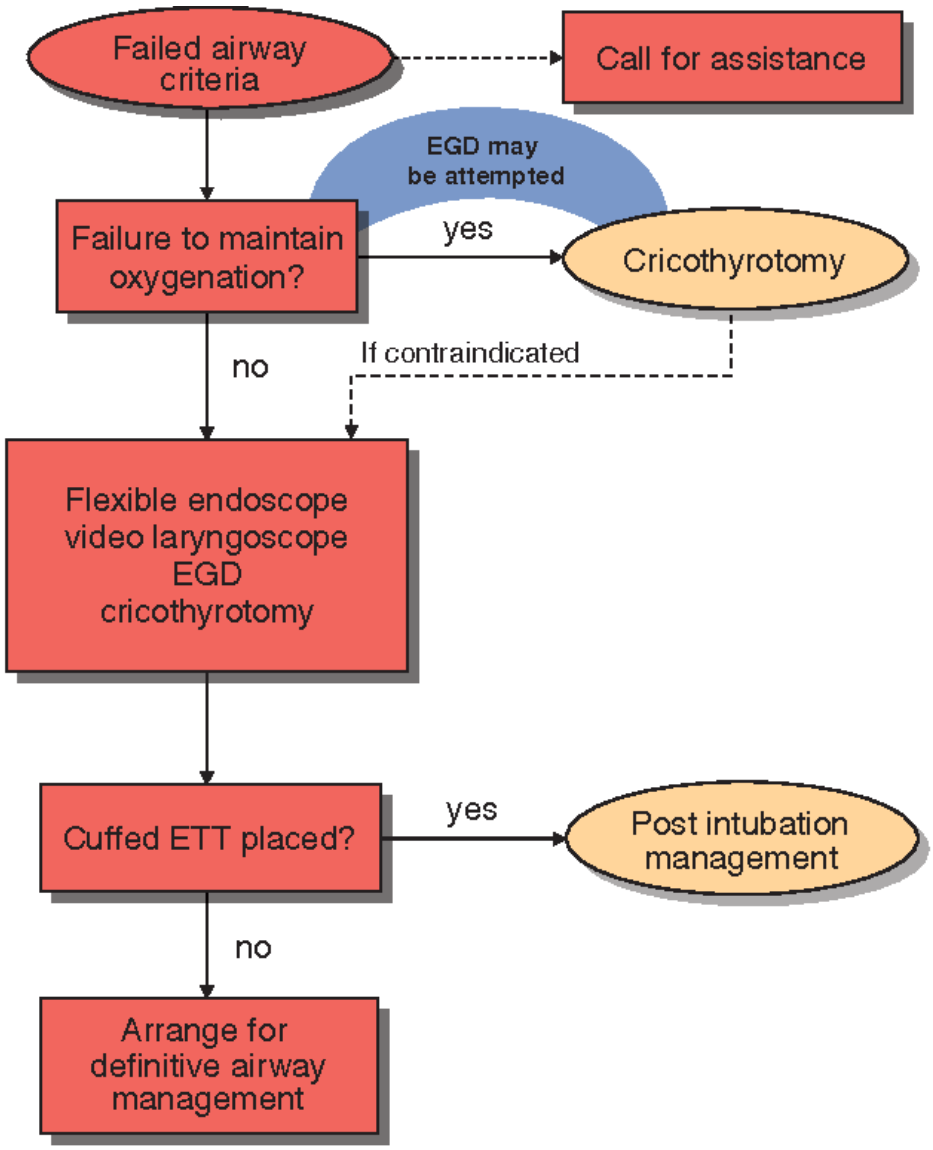
The key message here is that in general, one should not administer a neuromuscular blocking agent (paralytic) to this group of patients unless one has a measure of certainty that oxygenation can be maintained if laryngoscopy and intubation fail. Accordingly, if a difficult airway is identified, the difficult airway algorithm should be followed (e.g. the DAS algorithm, as discussed earlier).

A failed airway situation occurs when a provider has embarked on a certain course of airway management (e.g. rapid sequence intubation) and has realized that intubation by that method is not going to be successful, requiring the immediate initiation of a rescue sequence (the failed intubation airway algorithm).

One could argue that in retrospect, a failed airway can be called a difficult airway because it has proven to be difficult or impossible to intubate but the terms failed airway and difficult airway must be kept distinct because they represent different situations requiring different approaches and arise at different points in the airway management sequence.

One way of thinking about this is that the difficult airway is something one anticipates and plans for while the failed airway is something unexpected that one experiences during airway management and that needs an immediate rescue intervention.

See below for the failed airway algorithm.




**Failed Airway Algorithm.** See text for details. EGD, extraglottic devi

**SECTION 5**

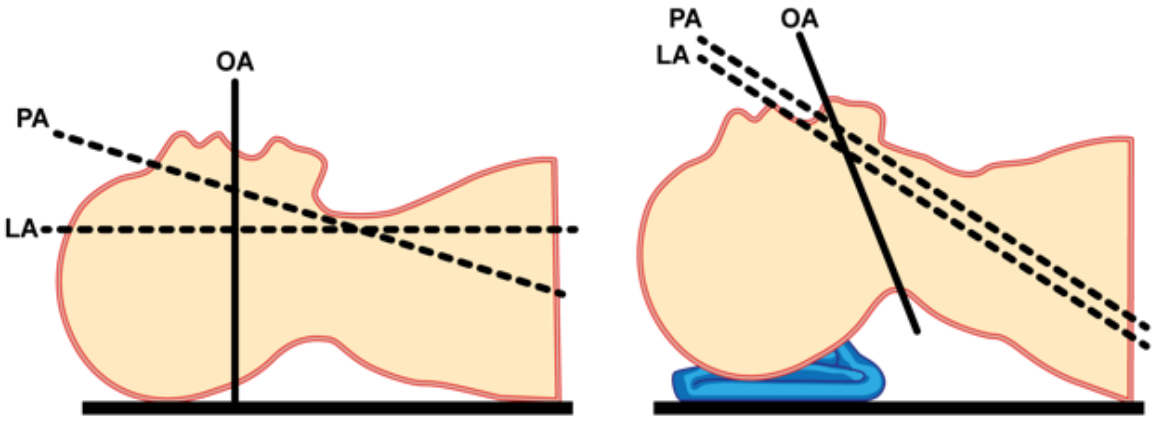
**VIDEO LARYNGOSCOPY**

Video laryngoscopy has transformed airway management in a short span of time. Laryngoscopy was once considered an art which could be mastered only with years of experience. As the view was only available to the operator, subtleties of techniques weren't easily shared, and expertise required a great deal of practice. With the advent of video laryngoscopes, it has become a more accessible and attainable skill.

A true video laryngoscope has a digital video camera mounted on the tip of a laryngoscope with no fiber optic components making it easy to handle the camera images and easy to produce.

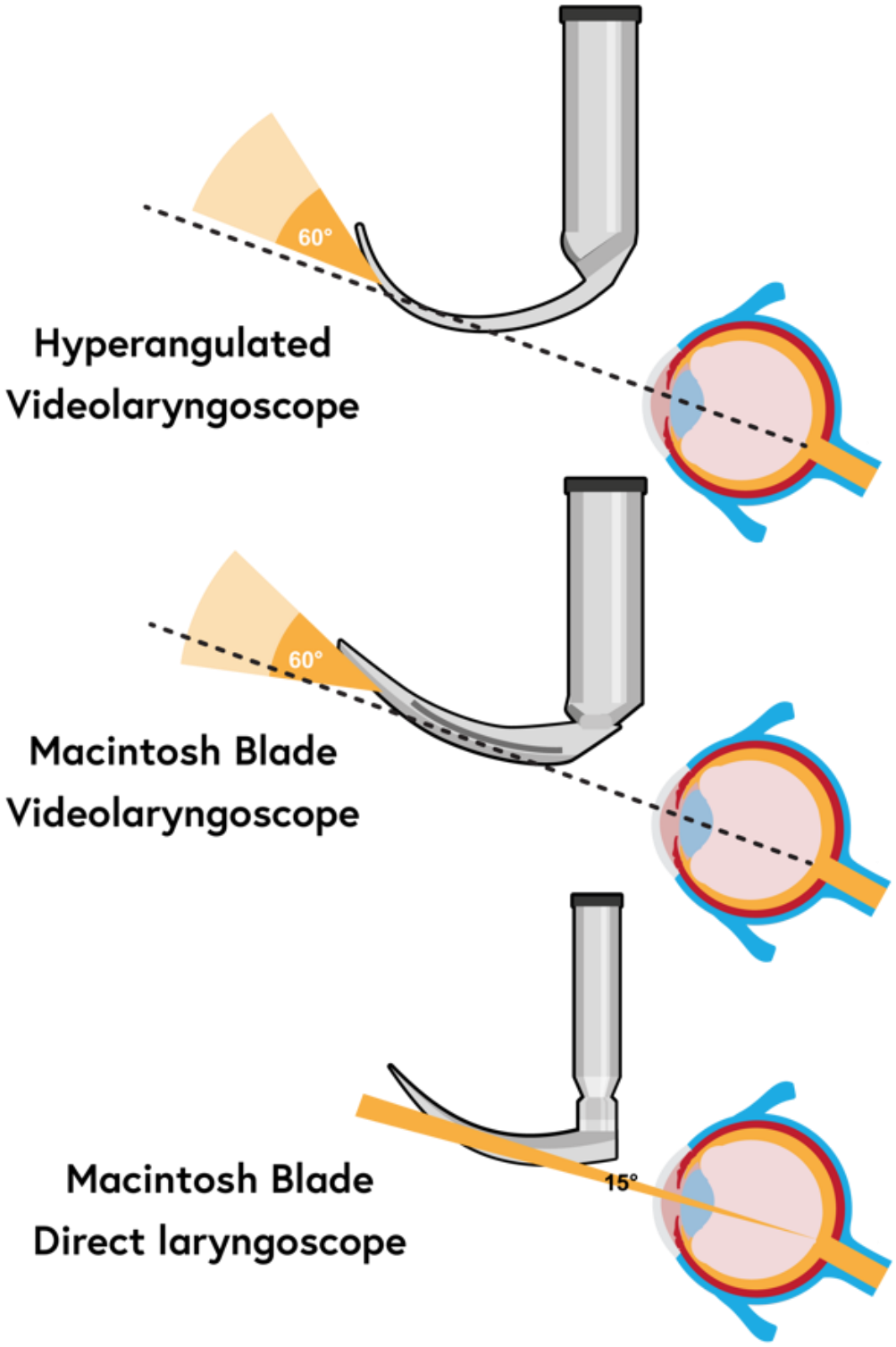
**Principles of laryngoscopy**

Standard direct laryngoscopy requires alignment of three axes with the eye to achieve a direct view of the larynx: the oral axis, the pharyngeal axis, and the laryngeal axis. Traditionally the 'sniffing the morning air' position is used (flexion of the neck and extension of the head) to create a 'line of sight'.




*Angles of alignment- Oral axis (OA), Pharyngeal axis (PA) and Laryngeal axis (LA)*

The camera lens on a videolaryngoscope is sited towards the tip or distal end of the laryngoscope blade. This allows the operator to have a closer and wider-angle view of the laryngeal structures than a direct laryngoscope but it is also in effect an 'around the corner' view which is further extended when the blade has a hyper-angulated shape. The hyper-angulated or 'difficult' blades have greater radius of curvature than the standard Macintosh laryngoscope blades and were designed to be used in patients in whom it is difficult or impossible to obtain a direct line of sight view.




*Increased angle of view (60°) with a videolaryngoscope Macintosh type blade and a hyper-angulated blade, compared with a 15° view using direct laryngoscopy.*

**Classifications**

Videolaryngoscopes can generally be divided into two groups: those with **Macintosh type blades** and those with **hyperangulated blades**. Devices with hyperangulated blades are further subdivided into **non-channelled** and **channelled**.

Devices with a Macintosh type blade can be used either for a direct, line of sight view or for an indirect, enhanced view via the camera and screen. A wider angled view of the larynx is provided. Tube insertion technique is similar to direct laryngoscopy, a stylet, introducer or bougie may be helpful but are not essential. Examples include Storz C-MAC, Glidescope Titanium MAC and AP Advance Normal Macintosh blade.

The **hyperangulated blades** provide indirect glottic visualisation via the camera and screen, they do not provide a direct view of the larynx. **The channelled devices** have a back wall or 'open tunnel' shape incorporated into the blade design and this helps direct the tracheal tube towards the glottis. Examples include Pentax AWS, AP Advance Difficult airway blade & King Vision. A preformed malleable stylet or introducer is not needed with channelled devices.

When using **non-chanelled hyperangulated** devices a stylet with a similar curvature to the blade, introducer or bougie is recommended to help guide the tip of the tracheal tube through the cords. Examples include Storz D-Blade, Glidescope LoPro and McGrath X-blade.


*Glidescope Macintosh blade and hyper-angulated blade*

The technique for laryngoscopy depends on the blade you are using and varies from one device to another. There are other differences between devices which are sometimes quite subtle; these include screen position, portability, single-use (disposable) blades or reusable blades. Familiarity and expertise with one device may not be completely transferable to another.

*Tracheal tube mounted on a stylet*

*Intubating stylet removal after tracheal tube intubation using hyperangulated blade*

**Advantages**

Videolaryngoscopy (VL) offers the following advantages:

- The view of the larynx is better than with direct laryngoscopy
- Successful intubation is more likely in those patients who have difficult airways
- Less soft tissue force is needed to obtain a view of the larynx which results in less sympathetic stimulation
- Sore throat and dental trauma are less common
- The indirect view is not obscured by the advancing tracheal tube, so there is more precise visual control when inserting the tracheal tube
- VL improves teamwork and human factors. All team members share the view and can offer advice, see the effect of cricoid/anterior pressure and anticipate next steps such as the need for suction or alternative intubating aid.
- The shared view aids the teaching and training of novice 'intubators'. Airway anatomy can be demonstrated during intubation and the attempts at intubation by a novice can be more closely and clearly observed. Instruction and advice can be given in real time and the need to intervene can be judged more easily.
- The position of the tube in relation to the cords can be checked.
- Nasogastic and orogastric tube insertion is easier.
- VL can be used to assist fiberoptic intubation and tube exchange.
- VL can be used for awake intubation in selected patients.

**Disadvantages**

- Although it is usually easy to view the larynx with a videolaryngoscope, it may not be easy to pass the tube into the trachea. This is a particular feature of hyper-angulated blade devices, the working space is different, perception of depth is altered, and it can be challenging to direct the tube through the vocal cords. Impingement of the tube can occur as it approaches the glottis at a slightly more acute angle than with direct laryngoscopy. This problem can be overcome with good technique and experience
- Videolaryngoscopes are relatively expensive to buy and to maintain
- Technical problems such as fogging, poor connections, availability of components can be problematic

**Summary**

The introduction of videolaryngoscopy has been a significant step forward in airway management. Some anaesthetists argue that videolaryngoscopy should be the first-line technique for intubation. Although this is not yet the universal standard of care, it is recommended that videolaryngoscopes should be immediately available wherever intubation is performed and all anaesthetists be trained and expert in their use.

*Do you think videolaryngoscopy should be the first choice for all intubations? Why?*

*What difficulties might you encounter when trying to introduce videolaryngoscopy into your work-place?*

*With so many makes and models widely available, how do you decide which videolaryngoscope to purchase for your department?*

*Is it better to choose one device or to have a selection and master them all?*

Click on this link and you will find an infographic summary on video laryngoscopes

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**SECTION 6**

**RAPID SEQUENCE INDUCTION AND INTUBATION**

***Always remember that in emergency medicine situations, we rarely manage an airway in isolation!***

We manage the airway as part of the management or resuscitation of a critically ill patient. It is therefore essential that we consider the essential physiology (not only just the essential anatomy) of the patient when deciding on the most appropriate method and the most appropriate time for advanced airway management.

It goes without saying that the peri-intubation period is a time of high risk for cardiovascular collapse. Occasionally, rapidly evolving airway obstruction mandates immediate intervention but for the vast majority of critically ill patients, rushing to an advanced airway intervention actually increases the risk.

When intubating critically ill patients, always consider the following 5 major risk factors for collapse during RSI and intubation.

1. **Hypoxaemia**
2. **Hypotension**
3. **Metabolic acidosis**
4. **Severe bronchospasm**
5. **Right ventricular failure.**

We will discuss some of the detail in the subsequent sections here although a fully detailed discussion is perhaps beyond the scope of this pre-reading document.

What is a Rapid Sequence Induction (RSI)?

Rapid sequence induction or intubation (RSI) is a technique which was first described in 1970 [1] and is now routinely used for many emergency intubations.

RSI is performed in order to reduce the risk of aspiration (stomach contents entering the airway and lungs) during the induction of anaesthesia. Aspiration can be fatal and is the commonest cause of airway related morbidity and mortality during general anaesthesia as we learnt in Week 1 when we discussed the 4th National Audit Project (NAP4) report.

A recent international survey of over 10,000 airway experts on preferences for clinical practices associated with RSI [2] demonstrated a wide variation in practice. Here we describe the principles of RSI, the “classic” technique and discuss some of the variations.

What are the indications for RSI?

RSI is performed on patients that are at high risk of aspiration, for example:

- Patients with pre-existing conditions which predispose to regurgitation: gastro-oesophageal reflux, neurological or neuromuscular conditions affecting the airway and upper Gastro-Intestinal (GI) tract.

- Patients with acute conditions which delay or prevent gastric emptying or impair airway reflexes: bowel obstruction, delayed gastric emptying due to trauma or drugs, reduced level of consciousness.
- Patients who are not starved: intubation may be required for urgent life-saving care in patients who are not starved, patients with upper GI bleeds may have blood in their stomachs even if technically 'fasted'.

RSI involves 3 key objectives.

1. Maximising the oxygen levels in the lungs prior to induction of anaesthesia
2. Minimising the time between induction of anaesthesia and intubation of the trachea with a cuffed tracheal tube
3. Preventing aspiration of stomach contents by optimising the patient position and the administration of cricoid force (see below) to occlude the hypopharynx, and by avoiding positive pressure ventilation until the trachea has been intubated.

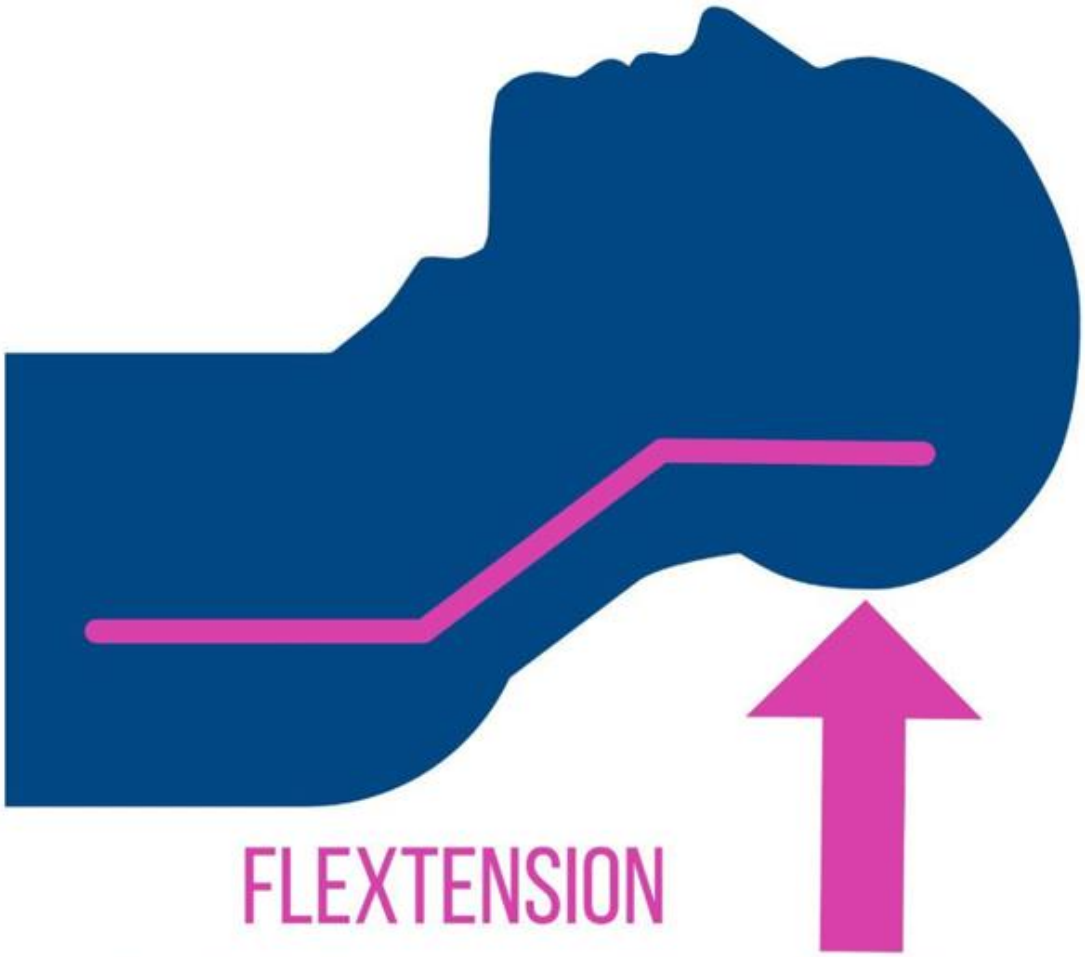
If a difficult or failed intubation is encountered during an RSI, oxygenation of the patient is the priority.

**THE 7 Ps of RSI:**

6. Preparation
7. Preoxygenation
8. Pretreatment
9. Paralysis with induction
10. Positioning
11. Placement with proof
12. Post-intubation management.

Preparing for RSI

Patient - The procedure should be explained to the patient, particularly pre-oxygenation with a tight-fitting facemask and the feeling of pressure on the neck when cricoid force is applied, as both of these occur before the patient is unconscious (see below). The patient's position should be optimised to achieve the best chance of a good view at laryngoscopy, with the lower neck flexed, and the upper neck extended, also described as the "Flextension" position:






*©Nicholas Chrime, Flextension term attributed to Tim Cook*

Equipment – As well as the standard equipment, two sets of suction should be available if there is copious airway bleeding or significant gastrointestinal content. The adjuncts required for a 'failed intubation' should be immediately available as the anaesthetic assistant will not be able to leave once RSI has started.

You may want to read about SALAD (Suction Assisted Laryngoscopy and Airway Decontamination). This technique provides constant suction via a catheter in the upper airway, continuously removing vomit, blood and other materials, around which the practitioner intubates the patient.

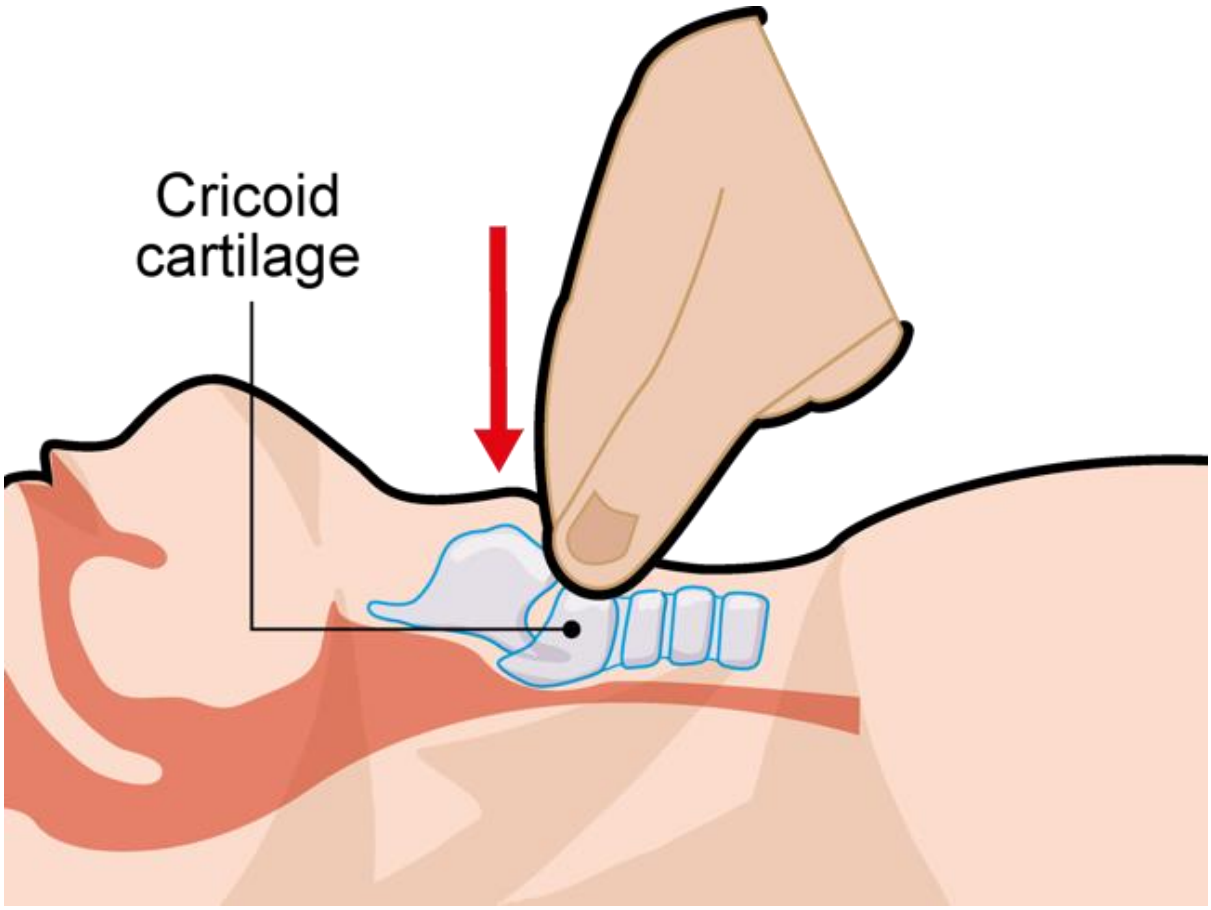
Team - The strategy for managing a failed intubation or difficult ventilation should be described at the team brief, an intubation checklist is a helpful cognitive aid. A trained assistant is required to help and to provide cricoid force. A third person should also be available to seek help and extra equipment if problems arise.

**Classical RSI Technique - step by step**


1. Pre-oxygenation. After ensuring adequate position, IV access and monitoring, the patient should be pre-oxygenated. Pre-oxygenation replaces nitrogen, which is the predominant gas in the air and in our lungs, with oxygen. A tight-fitting face mask is applied with 100% oxygen at high flow. In order to maximally pre-oxygenate the patient, they should breathe spontaneously for 3 minutes or until the exhaled or End Tidal Oxygen ($EtO_2$) is greater than 85%. Filling the lungs with oxygen increases the time to desaturation once spontaneous breathing ceases.

2. Administration of induction agents. A pre-determined dose of induction agent and neuromuscular agent are given in quick succession. Traditionally thiopentone and suxemethonium were used as they have a rapid and predictable onset and offset but many anaesthetists now use more modern drugs. It should be noted that even if drugs with a rapid offset are used, in the event of a failed or difficult intubation oxygenation and ventilation of the patient remain a priority as the patient will become hypoxic *before* they wake up.

3. Cricoid Force. This is a technique aimed at reducing the risk of of gastric contents entering the airway. The technique involves applying 10 N of force (equivalent to registering 1kg on a weighing machine) onto the cricoid cartilage (the only complete ring of cartilage in the trachea) before induction and increasing it to 30 Newtons (3kg) as the patient goes to sleep. This compresses the hypopharynx, which lies behind the cricoid cartilage, against the 6th cervical vertebrae.




4. Tracheal intubation Once the muscle relaxant has taken effect the trachea should be intubated as quickly as possible.

Cricoid force should not be removed until intubation has been confirmed by capnography and the cuff inflated.

Currently, there are many controversies regarding the benefits vs harms of cricoid pressure (see below video) and I can almost certainly say that in Australian EDs and in many pre-hospital intubations, use of cricoid pressure is now the exception rather than the rule. However, it is important to look at your departmental and organisational guidelines around this. Use of cricoid pressure during RSI is by no measure obsolete (yet).

The use of a videolaryngoscope with a remote screen helps optimise cricoid force as the operator and assistant can directly observe its effect. If you are unable to intubate the trachea with cricoid force applied, it should be adjusted or removed.

**IS CRICOID PRESSURE A FRIEND OR A FOE?**

Please Ctr+Click on the following link for a brilliant discussion by John Hinds (RIP). This video was part of SMACC Gold conference and is available for public viewing.

https://www.youtube.com/watch?v=0oXdDOBsRm8

**Complications of RSI**

Failed intubation There is a higher rate of failed intubation for all emergency intubations. The team should have an explicit strategy to deal with this, it should be discussed before induction.

Awareness There is an increased incidence of awareness associated with RSI: this is thought to be multi-factorial. Many cases are emergencies, so it is possible that induction agents are under dosed to prevent cardiovascular instability. If there is difficulty or delay in intubating the patient the induction agents may have worn off before the inhalational agents or further IV hypnotics can be given.

**RSI Controversies**

Although the classic RSI technique has been used for over 50 years there is no evidence that it is superior to other techniques at preventing aspiration. Over the years the validity of various components of the classical RSI have been questioned and have been modified.

As aspiration remains one of the biggest causes of anaesthesia related deaths, practice should be tailored and modified to minimise this risk. The different modifications, whether it is the technique of pre-oxygentation, the drugs used or the application of cricoid force, should be determined by the clinical circumstances.

Oxygenation: Pre-oxygenation with a face mask may be difficult in confused or agitated critically ill patients. In these instances, it may be preferable to oxygenate with nasal cannula with oxygen flow increased to 12-15 L/min, or with high flow nasal oxygen (HFNO)[3]. The nasal cannula can be kept on the patient during attempts at intubation, allowing apnoeic oxygenation to continue.

**Drugs**

The classical RSI uses thiopentone for induction and suxamethonium as a muscle relaxant. Other drugs are increasingly used as induction agents in RSI. Propofol improves the intubation conditions, however the haemodynamic instability it causes can be problematic. If significant haemodynamic instability is anticipated then ketamine, and the co-administration of vasoactive agents may be a more appropriate choice. Midazolam and judicious doses of opiates are also used by some anaesthetists as co-induction agents. *Many anaesthetists and ED and ICU specialists now use high-dose rocuronium instead of suxamethonium*.

If rocuronium is used, sugammadex (the reversal agent) should be immediately available in an adequate dose.

Cricoid force Cricoid force is widely used in the UK and many other countries despite the lack of compelling evidence for its use.

**Accelerated, Immediate and Delayed sequence intubation:**

When rapid sequence intubation is required, the RSI sequence can be compressed so the steps are conducted much more rapidly that the standard RSI.

***Accelerated RSI:***

Shorten preoxygenation to 30 seconds by using eight vital capacity breaths. Also, shorten the pre-treatment interval to 1-2 minutes from 3 minutes.

***Immediate RSI:***

Pre-oxygenate with eight vital capacity breaths. Eliminate pre-treatment.

Alternatively, ***delayed sequence intubation*** has been advocated and now often practiced in emergency situations when the patient is hypoxic, agitated or otherwise critically unwell, with a high risk of rapid oxygen desaturations during RSI. This technique involves administration of smaller doses of induction agents (typically ketamine) followed by several minutes of oxygenation using pressure support mask (such as BiPAP) or CPAP or Nasal high flow cannula. When oxygenation is felt to be optimal, the operator pushes the paralytic agent and proceeds with intubation.

**Additional reading (recommended):**

**Intubation in the hypoxic patient**:

Always address actual or potential hypoxia before committing to RSI/DSI. During the preparation phase discussed above, there are mainly 2 priorities: First, we want to denitrogenate the lungs with oxygen. Second, we want to get the oxygen saturations as high as possible. Remember, if the patients' oxygen saturations are not at least above 94-95%, they risk a very high likelihood of steep and rapid desaturation and associated complications. Proper positioning, head end elevation, ramping under the shoulder and the "flextionsion" position improves airway alignment and patiency, respiratory mechanics and also facilitates passive oxygenation.The classic teaching of 3-5 minutes of breathing 100% oxygen or 8 full vital capacity breaths is all about washing out the nitrogen from the

lungs and replacing it with oxygen. Just remember that when getting your patients saturation up, use non-rebreather mask at flush rate (meaning turn on the oxygen supply to the maximum that it can go) and at the same time, always use nasal prongs under the mask delivering the same flush rate of oxygen. There is now good evidence that doing this significantly prolongs the apnoea time before that dangerous desaturation starts to happen.

Other measures to help quickly and effectively improve oxygenation and saturation in already hypoxic patients are (alone or in combination)

- Positive pressure ventilation via BMV
- Use of PEEP
- Use of NIV pre-induction and during preparation phase to optimise oxygenation as much as possible. For this, if the airway positioning, patency, inspiratory effort and mask seal is not optimal, it is unlikely to improve the situation. Using NIV pre-induction always frees up a pair of hands for other tasks if needed.

Another option, depending on the patient is to first insert a Supraglottic airway device (SAD), like the LMG/iGEL and pre-oxygenate through that device prior to intubation. If the patient physiology allows, placement of a SAD can be facilitated by administering standard RSI drugs – a procedure now actually called "rapid sequence airway" rather than rapid sequence intubation.

Lastly, some patients will not be able to tolerate these pre-oxygenating procedures due to hypoxic/hypotension related agitation. Those patients will need a Delayed Sequence Intubation (DSI).

DSI involves providing an anxiolytic/sedative to the patient to facilitate optimising oxygenation as much as possible prior to airway control. Ketamine in doses of 0.5mg/Kg is generally considered the go-to agent of choice for this, owing to its favourable haemodynamic and respiratory profile.

## Addressing hypotension prior to intubation:

- **Resuscitate before you intubate!** Induction agents and use of positive pressure ventilation post-intubation already leads to a hypotensive state. A pre-existing hypotension that is not addressed prior will almost certainly lead to dangerous and potentially catastrophic cardiovascular collapse peri-and post intubation. Appropriate management will of course depend on the cause of the hypotension but if undifferentiated – the following are useful considerations/interventions:
  1. Fluid bolus
  2. Giving blood if bleeding is the cause of hypotension.
  3. Starting a vasopressor – usually noradrenaline or adrenaline infusions but metaraminol infusions (as opposed to bolus doses) can also be effective. Sometimes, using a combination of vasopressor becomes necessary too.
  4. Prepare for deterioration post-intubation prior to intubation.

## Metabolic acidosis and RSI

Metabolic acidosis is bad when it comes to RSI and emergency intubation. The causes are numerous and often, there will be more than one causes contributing to it. Those same causes will also be the reason why the patient is critically unwell. The key considerations with

metabolic acidosis and RSI are that patients will almost always have high ventilatory minute volume secondary to a compensatory tachypnoea as a response to acidaemia. Any slowing down or pause to that respiratory rate or minute ventilation can cause profound acidaemia and acidosis such that severe cardiovascular collapse and cardiac arrest become very real possibilities peri- and post intubation.
Always beware and pause and check:

*Patients respiratory rate before intubation/induction.*
*Can intubation be delayed to allow resuscitation and optimisation for intubation?*

Consider temporising with NIV if hypoxia is an issue.
When proceeding with RSI – always go for non-apnoeic RSI. Even brief apnoea can cause rapid worsening of acidaemia and potential cardiovascular collapse and arrest. This means that you will need to bag ventilate the patient during the procedure and then ensure that the patient's respiratory rate and minute ventilation match with the patient's pre-induction values.

## Consider Right Ventricular Failure.

You might wonder why right ventricular function and right ventricular dysfunction are problematic during RSI. Although often overlooked, right ventricular dysfunction can lead to disastrous consequences if special care is not taken for this group of patients. The most important thing one could do for such patients is to possibly delay or even avoid intubation if at all possible. The problem here is that with positive pressure ventilation and application of PEEP, the already sub-optimal RV output and RV functions will deteriorate further due to increased intrathoracic pressures causing near total collapse of RA and RV. Therefore, aim to delay RSI while focussing on medical therapy to optimise and stabilise the patient and if using NIV, use as low a PEEP as possible.
Typical groups of patients who may possibly have a degree of RV dysfunction are COPD, PE, Congenital heart disease, bronchiectasis and patients with sepsis and known CCF. If time allows and the skills are available, a bedside ECHO to assess RV function prior to RSI will be extremely useful in these situations. It is important to choose induction and sedating agents carefully in these patients. Every attempt should be made to avoid or worsen hypoxia, to address hypotension and ideally, if intubation cannot be delayed or avoided altogether, seek expert help and the most experienced intubator to carry out this risky procedure in these patients, ideally using an awake intubation procedure.

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## SECTION 7

**POST INTUBATION CARE**

In critically ill patients, while securing an airway urgently is potentially lifesaving, successful RSI and intubation doesn't mean that all the problems are over! In fact, the problems might just have started to get worse or new problems directly as a result of the intubated and ventilated state might arise.

The critical components of post-intubation care are:

1. Confirm tube placement with end-tidal capnography (as opposed to capnometry). Make sure tube position is checked as expeditiously as possible and don't hesitate to re-position or re-adjust if not satisfied. Take your time to ensure proper securing of the tube and check with other team members to see if anyone has any concerns. Chest X ray is invaluable in this.
2. Continue resuscitation of the critically unwell patient! Do not forget that your patient in the emergency department that you just intubated likely needs ongoing management and resuscitation for the very condition that brought them to ED and necessitated airway management and that airway management is but one aspect of their overall resuscitation and treatment. Their main enemies are going to be the drugs used for ongoing sedation, paralysis, PEEP and positive pressures associated with mechanical ventilation, ongoing pathophysiology associated with their illness, be it sepsis, hypovolemia, shock or a toxic condition (e.g, toxic overdose causing CVS, respiratory, CNS or metabolic and electrolyte dysfunction). Focused medical treatment aimed at those underlying patho- physiologies must continue.
3. Carefully chose the most suitable and safest sedating and paralytic agents for your patient. Get an opioid on board for analgesia and especially if you don't want sympathetic surge responses in your patients (eg ICH), use fentanyl boluses and then a titrated drip. Fentanyl is excellent in these situations.
4. Continue fluid resuscitation as appropriate especially if hypotension is likely related to hypovolemia. However, do not hesitate to initiate/continue vasopressors if hypotension continues to be a problem despite adequate fluid repletion. Bedside US scans are invaluable in ruling out uncommon but dangerous causes of hypotension, for example occult bleeding, pericardial tamponade and other causes of obstructive shock.
5. Carefully select your ventilation settings. From amongst the various modes of ventilation available, in an emergency intubation setting, it really doesn't matter generally as to which mode is better. What does matter is to have some understanding of tidal volumes, FiO2,

PEEP and why and when you might have to adjust those parameters. If lung protection is the main goal, adjust tidal volumes accordingly, if ventilation is the main issue – adjust respiratory rate (for example, maintain a higher rate in metabolic acidosis as discussed earlier). If oxygenation is the issue – use a combination of FiO2 and PEEP adjustment to attain optimal oxygenation. Further discussion of this topic of ventilation is beyond the scope of this discussion.

## SECTION 8

## EMERGENCY FRONT OF NECK ACCESS (eFONA)

**eFONA is the final step in the VORTEX approach and forms the plan D when faced with a Can't intubate, can't oxygenate (CICO) situation.**

There is good quality evidence to prove that the clinician's reluctance to perform eFONA is a major contributor to morbidity and mortality in CICO situations [1].

It can be difficult to accept that attempts at oxygenation have failed, and this can delay the decision to take that final, invasive step and access the trachea through the front of the neck. Many factors contribute to a reluctance to perform eFONA, the most important are lack of preparation and planning for failure, lack of training in skills and drills, lack of awareness or understanding of guidelines and cognitive aids, the effect of stress on performance, and equipment issues.

### Lack of preparation and planning for failure

Fortunately, the "Can't Intubate, Can't Oxygenate" (CICO) emergency is rare. NAP4 estimated that it occurs within 1 in 5,000 to 10,000 cases. Although it is uncommon, the consequences are often catastrophic, and CICO accounts for 25% of all anaesthesia-related deaths. In Step 2.2 we learned that it is important to carry out a thorough airway assessment to identify patients in whom bag mask ventilation, supraglottic airway insertion or tracheal intubation might be difficult. On the other hand, we know that airway assessment is sometimes unreliable and difficult airway management is often unanticipated[2].

This is why guidelines emphasise the importance of approaching every intervention with an airway strategy, a structured and organised plan that includes **a plan for failure**.

### Lack of training in skills and drills

In NAP4, poor training and education was one of the commonest contributory causes to serious airway events. Clinicians must train and maintain skills for rare but life-threatening emergencies. We are hardly ever faced with these events on our own which is why we should train with our multi-disciplinary team. Decision-making, planning, preparation, and technical proficiency all improve with practice. Regular training in both technical and non-technical elements helps reinforce and retain skills which we don't use routinely. In a crisis, cognitive overload makes it hard to make decisions; we are more likely to succeed if we follow a simple plan which we have rehearsed. Regular refresher training helps prevent skill fade.

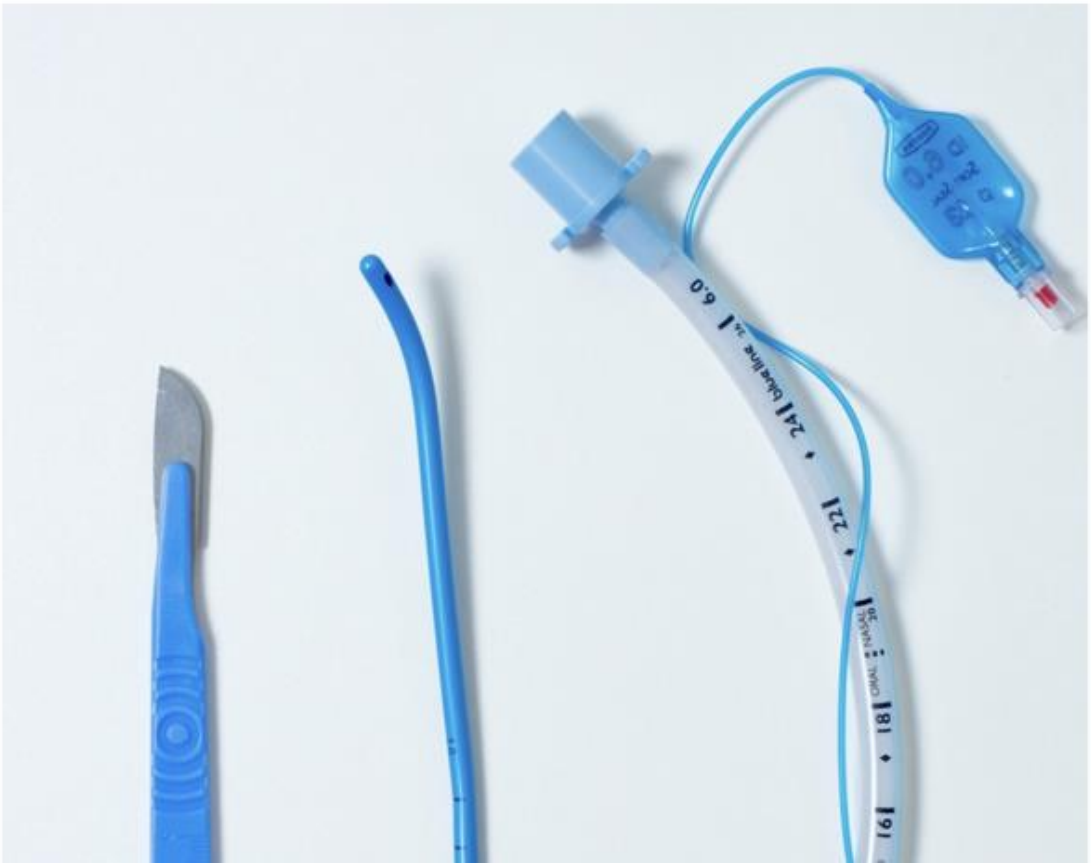
### Lack of shared understanding of guidelines and cognitive aids

Earlier in this week, we looked at the role of guidelines, algorithms and cognitive aids in airway management. The DAS Guidelines for unanticipated difficult intubation is a teaching and learning

tool and the Vortex Approach is a simple cognitive aid designed to be used in a crisis, and also in training for crisis, team work and human factors are improved if everyone shares the same plan.

**Stress**

When a CICO situation arises, hypoxia develops rapidly, and will ultimately lead to cardiac arrest and death. As you can imagine, this is a very stressful situation and it may be hard to make the decision to perform eFONA. When we are stressed it is difficult to perform even simple tasks, or to communicate effectively, this is called cognitive overload. Decision making, motor skills and peripheral vision decline, task fixation is common. Team based training to learn technical skills, to recognise an impending failure, and to feel able to speak up and declare a crisis, improve our ability to manage stressful situations.



**Equipment**

Knowing where to find the equipment we need is vital in a time critical emergency. The location of eFONA kit should be standardised in every area where airway management is performed, and it should be clearly signposted. eFONA packs, containing essential equipment and prompt cards are helpful. The DAS 2015 Guidelines recommend that all anaesthetists learn a surgical cricothyroidotomy technique but some organisations choose a cannula technique as their initial approach. It's important that local skills training and equipment reflects the preferred technique.

Please Ctr+Click the following link to watch a very useful video by Scott Weingart on surgical airway. This technique of scalpel – finger – bougie – tube is useful and simple.

https://www.youtube.com/watch?v=Q0RVlgwC9rs

There is another brilliant video on the creation of eFONA below, courtesy of DAS via FutureLearn Airway Course team. Please Ctr+Click on the below link to watch the video. This technique is useful if the cricothyroid membrane is easily palpable.

https://www.futurelearn.com/courses/airway-matters/6/steps/1344114

*Do you feel prepared to perform eFONA? Do you know what equipment you would need and where to find it? Has anything been done in your workplace to make it easier to perform eFONA?*

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**See also**:


**The Vortex Approach.**


## SECTION 8

## AWAKE TRACHEAL INTUBATION.

### Introduction

Awake tracheal intubation (ATI) includes any technique in which the patient is intubated whilst awake and spontaneously breathing. A flexible bronchoscope is generally the device of choice but videolaryngoscopy (VL) is gaining in popularity, optical stylets or a front of neck airway are alternatives. ATI has a high reported success rate and is generally a safe technique because the patient maintains their own airway until they are intubated.

.

*There are occasions when your patient in emergency department will need awake intubation. For example, the potential or impending airway obstruction patient, patients with airway burns, some patients with anticipated significantly difficult airway and so on and so forth.*

*This technique is best utilized only by those who are familiar with it – generally a senior anaesthetist when available but sometimes, it may fall upon the ED team to perform or at least assist and facilitate its performance by a specialist airway clinician in ED.*

In anticipated difficult airways, the incidence of difficult facemask ventilation is up to 22%, difficult intubation is 25%, failed intubation 0.36%, can't intubate can't oxygenate 0.75% and emergency surgical airway 0.12%. A thorough airway assessment is essential to form a tailored airway management plan for each patient. If difficult mask ventilation and/or intubation are predicted, awake intubation is the safest approach.

**ATI with a flexible bronchoscope (also known as fibreoptic intubation)**

To perform an awake tracheal intubation safely, preparation, good communication and teamwork are key.

**Premedication**

Drying the secretions can be helpful but, in most situations, an anti-sialogogue is not required. Intravenous glycopyrrolate can be given approximately 20 minutes before the procedure if needed.

**Monitoring**

Full monitoring of oxygen saturation, capnography, blood pressure and ECG should be used as per the Association of Anaesthetists of Great Britain and Ireland (AAGBI) guidelines, although monitoring end tidal carbon dioxide can be difficult during ATI.

**Position**

- Position the patient sitting upright or semi-upright
- Ensure the patient's head is in the neutral position if possible
- Approach the patient from the front
- Ensure the scope screen, patient and operator are well aligned

*Patient, operator and screen positioning and set up prior to ATI*

**Oxygenation**

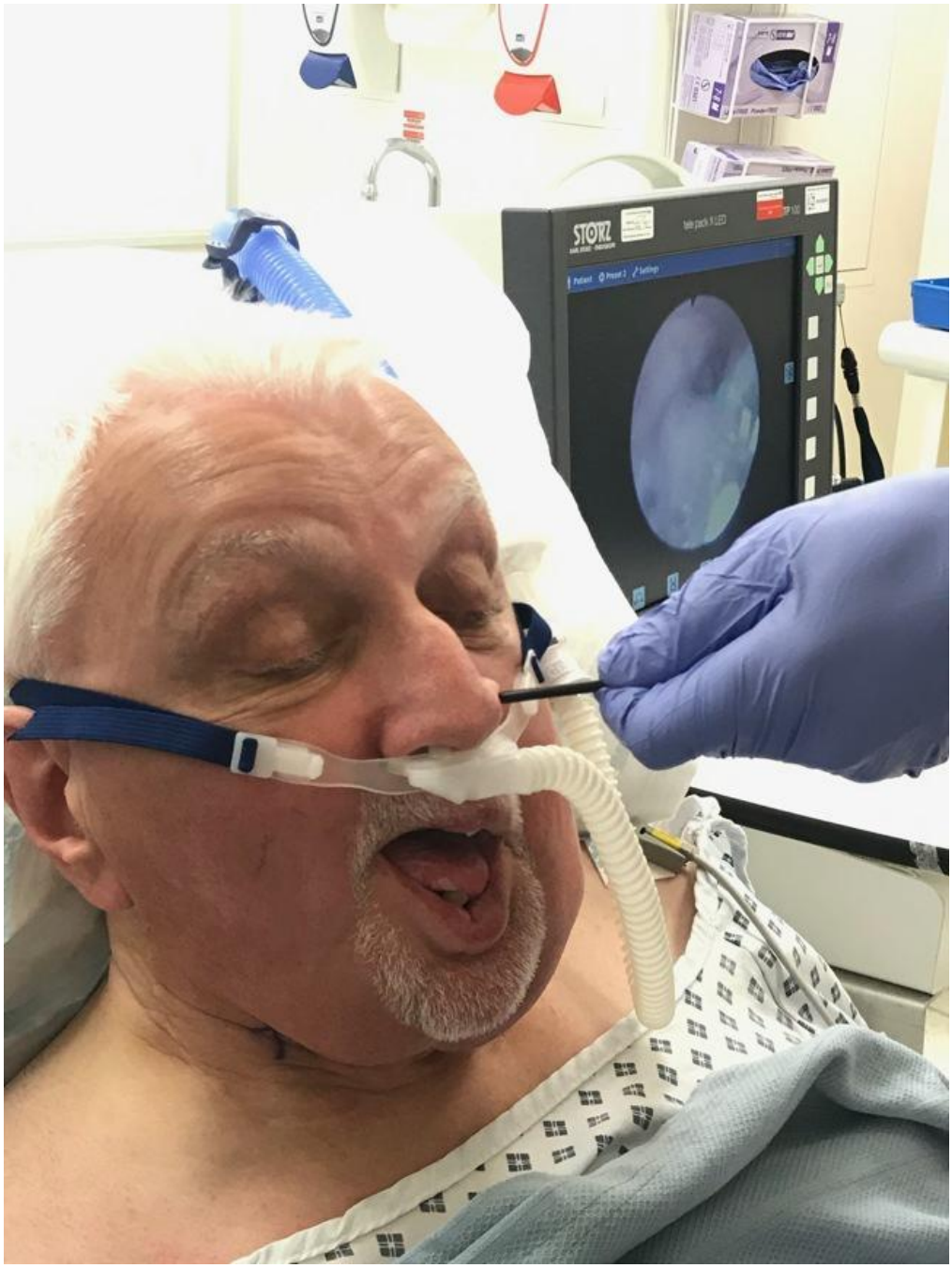
High-flow nasal oxygen (HFNO) is a commonly used technique to maintain oxygenation and helps the spread of local anaesthetic when topicalising the airway. Other options include using nasal cannulae, a nasal sponge, or a Hudson mask with a hole cut out to allow for access.

**Topicalisation**

Local anaesthetic (LA) should be applied to the oropharynx and larynx for oral intubation. If using the nasal route, a vasoconstrictor and local anaesthetic should also be applied to the nasopharynx. In our hospital, we use a pre-mixed combination of phenylephrine and lidocaine (co-phenylcaine) to the nostrils via a mucosal atomising device (MAD)

**Sedation**

Although not compulsory, sedation helps with patient compliance and comfort. Remifentanil given as a target-controlled infusion is often used in UK practice. Ideally a separate practitioner should be responsible for sedating the patient as the commonest complications of ATI, such as apnoea, airway obstruction and desaturation occur due to over-sedation.




*Use of HFNO during ATI*

**Tracheal Tubes**

A flexible nasal or a reinforced tracheal tube are used for nasal intubations. A small tube (6-6.5mm internal diameter) reduces the risk of trauma and impingement. A reinforced tube is best for oral intubations. When using a VL, a bougie or stylet may be needed to assist with tube placement.

**Oral or Nasal Route?**

When using a flexible bronchoscope the nasal route is more comfortable for the patient. The choice of oral or nasal route depends on patient factors, pathology and surgical procedure, this should be discussed with the surgeon at the team brief.

Once the tracheal tube is in place its position must be confirmed with a two-point check 1 - capnography and 2 - viewing the tracheal lumen with the bronchoscope.

**Awake Videolaryngoscopic Intubation**

Awake videolaryngoscopic intubation may be easier, faster and safer to perform than flexible bronchoscopy because most anaesthetists are familiar with laryngoscopy. Patient preparation should be the same as the oral bronchoscopic technique with thorough topicalisation of the airway. Limited mouth opening is an obvious restriction to its use.


*Use of a videolaryngoscope in an awake patient*

If there is significant supraglottic swelling and passing of the bronchoscope causes obstruction of the airway (the 'cork in bottle' effect) an awake VL technique may be better tolerated.

**Fibreoptic assisted awake VL** - A common problem with VL is that even with a good view of the glottis it may not be possible to pass the tube into the trachea. A second operator can guide a flexible bronchoscope into the trachea and then railroad the tube, as when using a bougie.

**Awake tracheostomy under Local Anaesthesia**

If flexible bronchoscopic or videolaryngoscopic techniques are not possible a surgical tracheostomy under local anaesthesia is an option. The most common indication is a tumour involving the airway. This relies on a patient who is able to be compliant and lie flat for the duration of the procedure. This technique should only be performed by a skilled surgeon and only when all other options have been excluded.

**END OF PRE-READING**