AWAKE FIBREOPTIC INTUBATION – THE BASICS ANAESTHESIA TUTORIAL OF THE WEEK 201

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SELF ASSESSMENT QUESTIONS

Before continuing, please attempt the following True/False questions. The answers can be found at the end of the article.

1. Regarding assessment of a patient's airway
    a. A Mallampati class III view means that the hard palate, soft palate and uvula are visible
    b. A sternomental distance of <12.5cm predicts a difficult intubation
    c. A thyromental distance of <6.0cm predicts a difficult intubation
    d. The thyromental distance is measured with the patient's head fully flexed
    e. A horizontal mandibular length of >5cm suggests a good laryngoscopic view

2. The following are indications for an Awake Fibreoptic Intubation:
    a. A patient with atlanto-axial instability of their cervical spine, secondary to Rheumatoid Arthritis
    b. Impending airway obstruction secondary to acute epiglottitis
    c. A history of difficulty in mask ventilation
    d. A predicted difficult airway in an uncooperative patient
    e. A patient with severe facial injuries and active intra-oral haemorrhage

3. Regarding Awake Fibreoptic Intubation:
    a. The maximum topical dose of Lignocaine for an 80kg patient is 880mg
    b. When a trans-tracheal injection of Lignocaine is performed to anaesthetise the subglottic region, the patient is asked to exhale prior to injection of the Lignocaine
    c. Trans-tracheal injection is performed between the 2nd and 3rd tracheal rings
    d. The fibrescope is passed along the superior nasal meatus
    e. A white out of the view with the fibrescope is caused by secretions
    f. The patient can be safely extubated deep at the end of the surgery

INTRODUCTION

Awake fibreoptic intubation (AFOI) is an essential skill in the management of a patient with a known difficult airway (who has previously required AFOI or other procedures and adjuncts aside from normal airway adjuncts for ventilation and intubation), or who has an anticipated difficult airway as found during the airway assessment preoperatively.

AFOI is a technique which allows a flexible oral or nasal route to provide a clear visualisation of the vocal cords, and subsequent passage of an endotracheal tube into the trachea under direct vision.

The aim of this tutorial is to provide a basic recipe for carrying out an awake fibreoptic intubation, safely, in a patient whom you have assessed to have a predicted difficult airway.

It is important to know the anatomy of the normal upper and lower airways, from the nasal passage to the carina/bifurcation of the trachea. It is also essential to have a good knowledge of the mechanisms of action and maximum dosages of various local anaesthetic agents and vasoactive drugs, as these are used widely in this technique. Recognition of the signs, symptoms and treatment of local anaesthetic toxicity is essential.

Furthermore, the anaesthetist should have a management plan for dealing with any difficult airway scenario, predicted or unpredicted. Here is a brief overview and some links for the management plans of some of these scenarios.

1. The *anticipated* difficult airway:
   - **Without** airway obstruction – AFOI is the gold standard in managing this airway
   - **With** airway obstruction – untreated, this will lead to hypoxia and all the consequences thereof. The management of this airway depends on the scenario, the site, and the severity and progression of the obstruction, as well as the expertise of the anaesthetist.
     Examples of this would be upper airway trauma, rapidly progressing infections of any aspects to the upper airway (acute epiglottitis, croup, tonsillar abscesses), and the all too common foreign bodies stuck in upper airways.

2. The *unanticipated* difficult intubation – airway difficulties occurring despite a "normal" preoperative airway assessment:
   - Following routine induction of anaesthesia, "can't intubate, can ventilate" scenario. This is where the patient can still be ventilated and oxygenated by means of a face mask or other supraglottic device (laryngeal mask airway), but an inability to intubate the trachea
   - During routine induction, where there is no risk of aspiration, and a non-depolarising neuromuscular blocking agent is used.
   - During rapid sequence induction, where there is a risk of aspiration and Suxamethonium is used.

3. *Can't intubate, can't ventilate*
   - The inability to secure the airway and inability to oxygenate the patient's lungs.

DEFINITION OF THE DIFFICULT AIRWAY

There are various definitions of "the difficult airway".

The American Society of Anaesthesiologists Task Force describes it as the clinical situation in which and anaesthetist experiences difficulty with facemask ventilation, difficulty in supraglottic device ventilation, difficulty in tracheal intubation or all three.

Another description of the difficult airway is, while using direct laryngoscopy
- >2 attempts at intubation with the same or different blade
- Or using adjuncts to direct laryngoscopy
- Or using an alternative device or technique following failed intubation with direct laryngoscopy

Difficult laryngoscopy equates to Cormack and Lehane's Grade 3 or 4 view of the larynx.

Perhaps the most appropriate definition is a scenario in which safe oxygenation and ventilation of a patient cannot be achieved in the desired manner.

MANAGEMENT OF THE DIFFICULT AIRWAY

Preoperative airway assessment

Recognition of the difficult airway by history, examination and predictive tests (these can be found in any anaesthetic textbook).
In the patient's history, look particularly for previous difficulties in mask ventilation or intubation.

- Reduced neck mobility: Rheumatoid arthritis, Ankylosing spondilitis, osteoarthritis, surgical fixation of cervical spine
- Reduced mouth opening: reduced mobility of TM joint, trismus, scarring and fibrosis, local lesions, swelling
- Lesions of the larynx, pharynx and tongue – tumours, fibrosis (previous radiation of neck), swelling
- Congenial syndromes and conditions: with facial deformities (Goldenhaur, Pierre Robin), cystic hygromas, achondroplasia
- Anatomical variants of the normal

If available, always review previous anaesthetic charts.

Plan

Always have a primary plan – the best chance of success and the safest.
Have a secondary "backup" plan, worked out in advance.

Procedure

- Communicate your plan to the patient, gaining verbal consent.
- To execute the plan, be thoroughly prepared – have skilled assistance available (a second pair of hands is essential) and communicate the plans to them thoroughly. An ENT surgeon in the vicinity may be beneficial.
- Have all the equipment ready for the procedure, including equipment from the most basic to advanced techniques.

Post procedure

Plan the extubation, having all the necessary equipment at hand, should the patient require reintubation.

INDICATIONS FOR AFOI

- Previous difficult airway or AFOI
- Previous difficulty in mask ventilation
- Anticipated difficult airway as found on preassessment, with other complicating factors such as contraindications to the use of Suxamethonium and Inhalational anaesthetic agents, aspiration risk, inability to access the pre-cricoid or pre-tracheal region
- To avoid iatrogenic injury – such as patients with unstable C-spine as result of trauma, rheumatoid arthritis etc

CONTRA-INDICATIONS FOR AFOI

- Lack of airway skills
- Difficult airway with impending airway obstruction
- Allergy to local anaesthetic agents
- Infection/contamination of the upper airway – blood, friable tumour, open abscess
- Grossly distorted anatomy
- Fractured base of skull (CI to nasal route)
- Penetrating eye injuries
- Patient refusal or uncooperative patient

REQUIREMENTS FOR THE PROCEDURE

- Ensure that you are familiar with using the fibreoptic scope, and have reviewed manufacturer's guidance on its use, including handling, cleaning and storage.
- Make sure that you have all the appropriate resuscitation equipment to hand.
- The patient should be fully monitored throughout the procedure (blood pressure, pulse oximetry, ECG). Ideally, capnography should be available.

- Calculation of your local anaesthetic dose beforehand is essential. We recommend a maximum dose of 9mg/kg of Lignocaine, based on lean body weight, for topical anaesthesia in adults. Extra caution is required in patients with a body weight below 50kg. In children, some centres recommend no more that 4.5mg/kg of Lignocaine for topical analgesia. Various concentrations of Lignocaine are desirable (to minimise the volume), however, provided the maximum dose is not exceeded, any concentration can be used. We advise 4% and 10% Lignocaine, and Co-phenylcaine (5% Lignocaine with 0.5% Phenylephrine)
- Xylometazoline or Oxymetazoline nasal spray (or any other available topical vasoconstrictors)
- Obtain intravenous access and administer Glycopyrronium 3-4mcg/kg IV to minimise the airway secretions (alternatively, Atropine can be given). This can also be administered on the ward, up to half an hour before the procedure. Connect a litre of IV fluids of your choice (Ringer's lactate/Hartmann's/Normal Saline).
- Administer Oxygen 4L/min to the opposite nostril using a nasal cannula (sponge plug with a central orifice for oxygen tubing, or cut nasopharyngeal airway/small endotracheal tube with 15mm connector, connected to oxygen supply)
- **Communication with your patient throughout the procedure is of vital importance.**

ANAESTHETISING THE AIRWAY

1. Position the patient on the trolley for administration of local anaesthetic, followed by a semi-recumbent or supine position, depending on operator's preference/patient convenience, for the endoscopy and intubation.
2. Identify the patient's most patent nasal passage.
3. Spray nasal mucosal with vasoconstrictor (oxymetazoline/xylometazoline)
4. Nebulise 2ml 4% Lignocaine (80mg, of which 25% is typically absorbed =**20mg**)
5. *Nose and nasopharynx:* Soak cotton bud (cotton applicators mounted on sticks)/pus swab sticks/ribbon gauze in measured dose of *either*
   - Co-phenylcaine (5% Lignocaine + 0.5% Phenylephrine) (2.5ml = 125 mg)
   - *or* Xylocaine (2% Lignocaine + 1:200000 Adrenaline) (5ml = 100mg)
   - *or* "home made" solution of 4% Lignocaine + 1:200000 or 1:100000 Adrenaline (3ml = 120mg)
   - Insert the cotton buds/pus swab/ribbon gauze into the nasal cavity (inferior nasal meatus) and posterior nasal space, ensuring that the anterior part/entrance of the nostril is also anaesthetised, leaving it in situ for around 3 minutes.
6. Alternatively, if Co-phenylcaine and mucosal atomiser device (MAD) are available, administer to selected nostril via MAD (**125mg**)
7. *Tongue and oropharynx:* 4 puffs 10% Lignocaine to throat (2 each side, tonsillar pillows and back of throat – **40mg**). Alternatively Benzocaine 100mg lozenges can be sucked half an hour beforehand.
8. *Pharynx and Larynx above cords:* can be anaesthetised by 1-4% Lignocaine via metered spray or soaked swabs at increasing depths into the mouth, using a spatula or laryngoscope as alternative to step 7.
9. 4 puffs 10% Lignocaine to nose and post nasal space (**40mg**)
10. Total dose so far **= 225mg**
11. Subtract this from the total maximum dose (9mg/kg), and allocate the remaining 4% Lignocaine in 1 ml aliquots to anaesthetise *the larynx below the vocal cords, and tracheo-bronchial tree*, using:

    - "Spray as you go" technique during endoscopy. If an epidural catheter is available (16G), advance it through the working channel of the fibrescope, until it protrudes at the end. Cut the tip containing side holes off. Attach a 2ml syringe with 1ml 4% Lignocaine to the luer lock at the proximal end, to "drop" the local anaesthetic onto the mucosa, as the fibrescope is advanced through the distal airways. The tip of the epidural catheter should be advanced about 1cm distal to the tip of the fibrescope whilst dropping the anaesthetic onto mucosa, and retracted while advancing the fibrescope. Target the post-nasal space, back of the throat, epiglottis, vocal cords, and trachea.

- If you do not have a catheter, a 2ml syringe containing the Lignocaine with 1-1.5ml of air, can be attached directly to the working channel, and thus "sprayed" directly from the tip of the fibrescope onto the mucosa. This method is less reliable.

- Cricothyroid (trans-tracheal) injection, to anaesthetise subglottic region, vocal cords and trachea. A 21-23G needle is used to pierce the crico-thyroid membrane, aspirating whilst inserting, to confirm position. The patient is told to exhale prior to the injection of 3-5ml of 1% - 4% Lignocaine. Remove the needle immediately following injection, to prevent trauma of the airway when the patient coughs. The resultant inspiration and cough aids the spread of the local anaesthetic within the tracheo-bronchial tree.

- Alternatively, if familiar with the technique, various nerve blocks can be performed – glossopharyngeal, superior laryngeal and recurrent laryngeal nerve blocks (this is beyond the scope of this tutorial but may be found in an anaesthetic text book).

ENDOSCOPY AND INTUBATION

Basic principles:

- Know the anatomy
- Where am I?
- What am I looking at?
- What do I hope to see next?
- Be gentle, avoid forcing the fibrescope, and avoid mucosal trauma, at all costs.
- Ensure laryngeal activity is lost before approaching with the fibrescope.Try to keep the fibrescope as sterile as possible, using sterile gloves and a sterile work surface.

1. Lubricate the fibrescope with aqueous gel/KY jelly, and load it with the uncut Endotracheal Tube (ETT) (size 6.0 to 7.0), securing it to the fibrescope with tape. Ensure that it can be released easily and quickly.
2. *Tips for performing endoscopy:*
   - Orientate the fibrescope and white balance before starting
   - Keep the air cavity (the dark space) constantly in the centre of your visual field. The awake patient can assist in opening the airway by protruding the tongue (opens oropharynx), saying "eeh" (opens pharynx, and epiglottis comes into view), deep inspiration (opens glottis)
   - A good view may be spoilt by blood = red out, secretions = white out, no cavity = pink out, moving target, reduced air space
   - If an area is not anaesthetised, pull the fibrescope back by 1-2cm, advance the epidural catheter, and anaesthetise the area as described above.
3. *Endoscopy:*
   - Introduce the fibrescope through the nostril, into the lower nasal meatus (inferior, largest). Identify nasal septum medial, floor of nose superior, turbinate lateral. Beyond the nasal septum, enter the nasopharynx.
   - Steer the fibrescope into the oropharynx, before which you may need to gently part the soft palate from the posterior pharyngeal wall. Once in the oropharynx, you may see the epiglottis, the 1st landmark. Advance the fibrescope into the laryngeal opening. Here you will require the first dose of topical anaesthetic. Alert the patient that they may cough at this point. Wait a few minutes.
   - Advance the fibrescope until it enters the subglottic space, and identify the trachea, 2nd landmark. Apply your 2nd dose of local anaesthetic. This again may cause the patient to cough. Retract to just before the laryngeal opening.
   - Advance the fibrescope again into the trachea, identifying the carina, 3rd landmark.
4. *Intubation:*
   - Lubricate the tip of the ETT, and the fibrescope, so as to ease the passage of the ETT over the fibrescope and the ETT through the nasal passage and vocal cords.
   - At this point, ask your assistant to hold fibrescope in position, as you perform intubation.
   - Release the ETT and advance it with a gentle rotating motion through the nose, naso/oropharynx, pharynx and larynx.

- Alert the patient of discomfort as the tube is passed through the nose.
- If any resistance is felt, do not force the tube, but withdraw slightly, rotate the ETT 90 degrees anti-clockwise, and advance gently again.
- **Keep the carina in the field of vision at all times to prevent dislocation of the fibrescope out of the larynx into the oesophagus**
- Remove the fibrescope whilst visualising, to ensure tip of the ETT is in the trachea, and maintaining the ETT in place, with the tip at 3-5cm above the carina.
- Fix the ETT in place and connect to the anaesthetic breathing circuit
- Confirm the ETT position by capnography, auscultation of bilateral air entry, observation of bilateral chest movement and misting of the tube, and feeling air movement at the tip of the tube.
- If there is any concern about the stability of the patient's C-spine (trauma, Rheumatoid Arthritis, Ankylosing Spondilitis), assessment of their neurology at this point, following positioning of the patient, is recommended.

5. *Induce* the patient using appropriate anaesthetic agents (intravenous, inhalational, neuromuscular blockers), and inflate the ETT cuff.

POST PROCEDURE

At the end of surgery, before extubation is performed, ensure that

- The patient has been oxygenated with 100% for 3-5min
- Any muscle relaxants have been adequately reversed
- The upper airway is free of all secretions – the airway may still be anaesthetised, and hence, laryngeal reflexes are not intact. Pulmonary aspiration is therefore possible
- The patient is breathing spontaneously with adequate tidal volumes
- The patient is awake

Have all the necessary equipment for potential reintubation at hand.

Extubate the patient.

ANSWERS TO QUESTIONS

1 .FTTFF
2. TFTFF
3. FTFFTF

WEBLINKS

1. http://www.das.uk.com/files/ddl-Jul04-A4.pdf (Difficult Airway Society Guidelines)
2. http://www.das.uk.com/files/rsi-Jul04-A4.pdf (Difficult Airway Society Guidelines)
3. http://www.das.uk.com/files/cvci-Jul04-A4.pdf (Difficult Airway Society Guidelines)

REFERENCES and FURTHER READING

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2. NEAT Course (Norwich Endoscopic Airway Training Course)
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4. Lipp M, Golecki N. Fiberoptic Intubation: An Introduction and Review of Case Histories. Endo Press, Germany, 2008 (Karl Storz GmbH & Co)
5. Popat M. Difficult Airway Management. Oxford University Press, UK, 2009; 13-17, 72-73.
6. Yentis SM, Hirsch NP, Smith GB. Anaesthesia and Intensive Care A-Z. Butterworth-Heinemann, UK, 2004; 287-288, 289-290.