Pre anaesthetic evaluation of difficult tracheal intubation

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Introduction

The American Society of Anesthesiologists (ASA) defined the difficult Airway as “The Clinical Situation in which conventionally trained Anesthesiologist experiences difficulty with mask ventilation, difficulty with tracheal intubation or both”. This difficulty is a result of a complex interaction between patient factors, the clinical settings and the skills of the practitioner. Difficult mask ventilation was defined as “Not possible for the unassisted Anesthesiologist to maintain SpO2 of >90% using 100% oxygen using positive pressure mask ventilation in a patient whose oxygen saturation was more than 90% before anesthetic intervention and it is not possible for the unassisted Anesthesiologist to prevent or reverse the signs of inadequate ventilation during mask ventilation. Difficult laryngoscopy was defined as “Not possible to visualise any portion of the vocal cords with conventional laryngoscopes. Difficult Endotracheal intubation is defined as occurring When “proper insertion of the tracheal tube with conventional laryngoscopy requires more than three attempts or more than ten minutes”

Airway

It is divided in to upper and lower airway. Upper airway comprises mouth, nassopharynx, oropharynx, pharynx and larynx. The lower airway includes trachea, bronchi, bronchioles and alveoli. The upper airway is most vulnerable to obstruction in unconscious patients as tongue and/or epiglottis fall back and obstruct the airway. The assessment includes examination of upper and lower airways. The

The pathological states of the lower airway which can lead to difficult airway include 1. Tracheal pathology - TEF, Stenosis, webbing, FB 2. Bronchial tree pathology, FB, Tumour

Disease states of the neck and cervical spine often constitute easily identifiable factors responsible for difficult airway 1. Neck - Large goitres, abscess, skin contractures 2. Spine - Limitation of movements (Klippel-Feil syndrome, Fracture cervical spine

**Why airway assessment?**

Preoperative assessment is the first contact between the patient and Anesthesiologist and airway is of prime importance in ensuring safety of the patients. The purpose of airway assessment is to have a 1. Optimal patient preparation 2. Proper selection of patient and technique 3. Mobilisation of personnel if required. There are so many tests and examinations have been advocated for airway assessment but none have the reliability of 100% and hence in spite of preoperative assessment airway problems may arise and the anaesthesia team should be always prepared to meet out the eventuality.

**Essential components:**

The essential components of airway assessment are History taking, General examination and specific tests/indices to predict difficult airway. Previous anesthesia records, history of burns, trauma to the neck or oral cavity could give a clue in airway assessment. A general examination of the patient should be done keeping in mind the conditions that compromise upper and/or lower airways. Specific tests should follow general examination to improve the accuracy and it should be done methodically like assessing the status of mask ventilation first followed by laryngoscopy and intubation status.
Ability to mask ventilate is of prime importance which can save the patient even if intubation is not possible. The individual indices which can help in assessing mask ventilation are

1. **Beard**: Presence of beard prevents effective seal of the mask over face and shaving the beard is not practically easy as in India some religious sentiments are attached to the beard in some communities and religions. Opsite and Vaseline could be used to overcome the problem.

2. **Obesity**: Patients with BMI>30 are difficult candidates for mask ventilation and excess pressure is required which may lead to oesophageal insufflations (Aspiration). Further they have reduced FRC and hence desaturate easily. Large mask, Oral/nasal airways, help from assistants can overcome the problem.

3. **Abnormality of teeth**: Irregular teeth, dentures, edentulous patients pose problems with mask ventilation. Dentures, if well attached could be allowed to remain on place for mask ventilation and could be removed just before laryngoscopy. Large mask, centrally placed airway will help in edentulous patients.

4. **Elderly patients**: In patients over the age of 55 years mask ventilation may be difficult.

5. **Snorers**: Ventilation with CPAP of 5-10cm may help

6. **Hair bun**: tying of hair in a bun over occiput is often practised by paramedics in OT. Positioning for laryngoscopy is difficult as it prevents extension of atlanto occipital joint. It is advisable to undo the bun prior to laryngoscopy or hair could be tied to both sides of occiput.

7. **Jewellery and facial piercings**: Even though it is not common in India, certain groups practice it and in that case lip, tongue and cheek piercings may pose problems in mask ventilation. Removal of piercings interfering with mask ventilation is to be done.

**Difficult laryngoscopy and tracheal intubation**

They can be divided into Physical examination, Radiological examination and advanced indices.

I **Physical examination:**

1. **Assessment of cervical A-O joint movement**:

   Direct assessment: Laryngoscopy becomes easier when the neck is flexed on the chest by 25-35 degree and the A-O joint is well extended to 85 degree. This is called “sniffing Position”. If the patient could touch his manubrium with chin and could look at the ceiling without raising the eyebrows both cervical flexion and extension of A-O joint is within the
acceptable limit. More than two third reduction in A-O joint points to difficult laryngoscopy.

Indirect Assessment: Diabetic patients have difficulty in approximating their palms due to stiff joint syndrome (prayer sign) which can predict reduction in cervical spine and AO joint movement.

2. Assessment of TM joint function:

Rotation of the condyle within the synovial cavity and forward displacement of condyle are two functions of TMJ. The former is responsible for 2-3 cm mouth opening and the latter for a further 2-3 cm mouth opening. If the patient could open the mouth to >5cm (three finger breadth) and if the index finger can be indented in the space of TMJ while the mouth is opened, it will point to easy laryngoscopy.

3. Assessment of the mandibular space:

The space anterior to the larynx determines how easily the laryngeal and pharyngeal axis will fall in line when the AO joint is extended. Further laryngoscopy pushes the tongue into this space and if reduced exposure of the glottis may be inadequate. This can be gauged by Thyromental distance and hyomental distance.

Thyromental distance: Distance between the thyroid notch and mental symphysis when the neck is fully extended. If >6.5cm-easy, 6-6.5cm-difficult laryngoscopy, <6cm-impossible laryngoscopy

Hyomental distance: Distance between the mentum and hyoid bone if >6cm easy and <4cm difficult laryngoscopy.

4. Tests for assessing the adequacy of oropharynx:

A. Mallampatti Grading: Most commonly employed test for predicting difficult airway. It indicates the amount of space within the oral cavity to accommodate the laryngoscope and ETT. This is performed by having the patient open the mouth as wide as possible and stick out the tongue without phonation. It is ensured that the patient is sitting position with the head protruding forward, mimicking the “sniffing” position for laryngoscopy and intubation. The eye of the observer should be at the level of the patient mouth. According to Samson & Young modification of Mallampatti Grading Grade I: Faucial pillar, Uvula, Soft palate, Hard palate are visible Grade II: Uvula, Soft palate, Hard palate are visible Grade III: Soft palate, Hard palate are visible Grade IV: only Hard palate is visible.

B. Narrowness of the palate: Narrow, high arched palate offers very little space for laryngoscopy and ETT manipulation.

5. Assessment for quality of glottis viewing:
This can be done by indirect mirror laryngoscopic view and the direct laryngoscopy. The indirect mirror laryngoscopy may be disturbing for the patient but gives useful information. It can be graded in the increasing order of difficulty as a. Complete vocal cords visible b. Posterior commissure visible c. Epiglottis visible d. No glottic structures visible. Direct laryngoscopy in awake patients with sedation and topical analgesia gives the best estimate. Cormack and Lehane graded the view as

Grade I: Visualisation of entire vocal cords Grade II: Visualisation of posterior part of laryngeal aperture Grade III: Visualisation of epiglottis Grade IV: No glottic structures seen

6. Thyroid-Floor of mouth distance:

This gives the clue regarding the position of the larynx in the neck. The distance if more than 2 finger breadth it would be easy intubation. Higher placement of the larynx (obese) poses difficult laryngoscopy

7. Sterno mental distance:

Measured with the head in full extension and mouth closed and if less than 12.5 cm poses difficult laryngoscopy. This is a high reliability test for airway assessment (sensitivity: 0.82 and specificity: 0.89)

**Other indices for predicting difficult laryngoscopy:**

- **Wilson scoring system** analyses 5 parameters (weight, Head and neck movement, Jaw movement, receding mandible, buck teeth) and **Benumof system** analyses 11 parameters (Inter incisor gap, buck teeth, length of upper incisors, voluntary protrusion of the mandibular teeth anterior to maxillary teeth, Mallampatti class, palate configuration, Thyromental distance, compliance of mandibular space, neck thickness and head and neck position) and **Rocke system in obstetrics** combines Mallampatti grading with factors such as obesity, short neck, abnormality in teeth, receding mandible, facial edema. **Rapid airway assessment** (in emergency) allows 1-2-3 finger assessment test to assess TM joint function, mouth opening and mandibular space.

**II Radiological indices:**

X ray of the neck along with (i) ratio of effective mandibular length to its posterior depth that is less than 3.6 (ii) Reduced distance between occiput and spinous process of C1 of less than 5cm (iii) An increase in the posterior depth of mandible of more than 2.5cm poses problems in laryngoscopy.

**III Advanced tests to predict difficult airway:**
1. Flow volume loops 2. Acoustic response measurements 3. MRI of airways are advanced tests used to assess the airway but less commonly used in clinical practice.

**LEMON law:**

It represents assessment of 5 parameters 1. **Look** for anatomic features suggesting difficult airway 2. **Examination** of airway anatomy 3. **Mallampatti grading** 4. **Obstruction** of the airway 5. **Neck mobility**

**Upper lip bite test:**

Proposed by Khan et al in the year 2002 and it basically tests the freedom of mandibular movement. Class I: Lower incisor can bite the upper lip above vermilion line. Class II: Lower incisors can bite the upper lip below the vermilion line Class III: Lower incisors cannot bite the upper lip. Patients having Class III of upper lip bite test may have Cormack and Lehane’s grade III and IV laryngoscopic view of larynx.

**Conclusion:**

The presence of this many tests in airway assessment clearly says no single test could be relied upon. To predict the difficult airway, it would be better to practice group tests(indices) and even then one should not be surprised if he happens to see a difficult airway in spite of a good assessment. The idea of assessment of airway in the preoperative period is to reduce the incidents of accident due to airway.