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Use of Video Assisted Laryngoscope in Difficult Airway Management

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Abstract

Background: Endotracheal intubation is the most important and crucial step during administration of general anesthesia. It helps in maintaining the airway patency, makes procedure safe and also protects the lungs from aspiration. Difficult tracheal intubation can be defined as one that requires multiple attempts, multiple operators, multiple devices, excessive lifting force, or external laryngeal manipulation, Performing tracheal intubation by direct laryngoscopy uses a series of maneuvers, such as extending the head, opening the mouth, displacing and compressing the tongue, and lifting the mandible forward, in order to directly visualize the vocal cords and place a flexible polyvinyl chloride tube into the trachea. Video assisted laryngoscope requires the application of less force (5-14 N) to the base of the tongue, therefore is less likely to stimulate stress response or induce local tissue injury. It also produces less cervical movement when compared to conventional Macintosh laryngoscope, whereas some devices feature a conventional Macintosh blade form, others show a distinct blade design.

Keywords: Video Assisted Laryngoscope, Difficult Airway Intubation.

Background

Repeated airway interventions in patients whose intubation maybe difficult can potentiate tissue trauma, bleeding and mucosal oedema, this can transform an airway that can be ventilated to one that cannot (cannot ventilate, cannot intubate situation). The rate of complications is directly related to the number of laryngoscopic attempts **[1,2]**.

Difficult airway causes

The American Society of Anesthesiologists (ASA) defined difficult airway as the existence of clinical factors that complicate both ventilation administered through a face mask and intubation performed by an experienced person.

Difficult ventilation is defined as the inability of a trained anesthesiologist to maintain oxygen saturation >90% using a face mask, with a goal of oxygen fraction of 100 % **[3]**.

Difficult intubation is defined as the need for more than three attempts for intubation of the trachea or more than 10 min to achieve it. A situation that occurs in between 1.5 and 8% of general anesthesia procedures **[4]**.

1. Difficult laryngoscopy

It is not possible to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy.

2. ***Difficult facemask ventilation:***

i. It is not possible for the anesthesiologist to provide adequate face mask ventilation due to one or more of the following problems: inadequate mask seal, excessive gas leak, or excessive resistance to the ingress or egress of gas **[3]**.

ii. Signs of inadequate face mask ventilation include (but are not limited to) absent or inadequate chest movement, absent or inadequate breath sounds, auscultatory signs of severe obstruction, cyanosis, gastric air entry or dilatation, decreasing or inadequate oxygen saturation (SpO2), absent or inadequate exhaled carbon dioxide, absent or inadequate spirometric measures of exhaled gas flow and lastly hemodynamic changes associated with hypoxemia or hypercarbia (e.g. hypertension, tachycardia and arrhythmia) **[5]**.

3. ***Difficult tracheal intubation:***

Tracheal intubation requires multiple attempts, in the presence or absence of tracheal pathology.

4. ***Failed intubation:***

Placement of the endotracheal tube fails after multiple intubation attempts **[3].**

Management of difficult airway:

Assessment:

A complete airway assessment for every patient requiring airway management is mandatory in all guidelines, to predict the difficulty with tracheal intubation **[6],** face mask ventilation, supraglottic device use, and surgical airway, The proper prediction directs the proper preparation and planning to reduce the risk of difficult airway **[7].**

Tests for assessment*:*

A) ***Anatomical criteria:***

1- Mallampatti test: The Mallampati classification correlates tongue size to pharyngeal size**[8]**. This test is performed with the patient in the sitting position, head in a neutral position, the mouth wide open and the tongue protruding to its maximum. Patient should not be actively encouraged to phonate as it can result in contraction and elevation of the soft palate leading to a spurious picture. Classification is assigned according to the extent the base of tongue is able to mask the visibility of pharyngeal structures into three classes **[9]**:

- **Class I:** Visualization of the soft palate, fauces, uvula, anterior and the posterior pillars.
- **Class II:** Visualization of the soft palate, fauces and uvula.
- **Class III:** Visualization of soft palate and base of uvula
- **Class IV:** Only hard palate is visible. Soft palate is not visible at all.

2- Atlanto-Occipital joint (AO) extension:

The combination of flexion at the atlanto-axial joint and extension at the atlanto-occipital joint is also known as the Sniffing Position (SP). It is traditionally recommended for induction of general anaesthesia unless contraindicated. SP is known to provide better laryngeal view during direct laryngoscopy than Simple Head Extension (SHE) or a neutral head position.

. Any reduction in extension is expressed in grades.

- **Grade I:** >35° **Grade II:** 22°-34° **Grade III:** 12°-21° **Grade IV:** < 12°

Normal angle of extension is 35° or more **[10,11]**.

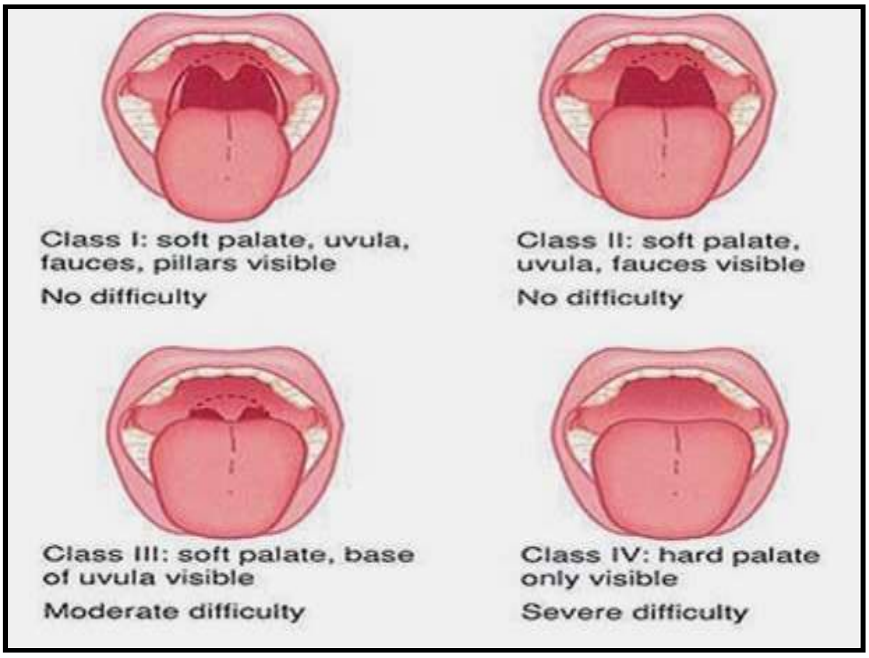

Fig. (1): Mallampatti classification **(9)**

3- Thyromental (T-M) distance (Patil's test):

It is defined as the distance from the mentum to the thyroid notch while the patient's neck is fully extended. This measurement helps in determining how readily the laryngeal axis will fall in line with the pharyngeal axis when the atlanto-occipital joint is extended. Alignment of these two axes is difficult if the T-M distance is < 3 finger breadths or < 6 cm in adults; 6-6.5 cm is less difficult, while > 6.5 cm is normal (figure 8) **[12]**.

4- Sterno-mental distance

Estimated the distance from the suprasternal notch to the mentum and investigated its possible correlation with Mallampati class, jaw protrusion, interincisor gap and thyromental distance. It was measured with the head fully extended on the neck with the mouth closed. A value of less than 12 cm is found to predict a difficult intubation **[13]**.

5- Mandibulo-hyoid distance:

Measurement of mandibular length from chin (mental) to hyoid should be at least three finger breadths. It was found that laryngoscopy became more difficult as the vertical distance between the mandible and hyoid bone increased **[14]**.

6- Inter-incisor distance:

It is the distance between the upper and lower incisors. Normally it is 4.6 cm or more; while < 3.8 cm predicts difficult airway

Video laryngoscope:

The development of video and optical laryngoscopy could be the most important change in this paradigm. Video laryngoscopes are new intubation devices, which contain miniature video cameras, enabling the operator to visualize the glottis indirectly**[15]** , Their design is similar to conventional laryngoscopes, enabling clinicians familiar with direct laryngoscopy to use them successfully without the need for any extensive special training **[16]**.

Video assisted laryngoscope has a flexible monitor that allows physicians to secure the airway under vision and additionally capture pictures and videos in real time, and its D-blade was designed for anticipated difficult airway and airway management of obese patients**[17]** , Indirect visualization of the laryngeal inlet provided by the newly designed video assisted laryngoscope facilitates tracheal intubation **[18].**

Types of video laryngoscope:

Videolaryngoscope are classified into categories according to its shape into conventional shaped and highly angled blade, operators usually prefer conventionally shaped blades like McGrath VL and Glidescope VL. The highly angled blades like Airtraq VL which is valuable in very difficult cases of intubating trachea **[19]**.

There are subcategories from highly angled blade which have channel that hold the ETT eliminating effect of using stylets of rigid or semi rigid stylets. Also, presence of external viewing display allows operators to add educational actions to intubation. Operators should be minded by battery life and charging, not to abort the procedure because of dimming light **[20]**.

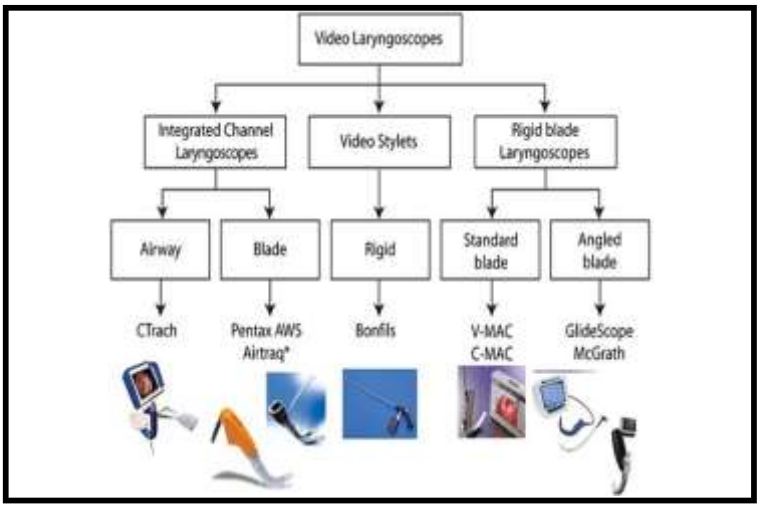

Fig. (2): Classification of video laryngoscopic devices **(16)**.

The advantages of video laryngoscope over Macintosh laryngoscope are

- When compared with fiberoptic bronchoscope, they are more resistant to damage.
- Video laryngoscopes produce a higher proportion of successful laryngeal visualizations than DL.

- When DL fails, we try harder, so more forceful elevation and multiple attempts are associated with greater morbidity and mortality.VL requires less force about (5-14 N) on the base of the tongue**[21]**.
- Many of the newer techniques are easy to learn and can be easily introduced into our practice. This is more applicable to video laryngoscopy than rigid fiberoptic laryngoscopy.
- Ideally, the technique should be suitable in challenging situations (blood, secretions, rapid-sequence induction, poor oxygenation, awake patient) and resistant to fogging .

The VL3R videolaryngoscope (HugeMed) is portable device designed to perform indirect laryngoscopy in both routine and difficult airway intubations, in elective or in emergency settings, It weighs 350 g and has a 3.5" display with a 2-megapixel sensor and an antifog lens; the blade has an angle of 66°, available in neonatal, pediatric, and adult sizes, in both reusable and disposable version **[22].**

Utilization of the McGrath VL is basic. The unit which is used as a part of much the same way as common as an ordinary Classic Macintosh laryngoscope with a special case that once it has been brought into mouth by a couple centimeters, operator's attention must be directed to the LCD show. With ordinary direct laryngoscopy (DL), the hands, gadgets and targets are present of reality, and basic mandatory hand to eye coordination is a must down here. In video laryngoscopes (VL) we pay attention on the superior view and access provided by video screen show **[23]**.

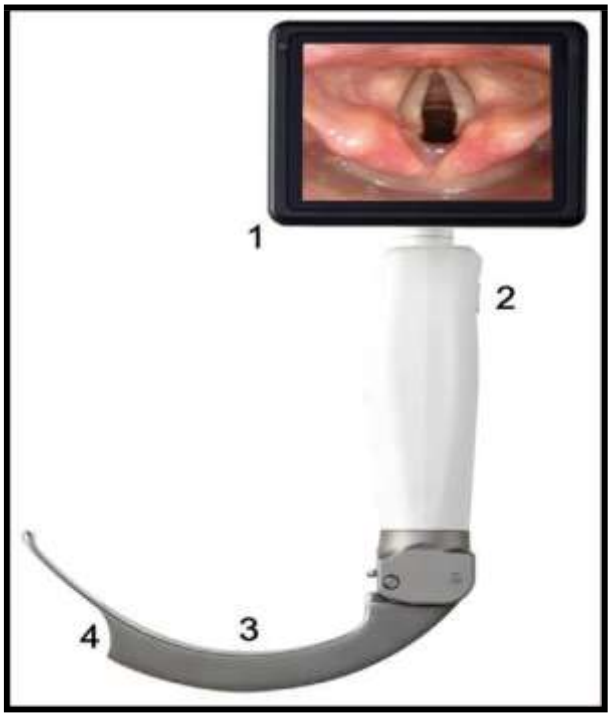

Fig. (3): The VL3 videolaryngoscope **(22)**.
1-screen
2-handle
3-blade
4-cammera

How to use:

It is crucial to differentiate which VL steps work best using direct hand to eye coordination, and which, are better to be done in video screen environment. So, VL can be used in 4 steps:

1) Advance the laryngoscope into the mouth.
2) Get best screen view.
3) Advance and push the ETT with stylet.
4) Intubating the trachea.
5) Remove the stylet.
6) Fix after confirmation with auscultation.

The person who intubate the patient uses direct vision to insert the video laryngoscope in the mouth and then the video-imaging screen to obtain the best possible perspective view of the glottis (step 2). In step 3, the eyes then returned to the oropharynx to introduce the ETT and then back to the video image screen to accomplish the intubation (step 4) **[24]**.

In conclusion: video laryngoscope can be used to manage predicted difficult airway .It doesn't require a line of sight, excessive force on the base of the tongue or excessive cervical movement to introduce the endotracheal tube.

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