"COMPARISON OF CONVENTIONAL LARYNGOSCOPE WITH VIDEO LARYNGOSCOPE FOR TRACHEAL INTUBATION IN PATIENTS WITH NON DIFFICULT AIRWAYS"

By

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ABBREVIATIONS

ETT- EndoTrachealTube

GA- General Anaesthesia

mm- millimetre

cm- centimeter

ASA- American Society of Anaesthesiologists

ECG-electrocardiogram

NIBP- Non-invasive Blood Pressure

SPO2- Oxygen Saturation

S.D- Standard Deviation

hrs- Hours

min- Minutes

n- Number of Subjects

p- ‘p’ value

Sl. No.- serial no

BMI – Body Mass Index

BURP-Backward upward rightward pressure

KVVL – King Vision Video Laryngoscope

VL- Video Laryngoscope

DL- Direct Laryngoscope

GS- Glidescope

IDS – intubation difficulty score

ABSTRACT

Background and aims

Direct laryngoscopy necessitates the alignment of the oropharyngeal-laryngeal axis. This study aimed to compare direct laryngoscopy with a Macintosh blade to King-Vision Video laryngoscope for tracheal intubation in patients with non-difficult airways who were scheduled for elective operations under general anaesthesia.

Methods

In this prospective randomised clinical trial,118 adults with ASA I and II requiring endotracheal intubation for surgeries under general anaesthesia, were enrolled and randomised into either of the two groups(Group DL-direct laryngoscope and Group VL-video laryngoscope), where they were intubated using King Vision or direct laryngoscope with Macintosh blade. The Primary objective was to compare time to intubate, Visualization of the laryngeal view by Cormack-Lehane grade and Successful first attempt. Secondary objective were to record the number of intubation failure, number of attempts, change of anaesthetist and use of adjunct equipment and the complications such as oropharyngeal trauma, neck pain, dysphagia, hoarseness.

Result

In comparison to DL group (21.67±4.318s), VL group took longer to intubate(26.21± 4.150s) but had superior glottic vision. Compared to DL group(72.4%), VL group(84.5%) patients had their first successful attempt, inspite of 2 failures. Complications such as pharyngeal pain (8.6%vs29.3%),hoarseness (5.2%vs29.3%), use of adjunct equipment like bougie(19%vs 3.4%) were significantly higher in DL group compared to VL group, while oropharyngeal

injury, dysphagia, number of attempts and change of anaesthetists were similar in both groups.

Conclusion

In comparison to the Macintosh laryngoscope, the King-vision VideoLaryngoscope took longer to intubate but had clearer glottis visualisation and a higher first-time success rate. With King-vision video laryngoscope, there was less use of auxiliary equipment and fewer complications.

Keywords-

King vision Video laryngoscope, Macintosh laryngoscope, non-difficult airway

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INTRODUCTION

Securing the airway is the main step in anaesthesiology, which directly regulates the safety and outcome of patients.[1,2] Direct laryngoscopy is the standard technique performed in securing the airway followed by tracheal intubation.[3,4]

Difficulties in carrying out a direct laryngoscopy commonly emerges due to its limited view angle of approximately 10-15 degree and poor illumination[3,4,5].Hence, the requirement of the direct laryngoscopy for the alignment of the oropharyngeal-laryngeal axis results in poor visualization of the glottis.[5,6] With insufficient visualization, intubation is unsafe and associated with increased risk for trauma .The limited view of airway anatomy can further be obscured during the attempt to pass the endotracheal tube and therefore the endotracheal tube may slip in to esophagus. Thus, difficult laryngoscopy and unsuccessful intubations has been a cause for patient morbidity and mortality under general anesthesia.[3,5]

Various new devices and techniques have been introduced over the years. To improve the intubation success, different blade designs such as McCoy leverage blade, Dorges universal blade were developed. Even different instruments allowing indirect glottis view such as flexible and rigid fibrescopes , intubation endoscopes and optical stylets were introduced. However there was a limited spread of many of these instruments due to their extensive costs and need for appropriate training.[3,5]

Single –use devices like video laryngoscopes are being increasingly used in anesthetic practice due to its advantages[7] Video laryngoscope is the most innovative advancement in the management of difficult airways. [4,5] In 2001,Glidescope was the 1st generation of video laryngoscope invented by a vascular and a general surgeon , John Pacey of Canada.[4,5] Other video laryngoscopes, such as the traditional Macintosh video laryngoscope, the Airtraq laryngoscope, the Pentax AWS laryngoscope, and the King Vision video laryngoscope, were developed as a result. It depends on digital technology where the image is projected from the tip to an eyepiece or monitor.[4]In contrast to conventional direct laryngoscopy, the video laryngoscopy was developed to improve glottic visibility without requiring the oropharyngeal laryngeal axis to be oriented. Advantages of video laryngoscopy include less upward lifting force exerted with less neck movements , short learning curve ,better portability and cost compared to flexible fiber optic laryngoscopes.[5,8] In cases with problematic airways, the use of video laryngoscopes has resulted in a significant rise in the success rate of tracheal intubation.[6,7]

Thus video laryngoscopes may therefore provide the possibility of more successful intubation, and reduced complications associated with it. In pursuit of this, it becomes necessary to completely replace direct laryngoscopy.[9]

The goal of this study was to see how direct laryngoscopy with a traditional Macintosh blade compared to indirect laryngoscopy with a King Vision Video laryngoscope for tracheal intubation in individuals with non-difficult airways.

AIMS AND OBJECTIVES

AIM: To compare the conventional direct laryngoscope with the video laryngoscope for tracheal intubation in patients with non-difficult airways scheduled for elective surgeries under general anaesthesia.

OBJECTIVE :

Primary objective

- To compare time to intubate
- Visualization of the laryngeal view by Cormack-Lehane grade
- Successful first attempt

Secondary objective

- No of attempts
- Change of anaesthesist and use of adjunct equipment
- No of intubation failure
- Complications
  - oropharyngeal trauma
  - neck pain
  - dysphagia
  - hoarseness

Main observational indicators and their definitions

- Total time for intubation- time between insertion of blade to first upstroke of capnography.
- Cormack Lehane Grade

  Clearly visible vocal chords in Grade 1

  Only the posterior half of the glottis is visible in grade 2a.

  Only arytenoids are evident in Grade 2b.

  Only the epiglottis is observable in grade 3.

  Epiglottis is not seen in grade 4
- Intubation failure-failed intubation with 3rd attempt by senior anaesthesist.

REVIEW OF LITERATURE

T J Lim, Y Lim, E H C Liu et al (2005)[10] In both simple and difficult laryngoscopy, anaesthetists utilised the GlideScope or Macintosh laryngoscope to determine the simplicity of intubation.Twenty anaesthetists were allowed three attempts to intubate in each of four laryngoscopy scenarios in a high fidelity simulator. In the simulated easy laryngoscopy scenarios, the anaesthetists took longer to intubate using the GlideScope than the Macintosh laryngoscope. The number of satisfactory intubations, simplicity of intubation, or choice of intubating equipment were all the same. In the simulated difficult laryngoscopy scenarios, the anaesthetists took less time to intubate using the GlideScope . The slightly higher success rate with the GlideScope was not statistically significant . However, the anaesthetists found it easier to intubate using the GlideScope .

Marshal B. Kaplan, Carin A. Hagberg, Denham S. Ward, et al (2006)[11] compared the direct and video monitor views of the glottic opening using a new Macintosh blade that provides a video image of airway structures during laryngoscopy. It was a prospective multicenter trial done in 11 university-affiliated hospitals. Subjects involved were 867 adults undergoing elective surgery requiring general anesthesia and tracheal intubation . Data from 865 subjects were taken to analyse. Glottic view was easy (Cormack-Lehane grade< 3) in 737 subjects and difficult (Cormack-Lehane grade = 3 or 4) in 21 for both type of views. In 7 subjects, the glottic view was considered easy during direct visualization yet difficult on the video monitor . On the other hand, the view was considered difficult in 100 subjects during direct view yet easy on the video monitor visualisation. As a result, video-assisted laryngoscopy was found to provide a better image of the larynx than direct viewing. This

approach can be used for difficult intubation and reintubation, as well as teaching laryngoscopy and intubation techniques.

Keerthi P Nandakumar, Amar P.Bhalla, Ravindra Kumar Pandey et al(2007)[12] conducted a study in 45 ASA I-III morbidly obese patients. The Time to intubate and Intubation Difficulty Score were compared. It was concluded that Glidescope takes prolonged Total time of intubation with no added advantage in Intubation difficulty score . The hemodynamic response to intubation in morbidly obese participants similarly showed no further benefit. Because MCcoy is as effective as a traditional laryngoscope, the Macintosh laryngoscope should be the laryngoscope of choice because to its widespread availability and familiarity.

Philip M.Jones ,Timothy P Turkistra,Kevin P Armstrong et al (2009)[7] conducted a study in 100 patients requiring orotracheal intubation for elective surgeries. They were randomly allocated to have their tracheas intubated by a heterogenous group of operators with the Cobalt Glidescope or the conventional Glideoscope. The time to intubate was assessed by a blinded observer and number of intubation attempts and number of failures were recorded. It was concluded that The Glideoscope Cobalt has similar performance characteristics compared with the conventional Glideoscope videolaryngoscope when used for orotracheal intubation. The two devices can likely be used interchangeably.

Konstantinos Stroumpoulisa, Alexandra Pagoulatoua, Magda Violaria et al (2009)[13] did study to assess whether videolaryngoscope could provide better laryngeal exposure than

conventional laryngoscopy and hence facilitate intubation in difficult laryngoscopy cases. 112 patients with an estimated difficult intubation, requiring general anaesthesia and endotracheal intubation, were studied. Direct laryngoscopy with a Macintosh was performed, followed by videolaryngoscopy and intubation attempted. The laryngeal views obtained in each method were recorded according to the Cormack/Lehane grade. The percentage of Cormack–Lehane 1 and 2 views obtained by macintosh laryngoscopy rose from 63.4 to90.2% with videolaryngoscopy, whereas Cormack–Lehane III and IV views declined from 36.6 to9.8%. Intubation was successful in 98.2% of the cases. It was concluded that patients with an anticipated difficult airway, videolaryngoscopy significantly improved the laryngeal exposure thus facilitating endotracheal intubation.

GotzSerocki, Berthold Bein, Jens Scholz et al (2010)[3] did study to investigate whether the use of two different video layngoscopes would improve the glottic view and intubation success compared with the conventional Macintosh laryngoscope in patients with a predicted difficult airway.Both video laryngoscopes showed significantly better laryngoscopic view than direct laryngoscope.It was concluded that the videolaryngoscope and GlideScope in particular may be useful instruments in the managementof predicted airways.

L H Andersen , L Rovsing, K S Olsen(2011) [14] A randomised trial comparing the GlideScope and the Macintosh laryngoscope for intubation of morbidly obese patients. 100 patients with a BMI of less than 35 $kg/m^{(2)}$ who were due for bariatric surgery were assigned to either GS or DL intubation. Intubation in group GS and group DL took 48 and 32 s respectively. Laryngoscopic views were better in group GS with Cormack-Lehane grades better than group DL .IDS scores were significantly lower with GS . . Two cases of failed

intubation occurred in group DL vs. none in group GS which was not significant. With GS, intubating morbidly obese individuals was prolonged than with DL. The longer intubation duration had no clinical implications because no patients' saturation levels dropped.In the study subjects, both devices performed well, although the GS gave better laryngoscopic images and lower IDS ratings.

E Cavus , Carsten Te , T Moeller, Joerg Kieckhaefer et al (2011) [15] evaluated the C-MAC videolaryngoscope to traditional direct laryngoscopy in a randomised, controlled crossover study in 150 patients during routine induction of anaesthesia. There was no significant difference of laryngeal view between DL, C-MAC3, C-MAC4, and C-MAC4/SBT groups; but, worst glottic view (C/L 4) was noted with DL, but not with C-MAC videolaryngoscopy. In subjects that had suboptimal glottic view with DL , view was better with the C-MAC4/SBT group; C/L class improvement was noted by three classes in five patients, by two classes in two patients, by one class in eight patients, remained unchanged in eight patients, or decreased by two classes in one patient. The median time taken for tracheal intubation in the DL, C-MAC3, C-MAC4 and C-MAC4/SBT groups was 8 sec ,10 sec ,8 sec and 12 sec respectively. It was concluded that , the C-MAC may serve as a better standard device for intubation in both routine airway management and educational purposes. But further studies on patients with difficult airway should be performed to confirm these findings.

Sherif M Elhadi, Wafaa K Rady, Ahmed M Elfadly (2016)[4] conducted comparative study in 100 patients to assess in terms of vision of the glottic view, rapidity and success rate in intubation, the performance of Macintosh blade vs King Vision Video laryngoscope. In comparison to the Macintosh laryngoscope, KVVL faired better by minimising the

haemodynamic reaction to laryngoscopy and intubation, enhancing the CL view, limiting the requirement for optimization manoeuvers, and lowering the difficulty Likert scale score. There were no big variation between the devices in terms of intubation time, success rates, or problems. This study concluded that the KVVL performed better than ML.

Sunil Rajan, Dilesh Kadapamannil, Kaushik Barua, Pulak Tosh et al (2018)[16] The simplicity of intubation during C-MAC videolaryngoscope-assisted nasal intubation with the D blade was matched to classic Macintosh laryngoscope-assisted nasal intubation with the D blade. In two groups of sixty patients who needed nasal intubation, laryngoscopy was conducted with a standard Macintosh laryngoscope and a Storz C-Mac videolaryngoscope with D-blade. Intubation was shown to be substantially easier in 70% of videolaryngoscope subjects compared to only 3.3 percent in Macintosh blade patients. Intubation time was greatly reduced when using a videoscope (24 vs 68 s). Despite the fact that the majority of patients were intubated on the first try in both groups, the videolaryngoscope group had a higher number (96.7 vs 70 percent). In contrast to two patients (6.7 percent) in Macintosh, there were no occurrences of esophageal intubation with videoscope. The Macintosh group had much higher mucosal injury. In both groups, there was no large discrepancy in hemodynamics. When compared to the standard Macintosh laryngoscope, C MAC videolaryngoscope-aided nasotracheal intubation with D blade is preferable since it is simple, rapid, and has proven less stressful intubation.

Marc Kriege, Nina Pirlich, Thomas Ott et al(2018)[6] conducted a study in infants to compare the two hyperangulated laryngoscope blades to direct laryngoscopy in normal airway and simulated difficul tairway: 80 physicians were included. In the normal airway

scenario, the median time to successful time to ventilation was significantly shorter for the king vision videolaryngoscope at 13s than for the macintosh blade at 14.5s whereas time to ventilation was 23s with the macintosh blade,27s with the miller blade. There was no difference in first pass intubation success rates between hyperangulated blades and direct laryngoscopes in normal airways. It was concluded that the videolaryngoscopes with hyperangulated blades were associated with shorter time to ventilation in normal and difficult infant airway situations.

De-Xing Liu, Ying Ye, Yu-Hang Zhu et al(2019)[17] conducted a study in 360 patients scheduled for elective abdominal surgeries who were randomly assigned to undergo intubation using either video laryngoscope or direct laryngoscope. Intubation success was 96.1 percent with a video versus 90.1 percent in video laryngoscope and direct laryngoscope respectively on the first try, and overall intubation success was 100 percent with a versus 94.5 percent. Intubation with a direct laryngoscope resulted in dramatic oropharyngeal injury in 5.1 percent of patients versus 1.1 percent with a videolaryngoscope On the first postoperative day, 7.9% of patients intubated with a macintosh laryngoscope had evident voice change , compared to 2.8 percent with a video laryngoscope. Intubation with a videolaryngoscope had much greater intubation success rates and significantly fewer postoperative problems than intubation with a Macintosh laryngoscope in subjects with non problematic airways.

ANATOMY AND PHYSIOLOGY OF UPPER AIRWAY

The upper airway has a major role in normal respiration which is a highly detailed neurophysiological process. Both the anatomy and the functions influence the exchange of inspired and expired air. The upper airway is from mouth to trachea which comprises of the mouth, nose, palate, uvula, pharynx, and the larynx. Knowledge about the functional anatomy of the airway is important to the anaesthesiologist to maintain the normal airway.The airway is divided in to:-

Upper airway is subdivided in to nasal cavity, oral cavity, pharynx and larynx.

Lower airway which includes the tracheobronchial tree. [18]

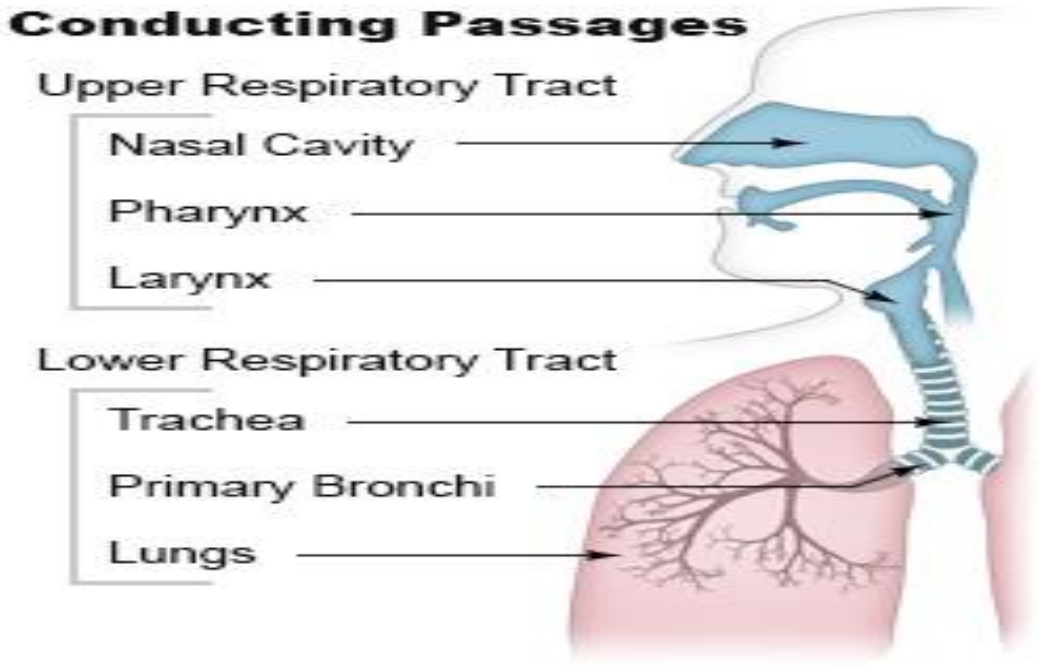


Figure 1 : Showing anatomical structures in upper and lower airway

UPPER AIRWAY

NOSE

The formation of the external part of the nose is by the nasal bones, upper and lowers lateral cartilages, the cartilaginous part of the nasal septum and skin. The paired nostrils are separated by the pliable part of the nasal septum and columella. The upper portion of the nose is a bony framework which is formed by the two nasal bones. The vomer forms the inferior and the perpendicular plate of ethmoid forms the superior part of the bones of the posterior septum. Cartilage supports the lower and anterior portion of the nose.[18,19,20]

NASAL CAVITY

The nasal septum seperates the nasal cavity in to two passages.The perpendicular plate of ethmoid, the vomer and septal cartilage forms the nasal septum. It is usually a midline structure but can be deviated also. Each nasal fossa is formed by a roof , a floor, nasal septum as the medial wall and a lateral wall, opened anteriorly by anterior nares, posteriorly opened in to nasopharynx by the choana. Nasal vestibule is the anterior aspect of the nasal cavity located above each anterior nares. Medial and lateral crura of the alar cartilage surrounds the nares and vestibule. Medial wall of the vestibule is formes by the anterior part of the cartilaginous septum and the columella(connective tissue septum) , the lateral portion contains the coarse hairs-the vibrissae in the skin which guards the nasal entrance and assist in air filtration.[18,19,20]

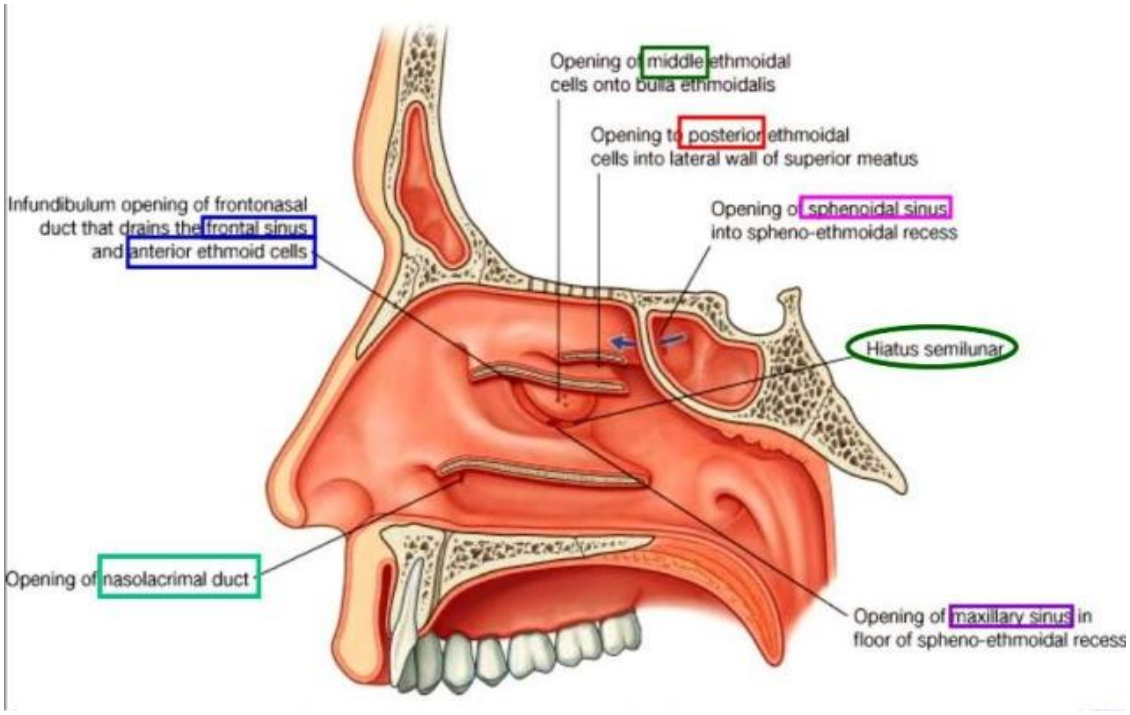


Figure 2: Shows the opening of all sinuses in the lateral wall of nose.

Lateral wall: It is composed of irregular bony projections, covered by soft tissue , mucous membrane. These projections are the inferior ,middle, superior and supreme nasal conchaeor turbinates. Meatus is the space beneath each turbinate and its nomenclature corresponds to that of adjacent turbinate. The structure of supreme , superior and middle turbinates is from the ethmoid bone and inferior turbinate derives its structure from separate bone. Ostia of paranasal sinuses and the nasolacrimal duct is in the lateral wall.The inferior meatus contains the opening of the nasolacrimal duct which is located approximately 3cm posterior to the external nasal opening.The middle meatus contains the opening of nasofrontal duct, maxillary sinus and the middle turbinate.The opening for the posterior ethmoid cells is in the superior meatus.The sphenod opening is in the anterior wall of sphenoid sinus in the area of the sphenoethmoidal recess.[18,19,20]

Posterior Nares(Choana): Each choana is oval and measures 2.5cm vertically and 1.5cm horizontally approx.It si bounded by bone and covered by mucoperiosteum. The posterior

portion of the septum is usually consistent , however rare cases of congenital choanal atresia and post trumatic bony deviations are seen which can cause posterior obstruction of the septum.[18,19,20]

FUNCTION OF THE NOSE:

It acts as the conduit to the lower respiratory tract, warms,humidifies and cleanses the inspired air during its turbulent flow over the membranous lining of the nasal passages.Its rich vascular supply allows the nasal passafe to expand and contract according to the degree of vascular engorgement but the trauma to the nasal airway can lead to profuse haemorrhage. Other functions are olfaction and phonation.[18,19,20]

THE PHARYNX

This musculofacial tube connects the nasal and oral cavities to larynx and esophagus. The buccopharyngeal fascia is the outer thin fascial layer of the pharyngeal tube which is thickened. Inferiorly its continuous with the adventitia of the esophagus and superiorly attaches to the skull bone.

Constrictor muscles: Three pharyngeal constrictor muscles forms the middle muscular layer. They are the superior , middle and inferior constrictor muscles.

The superior constrictor inserts to the base of the skull, middle to the hyoid bone and inferior to the cricoid cartilage. The inferior also contributes to the muscular band known as cricopharyngeus, which is the upper esophageal sphincter.All the segments attaches to posteriorly in to tendinous median raphe.[18,19,20]

DIVISIONS OF PHARYNX :

It is divided in to three: the nasopharynx, the oropharynx and the hypopharynx. Because of its delicate muscular framework , it is prone to lacerations, retropharyngeal dissection and iatrogenic creation of false passages. Therefore this knowledge is critical for anaesthesiologists before attempting endolaryngeal intubation.

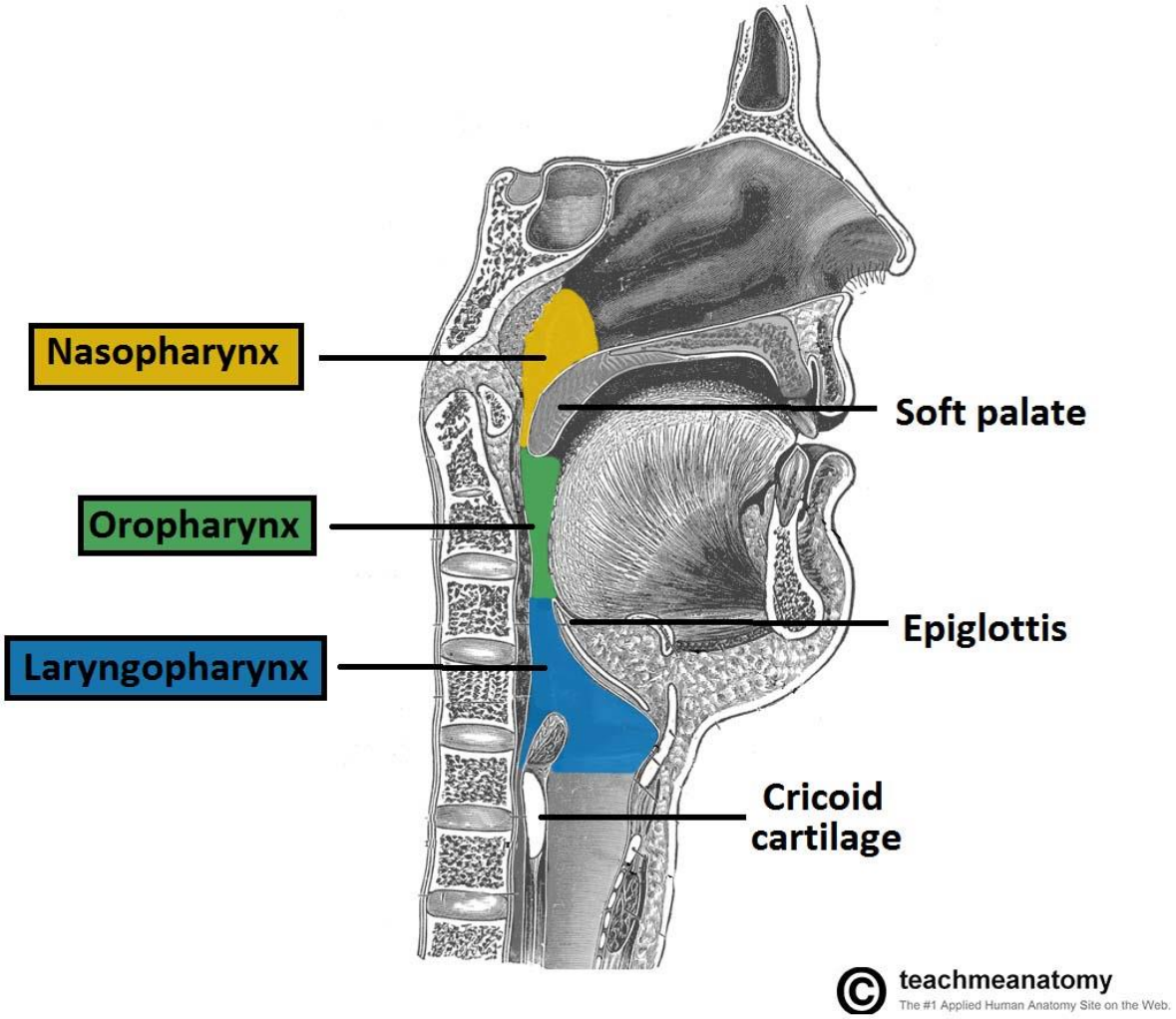


Figure 3: Sagittal section through the head and neck showing the subdivisions of the pharynx.

NASOPHARYNX:

It is directly behind the nasal cavity.Five opening communicate with the nasopharynx- two nasal choanae, two orifices of Eustachian tubes and inferior passage to oropharynx.Its inferior borderis at the level of the soft palate, the roof is composed by the sphenoid and the occipital bones of the skull base. Its continuous with the posterior nasopharyngeal wall. The posterior wall is separated from the spine by the prevertebral fascia, which contains the longus capitis muscle, the deep prevertebral musculature and the arch of the first cervical vertebrae.

Eustachian tube: It equalizes the middle ear and the atmospheric pressure when opened by the palatal muscles.The orifice of the tube is situated medial to the lateral cartilaginous prominence known as the torus tubarius. Fossa of rosenmullar is a recess above and behind the torus.

Adenoid tonsil is the lymphoid tissue in the mucous membrane of the roof and posterior walls.Its hypertrophy can result in chronic nasal obstruction and may contribute to sleep apnoea and altered carbon dioxide levels.[18,19,20]

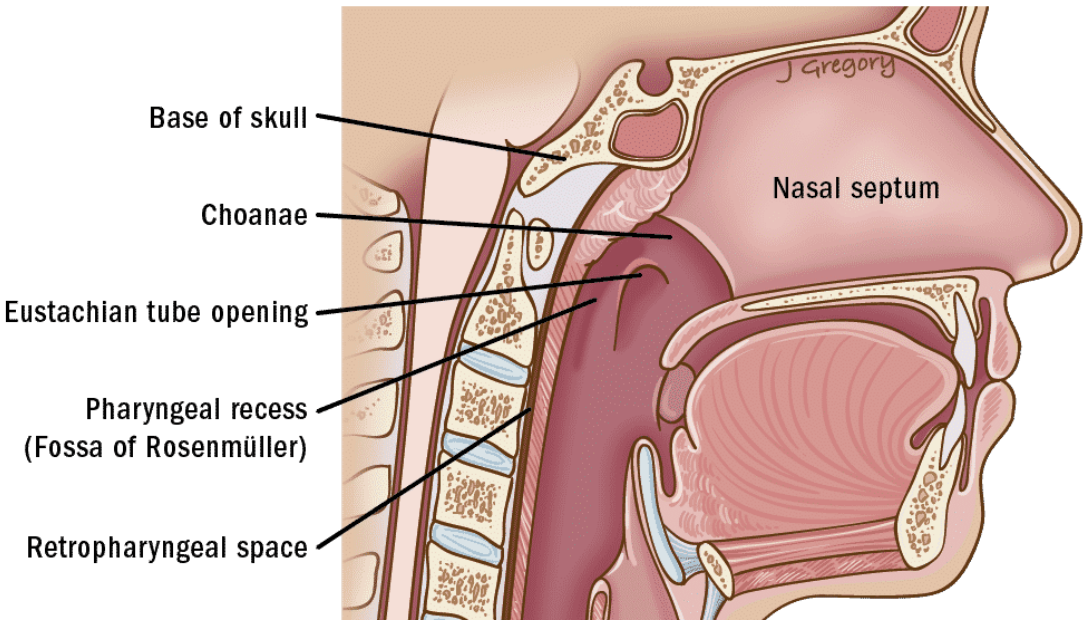


Figure 4 : Sagittal section showing parts of nasopharynx.

OROPHARYNX:

It is posterior to the oral cavity and extends from soft palate superiorly to the epiglottis inferiorly. Prevertebral fascia and the bodies of the second and third cervical vertebra forms the posterior wall of the oropharynx. The lateral wall contains the paired tonsillar fossae. These fossae contains the anterior pillar which is palatoglossal folds and posterior pillar – the palatopharyngeal folds , contains the palatine tonsils.

Medial to the tonsillar fauces is the base of the tongue. The tongue base attaches to the epiglottis by the paired lateral glossoepiglottic fold and single median glossoepiglotic fold.The lingual tonsils is in the posterior dorsal tongue.Tongue musculature are of two types – muscles attached to fixed points that are styloglossus, genioglossus, hyoglossus and palatoglossus. Muscles freely running in the body of the tongue-transverse, superior and inferior longitudinal muscles and vertical muscles. The floor of the mouth is formed by the paired myohyoid muscles arising from the mandible and inserting in to the hyoid bone.

Cellulitis involving the floor of the mouth such as the ludwings angina of the submandibular and submental spaces can produce airway obstruction. So tracheostomy can be done to secure the airway in such conditions.[18,19,20]

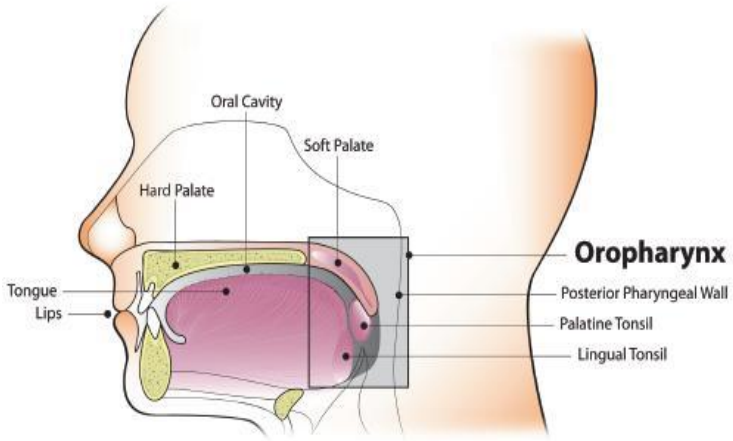


Figure 5 : Sagittal section showing various parts of oropharynx.

HYPOPHARYNX:

The hypopharynx is situated at the level of the fourth through sixth cervical vertebrae. It runs inferiorly from the point of the epiglottis to the inferior surface of the cricoid cartilage.It opens with the oropharynx, laryngeal inlet, esophagus. Either side of the hypopharynx is the pyriform fossa which is bounded superiorly by the lateral glossopharyngeal folds.The posterior border is the buccopharyngeal and prevertebral fascia and deep prevertebral musculature.[18,19,20]

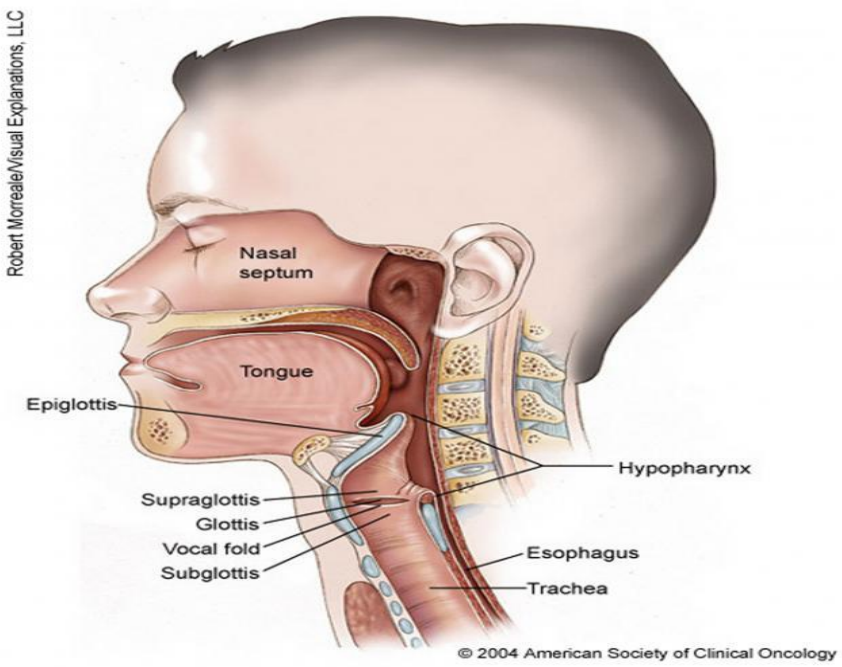


Figure 6: Sagittal section of hypopharynx.

THE LARYNX

It acts as the protective sphincter of the respiratory tract, preventing aspiration during swallowing by separating the trachea from the upper gastrointestinal tract It contains the vocal cords,which is important in communication and also required for an effective cough and to perform a valsalva manoeuvre.[18,19,20]

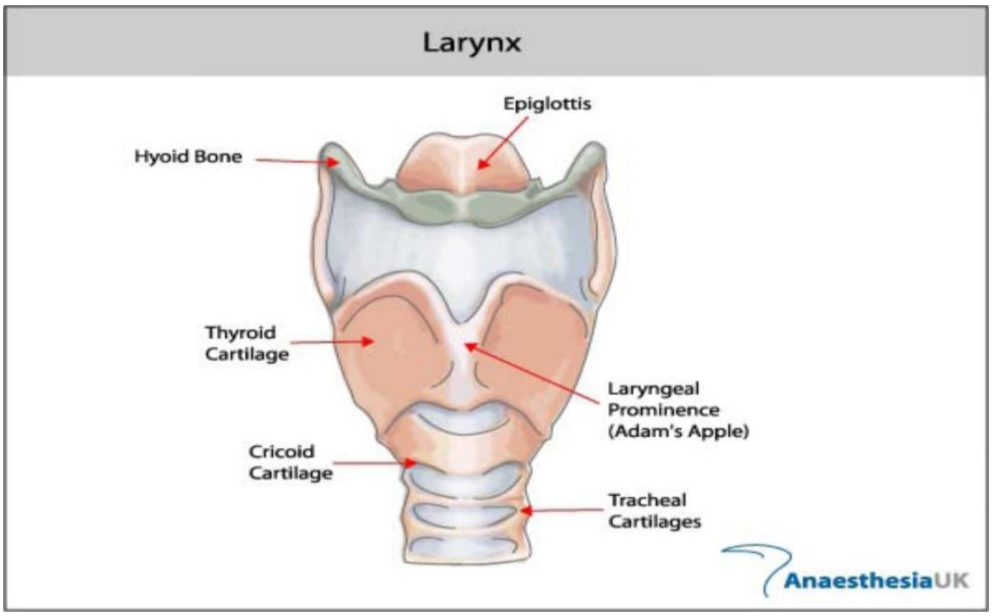


Figure 7: Anterior view of laryngeal cartilages

The location of the larynx is in the anterior part of the neck, anterior to the bodies of the C4-C6 vertebrae and the laryngopharynx . Carotid sheath and one lobe of thyroid gland is on each side of the larynx . The thyroid gland is joined anteriorly by the thyroid isthmus that overlies the second to fourth tracheal rings. The superficial, deep fascia and platysma musclelies further anteriorly.

Nine cartilages forms the laryngeal skeleton, which are joined by various ligaments and membranes . Of which three are unpaired cartilages (thyroid, cricoid, epiglottis) and three are paired cartilages (arytenoid, corniculate, cuneiform).[21,22]

Thyrohyoid membrane attaches the hyoid bone (level with C3) to the thyroid cartilage. Below this are the three unpaired midline cartilages:

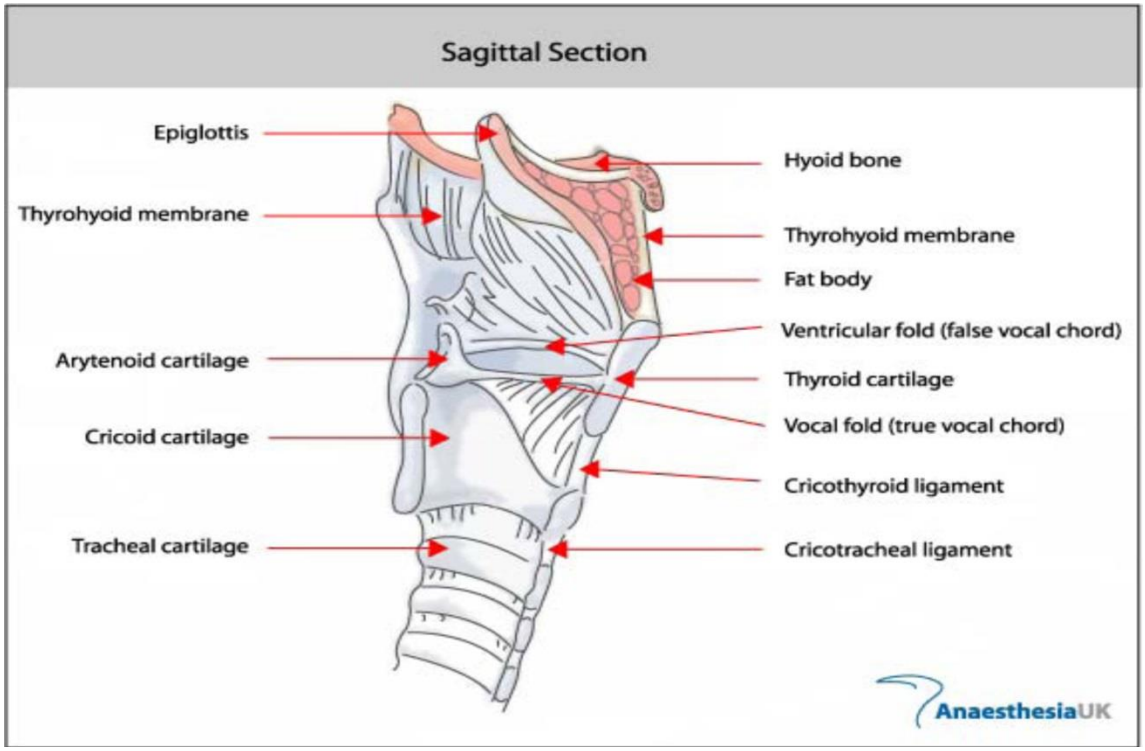


Figure 8: Lateral view of laryngeal cartilages

Thyroid cartilage. The largest of the laryngeal cartilages which is shaped like a 'shield'.It has two laminae fused in the midline at an angle of 90°in men ,120° in women forming the subcutaneous laryngeal prominence (Adam's apple). The upper (C4) and lower (C5) borders comprise superior and inferior cornua (horns). The thyrohyoid membrane attaches superior border to hyoid bone. The cricoid cartilage articulates with the inferior cornua.

Cricoid cartilage. It is a complete ring of cartilage at level of C6. It has a larger posterior lamina and narrower anterolateral arch. It communicates laterally with the inferior thyroid cornua, and posteriorly with the arytenoid cartilages. The cricothyroid ligament attaches it to the inferior border of the thyroid cartilage and cricotracheal ligament attaches it to the superior border of the first tracheal ring. (Cricoid pressure, Sellick's manoeuvre) Because it is a complete ring, application of pressure anteriorly will compress the oesophagus lying

posteriorly – a technique used during rapid sequence induction of anaesthesia to help prevent aspiration of regurgitated gastric contents.

Epiglottis. It is a "leaf-shaped" elastic cartilage .The thyroepiglottic ligament attaches the inferior narrower end to the thyroid cartilage (to the back of the laryngeal prominence). Attachment is anteriorly to the hyoid bone by the hyoepiglottic ligament. The upper border end is free to project upwards and the depression between the mucous membrane covering the posterior part of the tongue with epiglottis is called the vallecula.[21,22]

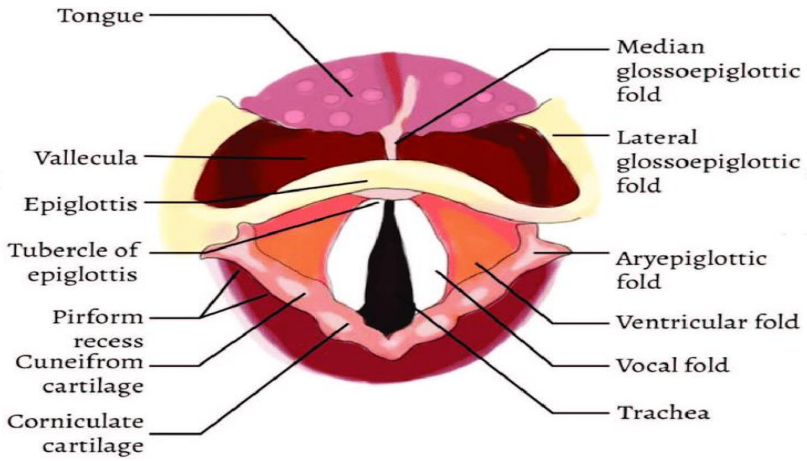


Figure 9: Showing the paired cartilages

Below are the three unpaired cartilages

Arytenoids. These are paired cartilages which are pyramidal shaped and communicates with the superior border of the cricoid. Each has an apex to which the corniculate cartilages articulates, an anterior vocal process (posterior attachment of vocal ligament) and a lateral muscular process which articulates with the cricoarytenoid muscles. The arytenoids are the only visible structures in an "anterior" airway, as they are the posterior attachment of the vocal cords**.**

Cuneiforms and corniculates. Small cartilages found in the aryepiglottic folds [21,22]

Ligaments and membranes

There are various ligaments and membranes within the larynx. The ligaments connects the cartilages together and with the membrane forms the vocal structures. The hyoid bone and thyroid cartilage are united by the thyrohyoid membrane.The hypo-epiglottic ligament links the epiglottis to the hyoid bone at the lower end.Cricothyroid membrane joins the cricoid and thyroid, and is where cricothyroidotomy is performed.The cricotracheal ligament binds the trachea's first ring to the cricoid.

Cricovocal membrane – connects from the superior border of the cricoid to the laryngeal prominence of the thyroid cartilage and vocal process of the arytenoid. The uppermost border forms the vocal ligament, which provides the structure for the true vocal cord.

Blood supply of the larynx. Larynx is supplied by the superior laryngeal artery, a branch of the superior thyroid artery and the inferior laryngeal artery a branch from the inferior thyroid artery.

The innervation of the larynx The larynx is supplied by branches from the vagus (X) nerve:

Superior laryngeal nerve exits the vagus high in the neck and separates into Internal branch is the sensory supply to the glottis, supraglottis and the cricothyroid muscle, which is the tensor of the vocal folds, receives its motor supply from the external branchThe recurrent laryngeal nerve provides sensory input to the subglottis and motor input to all intrinsic laryngeal muscles except the cricothyroid.The sensory supply to the tongue base and vallecula, which forms the superior border of the epiglottis, is provided by the glossopharyngeal nerve.[21,22]

THE APPLIED ANATOMY OF THE LARYNX

The laryngeal nerves can be injured in various ways such as surgery to thyroid, carotid artery, lung and cardiac surgeries, Cancers involving lung, oesphagus or enlarged lymph nodes, enlarged right atrium, thyroid gland, Cervical trauma, insertion of laryngeal mask Airways and following endotracheal intubation

SLN which is the external branch may be damaged during thyroid surgeries, as it lies near the superior thyroid vessels. Loss of cricothryoid function causes loss of vocal cord tension and hoarseness following unilateral damage and it may be temporary as the opposite cricothyroid usually compensates.

RLN , may be damaged during thyroid surgeries, as it lies near to the inferior thyroid vessels. It can be damaged by aortic aneurysm, enlarged right atrium, neoplasms of lung and esophagus, enlarged lymph nodes as it has longer course.

If unilateral RLN damage occurs, the vocal cord will adopt a midline position, resulting in hoarseness , ineffective cough and can lead to recurrent aspiration. In the case of bilateral RLN injury, vocal cord function may be completely lost, resulting in life threatening airway obstruction.[20,21,22]

AIRWAY ASSESSMENT[23,24][25,26]

History

- Difficult airway management in the past to predict challenging airway.
- Old medical records to be reviewed for anaesthetic records like number of intubation attempts, ability to mask ventilate, type of blades ,use of adjunctive equipments, modification of techniques.
- Diseases that affect the airways.
- Symptoms of airway compromise such as hoarseness, stridor, wheezing, dyspnoea, dysphagia.
- Associated diseases such as rheumatoid arthritis,morbid obesity.Physiological conditions such as pregnanacy.
- Prior surgery, burns, injuries, or malignancies affecting the mouth, neck, or spine.
- Congenital syndromes , other diseases of infectious, traumatic , neoplastic or inflammatory that involve the airway.

General examination

- Patency of nares - masses inside cavity like polyps, growths, DNS
- Teeth – Prominent upper incisors, canine
- Palate – High archedpalate, long narrow mouth.
- Prognathism – ability to protrude the lower jaw beyond upper incisors.
- Temporo-mandibular joint – movement may be restricted in akylosis/fibrosis, tumors etc
- Mouth opening – at least 2 large fingers breadths between upper and lower incisors.
- Measurement of submental space – hyomental/thyromental >6cm

- Neck – Short, thick neck, masses in neck, extension and mobility ofneck.Previous tracheostomy suggest stenosis.
- Infections of airway – epiglottis, abscess, croup, bronchitis,pneumonia.

Difficult mask ventilation BONES

- B – Beared individual
- O– Obesity
- N – no or lack of teeth
- E – elderly
- S – snorers

Specific tests

To predict difficult laryngoscope and intubation. Combination of two or more tests improves positive predictive value.

Direct assessment:

Assessing the flexion and extension of neck – To assess the flexion ,ask the the patient to touch the manubrium sterni with his chin which ensures the neck flexion of 25-30 degree.

To assess the neck extension - Instruct the patient to look skyward without elevating their eyebrows, allowing neck extension for intubation.

Indirect assessment:

Palm print : In a sitting position, the patient is requested to push his right hand firmly against a white paper placed on a hard surface, with his palm and fingers smeared with blue ink.

All pharyngeal regions are evident in grade 0

Grade 1 - a deficit in the 4th and 5th digits' interphalangeal regions.

Grade 2 - the interphalangeal portions of the 2nd and 5th digits are poor.

Only the tips of digits are visible in Grade 3.

Prayer sign *:* The patient is asked to make “Namaste” by bringing both the palms together.

Positive : when there is gap between palms, which suggest limited cervical mobility leading difficulty in laryngoscopy and intubation.

Negative : when ther is no gap.

Assessment of tempero-mandibular joint function :

Interincisor gap : Distance between the upper and lower incisors. If the patient is able to place his three finger in the opening ,that is >5cm then it is adequate for direct laryngoscopy and <2 figer breadth that is <3cms is associated laryngoscopy.

TMJ movement : Ask the patient to open his mouth as the examiner places his index finger next to the tragus and his thumb in front of the bottom half of the mastoid process. If the index finger next to the tragus is depressed in its space and the thumb can feel the condyle slipping, this indicates that the mandible has a good sliding function.

Protrusion of the mandible :

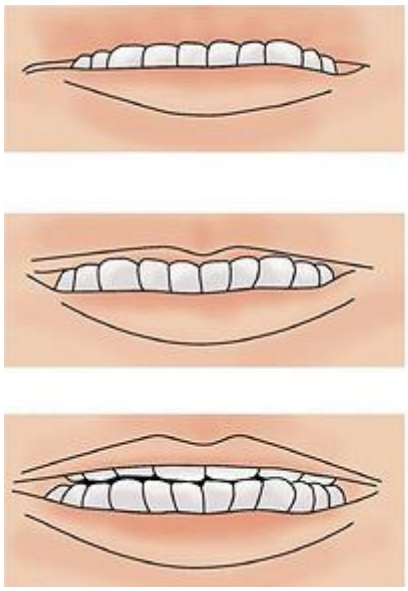
Whn patient protrudes the mandible, examiner should look the position of the lower teeth in relation to the upper teeth.

Class A : the lower incisor is protruded anterior to the upper incisors.

Class B : the lower incisor is edge to edge with upper incisors.

Class C : the lower incisor is not in edge to edge with upper incisor.

Upper lip bite test :



Mallampati test :

It shows the correlation between the tongue and pharyngeal size. Examiner should sit in front of the patient, wher the patient should be sitting up with their head in the neutral position and ask him toopen their mouth maximally and protrude their tongue without phonating.

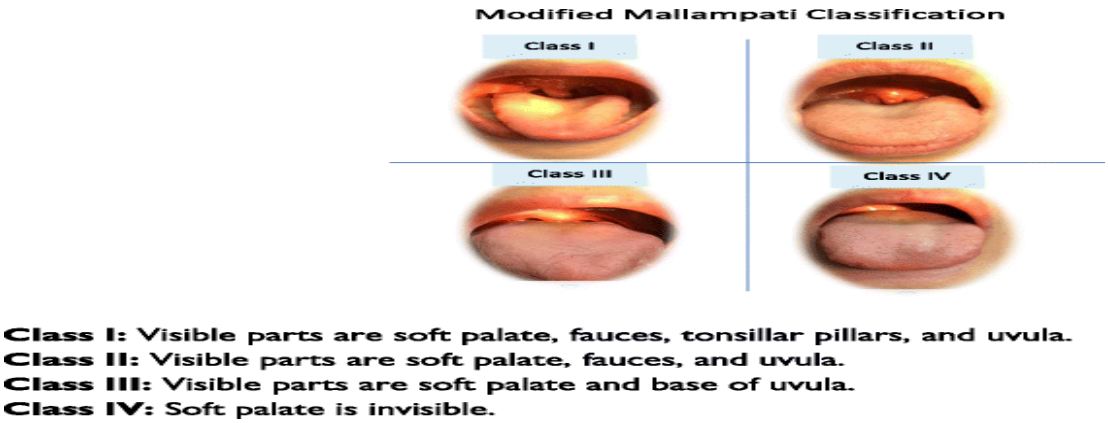


Figure 10: Modified Mallampati Classification

Assessment of mandibular space :

Thyromental distance(Patils test) :

When the patient's neck is fully stretched, the space between the mentum and the thyroid notch is measured which estimates the potential space in to the which the tongue can be displaced on laryngoscopy. Normal is greater than 6.5cm.

Sterno – mental distance : Distance between the suprasternal notch to the mentum with neck full extended and mouth closed. Normal is more than 12.5cm.

Hyo –mental distance : Distance between the mentum to hyoid bone.Normal is greater than 6cm.

Difficulty scores:

Wilson score *:*

Wilson risk sum score	0	1	2
Weight	<90 kg	90-110 kg	>110 kg
Head & neck movement	>90 degrees	About 90 degrees (i.e. +/- 10 degrees)	<90 degrees
Jaw movement	IIG >5 cm or Slux >0	IIG <5 cm and Slux =0	IIG <5 cm and Slux <0
Receding mandible	Normal	Moderate	Severe
Buck teeth	Absent	Moderate	Severe

These factors are given scores between 0 to 10, the greater the score , greater the risk for difficult intubation.

LEMON/MELON : A score of up to ten points is derived by awarding one point to each of the following factors.Patient in difficult intubation has high lemon scores.

LEMON Airway assessment method

L	Look externally (Facial trauma, large incisors, beard or moustache, large tongue
E	Evaluate the 3-3-2 rule - Incisor distance: 3 FB - Hyoid-mental distance: 3 FB - Thyroid-to-mouth distance: 2 FB
M	Mallampati Score ≥ 3
O	Obstruction : Presence of any condition like epiglotitis, Peritonsillar abscess, trauma
N	Neck Mobility (Limited neck mobility)

Rapid assessment of the airway by rule 1-2-3 : Three factors to determine the ease visualisation of glottis in an emergency

- Mobility of TM joint
- Mouth opening
- Thyromental distance[23,24,25,26]
- **Cormack and Lehane Classification:** It is divided in to four grades according to degree of glottic exposure.

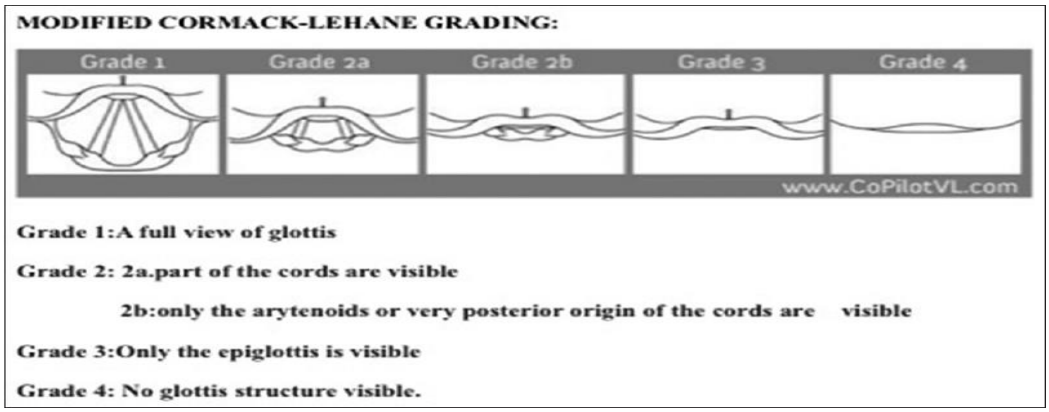


Figure 11: Laryngoscopic view of glottis-Cormack Lehane Grade

LARYNGOSCOPES

The larynx is viewed with laryngoscope, which is most usually used to introduce the tube into the tracheobronchial tree. Other applications are placing a feeding tube or transesophageal echocardiac probe, removal of foreign body , and visualizing and assessing the upper airway. They are of various types ranging from simple rigid scopes to complex fiberoptic video devices.[27,28]

Rigid Laryngoscope :

Rigid laryngoscopes are mostly of two types - as a single-piece or a separate detachable blade and handle. In the detachable type , the light source is either a lamp fitted to the blade or a light indicator in the blade with a bulb in the handle. In detachable type the light source turns on when the blade and handle are in locked position. The most typical connection between the handle and blade is a hook-on attachment. A hinge pin that fits into a groove on the blade's base connects the handle to the blade. This makes it easier to connect and disengage the blade. A switch on the handle in single piece laryngoscope controls power to the lamp.

Handle

Figure 12: Laryngoscope handle

It's the part of the laryngoscope that you hold in your hand, and generates the light.The handle has a rough surface to improve the grip. Most commonly, power source for the light are the disposable batteries. The metallic contact in the handle attaching to the blade having a light bulb, completes an electrical circuit when they are in the operating position. Some handles has the bulb and battery portion to be removed as a unit which allows the outer part of the handle to be cleaned and sterilized.

Handles are available in different sizes. Short handles are recommended for patients whose chest and/or breasts come into touch with the handle, when cricoid pressure is applied, or when the subject is in a body cast. Most blades forms right angle with handle but the angle may also be acute or obtuse. An adapter that can be inserted between the handle and the blade can change the angle.

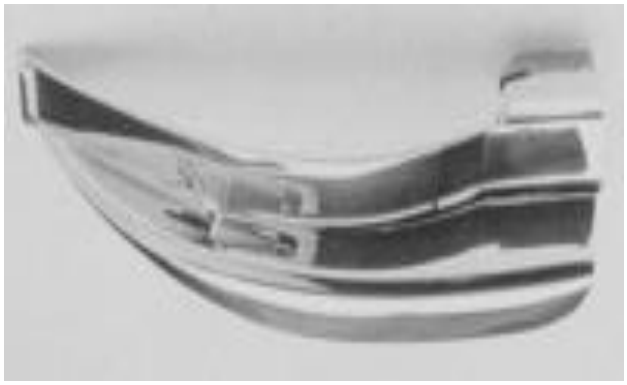


Figure 13 : Laryngoscopy Blade

This is the section that goes into the mouth. Because blades come in a variety of sizes, they are numbered, with the number increasing as the size decreases. The base, heel, tongue, flange, web, tip, and light source are all elements of the blade. The section of the base that attaches to the handle is called the base. It has a groove where the handle's hinge pin is mounted. The base comes to a stop at the heel. The tongue, which pressures and manipulates the soft tissues (particularly the tongue) and lower jaw, is the major shaft. The blade can be curved or straight, depending on the form of the tongue.Better laryngeal visualization is seen with straight blade, while curved blades make intubation easier.

The flange, which protrudes from the side of the tongue, guides equipment and diverts tissues out from the line of vision. The blade's cross-sectional form is regulated by the flange. The step is a term used to describe the vertical height of a blade's cross-sectional form. The epiglottis is directly or indirectly elevated by the tip of the blade so to decrease the trauma the tip is blunted or thickened.The blade has a bulbs which screws into a socket located near the tip that has a metallic contact.[27,28]

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Macintosh Blade

It is one of the most popular and used blades . The tongue has a slight curve that reaches to the tip. The tongue, web, and flange form an inverse Z in transverse section.Cervical spine movement is greater with this blade compared with the others.

Left-handed Macintosh Blade

The flange on the left-handed blade is on the opposite side of the blade than on the normal Macintosh blade. This blade may be useful in cases involving right-sided deformities of the face or oropharynx, left-handed intubators, persons with restricted use of the left arm, intubating in the right lateral position, or putting a tracheal tube employed directly on the left side of the mouth.

English Macintosh

In this blade the flange is curved and lower at the handle end.

Figure 14 : English Macintosh blade with reduced flange

Curved Blade Technique

Following epiglottis imaging, the blade is progressed until the tip fits into the vallecular, and traction is used all along handle at right angles to the blade, moving the base of the tongue and epiglottis forth and revealing the glottis. Pulling the handle backwards may force the tip to push the larynx upward and out of sight, as well as potentially damaging the teeth and gums.

Other Maneuvers

A left-molar or right-molar approach may often improve the laryngeal view in case of difficult laryngoscopy. The left-molar approach may spare the incisor teeth.

Sometimes the larynx may not be visualized with a correct technique. Outward backward, upward, and rightward pressure (BURP) on the thyroid cartilage causes the larynx to be pushed and mandibular advancement may improve visualization of the glottis.[27,28]

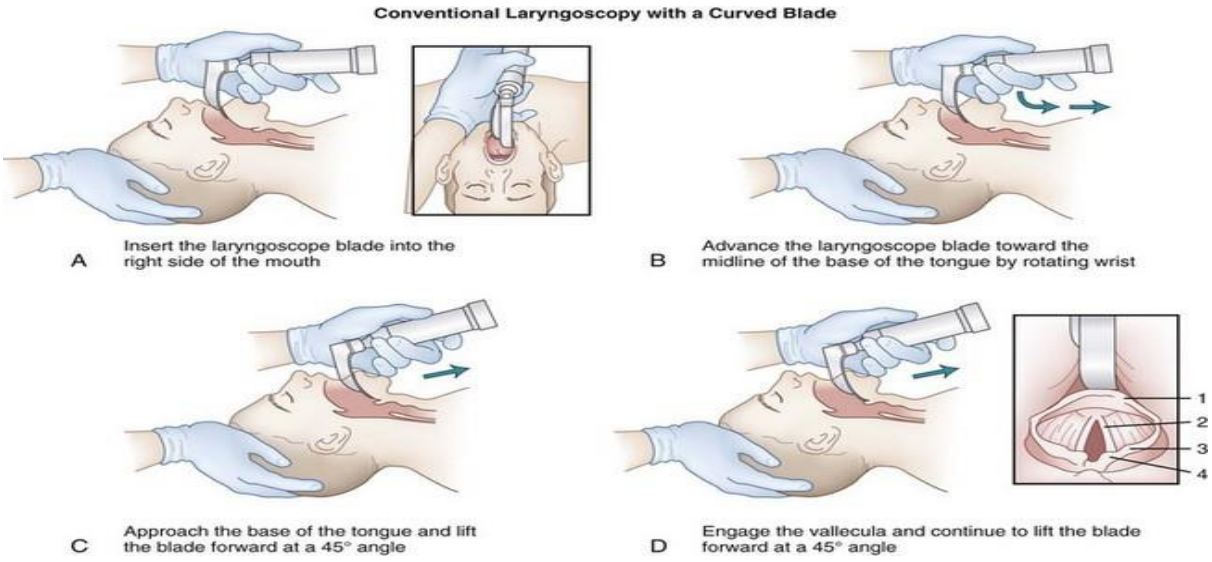


Figure 15 : Conventional Laryngoscopy with Curved blade

Video Laryngoscopes [27,28,29,30]

Connecting a video system to a laryngoscope creates a video laryngoscope. Several commonly available laryngoscopes are specifically designed to function with a video system. There are many advantages for video laryngoscopes like the displayed anatomy is magnified, and a larger viewing angle is provided. As the same image is seen on the monitor the movement between the operator and assistant can be coordinated and can act as a good teaching tool allowing the supervisor to monitor the intubation. Less cervical movement is involved while using a videolaryngoscope compared to conventional. It also allows the anesthesia provider to maintain a distance from the patient during intubation, and this could be useful in patients who have infectious diseases .

In addition to allowing easy laryngoscopy and intubation , it can be used to observe placement of bougie, movement of the vocal cords after thyroid surgery, verify tracheal tube position, and aid in tracheal tube exchange [34].

Figure 16 : Different types of videolaryngoscopes

King Vision Videolaryngoscope [31,32,33,34,35]

Description

King Vision Videolaryngoscope is a portable, rigid, battery - operated video laryngoscope that has an integrated reusable display, two reusable video adapters and a choice of disposable blades.

Components

The King Vision Videolaryngoscope consists of the following components:

1. A integrated reusable display

2. A reusable video

3. Disposable blades, with or without a channel for tracheal tube guidance.

None of the product components are made of natural rubber latex and all components are supplied clean, non-sterile, ready to use.

Reusable Display The main reusable part of the King Vision Videolaryngoscope is its TFT LCD (Thin Film Transistor Liquid Crystal Display) screen which is durable, high quality, portable, battery operated display. It receives images from the distal tip of the video adapter and displays the image on the anti-glare screen. The reusable screen consists of an on/off switch a battery indicator light and a video-out port. It has an advanced power management system with automatic gain and exposure control. Power is provided by three AAA batteries with in the battery compartment .

Figure 17 : Reusable display screen of KVVL.

Reusable Video Adapter The second reusable part of this Videolaryngoscope is a video adapter that connects to the display screen in order to transmit an image to the display when turned on. The video adapter comes in two sizes and each video adapter includes an LED light source and CMOS camera housed within the distal tip.

Single Use aBlades The disposable component of this Video Laryngoscope consists of two types of disposable blade versions:

The King Vision Channeled aBlade - The "Channeled" blade consists of a guiding channel to facilitate the delivery of an endotracheal tube (ETT) through the vocal cords. No stylet is required.

The King Vision Standard aBlade - There is no guiding channel in the "Standard" blade. Therefore, these blades requires the use of a stylet to assist in delivering the ETT to the vocal cords.

Both blade versions connects to the reusable display. The distal component of the blade has an anti-fog coating to provide a clear image. Blade size is intended to be consistent with standard rigid laryngoscopes such as Macintosh and miller.[31,32]

Indications For Use:

The King Vision Video Laryngoscope is rigid laryngoscope which is used to examine and visualize a patient's upper airway and help in in the placement of a tracheal tube.

The King Vision® Video Laryngoscope with channelled Blade

Figure 18 : King Vision VideoLaryngoscope

Figure 19 : Comparison between Macintosh and KVVL blade[33,35]

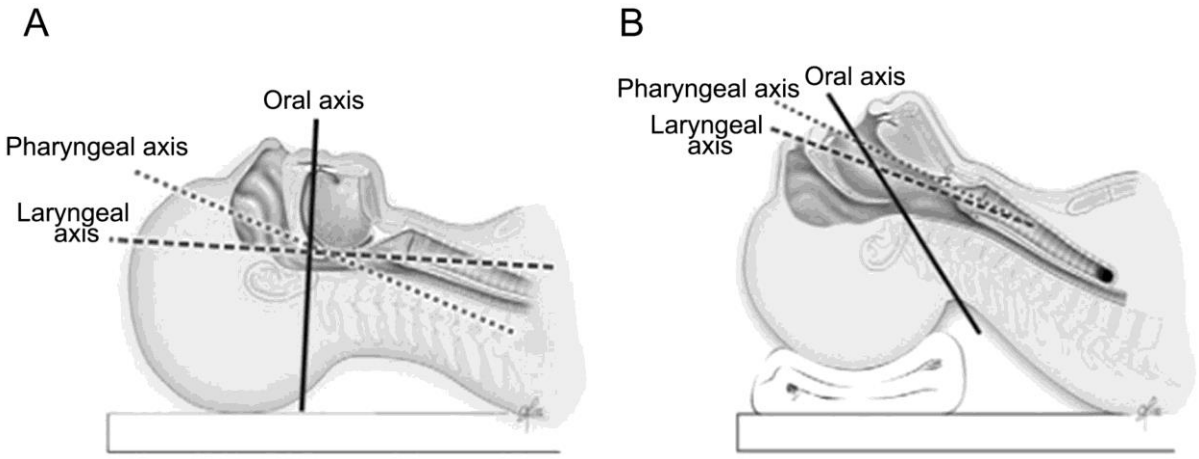


Figure 20 : Indirect laryngoscopy vs. direct laryngoscopy: the best head posture for 3 axis alignment [36,37]

The 3-axes synchronisation hypothesis and the classic sniffing position or ideal head position for direct laryngoscopy The oral axis is a horizontal line that runs throughout the front of the tongue. The pharyngeal axis is a tangential line that runs from the uvula to the epiglottis' inferior aspect. A: A line formed at a right angle to the voice cords is known as the laryngeal axis. B: The oral axis is more strongly connected with these two axes when the head is extended at the atlanto-occipital joint.

COMPLICATIONS OF LARYNGOSCOPY [27,28,38]

The oropharyngeal tissues may be damaged by the laryngoscope, which can produce blunt or piercing trauma.

COMPLICATIONS ARISING DURING LARYNGOSCOPY

Dental Injury

The most frequent anesthesia-related insurance claim is the cosmetic disfigurement and discomfort due to the damage to teeth, gums, or dental prostheses. In addition to that, there may be pulmonary complications if the dislodged tooth is aspirated.

The teeth mostly damaged are the loose tooth, but sound tooth can also be affected. The upper incisors are most frequently involved, which is most often due to using the teeth as a fulcrum point for the laryngoscope while elevating the epiglottis. A thorough assessment must be done preoperatively and inquiry should be made regarding the vulnerable dental repair work or loose or carious teeth. Deciduous teeth are easily dislodged in patients 4 to 11 years old. In such suspected problematic cases the patient should be advised beforehand, or a suture may be placed around loose tooth to prevent its dislodgment or removal before or during anesthesia is indicated.

An immediate search should be conducted if a tooth or fragment is dislodged, starting with an examination of the oral cavity and the area surrounding the patient's head as aspiration is the major concern. Chest and neck radiographs must be taken if the fragment is not recovered.

Various types of tooth damage can occur which may require different treatments. A qualified dentist or oral surgeon should be called as immediate replacement in its original position and stabilization will increase the chances of successful reimplantation.

Keeping a partial upper denture in places where there are gaps between the upper front teeth to bridge the gap, or a tooth protector may prevent the laryngoscope from slipping into gaps between teeth. One more effective method indicated is placing adhesive tape on the flange of the blade.

Cervical Spinal Cord Injury

In patients with unstable cervical spine, aggressive head and neck extension during intubation, has the potential to cause damage. Patients with an unstable cervical spine can be associated with a congenital weakness, malformation, fracture, or dislocation of a cervical vertebra or other conditions such as osteoporosis, connective tissue disease, or tumor. The likelihood of cervical injury can be reduced with manual in-line immobilization which reduces spinal movement .

Damage to Other Structures

Erosion, haemorrhage, and cuts and bruises of the lips, tongue, palate, pharynx, hypopharynx, larynx, and oesophagus are other upper airway injuries. injury to the lingual and/or hypoglossal hypoglossal nerve: subluxation of arytenoid ; dislocation of temporomandibular joint.

As the number of laryngoscopic attempts increases there is a significant increase in the rate of airway-related complications also seen so the number of attempts has been limited to three by The American Society of

Anesthesiologists (ASA) Task Force on the Management of the Difficult Airway .

Shock or Burn

Sometimes a short circuit can result in the handle and blade rapidly heating leading to burns in patient

Swallowing or Aspirating a Foreign Body

Various cases have been reported where bulb or other part of a laryngoscope was aspirated,part of tumore may be dislodged in to airway and resulting in obstruction. Attempts to be made to find these foreign bodies and If not found in the oral cavity or around the patient's head, x-rays of the chest and neck should be taken

Laryngoscope Malfunction

Light failure is the most common laryngoscope malfunction. This may result from defective power source, lamp, or socket; incorrect assembly; or poor contact between the blade and handle. Immediately availability of an extra handle and blade and a preuse check may prevent disasters especially in rapid sequence induction

Circulatory Changes

A significant increases in blood pressure and heart rate may be seen during laryngoscopy. Stimulation of the highly innervated glottis by the laryngoscopy blade can cause sympathetic surge resulting in tachycardia, dysrhythmias, myocardial ischemia and/or

infarction and hypertension. Similarly,profound bradycardia can occure due to stimulation of vagus nerveby the blade.

Disease Transmission

The risk of infection transmission, via laryngoscopes, is a matter of concern to anesthesia providers.

Others

Other complications during intubation are failure of oxygen at the source; Failure of oxygen at the delivery site; Improper procedure; Inability to intubate or ventilate; Vomiting and aspiration.

COMPLICATIONS ARISING IMMEDIATELY AFTER INTUBATION

Hypoxemia Accidental esophageal intubation ;Ingestion of laryngoscope lightbulb; Accidental endobronchial intubation; Bronchospasm ;Difficulty with ventilation; Laryngeal intubation; Accidental extubation; Rupture of the trachea or bronchus Tension pneumothorax Hypertension, tachycardia, and arrhythmia;s Elevated intracranial pressure

COMPLICATIONS ARISING UPON REMOVAL OF ENDOTRACHEAL TUBE

Sore throat ;Temporomandibular joint dysfunction ;Vocal cord injury ;Postintubation croup; Arytenoid dislocation ;Cord avulsion; Neural injury - Recurrent laryngeal nerve injury Lingual, hypoglossal, and mental nerve damage

Sore throat

Sore throat is the most common complication reported post extubation especially in recovery room.,. Sore throat includes pain, discomfort, hoarseness of voice, dysphagia, and dry throat; these can occur alone or in a combination following extubation which is thought to be due to laryngeal inflammation and edema. Major reason is trauma to airway mucosa during management of. The degree of damage is related to amount of forces applied during laryngoscopy and the number of attempts required for successful intubation .It usually resolves in 48 hrs. Management strategies include nebulized racemic epinephrine, heliox, glucocorticoids, and reintubation

Vocal cord paralysis

It is one of the rare complication of intubation ,usually occurs due to the compression of the anterior branch of the recurrent laryngeal nerve between the cuff and the thyroid cartilage in the subglottic larynx ; also may be due to arytenoid dislocation, possibly from forceful intubation .When paralyzed, abduction of the affected vocal cord is impaired so that it becomes fixed in the adducted position .Paralysis can be unilateral or bilateral.[27,28,38]

MATERIALS AND METHODS

SOURCE OF DATA

This study was carried out in Department of Anesthesiology, B.L.D.E.(DU)'s Shri. B. M. Patil Medical College, Hospital and Research center, Vijayapur

METHOD OF COLLECTION OF DATA:

Study method : The study population of 118 with age,weight and sex matched were assigned using computerized random table number in to two groups with 58 patients in direct laryngoscopy and 60 patients in videolaryngoscope group were included.

Study Period: one and half year from December 2019 to August 2021

Sample size

On the basis of a study the anticipated mean±SD of Total time of Intubation in two groups is 31.81±8.57 and 53.6±19.27, Comparison of Macintosh, McCoy, and Glidescope video laryngoscope for intubation in morbidly obese patients: Randomized controlled trial by Keerthi et al[12] the minimum sample size was 110 group with 95% level of significance and 90% power.

Formula used is

$$N = 2\left[\frac{(Z_{\propto} + z_{\beta}) * S}{d}\right]^2$$

Z_{α} Level of significance=95%

Z_{β}--power of the study=90%

d=clinically significant difference between two parameters

SD= Common standard deviation

Sample size per group =55

Statistical method:

- Data is represented using Mean ±SD, percentages and diagrams
- Significant difference between quantitative data was found using unpaired t test/ Mann whitney U test to compare two groups.
- Significant difference between Qualitative data was found using Chi square or Fisher's Exact test.

Randomization: The study population were assigned using computerized random number table in to two groups.

Group DL: Intubation performed using conventional Macintosh laryngoscope

Group VL: Intubation performed using videolaryngoscope

Results were recorded using a preset performa

STUDY POPULATION

This study was done in adult patients aged between 18-60 years undergoing various elective surgical procedures under general anaesthesia.

INCLUSION CRITERIA:

- ASA I and II class of patients requiring endotracheal intubation for surgeries under general anaesthesia.
- Age between 18 and 60 years.
- Both male and female patient.

EXCLUSION CRITERIA

- Patient refusal or inability to consent
- Patients undergoing rapid sequence intubation.
- Patients having restricted cervical extension and movements, tumours of oropharyngeal region, trauma to airway, previous surgeries in neck, local infection of neck, burns and swellings in neck region, previous difficult intubation.
- Pregnant patients.
- Obese patients BMI >30kg/m^2

Patients with any of the following conditions were predicted to have difficult airway

- thyromental distance less than 6cm
- more than 3cm of mouth opening
- cervical ankyloses
- Mallampati score-IV

METHODOLOGY:

Preanaesthetic evaluation :

Preanasesthetic evaluation included the following:

History:

History of underlying medical illness, previous history of surgery, anaesthetic exposure and hospitalization were elicited

Physical examination

General condition of patient

Vital signs -heart rate, blood pressure, respiratory rate

Height and weight

Examination of respiratory system, cardio vascular system, central nervous system and the vertebral system.

Airway assessement by Mallampatti grading

Procedure was explained to the patient

INVESTIGATIONS /INTERVENSIONS

Investigations or interventions required in this study were routine standardized procedures like:

CBC, BT,CT,HIV, HbsAg, Urine routine ,Random blood sugar, Blood Urea, Serum Creatinine, chest radiograph and ECG.

Procedure:

- Preanaesthetic checkup was done in the ward.
- Patients were kept nil by mouth 6 hours before surgery.
- Patients were selected for the study based on inclusion and exclusion criteria.
- Procedure was explained to the patients and informed consent taken.
- The study population were randomly arranged for intubation using conventional Macintosh laryngoscopes or using video laryngoscopes based on computerized random number table prior to induction of anesthesia.
- The primary investigator who will be performing the laryngoscopy was a trainee with experience of more than 25 successful intubations with each study devices.
- Attending anesthesiologist chose the endotracheal tube size and prepared for the intubation. The study device along with alternate rescue devices (bougie, intubating LMA, fiberoptic scopes) were also kept ready.
- Patients were taken to the operation theater, standard monitoring devices including pulse oximeter, sphygmomanometer cuff, $ETCO_2$, ECG leads were connected and baseline values were recorded.
- Iv line was secured and patients were optimally preoxygenated with 100% oxygen by facemask for 3 min and premedicated with iv 0.01 mg/kg glycopyrollate, 0.15 mg/kg ondansetron, 0.02 mg/kg midazolam. Fentanyl 2mcg/kg and Propofol 2mg/kg iv were used to induce anaesthesia. Succinylcholine 2mg/kg was administered to aid tracheal intubation after ensuring sufficient mask breathing.
- Patients of Group DL where Macintosh blade was used had their head positioned in sniffing position to attain the laryngoscope view.
- Group VL had their head in neutral position to attain the laryngoscopic view.

- Laryngoscopy was performed. Operator was permitted to use external laryngeal manipulation or change position of head to improve glottis view to facilitate intubation.

Figure 21 : Showing images of laryngoscopes used- KVVL and Macintosh

- If the laryngeal view is not proper , operator had to remove laryngoscope , then the next attempt will be counted as an additional attempt.
- Each intubation attempt was terminated if there was a desaturation of less than 95%.
- Ventilation by mask was permitted with 100% oxygen between attempts, if necessary, till saturation returned to 100%.
- The total time for intubation (TTI) was noted, which is defined as time between insertion of blade to first upstroke of capnography.
- The operator would also record the ease of visualization of the glottis structures based on the classification described by Cormack and Lehane and the successful first attempt.
- Number of attempts and use of adjunct equipment was recorded.
- After 2 unsuccessful attempts, a senior practitioner would attempt for the intubation.

- After the third failed intubation attempt, patient was called off from the study protocol and excluded from the study.
- Patients getting successfully intubated as per protocol, were maintained under anaesthesia using oxygen, air and isoflurane and atracurium.
- Patients were reversed with 0.05mg/kg of neostigmine with 0.01mg/kg of glycopyrollate, in the end, at the first attempts of breathing. They were extubated when fully awake and adequately reversed.
- Patients were further assessed regarding the complications related to the laryngoscopy and intubation, in the recovery room and further within 24 hours, as per the proforma.

Figure 22: Showing placement of ETT within KVVL and insertion in to the oropharynx.

STATISTICAL ANALYSIS

Data was represented using Mean ±SD, percentages and diagrams. For continuous variables, the summary statistics of mean± standard deviation (SD) were used . Basic variables such as age, BMI, ASA Grade and the primary objective in this study that is Time to intubate were represented using Mean ±SD and comparison between the variables was done using Mann Whitney U test.Significant difference between Qualitative data was found using Chi square or Fisher's Exact test.

For categorical data, the number and percentage were used in the data summaries and diagrammatic presentation. These data includes comparison of age(group wise), Gender, other objectives in the study such as Cormack –Lehane grade, Number of intubations, number of intubation failures, change of anaesthesist and adjunct equipment used between video laryngoscopy and macintosh group.Chi-square (χ^2) test was used for association between two categorical variables.

The formula for the chi-square statistic used in the chi square test was:

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

The subscript "c" are the degrees of freedom. "O" is observed value and E is expected value.
C= (number of rows-1)* (number of columns-1)

The difference of the means of analysis variables between two independent groups was tested by unpaired t test.

The t statistic to test whether the means are different can be calculated as follows:

$$t = \frac{(\overline{x_1} - \overline{x_2}) - (\mu_1 - \mu_2)}{\sqrt{\frac{{s_1}^2}{n_1} + \frac{{s_2}^2}{n_2}}}$$

where $\bar{x}_1$ = mean of sample 1

$\bar{x}_2$ = mean of sample 2

n_1 = number of subjects in sample 1

n_2 = number of subjects in sample 2

${s_1}^2$ = variance of sample 1 = $\frac{\Sigma(x_1 - \bar{x}_1)^2}{n_1}$

${s_2}^2$ = variance of sample 2 = $\frac{\Sigma(x_2 - \bar{x}_2)^2}{n_2}$

If the p-value was < 0.05, then the results were considered to be statistically significant otherwise it was considered as not statistically significant. Data were analyzed using SPSS software v.23 (IBM Statistics, Chicago, USA) and Microsoft office 2007.

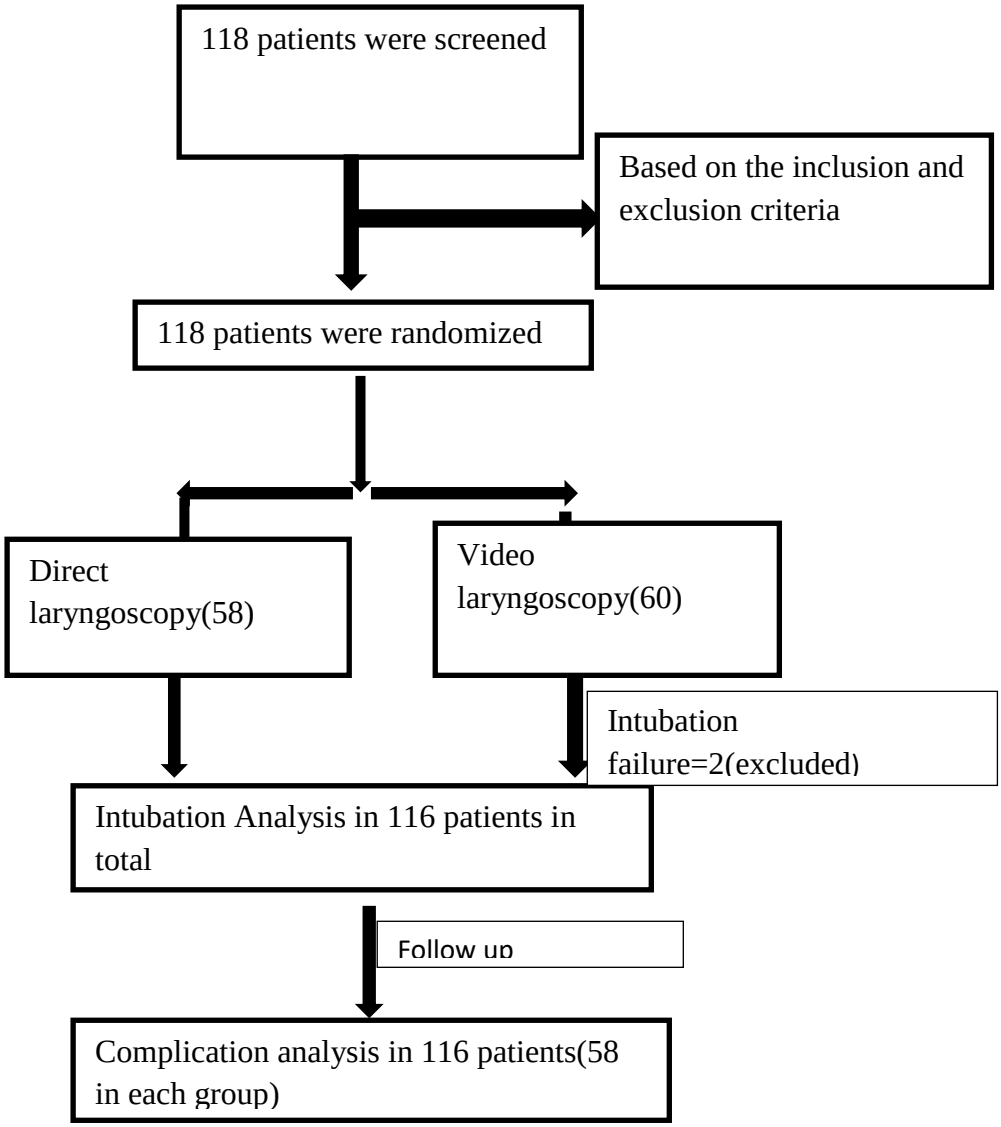


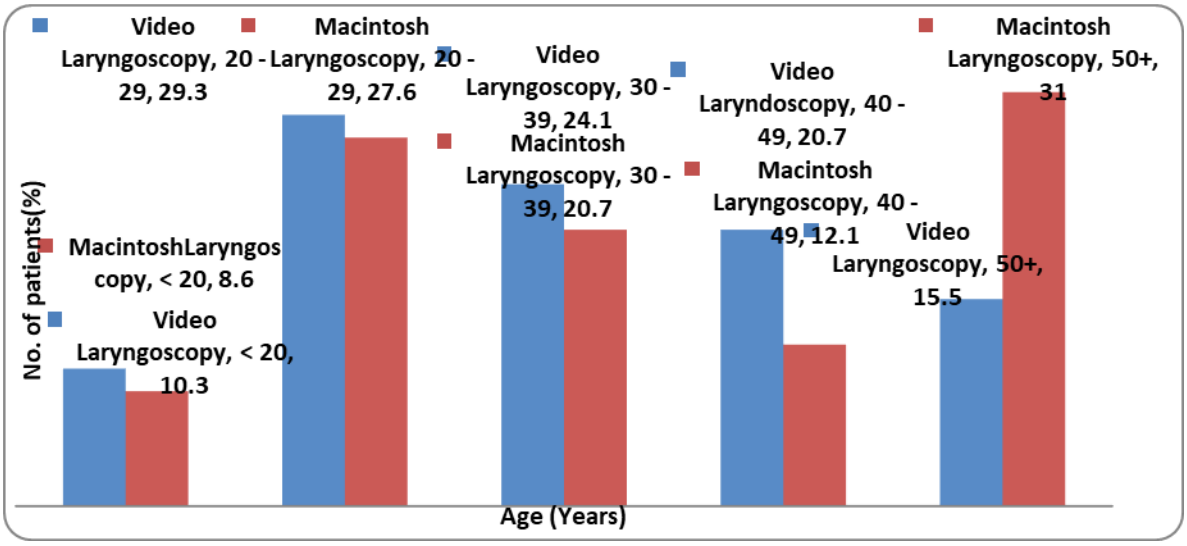
Figure 23 : Flow chart illustrating patient inclusion

OBSERVATION AND RESULTS

Table 1: Distribution of patients according to Age-Years wise

Age(Years)	Video Laryngoscopy(VL)		Macintosh Laryngoscopy(DL)	
	No. of Patients	Percentage(%)	No. of patients	Percentage(%)
< 20	6	10.3	5	8.6
20 – 29	17	29.3	16	27.6
30 – 39	14	24.1	12	20.7
40 – 49	12	20.7	7	12.1
50+	9	15.5	18	31.0
Total	58	100.0	58	100.0

- Age wise distribution of the sample in both the groups are comparable. There is no statistical difference between both Video laryngoscopy and direct (Macintosh) laryngoscopygroups.

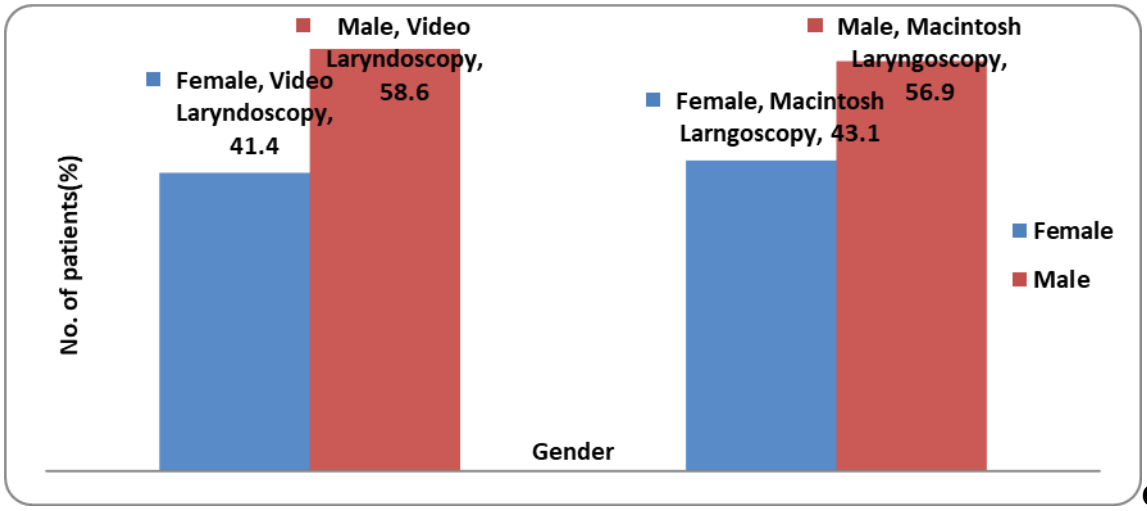


Graph 1: Age wise distribution in both the groups

Table 2: Distribution of patients according to Gender

Gender	Video Laryngoscopy(VL)		MacintoshLaryngoscopy(DL)		Chi square test	P value
	No. of Patents	Percentage(%)	No. of patients	Percentage(%)		
Female	24	41.4	25	43.1	X^2=0.0353	P=0.9509
Male	34	58.6	33	56.9		
Total	58	100.0	58	100.0		
Insignificant, as p value is more than 0.05						

Table shows that male and female were equally distributed in both the groups (p value 0.95)



Graph 2: Gender wise distribution in both groups

- Percentage of female were 41.4% and 43.1% in Video Laryngoscopy and Macintosh group respectively
- Percentage of males were 58.6% and 56.9% in Video laryngoscope and Macintosh laryngoscopy group respectively. Both groups are comparable.

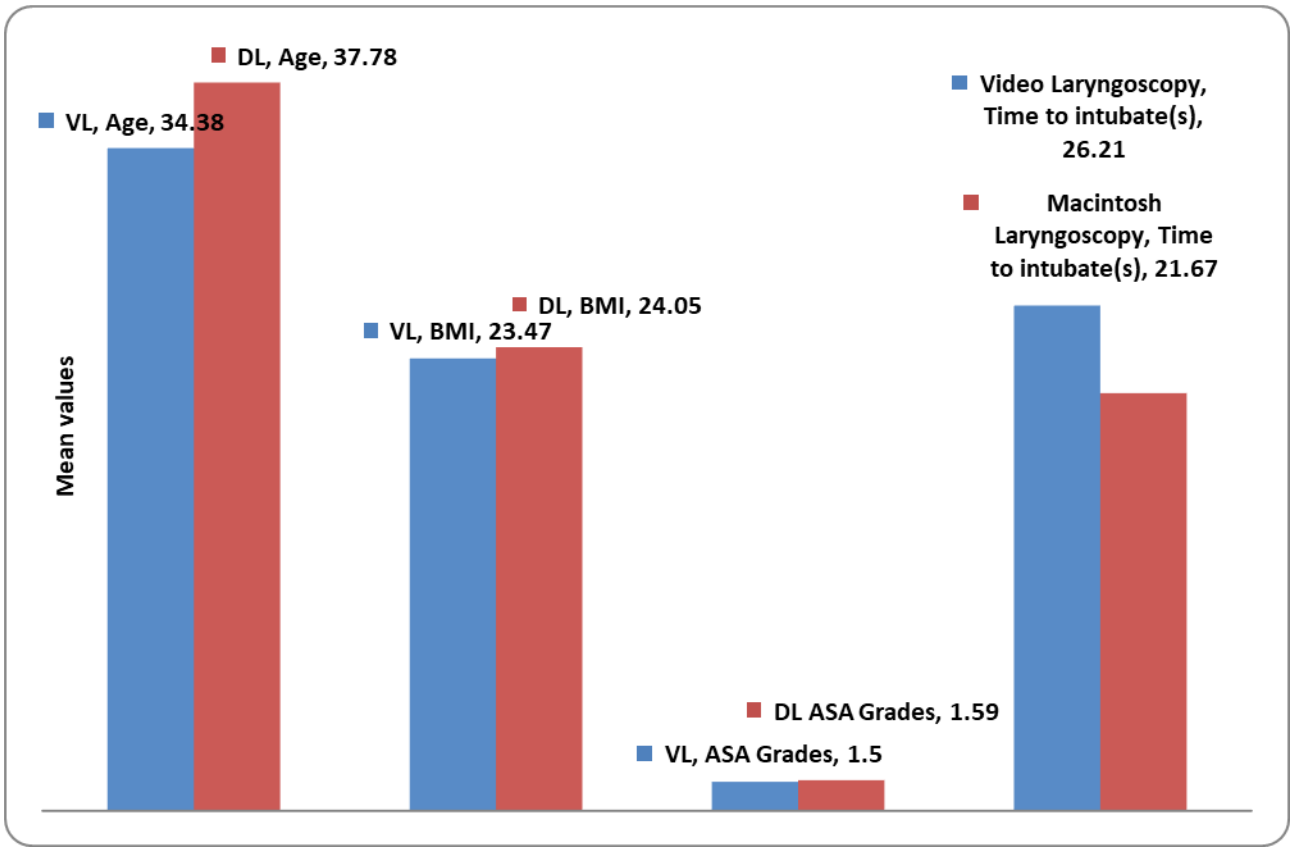
Table 3: Comparison of basic variables like Age, BMI, ASA grades and Time to Intubate between two groups.

Variables	Video Laryngoscopy		Macintosh Laryngoscopy		Mann whitney U test	P value
	Mean	±SD	Mean	±SD		
Age	34.38	12.732	37.78	14.391	U=1456	P=0.212*
BMI	23.47	3.004	24.05	3.400	U=1498	P=0.309*
ASA Grades	1.50	.504	1.59	.497	U=1537.00	P=0.353*
Time to intubate(s)	26.21	4.150	21.67	4.318	858.000	P=0.001**

*: Insignificant (p value is more than 0.05) **: Highly Significant (p value is less than 0.05)

- There was no difference in **age, BMI and ASA class** between two groups.
    - All were represented as Mean ±SD. Mann whitney U test was used to compare the data between both the groups.
    - Both groups were comparable.
- **Time to intubate** was also represented as Mean ±SD. It is seen that Time to intubate in Video laryngoscope group took longer time compared to Macintosh group.P value =0.001, which is highly significant

Graph 3: Comparison of basic variables and time to intubate between both the groups.

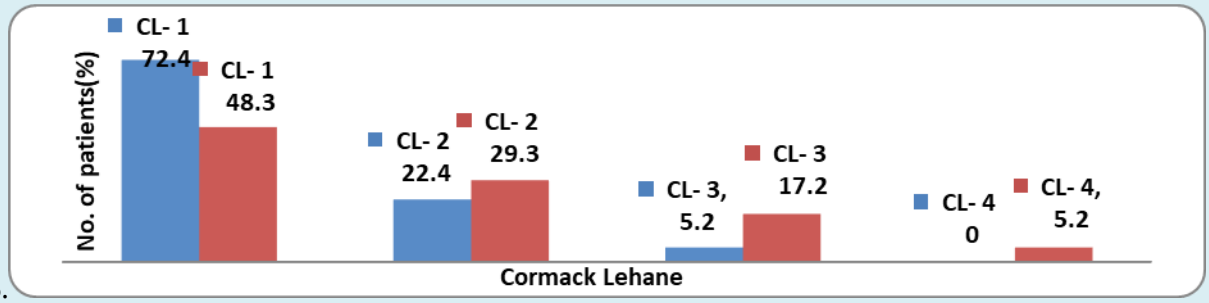


- There was no difference in age, BMI and ASA class between two groups.
- The mean BMI in Videolaryngoscopy was 23.47±3.004 and in Macintosh Laryngoscopy was 24.05 ± 3.400 .The mean BMI in both the groups were comparable.
- The ASA grade was also comparable in both the groups.
- There was significant difference between two groups with videolaryngoscopy (VL) taking more time to intubate 26.2s±4.150 compared to Macintosh Laryngoscopy(DL) 21.67s±4.318.Pvalue 0.001 which is highly significant.

Table4: Distribution of patients according to Visualisation of the laryngeal view by Cormack-Lehane grade

Cormack Lehane grade	Video Laryngoscopy(VL)		MacintoshLaryngoscopy(DL)		Chi square test	P value
	No. of Patents	Percentage(%)	No. of patients	Percentage(%)		
1	42	72.4	28	48.3	X^2=10.103	P=0.0177*
2	13	22.4	17	29.3		
3	3	5.2	10	17.2		
4	0	0	3	5.2		
Total	58	100.0	58	100.0		

*: Highly Significant-P value for this particular data is more than 0.05.



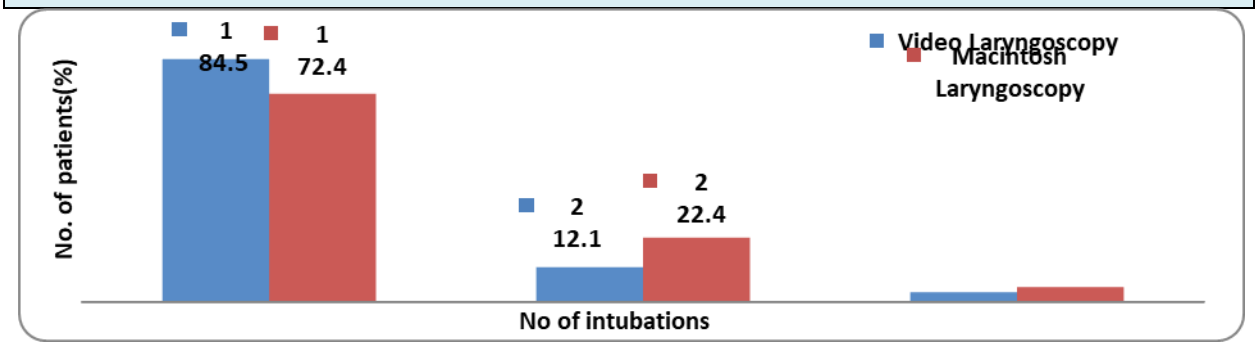
Graph 4:Distribution of both the study group according to Cormack-Lehane Grading

- 72.4% of VL had better glottis visualization that is Cormack lehane(CL) grade 1 compared to 48% in DL.In VL group out of total 58 patients 22.4%, 5.2% and 0 subjects were having C-L grade 2,3,4 respectively .

- Similarly in Macintosh group out of total 58 patients 29.3%, 17.2%, 5.2% were having C-L grade 2,3,4 respectively which was statistically significant.

Table 5 : Distribution of patients according to Number of intubations and Number of first successful attempt

No of intubations	Video Laryngoscopy(VL)		MacintoshLaryngoscopy(DL)		Chi square test	P value
	No. of Patents	Percentage(%)	No. of patients	Percentage(%)		
1	49	84.5	42	72.4	X^2=2.538	P=0.2810
2	7	12.1	13	22.4		
3	2	3.4	3	5.2		
Total	58	100.0	58	100.0		
Insignificant-P value is more than 0.05,but percentage wise number of first attempt in VL (84.5%) is higher than DL(72.4%).						



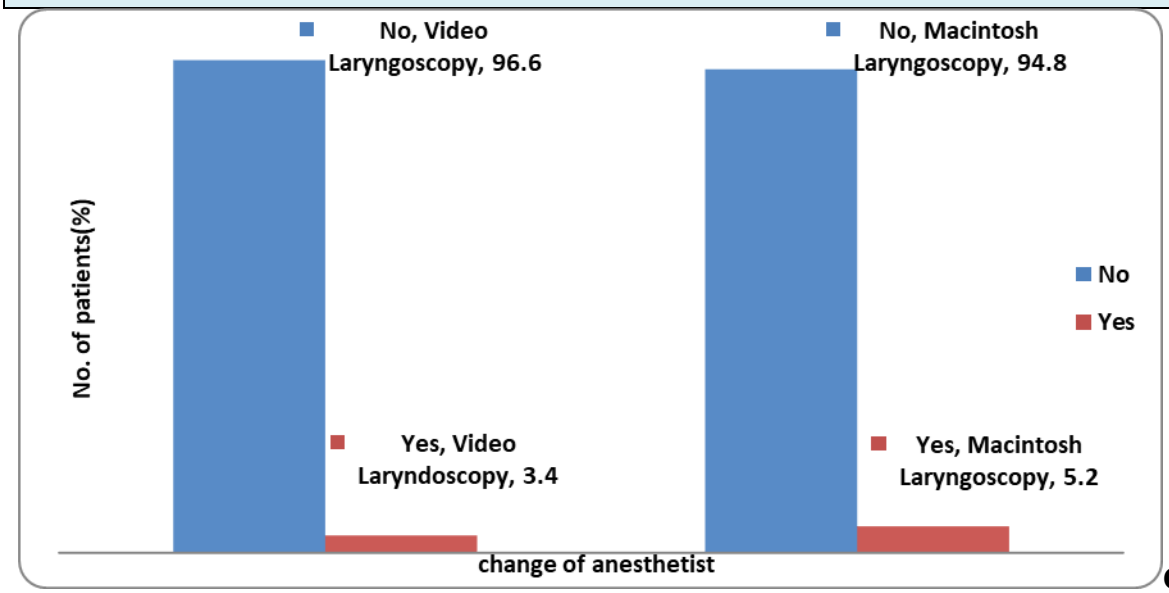
Graph 5: Graph showing number of intubation attempts made and percentage of first successful attempt.

- Total number of intubations are statistically insignificant between both groups.(P value=0.2810).

- But out of 58 patients number of first successful attempt are in VL is 84.5% compared to 72.4% in DL.This difference percentage wise in both group is significant.
- No of intubations done in second attempt in Videolaryngoscopy is 12.1 % compared to 22.4 % in macintosh group.

Table 6 : Distribution of patients according to change of anaesthetist

change of anaesthetist	Video Laryngoscopy(VL)		Macintosh Laryngoscopy(DL)		Chi square test	P value
	No. of Patents	Percentage	No. of patients	Percentage		
No	56	96.6	55	94.8	X^2=0.2090	P=0.6475
Yes (Snr Practitioner)	2	3.4	3	5.2		
Total	58	100.0	58	100.0		
Insignificant-P value is more than 0.05						



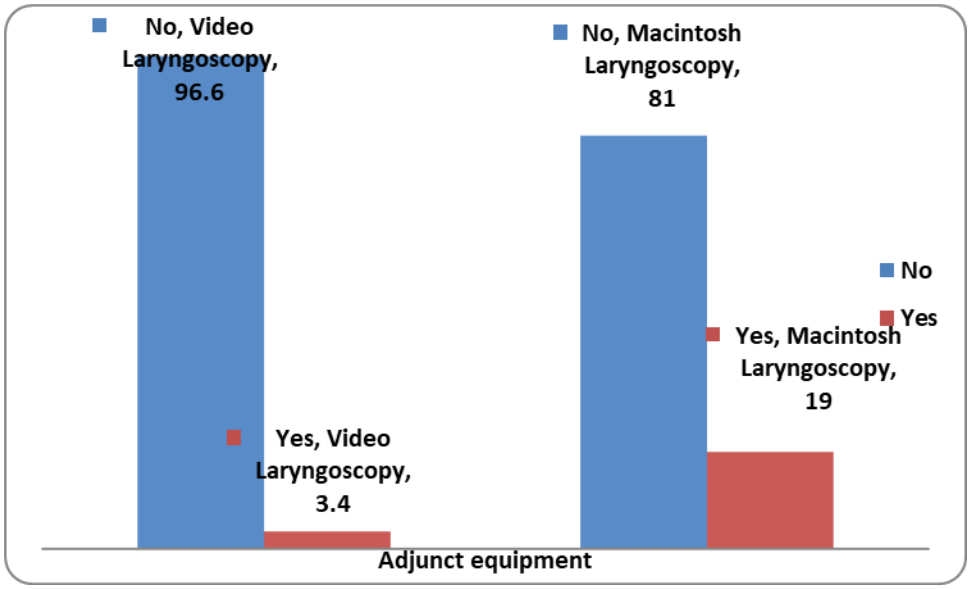
Graph 6: Graph showing change of anaesthetist in both the groups

- Out of total 58 subjects, there was no change of anaesthetist in 96.6 % in VL group and 94.8% in Macintosh group.
- Senior practitioner intubated in 3.4 % in VL group and 5.2% in DL group. P value=0.6475
- There was no significant difference between both groups with regards to change of anaesthetist.

Table 7: Distribution of patients according to adjunct equipment

Adjunct equipment	Video Laryngoscopy(VL)		Macintosh Laryngoscopy(DL)		Chi square test	P value
	No. of Patients	percentage	No. of patients	Percentage		
No	56	96.6	47	81.0	X^2=7.017	P=0.0081*
Yes (Bougie)	2	3.4	11	19.0		
Total	58	100.0	58	100.0		
*: Highly Significant- p value is less than 0.05.						

Graph 7: Showing use of adjunct equipment in both groups

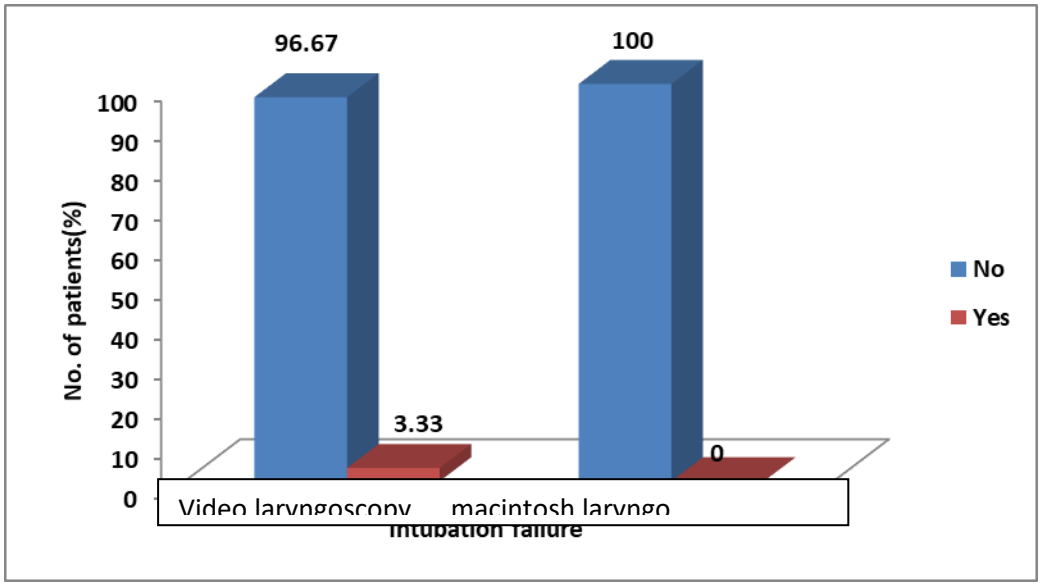


- Out of total 58 subjects 19% of practitioners in Macintosh (DL) group used adjunct equipment compared to 3.4% in video group.
- P value=0.0081.This is statistically highly significant. Therefore DL group had more usage of adjunct equipment.
- 96.6 % in VL group were intubated without use of auxiliary equipment.

Table 8 : Distribution of patients according to Intubation failure

Intubation failure	Video Laryngoscopy(VL)		Macintosh Laryngoscopy(DL)		Chi square test	P value
	No. of Patents	percentage	No. of patients	Percentage		
No	58	96.67	58	100.0	NA	
Yes	2	3.33	0	0		
Total	60	100.0	58	100.0		
Insignificant						

Graph 8 : Showing intubation failure in both groups



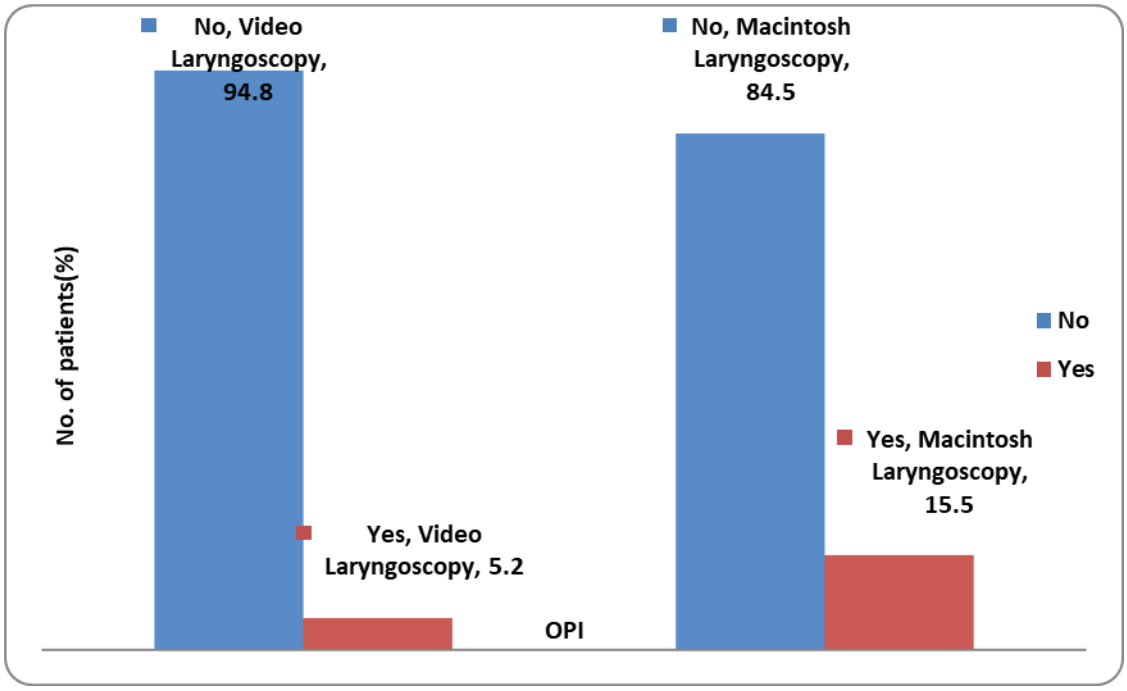
- There were two intubation failures in video laryngoscopy group (3.33 %)
- No failure in intubation was seen in Macintosh group
- However it was not statistically significant, thus they were excluded from the study.

Complications

Table 9: Distribution of patients according to Oropharyngeal injury (OPI)

OPI	Video Laryngoscopy(VL)		Macintosh Laryngoscopy(DL)		Chi square test	P value
	No. of Patients	percentage	No. of patients	Percentage		
No	55	94.8	49	84.5	X^2=3.346	P=0.0674
Yes	3	5.2	9	15.5		
Total	58	100.0	58	100.0		
Insignificant- p value is more than 0.05.						

Graph 9: Distribution of subjects having oropharyngeal injury post intubation in both groups

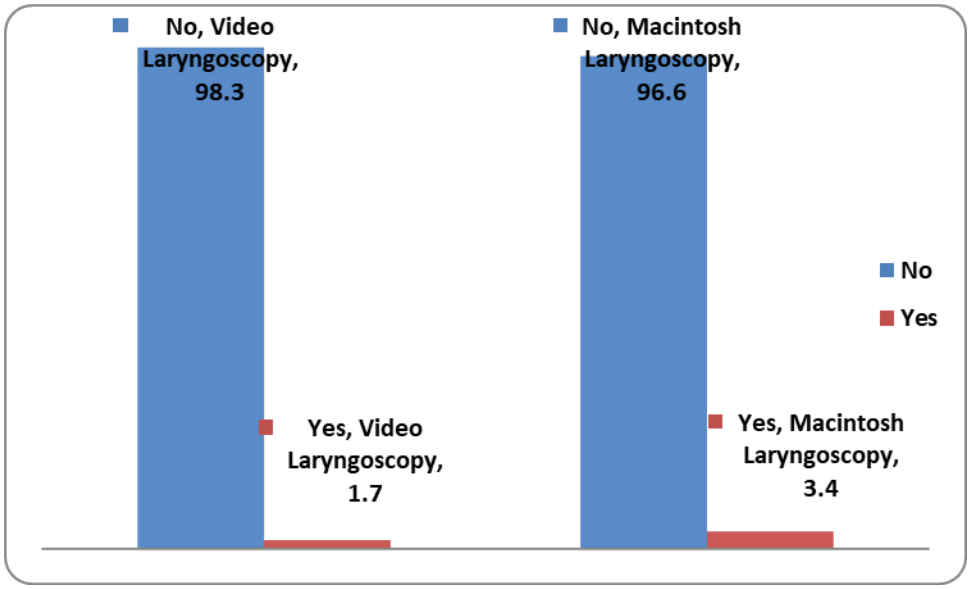


- Out of 58 subjects 5.2% in videolaryngoscopy group and 15.5 % in macintosh group suffered from oropharyngeal injury post intubation.
- P value is 0.0674. Statistically it is insignificant in both the groups.

Table 10: Distribution of patients according to Dysphagia

Dysphasia	Video Laryngoscopy(VL)		Macintosh Laryngoscopy(DL)		Chi square test	P value
	No. of Patents	Percentage	No. of patients	Percentage		
No	57	98.3	56	96.6	X^2=0.3422	P=0.5586
Yes	1	1.7	2	3.4		
Total	58	100.0	58	100.0		
Insignificant- p value is more than 0.05.						

Graph 10 : Distribution of subjects suffering from dysphagia in both groups



- Out of 58 subjects 1.7% in VL group and 3.4 % in DL group suffered from dysphagia post intubation.
- P value is 0.5586 . Statistically it is insignificant.

Table 11: Distribution of patients according to Pharyngeal Pain

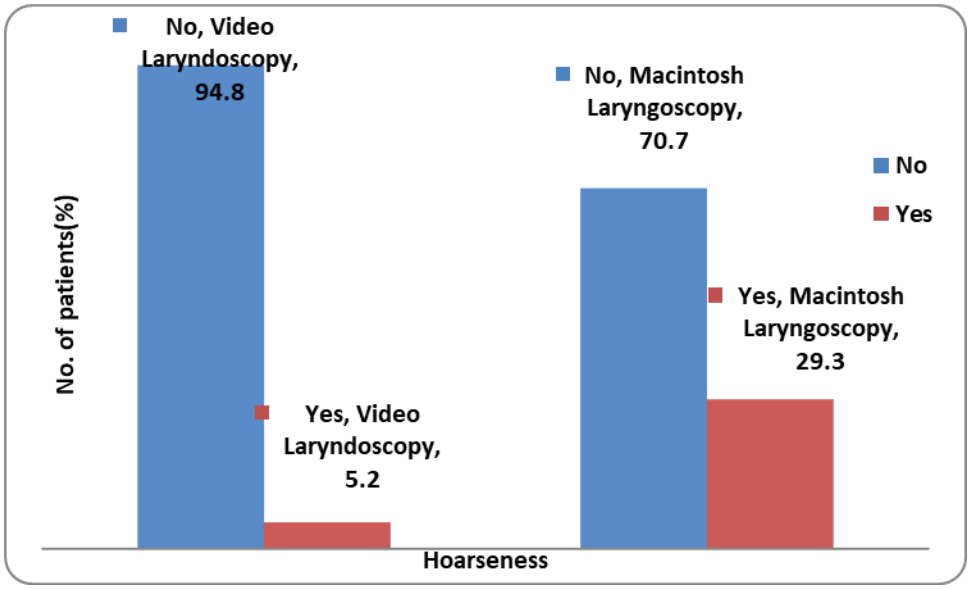
Pharyng Pain	Video Laryngoscopy(VL)		Macintosh Laryngoscopy(DL)		Chi square test	P value
	No. of Patents	percentage	No. of patients	Percentage		
No	53	91.4	41	70.7	X^2=8.0777	P=0.0045*
Yes	5	8.6	17	29.3		
Total	58	100.0	58	100.0		
*: Highly Significant-p value is less than 0.05.						

Out of 58 subjects in each group

- 8.6 % of videolaryngoscopy group had pharyngeal pain
- 29.3% of macintosh group had pharyngeal pain.
- Subjects in macintosh group suffering from pharyngeal pain is more compared to videolaryngoscopy group
- p value is 0.0045, Chi square test used
- This difference is statistically highly significant.

Table 12 : Distribution of patients according to Hoarseness

Hoarseness	Video Laryngoscopy(VL)		Macintosh Laryngoscopy(DL)		Chi square test	P value
	No. of Patents	percentage	No. of patients	Percentage		
No	55	94.8	41	70.7	X^2=11.843	P=0.0006*
Yes	3	5.2	17	29.3		
Total	58	100.0	58	100.0		
*: Highly Significant- p value is less than 0.05.						



Graph 11 : distribution of patients having hoarseness in both groups

- There was significant difference between both groups in complication such as hoarseness.
- 29.3% of patients in macintosh group had hoarseness compared to 5.2% in video laryngoscope group .
- Chi square test used, p value is 0.0006, which is statistically highly significant.

DISCUSSION

Endotracheal intubation is a necessary life-saving skill which as an anaesthetist we must acquire and master, while we keep experimenting with various types of intubating modalities. Direct laryngoscopy is the standard technique performed in endotracheal intubation.[3,4]But, The shape of the laryngoscope blade affects the exposure of the larynx and its requirement for the alignment of the oropharyngeal-laryngeal axis results in poor visualization of the glottis.[5,6]

Since the introduction of video laryngoscope, the approach to airway care has changed dramatically. Video laryngoscopes have quickly gained favour as intubation equipment in a variety of clinical scenarios and places, as well as in the hands of airway professionals and nonexperts. Their indirect view of the upper airway aids glottis visualisation, which is especially useful when difficult intubation is suspected or encountered.[53,54,55] The American Society of Anaesthesiologists (ASA) has previously included VL in its practise recommendations for difficult airway management as a complement to 'Alternative Difficult Intubation Approaches [55,56]. The King Vision video laryngoscope (KVVL) has a camera and light source on the tip of its blade, allowing for indirect glottic view without having to align the oral–pharyngeal–tracheal axis. As a result, there is minimal tissue injury during laryngoscopy[39,40,41,42,43,44]

This prospective randomised study aimed to compare the efficiency of using a KVVL versus the use of a Macintosh laryngoscope, on total 118 adult patients in the age group of 20-60years with non-difficult airways, scheduled for general anaesthesia. Our first objective was to evaluate the time to intubate in both the groups and it was found that time to intubate in video laryngoscopy group was prolonged compared to Macintosh group (26.2s±4.15s vs 21.67s±4.318s).These findings were similar to other studies conducted by Basar erdivanli et al[39], where it was found in their study that King Vision resulted in a longer average time to glottis view and time to intubation. Our findings also matched those of Keerthi et al [12], who observed that GVL took longer to intubate than both Macintosh and McCoy laryngoscopes. Andersen et al[14] and Vasileiou et al.[45] also observed similar results in morbidly obese patients[45]. In contrast to our findings in another study conducted by De-Xing Liu et al[17] which was a random comparison study between video laryngoscopy and Macintosh group, it

was seen time for intubation in video Laryngoscopy group took less time compare to Macintosh group which was 53.9s and 58.2s respectively.

Intubating with a video laryngoscope (KVVL) took longer than intubating with a Macintosh laryngoscope. This could be because the King Vision blade is longer and more acutely angled, it may be necessary to enter the King Vision 'L' shaped blade at a certain angle to the patient's chest. Other video laryngoscopes, such as the McGrath VL, have blade designs that are comparable to the traditional Macintosh DL. This simulates a laryngoscopy procedure for the intubator. The King Vision blade may narrow the mouth canal, making tube passage and adjustment more challenging during oral intubation.

The other objectives in our study were the visualisation of the laryngeal view by Cormack – lehane grade and first successful attempt which was better with video laryngoscope than Macintosh. In video laryngoscopy group (VL) 72.4% had better glottis visualization that is Cormack lehane (CL) grade 1 compared to 48% Macintosh laryngoscopy(DL) group. This was similar to study conducted by De-Xing Liu et al[17] where the percentage of patients with glottic exposure of Cormack lehne grade 1,2 in the video laryngoscope group was higher. Similar to this were found in the study conducted by Sherif M Elhadi et al[4] .

In a study by Ibinson et al[46], the success rate for one-time intubation with video laryngoscope was reported to be 93.6 percent. Our findings showed that the intubation success rate for first-time intubation in the video laryngoscope group (84.5 percent) was higher than that in the direct laryngoscope group (72.4 percent). This difference percentage wise was significant. But these findings where opposite to the findings obtained in Keerthi et

al [12] where more number of attempts where made with GVL used in their study compared to Macintosh and Macoy blade.

Regarding the total number of trials, out of 58 patients 7 patients in VL group needed 2 attempts and 2 subjects needed 3 attempts compared to Macintosh group where subjects needing 2 and 3 attempts were 13 and 3 respectively. However it was statistically insignificant. This was in agreement with the study conducted by Sherif M hanif et al[4]. However, there were two intubation failures in VL group out of 60 patients taken and they were excluded from the study. It was statistically insignificant and in agreement with the study conducted by De Xing Liu et al[17] .

In our study out of total 58 subjects , there was no change of anaesthetist in 96.6 % in VL group and 94.8% in Macintosh group. This difference between both groups with regards to change of anaesthetist was not significant which was similar to the study conducted by Du Xing et al [17]. Ambrosio et al[47] looked at how first-year resident physicians approached problematic airways using the video laryngoscope. After studying both video and direct laryngoscope procedures, they discovered that anaesthetists were far better at using the video laryngoscope than the direct laryngoscope

Out of total 58 subjects Macintosh (DL) group(19%) had more usage of adjunct equipment compared to video group(3.4%).This is statistically highly significant. Above findings were contrary to the Study conducted by B . M. A Pieters et al[48] that is in manikins, expert and rookie staff compared seven videolaryngoscopes to the Macintosh. And macintosh group had scored highest in user satisfaction.

In our study it was found that out of 58 subjects 5.2% in video laryngoscopy group and 15.5 % in Macintosh group suffered from oropharyngeal injury, which was statistically insignificant in both the groups. Out of 58 subjects 1.7% in VL group and 3.4 % in DL group suffered from dysphagia post intubation, again was Statistically insignificant. Out of 58 subjects in each group, 8.6 % of video laryngoscopy group had pharyngeal pain and 29.3% of Macintosh group had pharyngeal pain. Subjects in Macintosh group suffering from pharyngeal pain were more compared to video laryngoscopy group, Even there was significant difference between both groups in complication such as hoarseness, 29.3% of patients in Macintosh had hoarseness compared to 5.2% in video laryngoscope .

De Xing Liu et al [(17)] found 6 occurrences of oropharyngeal bleeding, 2 cases of lip injury, and 1 case of incisor injury following intubation in the direct laryngoscope group, which was almost identical to the findings in this investigation. In the video laryngoscope group, however, there were only two incidences of lip damage and less subjects had obvious sound changes. The intubation device and catheter harm the throat due to increased tissue tension induced by raising the jaw with the direct laryngoscope to align the oro-pharyngeal laryngeal axis anatomically . Several studies have shown that the video laryngoscope lifts the mandible with even less force than a direct laryngoscope in both normal and troublesome airways. As a result, when the endotracheal tube is properly inserted, it lessens the stress in the throat tissue and the harm produced by tracheal intubation. [(49,50,51)]

However this study had few limitations. First, haemodynamic responses following laryngoscopy were not included in this study. Duration of laryngoscopy and intubation it is important, especially in ASA grade III and IV patients, cardiac disease, and hypertensive patients where they can cause an exaggerated hemodynamic response, which can worsen

their clinical condition. Second, the sample involved in this study was regional cases, so the anatomical data may vary due to differences in ethnicity. As a result, many more research may be required to complete the validation analysis based on the findings of this investigation

CONCLUSION

Video laryngoscope is a new digital technology which utilizes indirect laryngoscopy via its camera where the image is projected from the tip to an eyepiece or monitor .It was developed to improve glottic visibility which eliminates the requirement for the orientation of oropharyngeal laryngeal axis to be oriented and needs less upward lifting force exerted with less neck movements with short learning curve.

In our study, the King-vision Video Laryngoscope took longer to intubate than the Macintosh laryngoscope, but it had better glottis visualisation and a greater first-time success rate with less auxiliary equipment and fewer difficulties. Therefore , video laryngoscopes are worth considering over direct laryngoscopes in non-difficult airways because of their ease of use and acceptable safety profile.

SUMMARY

This randomised comparative study titled **"COMPARISON OF CONVENTIONAL LARYNGOSCOPE WITH VIDEO LARYNGOSCOPE FOR TRACHEAL INTUBATION IN PATIENTS WITH NON DIFFICULT AIRWAYS"** was carried out from December 2019 to august 2021 in the department of anaesthesiology at B.L.D.E (DU) Shri. B. M. Patil Medical College and Hospital, Vijayapura.

The study was designed to compare the conventional laryngoscope with the video laryngoscope for tracheal intubation in patients with non-difficult airways scheduled for elective surgeries under general anaesthesia. The following were the objectives :

Primary objective To calculate and compare time to intubate, Visualization of the laryngeal view by Cormack-Lehane grade, Successful first attempt

Secondary objective : No of intubation failure, No of attempts, Change of anaesthesist and use of adjunct equipment, Complications such as oropharyngeal trauma, neck pain, dysphagia, hoarseness

The study population of 118 with age and sex matched was randomly selected, screened and divided by computer generated random number tables in to two groups with 58 in DL group and 60 in VL group, with patients between the age of 18 years to 60 years of ASA grade I and II in each group:

Group DL: intubation performed using conventional Macintosh laryngoscope

Group VL: intubation performed using video laryngoscope(King vision video laryngoscope)

The observations and results were analysed statistically and were as follows:

The demographic data of all the two groups were not statistically significant; meaning all the groups were comparable and randomised properly.

In comparison to group DL (21.67±4.318s), group VL took longer to intubate(26.21± 4.150s) but had superior glottic vision.

Compared to DL group(72.4%), VL group(84.5%) patients had their first successful attempt, inspite of 2 failures.

Use of adjunct equipment like bougie(19%vs 3.4%) were significantly higher in DL group compared to VL group,

No of attempts and change of anaesthetists were similar in both groups.

Complications such as pharyngeal pain (8.6%vs29.3%),hoarseness (5.2%vs29.3%) were significantly lower in VL group compared to DL group where as oropharyngeal injury, dysphagia were comparable means no significant difference was noted.

Thus in this study videolaryngoscope was easy to use and had an acceptable safety profile.

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ANNEXURE: I

ETHICAL CLEARANCE CERTIFICATE

IEC/No-131/2019
22-11-2019

B.L.D.E. (DEEMED TO BE UNIVERSITY)

(Declared vide notification No. F.9-37/2007-U.3 (A) Dated. 29-2-2008 of the MHRD, Government of India under Section 3 of the UGC Act, 1956)

The Constituent College

SHRI. B. M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The ethical committee of this college met on 13-11-2019 at 3-15 pm to scrutinize the synopsis of Postgraduate students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected and revised version synopsis of the Thesis has been accorded Ethical Clearance

Title: Comparison of conventional laryngoscope with video laryngoscope for tracheal intubation in patients with non difficult airways

Name of PG student: : Dr Lakshmi S. Pillai, Department of Anaesthesiology

Name of Guide/Co-investigator: Dr. Sridevi Mulimani, Associate Professor Department of Anaesthesiology

DR RAGHVENDRA KULKARNI
CHAIRMAN
Institutional Ethical Committee
BLDEU's Shri B.M. Patil
Medical College,BIJAPUR-586103

Following documents were placed before Ethical Committee for Scrutinization:

1. Copy of Synopsis / Research project
2. Copy of informed consent form
3. Any other relevant documents.

B.L.D.E.(Deemed to be University)
SHRI B.M.PATIL MEDICAL COLLEGE,VIJAYAPUR-586103
INSTITUTIONAL ETHICAL COMMITTEE

Date : 13-11-2019

1. Name of UG/PG Students/Researcher: Dr Lakshmi S. Pillai
2. Department : Anaesthesiology
3. Title : Comparison Of Conventional Laryngoscope With Video Laryngoscope For Tracheal Intubation In Patients With Non Difficult Airways
4. Guide/Co-Guide/Principle Researcher: Dr. Sridevi Mulimani, Associate Professor
5. Date of Admission (PG Only) :

Observation :

- There are no ethical issues.

I.E.C. Remarks : Ethical Clearance accorded/be Chairman after corrected revised version is submitted by stipulated time.
1. Any alternation in Synopsis protocol should be intimated to E.C. in writing for review & approval.
2. Any adverse effects to subject of the study should be intimated in writing to E.C.
3. If study is stopped or an included patient is out of study inform E.C. the same with reason.

Signature of the Committee Members :

1. Dr Raghavendra Kulkarni, Chairman
2. Dr Tejaswini Vallabha
3. Dr Akram Naikawadi
4. Dr P.B.Jaju
5. Dr Chandrashekhar Bhuyyar
6. Dr Pranesh Jahagirdar
7. Dr Manjunatha Aithala
8. Dr Satish Patil
9. Dr Mohammed Shannawaz

ANNEXURE-II

SAMPLE INFORMED CONSENT FORM

B.L.D.E.U's SHRI B.M.PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTER, BIJAPUR-586103,KARNATAKA

TITLE OF THE PROJECT: COMPARISON OF CONVENTIONAL LARYNGOSCOPE WITH VIDEO LARYNGOSCOPE FOR TRACHEAL INTUBATION IN PATIENTS WITH NON DIFFICULT AIRWAYS

PRINCIPAL INVESTIGATOR: Dr LAKSHMI S. PILLAI

Department of Anaesthesiology

BLDE University's Shri B M Patil Medical College &

Research Center, Sholapur Road Vijayapura-03

E mail: lakshmisp13@gmail.com

PG GUIDE : Dr SRIDEVI MULIMANI

M.D ANAESTHESIOLOGY

Professor

Dept of Anaesthesiology

BLDE University's Shri B M Patil Medical College &

Research Center, Sholapur Road Vijayapura-03

PURPOSE OF RESEARCH:

I have been informed that this study is COMPARISON OF CONVENTIONAL LARYNGOSCOPE WITH VIDEO LARYNGOSCOPE FOR TRACHEAL INTUBATION IN PATIENTS WITH NON DIFFICULT AIRWAYS. I have been explained about the reason for doing this study and selecting me/my ward as a subject for this study. I have also been given free choice of either being included or not in the study.

PROCEDURE:

I understand that I will be participating in the study COMPARISON OF CONVENTIONAL LARYNGOSCOPE WITH VIDEO LARYNGOSCOPE FOR TRACHEAL INTUBATION IN PATIENTS WITH NON DIFFICULT AIRWAYS.

RISKS AND DISCOMFORTS:

I understand that my ward may experience some discomfort during the procedure and I understand that necessary measures will be taken to reduce them

BENEFITS:

I understand that my ward participating in this study will help in finding out COMPARISON OF CONVENTIONAL LARYNGOSCOPE WITH VIDEO LARYNGOSCOPE FOR TRACHEAL INTUBATION IN PATIENTS WITH NON DIFFICULT AIRWAYS

CONFIDENTIALITY:

I understand that medical information produced by this study will become a part of this hospital records and will COMPARISON OF CONVENTIONAL LARYNGOSCOPE WITH VIDEO LARYNGOSCOPE FOR TRACHEAL INTUBATION IN PATIENTS WITH NON DIFFICULT AIRWAYS be subjected to the confidentiality and privacy regulation of this hospital.

If the data are used for publication in the medical literature or for teaching purpose, no names will be used and other identities such as photographs and audio and video tapes will be used only with my special written permission. I understand that I may see the photograph and videotapes and hear audiotapes before giving permission.

REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at any time. Dr LAKSHMI S. PILLAI is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of this study, which might influence my continued participation.

If during this study ,or later I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me. And that a copy of this consent form will be given to me for keep for careful reading.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital.

I also understand Dr. LAKSHMI S. PILLAI will terminate my participation in this study at any time after she has explained the reason for doing so and has helped arrange for my continued care by my own physician or therapist, if this is appropriate.

INJURY STATEMENT:

I understand that in the unlikely events of injury to me/my ward, resulting directly due to my participation in this study, such injury will be reported promptly, then medical treatment would be available to me, but no further compensation will be provided.

I understand that by my agreement to participate in this study, I am not waiving my legal rights. I have explained to_____ the purpose of this research , the procedure required and the possible risk and benefits, to the best of my ability in patients own language

DATE Dr.LAKSHMI S.PILLAI

(investigator)

PATIENT/PARENT SIGNATURE Witness

STUDY SUBJECT CONSENT STATEMENT:

I confirm that Dr.LAKSHMI S. PILLAI has explained to me the purpose of this research, the study procedure that I will undergo and the possible discomforts and benefits that I may experience, in my own language.

I have been explained all the above in detail in my own language and I inderstand the same. Therefore I agree to give my consent to participate as a subject in this research project.

_____ _____

(participant) (date)

_____ _____

(witness to above signature) (date)

ANNEXURE –III

10. SCHEME OF CASE TAKING

PROFORMA

STUDY: COMPARISON OF CONVENTIONAL LARYNGOSCOPE WITH VIDEO LARYNGOSCOPE FOR TRACHEAL INTUBATION IN PATIENTS WITH NON DIFFICULT AIRWAYS.

PATIENT DETAILS

Name Age Gender Height weight BMI

Ward Group allotted by randomization:D/V

Diagnosis Comorbidities

Surgical procedure

Past history

General physical examination:

Pallour ictreus cyanosis clubbing lymphadenopathy edema

Mallampatti Grade:

Vital parameters:

Pulse blood pressure respiratory rate temperature

Systemic Examination

CVS

RS

CNS

PA

Investigations

Haemoglobin: TLC: Platelet count:

Urine routine: HIV: HbsAg:

Other investigations

ASA grade

Parameters:

METHOD USED	GROUP D Conventional direct laryngoscope using Macintosh(DL)	GROUP V Video laryngoscope using KVVL (VL)
Time to intubate(sec)		
Glottic grade(CL)		
Successful first attempt(y/n)		
No of intubations		
Change of anaesthesist(y/n)		
Use of adjunct equipment(y/n)		
Intubation failure(y/n)		

COMPLICATIONS

	GROUP 1(DL)	GROUP 2(VL)
Oropharyngeal injury(y/n)		
Pharyngeal pain(y/n)		
Dysphagia(y/n)		
Hoarseness(y/n)		

BIO-DATA

GUIDE NAME: Dr. SRIDEVI MULIMANI

DATE OF BIRTH: 11/11/1966

EDUCATION: MBBS-1990

KIMS, HUBLI

DIPLOMA IN ANASESTHESIOLOGY-1993

KIMS,HUBLI

MD ANAESTHESIOLOGY-2007

SHRI B M PATIL MEDICAL COLLEGE HOSPITAL AND

RESEARCH CENTER, VIJAYAPUR, KARNATAKA

DESIGNATION: PROFESSOR

DEPARTMANT OF ANAESTHESIOLOGY

TEACHING: UG TEACHING-27YRS

PG TEACHING-13YRS

ADDRESS: PROFESSOR

DEPARTMENT OF ANAESTHESIOLOGY B.L.D.E.U'S

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KARNATAKA

(08352)262770 EXT 2052, 08352-263266(R)

944953421

INVESTIGATOR

NAME: Dr LAKSHMI S. PILLAI

QUALIFICATION: M.B.B.S, K. S. HEGDE MEDICAL ACADEMY

KMC REG.NO: 112660

ADDRESS: DEPARTMENT OF ANAESTHESIOLOGY

B.L.D.E.U'S SHRI B.M.PATIL MEDICAL COLLEGE

HOSPITAL AND RESEARCH, 586103,KARNATAKA

MASTERCHART OF DIRECT LARYNGOSCOPY GROUP

SL No	Group	Age	Sex	BMI	ASAgrade	Time to intubate(s	Cormack Lehane	No of intubations	change of anaesthetist(y/n)	adjunct equipment(y/n)	intubation failure(y/n)	Complications (y/n)			
						(s)						OPI	Pharyng pain	Dysphagia	Horseness
1	DL	28	M	24	1	18	1	1	N	N	N	N	N	N	N
2	DL	23	M	26	1	14	1	1	N	N	N	N	N	N	N
3	DL	45	M	29	2	25	2	2	N	N	N	N	Y	N	Y
4	DL	32	M	19	2	24	1	1	N	N	N	N	N	N	N
5	DL	23	M	20	1	16	1	1	N	N	N	N	N	N	N
6	DL	60	F	26	2	27	3	2	N	Y-Bougie	N	Y	Y	N	Y
7	DL	31	M	22	1	18	2	1	N	N	N	N	N	N	N
8	DL	20	M	25	1	17	1	1	N	N	N	N	N	N	N
9	DL	57	F	24	2	26	3	2	N	Y-Bougie	N	Y	Y	N	Y
10	DL	55	M	23	2	25	3	2	N	Y-Bougie	N	N	Y	N	Y
11	DL	36	M	29	2	20	1	1	N	N	N	N	N	N	N
12	DL	24	F	28	1	19	1	1	N	N	N	N	N	N	N
13	DL	50	F	20	2	25	2	2	N	N	N	N	N	N	N
14	DL	18	M	19	1	19	1	1	N	N	N	N	N	N	N
15	DL	24	M	26	1	15	1	1	N	N	N	N	N	N	N
16	DL	50	M	23	2	28	3	1	N	Y-Bougie	N	N	Y	N	Y
17	DL	61	F	23	2	29	4	3	Y-Snr practitioner	Y-Bougie	N	Y	Y	Y	Y
18	DL	40	F	21	2	24	2	1	N	N	N	N	N	N	N
19	DL	35	F	19	2	22	2	1	N	N	N	N	Y	N	Y
20	DL	18	M	28	1	12	1	1	N	N	N	N	N	N	N
21	DL	25	F	25	1	16	1	1	N	N	N	N	N	N	N
22	DL	18	F	29	1	12	1	1	N	N	N	N	N	N	N
23	DL	27	M	26	1	21	1	1	N	N	N	N	N	N	N
24	DL	30	M	27	1	22	2	1	N	N	N	N	Y	N	Y
25	DL	38	M	22	2	26	2	2	N	N	N	N	Y	N	Y
26	DL	20	M	22	1	18	1	1	N	N	N	N	N	N	N
27	DL	18	M	20	1	16	1	1	N	N	N	N	N	N	N
28	DL	21	M	29	1	15	1	1	N	N	N	N	N	N	N
29	DL	32	F	21	1	24	2	1	N	N	N	N	N	N	N
30	DL	18	M	24	1	20	1	1	N	N	N	N	N	N	N
31	DL	60	F	27	2	27	3	2	N	Y-Bougie	N	Y	Y	N	Y
32	DL	45	F	29	2	25	3	1	N	N	N	N	N	N	N
33	DL	21	F	20	1	20	2	1	N	N	N	N	N	N	N
34	DL	60	M	27	2	25	4	3	Y-Snr practitioner	Y-Bougie	N	Y	Y	N	Y
35	DL	26	F	28	1	17	1	1	N	N	N	N	N	N	N
36	DL	35	M	29	2	23	1	1	N	N	N	N	N	N	N
37	DL	48	F	26	2	26	3	2	N	Y-Bougie	N	Y	Y	N	Y
38	DL	58	M	25	2	24	2	1	N	N	N	N	N	N	N
39	DL	59	F	27	2	27	3	2	N	Y-Bougie	N	Y	Y	N	Y
40	DL	52	F	26	2	24	2	1	N	N	N	N	N	N	N
41	DL	58	F	25	2	25	2	1	N	N	N	N	N	N	N
42	DL	45	M	24	2	23	2	1	N	N	N	N	N	N	N
43	DL	44	M	20	2	24	1	1	N	N	N	N	N	N	N
44	DL	21	F	19	1	17	1	1	N	N	N	N	N	N	N
45	DL	55	M	18	2	26	3	2	N	Y-Bougie	N	Y	Y	N	Y
46	DL	50	M	20	2	25	2	1	N	N	N	N	N	N	N
47	DL	38	M	18	2	23	1	1	N	N	N	N	N	N	N
48	DL	27	F	20	1	16	1	1	N	N	N	N	N	N	N
49	DL	50	F	28	2	24	2	1	N	N	N	N	N	N	N
50	DL	60	F	27	2	27	4	3	Y-Snr practitioner	Y-Bougie	N	Y	Y	Y	Y
51	DL	34	M	26	2	22	1	1	N	N	N	N	N	N	N
52	DL	54	M	19	2	26	3	2	N	N	N	N	N	N	N
53	DL	25	F	23	1	20	1	1	N	N	N	N	N	N	N
54	DL	37	M	22	2	21	1	1	N	N	N	N	N	N	N
55	DL	51	F	26	2	24	2	2	N	N	N	N	Y	N	Y
56	DL	22	M	25	1	16	1	1	N	N	N	N	N	N	N
57	DL	37	F	24	2	23	1	1	N	N	N	N	N	N	N
58	DL	42	M	28	2	24	2	2	N	N	N	N	Y	N	Y

MASTERCHART OF VIDEO LARYNGOSCOPE GROUP

SL No	Group	Age	Sex	BMI	ASAgrade	Time to intubate(s)	Cormack Lehane	No of intubations	change of anaesthetist(y/n)	adjunct equipment(y/n)	intubation failure(y/n)	Complications (y/n)			
												OPI	Pharyng Pain	Dysphagia	Hoarsenes
1	VL	35	F	18	2	25	1	1	N	N	N	N	N	N	N
2	VL	35	F	20	1	26	1	1	N	N	N	N	N	N	N
3	VL	22	M	25	1	27	1	1	N	N	N	N	N	N	N
4	VL	32	M	27	2	24	1	1	N	N	N	N	N	N	N
5	VL	55	M	28	2	30	2	2	N	N	N	Y	Y	N	Y
6	VL	40	M	22	2	26	1	1	N	N	N	N	N	N	N
7	VL	45	F	23	2	34	2	2	N	N	N	N	N	N	N
8	VL	40	M	19	2	28	1	1	N	N	N	N	N	N	N
9	VL	18	M	25	1	29	1	1	N	N	N	N	N	N	N
10	VL	30	F	27	2	30	2	1	N	N	N	N	N	N	N
11	VL	25	M	26	1	28	1	1	N	N	N	N	N	N	N
12	VL	52	F	20	2	34	2	2	N	N	N	N	Y	N	N
13	VL	23	M	21	1	23	1	1	N	N	N	N	N	N	N
14	VL	39	M	22	2	29	2	1	N	N	N	N	N	N	N
15	VL	38	M	22	1	27	1	1	N	N	N	N	N	N	N
16	VL	19	F	28	1	26	1	1	N	N	N	N	N	N	N
17	VL	42	F	29	2	33	2	1	N	N	N	N	N	N	N
18	VL	22	F	21	1	22	1	1	N	N	N	N	N	N	N
19	VL	56	M	20	2	37	3	3	Y-Snr Practitioner	Y-bougie	N	Y	Y	Y	Y
20	VL	46	M	28	2	26	1	1	N	N	N	N	N	N	N
21	VL	21	M	19	1	23	1	1	N	N	N	N	N	N	N
22	VL	31	F	24	1	21	1	1	N	N	N	N	N	N	N
23	VL	59	F	25	2	35	3	2	N	N	N	N	Y	N	N
24	VL	22	M	27	1	25	1	1	N	N	N	N	N	N	N
25	VL	18	M	24	1	26	1	1	N	N	N	N	N	N	N
26	VL	26	M	23	1	25	1	1	N	N	N	N	N	N	N
27	VL	20	F	28	1	21	2	1	N	N	N	N	N	N	N
28	VL	24	F	21	1	23	1	1	N	N	N	N	N	N	N
29	VL	40	M	23	2	25	1	1	N	N	N	N	N	N	N
30	VL	30	M	22	1	24	1	1	N	N	N	N	N	N	N
31	VL	33	F	24	2	26	1	1	N	N	N	N	N	N	N
32	VL	49	M	23	2	28	1	1	N	N	N	N	N	N	N
33	VL	22	F	22	1	23	1	1	N	N	N	N	N	N	N
34	VL	40	M	21	2	21	1	1	N	N	N	N	N	N	N
35	VL	59	F	28	2	36	3	3	Y-Snr Practitioner	Y-bougie	N	Y	Y	N	Y
36	VL	18	M	28	1	21	1	1	N	N	N	N	N	N	N
37	VL	45	F	22	2	26	1	1	N	N	N	N	N	N	N
38	VL	56	M	27	2	28	2	2	N	N	N	N	N	N	N
39	VL	50	M	24	2	23	2	1	N	N	N	N	N	N	N
40	VL	19	F	19	1	22	1	1	N	N	N	N	N	N	N
41	VL	45	M	22	2	24	1	1	N	N	N	N	N	N	N
42	VL	20	M	20	1	25	1	1	N	N	N	N	N	N	N
43	VL	24	F	21	1	28	1	1	N	N	N	N	N	N	N
44	VL	35	M	24	1	24	1	1	N	N	N	N	N	N	N
45	VL	44	F	23	2	23	2	1	N	N	N	N	N	N	N
46	VL	53	M	27	2	32	2	2	N	N	N	N	N	N	N
47	VL	21	M	20	1	25	1	1	N	N	N	N	N	N	N
48	VL	18	F	19	1	24	1	1	N	N	N	N	N	N	N
49	VL	20	M	19	1	21	1	1	N	N	N	N	N	N	N
50	VL	22	F	20	1	26	1	1	N	N	N	N	N	N	N
51	VL	26	M	24	1	27	1	1	N	N	N	N	N	N	N
52	VL	32	M	25	2	24	1	1	N	N	N	N	N	N	N
53	VL	37	F	25	2	25	1	1	N	N	N	N	N	N	N
54	VL	58	M	28	2	36	2	2	N	N	N	N	N	N	N
55	VL	47	F	25	2	23	2	1	N	N	N	N	N	N	N
56	VL	39	M	24	2	21	1	1	N	N	N	N	N	N	N
57	VL	32	F	24	1	22	1	1	N	N	N	N	N	N	N
58	VL	25	M	26	1	24	1	1	N	N	N	N	N	N	N
59	VL	56	F	27	2	39	3	3	Y-Snr Practitioner	Y	Y	Y	Y	N	Y
60	VL	55	F	23	2	40	3	3	Y-Snr Practitioner	Y	Y	Y	Y	N	Y