"TO COMPARE THE EASE OF TRACHEAL INTUBATION USING McGRATH MAC VIDEOLARYNGOSCOPE IN DIRECT AND INDIRECT MODE WITH THE STANDARD MACINTOSH LARYNGOSCOPE: A ONE YEAR RANDOMISED CLINICAL TRAIL"

By

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Dissertation

Submitted to the
KLE University, Belagavi, Karnataka

in partial fulfillment
of the requirements for the degree of

M. D.
in
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Under the Guidance of

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APRIL – 2018

KLE UNIVERSITY, BELGAUM,

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LIST OF ABBREVIATIONS USED

ASA	-	American Society of Anesthesiology
ADS	-	Airway Difficulty score
CL	-	Cormack Lehane
CMOS	-	Complementary metaloxide semiconductor
Cms	-	Centimeters
ECG	-	Electrocardiogram
ETT	-	Endotracheal tube
I.V	-	Intravenous
EtCO2	-	End tidal carbon dioxide concentration
ICU	-	Intensive care unit
IDS	-	Intubation Difficulty score
LED	-	Liquid electronic display
LCD	-	Liquid crystal display
min	-	Minute
POGO	-	Percentage of glottic opening
SD	-	Standard deviation
VL	-	Videolaryngoscope

ABSTRACT

Background and Objectives

Video laryngoscopy is becoming a widely accepted airway management. They are described as device helping to reduce peri intubation complication for instance by reducing the amount of intubation attempts and shortening its time. McGrath Video-laryngoscopy (McGrath MAC), is easy to use and enables clinicians to achieve direct and indirect laryngoscopy where required. The McGrath MAC is similar to Macintosh blade in its design it enables clinicians to effectively secure patent airways, even in difficult intubation. The present study was taken up to measure the ease of endotracheal intubation using Mc GRATH MAC videolaryngoscope in direct, indirect mode with Macintosh laryngoscope using intubation difficulty score.

Methods

The present study is randomized clinical trial, conducted in the department of Anaesthesiology, during the period October 2016- June 2017 at KLE's Dr.Prabhakar Kore Hospital and Medical Research Center, Nehru Nagar, Belagavi- on 150 patients undergoing general anaesthesia, 50 patients in each group. Intubation was done using McGrath in direct mode, indirect mode and Macintosh group to measure the ease of intubation using Airway Difficulty Score.

Results

In this study there was no major difference in patient characteristics across the three groups; ADS among the three groups was 7. The majority of the patients were in the age group of 47-50 years. The time taken for intubation using McGrath Videolaryngoscope in indirect mode (25 sec) was lesser than Macintosh group (28sec)

whereas direct mode McGrath Videolaryngoscope group (38sec) took the longest of the three groups, which are statically significant. The IDS was seen to be higher in McGrath direct mode 4(0-4[2-6]), where as it was seen that IDS between McGrath indirect1(0-1[0-3]) and Macintosh group1(0-1[0-2]) was comparable.

Conclusion and Interpretation

The ease of intubation using McGrath videolaryngoscope in indirect mode is better than using McGrath videolaryngoscope in direct mode and is comparable with Macintosh direct laryngoscope. The time taken for intubation using McGrath Videolaryngoscope in indirect mode was lesser than Macintosh group whereas McGrath used as direct mode took the longest of the three groups.

Keywords: McGrath, Macintosh, Airway difficulty score, Intubation difficulty score

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INTRODUCTION

Airway management remains the most important responsibility of an anaesthesiologist. Endotracheal intubation remains the gold standard of securing airway. As with any other procedure endotracheal intubation is also associated with many complications, trauma to the teeth and stress response to laryngoscopy to name a few [1]. Sometimes it may lead to catastrophic complications like delayed or failed intubation which may result in failure to oxygenate and may lead to death or hypoxic brain injury leaving the patient in vegetative state.

Direct laryngoscopy using Macintosh blade is the intubating technique of choice of most anaesthesiologists. One third of failed tracheal intubation is unanticipated and because the first attempt at intubation represents the best chance of securing the airway without complication. Difficult laryngoscopy leading to failed intubation result in severe morbidity [2]. This has forced anaesthesiologists to pursue their interest in developing newer gadgets to facilitate successful and safe endotracheal intubation. The search for new devices to be employed in difficult intubating conditions has resulted in development of video laryngoscope which is now widely used for airway management and has secured a place in difficult airway algorithm. [3, 4, 5]

Video laryngoscopy is becoming a widely accepted airway management technique as it offers a better view of the glottis when compared with standard direct laryngoscopy for the management of both normal and difficult airway .[6, 7, 8] These devices can significantly help the operator to visualize the entrance to the larynx in difficult intubation even if the patient was graded three or four by Cormack Lehane

scale with the use of traditional Macintosh Laryngoscope. Therefore videolaryngoscopes are described as devices helping to reduce peri-intubation complication by reducing the amount of intubation attempts and shortening its time.

McGrath Video-laryngoscopy (McGrath MAC), Aircraft Medical Ltd Edinburgh UK, is easy to use and enables clinicians to achieve direct and indirect laryngoscopy when required. It is based on the familiar design of the Macintosh blade and allows clinicians to effectively secure patent airways, even in difficult intubation.

The device has built in vertical display of 2.5" LCD monitor which displays a clear view of the vocal cords and laryngeal inlet. It has a long lasting battery, lasting for 250minutes under normal operating conditions. It has slimline single use blade of 119 mm which minimises obstruction of the tube path and reduces blade width at the patient's mouth, providing greater ability to manoeuvre the device without pressing on teeth. It contains the COMOS camera and high intensity LED. The blade covers and attaches to handle during use. The screen connects to the handle by the way of hinge with a tilt of 45degrees [9].

A literature search did not yield any studies evaluating McGrath MAC videolaryngoscope on Indian subjects. Hence we are making an attempt to compare the ease of intubation using McGrath MAC videolaryngoscope in both direct and indirect mode, with standard Macintosh laryngoscope.

Our null hypothesis is that all three methods would be equally effective for endotracheal intubation.

OBJECTIVES

PRIMARY OBJECTIVE:

To compare the ease of endotracheal intubation using McGrath MAC video laryngoscope in direct, indirect mode with Macintosh laryngoscope using intubation difficulty score.

SECONDARY OBJECTIVE:

To measure, time taken to successfully intubate the trachea and incidence of complication.

REVIEW OF LITERATURE:

Tracheal intubation is regarded as the ideal means of securing the airway. It provides effective ventilation for patients and protects them from aspiration. Intubation might not be simple procedure and may lead to adverse consequence when performed by an inexperienced anaesthesiologist.

John Snow in 1858 had accomplished administration of chloroform through tracheostomy tubes in animals. ***Fredrick Trendelenberg*** in 1871 used the same technique in humans. ***Sir William MaEwan*** was the first physician to intubate the trachea for the sole purpose of administering anaesthesia in the year 1878.[10]

The cuffed endotracheal tube was promoted by ***Arthur Guedel*** and ***Ralph M Waters*** in the year 1928 and this allowed true isolation of the airway, paving the way for closed circuit anaesthesia. ***Alfred Kirsten*** in 1895 and ***Gustav Kellian*** in 1912 pioneered direct laryngoscopy for the purpose of endotracheal intubation. ***Chevalier Jackson*** published a book that popularized direct laryngoscopy in the year 1907.[10]

In 1984, ***Cormack*** and ***Lehane*** introduced grading system for the degree of glottic exposure upon direct laryngoscopy. This grading system became the basis for documenting difficult laryngoscopy[11]. Tracheal intubation is attempted if the laryngeal structures especially the cords are distinctly seen. Direct laryngoscopy depends on being able to bring the three axes viz laryngeal, pharyngeal and the oral, into alignment to see the larynx. Curved blade is usually used by the beginners as they provide more room to pass the tube.

Unanticipated difficult airway, remains the frequent cause of anaesthesia related morbidity and mortality. Different types of blades namely Macintosh, Miller,

Mc Coy, etc have been devised with changes in the curvature of the blade to overcome these conditions of difficult intubation.

Videolaryngoscopes have gained popularity in the recent years. They are relatively new devices available for endotracheal intubation, which provides a view of glottis from a video camera or a video chip position close to the tip of the laryngoscope blade. Of the various video laryngoscopes available, each is unique in design. They can be categorized into three main types: one with standard Macintosh shaped blade, one with the angulated blade and one with a channel for tube passage. Each design has its own advantages and disadvantages.[12]

McGrath MAC Videolaryngoscope with curved blade similar to that of Macintosh blade provides a direct view of glottis and an indirect view via a camera, this combination is helpful in the event of oropharyngeal malalignment. Being a light weight one can be handled easily, intubators with experience using the Macintosh laryngoscope should be able to use this easily and the video monitor of the McGrath MAC videolaryngoscope allows for monitoring. Thus it offers a clear view of the glottis, vocal cord and surrounding airway anatomy on LCD screen, without requiring alignment of oral, pharyngeal and laryngeal axes in patients with both normal and potential difficult airways.

In the year 2012 Noppens RR et al, conducted a prospective comparative study in ICU on 274 critically ill patient to compare intubation using either Macintosh laryngoscope or C-MAC videolaryngoscope and concluded that C-MAC videolaryngoscope improved laryngeal imaging and success rate on the first attempt in patient with 79% than that with Macintosh 56% with predictors for difficult intubation in ICU setting.[13]

Simon S et al, in (2015) compared C-MAC videolaryngoscope with conventional laryngoscope for rapid sequence intubation at the emergency department in 150 patient and observed that C-MAC videolaryngoscope showed 99% of success rate for intubation which was comparable with Macintosh with 85%.[14]

Ravi Bhat et al, (2015) compared Macintosh laryngoscope with C-MAC videolaryngoscope for endotracheal intubation in lateral position on 100 pts and observed that C- MAC videolaryngoscope had a higher rate of successful intubation at first attempt which was about 94% than that of Macintosh which was about 86%.[15]

In a randomized controlled trial conducted on 130 patients with potential difficult airway (with Mallampati grade of > 3) by I. Nig et al, (2012) compared Mc Grath videolaryngoscope with C MAC videolaryngoscope concluded that C-MAC video laryngoscope allowed a quicker intubation, but it was observed that laryngeal view was better with Mc Grath (CL grade 1 60/65) where as with C -MAC it was (CL grade 1 50/65) .[16]

A randomised, crossover Manikin study was conducted by Myungju S et al, in the year 2016 to compare Mc Grath MAC,C-MAC and Macintosh laryngoscopes operated by medical students in which sequential intubation was done by 39 participants on the manikin in two simulated settings that included normal airway and a difficult airway(tongue oedema). Improved Cormack Lehane grade and decreased the difficulty score was observed in McGrath MAC and C-MAC compared to the Macintosh blade in both airway settings and most of the participants selected Mc Grath MAC as the most useful device.[17]

A comparative study conducted by Zi Jia Liu et al, **(**2016) on 180 patients to

compare McGrath series 3 and Macintosh for tracheal intubation in patients with normal airway in inexperienced anaesthetists found that there was no significant difference between McGrath and Macintosh in median time to intubation but it was observed that McGrath was associated with higher Cormack Lehane grade I view than Macintosh (71 v/s 48) and the difference was statistically significant. [18]

Semih A et al**,** (2014) conducted a randomized clinical trial on 80 obstetric patients with normal airway, comparing McGrath Videolaryngoscope and Macintosh laryngoscope, observed that McGrath Videolaryngoscope provides a good view of the glottic opening as the blade angle of the McGrath Videolaryngoscope is relatively close to the tracheal aperture which was very much comparable (82% with grade I) to (67% with grade I) in Macintosh blade.[19]

Arthur B.et al**,** conducted a randomized multi centre open label trial on 370 critically ill patients requiring emergency tracheal intubation to compare McGrath MAC videolaryngoscope v/s Macintosh laryngoscope. They observed that McGrath videolaryngoscope reduced the duration of endotracheal intubation and the frequency of serious complication; hence videolaryngoscope would deserve consideration use outside the ICU in setting where emergency intubation is required.[20]

A randomised trial conducted by Mehemet S et al, conducted on 100 patients requiring orotracheal intubation to compare POGO score and Cormack & Lehane grading on laryngoscopy using either Mc Grath Videolaryngoscope and Macintosh laryngoscope , concluded that Mc Grath videolaryngoscope allows patients with normal airway to achieve higher POGO (87%) than Macintosh group showed (60%).[21]

Karaman S et al, (2014) conducted a study on 50 patients, who were intubated with Mc Grath videolaryngoscope after maximum number of two unsuccessful attempts with Macintosh laryngoscope. The percentage of glottic opening is improved by 80% with Mc Grath videolaryngoscope compared to Macintosh laryngoscope, the success rate by using Mc Grath videolaryngoscope for tracheal intubation was 98%.[22]

A randomised clinical trial to compare C -MAC videolaryngoscope as a direct laryngoscope and videolaryngoscope was conducted by David C et al, on 50 adult patients with BMI less than 40 kg revealed that C-MAC videolaryngoscope was comparable in terms of time required for endotracheal intubation and first attempt success rate when used as direct or indirect laryngoscope.[23]

In a study to compare Mc Grath MAC videolaryngoscope when used as both direct and indirect laryngoscope with a standard Macintosh laryngoscope in patient without predictors of a difficult tracheal intubation by Wallace CD et al, (2015) it was observed that there was no difference in groups in time taken to intubate and incidence of complications.[24]

In a single centre randomised clinical study conducted on 158 patients older than 16 years undergoing elective surgery under general anaesthesia to compare glottic view and first attempt success rate using Macintosh direct laryngoscope, a Mc Grath MAC videolaryngoscope used as an indirect laryngoscope or as a direct laryngoscope (the video screen was covered), Calvin A brown (2015) observed that Mc Grath MAC videolaryngoscope was inferior in terms of glottic view and first attempt success rate and hence commented that the blade has more curve and has a narrow profile blade than conventional laryngoscope which is not designed to obtain direct views[25].

BASIC SCIENCES

APPLIED ANATOMY OF UPPER AIRWAY

The upper airway consists of nose and nasal cavity, mouth and oral cavity, the pharynx, the larynx and trachea.

1. **Mouth and oral cavity:**

- **Mouth:** The mouth extends from the lips to the oropharyngeal isthmus at the level of the palatoglossal folds and is divided by the teeth into an outer vestibule and oral cavity proper.
- **Oral cavity:** The oral cavity is lined by the squamous epithelium containing mucous secreting glands.
- **Boundaries:** It is bounded anterolaterally by the teeth and gums, superiorly by the hard and soft palates. The palatoglossal fold (anterior pillar of the tonsil) runs between the soft palate and the tongue which marks the oropharyngeal isthmus. It joins the tongue at the junction of its anterior two thirds and posterior one third.

- **Tongue:** The tongue sits on the floor of the mouth, almost filling it. It contains intrinsic and several extrinsic muscles connecting it to the associated structures like,
    a. Genioglossus: Connects to mandible
    b. Hyoglossus : Connects to hyoid bone
    c. Styloglossus : Connects to styloid process at base of the skull
    d. Palatoglossus : Connects to the soft palate

The under surface of the tongue is attached to the floor of the mouth by a fold of mucous membrane called the frenulum. Posterior third of the tongue has a different embryological origin and is contained within the oropharynx.

2. Soft Palate:

Soft palate consists of an aponeurotic sheath into which several muscles are inserted laterally. It is attached anteriorly to the back of the hard palate and its free posterior edge bears the midline uvula which separates nasopharynx from the oropharynx. While the inferior aspect of the soft palate is covered with a squamous epithelium, its superior aspect bears a ciliated columnar epithelium.

2.1 Muscles acting on the soft palate:

- Tensor palate and levator palate attach laterally and they tense and elevate the palate respectively.
- Palatoglossus passes in the palatopharyngeal fold to the tongue and narrows the oro-pharyngeal opening.
- Palatopharyngeus lies in the palatopharyngeal fold (posterior pillar) and joins with pharyngeal constrictor muscle. It narrows the oro-pharyngeal opening.
- Musculus uvula is an intrinsic muscle which draws up the uvula.

2.2 Somatic innervations of the oral cavity:

- **The vestibule:**
    a) *Sensory*: Trigeminal (V_2 & V_3) via alveolar and labial branches
    b) *Motor* : Facial (VII)

- **Hard palate:**
    a) *Sensory*: Trigeminal (V_2) via palatine and nasopalatine branches
    b) *Taste* : Facial (VII) via branches of V_2.
- **Soft palate:**
    a) *Sensory*: Trigeminal (V_2) via palatine branches to anterior region and Glossopharyngeal to the posterior region.
    b) *Motor* : Trigeminal (V_3) to tensor veli-palate and via pharyngeal plexus (IX, X, XI) to all other muscles.
    c) *Taste* : Facial (VII) via greater petrosal nerve.
- **Tongue:**
    a) *Sensory*: Trigeminal (V_3) via lingual nerve to anterior ⅔, Glossopharyngeal (IX) to posterior 1/3.
    b) *Motor*: Pharyngeal plexus (IX, X, XI) to palatoglossus and hypoglossal nerve supplies all other muscles.
    c) *Taste*: Facial (VII) via chorda tympani to anterior 2/3 and Glossopharyngeal (IX) to posterior 1/3.
- **Blood Supply and Lymphatic Drainage:**
    a) Arterial Supply: lingual, facial and maxillary branches of external carotid artery. Drainage of blood is to the corresponding veins. Soft palate drains into the pharyngeal venous plexus.
    b) Lymphatic drainage: Deep cervical lymph chain drains the anterior tongue and floor of the mouth drain initially into sub mental and subsequently to the submandibular node

THE PHARYNX

The pharynx is a fibromuscular tube which connects the nasal and oral cavities with the larynx and oesophagus. It is composed of a thin facial layer that forms thick buccopharyngeal fascia posteriorly, continues as adventitia of the oesophagus inferiorly and gets attached to the skull base superiorly.

There are three constrictor muscles within the pharynx.

The superior constrictor which inserts into the base of the skull.

The middle constrictor which inserts into the mandible and hyoid bone.

The inferior constrictor which insert into the cricoid cartilage.

The inferior constrictor contributes to a muscular band the cricopharyngeus that forms the upper oesophageal sphincter. All the muscle segments are inserted posteriorly into a tendinous median raphe.

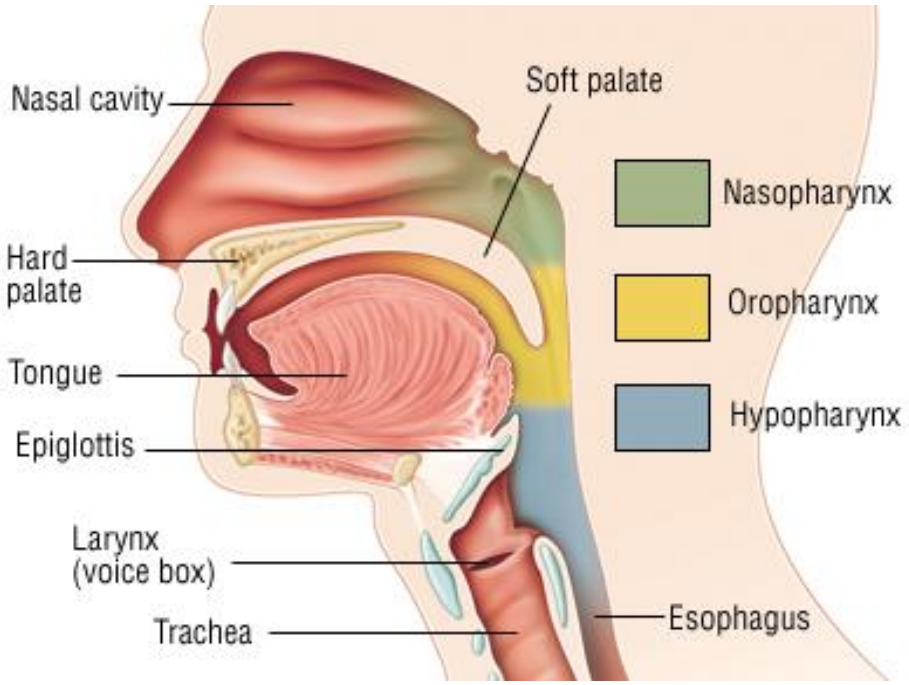


Fig.1: Division of pharynx

3.1 Divisions of the pharynx:

The pharynx is divided into the nasopharynx, the oropharynx and the hypopharynx.

a) ***Nasopharynx*:** It is situated directly behind the nasal cavity. Its inferior boundary lies at the level of the soft palate. The roof is formed by the sphenoid and occipital bones of the skull base. The posterior wall is separated from the spinal column by a tough prevertebral fascia which covers the longus capitis muscle, the deep prevertebral musculature and the arch of the first cervical vertebra. Five passages communicate with nasopharynx. The two nasal choanae, the orifices of the two Eustachian tubes, and the oropharynx. Mucous membranes of the roof and posterior wall contain lymphoid tissue termed as the adenoid tonsil.

b) ***Oropharynx*:** It lies directly posterior to the oral cavity and extends from the soft palate superiorly to the tip of the epiglottis inferiorly. The posterior wall consists of the prevertebral fascia and the bodies of the second and third cervical vertebrae. The lateral walls contain the paired tonsillar fossae which are formed by the palatoglossal and palatopharyngeal folds and contain the palatine tonsils. Medial to the tonsillar fauces lie the base of the tongue. The tongue base is anterior to the laryngeal inlet and attaches to the epiglottis by the paired lateral glossoepiglottic folds and by the single median glossoepiglottic fold. Glossoepiglottic folds bind two spaces, the epiglottic and the valleculae. The posterior dorsal tongue surface is irregularly contoured because of the lingual tonsils.

c) ***Hypopharynx:*** It extends inferiorly from the upper edge of the epiglottis to the inferior edge of the cricoid cartilage and communicates with the oropharynx, the laryngeal inlet and the esophagus. On the side of the larynx are funnel shaped pyriform recesses. These recesses are bound superiorly by the lateral glossoepiglottic folds and lie between the aryepiglottic folds and the internal lining of the thyroid cartilage. The posterior border of the hypopharynx comprises the buccopharyngeal, prevertebral fascia and the deep prevertebral musculature.

THE LARYNX

It lies at the level of the 4th to 6th cervical vertebrae. It is "slung" from the underside of the hyoid bone and can be easily palpated through the skin of the anterior neck. It is covered superficially by the skin, deep fascia and the thin strap muscles of the neck. Larynx is made up of skeletal framework of cartilages connected by joints, ligaments and membranes. The cartilages are moved by various muscles.

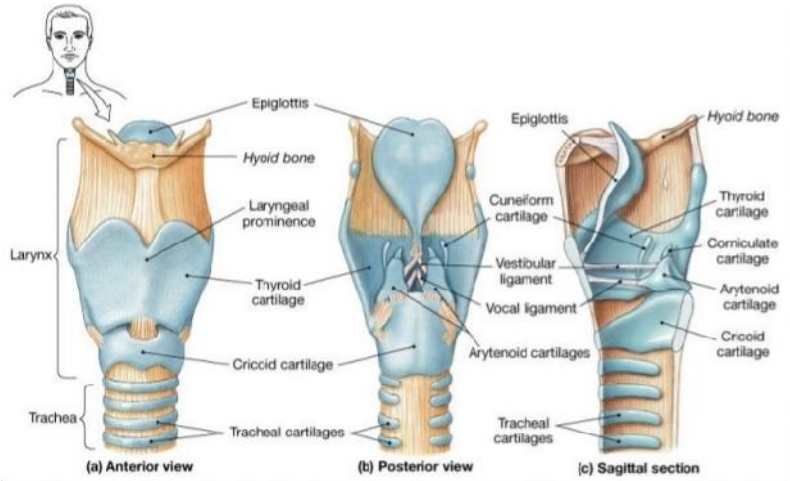


Fig.2: Anterior, posterior and sagittal view of larynx

4.1 Functions of the larynx:

The larynx is continuous with the trachea and has specialized constrictor dilator mechanism in the airway. The constrictor mechanism results in an effective and rapid closure that prevents aspiration into the lower airway. The vocal cords help in the act of phonation.

4.2 Laryngeal skeleton: There are three unpaired (thyroid, cricoid and epiglottis) and three paired (arytenoids, corniculate and cuneiform) cartilages which form the skeleton of the larynx.

a) ***Thyroid cartilage*:** It is the largest cartilage of the larynx. It is composed of two superior horns that aid in its suspension from the hyoid bone. The inferior horns articulate with the cricoids cartilage below to form the cricothyroid joint, described as 'shield shaped' and consists of two laminae that join in the midline anteriorly but posterior borders are far apart. The cartilaginous protrusion in front of the neck is known as the Adam's apple.

b) ***Cricoid cartilage:*** Signet ring shaped. Lies immediately below the thyroid cartilage, only complete cartilaginous ring in the larynx. The anterior portion 5-7 mm in height and is called the arch, the posterior portion is taller, 2-3 cm in height and is called the lamina. The lamina project upwards behind the thyroid cartilage and articulates superiorly with the arytenoids cartilages. The inferior cornu of the thyroid cartilage articulates with the side.

c) ***Epiglottis cartilage***: It is a leaf shaped cartilage placed in the anterior wall of the upper part of the larynx. Upper end is broad and free, it projects upward behind the hyoid bone and the tongue, overhangs the

laryngeal inlet. The lower end is attached to the laryngeal inlet. The lower end is attached to the upper part of the angle between the two laminae of the thyroid cartilage and to the back of the hyoid bone on its upper end.

d) ***Arytenoid cartilage:*** The two arytenoids are pyramidal in shape, articulate into the upper lateral border of the cricoids. The vocal folds are attached to the anterior surface of the arytenoids. The posterior and lateral cricoarytenoid muscles are inserted onto the lateral sides of the arytenoids.

e) ***Corniculate cartilage:*** These are the two small cartilages which articulate with the apex of the arytenoids cartilages and lie in the posterior part of the aryepiglottic folds.

f) ***Cuneiform cartilages*****:** These are two small cartilages placed in the aryepiglottic folds just vertical to the corniculate cartilages of cricoids cartilage at the junction of the arc.

Laryngeal joints:

a) Cricothroid joint

b) Cricoarytenoid joint

Laryngeal ligament and membranes

Extrinsic

1. Thyroihyoid membrane
2. Hyo and thyroepiglottic ligaments
3. Cricotracheal ligament

Intrinsic

1. Quadrate membrane

2. Cricothyroid membrane

Intrinsic muscle of larynx

1. Oblique artenoid and Aryepiglotticus-Sphincter action at the laryngeal inlet
2. Transverse arytenoids-adductor of vocal cord
3. Posterior cricoarytenoid-opens the glottis
4. Lateral cricoarytenoid-adducts the vocal cords
5. Cricothyroid-lengthens and affects tension in the vocal cord
6. Thyroarytenoids and vocalis-relaxes the vocal cords
7. Thyroepiglotticus –opens the inlet of larynx

Extrinsic muscles of larynx

Include the intrahyoid strap muscles, thyrohyoid, sternohyoid and the inferior constrictor of the pharynx.

Vocal cords:

These are composed of muscles, ligaments, sub-mucosal soft tissue and the covering mucous membrane. They extend from the arytenoids posteriorly to the thyroid cartilage anteriorly. The laryngeal cavity begins at its entrance. The vestibule of the larynx lies below the vocal cords, which in turn leads to the rima vestibuli. Two mucosal folds that bind the rima vestibuli are called the ventricular folds. The lateral spaces between the ventricular and vocal folds are called the ventricles. The narrow space between the vocal folds is called the rima glottidis (glottis). The space that leads from the rima glottidis to the trachea is the infraglottic cavity or the subglottis.

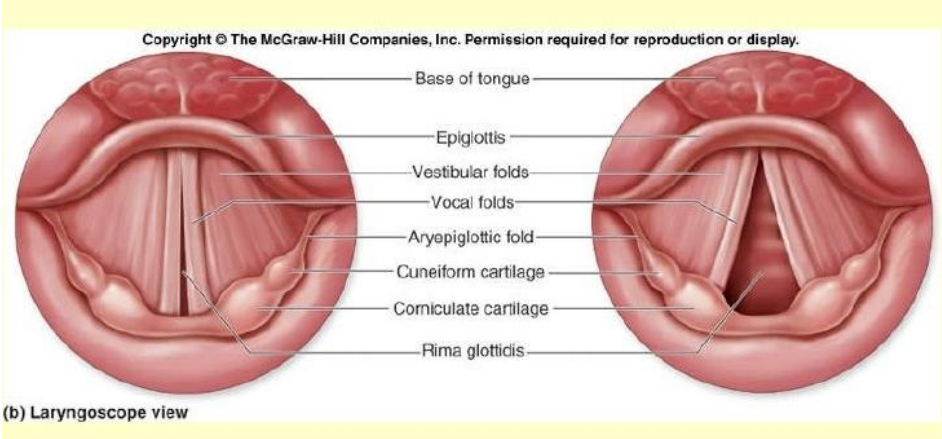


Fig.3: Superior view of larynx

4.3 Cavity of larynx:

It is bound anteriorly by the epiglottis, posteriorly by the interarytenoid fold of mucous membrane and on each side by aryepiglottic fold. The area extending from the laryngeal inlet to the vestibular folds is known as vestibular or supraglottic larynx. The laryngeal space from the free borders of cords to inferior border of cricoids is called infraglotttic or subglottic space. The region between vestibular folds and vocal cords is termed as ventricle. The pyriform sinus lies lateral to the aryepiglottic fold within the inner surface of the thyroid cartilage.

4.4 Nerve supply of the larynx:

The nerve supply of the larynx is from the vagus via its superior and recurrent laryngeal branches. The superior laryngeal never passes deep to both the internal and external carotid arteries and divides into a small external branch, which supplies the cricothyroid muscle, and a larger internal branch that pierces the thyrohyoid membrane to provide the sensory supply to the interior of the interior of the larynx as far down as the vocal cords. The

internal laryngeal nerve runs beneath the mucosa of the pyriform fossa. In this position it can easily be blocked by the topical application of local anaesthetic to provide for laryngoscopy and bronchoscopy.

The recurrent laryngeal nerve, on the right side, crosses the right subclavian artery, it then loops under the artery and ascends to the larynx in the grove between the esophagus and trachea. One the left side, it crosses the aortic arch; the nerve then passes under the arch to reach the groove between the esophagus and the trachea. Once it reaches the neck, the left nerve assumes the same relationship as on the right. The recurrent laryngeal nerve provide the motor supply to the intrinsic muscle of the larynx apart from cricothyroid, as well as sensory supply to the laryngeal mucosa inferior the vocal cord.

Nerve supply

Motor: Vagus nerve via recurrent laryngeal nerve to all intrinsic muscles except cricothyroid (supplied by external laryngeal nerve).

Sensory: Mucosal membrane is supplied by internal laryngeal nerve up to the level of vocal cords and recurrent laryngeal nerve below the level of the vocal cord.

Arterial supply

1. Superior laryngeal artery and cricothyroid artery (branches of superior thyroid artery).

2. Inferior laryngeal artery (branch of inferior thyroid artery).

Venous drainage:

It is via superior and inferior laryngeal veins to superior and inferior thyroid veins respectively.

Lymphatic drainage:

The lymph vessels draining the supra glottis part of the larynx end in the upper deep cervical lymph nodes and below the vocal cords, lymph vessels reach pre and para tracheal lymph nodes and join the lower deep cervical lymph nodes.

TRACHEA

The trachea begins at the level of C5 vertebra, where it is attached to the lower side of the cricoid cartilage. It is about 11-14 cm long in adults and ends at the carina. The position of the carina alters with posture and respiration but is usually regarded to begin at about T4-5 level. At the carina, it divides into right and left main bronchi. Tracheal wall is supported by many 'C' shaped cartilages which are deficient posteriorly. This part of the tracheal wall is lined by the trachealis muscle.

The anterior aspect of the trachea is covered with skin, pretracheal fascia, the thyroid isthmus, and the thin strap muscles of the neck until it passes behind the sternum. Posteriorly it is related to the esophagus. The mucosa of the trachea is lined by pseudostratified ciliated columnar epithelium. The sensory supply is from the vagus.[26-30]

Laryngoscopy:

The laryngoscope is held in the left hand and introduced into the right hand side of the mouth. The tongue is swept to the left and the tip of the blade is advanced until a fold of cartilage is visualized at 12 O'clock position.

The tip of the blade is advanced to the base of the epiglottis, known as the vallecula, and the entire laryngoscope is lifted upwards and outwards. This flips the epiglottis upward and exposes the glottis below. An opening is seen with two white vocal cords forming a triangle on each side.

7. Intubation:

The endotracheal tube is inserted into the right side of the mouth and inserted between the open vocal cords under direct vision. The correct position of the tube is confirmed by auscultation or capnography. The tube is secured at this level and the cuff is inflated.

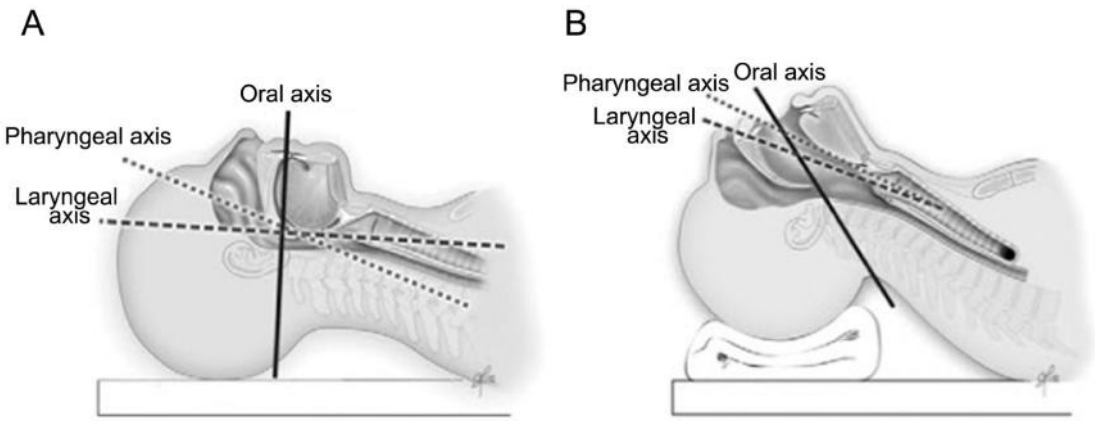


Fig.4: Positioning for direct laryngoscopy

TECHNIQUE OF ORAL INTUBATION

Predictors of difficult intubation

Unanticipated difficult intubation can be challenging to anaesthesiologist. Simple beside physical examination have been attempted to predict difficult intubation. In 1985 Mallampati introduced well known screening test that classifies visibility of the oropharyngeal structures. The distance from the thyroid notch to the mentum (thyromental distance),the distance from the upper border of the manubrium sterni to the mentum (sternomental distance),and a simple summation of risk factors(Wilson risk sum score)are widely recognized as tools for predicting difficult intubation. The diagnostic accuracy of these screening tests has varied from to trail, probably because difference in the incidence of difficult intubation, inadequate statistical power, different test thresholds, or different in patient characteristics.

Modified Mallampati test

Mallampati test is the most commonly employed bedside test for airway assessment. It indicates the amount of space within the oral cavity to accommodate the laryngoscope and endotracheal tube. This is performed by having the patient head in neutral position with mouth open as wide as possible and protruding the tongue without phonation. The observer eye should be at the level of patient mouth. The degree to which faucial pillar, uvula, soft palate and hard palate are visible is observed. Modified Mallampati was coined by Samsoon and Young, following 4 grades may be noted[31, 32]

Class I: Faucial pillars, uvula, soft and hard palate visible

Class II: Uvula, soft and hard palate visible

Class III: Base of uvula and hard palate visible

Class IV: Hard palate visible

Assessment of intubation difficulty

The efficacy of direct laryngoscopy is measured in terms of best view of the vocal cords. The degree of difficulty encountered during direct laryngoscopy and intubation is most commonly assessed using Cormack Lehane grading. The other indicators include POGO (Percentage of Glottic Opening) and Intubation Difficulty scale (IDS) score, a quantitative scale of difficult intubation with seven variables assessing the complexity of tracheal intubation, developed by Adnet et al.[33]

7.1 Cormack and Lehane classification

Difficult intubation has been classified into four grades according to the view obtainable at laryngoscopy. Cormack and Lehane Grade I – IV are as follows.

Grade I – Visualization of entire vocal cords

Grade II-Visualization of posterior part of the laryngeal aperture

Grade III-Visualization of epiglottis

Grade IV-No glottis structure seen

Cook(1999) has further subdivided Cormack and Lehane s Grade II and Grade III as IIa,IIb,IIIa and IIIb

IIa-Visualization of posterior part of vocal cord

IIb-Visualization of arytenoids only

IIIa-epiglottis liftable

IIIb-epiglottis adherent or only tip visible

As per Cook, Grade I and Grade IIa patient can be directly intubated, IIb and IIIa would require intubating aids like bougie, stylet, lightwand, while IIIb and IV cannot be intubated using conventional laryngoscope but would require alterative specializes technique and equipments.[34]

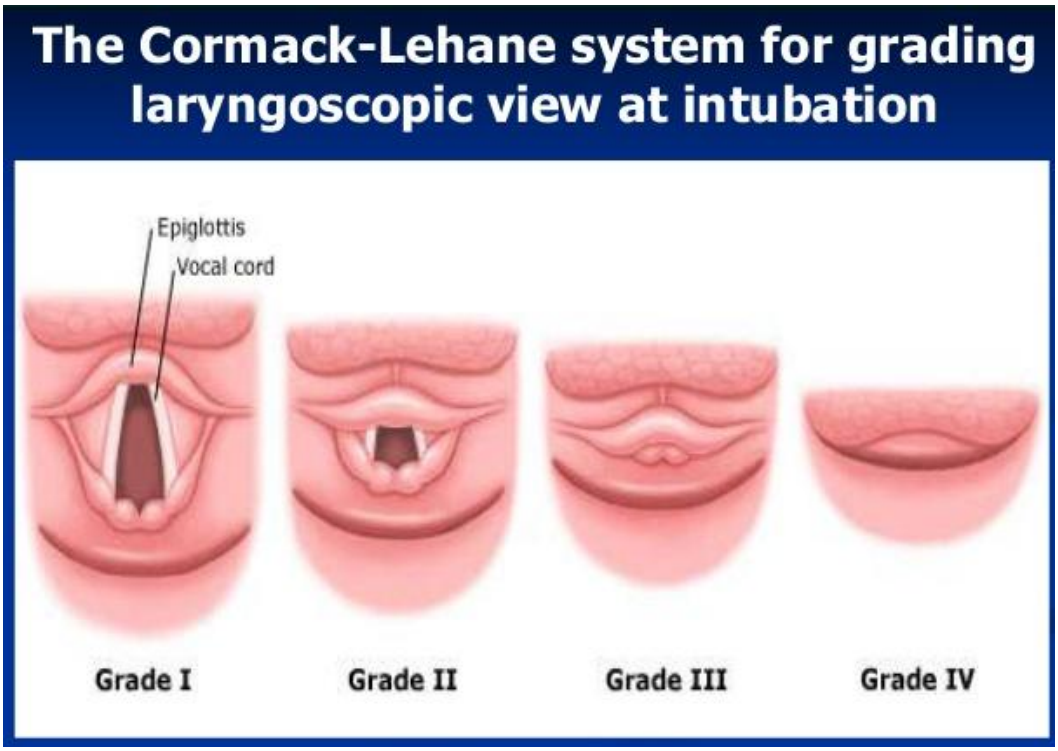


Fig.5: Cormack-Lehane grading

8. Rigid Laryngoscope:

Various laryngoscopes have been described since ***MacEvan,*** a distinguished surgeon of the Glasgow Royal infantry, who first used his fingers to guide an endotracheal tube into the trachea in 1878.[35] Hundreds of blades have since been described, with a whole new generation of video assisted laryngoscopes

9. Design of Laryngoscope:

A laryngoscope consists of a handle joined to a blade. This junction is usually referred to as the fitting. The blade consists of five parts. And they are as follows:

1. The spatula is the main shaft of the blade. The bottom contacts the tongue and the top faces the roof of the mouth.
2. The web or step projects upwards from the blade towards the roof of the mouth.
3. The flange projects laterally from the web. The direction may be over the blade so that a cross sectional area is open partially, or completely enclosed to form tube. Alternatively, the flange bends away from the blade and is referred to as reversed flange.
4. The beak is the tip of the blade, placed in the vallecula or beyond the epiglottis to elevate it directly.
5. Approximating the beak is a light source. There may be additional features, such as oxygen delivery and suction.

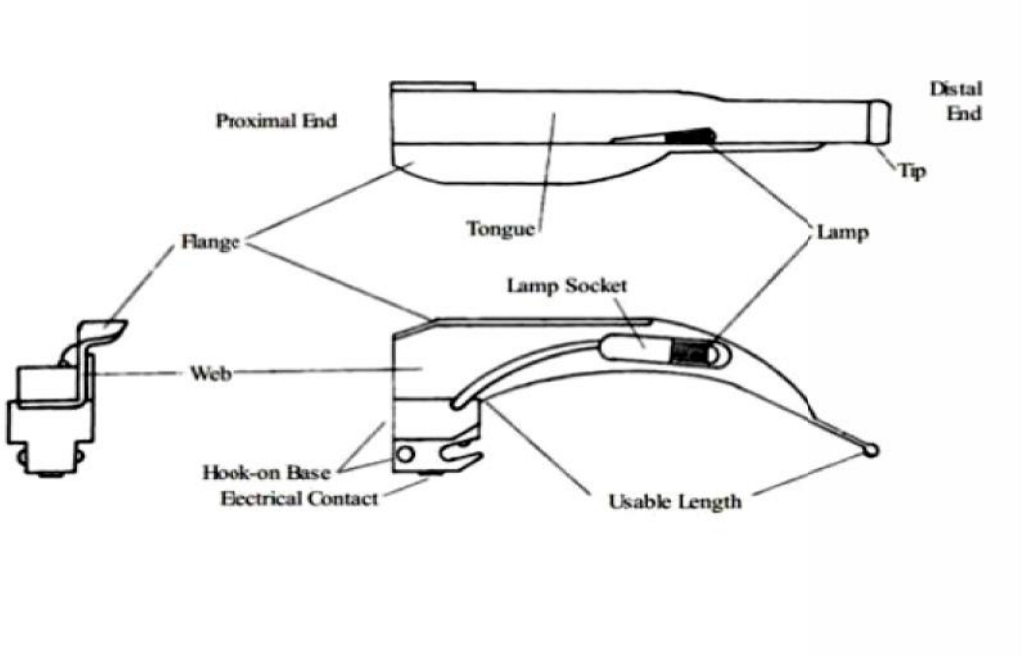


Fig.6: Parts of Macintosh Blade

Macintosh Laryngoscope

The Macintosh curved laryngoscope is a type of rigid laryngoscope described in 1943 and is the most commonly used laryngoscope in day to day practice. The blade is curved, the cross section is a right angled Z section and tip is atraumatic.

Handle

The handle is the part held in the hand during use. Disposable batteries in the handle provide the power source to the light on the handle which completes an electric circuit when the handle and blade are in working position. Surface of the handle is rough to improve the grip and also available in several size.

Although most blades form a right angle with the handle when ready for use, the angle may also be acute or obtuse. An adapter may be fitted between the handle and the blade to allow angle to be altered.

Blade

The blade is the component that is inserted into the mouth. The blades are numbered, the number increasing with size. The blade is composed of several parts including the base, heel, tongue, flange, web, tip and the light source. The base is the part that attaches to the handle. It has a slot for engaging the hinge pin of the handle. The end of the base is called the heel. The tongue (spatula) is the main shaft. It serves to compress and manipulate the soft tissues especially the tongue and lower jaw. In Macintosh blade the tongue has gentle curve that extends to the tip. In cross section, the tongue, web and the flange forms a reverse.

The flange projects off the slide of the tongue and is connected to it by the web. It serves to guide instrumentation and deflect the tissues from the line of vision.

The tip contacts the vallecula and indirectly elevates the epiglottis. It is usually blunt and thickened to decrease trauma.

The blade has an l amp (bulb) which screws into a socket that has a metallic contact. When the blade is in working position, electrical contact with the power source in the handle is achieved. The socket is subject to soiling by fluids that can affect the electrical contacts, causing the light to fail.

Numerous modifications to the conventional Macintosh blade exist like Left handed Macintosh blade, English Macintosh, Polio blade, improved vision Macintosh blade, Tull (Suction) Macintosh blade.[36]

Positioning for direct laryngoscopy

The optimum position for direct laryngoscopy has long been controversial. The concept of 'SNIFFING' position was introduced by Magill. The triple axis alignment was first proposed by Bannister (an anaesthetist) and McBeth (an ENT surgeon) in 1944. They suggested that positioning with flexion at lower cervical spine and extension at atlanto-occipital joint aligned the axis of oral cavity, pharynx and larynx.

Macintosh Laryngoscopy technique

The patient's head and neck are correctly positioned so that the three axes of the airway have been established and the patient has assumed the "sniffing" position. The laryngoscope handle is normally held in the left hand. The laryngoscope is inserted into right side of the patient's mouth, with pushing the tongue towards left. Care is taken as to not get lips trapped between the laryngoscope blade and the teeth. The laryngoscope is advanced and simultaneously moved medially into the midline to displace entire tongue to the left of midline.

Video Laryngoscope:

Both direct and video laryngoscopes share the common feature of a handle attached to a blade with a light source, but in video scopes there is a camera at the tip of the blade allowing indirect visualization of the glottis on a screen.

10.1 Classification of video Laryngoscope: [37]

1. Presence of an integrated channel (to guide the placement of the endotracheal tube)

2. The form of a video stylet (with the endotracheal tube placed around the device)

3. A rigid laryngoscope (without a channel, the endotracheal tube requiring some kind of independent stylet to guide placement)

   Rigid blade laryngoscopes are subdivided into those with a "standard" blade and those with an angled blade.

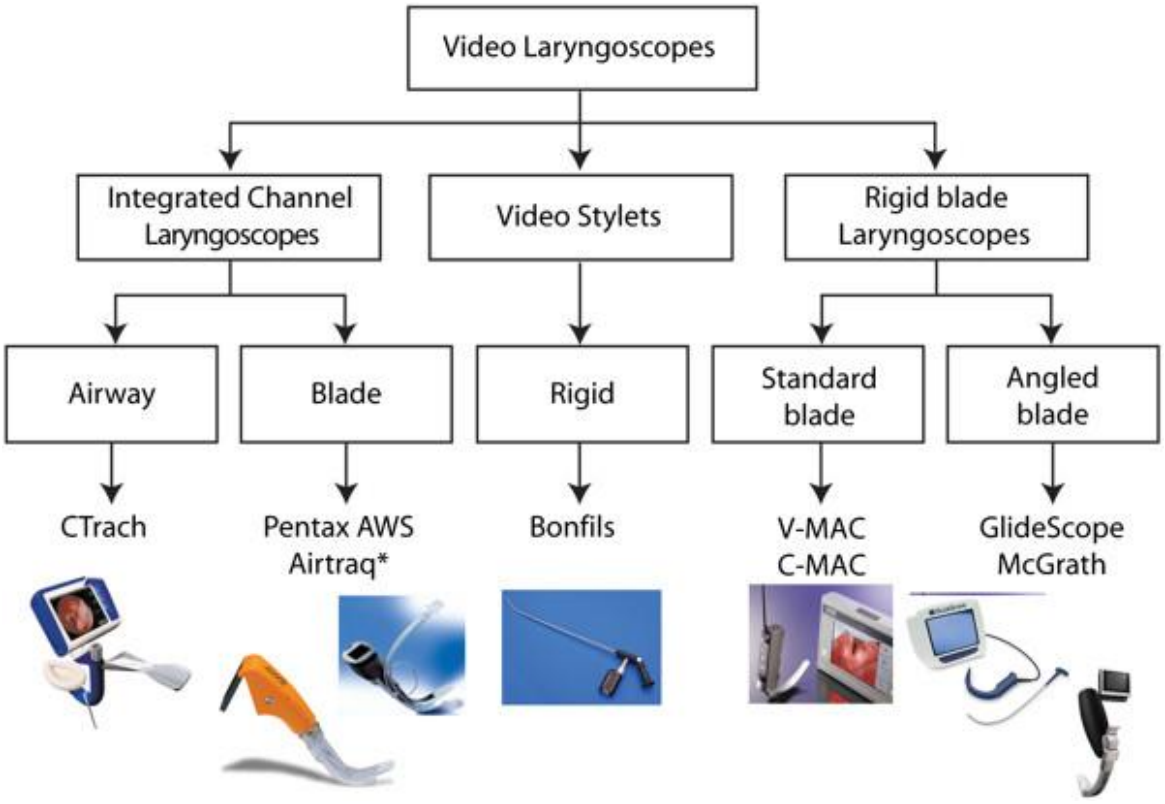


Fig.7: Classification of Video Laryngoscope

RIGID VIDEOLARYNGOSCOPES WITH ANGLED BLADE

The McGRATH MAC video laryngoscope is easy to use and enables clinicians to achieve direct and indirect laryngoscopy when required. The design is similar to the Macintosh blade and therefore enables clinicians to effectively secure patents airways, even in difficult to intubation patients.

DEVICE DESIGN

Built in vertical display, 2.5”LCD monitor display a clear view of the vocal cord and laryngeal inlet for an improved anatomical view. The vertically aligned optics of McGrath displays an earlier visualization of the tube to address tube induced trauma.

LONG LASTING BATTERY: lasting for 250 minutes

Mc GRATH MAC blade range: The McGrath MAC with 119mm slimline single use blade minimises obstruction of the tube path and is especially beneficial in cases of small paediatric patient. Blade size 2, 3, 4 are available, ensuring you have the range you need.

DIRECT AND INDIRECT: The McGrath MAC can be used as direct or indirect laryngoscopy with or without the aid of a stylet to facilitate quicker adoption of technique and quicker tube placement.

HANDLE OVERVIEW: The Camera stick has a steel reinforced .It contains the COMOS camera and high intensity LED. The blade covers and attaches to during use. The screen connects to the handle by the way of hinge. The screen tilts by up 45 degrees.

BLADE OVERVIEW: Each disposable blade is for single use. They are made from a robust optical polymer and the lenses are coated with an anti fog optical surface treatment.

POWER: The handle is supplied with one proprietary 3.6V lithium battery (non rechargeable) in situ. It is embedded in the side of the handle

A new non rechargeable battery provides up to 250 minutes of operating time under normal operating condition. Battery minutes remaining are displayed on screen, the battery icon begins flashing when reaches five minutes-changing battery.

IMPROVED VIEW: 1 TO 2 grade of improvement in view are possible.

SLIM LINE BLADE: The 119mm slim line blade reduces blade width at the patient's mouth, providing greater ability to manoeuvre the device without pressing on teeth.[9]

RIGID VIDEOLARYNGOSCOPE WITH STANDARD MACINTOSH BLADE

GLIDESCOPE DIRECT: The Glide Scope is the prototype of obligate indirect video laryngoscope that displays an image of the laryngeal inlet on an accompanying monitor. Made of medical grade plastic, the laryngoscope is available in different size. A high power LED and miniature CMOS video camera are embedded posteriorly midway along the blade, resulting in a vertical profile up to 16mm. Angulation of 60 degrees at mid blade permits laryngeal inlet visualization with little tissue manipulation. An antifogging mechanism is effectively maintains the view. The video image is transmitted to 7 inch monitor through a video cable: an integrated USB port allows recording of capture images and videos.

CMAC VIDEOLARYNGOSCOPE: C- MAC is based on a modified Macintosh blade that has the same curvature as the standard, but it is different from the original, Macintosh blade in its thinner profile and its bevelled shoulder, which reduces the risk of oral and dental injuries. Its combined optical system of the CMAC consists of a complementary metal oxide semiconductor, high power LED at the distal third of the blade with effective antifogging properties. The external 7 inch LCD colour monitor have a push button, storable standard SD memory with 2 GB capacity.

TRUVIEW PICTURE CAPTURE DEVICE: The Truview picture capture device has an integrated optical lens, unique 42 degree blade tip angulation, and a view through a 15 mm eyepiece. The LED light source is stored in handle and the light transmitted to the blade tip by fibreoptic strands. It's available in five blades sizes, and all of them allow direct laryngoscopy. The blades are equipped with an integrated oxygen jet cleaning and insufflations system, which can connect to an external oxygen flow meter and provide oxygen at a rate of 4 to 6L/min. The video properties of the optical Truview blade can be achieved by magnetic connection of the eyepiece to camera of Truview PCD screen.

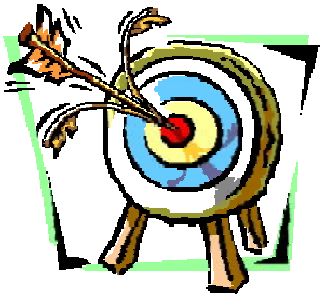
VIDEO LARYNGOSCOPE WITH TUBE GUIDING CHANNLES

KING VISION: The king vision is with high angulation blade with a reusable battery. It has a reusable battery operated monitor and a disposable blade that also includes a CMOS video camera. It has a disposable blade which is available with or without a tube guiding channel and one blade size is provided for adult use. It has a video output which allows the bystanders to view the image on an external medical monitor.

PENTEX AIRWAY SCOPE: A portable, battery operated, wireless VL that is available in one size only. Has a transparent blade equipped with a port through which a suction catheter can be passed. It uses an LED light and flexible wire for a charge coupled device camera, rather than the CMOS camera chip used in other VLs.

AIRTRAQ: The AIRTRAQ is a single use, indirect laryngoscope that incorporates two channels. One transfers the image to a proximal view finder through a series of prisms and lenses and the other acts as a conduit for the ETT. A clip on camera can transfer the image from the view finder to an external monitor. The Airtraq is available in different size for paediatric and adult patient. Nasal and double lumen version is also available.

Introduction



Objectives

Review of Literature

Basic Sciences

Methodology

Results

Discussion

Limitations Of The Study

Conclusion

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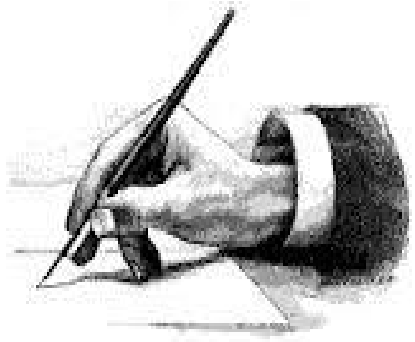


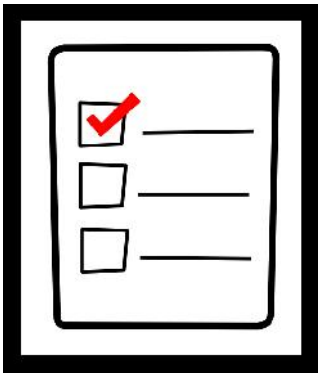
Annexure-I

Annexure-II

Annexure-III

Annexure-IV

Annexure-V



Annexure-VI

MATERIALS AND METHODS

SOURCE OF DATA:

Patient aged 18 – 50 yrs, of either gender, belonging to ASA grade I and II, undergoing elective surgery in supine position under general anaesthesia with tracheal intubation at KLE's Dr.Prabhakar Kore Hospital and Medical Research Center, Nehru Nagar, Belagavi-10 during the period from October 2016-June2017

METHODS OF COLLECTION OF DATA:

TYPE OF STUDY: Randomised clinical trial

DURATION OF STUDY AND STUDY POPULATION:

Adult patients posted for surgery under general anaesthesia between October 2016-June2017 at KLE's Dr.Prabhakar Kore Hospital and Medical Research Center, Nehru Nagar, Belagavi-10, were recruited as per inclusion and exclusion criteria.

INCLUSION CRITERIA:

- ASA physical status I and II
- Age between 18 to 50 years
- Patients undergoing elective surgeries under general anaesthesia
- Provides consent

EXCLUSION CRITERIA:

- Patient undergoing emergency surgery
- Patient who are not able to give consent
- Patient requiring rapid sequence intubation

SAMPLE SIZE CALCULATION:

Statistical power analyses using G *Power 3.1: Tests for correlation and regression analyses (Heinrich Heine University) which came up to 50 in each group

SAMPLING PROCEDURE:

Randomization will be achieved by computer generated randomization chart

1. **METHODOLOGY:**

After obtaining the approval of ethical committee and written informed consent, a total of 150 patients undergoing surgery under general anaesthesia were included in study, 50 in each group.

After having met inclusion and exclusion criteria, having obtained informed consent, patients were randomised based on computer generated randomization table into one of the three groups.

- GROUP A: Patients in whom laryngoscope and endotracheal intubation is done using Mc GRATH MAC Videolaryngoscopy by indirect mode (video mode)
- GROUP B: Patient in whom laryngoscopy and endotracheal intubation is done using Mc GRATH MAC videolaryngoscopy by direct mode
- GROUP C:Patients in whom laryngoscopy and endotracheal intubation is done using Macintosh laryngoscope

A thorough pre anaesthetic evaluation was done on the day before surgery. Airway assessment was done and airway difficulty score noted. Following are the observations made as per the table given below.

Numerical Score ranging from5-15

5 –low risk

15-high risk of intubation

AIRWAY DIFFICULTY SCORE (ADS)

Criteria	**SCORE 1**	**SCORE 2**	**SCORE 3**
Thyromental distance	>6cm	5-6cm	<5cm
Mallampatti score	I	II	III&IV
Mouth opening	>4	2-3	<1
Neck mobility	Normal	Reduced	Fixed Flexion
Upper Incisors	Absent	Normal	Prominent

On the day of surgery intravenous access is secured using 18G or 20G IV cannula and IV fluids started.

Standard monitoring devices were attached before induction of anaesthesia, including noninvasive arterial blood pressure, heart rate, and oxygen saturation, ECG.

Patients were premedicated with Inj.Glycopyrrolate 0.004mg/kg and Inj.Midazolam 0.05mg/kg and Inj.Pentazocine 0.5mg/kg and pre oxygenated with 100% oxygen for 3 minutes. Induction was done with Inj.Thiopentone 5mg/kg and Inj. Succinylcholine 2mg/kg.

With the onset of neuromuscular blockade, laryngoscopy is done in either of the groups with McGRATH MAC videolaryngoscope using it as indirect laryngoscope(group A),McGRATH MAC videolaryngoscope using it as direct laryngoscope(group B) and Macintosh laryngoscope (group C)

Tracheal tubes of internal diameter 7.5mm were used for women and 8.5mm for men. The following were noted

2. Intubation difficulty score

IDS parameters	Scores
Number of attempts>1	N1
Number of operators>1	N2
Number of alternative techniques	N3
Cormack Lehane Grading minus 1	N4
OPERATOR'S PERCEPTION OF LIFTING FORCE	
Normal	N5=0
Greater than routine practice	N5=1
LARYNGEAL PRESSURE APPLIED	
Not applied	N6=0
Applied	N6=1
VOCAL CORD MOBILITY	
Abduction	N7=0
Adduction/Impending tube passage	N7=1

TOTAL IDS=SUM of scores N1-N7

IDS score	Degree of difficulty
0	Easy
1-5	Slightly difficult
>5	Moderate to Major difficulty
∞	Impossible

- Time taken for successful intubation (in seconds) defined as the time from passage of laryngoscope tip past the incisors to the appearance of end tidal CO2 trace.
- Any complication like desaturation/bleeding.
- Then after confirming the equal air entry endotracheal tube was secured with tapes at appropriate length and mechanically ventilated.
- Patients were maintained with oxygen, nitrous oxide, Isoflurane, and Inj. Vecuronium (0.08-0.1mg).
- At the end of the procedure patients were reversed with Inj.Glycopyrrolate 0.008mg/kg and Inj.Neostigmine 0.005mg/kg and extubated after through suctioning.
- *Analysis:* Data analysis was done using Shapiro Wilk and d'Agostino test. Parametric continuous data will be analysed ANOVA.
- Categorical data was analysed using the Chi Square test.

RESULTS

The present randomised control trial was conducted to compare the ease of endotracheal intubation using McGrath videolaryngoscope as direct mode, indirect mode with Macintosh laryngoscope using intubation difficulty score.

Group A: McGrath videolaryngoscope by indirect method.

Group B: McGrath videolaryngoscope by direct method.

Group C: Macintosh laryngoscope.

The study included 150 patients, 50 in each group ages between 18 to 50 years of either sex belonging to ASA class I and II scheduled for elective surgeries under general anaesthesia in whom endotracheal intubation was indicated.

Table1. Gender distribution in the three study groups

Gender	Group A		Group B		Group C	
	No	**%**	**No.**	**%**	**No.**	**%**
Male	30	60	22	44	29	58
Female	20	40	28	56	21	42
Total	50	100	50	100	50	100

There was no extreme variation in gender distribution in the three groups in our study.

Graph 1: Gender distribution of Group A, Group B, Group C

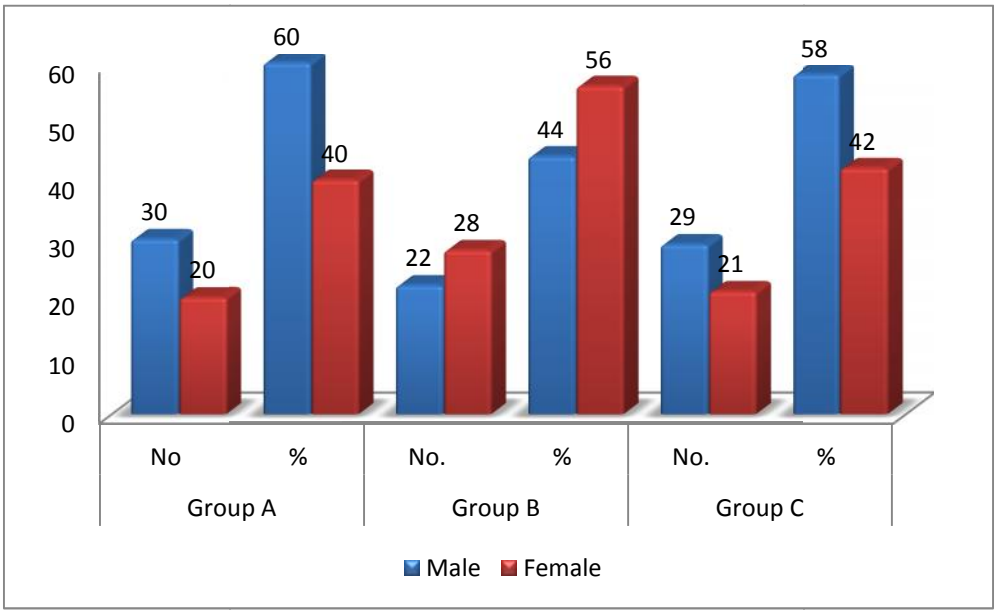
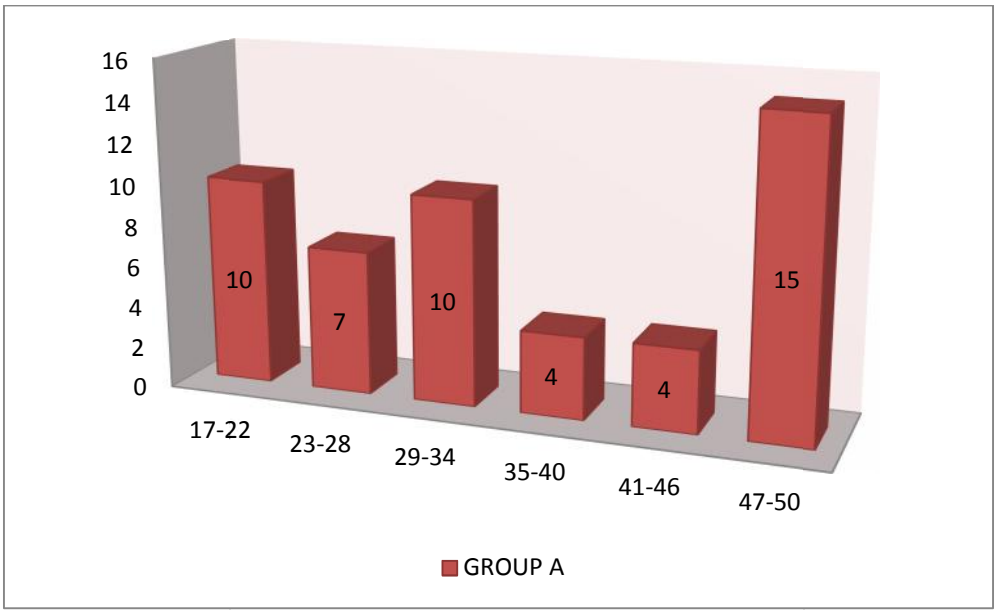


Table 2: Age distribution of the three study groups

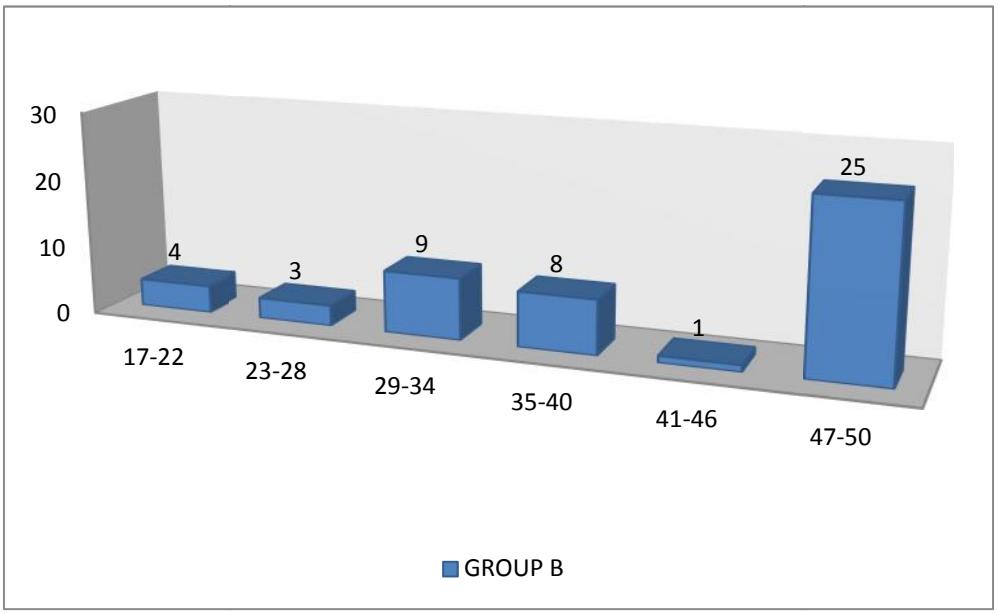
Age Group (in years)	Group A		Group B		Group C	
	No	%	No.	%	No.	%
17-22	10	20	4	8	4	8
23-28	7	14	3	6	3	6
29-34	10	20	9	18	9	18
35-40	4	8	8	16	8	16
41-46	4	8	1	2	1	2
47-50	15	30	25	50	25	50
Total	50	100	50	100	50	100

The majority of the study subjects were in the age group of 47-50 years in the three groups

Graph 2: Age distribution of Group A



Graph 3: Age distribution of Group B



Graph 4: Age distribution of Group C

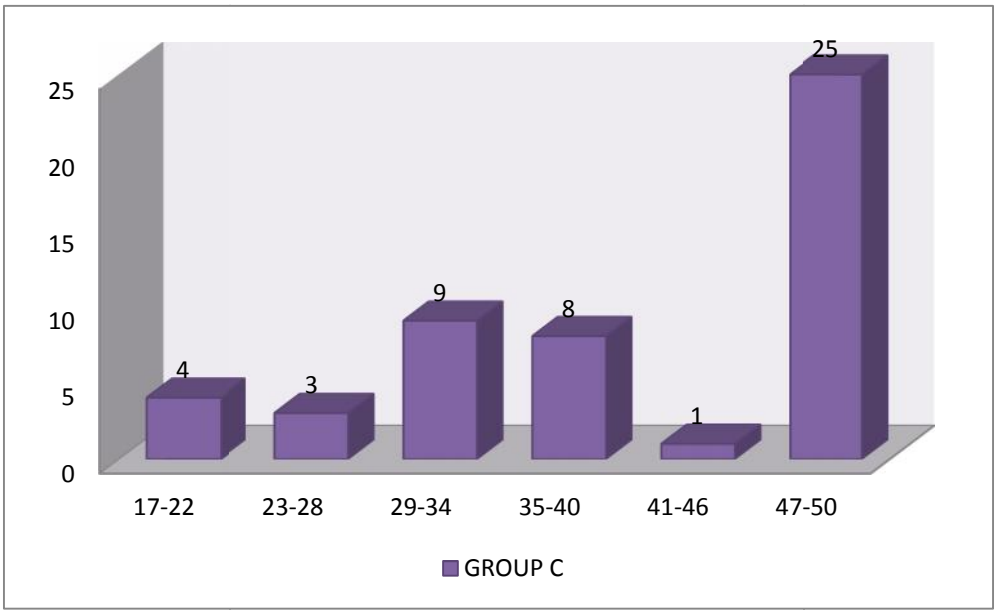


Table 3: Patient characteristics in the three intervention groups.

Mean (±SD), Median (IQR[Range])

Patient Characteristics	Group A McGrath Indirect Method	Group B Mc Grath Direct Method	Group C McIntosh Method
Age (in years)	34.9 (±11.9)	39.8(±10.9)	38.02(±12)
BMI (kg/m^2)	23.6 (±4.2)	24.5(±2.9)	23.8(±2.8)
ADS scores	7(7-8[6-8])	7(6-7[6-9])	7(6-7[6-8])

BMI- Body Mass Index, ADS- Airway Difficulty Score.

There are no major differences in patient characteristics across the three groups. The median score for Airway Difficulty Score (ADS) was 7 in all the groups showing that the airway difficulty did not vary in the three groups.

Table 4: Intubation characteristics in the three intervention groups.

Mean (±SD), Median (IQR[Range])

Intubation Characteristics	**Group A McGrath Indirect Method**	**Group B Mc Grath Direct Method**	**Group C McIntosh Method**	**ANOVA p value**
Time to intubate (in seconds)	25(20-28[15-38])	38(38-40[32-44])	28(28-30[22-33])	<.00001
IDS	1(0-1[0-3])	4(0-4[2-6])	1(0-1[0-2])	<.00001

IDS- Intubation Difficulty Score.

There is a significant difference in time of intubation and Intubation difficulty score in the three groups.

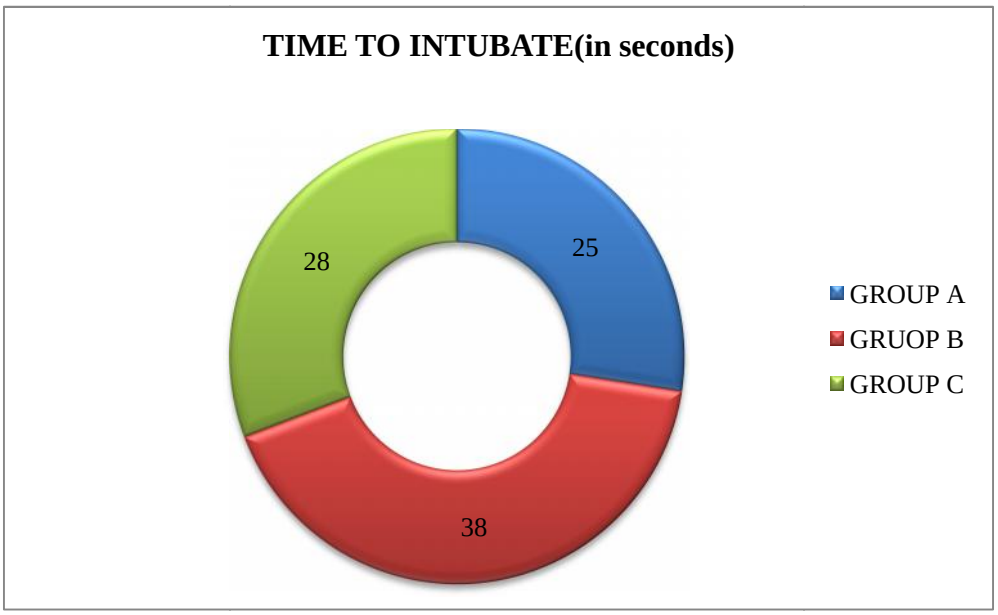
t- Test: Pairwise T test was done between Group A and Group B, Group B and Group C and Group A and Group C to find out which groups differ significantly from one another.

Post-ANOVA t-test was done to find out which group differed significantly from other in terms of Time of intubation and IDS.

T-test revealed IDS in Group A was significantly lower from Group B ($p<0.0001$) and IDS in Group A was comparable with Group C ($p=0.39$) which is not statistically significant.

Similarly, post AVOVA t-test revealed that time to intubate was significantly less in Group A compared to Group B ($p<0.0001$) and Group C ($p<0.00028$). Time to intubate was significantly longer in Group B compared to Group C ($p<0.0001$). The time taken for intubation in Group A(Indirect) was least, intermediate in GroupC(Macintosh) and longest in Group B(Direct).

Graph 5: Time to intubate in three groups in seconds



T test to find out difference of time of intubation between groups

Table 5: Time of intubation between Group A and Group B

	Group A	Group B	T test	P value
N	50	50	-16.17922	< .00001
Degree of freedom = N-1	49	49		
Mean	24.76	38.78		
Std Dev	1571.2	268.48		
SE = SS1/(N – 1)	32.06	5.48		

The t-value is -16.17922. The p-value is < .00001. The result is significant at $p < .05$.

Table 6: Time of intubation between Group A and Group C

	Group A	Group C	T test	P value
N	50	50	- -4.2087	.000028
Degree of freedom = N-1	49	49		
Mean	24.76	28.46		
Std Dev	1571.2	322.42		
SE = SS1/(N – 1)	32.06	6.58		

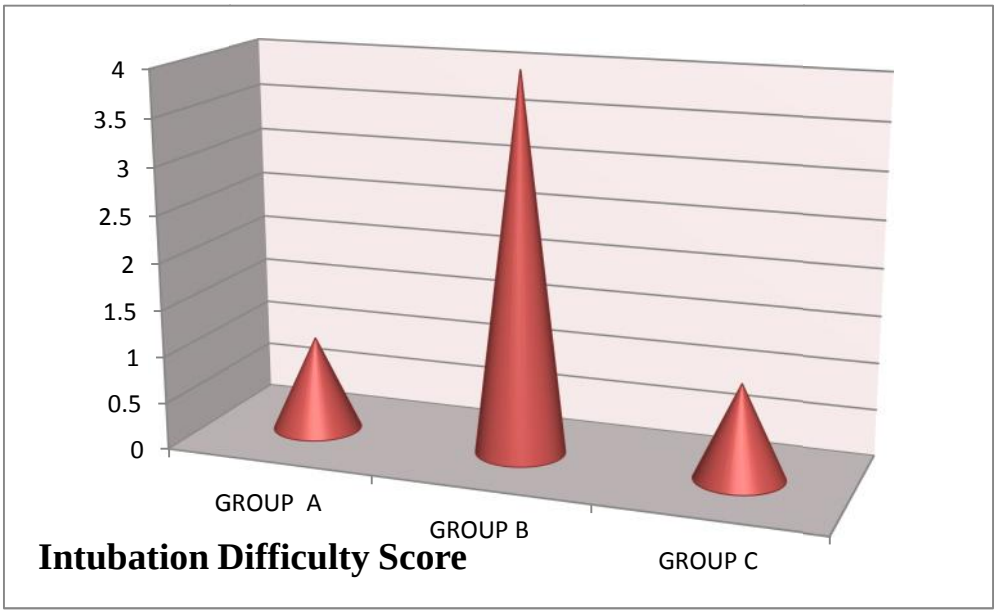
The t-value is -4.2087. The p-value is .000028. The result is significant at $p < .05$.

Table 7: Time of intubation between Group B and Group C

	Group B	Group C	T test	P value
N	50	50	21.01208	< .00001
Degree of freedom = N-1	49	49		
Mean	38.78	28.46		
Std Dev	268.48	322.42		
SE = SS1/(N – 1)	5.48	6.58		

The t-value is 21.01208. The p-value is < .00001. The result is significant at $p < .05$.

Graph 6: Intubation difficulty Score between the three groups



Pairwise t- test for IDS difference between groups:

Unpaired t test done between two groups to find out which group has significant difference from one another.

Table 8: Intubation Difficulty Score between Group A and Group B

	Group A	Group B	T test	P value
N	50	50	-20.39	< .00001
Degree of freedom = N-1	49	49		
Mean	0.72	3.86		
Std Dev	32.08	26.02		
SE = SS1/(N – 1)	0.65	0.53		

The t-value is -20.39035. The p-value is < .00001. The result is significant at p < .05.

Table 9: Intubation Difficulty Score between Group A and Group C

	Group A	Group C	T test	P value
N	50	50	0.875	.383713
Degree of freedom = N-1	49	49		
Mean	0.72	0.6		
Std Dev	32.08	14		
SE = SS1/(N – 1)	0.65	0.29		

The result is not significant at $p < .05$

Table 10: Intubation Difficulty Score between Group B and Group C

	Group B	Group C	T test	P value
N	50	50	25.50716	p < .05.
Degree of freedom = N-1	49	49		
Mean	3.86	0.6		
Std Dev	26.02	14		
SE = SS1/(N – 1)	0.53	0.29		

The result is significant at $p<0.05$.

DISSCUSSION

Difficult intubation is associated with substantial morbidity and mortality and is a challenging part for anaesthesiologist. The Macintosh laryngoscope is still the most common device for tracheal intubation since until first entered clinical use. Difficult laryngoscopy is estimated at a rate of 2-8% in all general anaesthetic procedure and inability to achieve an adequate glottic view with traditional laryngoscope is described as difficult intubation.

Several techniques and devices are being used to intubate the trachea while the tracheal aperture cannot be seen. Currently it is well practiced and documented that direct laryngoscope has several limitation to cope with securing difficult airway during orotracheal intubation. Videolaryngoscope which may provide after view of the tracheal aperture with failed direct laryngoscopy creates a potential cure to the problem.

A hospital based randomized control trial was undertaken in the department of Anaesthesiology, KLE's Dr Prabakar Kore Hospital and Medical Research Centre from October 2016 to June 2017.A total of 150 patient posted for surgery under general anaesthesia were randomized based on computerizes generated table into 3 groups, 50 in each group. Group A patient who underwent intubation with Mc Grath MAC videolaryngoscope indirect mode), Group B (who underwent intubation with Mc Grath MAC using it as direct mode), Group C (who underwent intubation with Macintosh laryngoscope).

In our study there was no extreme variation in gender distribution in the three groups. Majority of the study subjects were in the age group of 47-50yrs. There was

no statistically significant difference in the patient characteristics across the three groups. The mean score for airway difficult score (ADS) was 7, in all the three groups showing that ADS did not vary.

We tested Mc Grath videolaryngoscope in direct mode and indirect mode, observed that when Mc Grath used as indirect mode offered a better IDS score than used as direct mode with a significant p value of $p<0.001$, also lesser time for intubation with a mean intubation time of 25seconds in indirect mode and 38seconds in direct mode.

In the study conducted by Zi Jia Liu et al [18], on patients with normal airway comparing Mc Grath series 3 and Macintosh laryngoscope observed the ease of intubation assessed by five point ordinal scale, found that the ease of intubation was statistically significant($p=0.01$) between both the groups. Cormack Lehane view attained using McGrath was superior($p<0.01$) but they found that there was no statistically significant difference in the mean intubation time (McGrath=30.6sec and Macintosh=28.7sec, $p=0.46$) which is comparable to our study where we noted that Intubation Difficulty Score was not significant with $p=0.039$ between Group A(indirect mode) and Group C(Macintosh) whereas the mean time for intubation was statistically significant in both the groups with group A as 25sec and group C as 28sec.

A similar study conducted by Semih A et al [14], on 80 obstetric patients to compare Mc Grath series 5 videolaryngoscope verses Macintosh laryngoscope, were able to conclude that the percentage of glottic opening (POGO) found to be higher in McGrath group ($p=0.002$) whereas Cormack Lehane grading in Mc Grath and Macintosh revealed no difference ($p=0.121$) but mean time for intubation was longer

in McGrath than that of Macintosh group. Whereas in our study we observed that mean intubation time with McGrath MAC indirect mode was 25seconds and Macintosh was 28 seconds with p=0.00028. Intubation difficulty score was comparable in both the groups which were not statistically significant.

A study conducted by A.M.Taylor et al [38], on 88 patients with a simulated difficult airway comparing Mc Grath series 5 videolaryngoscope verses Macintosh laryngoscope found that Mc Grath videolaryngoscope improved the glottic view by one to three grades($p<0.001$) with 100% successful intubation. The mean intubation time using Mc Grath videolaryngoscope was 37.2 seconds. In our study 100% intubation was noted with Mc Grath videolaryngoscope in indirect mode with lesser mean time for intubation i.e. 25 seconds .Intubation Difficulty Scores used as a tool to measure ease of intubation which was comparable between both the groups i.e. Mc Grath indirect and Macintosh laryngoscope.

Karman et al [22], conducted a study in 50 patients using McGrath videolaryngoscope after failed conventional laryngoscope observed that the percentage of glottic opening (POGO) improves by 80% with McGrath videolaryngoscope compared to Macintosh laryngoscope($p<0.01$) with success rate of 98% by using McGrath videolaryngoscope for tracheal intubation which was comparable to our study with similar ADS of 7 in all three the groups, but lesser mean time of intubation i.e. 25seconds and 100% successful intubation when McGrath videolaryngoscope used as in indirect mode.

A comparable study conducted by Mehmet S et al [21], on 100 patient with normal airway to compare McGrath series 5 videolaryngoscope with Macintosh laryngoscope observed that the percentage of glottic opening(POGO) score was

significantly higher in Mc Grath group compared with Macintosh group($p<0.001$) despite time to successful intubation being similar in both the groups. Number of multiple attempt in order to achieve success was significantly higher in Macintosh group($p=0.001$) which was comparable to our study where the mean intubation time for Macintosh group was longer compared to that of Mc Grath which is statistically significant $p<0.5$.

A study conducted by Wallace et al [24], to compare the ease of tracheal intubation using McGrath MAC laryngoscope and a standard Macintosh laryngoscope, showed higher median Intubation Difficulty Score[IDS] with Mc Grath MAC as a direct laryngoscope 1[0-3(0-5)] than when using it as Indirect videolaryngoscope 0[0-1(0-5)] and Macintosh laryngoscope 0[0-1(0-5)].There was no difference between the groups in time taken to intubate or incidence of complication. There was no statically significant difference in the performance as measured between the Mc Grath MAC used as an indirect videolaryngoscope and the Macintosh laryngoscope, which is comparable to our study and observed that higher median Intubation Difference Score with Mc Grath MAC as a direct laryngoscope 4[0-4(2-6)] than when using it as a indirect videolaryngoscope 1[0-1(0-3)], or when using Macintosh laryngoscope 1[0-1(0-2)] with statistically significant mean intubation time with Mc Grath in indirect mode(25 sec) with a McGrath in direct mode (38 sec).

A study conducted by Vargus M et al [39,] to compare videolaryngoscope for tracheal intubation in predicted difficult airway on 42 patients ,using Glidescope and Imago V Blade used IDS (intubation difficulty score) as a tool for assessment, found that IDS score was less than 5 in both the groups with (median and IQR) Group

G(Glidescope) 1(0-1),Group I(Imago)1(0-2) which proved that in more than 70% population the IDS score showed an ideal condition of intubation. Hence they could say that IDS score was a descriptive method to assess difficult endotracheal intubation, may be more appropriate than Cormack and Lehane score to predict difficult intubation during videolaryngoscope which was comparable to our study where in IDS used as a tool for assessment of ease of intubation noted that IDS was higher in when McGrath used as in direct mode 4[0-4(2-6)] but IDS was comparable between Mc Grath Indirect1[0-1(0-3)] and Macintosh1[0- 1(0-2)] hence we could say that McGrath used as direct laryngoscope makes intubation more difficult.

A study conducted by Arthur Bailly et al [20], on 370 patient using Mc Grath MAC videolaryngoscope versus Macintosh laryngoscope for orotracheal intubation in intensive care, observed that McGrath MAC videolaryngoscope reduce the duration of intubation, decreases the frequency of serious complications hence can be considered for outside ICU setting where emergency endotracheal intubation is often required which was very much comparable to our study as the mean time required for intubation using McGrath MAC in indirect mode (25sec) was less compared to that of Macintosh (28sec) which is statistically significant and coincidently with no complication.

In our study we observed that intubation using Mc Grath as direct videolaryngoscope resulted in proportionally higher Cormack Lehane grading, greater Intubation Difficulty Score 4(0-4[2-6]),even time taken for intubation was higher mean of(38sec),compared to that of Mc Grath as indirect and Macintosh laryngoscope. McGrath used as indirect mode resulted in lesser intubation time, with mean of 25sec, than that of Macintosh laryngoscope with mean intubation time of

28sec, which were statistically significant. The Intubation Difficulty Score with McGrath Indirect mode 1(0-1[0-3]) and Macintosh laryngoscope 1(0-1[0-2]) which was comparable and not statistically significant whereas IDS of Mc Grath used as direct mode 4(0-4[2-6]) statistically significant with indirect mode. Hence we would like to say that McGrath used as a direct mode for intubation requires more force, more adjuvant and makes intubation more difficult.

LIMITATION OF THE STUDY

There were some limitations in our study.

- Anaesthesiologists were not blinded to the devices used.
- The results varied according to the expertise in the use of device
- The use of stylet would have achieved faster intubation.

CONCLUSION

In conclusion, the ease of intubation using McGrath videolaryngoscope in indirect mode is better than using McGrath videolaryngoscope in direct mode and is comparable with Macintosh direct laryngoscope.

The time taken for intubation using McGrath Videolaryngoscope in indirect mode was least, intermediate in Macintosh laryngoscope and longest in McGrath used as direct mode.

No complication were noted in either of the three groups.

SUMMARY

Successful and rapid airway management is of at most important in an emergency setting .High level expertise along with regular training and practice, is required for successful endotracheal intubation. Sometimes additional tools are required. Videolaryngoscope has been introduced to allow monitoring of conventional tracheal intubation and to assist during unexpected difficulties of the glottic visualization.

The present study was conducted to compare the ease of endotracheal intubation using Mc Grath videolaryngoscope as direct mode and indirect mode with Macintosh laryngoscope using Intubation Difficulty Score. 150 patients of ASA I and II, of either gender between the age group of 18 -50years, undergoing elective surgery requiring endotracheal intubation were included with a mean score for Airway Difficulty score of 7 in all three groups. The mean intubation time was statistically significant in between the three groups that i.e 25seconds in group A, 38seconds in group B and 28seconds in group C, p value was less than 0.001.

The Intubation Difficulty Score were significant between group A 1(0-1[0-3]) and group B 4(0-4[2-6]) also between group B 4 (0-4[2-6]) and group C 1(0-1[0-2]) whereas it was not significant between group A and group C.

Hence we concluded that Mc Grath used as a direct mode for intubation as it requires more force and adjuvant suggesting the design of the blade not appropriate for using it as a direct videolaryngoscope.

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ANNEXURE-I

CONSENT FORM

Mr/Mrs/Miss. _____ we are requesting you to enrol you in study titled **"To Compare the ease of tracheal intubation using McGrath MAC Videolaryngoscope in direct and indirect modes with the standard Macintosh Laryngoscope:One year randomized clinical trial,** conducted by Dr.Gadvi Priyanka Mallikarjun Post Graduate in M.D. Anaesthesiology under the guidance of Dr. Manjunath C. Patil$_{M.D}$ Professor, Department of Anaesthesiology, J.N. Medical College, Belagavi under KLE University, Belagavi.

Respected Sir/Madam We request you to participate in our study as you are eligible for participating in the study. During the study you will be asked some questions regarding your present complaint and you are supposed to answer to the best of your knowledge.

Your participation in this research is voluntary. Your decision whether or not to participate in the study will not affect your relationship with J.N.Medical College. If you decide to participate you are free to withdraw at any time.

Purpose of the study:

The purpose of research is to know whether the study will be helpful in evaluating the efficacy of McGrath MAC video laryngoscope used for direct laryngoscope with regards to ease of tracheal intubation in comparison to Mc Grath MAC video laryngoscope used as indirect laryngoscope and Macintosh laryngoscope,

hence will be helpful in assessing whether the laryngoscope curvature (McGrath MAC video laryngoscope curvature) can be helpful for direct laryngoscope.

Procedure Involved:

If you agree to enroll in my study, I will ask you present, past and family history. Then you will be clinically examined in detail. You will be allotted into one of the three groups randomly using computer generated software. Group A will undergo intubation with Mc grath videolaryngoscope by indirect method Group B will undergo intubation with using Mc Grath videolaryngoscope by direct method .Group C will undergo intubation with Macintosh laryngoscope.

Risks:

There is almost no risk involved with using Mc Grath videolaryngoscope as direct and indirect.

Benefits: Mc Grath videolaryngoscope benefits in using like both direct and indirect, with a affordable price than other videolaryngoscope which is more use full in difficult airway settings.

Voluntary Participation/Withdrawal:

Taking part in the study is voluntary. You may choose not to enroll yourself in this study. Your decision will not change present or future health care services offered to you at K.L.E. S Hospital & MRC

Alternatives: Even if you decline the participation in the study, you will get the routine line of management.

Privacy and Confidentiality: The only people to know that you are a research subject are you and members of the research team. No information provided by you during the research will be disclosed to other without your written permission except:

1. In emergency to protect your rights and welfare.
2. If required by law.

Authorization to Publish Results:

When the results of the research are published or discussed, in a conference, no information will be displayed that would disclose your identity. Any information that is obtained in connection with this study and that can be identified with your identity remaining confidential.

Financial Incentives for participation: No financial incentives are being offered to enrolled patients. It is purely being done with the idea of research and all the cost of the study will be borne by the investigator.

Compensation: In the event of injury related to the study, treatment will be made available through KLES Hospital and MRC, Belagavi. There is no compensation or payment for such medical treatment by law. If you get injured you may contact Dr.Gadvi Priyanka Mallikarjun at Department of Anaesthesiology, KLES Hospital and MRC or by Ph. No: 9845801642

Questions: In case you have any questions related to the study, in future or in case of study related injury or illness, you can contact Dr. Gadvi Priyanak Mallikarjun Department of Anaesthesiology, KLES Hospital and MRC, Belagavi. Phone number: 9845801642. Or Dr. Manjunath C. Patil$_{M.D.}$, Professor, Dept. Of Anaesthesiology, KLES Hospital and MRC, Belagavi. Ph. No: 9743110637.

If you have any queries about your rights as a study subject, you may call Dr. Ganga Pilli, Professor, Department of Pathology and Chairman, J.N. Medical College Institutional Ethical Committee for Human Subjects Research, Phone number-9480275601, or extension 4052 at J.N. Medical College, Belagavi.

INFORMED CONSENT FOR PARTICIPATION IN RESEARCH TRIAL

"TO COMPARE THE EASE OF TRACHEAL INTUBATION USING Mc GRATH MAC VIDEOLARYNGOSCOPE IN DIRECT AND INDIRECT MODES WITH THE STNDARD MACINTOSH LARYNGOSCOPE :ONE YEAR RANDOMISED CLINICAL TRIAL.

I, Mr/Ms/Mrs _____ voluntarily agree for the participation of as a subject of study. By signing this consent form I am not giving up any of my legal rights, I may withdraw from the study anytime. I am signing the consent form after having read or been read for me in vernacular language, including the risks and the benefits and having all my questions answered.

Subject Name : _____

Guardian Name: _____

Signature or the Left Thumb Print

of Subject/Guardian : _____

Date:

Witness Name:_____ Signature:_____

Investigators Name: _____ Signature:_____

Date:

Place : _____.

ANNEXURE-II

PROFORMA

Title: To compare the ease of tracheal intubation using Mcgrath Mac videolaryngoscope in direct mode, indirect mode and Macintosh laryngoscope: One year randomized clinical trial.

Patients Name	:	I.P No.	:
Age	:	Weight	:
Height	:	Gender	:
Date of operation	:	Occupation	:
Address	:	Anaesthesiologist:	

Pre anaesthetic evaluation

Chief complaints

Past History

- HTN / DM/ IHD / Arrhythmia / LVH / Valvular heart disease
- H/o uncontrolled hypertension/diabetes mellitus
- H/o previous surgery/(s) where airway difficulty was encountered.

Family History

General physical examination

Weight (Kg)	:	Temperature (^{0}F)	:	Pallor	:
Cyanosis	:	Pedal oedema	:	Clubbing	:
PR	:	BP	:	RR	:

Systemic examination:

RS	:	CNS	:
CVS	:	GIT	:

Airway Assessment – Airway difficult score

Spine-

Investigations

Hb%	:	Urine routine	:	Blood urea	:
Serum creatinine:		FBS	:	CXR	:

Diagnosis

Proposed surgery

Preoperative physical status ASA Grade I II III IV V

- **Inclusion Criteria**:
- ASA physical status 1 and 2.
- Age between 18 to 50 years.
- Patients undergoing elective surgeries under general anaesthesia.
- Provides Consent

- **Exclusion Criteria** :

- Patient undergoing emergency surgery.
- Patient who are not able to give consent.
- Patients requiring rapid sequence intubation

Methodology

After obtaining the approval of ethical committee and written informed consent, a total of 150 patients undergoing surgery under general anaesthesia will be included in the study.

After having met inclusion and exclusion criteria and having obtained informed consent, patients will be randomized based on computer generated randomization table into one of the three groups.

Group A: Patients in whom laryngoscopy and endotracheal intubation is done using McGrath video laryangoscope by indirect method.

Group B: Patients in whom laryngoscopy and endotracheal intubation is done using McGrath video laryangscope by direct method.

Group C: Patients in whom laryngoscopy and endotracheal intubation is done using Macintosh laryngoscope.

A through pre-anaesthetic evaluation will be done on the day before surgery. Airway assessment will be done and airway difficult score noted.

Airway difficult score (ADS)

Criteria	Score 1	Score 2	Score 3
Thyromental distance	>6	5-6	<5
Mallampatti score	I	II	III&IV
Mouth opening	>4	2-3	<1
Neck mobility	Normal	Reduced	Fixed flexion
Upper incisors	Absent	Normal	Prominent

Score=

On the day of surgery intravenous access is secured using 18G OR 20 G iv cannula and iv fluids started.

Standard monitoring devices were attached before induction of anaesthesia, including non-invasive arterial blood pressure, heart rate, and oxygen saturation.

Premedicated

inj glycopyrrolate 0.004mg/kg

inj midazolam 0.05mg/kg

inj pentazocine 0.5mg/kg

Pre oxygenated with 100% oxygen for 3mins.

Induction with

inj thiopentone 5 mg/kg

inj succinyl choline 2mg/kg.

With the onset of neuromuscular blocked laryngoscope is done with McGrath MAC Video laryngoscope using it as indirect laryngoscope (in group A), McGrath

MAC video laryngoscope using it as direct laryngoscope (in group B) using Macintosh Laryngoscope (in group C).

Tracheal tubes of internal diameter 7.5mm were used for women and 8.5mm for men.

The following were noted.

1) Intubation difficult score was calculated (IDS)

IDS parameter	**Score**
Number of attempts >1	N1
Number of operators >1	N2
Number of alternative techniques	N3
Cormack Lehane Grading minus 1	N4
Operator's perception of lifting force required	
Normal	N5=0
Greater than in routine practice	N5=1
Laryngeal Pressure applied	
Not applied	N6=0
Applied	N6=1
Vocal cord mobility	
Abduction	N7=0
Adduction / impending tube passage	N7=1

N1=Every additional attempt add 1 point,N2=Every additional operator add 1 point,N3=Every alternative technique add 1 point, repositioning of patient, change of material(blade, ET, additional stylette)or use of another technique, fibreoptic/LMA

Total IDS = (Sum of scores N1-N7)

IDS score	Degree of difficulty
0	Easy
1-5	Slightly difficult
>5	Moderate to major difficulty
∞	Impossible

Score =

2) Time taken for successful intubation (in seconds) defined as the time from passage of laryngoscope tip past the incisors to the appearance of end tidal Co2 trace.

3) Any complications like desaturation/bleeding etc.

Then after confirming the equal air entry endotracheal tube will be secured with tapes at appropriate length and mechanically ventilated. Patients will be maintained with oxygen, Nitrous oxide, Isoflurane and inj.vecuronium 0.08mg/kg i.v.

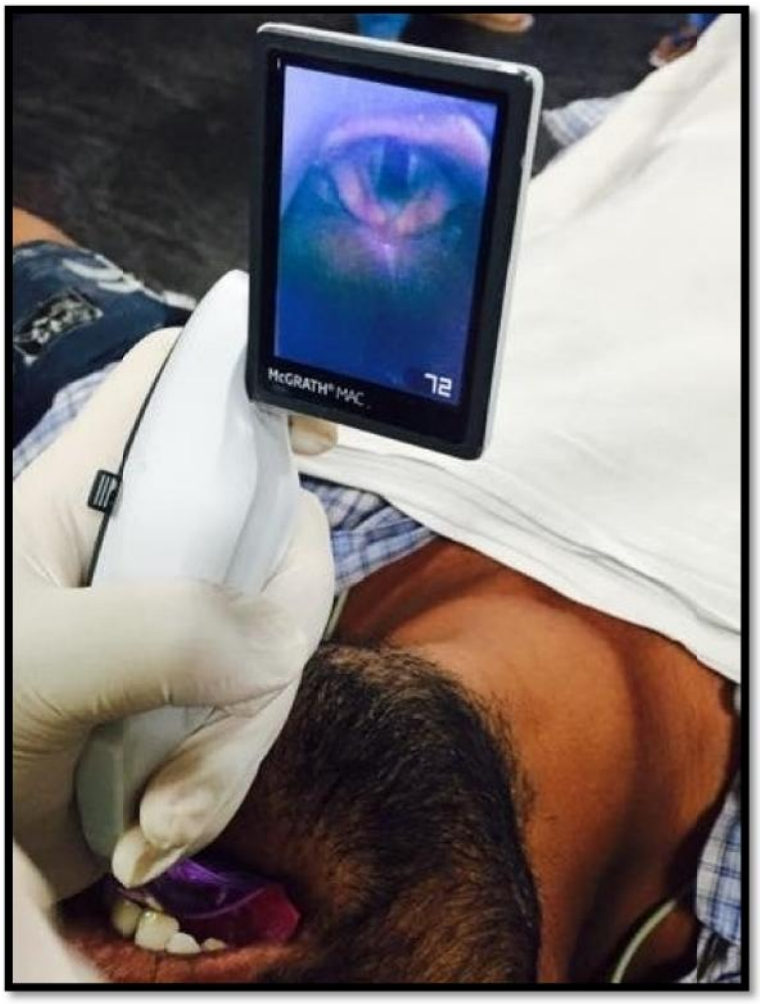
At the end of the procedure patients will be reversed with inj.glycopyrollate 0.008mg/kg and inj neostigmine 0.005mg/kg and extubated after through suctioning.

- SIGNATURE OF THE ANAESTHESIOLOGIST - _____
- SIGNATURE OF THE WITTNESS - _____
- SIGNATURE OF THE PRINCIPAL INVESTIGATOR - _____

ANNEXURE –III PHOTOGRAPHS

Photographs No.1 McGrath MAC Videolaryngoscope

Photographs No.2 Macintosh laryngoscope



Photographs No.3 Glottic view using McGrath MAC videolaryngoscope

GROUP- A

S.NO	IP NUMBER	AGE	GENDER	Height(cm)	Weight(kg)	ADS	TOTAL IDS	IDS	TIME	CL GARDE	LIFTING FORCE	PRESSURE APPLIED
1	A800284	48	MALE	162	64	7	1	S DIFFICULT	32SEC	0	NIL	1
2	801568	49	MLAE	168	64	7	1	S DIFFICULT	32 SEC	0	NIL	1
3	801629	45	MALE	160	66	7	1	S DIFFICULT	30 SEC	0	NIL	1
4	801618	42	MALE	162	64	7	1	S DIFFICULT	28 SEC	0	NIL	1
5	800318	27	FEMALE	160	54	7	0	EASY	28 SEC	0	NIL	1
6	800557	21	FEMALE	156	46	6	0	EASY	22SEC	0	NIL	NIL
7	799247	39	FEMALE	152	64	6	0	EASY	24SEC	0	NIL	NIL
8	800389	18	FEMALE	158	56	7	0	EASYT	26 SEC	0	NIL	NIL
9	800513	38	FEMALE	152	60	7	1	S DIFFICULT	34SEC	0	NIL	1
10	800594	21	FEMALE	156	62	6	0	EASY	22SEC	0	NIL	NIL
11	800376	40	MALE	160	66	7	1	S DIFFICULT	30SEC	0	NIL	NIL
12	788906	50	FEMALE	150	46	6	0	EASY	22SEC	0	NIL	NIL
13	799673	49	FEMALE	156	46	7	1	S DIFFICULT	26SE	0	NIL	NIL
14	798254	32	MALE	154	54	6	0	EASY	20SEC	0	NIL	NIL
15	796771	18	MALE	160	60	6	0	EASY	20SEC	0	NIL	NIL
16	794420	45	FEMALE	162	48	7	0	EASY	26SEC	0	NIL	NIL
17	797848	30	FEMALE	156	58	6	0	EASY	18SEC	0	NIL	NIL
18	764739	32	FEMALE	150	53	7	2	S DIFFICULT	36SEC	1	NIL	1
19	788744	18	FEMALE	156	50	6	0	EASY	20SEC	0	NIL	NIL
20	789842	50	MALE	160	80	8	2	S DIFFICULT	34SEC	0	1	1
21	787899	50	FEMALE	158	58	7	0	EASY	18SEC	0	NIL	NIL
22	789300	49	MALE	164	60	7	1	S DIFFICULT	26SEC	0	NIL	1
23	788238	18	FEMALE	158	52	7	1	S DIFFICULT	25SEC	0	NIL	1
24	783576	19	FEMALE	155	45	6	0	EASY	24SEC	0	NIL	NIL
25	782126	27	FEMALE	150	60	7	0	EASY	20SEC	0	NIL	NIL
26	782384	27	MALE	162	63	7	0	EASY	18SEC	0	NIL	NIL
27	775648	25	FEMALE	150	54	6	0	EASY	20SEC	0	NIL	NIL
28	775552	50	MALE	163	60	8	1	S DIFFICULT	25SEC	0	NIL	1

29	776608	50	FEMALE	150	52	7	0	EASY	18SEC	0	NIL	NIL
30	779265	50	FEMALE	150	28	7	2	S DIFFICULT	28SEC	0	NIL	NIL
31	778938	49	MALE	160	48	6	1	S DIFFICULT	22SEC	0	NIL	1
32	778354	26	MALE	164	66	6	0	EASY	18SEC	0	NIL	NIL
33	765346	17	MALE	160	75	8	3	S DIFFICULT	38SEC	0	1	1
34	769172	22	FEMALE	156	50	6	0	EASY	18SEC	0	NIL	NIL
35	776978	28	FEMALE	150	50	7	0	EASY	15SEC	0	NIL	NIL
36	773412	38	FEMALE	154	78	7	0	EASY	15SEC	0	NIL	NIL
37	763971	49	MALE	154	54	6	1	S DIFFICULT	25SEC	0	NIL	1
38	762596	43	MALE	158	56	7	1	S DIFFICULT	28SEC	0	NIL	1
39	799094	50	FEMALE	150	66	7	1	S DIFFICULT	30SEC	0	NIL	1
40	776250	50	FEMALE	148	60	6	0	EASY	20SEC	0	NIL	NIL
41	775522	49	MALE	160	70	7	2	S DIFFICULT	26SEC	1	NIL	1
42	768791	30	MALE	156	74	7	2	S DIFFICULT	25SEC	1	NIL	1
43	769161	21	MALE	162	74	7	1	EASY	20SEC	0	NIL	1
44	764922	30	FEMALE	150	45	6	1	S DIFFICULT	30SEC	0	NIL	1
45	763995	26	MALE	156	42	6	2	S DIFFICULT	25SEC	1	NIL	1
46	788942	31	FEMALE	150	75	7	1	S DIFFICULT	26SEC	0	NIL	NIL
47	787862	30	FEMALE	168	50	6	0	EASY	20SEC	0	NIL	NIL
48	788391	30	FEMALE	154	67	7	2	S DIFFICULT	30SEC	1	NIL	1
49	764617	28	FEMALE	145	42	6	2	S DIFFICULT	35SEC	1	1	1
50	788676	21	FEMALE	150	49	7	0	EASY	20SEC	0	NIL	NIL

GROUP- B

S.NO	IP NUMBER	AGE	GENDER	Height(cm)	Weight(kg)	ADS	TOTAL IDS	IDS	TIME	CL GRADE	LIFTING FORCE	PRESSURE APPLIED	ALTERNATIVE USED
51	B 793111	28	FEMALE	152	65	7	4	S DIFFICULT	42SEC	2	1	1	
52	793065	29	FEMALE	155	66	7	5	S DIFFICULT	42SEC	2	1	1	1
53	791598	38	MALE	166	60	7	4	S DIFFICULT	38SEC	2	1	1	
54	793976	50	MALE	162	67	7	3	S DIFFICULT	40SEC	1	1	1	
55	793947	20	MALE	158	58	6	3	S DIFFICULT	38SEC	1	1	1	
56	798526	49	MALE	167	68	6	5	S DIFFICULT	40SEC	2	1	1	1
57	794860	18	MALE	158	50	7	3	S DIFFICULT	38SEC	2	NIL	1	
58	795103	48	MALE	160	60	7	5	S DIFFICULT	42SEC	2	1	1	1
59	794105	49	MALE	165	65	7	4	S DIFFICULT	40SEC	2	1	1	
60	791716	48	MALE	162	60	7	4	S DIFFICULT	40SEC	2	1	1	
61	794323	23	MALE	164	64	6	4	S DIFFICULT	38SEC	2	1	1	
62	796186	38	FEMALE	152	62	6	3	S DIFFICULT	36SEC	1	1	1	
63	765565	35	FEMALE	156	48	6	3	S DIFFICULT	38SEC	2	NIL	1	
64	799857	35	FEMALE	150	56	7	4	S DIFFICULT	38SEC	2	1	1	
65	775203	50	FEMALE	150	56	7	4	S DIFFICULT	40SEC	2	1	1	
66	776448	18	FEMALE	148	28	6	3	S DIFFICULT	38SEC	2	NIL	1	
67	775333	22	FEMALE	152	60	6	3	S DIFFICULT	40SEC	2	NIL	1	
68	778808	50	MALE	160	58	7	4	S DIFFICULT	36SEC	2	1	1	
69	786432	49	MALE	168	68	7	5	S DIFFICULT	40SEC	2	1	1	1
70	791450	32	MALE	160	68	7	4	S DIFFICULT	40SEC	2	1	1	
71	790448	52	FEMALE	158	60	7	4	S DIFFICULT	38SEC	2	1	1	
72	779553	26	MALE	164	60	7	4	S DIFFICULT	36SEC	2	1	1	
73	782210	49	FEMALE	154	58	7	4	S DIFFICULT	40 SEC	2	1	1	
74	782524	32	MALE	164	70	7	4	S DIFFICULT	35SEC	2	1	1	
75	783369	50	FEMALE	156	61	7	4	S DIFFICULT	36SEC	2	1	1	
76	784783	30	FEMALE	154	62	6	4	S DIFFICULT	42SEC	1	NIL	1	
77	796096	50	FEMALE	154	65	7	4	S DIFFICULT	36SEC	2	1	1	
78	794145	37	FEMALE	158	64	7	4	S DIFFICULT	40SEC	2	1	1	
79	792155	30	MALE	163	68	7	4	S DIFFICULT	39 SEC	2	1	1	
80	785607	28	MALE	164	70	7	4	S DIFFICULT	43SEC	2	1	1	
81	792134	20	MALE	158	60	7	6	S DIFFICULT	42SEC	3	1	1	1
82	791491	50	MALE	158	56	7	4	S DIFFICULT	38SEC	2	1	2	
83	792268	50	MALE	163	56	7	4	S DIFFICULT	40SEC	2	1	1	

84	797843	48	FEMALE	148	50	6	3	S DIFFICULT	36SEC	2	NIL	1	
85	797828	30	FEMALE	150	60	6	4	S DIFFICULT	40SEC	2	1	1	
86	775654	50	MALE	162	60	6	3	S DIFFICULT	36SEC	1	1	1	
87	794122	48	MALE	160	60	6	3	S DIFFICULT	38SEC	1	1	1	
88	786243	49	FEMALE	150	54	6	4	S DIFFICULT	40SEC	2	1	1	
89	802466	35	MALE	165	70	6	4	S DIFFICULT	42SEC	2	1	1	
90	802766	36	FEMALE	160	90	9	6	M DIFFICULT	44SEC	3	1	1	1
91	797117	40	FEMALE	158	68	7	5	S DIFFICULT	38SEC	2	1	1	1
92	797895	48	MALE	166	68	6	5	S DIFFICULT	38SEC	2	1	1	1
93	797706	49	MALE	168	64	6	3	S DIFFICULT	36SEC	1	1	1	
94	798611	50	FEMALE	160	68	7	4	S DIFFICULT	40SEC	2	1	1	
95	798702	50	MALE	167	60	7	4	S DIFFICULT	40SEC	2	1	1	
96	800681	30	FEMALE	154	60	6	3	S DIFFICULT	36SEC	1	1	1	
97	801954	50	MALE	168	70	7	3	S DIFFICULT	38SEC	1	1	1	
98	803770	49	MALE	169	75	7	2	S DIFFICULT	32SEC	1		1	
99	801820	50	MALE	164	68	7	4	S DIFFICULT	38SEC	2	1	1	
100	797001	44	FEMALE	152	58	7	4	S DIFFICULT	38SEC	2	1	1	

GROUP- C

S.NO	IP NUMBER	AGE	GENDER	Height(cm)	Weight(kg)	ADS	TOTAL IDS	IDS	TIME	CL GRADE	LIFTING FORCE	PRESSURE APPLIED
101	C792662	40	MALE	160	70	7	1	S DIFFICULT	30SEC	0	NIL	1
102	790652	49	MALE	158	56	6	0	EASY	30SEC	0	NIL	NIL
103	792201	21	FEMALE	164	56	6	1	S DIFFICULT	30SEC	1	NIL	NIL
104	792113	16	MALE	158	40	6	0	EASY	28SEC	0	NIL	NIL
105	794129	50	MALE	154	56	6	1	S DIFFICULT	26SEC	1	NIL	NIL
106	795233	18	FEMALE	158	50	6	0	EASY	30SEC	0	NIL	NIL
107	796895	21	FEMALE	155	48	6	1	S DIFFICULT	31SEC	1	NIL	NIL
108	790142	20	MALE	160	62	6	0	EASY	25SEC	0	NIL	NIL
109	791432	32	FEMALE	152	54	7	2	S DIFFICULT	32SEC	1	NIL	1
110	790442	52	FEMALE	160	52	7	0	EASY	30SEC	0	NIL	NIL
111	792444	49	FEMALE	150	48	6	0	S DIFFICULT	28SEC	0	NIL	NIL
112	792014	20	MALE	156	68	7	0	EASY	25SEC	0	NIL	NIL
113	792434	25	FEMALE	154	45	6	1	S DIFFICULT	30SEC	1	NIL	NIL
114	792328	35	FEMALE	154	60	7	1	S DIFFICULT	28SEC	1	NIL	NIL
115	790214	50	FEMALE	152	60	7	1	S DIFFICULT	28SEC	0	NIL	1
116	790223	42	MALE	150	56	7	0	EASY	22SEC	0	NIL	NIL
117	792555	20	FEMALE	160	60	7	0	EASY	28SEC	0	NIL	NIL
118	781934	31	FEMALE	154	64	6	0	EASY	24SEC	0	NIL	NIL
119	780805	32	MALE	166	66	7	1	S DIFFICULT	32SEC	0	NIL	1
120	781764	50	MALE	162	60	6	1	S DIFFICULT	30SEC	0	NIL	1
121	781920	18	MALE	160	45	7	0	S DIFFICULT	22SEC	0	NIL	0
122	762269	37	MALE	162	68	7	1	S DIFFICULT	28SEC	0	NIL	1
123	782718	48	FEMALE	158	60	6	1	S DIFFICULT	32SEC	0	NIL	1
124	783220	54	MALE	164	70	7	1	S DIFFICULT	32SEC	1	NIL	1
125	792662	50	MALE	162	66	7	0	EASY	30SEC	0	NIL	0
126	802612	50	FEMALE	158	58	7	1	S DIFFICULT	26SEC	0	NIL	1
127	863803	38	MALE	166	70	6	0	EASY	28SEC	0	NIL	0
128	803961	48	MALE	164	66	7	1	S DIFFICULT	28SEC	0	NIL	1

129	803142	35	FEMALE	154	63	7	0	EASY	24SEC	0	NIL	0
130	800170	38	FEMALE	162	68	7	1	S DIFFICULT	28SEC	0	NIL	1
131	802660	25	FEMALE	155	50	7	0	EASY	28SEC	0	NIL	0
132	806377	50	FEMALE	152	54	7	0	EASY	28SEC	0	NIL	0
133	801927	50	FEMALE	158	64	7	0	EASY	26SEC	0	NIL	0
134	803255	48	FEMALE	155	50	6	1	S DIFFICULT	28SEC	0	NIL	1
135	803483	48	MALE	169	68	7	0	EASY	28SEC	0	NIL	0
136	801432	48	FEMALE	150	60	6	1	S DIFFICULT	30SEC	0	NIL	1
137	776608	38	FEMALE	154	52	7	0	EASY	30SEC	0	NIL	0
138	790727	26	FEMALE	158	58	7	0	EASY	28SEC	0	NIL	0
139	788152	46	MALE	156	50	7	1	S DIFFICULT	30SEC	1	NIL	0
140	780730	45	FEMALE	155	60	7	1	S DIFFICULT	32SEC	0	NIL	1
141	799609	26	FEMALE	150	65	7	1	S DIFFICULT	28SEC	0	NIL	1
142	775978	22	FEMALE	146	56	6	0	EASY	28SEC	0	NIL	0
143	797141	40	FEMALE	150	62	7	1	S DIFFICULT	33SEC	0	NIL	1
144	795476	46	MALE	160	63	7	0	EASY	28SEC	0	NIL	0
145	806582	18	MALE	158	60	6	0	EASY	26SEC	0	NIL	0
146	809125	48	FEMALE	166	65	7	1	S DIFFICULT	30SEC	0	NIL	1
147	808167	45	MALE	168	65	7	1	S DIFFICULT	30SEC	0	NIL	1
148	808502	50	MALE	167	66	8	2	S DIFFICULT	33SEC	1	NIL	1
149	804204	46	FEMALE	154	65	7	1	S DIFFICULT	28SEC	0	NIL	1
150	808076	47	FEMALE	158	68	7	1	S DIFFICULT	26SEC	0	NIL	1

ANNEXURE-V

KEY TO MASTER CHART

CMS	-	centimetre
Kg	-	kilograms
ADS	-	Airway difficulty Score
IDS	-	Intubation Difficulty Score
Sec	-	seconds
CL	-	Cormack Lehane
S Difficult	-	Slightly difficult

ANNEXURE – VI – ETHICAL CLEARANCE LETTER

K.L.E.U.NIVERSITY'S
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)
(Accredited 'A' Grade by NAAC)

Website: http//www.jnmc.edu
E-Mail : dome@jnmc.edu

Phone: (+ 91-(0)831 Office : 2471350
Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref: MDC/DOME/ 28 **Date: 17/10/2016**

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"TO COMPARE THE EASE OF TRACHEAL INTUBATION USING MC GRATH MAC VIDEOLARYNGOSCOPE IN DIRECT AND INDIRECT MODES WITH THE STANDARD MACINTOSH LARYNGOSCOPE: A ONE YEAR RANDOMISED CLNICAL TRIAL",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Arathi Darshan)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

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