# "EFFECT OF BENZYDAMINE HYDROCHLORIDE [0.15%] SPRAY AND LIDOCAINE HYDROCHLORIDE [10%] SPRAY ON ENDOTRACHEAL TUBE CUFF IN REDUCING POSTOPERATIVE SORE THROAT, HOARSENESS OF VOICE, AND COUGH –A RANDOMISED CLINICAL TRIAL"

**By**

**REG.NO: BA0120019**

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**JAWAHARLAL NEHRU MEDICAL COLLEGE**

**BELAGAVI, KARNATAKA**

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**KLE Academy of Higher Education & Research**
**[Deemed to be University], Belagavi, Karnataka**

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## ACCEPTANCE LETTER

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Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"A COMPARATIVE STUDY BETWEEN BENZYDAMINE HYDROCHLORIDE (0.15%) SPRAY AND LIDOCAINE HYDROCHLORIDE (10%) SPRAY ON ENDOTRACHEAL TUBE CUFF IN REDUCING POST-OPERATIVE SORE THROAT, HOARSENESS OF VOICE AND COUGH- A ONE YEAR RANDOMISED CLINICAL TRIAL ",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

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

**(Dr. Harsha Hegde)**
Chairman,
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# ABSTRACT

**TITLE:** "EFFECT OF BENZYDAMINE HYDROCHLORIDE [0.15%] SPRAY AND LIDOCAINE HYDROCHLORIDE [10%] SPRAY ON ENDOTRACHEAL TUBE CUFF IN REDUCING POSTOPERATIVE SORE THROAT, HOARSENESS OF VOICE, AND COUGH –A RANDOMISED CLINICAL TRIAL"

**INTRODUCTION:** Endotracheal intubation is a gold standard procedure followed in airway management to secure and maintain a definitive airway in patients undergoing surgery under general anesthesia. Postoperative sore throat [POST] is a common adverse event after general anesthesia with an incidence varying from 40% to 99%. Sore throat comprises symptoms of laryngitis, tracheitis, hoarseness, and cough. The symptoms are a result of mucosal injury with resulting inflammation caused by the process of airway instrumentation [i.e., laryngoscopy and suctioning] or the irritating effects of a foreign object [i.e., endotracheal tube].

**AIM:** To compare the effectiveness of 0.15% benzydamine hydrochloride puffs at the cuff level of the endotracheal tube with that of 10% lidocaine hydrochloride puffs in reducing the incidence and severity of postoperative sore throat, hoarseness of voice, and cough in patients undergoing general anesthesia with endotracheal intubation.

**METHODS:** A total of 60 patients of ASA [I, II];18-60yrs of age, undergoing elective surgery under general anaesthesia, were enrolled after obtaining written informed consent. They were randomly allocated into two groups of 30 each. Group A- 10 puffs of benzydamine hydrochloride 0.15% [alcohol-free in brilliant blue FCF aqueous base] were sprayed on the endotracheal tube cuffs, which contained approximately 1.5 mg of benzydamine hydrochloride., Group B- 10 puffs of 10% lidocaine hydrochloride [ethanol I.P and flavoured base] was sprayed on the endotracheal tube cuffs, which contained approximately 100 mg lidocaine hydrochloride. Patients were evaluated postoperatively for incidence and severity of sore throat, cough, and hoarseness of voice for 24hrs at a regular time interval. Analysis of data was done using student paired, chi-square test.

**RESULTS:** In this study group the overall incidence of POST was 18.95%, highest in the lignocaine group [26.25%], being statistically significant, maximum severity [Grade 2] was seen in the lignocaine group [36.67%], the incidence of hoarseness of voice was 20.41%, with maximum severity [Grade 2] being in lignocaine group [13.33%], the incidence of cough was 8.1%, with maximum severity [Grade 2] being in lignocaine group [8.3%]. No adverse effects were observed.

**CONCLUSION:** In conclusion to our study, we noted that the incidence and severity of post-operative sore throat, hoarseness of voice, and cough were significantly reduced in the Benzydamine group when compared to the lignocaine group.



**KEYWORDS:** Post-operative sore throat, Benzydamine hydrochloride, Lignocaine hydrochloride, Endotracheal tube cuff.

# LIST OF ABBREVIATIONS USED

| | | |
|---|---|---|
| IV | - | Intravenous |
| ASA | - | American Society of Anaesthesiologists |
| BMI | - | Body Mass Index |
| BP | - | Blood Pressure |
| HR/PR | - | Heart rate/ Pulse rate |
| cm | - | Centimetre |
| mm | - | Millimetre |
| ID | - | Internal Diameter |
| CNS | - | Central Nervous System |
| CVS | - | Cardio-Vascular System |
| ETT | - | Endotracheal Tube |
| GIT | - | Gastro-Intestinal tract |
| Kg | - | Kilogram |
| mg | - | Milligram |
| mcg | - | Microgram |
| RR | - | Respiratory rate |
| RS | - | Respiratory System |
| MPG | - | Mallampati Grading |
| O2 | - | Oxygen |
| N2O | - | Nitrous oxide |
| Inj | - | Injection |
| Gp/G | - | Group |
| S. D | - | Standard Deviation |

| | | |
|---|---|---|
| POST | - | Post-Operative Sore Throat |
| PVC | - | Poly Vinyl Chloride |
| URTI | - | Upper Respiratory Tract Infection |
| COPD | - | Chronic Obstructive Pulmonary Disease |
| OT | - | Operation Theatre |
| Mins | - | Minutes |
| Hrs | - | Hours |
| MAP | - | Mean Arterial Pressure |
| NS | - | Not significant |
| S | - | Significant |

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# INTRODUCTION

For patients undergoing surgery under general anaesthesia, endotracheal intubation is the gold standard approach used in airway management to establish and maintain a definitive airway [01]. Postoperative sore throat [POST] is a common adverse event after general anesthesia with an incidence of around 45% [02]. Sore throat comprises symptoms of laryngitis, tracheitis, hoarseness, and cough. The symptoms are brought on by a foreign item or the unpleasant effects of airway instruments [such as laryngoscopy and suctioning], which cause mucosal injury and subsequent inflammation [i.e., endotracheal tube]. [03]

The stimulation of tracheal pain receptors causes sore throat post-surgical procedure [04]. A variety of non-pharmacological and pharmacological methods had been used to prevent or reduce the incidence of postoperative sore throat. Prophylactic interventions such as the use of anti-inflammatory drugs, opioids, steroids, and local anaesthetics have been employed extensively. Studies have indicated that lubricating the endotracheal tube can reduce post-operative cough, hoarseness of voice, and sore throat [ETT] with lignocaine jelly or by spraying topical lignocaine to the airway or use of ketamine, 10% lignocaine sprays, steroids or benzydamine hydrochloride. [05,06,07,08,09]

A topical nonsteroidal anti-inflammatory medication [NSAID] with analgesic, antipyretic, and antibacterial effects is benzydamine hydrochloride, with the least systemic absorption, decreasing the chances of its systemic toxicity. The effectiveness of the use of benzydamine hydrochloride oral rinse [0.15%] in the management of acute sore throat is documented.[10]

Researchers have looked at how well the preventive use of benzydamine hydrochloride spray on the endotracheal tube affects the frequency and intensity of postoperative cough, hoarseness, and sore throat.[11]

Hence, we used Benzydamine hydrochloride spray in comparison with lignocaine spray in minimizing the frequency and intensity of postoperative cough, hoarseness, and sore throat after being awakened from general anaesthesia.

# OBJECTIVES OF STUDY

PRIMARY OBJECTIVE:

The incidence and severity of postoperative sore throat, hoarseness of voice, and cough in patients having general anaesthesia with endotracheal intubation must be compared between 0.15% benzydamine hydrochloride and 10% lidocaine hydrochloride puffs at the cuff level of the endotracheal tube.

SECONDARY OBJECTIVE:

To note down any peri-operative complications such as laryngospasm, hypotension, hypertension, and arrhythmias.

# REVIEW OF LITERATURE

Endotracheal intubation has been connected to morbidities like a sore throat, hoarseness of the voice, a cough, postoperative nausea and vomiting. Therefore, the objective of this study is to determine how well the medications reduce the likelihood of developing specific morbidities. [01]

Hippocrates [460-380 BC] described tracheal intubation in humans for breathing support in Greece. Dr. Charles Kite, a surgeon, developed the first ETT in 1778 and reported inserting a catheter into the nares or mouth of drowning victims to resuscitate them.[18]

William MacEwan, a Scottish surgeon, was the first to employ elective oral intubation in the year 1880.[19]

The first person to report using a cuffed ETT and the idea of a pilot balloon to assess intracuff pressure was Eisenmenger in 1893. [Reintroduced in 1939 by Langton Hewer].[20]

Janeway [1913] described their laryngoscopy experiences, setting the path for the invention and widespread use of flexible rubber tubes. They utilized insufflation, an anaesthetic technique in which exhaled gas flowed around the outside of a small tube as gas was blasted into the lungs.[20]

The expandable cuff was restored to Magill's rubber tube [1931] by Guedel [1928] and Waters [1929]. Their first cuffs were constructed of condoms and rubber glove fingers. These Cuffs measuring 3 to 4 inches long were made to sit midway above and midway below the glottis. They created 1.5-inch-long rubber dental dam restraints that rested behind the vocal cords.[21]

In the 1960s, rubber was phased out of ETT in favour of plastic. The late 1960 saw the introduction of HVLP [high-volume, low-pressure] cuffs. Manufacturers developed a PVC-cuffed HVLP ETT in 1970, now become the industry standard.[22]

Although HPLV cuffs are still accessible, they are not widely used. Red rubber tubes were manufactured of thick, low compliance rubber. These cuffs required a lot of strain to distend and had little volume. Rather than adapting to the contour of the trachea, these cuffs inflate in a circular shape. These cuffs feature a low residual volume and a tiny diameter at rest. It makes a small area of contact with the tracheal membrane causing the trachea to stretch and deform into a circular shape. Relative overinflation was required to achieve adequate contact with the tracheal wall and an acceptable seal, resulting in high pressure within the cuff being transmission.

HPLV cuffs caused tracheal injury, particularly during extended intubations. There were reports of tracheal rupture, stenosis, tracheoesophageal fistula, and tracheal dilatation. The difficulties were caused by the pressure that built up inside the HPLV cuff. The HPLV is less compliant, causing the trachea to deform. The pressure within this sort of cuff is unrelated to the pressure on the lateral wall. The initial pressure required to expand the less compliant cuff material is the reason for this. This resulted in a rise in mucosal pressure to critical levels, which could result in mucosal ischemia, tracheal scarring, and tracheal stenosis if left untreated. These cuffs offer superior protection against aspiration, improved visibility during intubation, and a reduced incidence of the sore throat than low-pressure cuffs.[23]

In their 184-student randomised clinical experiment, P. J. JENSEN et al. demonstrated that low-volume, high-pressure cuffs caused sore throats less frequently than high-volume, low-pressure cuffs, as long as intracuff volumes were kept at the "just-seal" level throughout anaesthesia. This benefit vanished when intracuff pressure in the low-volume, high-pressure cuffed tubes was raised and allowed to rise.[24]

Postoperative sore throat [POST] is a common side effect following general anaesthesia. Preventive intervention is nevertheless recommended to enhance the quality of post-anesthesia care by minimising the frequency and severity of the symptoms, even when

they go away on their own without therapy. POST refers to a group of signs and symptoms that include laryngitis, tracheitis, hoarseness, cough, and dysphagia. Difficult intubation, it is indicated, does not significantly enhance the risk of POST. Younger patients, gynaecological surgery, a large tracheal tube, cuff design, intracuff pressure, and a throat pack have all been linked to a higher risk of POST. [25]

Everyday intubation for normal surgical operations might create pathological changes that may give an organic basis for patients' postoperative throat discomfort, which is less known. POST may be caused by a lack of airway humidity, trauma during airway insertion, suctioning, high anaesthetic air flow rates, and surgical manipulation of the airway and associated tissue. Neuropraxia of the recurrent laryngeal nerve due to high intracuff pressure and nerve demyelination due to gas sterilization of the tubes are two possible explanations. [23]

POST can be reduced by employing a multi-modal approach that includes both non-pharmacological and pharmaceutical therapies, according to research. Some risk factors, such as sex, duration of surgery, use of the nasogastric tube, and surgical positioning, are beyond the anaesthesia provider's control. The identification of factors linked to a higher risk of POST, on the other hand, will allow anaesthesia providers to avoid combinations of controllable factors, lowering the incidence of POST and improving patients' anaesthetic outcomes. [23]

Various pharmacological treatments, including lignocaine, steroids, and ketamine, have been used to lower the occurrence and intensity of POST with varying degrees of success. [12,13,14,15]

Lehman et al.22, demonstrated in his interview-based questionnaire for 7440 patients mucosal damage occurring at the cuff level during general anaesthesia with endotracheal intubation is a significant contributing cause of tracheal irritation, which leads to postoperative sore throat, hoarseness of voice, and cough. [25]

Kuriyama et al. in his metanalysis of thirteen randomised controlled trials involving 1842 patients noted the presence of sore throat after anesthesia can contribute to patients' dissatisfaction with anesthesia and interfere with their return to daily activities, including eating and drinking. [26]

Huang et al. observed in thirty patients who underwent gynaecological laparoscopic surgery and 30 patients who underwent laparotomy under general anesthesia with endotracheal intubation that alkalizing lidocaine can increase in vitro diffusion by tens of times across the endotracheal tube cuff. The approach would be more effective if lidocaine was alkalized and surgery was performed for a long time. Warming the lidocaine solution can promote diffusion through the cuff membrane, therefore using a heated breathing circuit may have an added effect. [27]

Seventy-five ASA [I, II] patients were studied by Estebe JP, Dollo G et al whom underwent surgery in general anaesthesia with endotracheal intubation. They were separated into three groups of 25 each, i.e., Intracuff air, intracuff plain lidocaine and intracuff alkalinized lidocaine were used. 24hrs post extubation, incidence of POST was found to be lesser in group of patients who had received intracuff alkalinized lignocaine. [28]

Navarro et al in a prospective, double-blind trial involving 50 smoking patients undergoing surgery under general anesthesia including nitrous oxide [$N_2O$] investigated effects of intracuff alkalinized 2 percent lidocaine on emerging cough, sore throat, and hoarseness of voice. Saline/lignocaine with sodium bicarbonate were used to inflate endotracheal tube cuff. They found out that patients who had received intracuff lignocaine were superior to the ones who had received intracuff saline. In Post anaesthesia care unit, the lignocaine group had a significantly reduced incidence of POST. [29]

Fai Lam, Yu-Cih Lin, and colleagues conducted a meta-analysis of 19 randomised clinical trials investigating the outcome of intracuff lignocaine vs air/ saline involving 1566

patients receiving general anaesthesia with endotracheal intubation and found that incidence of POST, coughing, agitation, hoarseness, and dysphonia were significantly lower in the intracuff lignocaine group of patients. POST severity and the emerging phenomenon was also much reduced. [30]

PapuNath et al, undertook a prospective double-blind randomised controlled experiment to check if alkalinized lignocaine may lessen incidence of cough post extubation in 120 min procedure. Patients were divided in to 2 groups: one which was prefilled with alkalinized lignocaine [8.4%] or with normal saline 90 mins prior procedure. Prior intubation, the cuffs were promptly emptied. Following intubation, 2 mL of lignocaine 2% or 2 mL of NS were injected. Additional 8.4% sodium bicarbonate or normal saline was injected into the cuff. Patient was kept in deeper plane of anaesthesia. Extubation cough was found to be 12 % alkalinized lignocaine as compared to NS [22%]. The researchers discovered that alkalinized lidocaine in the ETT cuff decreased GA emergence cough after procedures lasting an average of little less than 1 hour. [31]

Gajal Lakhe et.al demonstrated in a prospective observational study, 128 patients between the ages of 18 and 65 with ASA physical status I and II who were having a laparoscopic cholecystectomy were enrolled. They were divided alternately into two groups: the Study Group [maintaining anaesthesia with sevoflurane 1-2%, oxygen/nitrous oxide mixture; 40/60], and the Control Group [maintaining anaesthesia with sevoflurane 1-2%, oxygen/air mixture]. And analysed tracheal mucosal erosion happens when the cuff pressure rises over the pressure required for tracheal mucosal perfusion. This element is responsible for the post-intubation sore throat. with overall incidence of sore throat being 49.9%. [32]

Yaofei Jiang et.al in a metanalysis of fourteen RCTs totalling 1,837 patients showed a significant reduction in the incidence of POST with Dexamethasone IV 0.1-0.2 mg/Kg had no statistically significant effect on lowering the incidence of POST, however intravenous

Dexamethasone more than 0.2 mg/Kg did. Dexamethasone was therefore equally beneficial as other medications for lowering POST, including magnesium sulphate, ketamine gargle, betamethasone gel, and ketorolac. [33]

Dipanjan et.al in their prospective double-blinded randomized control trial showed that prophylactic intravenous dexamethasone 0.2mg/Kg reduced the incidence of POST at one-hour post-extubation by 30%. [05]

P. A. Sumathi et.al, in their Using either betamethasone gel [betamethasone group] or lidocaine jelly [lidocaine group] and normal saline [control group] on the tracheal tube cuff during intubation, a prospective, randomised, double-blind, controlled study compared the incidence of postoperative sore throat, cough, and hoarseness of voice after general anaesthesia showed the incidence of postoperative sore throat was 40, 100, and 100%; cough was 6, 40, and 28%; and hoarseness of voice was 4.1, 32.9 respectively. [34]

In their prospective, double-blind, randomised controlled trial, Asish Subedi et al. enrolled 180 patients who needed general anaesthesia with endotracheal intubation for more than 90 minutes. Just prior to the onset of anaesthesia, each group received one of the four intravenous medications: group L received lidocaine [1.5 mg/kg], group D received dexamethasone [8 mg], group DL received dexamethasone [8mg] along with lidocaine [1.5 mg/kg] and group NS received placebo in the form of normal saline, their results showed that intravenous Dexamethasone, with intravenous lidocaine, was effective in reducing the incidence of POST in patients requiring prolonged tracheal intubation. [35]

Ge wang et.al, in their meta-analysis of Sixty-two RCTs [at least 73% of which were double blinded] that included a total of 6708 subjects and compared different categories of drugs and/or placebos which demonstrated corticosteroids, NSAIDs, NMDA receptor antagonists [ketamine and magnesium] were associated with a reduced post-operative sore throat when compared with lidocaine group. [08]

Bechara Farah et.al, documented the use of Benzydamine hydrochloride 0.15% rinse in treatment for relief of pain from acute sore throat however its clinical effectiveness was not able to be determined by them. [10]

# BASIC SCIENCES

## ANATOMY OF UPPER AIRWAY

PHARYNX [12,13,14]

The pharynx is a wide muscular tube that forms the common upper pathway of the respiratory and alimentary tracts. Anteriorly, it is in free communication with the nasal cavity, the mouth, and the larynx, which conveniently divides it into three parts, termed the nasopharynx, oropharynx, and laryngopharynx, respectively.

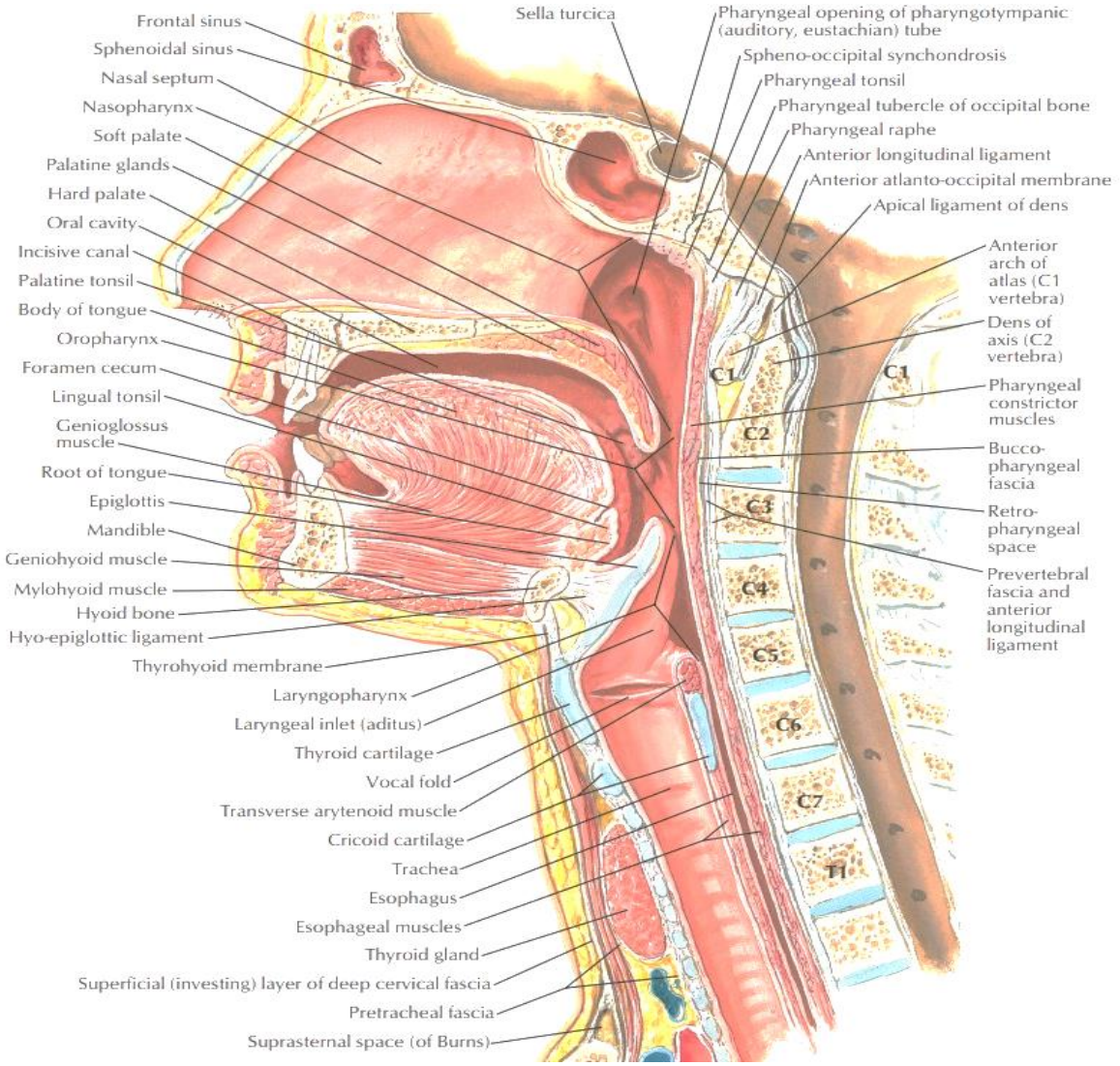



**Figure1 – Anatomy of Nasopharynx**

Nasopharynx:

The nasopharynx lies behind the nasal cavity and the soft palate. It communicates with the oropharynx through the pharyngeal isthmus. The eustachian tube, adenoids, and Fossa of Rossenmuller are the important structures present in the nasopharynx.

Extension:

Superior: Base of the skull.

Inferior: Soft palate's superior surface.

It allows free passage for respiration.

On each side, the eustachian tube opens.

Oropharynx:

The extension of the oropharynx is from the uvula to the hyoid bone.

The palatoglossal arch [that passes through the oropharyngeal isthmus] delineates the mouth and the oropharynx.

Lateral wall: Palatopharyngeal arch and palatine tonsil Laryngopharynx:

It forms the posterior part of the pharynx in its entire length.

Extension:

Superior – epiglottis

Inferior – cricoid cartilage.

Borders:

Superior: Lateral glosso-epiglottic folds - Delineates oropharynx and laryngopharynx

Inferior: continuous with the oesophagus.

On either side of the inlet of the larynx lies the pyriform fossa. Its boundaries include:

Medial: Aryepiglottic fold.

Lateral: Thyroid cartilage and thyrohyoid membrane.

Muscles of the pharynx:

Constrictors:

Superior,

Middle,

Inferior

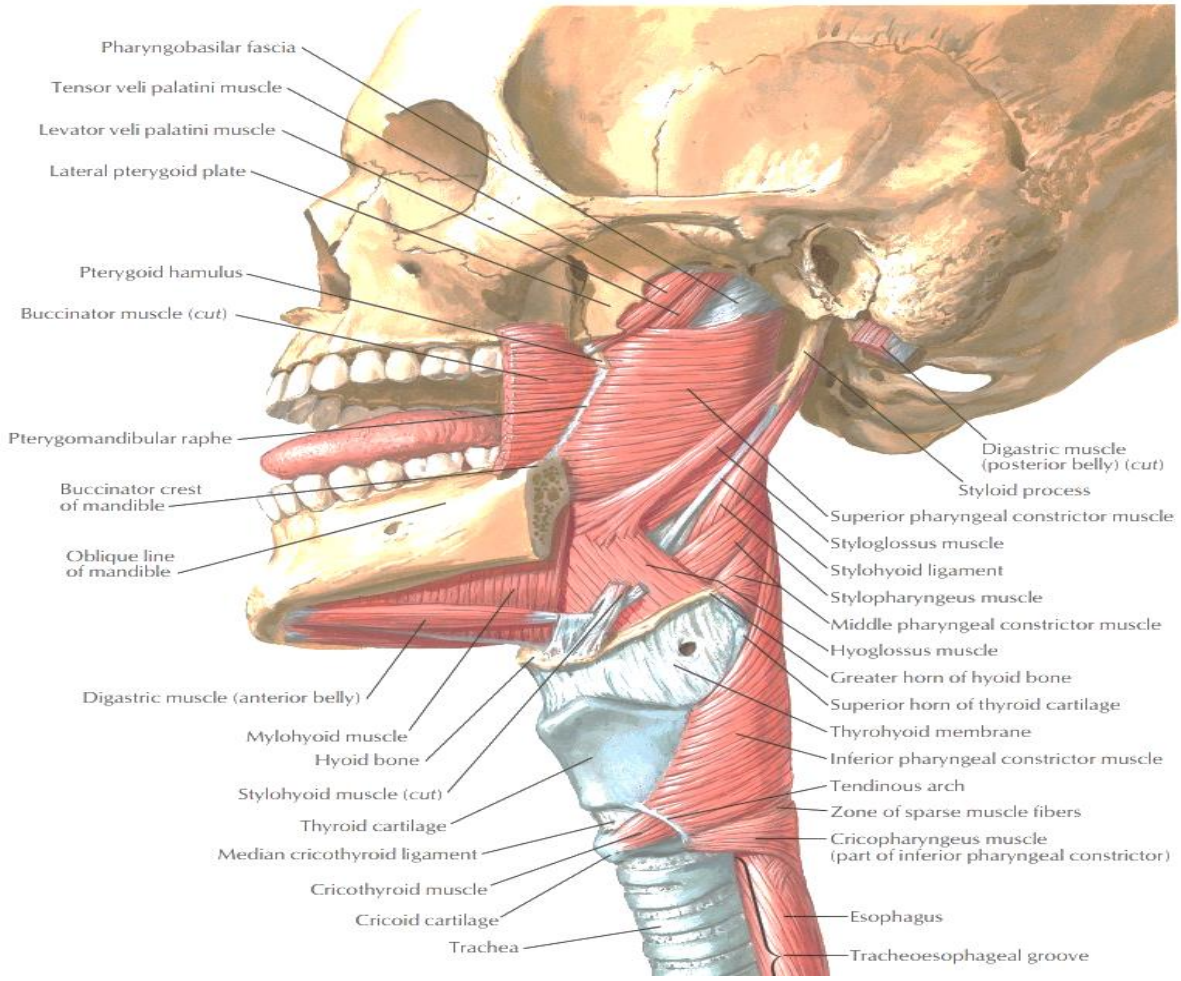



**Figure 2 – Constrictor pharyngeal muscles**

Longitudinal muscle coat:

The Palato-pharyngeus muscle,

The Stylopharyngeus muscle, and

The Salphingo-pharyngeus muscle.

Nerve supply of pharynx:

Motor: Glossopharyngeal nerve, cranial part of the accessory nerve.

Sensory: General sensation is carried by the pharyngeal branches of the glossopharyngeal nerve and palatine branches of the maxillary nerve.

Taste: The lesser petrosal nerve to the pterygopalatine ganglion [also has secretomotor innervations to the pharyngeal mucosa]

Arterial supply:

The arterial supply is provided by the lingual, facial, and maxillary arteries. Ascending pharyngeal as well as the superior thyroid artery also provides arterial supply.

Venous drainage:

Venous drainage is by both the pterygoid and the pharyngeal plexus which further drains into the internal jugular vein.

Lymphatic drainage:

Retropharyngeal lymph nodes

Upper deep cervical lymph nodes.

## LARYNX

By evolution, the larynx served as a protector of the upper airway from aspiration and later developed into an organ of phonation. It lies against the cervical vertebrae C4-6.

Various cartilages, ligaments, and muscles together form the structure of the larynx. Cartilages: Thyroid, epiglottis, cricoid, arytenoid, corniculate, and cuneiform.

Ligaments: Thyrohyoid, cricothyroid, cricotracheal, hyoepiglottic membrane. Muscles: Extrinsic- Sternothyroid, thyrohyoid, inferior constrictor.

Intrinsic-Posterior cricothyroid, lateral cricothyroid, inter arytenoid, thyroarytenoid, vocalis, and cricothyroid.

## CARTILAGES OF LARYNX

THYROID: Largest laryngeal cartilage and shaped like a shield with two laminae joining inferiorly in the midline to form a prominence commonly known as Adam's apple which is more prominent in males. The laminae have each superior and one inferior horn for articulation with other cartilages.

CRICOID: The only cartilage which forms a full circle within the trachea, shaped like a signet ring. Lying against the C6 vertebra, it forms an arch anteriorly and widens posteriorly as a lamina. The Cricoid articulates superiorly with the inferior horn of the thyroid and arytenoid.

EPIGLOTTIS: Shaped like a leaf, it is linked to the thyroid through the thyroid-epiglottic ligament. The mucous membrane of the upper part continues with that of the tongue and oropharynx forming the median and lateral glosso-epiglottic folds respectively between which lie the valecullae, a dangerous site for sharp objects like fish bones to get impacted. The hyo-epiglottic ligament links the lower part to the hyoid bone. Neonates have floppy epiglottis to protect the airway while suckling.

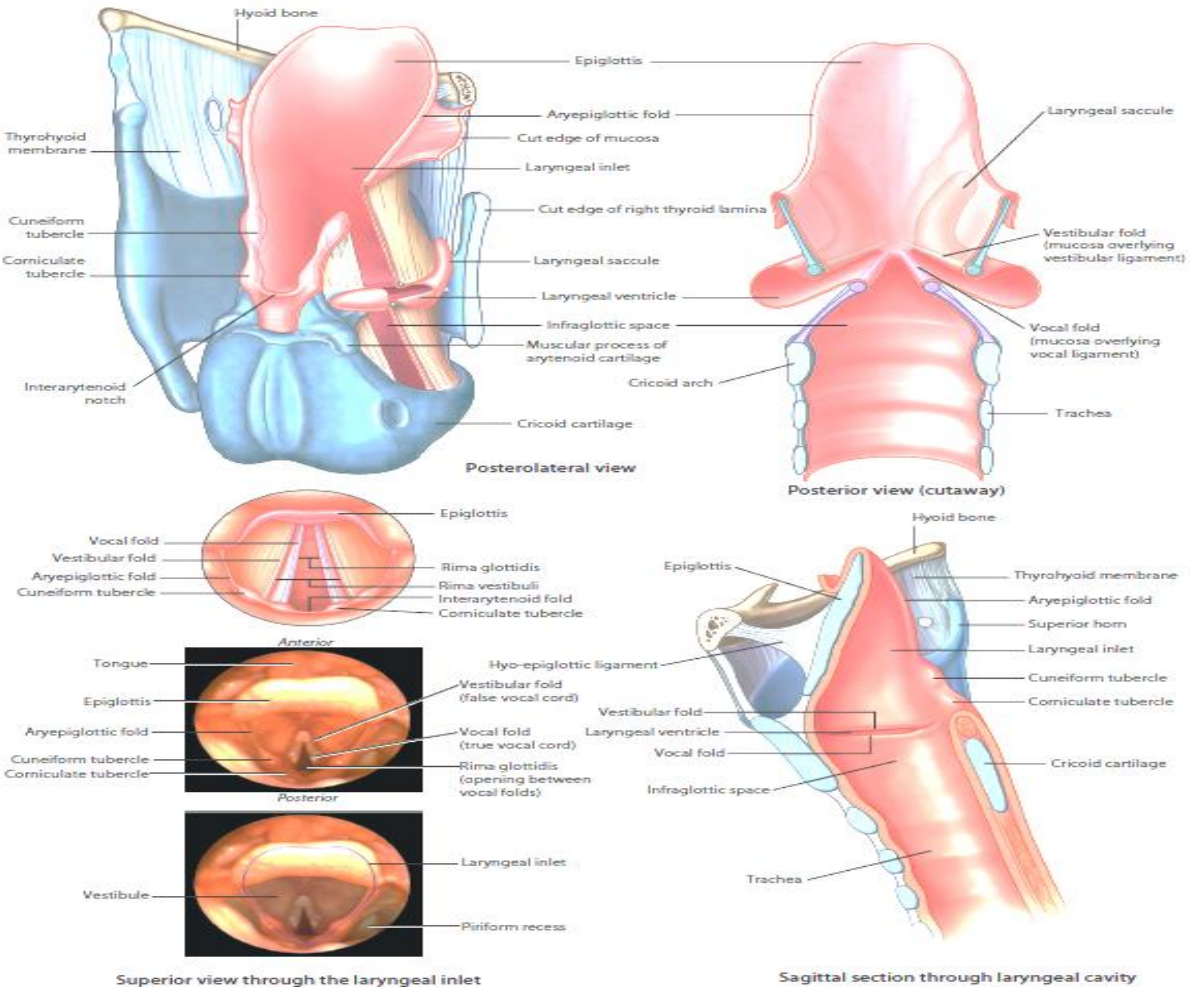



**Figure 3 – Laryngeal Cavity-Posterolateral, Posterior, Sagittal and Superior views**

ARYTENOID: They are paired pyramid-shaped cartilages lying on the posterior aspect of the cricoid. They each have a lateral process for muscular attachment and an anterior process for the vocal ligament to attach to its posterior aspect.

CUNEIFORM [Wrisberg cartilages]: These are paired cartilages present on either side of the aryepiglottic fold, supporting the vocal folds and epiglottis in its lateral aspect.

CORNICULATE [Cartilage of Santorini]: They are small, nodule-like, paired cartilages each lying on the apex of an arytenoid.

EXTRINSIC LIGAMENTS: Attach the larynx to the hyoid or trachea.

Thyrohyoid: Between the upper part of the thyroid to the posterior aspect of the hyoid.

Cricotracheal: Between the cricoid and the first ring of the trachea.

Hyoepiglottic: Between the upper aspect of the hyoid and epiglottis.

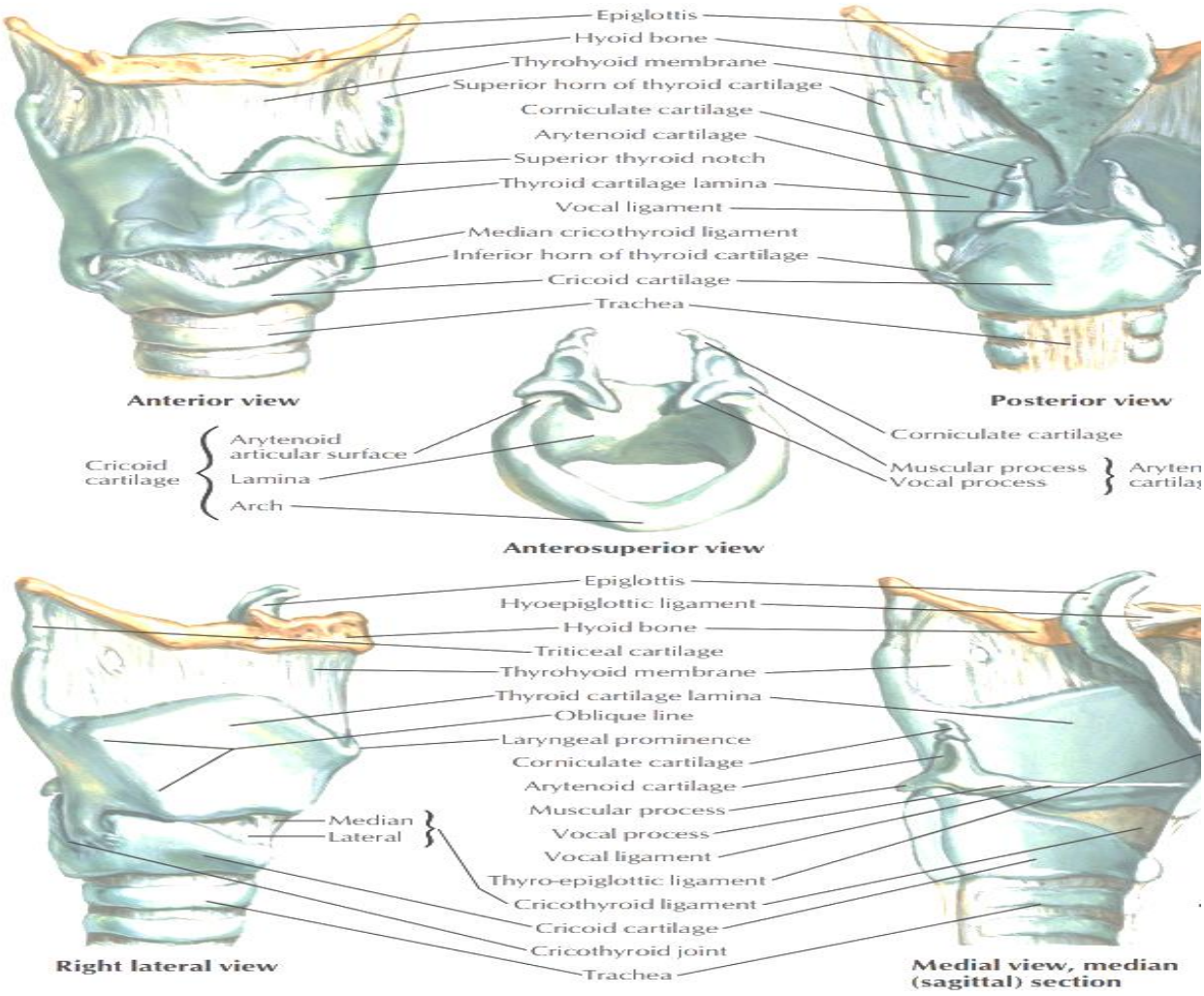



**Figure 4 – Laryngeal cartilages- Anterior, Posterior, right lateral, Sagittal and Anterosuperior views**

INTRINSIC LIGAMENTS: Connections within the larynx.

Cricothyroid membrane: Shaped like a pyramid, its apex lies on the thyroid cartilage and the base lies on the cricoid in its superior border.

Cricocorniculate: Between cricoid and corniculate.

Thyroepiglottic: Between thyroid and epiglottis.

Thyroarytenoid: Between the arytenoid and middle portion of the thyroid. The ligament is subdivided into superior and inferior ligaments in relation to vocal cords.

Arytenoidepiglottic: Between arytenoids and epiglottis.

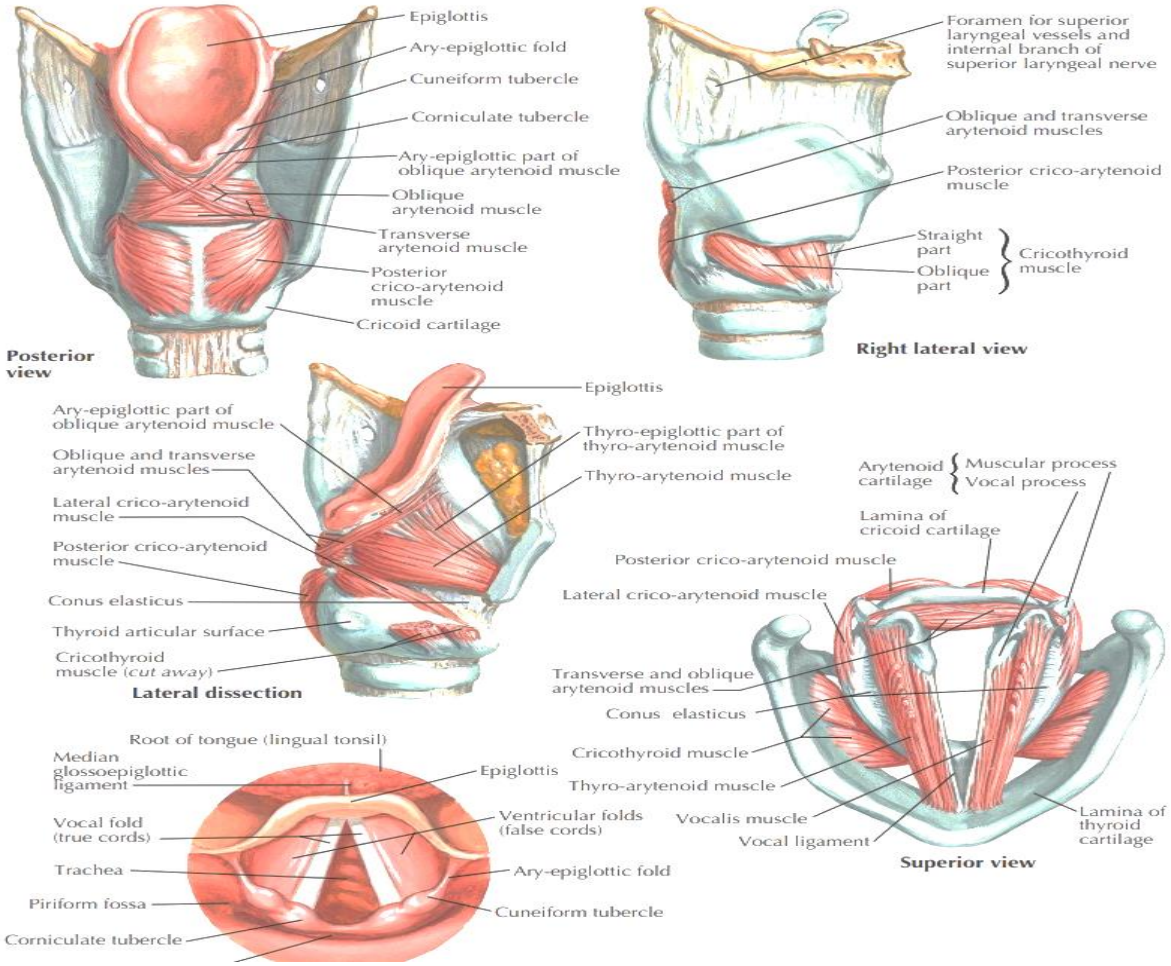



**Figure 5 - Laryngeal muscles- Posterior, right lateral and Superior views**

MUSCLES OF LARYNX: They have three functions which include closing the airway passage while swallowing, opening the inlet during respiration, and aiding in phonation.

Abductors: Posterior cricoarytenoids.

Adductors: Lateral cricoarytenoids, inter arytenoids.

Tensor: Cricothyroid.

Relaxer: Thyroarytenoid.

Fine adjustment: Vocalis

## LARYNGEAL CAVITY

Extends from the inlet of the larynx to the lower part of the cricoid. It is shaped as an inverted pyramid, with its oval base facing the tongue, apex into the trachea, two lateral parts, and one posterior part. The lateral aspects consist of the superior thyroid, middle cricothyroid, and inferior cricoid parts. The posterior part of the cavity is a part of the anterior aspect of the pharynx, consisting of two vertical recesses called pyriform sinuses. The middle portion of the laryngeal cavity, called the glottis, divides the cavity into supraglottic, glottic, and infraglottic regions. The glottic space is comprised of vocal cords, glottis, and ventricles of the larynx. The vocal cords are four in number, two lying superiorly and two inferiorly.

They attach to the thyroid anteriorly and the arytenoid posteriorly. The superiorly lying cords are relatively thin and devoid of muscles hence referred to as false vocal cords while the inferior folds comprise muscles that aid in adduction, hence referred to as true vocal cords. Ventricles of the larynx [Morgagni sinus] are present between the false and true vocal cords.

## BLOOD SUPPLY

The external carotid artery gives the superior thyroid artery and the thyrocervical trunk gives the inferior thyroid artery. These two arteries give superior and inferior laryngeal branches and the superior thyroid gives the cricothyroid branch. From epiglottis to superior vocal cords, the superior laryngeal artery supplies while for inferior vocal cords and below, the supply is the inferior laryngeal artery.

## NERVE SUPPLY

Superior Laryngeal Nerve [SLN]: It is a branch of the tenth cranial nerve Vagus from its inferior ganglion. It divides into internal and external laryngeal nerves beneath the hyoid. While the external branch innervates the cricothyroid, the internal branch runs caudally along the thyrohyoid membrane supplying the mucosa of the laryngeal inlet.

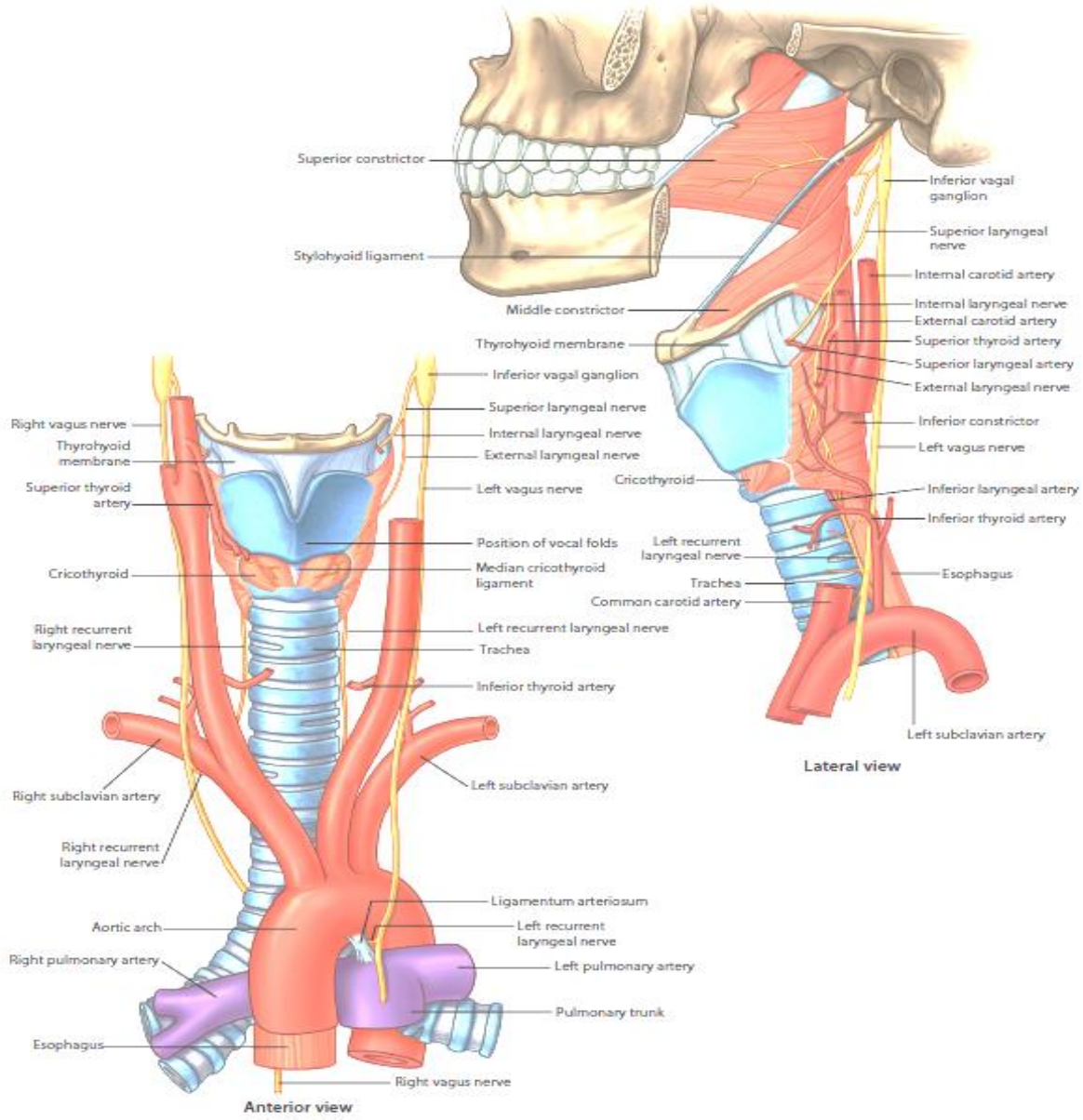



**Figure 6 - Blood supply and nerve supply of the larynx.**

The veins accompany the arteries and are hence named after the same. They eventually drain into subclavian and internal jugular veins via inferior and superior thyroid veins.

Inferior Laryngeal Nerve or Recurrent Laryngeal Nerve [RLN]: It supplies all the intrinsic muscles excluding cricothyroid. The left RLN takes origin from the vagus in the thorax, loops around the aortic arch, and then runs cranial to the trachea and finally enters the larynx. The right RLN originates at the neck base, loops around the right subclavian artery, and then runs cranial to trachea finally entering the larynx.

## LYMPHATIC DRAINAGE

Two groups of lymphatics namely supraglottic and infraglottic are present. The denser supraglottic and subglottic lymphatics drain ultimately into deep cervical nodes. The vocal cords do not have lymphatic drainage.

## SORE THROAT [4]

Sore throat pain is commonly reported following ETT. Although the underlying mechanisms promoting throat pain following ETT placement are yet to be described, there is evidence that neutrophils may trigger nociception. Previously it was shown that depletion of neutrophils can prevent the induction of hyperalgesia. The trachea is highly innervated with a subepithelial network of peripheral nerves that express transient receptor potential vanilloid calcium ion channels [TRPVs], which are well-established pain receptors. It was observed that neutrophilia was significantly greater in patients who reported sore throats when compared to patients without a sore throat. Neutrophils of sore throat patients also constitutively produced higher levels of ROS. Several studies have shown that ROS directly promotes hyperalgesia in both acute and inflammatory settings. In addition, tracheal lavage fluid of sore throat patients induced the release of HNE [human neutrophil elastase], a mediator of neuropathic pain. Recent work has revealed that neutrophil elastase generates pain through the activation of protease-activated TRPV4 receptors on nociceptive neurons. Finally, it was observed higher levels of IL-1β and TNF-α gene transcription in sore throat TLF-treated neutrophils, and similar secretion of these cytokines, IL-1β and TNF-α, increases the sensitivity of nociceptors by promoting TRPV1 activation. Data show that TLF from sore throat patients induces neutrophils to release significantly higher amounts of proinflammatory mediators known to trigger peripheral nerve pain.

## ENDOTRACHEAL TUBE [14]

These are the tubes through which the anaesthetic gases or vapours along with breathing gases are conveyed to and from the trachea.

An endotracheal tube has two ends. The bevelled distal end is called a patient end and a proximal end which is vertically cut is called the machine end

Some endotracheal tube has a side hole just above and opposite the bevel called the murphy eye. It helps ventilation to occur if the bevel is occluded by secretions, blood, or the tracheal wall. In some endotracheal tubes, there is a radio-opaque marker at the tip or along the length of the tube to detect the position of the tube after intubation.

Various substances like neutral rubber, synthetic rubber, silicon rubber, nylon, Teflon, polyethylene, and polyvinyl chloride [PVC] are used for manufacturing endotracheal tubes. Of these PVC is the most widely used.

To meet the standards of the American Society for Testing and Materials [ASTM], materials must pass a United States Pharmacopeia [USP] implantation test.

The distal end lies in the mid to lower part of the trachea, whereas the proximal end lies outside the mouth or nose where it is connected to the anaesthesia circuit or other device. Tracheal tubes used in adult patients have a cuff near the distal end that is inflated to provide a seal against the tracheal wall to protect the lungs from pulmonary aspiration and to ensure that the tidal volume delivered ventilates the lungs, rather than escapes into the upper airway. Cuffs are normally inflated with air and have an inflation tube with a pilot balloon that indicates cuff inflation.

The use of small tracheal tubes reduces the incidence of sore throat and hoarseness of voice. Small tracheal tubes may cause less tissue pressure in the larynx. Cuff inflation achieves

a seal between the tracheal tube and the wall of the trachea. Ventilation and the lungs should be protected from aspiration. The tracheal tube must be long enough for the cuff to lie 2 cm beyond the vocal cords.

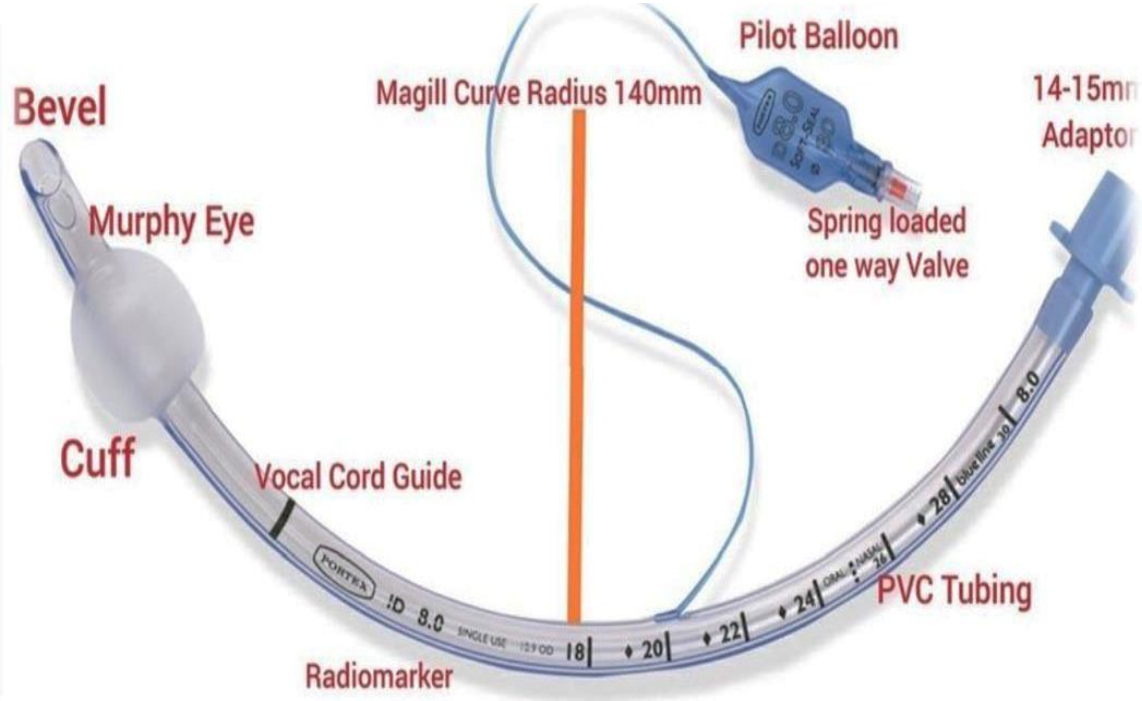



**Figure 7 – Parts of Cuffed Endotracheal Tube**

Cuff Types -it depends on its construction. The construction largely determines if the pressure needed to inflate the cuff is high or low.

A. Low-volume, High-pressure Cuff [small resting diameter, low residual volume, low−volume, small, standard, conventional, low-compliance, high pressure]

   It has a small diameter at rest and a low residual volume [the amount of air that can be withdrawn from the cuff after it has been allowed to assume its shape with the inflation tube exposed to atmospheric pressure]. It requires a high intracuff pressure to achieve a seal with the trachea. It has a small area of contact with the tracheal wall and distends and deforms the trachea to a circular shape.

Advantages- These cuffs offer better protection against aspiration and better visibility during intubation than low-pressure cuffs. They may be associated with a lower incidence of sore throat Because they are usually reusable, they are less expensive. They have been recommended for use in adolescent patients.

Disadvantages- The pressure on the tracheal wall exerted by such a cuff is difficult to determine but will likely be well above mucosal perfusion pressure. serious risk associated with high-pressure cuffs is ischemic damage to the tracheal wall mucosa following prolonged use and if planning for post-operative ventilation should be exchanged with low pressure cuffs.

B. High-volume, Low-pressure Cuff [large resting diameter; large residual volume; large; high-volume; high-compliance, low-pressure; floppy; low-pressure, HVLP]

It has a large resting volume and diameter. A thin compliant wall allows a seal with the trachea to be achieved without stretching the tracheal wall. As the cuff is inflated, it first touches the trachea at the widest part of the cuff or the narrowest point in the trachea under the cuff. As the cuff continues to inflate, the area of contact becomes larger and the cuff adapts itself to the tracheal surface. The intracuff pressure varies during the ventilatory cycle. During spontaneous breathing, airway [and cuff] pressure will be negative during inspiration and positive during exhalation. With controlled ventilation, when airway pressure exceeds intracuff pressure, positive pressure will be applied to the lower face of the cuff. If the cuff wall is pliable, it will be unable to resist this pressure and will be deformed into a cone shape as the distal portion is compressed and the proximal portion is distended. The air in the cuff will be compressed until intracuff pressure equals airway pressure. During exhalation,

the intracuff pressure will decrease until its resting is reached.

Advantages- being provided the cuff wall is not stretched, the intracuff pressure closely approximates the pressure on the tracheal wall. Thus, it is possible to measure and regulate the pressure exerted on the tracheal mucosa. With proper use, the risk of significant cuff-induced complications following prolonged intubation is reduced.

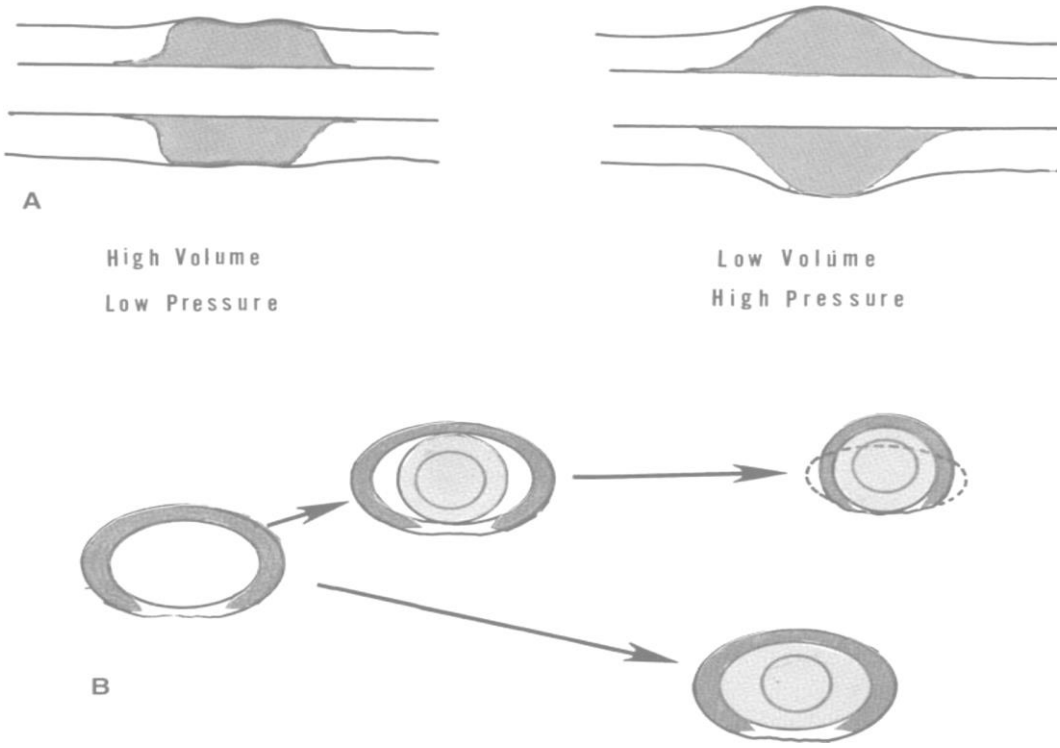



**Figure 8 – Types of Endotracheal Tube Cuffs**

Disadvantages- Tubes with these cuffs may be more difficult to insert, as the cuff may obscure the view of the tube tip and larynx. The cuff is more likely to be torn during intubation, especially if forceps are used. There may be a greater likelihood that the tracheal tube with his type of cuff will be dislodged. The incidence of sore throat may be greater with low pressure than with high-pressure cuffs. A major drawback of this type of cuff is that it may not effectively prevent fluid from leaking into the lower airway even at cuff pressures as high as 60 cm H2O. When nitrous oxide is used, it will

diffuse into the cuff. This added volume will increase the pressure on the tracheal mucosa.

## LIGNOCAINE [15]

Lignocaine is a tertiary amine which is an amide derivative of diethylaminacetic acid with the longest pedigree and the most widely used local anaesthetic in clinical medicine. It is effective in suppressing re-entry cardiac arrhythmias such as premature ventricular contractions and ventricular tachycardia. It has a pKa of 7.6. It is a standard antiarrhythmic agent when given intravenously. Initial dose is 1-1.5 mg/kg iv can be repeated at 0.5-0.75 mg/kg iv every 5-10 min up to maximum cumulative dose of 3mg/kg. Infusion dose is 1-4mg/min [30-50mcg/kg/min].

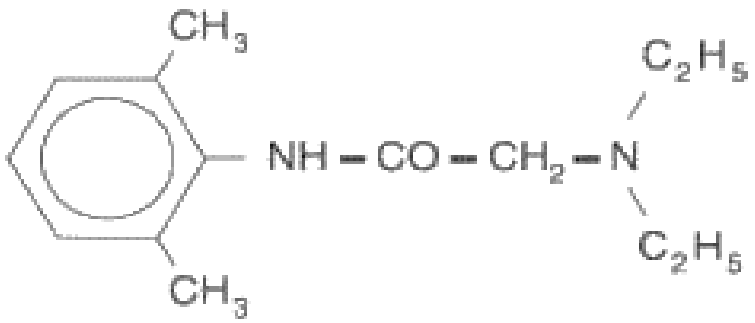



**Figure 9 – Molecular structure of the drug Lignocaine**

Structure of Lignocaine

It is available in the following forms:

Preservative-free solutions:

- 2% solution for intravenous use, as an antiarrhythmic agent, or to blunt responses to endotracheal intubation;

- 5%, 'heavy' solution for intrathecal use. It is made hyperbaric by the addition of 7.5% dextrose.

With preservative [methylparaben]:

- 1%, 2% solutions for use as a local anaesthetic – intradermal, subcutaneous injections, epidural anaesthesia, and nerve blocks.
- 2% viscous solution for gargling, 2% jelly for mucosal analgesia
- 2% lignocaine with adrenaline [5µg/ml] for local infiltration. This can also be used for peripheral nerve blocks.
- 4% solution for mucosal analgesia.
- 4% [provides 4mg/spray] and 10% [provides 10mg/spray] lignocaine spray.

Pharmacokinetics:

Due to the high first-pass metabolism in the liver, it is orally inactive. When given iv bolus, the action lasts only for 10–20 min because of rapid redistribution. Lidocaine is metabolized in the liver by N-dealkylation, with subsequent hydrolysis to monoethylglycine and xylidide. Monoethylglycine is further hydrolysed, whilst xylidide undergoes hydroxylation to 4- hydroxy- 2,6-xylidine which is the main metabolite and excreted in the urine. Metabolites of lidocaine may lower the fit threshold, thereby potentiating seizure activity, whilst others have some antiarrhythmic properties.

The t1⁄2 of the early distribution phase is 8 min and the elimination phase is nearly 2 hours. Its t1⁄2 is prolonged in Congestive Heart Failure [CHF] due to a decrease in volume of distribution and hepatic blood flow.

Mechanism of action:

Diffusion of the uncharged base form through neural sheaths and the axonal membrane to the internal surface of the cell membrane of Sodium [Na+] channels. There they combine

with hydrogen ions to form a cationic species which enters the internal opening of the Na+ channel and combines with a receptor. This produces blockade of the Na+ channel, thereby decreasing Na+ conductance which delays the rate of spontaneous phase 4 depolarization by preventing or diminishing the gradual decrease in potassium ion permeability that normally occurs during this phase.

Lidocaine is a blocker of inactivated Na+ channels more than that of the open state. As such, it is relatively selective for partially depolarized cells and those with longer Action potential duration. While normal ventricular and conducting fibres are minimally affected, depolarized/damaged fibres are significantly depressed. The brevity of atrial action potential and lack of lidocaine effect on channel recovery might explain its lack of efficacy in atrial arrhythmias.

It has minimal effect on normal Electrocardiogram - QT intervals may decrease. It causes little depression of cardiac contractility or arterial BP. There are no significant autonomic actions: all cardiac effects are direct actions.

The most prominent cardiac action of lidocaine is the suppression of automaticity in ectopic foci. Enhanced phase-4 depolarization in partially depolarized or stretched PFs, and after- depolarizations are antagonized, but SA node automaticity is not depressed.

Adverse effects:

Dose-related neurological effects are drowsiness, nausea, paraesthesia, blurred vision, disorientation, nystagmus, twitching, and seizures. When the plasma concentration remains less than 5 mg/mL there is no cardiovascular effect. Seizures occur at plasma concentrations of 5 to 10 mg/mL. CNS depression, apnoea, and cardiac arrest occur when plasma concentrations are greater than 10 mg/mL. The convulsive threshold for lidocaine is decreased during arterial hypoxemia, hyperkalaemia, or acidosis, emphasizing the importance of

monitoring these parameters during continuous infusion of lidocaine to patients for suppression of ventricular arrhythmias. The dose required to produce cardiovascular toxicity is said to be approximately 7 times higher than that required to produce central nervous system toxicity.

## BENZYDAMINE [16]

Benzydamine hydrochloride is a local anti-inflammatory drug that has analgesic and antipyretic properties. Formerly administered as tablets for systemic use, it is currently available only for local application: for the relief of sore throats, a mouth gargle or pump spray is available; gel ointment preparations are applied to the skin to treat inflammation of the soft tissues, skin, and joints. It is widely used and has negligible side effects when used locally.

Benzydamine has pharmacological effects which are quite dissimilar to other nonsteroidal anti-inflammatory drugs. In particular, benzydamine has little or no effect on the synthesis of prostanoids. The mechanism of the anti-inflammatory activity of benzydamine is unclear but may be due to its membrane-stabilizing effect or to inhibition of the synthesis of TNF-APLHA.

### PHARMACOKINETICS

When administered as a mouthwash, the recommended dose of benzydamine is 15 ml of a 4-mmol/L solution of hydrochloride salt in water. This high concentration is transient as the benzydamine solution is only used to rinse the mouth and the remaining material is diluted by saliva.

The depth of diffusion of the drug into oral tissues is not known but surface concentrations are probably higher than 100 ktmol/L. Commercially available benzydamine

mouthwash is typically pH 4.5-5.0 but is unbuffered, so should rise quickly to salivary pH which is about 7.

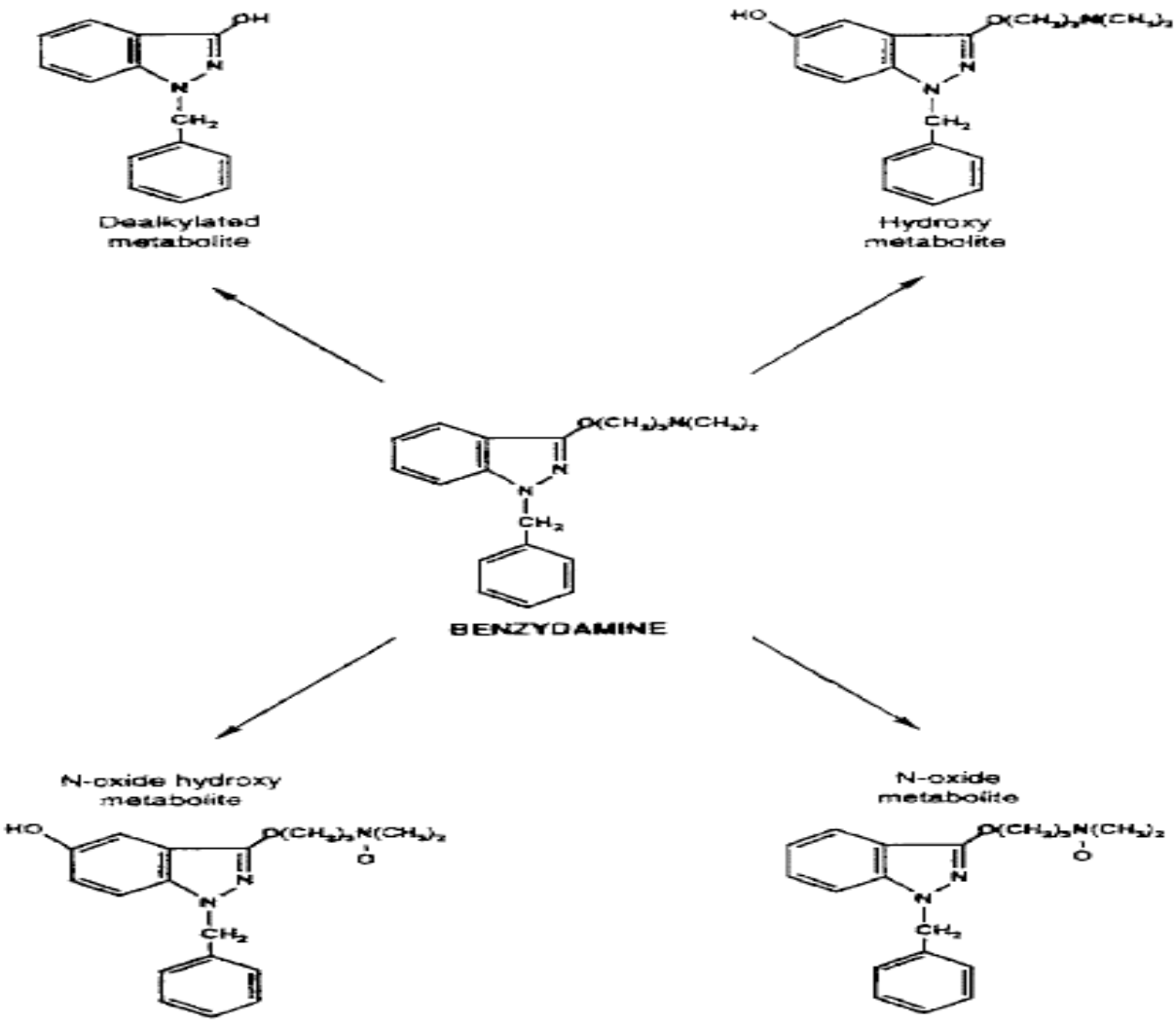



**Figure 10 – Molecular structure of the drug Benzydamine**

Judging from the uptake of other weakly basic, lipid-soluble drugs into buccal tissue, only a limited amount should be absorbed into buccal tissue during the recommended 30 s of mouthwash application. The predicted small amount of absorption into buccal tissue is confirmed by poor systemic availability [5%]. Peak plasma concentrations are obtained at about 3 h and reach 0.5 mcgmol/L.

Following the oral administration of 50 mg benzydamine, peak plasma concentrations

of 1.5 ~tmol/L are obtained after 1.5 h. Gastrointestinal absorption is rapid and almost complete. The high oral absorption of benzydamine is consistent with its high lipid solubility and relatively low clearance, which is about one-tenth of liver blood flow. There is no data on the penetration of the drug into the joints after local application to human subjects.

The protein-binding capacity of benzydamine is less than 20%. Because of its lack of protein binding and high lipid solubility in the unionized form, benzydamine should be freely diffusible into cells. Its volume of distribution is, in fact, somewhat greater than body water, indicating some binding to tissues. Its distribution, therefore, resembles several other basic lipid-soluble drugs although it is taken up by tissues to a lesser extent than many other basic drugs.

METABOLISM AND EXCRETION

There is conflicting data on the elimination of benzydamine. From two studies, it was reported that considerable amounts [50-65%] of the drug were excreted unchanged in the urine. Other work, however, indicates that only 5% is excreted unchanged in the urine. The high lipid solubility of the base form of benzydamine should be associated with considerable passive resorption in the renal tubule and the latter figure appears the more likely. Several inactive oxidized metabolites are excreted in the urine. One metabolite, benzydamine N-oxide, is present in plasma at a peak concentration of approximately 0.6 ~tmol/L [5]. Further metabolites may be present in plasma and it is of note that the half-life of total metabolites in plasma is longer than that of the parent compound.

USES OF BENZYDAMINE

- The topical application of 3% benzydamine cream is effective in the treatment of injuries, such as sprains and fractures.
- Benzydamine mouthwash is effective in the treatment of tonsillitis and pharyngitis,

- with significant improvement in the associated pain and dysphagia.
- Benzydamine produces significant pain relief from oropharyngeal mucositis, which is a common side-effect following radiation therapy of the mouth. It is also effective in pain relief from chemotherapy-induced mucositis, although minor side effects of oral discomfort were reported.
- Benzydamine is, however, ineffective in relieving pain following tonsillectomy and has little impact on recurrent aphthous stomatitis, although it produced transient pain relief attributed to local anaesthetic action.
- The local application of benzydamine may usefully decrease the pain and inflammation following dental surgery. The oral administration of 50 mg benzydamine had no effect on pain and trismus following impacted molar extraction.

# MATERIALS AND METHODS

Source of Data- Patients undergoing elective surgery in the supine position under general anaesthesia having endotracheal intubation, those between the ages of 18 and 60, of either gender, and who are in ASA grades I and II at KLE's Dr. Prabhakar Kore charitable Hospital and Medical Research Centre, Nehru Nagar, Belagavi -590010 during the period from January 2021 to December 2021.

Type of study: Hospital based Randomised Clinical Trial

Duration of study and study population:

Adult patients posted for surgery under general anesthesia between 1st January 2021-31st December 2021 at KLE'S Dr. Prabhakar Kore charitable Hospital and Medical Research Centre, Nehru Nagar, Belagavi-590010 were recruited as per inclusion and exclusion criteria.

Data Collection-12 Months

Formula to calculate the size of the sample in this study:

Formula for minimal sample size based on two proportions: $n = \frac{[z_\alpha + z_\beta]^2 \overline{p}[1-\overline{p}]}{d^2}$

where $p_1$ and $p_2$ are the proportions of the two groups.

$$p = \frac{p_1 + p_2}{2} and d = p_1 - p_2$$

zα is related to the degree of relevance and zβ is related to the test's power. zα and zβ values are 1.96 at 5% level of significance and 0.84 for 80% test power respectively. By assuming a success rate of 17.0% and 53.7%, a sample size of 27 is achieved. The sample size would be increased to 30, hence there would be two groups with size of 30 each.

Statistical Analysis:

The study's main objective is to compare the two groups. The mean and standard deviation for the continuous quantitative variables were determined. Suitable statistical techniques, such as the unpaired student's t test, were applied to compare the continuous

variables between groups. Using student's paired t test, two quantitative variables within a group have been compared.

Rates, ratios, and percentages were utilized to express the categorical data. Chi-square test was used to assess the relationship between the result, clinical, and demographic factors.

Median was used to represent discrete variables. Discrete variables were compared using nonparametric testing. The comparison was represented using the appropriate graphs. The value of p less than 5% [0.05] was regarded as significant for all tests.

Selection Criteria:

Inclusion Criteria:

- Patient who provides consent.
- ASA physical status I and II.
- Age between 18 to 60 years.
- Modified Mallampatti Grade [MPG] Grade I, II.
- Duration of surgery 30mins-120mins.
- Patients having single lumen oro-tracheal intubations while under general anaesthesia for elective surgery.

Exclusion Criteria:

- Patient already with upper respiratory tract infection.
- Patient on steroid therapy.
- History of asthma, COPD.
- Difficult airway intubation.
- Awake intubation.
- Retrograde intubation technique.

Sampling procedure:

A one-year randomized clinical trial. Randomisation was achieved by computer generated randomization chart.

Methodology:

A total of 60 patients undergoing surgery under general anaesthesia with endotracheal intubation were included in the study after receiving ethical committee clearance, Clinical trials registry – India - Trial Registered Prospectively and written informed agreement.

Patients who fulfilled the inclusion and exclusion criteria were then randomly assigned to one of the two groups described below using a computer-generated randomised table:

Group-A: The ETT cuffs were sprayed with 10 puffs of benzydamine hydrochloride 0.15% [alcohol free in brilliant blue FCF aqueous base] which contained about 1.5 mg of benzydamine hydrochloride.

Group-B: The ETT cuffs were sprayed with 10 puffs of 10% lidocaine hydrochloride [ethanol I.P. and flavouring base], which would have contained 100 mg of lignocaine hydrochloride.

The day before surgery, a full pre-anesthetic evaluation was performed with the required investigations. On the day of surgery intravenous access was secured using 18 G OR 20 G iv cannula and iv fluid [either Ringer lactate or Normal saline] was started. Standard monitoring devices were attached before induction of anesthesia, including NIBP, ECG, and pulse oximeter.

Patient were also receiving Inj ondansetron 4mg and Inj Ranitidine 50mg after shifting to operation theatre. Patient were preoxygenated with 100% Oxygen for three minutes. Patients were premedicated with Inj Glycopyrrolate 0.005mg/kg and Inj. Midazolam 0.05mg/Kg and Inj. Fentanyl 2mcg/Kg.

Patient were induced with Inj. Thiopentone 5 mg/Kg followed by Inj. Succinylcholine 2mg/Kg. With the onset of neuromuscular blockade direct laryngoscopy is done. The cuff [Polyvinyl chloride endotracheal tube of appropriate size.] of the endotracheal tube were sprayed with-

Group-A:

10 puffs of approximate 1.5mg of 0.15% benzydamine hydrochloride

Group-B:

10 puffs of 10%lignocaine of approximate 100mg of lignocaine hydrochloride.

Patients requiring multiple intubation attempts will not be included in the study. Correct inflation volume was confirmed by auscultation for air leak over trachea. Endotracheal tube was secured with tapes of appropriate length and mechanically ventilated. Monitoring of pulse oximeter, non-invasive blood pressure, electrocardiography, capnography, endotracheal tube cuff pressure was monitored between 25-30 cm of H2O every 10 mins of the surgery using a cuff pressure monitor. Isoflurane, nitrous oxide, and oxygen were used to keep the patients breathing. administered 0.1 mg/kg of vecuronium as a loading dose, top up of 1/4th of loading dose, i.e., 0.025mg/Kg were given. At the end of the procedure [of duration 30mins- 120 mins], patients were reversed with Inj.Glycopyrollate 0.01mg/Kg and Inj Neostigmine 0.05mg/Kg and then the patient were extubated. After extubation, heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and saturation were monitored at intervals of 1 min, 5 min and at 10 min after the procedure.

Post operative sore throat, hoarseness of voice and cough, at extubation, incidence and severity were reported, and follow-ups at 1 hour, 6 hours, and 24-hour intervals, with the blinding of the observer while taking note of the above parameters.

Their severity was graded according to the following, [based on Laryngo pharyngeal morbidity score; LPM score]: [28]

Table 1: Laryngo pharyngeal morbidity score(LPM score)

| **PARAMETERS** | **GRADE 0** | **GRADE 1** | **GRADE 2** | **GRADE 3** |
|---|---|---|---|---|
| **POST-OPERATIVE SORE THROAT** | No sore throat at any time since the operation. | Minimal- Patient answered in the affirmative when asked about sore throat | Moderate- Patient complained of sore throat on his/her own. | Severe- Patient is in obvious distress. |
| **HOARSENESS OF VOICE** | No complaints of hoarseness at any time since the operation | Minimal – Minimal change in quality of speech. Patient answers in the affirmative `only when enquired about. | Moderate – Moderate change in quality of speech of which the patient complains on his/her own | Severe – Gross change in the quality of voice perceived by the observer. |
| **COUGH** | No cough at any time since the operation. | Minimal-cough/ scratchy throat. | Moderate cough presents but present throughout. | Severe cough with signs of infection. |

Data obtained were entered in proforma, tabulated and analyzed.

Statistical Analysis

Study focused on two-group comparison. Mean and standard deviation was determined for continuous quantitative data. Intergroup continuous variables were compared using appropriate statistical procedures such as one-way ANOVA. For pair - wise comparison,

an unpaired student's t test was utilized. To compare two quantitative variables within a group, the students paired t-test was utilized. The median was used to represent discrete variables. The comparison was depicted usingappropriate graphs. Rates, ratios, and percentages were used to express categorical data. Associations amongstresults, clinical, and demographic features were studied using Chi-square-test or Fisher's- exact-test. All tests considered substantial if the *p-value* was less than 5% [0.05].

# RESULTS

The purpose of study was to compare efficacy of 10% Lignocaine Hydrochloride and 0.15% Benzydamine Hydrochloride in preventing incidence and severity of sore throat postoperatively, cough and voice hoarseness.

This was a 1-year hospital-based study ,conducted in the Department of Anaesthesiology, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi between 1st January 2021 to 31st December 2021 .

The study results were tabulated, analysed, observations and results are discussed below.

Sixty patients between 18-60 years of both sex belonging to ASA class I and II whom underwent elective surgeries under general anaesthesia with endotracheal intubation were included in present study and were classified in to 2 groups:

Group A – Benzydamine Hydrochloride.

Group B – Lignocaine Hydrochloride.

Table 2: Gender distribution

| | GROUP A | | GROUP B | |
|---|---|---|---|---|
| **GENDER** | **NUMBER** | **%** | **NUMBER** | **%** |
| **FEMALE** | 18 | 60.00 | 16 | 53.33 |
| **MALE** | 12 | 40.00 | 14 | 46.67 |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 |

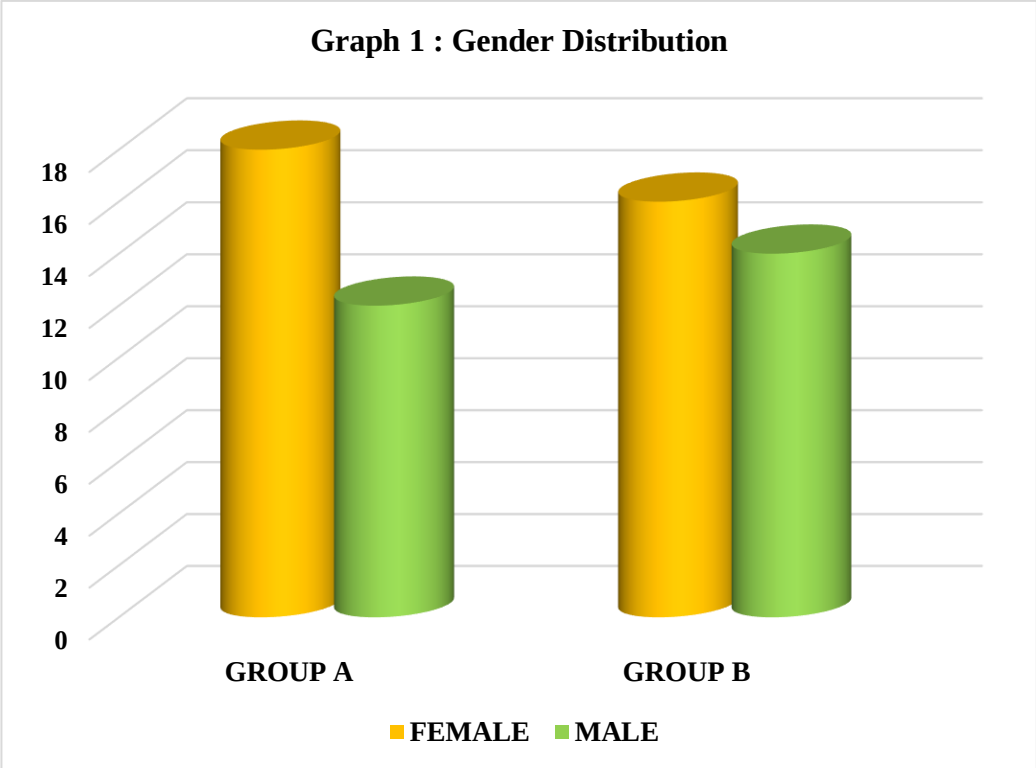



Table 1 and Graph 1 represents the gender distribution of patients. In group A, 60 % were females and 40% males. In group B, 53% were females and 37% males. The gender distribution was not statistically significant [p value 0.2789].Hence both the groups were comparable.

Table 3 : Age distribution

| AGE | GROUP A | | GROUP B | |
|---|---|---|---|---|
| | NUMBER | % | NUMBER | % |
| **15 - 24** | 5 | 16.67 | 5 | 16.67 |
| **25 - 34** | 9 | 30.00 | 5 | 16.67 |
| **35 - 44** | 7 | 23.33 | 8 | 26.67 |
| **45 - 54** | 7 | 23.33 | 9 | 30.00 |
| **55 - 64** | 2 | 6.67 | 3 | 10.00 |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 |

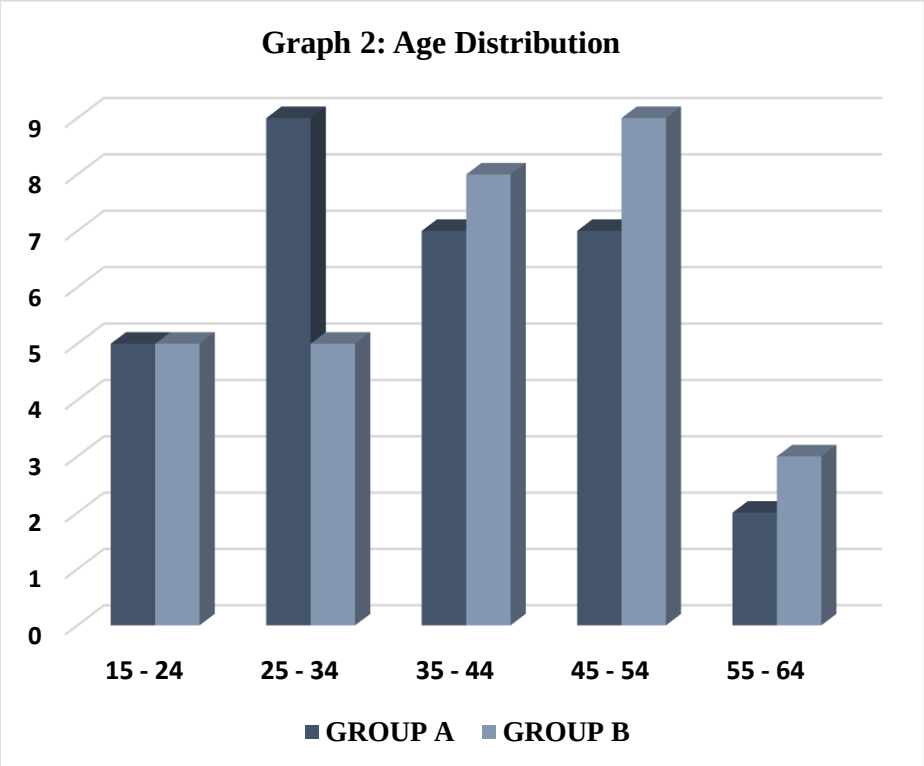



Table 2, 2A [below] and Graph 2 shows the age distribution of patients studied. Patients were above 18 years and up to 60 years old.

Table 3A: Age distribution across both groups after applying students unpaired t test

| | GROUP A | | | | GROUP B | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **MEAN** | **S.D.** | **MIN** | **MAX** | **MEAN** | **S.D.** | **MIN** | **MAX** | **p VALUE** | **INFERENCE** |
| **AGE** | 35.90 | 11.26 | 18 | 58 | 39.23 | 11.74 | 19 | 65 | 0.2663 | NS |

In group A, the average age of the patients was 35.90±11.26 and in group B 39.23±11.74 which were comparable with a p Value of 0.2663.

Table 4 : ASA distribution across both the groups

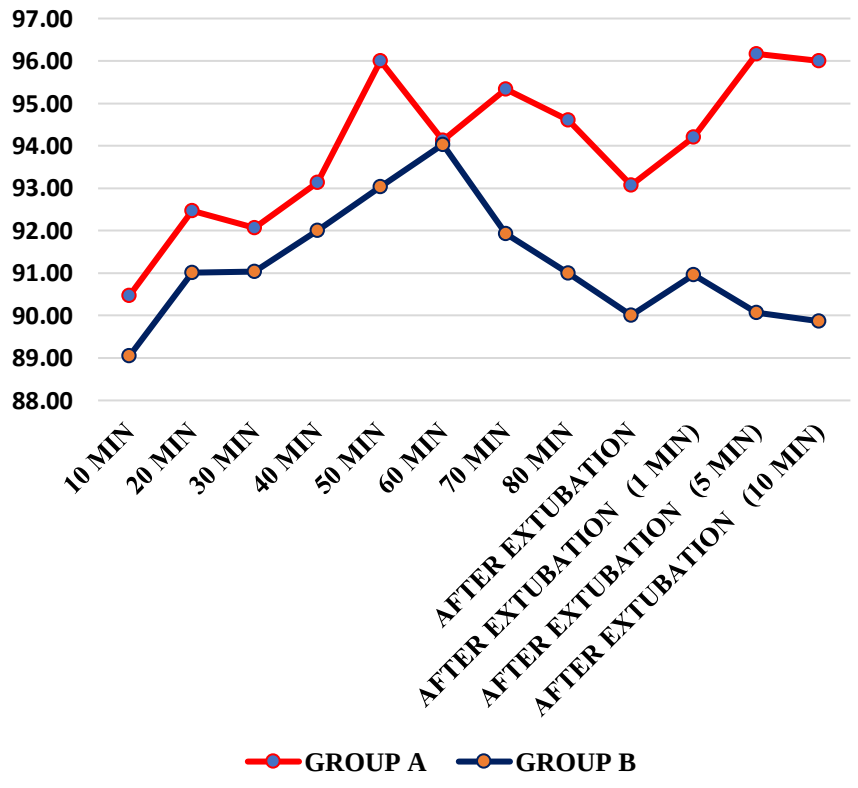
| | GROUP A | | GROUP B | |
|---|---|---|---|---|
| **ASA** | **NUMBER** | **%** | **NUMBER** | **%** |
| **1** | 19 | 63.33 | 15 | 50.00 |
| **2** | 11 | 36.67 | 15 | 50.00 |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 |

In this study, A and B groups have 63.33 and 36.67 and 50.0 percent each respectively of participants belonging to ASA I and II groups which were comparable in both the as shown in table 3.

Table 5: Comparison of mean Heart Rate at different time intervals in both the groups

| | GROUP A | | | | GROUP B | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | MEAN | S.D. | MIN | MAX | MEAN | S.D. | MIN | MAX | p VALUE | INFERENCE |
| **10 MIN** | 90.47 | 5.36 | 79 | 99 | 89.05 | 12.67 | 65.6 | 119.6 | 0.5730 | NS |
| **20 MIN** | 92.47 | 5.35 | 81 | 101 | 91.01 | 12.66 | 67.54 | 121.54 | 0.5630 | NS |
| **30 MIN** | 92.07 | 4.57 | 83 | 101 | 91.03 | 11.88 | 72.3 | 121.3 | 0.6582 | NS |
| **40 MIN** | 93.13 | 4.29 | 86 | 100 | 92.00 | 9.50 | 70.8 | 111.8 | 0.5536 | NS |
| **50 MIN** | 96.00 | 3.45 | 89.4 | 101.4 | 93.03 | 9.73 | 63.2 | 107.2 | 0.1209 | NS |
| **60 MIN** | 94.13 | 3.79 | 86 | 100 | 94.03 | 10.49 | 61.5 | 108.5 | 0.9610 | NS |
| **70 MIN** | 95.33 | 3.91 | 86 | 102 | 91.93 | 10.54 | 57 | 107 | 0.1030 | NS |
| **80 MIN** | 94.60 | 4.01 | 86 | 108 | 91.00 | 10.34 | 57.5 | 109.5 | 0.0807 | NS |
| **AFTER EXTUBATION** | 93.07 | 3.54 | 85 | 103 | 90.00 | 9.71 | 57.3 | 105.3 | 0.1097 | NS |
| **AFTER EXTUBATION [1 MIN]** | 94.20 | 3.84 | 86 | 104 | 90.97 | 9.30 | 59.7 | 104.7 | 0.0836 | NS |
| **AFTER EXTUBATION [5 MIN]** | 96.17 | 4.22 | 87 | 105 | 90.07 | 9.68 | 58 | 108 | 0.0025 | S |
| **AFTER EXTUBATION [10 MIN]** | 96 | 5.483518 | 86 | 104 | 89.87 | 9.78 | 58.3 | 110.3 | 0.0040 | S |

**Graph 3: Mean Heart Rate**

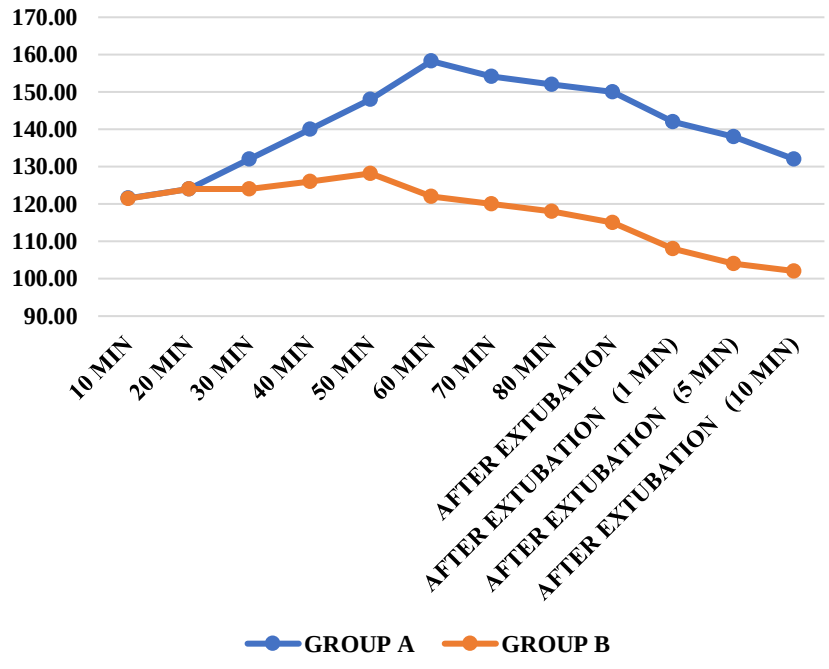



In this study, mean HR in both groups are comparable in preoperative period, intraoperative period. Mean HR is significantly reduced in Group B in postoperative period at 5mins[90.06±9.68] and 10 mins [89.87±9.78] while compared to group A [ p Value:0.0040] as shown in table 5 and depicted in graph 3.

Table 6 : Comparison of Mean Systolic Blood Pressure at different time intervals :

| | GROUP A | | | | GROUP B | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | MEAN | S.D. | MIN | MAX | MEAN | S.D. | MIN | MAX | p VALUE | INFERENCE |
| **10 MIN** | 121.53 | 3.55 | 114 | 128 | 121.50 | 8.67 | 102 | 131 | 0.9845 | NS |
| **20 MIN** | 124.03 | 3.55 | 116.5 | 130.5 | 124.00 | 8.67 | 104.5 | 133.5 | 0.9845 | NS |
| **30 MIN** | 132.00 | 3.66 | 125.13 | 137.13 | 124.00 | 5.41 | 113.5 | 134.5 | < 0.0001 | S |
| **40 MIN** | 140.00 | 3.79 | 134 | 148 | 126.03 | 6.70 | 108 | 133 | < 0.0001 | S |
| **50 MIN** | 148.03 | 3.04 | 142.1 | 154.1 | 128.20 | 6.29 | 114.5 | 136.5 | < 0.0001 | S |
| **60 MIN** | 158.27 | 2.38 | 153 | 163 | 122.02 | 4.87 | 111.25 | 131.25 | < 0.0001 | S |
| **70 MIN** | 154.13 | 3.64 | 148 | 160 | 120.03 | 4.73 | 110.1 | 130.1 | < 0.0001 | S |
| **80 MIN** | 152.00 | 4.18 | 146.2 | 162.2 | 118.03 | 4.67 | 111.7 | 129.7 | < 0.0001 | S |
| **AFTER EXTUBATION** | 149.97 | 3.60 | 140.5 | 158.5 | 115.00 | 4.35 | 109.1 | 123.1 | < 0.0001 | S |
| **AFTER EXTUBATION [1 MIN]** | 142.00 | 4.07 | 130 | 148 | 108.07 | 4.50 | 102 | 124 | < 0.0001 | S |
| **AFTER EXTUBATION [5 MIN]** | 138.00 | 4.25 | 127.8 | 147.8 | 104.07 | 4.04 | 96.9 | 116.9 | < 0.0001 | S |
| **AFTER EXTUBATION [10 MIN]** | 132.03 | 4.45 | 118.9 | 138.9 | 102.07 | 3.91 | 96.5 | 112.5 | < 0.0001 | S |

**Graph 4: Mean Systolic Blood Pressure**

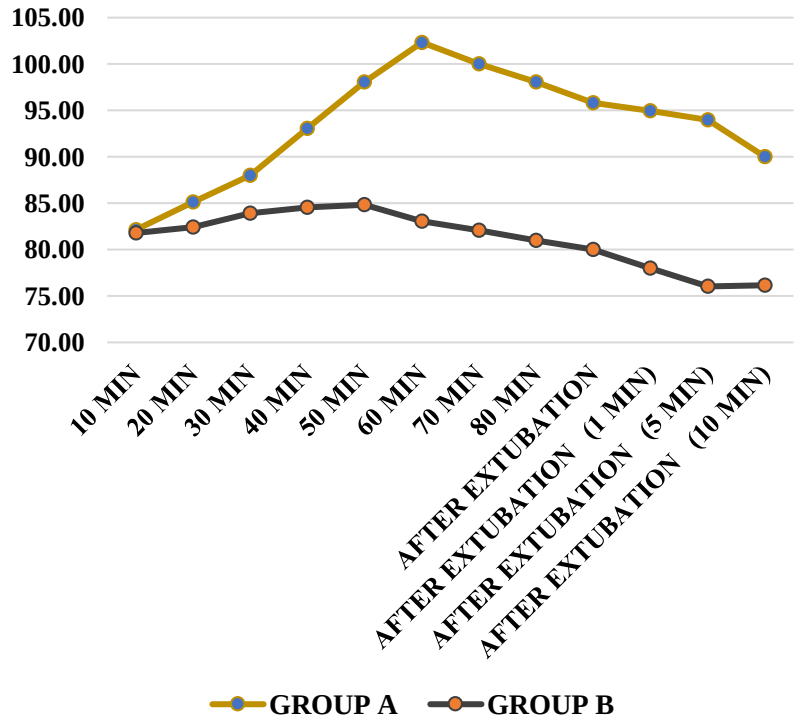



In this study, mean SBP in both groups are comparable in preoperative period, intraoperative period. Mean SBP is significantly reduced in Group B in postoperative period at 5mins[104.07±4.04] and 10 mins [102.07±3.91] while compared to group A [ p Value:0.0001] as shown in table 6 and depicted in graph 4.

Table 7 : Comparison of Mean Diastolic Blood Pressure at different time intervals :

| | GROUP A | | | | GROUP B | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | MEAN | S.D. | MIN | MAX | MEAN | S.D. | MIN | MAX | p VALUE | INFERENCE |
| **10 MIN** | 82.13 | 4.81 | 72 | 90 | 81.80 | 5.86 | 67 | 93 | 0.8106 | NS |
| **20 MIN** | 85.13 | 4.81 | 75 | 95 | 82.40 | 8.14 | 60 | 100 | 0.1189 | NS |
| **30 MIN** | 88.00 | 4.85 | 78.4 | 96.4 | 83.93 | 5.60 | 66 | 94 | 0.0039 | VS |
| **40 MIN** | 93.07 | 4.09 | 86.6 | 100.6 | 84.53 | 5.19 | 67 | 93 | < 0.0001 | S |
| **50 MIN** | 98.07 | 3.47 | 93 | 105 | 84.83 | 6.64 | 65.7 | 93.7 | < 0.0001 | S |
| **60 MIN** | 102.33 | 3.41 | 98 | 108 | 83.03 | 7.24 | 66.7 | 96.7 | < 0.0001 | S |
| **70 MIN** | 100.03 | 4.49 | 91.9 | 105.9 | 82.07 | 5.81 | 69.4 | 91.4 | < 0.0001 | S |
| **80 MIN** | 98.03 | 4.81 | 87.9 | 105.9 | 81.00 | 5.86 | 66.2 | 92.2 | < 0.0001 | S |
| **AFTER EXTUBATION** | 95.80 | 4.21 | 86 | 102 | 80.00 | 6.31 | 67.5 | 91.5 | < 0.0001 | S |
| **AFTER EXTUBATION [1 MIN]** | 94.97 | 3.61 | 88.3 | 104.3 | 78.00 | 5.29 | 67.6 | 89.6 | < 0.0001 | S |
| **AFTER EXTUBATION [5 MIN]** | 94.00 | 3.05 | 87 | 99 | 76.03 | 3.41 | 69.7 | 81.7 | < 0.0001 | S |
| **AFTER EXTUBATION [10 MIN]** | 90.00 | 3.73 | 81.6 | 97.6 | 76.17 | 3.59 | 69.3 | 85.3 | < 0.0001 | S |

**Graph 5: Mean Diastolic Blood Pressure**

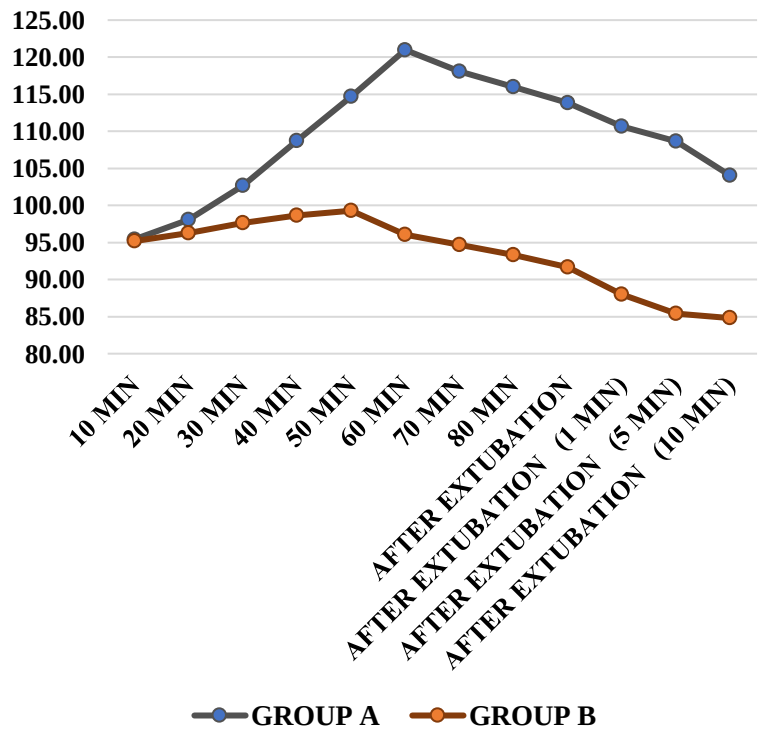



In this study, mean DBP in both groups are comparable in preoperative period, intraoperative period. Mean DBP is significantly reduced in Group B in postoperative period at 5mins[76.03±3.41] and 10 mins [76.17±3.59] while compared to group A [ p Value:0.0001] as shown in table 7 and depicted in graph 5.

Table 8 : Comparison of Means of Mean Arterial Pressure at different time intervals :

| | GROUP A | | | | GROUP B | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | MEAN | S.D. | MIN | MAX | MEAN | S.D. | MIN | MAX | p VALUE | INFERENCE |
| **10 MIN** | 95.43 | 3.06 | 88.83333 | 100.1667 | 95.20 | 5.68 | 79.83333 | 103.1667 | 0.8437 | NS |
| **20 MIN** | 98.10 | 3.60 | 90.83333 | 104.8333 | 96.27 | 7.48 | 74.83333 | 109.8333 | 0.2313 | NS |
| **30 MIN** | 102.67 | 3.54 | 95.97667 | 109.9767 | 97.62 | 4.79 | 82.16667 | 106.1667 | < 0.0001 | S |
| **40 MIN** | 108.71 | 2.85 | 104.4 | 116.4 | 98.67 | 4.25 | 87.97333 | 103.9733 | < 0.0001 | S |
| **50 MIN** | 114.72 | 2.47 | 110.7 | 121.3667 | 99.29 | 4.15 | 88.63333 | 105.9667 | < 0.0001 | S |
| **60 MIN** | 120.98 | 2.80 | 117 | 126.3333 | 96.03 | 4.67 | 85.55 | 104.2167 | < 0.0001 | S |
| **70 MIN** | 118.07 | 3.69 | 111.2667 | 123.9333 | 94.72 | 3.78 | 85.63333 | 100.6333 | < 0.0001 | S |
| **80 MIN** | 116.02 | 4.13 | 107.3333 | 122.6667 | 93.34 | 3.88 | 83.36667 | 101.3667 | < 0.0001 | S |
| **AFTER EXTUBATION** | 113.86 | 3.39 | 106.8333 | 119.5 | 91.67 | 4.17 | 82.7 | 100.7 | < 0.0001 | S |
| **AFTER EXTUBATION [1 MIN]** | 110.64 | 3.12 | 104.2 | 118.8667 | 88.02 | 3.55 | 80.4 | 95.73333 | < 0.0001 | S |
| **AFTER EXTUBATION [5 MIN]** | 108.67 | 2.48 | 101.9333 | 113.2667 | 85.38 | 2.31 | 80.1 | 89.43333 | < 0.0001 | S |
| **AFTER EXTUBATION [10 MIN]** | 104.01 | 3.32 | 96.03333 | 110.0333 | 84.80 | 2.60 | 81.03333 | 91.03333 | < 0.0001 | S |

**Graph 6 : Means Of Mean Arterial Pressure**




In this study, mean MAP in both groups are comparable in preoperative period, intraoperative period. Mean MAP is significantly reduced in Group B in postoperative period at 5mins[85.38±2.31] and 10 mins [84.80±2.60] while compared to group A [ p Value:0.0001] as shown in table 8 and depicted in graph 6.

Table 9 : Comparison of severity of post-operative sore throat at 0th hour after extubation:

AT 0th HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 16 | 53.33 | 4 | 13.33 | 0.0042 | S |
| **1** | 9 | 30.00 | 15 | 50.00 | | |
| **2** | 5 | 16.67 | 11 | 36.67 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 9A : Rate of incidence of POST at 0th Hour:

| GROUP A | GROUP B |
|---|---|
| 46.67% | 86.67% |

Table 9B: Comparison of severity of post-operative sore throat at 1st hour after extubation:

AT 1st HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 18 | 60.00 | 8 | 26.67 | 0.0334 | S |
| **1** | 10 | 33.33 | 18 | 60.00 | | |
| **2** | 2 | 6.67 | 4 | 13.33 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 9C: Rate of incidence of POST at 1st Hour

| GROUP A | GROUP B |
|---|---|
| 40.00% | 73.33% |

Table9D: Comparison of severity of post-operative sore throat at 6th hour after extubation:

AT 6th HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 29 | 96.67 | 20 | 66.67 | 0.0106 | S |
| **1** | 1 | 3.33 | 8 | 26.67 | | |
| **2** | 0 | 0.00 | 2 | 6.67 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 9E : Rate of incidence of POST at 6th Hour

| GROUP A | GROUP B |
|---|---|
| 3.33% | 33.33% |

Table 9F: Comparison of severity of post-operative sore throat at 24th hour after extubation:

AT 24th HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 29 | 96.67 | 25 | 83.33 | 0.3132 | NS |
| **1** | 1 | 3.33 | 4 | 13.33 | | |
| **2** | 0 | 0.00 | 1 | 3.33 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 9G : Rate of incidence of POST at 24th Hour:

| GROUP A | GROUP B |
|---|---|
| 3.33% | 16.67% |

Table 10: Comparison of severity of post-operative hoarseness of voice at 0th hour after extubation in both the groups:

AT 0th HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 11 | 36.67 | 2 | 6.67 | 0.0185 | S |
| **1** | 14 | 46.67 | 20 | 66.67 | | |
| **2** | 5 | 16.67 | 8 | 26.67 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 10A: Rate of incidence of Hoarseness of voice at 0th hour

| GROUP A | GROUP B |
|---|---|
| 63.33% | 93.33% |

Table 10B: Comparison of severity of post-operative hoarseness of voice at 1st hour after extubation:

AT 1st HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 17 | 56.67 | 7 | 23.33 | 0.0241 | S |
| **1** | 11 | 36.67 | 17 | 56.67 | | |
| **2** | 2 | 6.67 | 6 | 20.00 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 10C : Rate of incidence of Hoarseness of Voice after 1 hour

| GROUP A | GROUP B |
|---|---|
| 43.33% | 76.67% |

Table 10D: Comparison of severity of post-operative hoarseness of voice at 6th hour after extubation:

AT 6th HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 29 | 96.67 | 20 | 66.67 | 0.0106 | S |
| **1** | 1 | 3.33 | 8 | 26.67 | | |
| **2** | 0 | 0.00 | 2 | 6.67 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 10E : Rate of incidence of Hoarseness of Voice at 6th hour

| GROUP A | GROUP B |
|---|---|
| 3.33% | 33.33% |

Table 10F: Comparison of severity of post-operative hoarseness of voice at 24th hour after extubation:

AT 24th HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 29 | 96.67 | 27 | 90.00 | 0.5853 | NS |
| **1** | 1 | 3.33 | 3 | 10.00 | | |
| **2** | 0 | 0.00 | 0 | 0.00 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 10G :Rate of incidence of Hoarseness of Voice at 24th hour

| GROUP A | GROUP B |
|---|---|
| 3.33% | 10.00% |

Table 11: Comparison of severity of post-operative cough at 0th hour after extubation:

AT 0th HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 25 | 83.33 | 17 | 56.67 | 0.0453 | S |
| **1** | 5 | 16.67 | 10 | 33.33 | | |
| **2** | 0 | 0.00 | 3 | 10.00 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 11A : Rate of incidence of Post-operative Cough at 0th hour:

| GROUP A | GROUP B |
|---|---|
| 16.67% | 43.33% |

Table 11B: Comparison of severity of post-operative cough at 1st hour after extubation:

AT 1st HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 29 | 96.67 | 20 | 66.67 | 0.0103 | S |
| **1** | 1 | 3.33 | 7 | 23.33 | | |
| **2** | 0 | 0.00 | 3 | 10.00 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 11C : Rate of incidence of Post-operative Cough at 1st hour:

| GROUP A | GROUP B |
|---|---|
| 3.33% | 33.33% |

Table 11D: Comparison of severity of post-operative cough at 6th hour after extubation:

AT 6th HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 30 | 100.00 | 24 | 80.00 | 0.0357 | S |
| **1** | 0 | 0.00 | 4 | 13.33 | | |
| **2** | 0 | 0.00 | 2 | 6.67 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 11E : Rate of incidence of Post-operative Cough at 6th hour

| GROUP A | GROUP B |
|---|---|
| 0.00% | 20.00% |

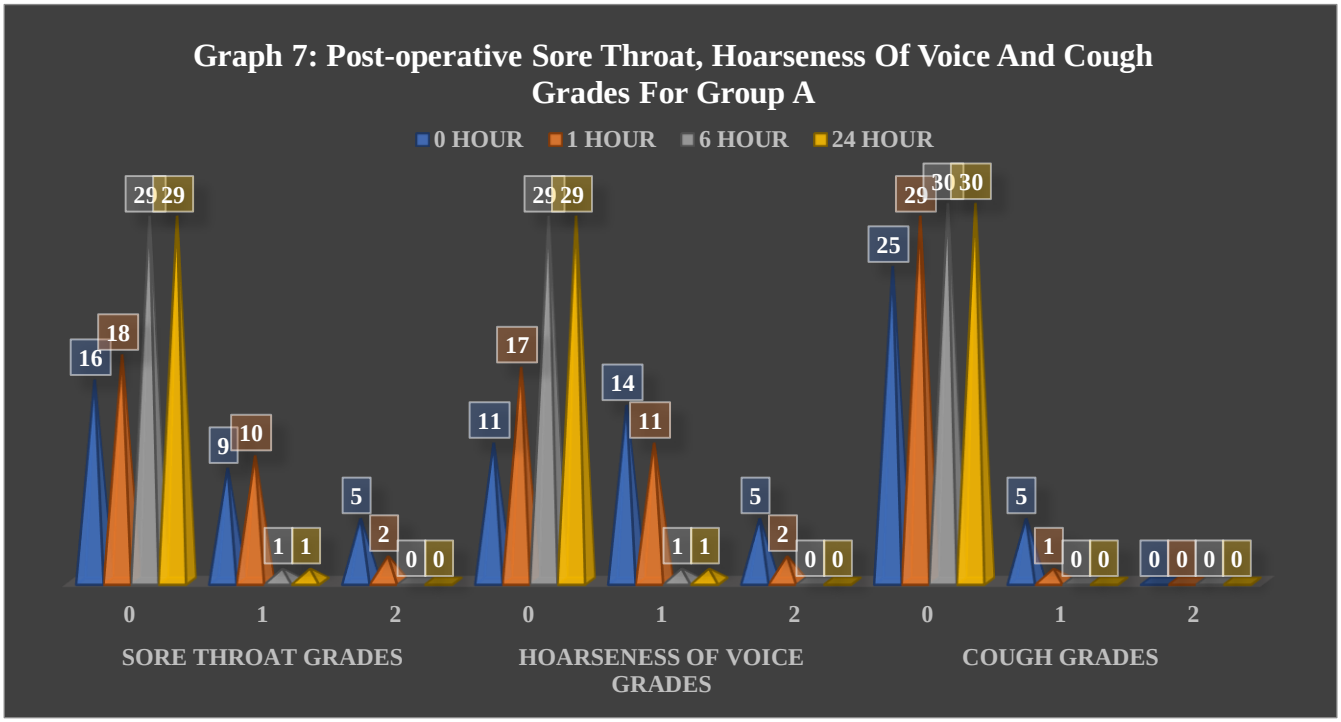
Table 11F: Comparison of severity of post-operative cough at 24th hour after extubation:

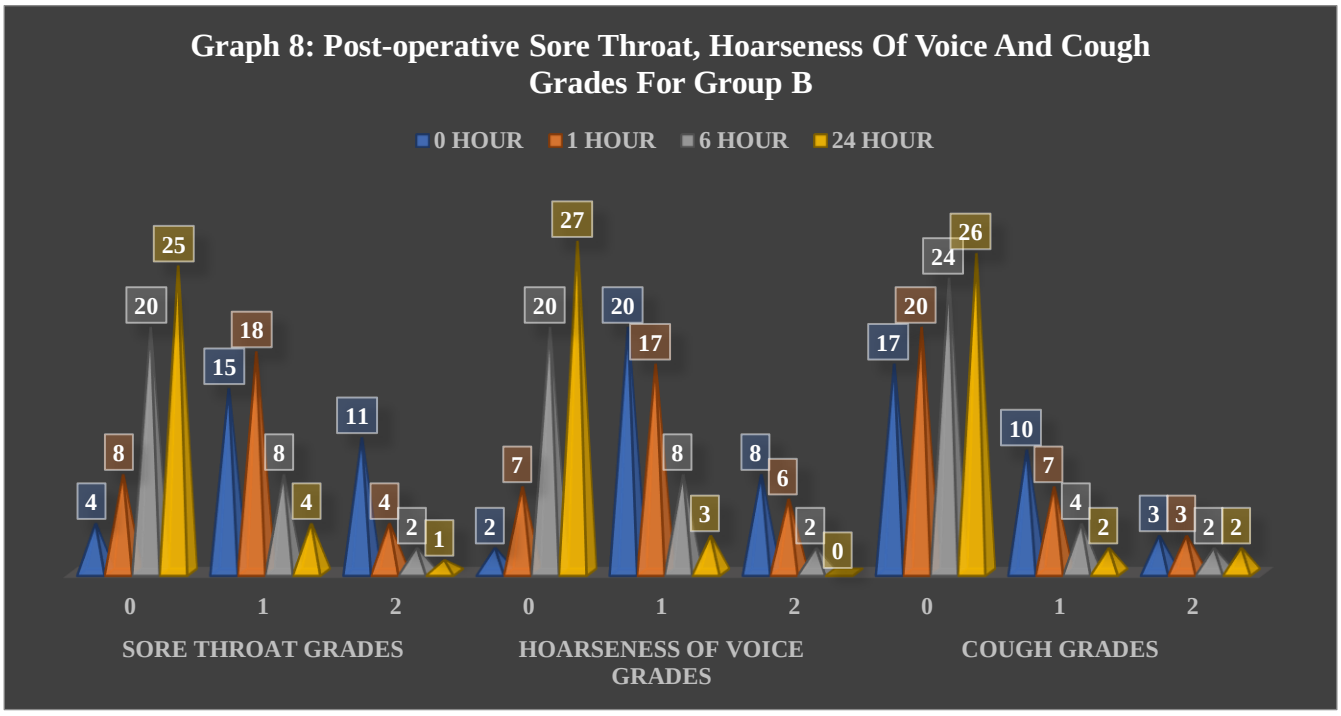
AT 24th HOUR:

| | GROUP A | | GROUP B | | | |
|---|---|---|---|---|---|---|
| **GRADE** | **NUMBER** | **%** | **NUMBER** | **%** | **p VALUE** | **INFERENCE** |
| **0** | 30 | 100.00 | 26 | 86.67 | 0.1173 | NS |
| **1** | 0 | 0.00 | 2 | 6.67 | | |
| **2** | 0 | 0.00 | 2 | 6.67 | | |
| **TOTAL** | 30 | 100.00 | 30 | 100.00 | | |

Table 11G : Rate of incidence of Post-operative Cough at 24th hour

| GROUP A | GROUP B |
|---|---|
| 0.00% | 13.33% |




The incidence of POST was 18.95%, highest in the lignocaine group [26.25%], being statistically significant, maximum severity [Grade 2] was seen in the lignocaine group [36.67%], the incidence of hoarseness of voice was 20.41%, with maximum severity [Grade 2] being in lignocaine group [13.33%], the incidence of cough was 8.1%, with maximum severity [Grade 2] being in lignocaine group [8.3%] as seen in the graph depicted above that is graph 7 and graph

# DISCUSSION

Many procedures under general anaesthesia are now carried out with endotracheal intubation in modern anaesthetic practise. POST, which occurs after endotracheal intubation, is a well-known side effect which is one of the most unfavourable because of the discomfort it causes. [01]

POST [Post-operative sore throat] is a phrase used to describe a variety of symptoms that accompany as sequalae post- intubation, including laryngitis, tracheitis, hoarseness, coughing, and dysphagia.[02]

After surgery, sore throat has been linked to the patient's sex, age, endotracheal tube size, cuff design, and intra cuff pressure, dry inhalational agents, respiratory mucosal inflammation and irritation. [03]

Due to stimulation of pain receptors in the throat mucosa owing to endotracheal tube adhesion, the incidence of postoperative sore throat is 21-65 percent after endotracheal intubation.[03]

Our study was to assess the effectiveness of benzydamine and 10% lidocaine in lowering the frequency and intensity of postoperative cough, hoarseness of voice, and sore throat.

In terms of gender, age, ASA physical status, Mallampatti grade, kind of surgical treatment, and length of surgical procedure, the sample distribution was comparable across both groups, making it more standardised.

In our study, Incidence of POST was 18.95%, highest in the lignocaine group [26.25%], being statistically significant, maximum severity [Grade 2] was seen in the lignocaine group [36.67%], the incidence of hoarseness of voice was 20.41%, with maximum

severity [Grade 2] being in lignocaine group [13.33%], the incidence of cough was 8.1%, with maximum severity [Grade 2] being in lignocaine group [8.3%].

Smaller endotracheal tubes, careful airway management, intubation after complete cord relaxation, gentle oral suctioning, minimising intra-cuff pressure, and extubation after complete deflation of the endotracheal tube's cuff are non-pharmacological ways to limit the occurrence of POST [41,42,43]. Other pharmacological treatments include betamethasone inhalation, IV preservative-free lignocaine, lubricating the tube with lignocaine jelly, gargling with lignocaine. All of these strategies have shortcomings, too, and they haven't entirely succeeded in lowering POST incidence and severity.

To reduce bias and minimise the impact of confounding factors as much as feasible, many of the risk factors for POST, cough, and hoarseness were avoided. These factors were controlled in this study by inclusion criteria, exclusion criteria, and equivalent use of anaesthetic drugs.

We used 8.5mm ID Portex endotracheal tubes for men and 7.5mm ID Portex endotracheal tubes for women in both the groups in our research because Stout D M et al in their clinical report involving 66 men and 35 women discovered that larger tubes cause more post-operative sore throat than smaller tubes with 48% in larger group and 22% with the smaller group. [41]

As the length of the surgery grows, the likelihood of sore throat rises. Therefore, the length of the procedure was established in our research. The duration was standardised among both the groups [up to 120minutes including intubation and extubation].

The prevalence of postoperative sore throat varied among various investigators in different studies due to a lack of consistent questioning techniques. Harding et al, in their direct questionnaire method found a higher occurrence of sore throats. [44] Thus, we employed a

similar direct line of questioning to determine the frequency of post-operative cough, hoarseness, and sore throat.

In a meta-analysis by Kuriyama et al., benzydamine was linked to a lower incidence of postoperative sore throat, but not a lower severity. The meta-analysis included thirteen randomised controlled trials with 1842 patients receiving general anaesthesia with endotracheal intubation. No serious side effects of benzydamine that were compatible with the findings of our investigation were reported. When compared to lidocaine, benzydamine was also linked to a lower incidence of postoperative sore throat.[26] Additionally, the topical NSAID benzydamine hydrochloride [10] is used. NSAIDs inhibit prostaglandin synthesis in peripheral tissues, which sensitises nerve terminals near the site of damage. [17] These outcomes come about as a result of phospholipases inhibiting the cyclooxygenase enzyme, which is in charge of converting arachidonic acid from the phospholipid membrane to prostaglandins. [17] Our findings imply that benzydamine hydrochloride inhibits inflammatory mediator responses and may lessen POST occurrence and severity than 10% lidocaine.

Smita.M. Gaikwad et al. conducted a prospective randomised clinical trial with 200 adult patients to determine the prevalence of sore throat, cough, and hoarseness of voice following tracheal intubation. The patients were split into two equal groups [groups B and C] of 100 each at random. Patients in group B were given benzydamine 0.15% gargles, whilst those in group C received a placebo. Five minutes before the induction of anaesthesia, patients were instructed to gargle for 30 seconds. At intervals of 0, 2, 4, and 24 hours after extubation, the patients were assessed for sore throat, cough, and hoarseness of voice. The findings demonstrated that preoperative gargling with Benzydamine hydrochloride was effective in reducing postoperative sore throat without causing any negative side effects. [36] The results obtained from our study also showed benzydamine hydrochloride, reduced the severity of post-

operative sore throat with no side effects with respect to application of spray on the endotracheal tube cuff.

Faiz SH et.al in their randomized control trial compared the effect of ketamine gel and topical use of benzydamine with normal saline on the post-operative sore throat in 60 patients undergoing elective hysterectomy under general anaesthesia with endotracheal intubation, it was equally effective in easing painful throat discomfort in the first day following surgery. [37] During the first 24hours post-extubation our study results showed benzydamine hydrochloride reduced the severity of post operative sore throat compared to lignocaine hydrochloride.

According to Baldock et al., *Department of Metabolism and Pharmacokinetics. Huntingdon Research Centre, Huntingdon, Cambridgeshire England in their clinical report told* that the Benzydamine plasma levels peaked at 2-6 hours after cutaneous application. [29] Based on the findings of the afore mentioned study we delivered the study drug right before endotracheal intubation and procedure which lasted not more than 2 hours.

There was a mechanism that's been known to reduce the stimulation of sensory C fibres in the airway and to regulate the release of sensory neuropeptides. Tanaka et al. found that lidocaine reduced the incidence of POST using ways that decreased the excitation of the sensory nerve fibres, such as the application of local anaesthetics, in their meta-analysis of 19 randomised clinical investigations including 1940 individuals. [40] However, they also noted that the effects of lidocaine depend on the route of administration, drug concentration, and physiology of study volunteers. In earlier research, it was observed that the incidence of POST would change after the larynx, trachea, or ENDOTRACHEAL TUBE were sprayed with a 10 percent lidocaine spray. [40] They even went so far as to say that the additives, which can irritate the tracheal mucosa, were most likely the cause of the throat problems linked to lidocaine spray. Regarding

the frequency and intensity of POST in the lidocaine group of our investigation, these findings were inconsistent.

We were unable to determine the ideal amount of topical Benzydamine to use on the endotracheal tube cuff as a preventative measure to lessen POST. However, clinical report done by Baldock.et al, *Department of Metabolism and Pharmacokinetics. Huntingdon Research Centre, Huntingdon, Cambridgeshire England* could not discover any correlation between dose and clinical effective magnitude of the drug. [39] No patients who took part in our trial had any negative effects from the study drug benzydamine hydrochloride.

In their randomised clinical trial of 92 adult patients undergoing thoracic surgery with double lumen tube intubation, Jee eun Chang et al. [45] evidenced that prophylactic application of benzydamine hydrochloride [group BH] to the endotracheal tube cuff and oropharyngeal cavity as opposed to the normal saline group [group S] reduced the incidence and severity of postoperative sore throat along with the incidence Postoperative sore throat that occurred less frequently in Group BH at one hour, six hours, and 24 hours following surgery when compared to Group S. The incidence and intensity of post-operative sore throats were significantly lower with benzydamine hydrochloride [group A] in our study than with lignocaine hydrochloride [group B].

Kim Doyeon et al. compared the effects of benzydamine hydrochloride and saline spray on the endotracheal tube cuff in preventing the incidence and severity of postoperative sore throat in their prospective, randomised, parallel-group, double-blind study. The incidence of POST at six hours after tracheal extubation was compared between groups, Total thyroid gland removal under general anaesthesia was performed on 113 patients, and it was found that application [46] of benzydamine hydrochloride spray on the endotracheal cuff reduced the incidence and severity of POST at 12 hours, which was consistent with the findings of our study when compared to

lignocaine hydrochloride. And he added that this approach was a non-invasive, successful POST therapeutic modality without undesirable side effects.

# SUMMARY

In this study, patients between the ages of 18 and 60 who underwent elective surgical procedures requiring general anaesthesia with single lumen Oro-tracheal intubation were compared to the effectiveness of 0.15% benzydamine hydrochloride puffs at the cuff level of the endotracheal tube and that of 10% lidocaine hydrochloride puffs in reducing the incidence and severity of postoperative sore throat, hoarseness of voice, and cough.

Using a computer-generated randomized table, patients were assigned at random to one of the two groups after providing their consent and meeting the eligibility and exclusion requirements.

Group A- 10 puffs of benzydamine hydrochloride 0.15%, which contained approximately 1.5 mg of benzydamine.

Group B- 10 puffs of 10% lidocaine hydrochloride approximately 100 mg of lidocaine.

Both groups used the same technique, endotracheal tube size, and medications for the surgery.

In the immediate aftermath of surgery, patients were directly questioned on the severity and frequency of POST, coughing, and hoarseness of voice.

Observation showed that age, sex distribution, preoperative vitals were similar in both groups but hemodynamic stability was better in the lidocaine group compared to benzydamine group.

Overall incidence of POST was 18.95%, highest in the lignocaine group [26.25%], being statistically significant, maximum severity [Grade 2] was seen in the lignocaine group [36.67%], the incidence of hoarseness of voice was 20.41%, with maximum severity [Grade 2] being in lignocaine group [13.33%], the incidence of cough was 8.1%, with maximum severity [Grade 2] being in lignocaine group [8.3%].

# CONCLUSION

When comparing the benzydamine group to the lignocaine group, we found that the incidence and severity of POST, cough, and voice hoarseness were much lower in the benzydamine group. The lignocaine group, however, provided more stable hemodynamics. However, benzydamine does assist with reducing hoarseness, coughing, and POST. resulting in improved patient satisfaction and a quicker recovery.

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# ANNEXURE I - INFORMED CONSENT FOR PARTICIPATION IN RESEARCH TRIAL

**"EFFECT OF BENZYDAMINE HYDROCHLORIDE [0.15%] SPRAY AND LIDOCAINE HYDROCHLORIDE [10%] SPRAY ON ENDOTRACHEAL TUBE CUFF IN REDUCING POST-OPERATIVE SORE THROAT, HOARSENESS OF VOICE AND COUGH – A RANDOMISED CLINICAL TRIAL**".

**PRINCIPAL INVESTIGATOR:** **BA0120019**

POST-GRADUATE STUDENT

DEPARTMENT OF ANAESTHESIA

J.N. MEDICAL COLLEGE, BELAGAVI.

**INTRODUCTION AND PURPOSE:**

The present study is conducted among patients in the age group of 18-60 years scheduled for various elective surgeries under general anesthesia with endotracheal intubation in the department of Anaesthesiology at KLE's Dr. Prabhakar Kore charitable Hospital and Medical Research Centre, Belagavi. You are requested to participate in the study and your participation is completely voluntary and to compare the prophylactic effectiveness of topical 0.15% benzydamine hydrochloride puffs at the cuff level of the endotracheal tube with that of 10% Lidocaine hydrochloride in reducing the incidence and severity of postoperative sore throat, hoarseness of voice and cough in patients undergoing general anaesthesia with endotracheal intubation.

**PROCEDURE:**

If you agree to enrol in my study, I will ask your present, past and family history. Then you will be clinically examined in detail. You will be allotted into one of the two groups randomly using computer generated randomisation software.

**Group-A:**

10 puffs of approximate 1.5mg of 0.15% benzydamine hydrochloride.

**Group-B:**

10 puffs of approximate 100mg of 10% lignocaine hydrochloride.

**BENEFITS:**

Patient will not be eligible for any kind of monetary benefits or free services by virtue of our participation in the study.

**RISKS:**

Methods applied to the study are safe.

**COST OF PARTICIPATION:**

The cost of the investigation will be borne by the study subject. The other indirect expenses will be borne by the investigator.

**PRIVACY AND CONFIDENTIALITY:**

The results of the study may be published in journals for scientific purposes. However, your identity will not be revealed. All information collected will be coded so that no one, other than the investigator will know your identity.

**WITHDRAWAL FROM THE STUDY:**

You can withdraw from the study at any time if you wish to do so.

**ALTERNATIVES:**

The researcher may use the information gathered from this study for presentation in scientific meetings. However, your identity will not be revealed. Any information that is obtained in connection with this study and that can be identified with your identity will remain confidential.

**PRIVACY AND CONFIDENTIALITY:**

The only people to know that you are as 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 BA0120019 at Department of Anaesthesiology, J.N. Medical College.

**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 BA0120019, Department of Anaesthesiology, J.N. Medical College, Belagavi.

## CONSENT SUMMARY:

**"EFFECT OF BENZYDAMINE HYDROCHLORIDE [0.15%] SPRAY AND LIDOCAINE HYDROCHLORIDE [10%] SPRAY ON ENDOTRACHEAL TUBE CUFF IN REDUCING POST-OPERATIVE SORE THROAT, HOARSENESS OF VOICE AND COUGH – A RANDOMISED CLINICAL TRIAL**".

I have been explained all the contents of this consent form in my vernacular language and having understood and clarified all my queries about the study to the best of my knowledge, I hereby give my voluntary consent for participation in the study, I do sign the informed consent form in front of an eye witness whom I recognize.

Subject Name:

Signature/Left thumb print:

Investigators Name:

Signature:

Witness Name:

Signature:

Date: Place:

# ANNEXURE II - PROFORMA

**"EFFECT OF BENZYDAMINE HYDROCHLORIDE [0.15%] SPRAY AND LIDOCAINE HYDROCHLORIDE [10%] SPRAY ON ENDOTRACHEAL TUBE CUFF IN REDUCING POST-OPERATIVE SORE THROAT, HOARSENESS OF VOICE AND COUGH – A RANDOMISED CLINICAL TRIAL**".

Group allotted: Date of Examination :

Name: Age:

Gender:

Address: Occupation:

History and examination:

Weight: Clubbing:

Height: Pulse:

Temp: B.P.:

Pallor: RR:

Cyanosis: $SPO_2$:

Pedal oedema: Allen's test:

Drugs and past history:

H/o previous surgery/[s] where airway difficulty was encountered. Yes No

Allergy and previous anesthetic experience:

Cardio-respiratory system:

Angina: CVS:

Dyspnoea: Heart sounds:

Cough: RS:

Expectoration: Trachea:

Asthma: Breath Sounds:

Haemoptysis:

CNS

P/A

Musculoskeletal system

Teeth:

Jaw movements:

Airway assessment:

Spine:

Preoperative physical status ASA Grade I II III IV V

Provisional diagnosis:

Proposed surgery:

Premedication

| Para meters | At 10 Min | At 20 Min | At 30 Min | At 40 Min | At 50m in | At 60M in | At 70M in | At 80M in | At 90M in | At 100 Min | At 110 Min | At 120 Min |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Systolic BP | | | | | | | | | | | | |
| Diastoli BP | | | | | | | | | | | | |
| MAP | | | | | | | | | | | | |
| Heart rate | | | | | | | | | | | | |
| Tube Cuff pressure | | | | | | | | | | | | |

| Parameter | After extubation | After extubation [At 1 min] | After extubation [at5 mins] | In recovery [At 10 mins] |
|---|---|---|---|---|
| Systolic BP | | | | |
| Diastolic BP | | | | |
| MAP | | | | |
| Heart Rate | | | | |

| Parameter | 0-hour at extubation | 1-hour post extubation | 6 hours post extubation | 24 hours post extubation |
|---|---|---|---|---|
| Post-operative Sore throat [Grade] | | | | |
| Hoarseness of voice [Grade] | | | | |
| Cough [Grade] | | | | |

SIGNATURE OF THE ANAESTHESIOLOGIST:

_____

SIGNATURE OF THE WITNESS:

_____

SIGNATURE OF THE PRINCIPAL INVESTIGATOR:

_____

# ANNEXURE III - ETHICAL CLEARANCE

K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH
(Deemed - to- be- University)
Accredited 'A' Grade by NAAC (2nd Cycle) Placed in Category 'A' by MHRD (GoI)
**JAWAHARLAL NEHRU MEDICAL COLLEGE,**
**NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)**
Website: http//www.jnmc.edu
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Principal: 2471701
Fax No. +91 (0)831 – 2470759

**Ref: MDC/DOME/** 98 **Date: 25/01/2021**

To,

BA0120019.
PG student in Anaesthesiology,
J.N.Medical College,
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"A COMPARATIVE STUDY BETWEEN BENZYDAMINE HYDROCHLORIDE (0.15%) SPRAY AND LIDOCAINE HYDROCHLORIDE (10%) SPRAY ON ENDOTRACHEAL TUBE CUFF IN REDUCING POST-OPERATIVE SORE THROAT, HOARSENESS OF VOICE AND COUGH- A ONE YEAR RANDOMISED CLINICAL TRIAL ",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

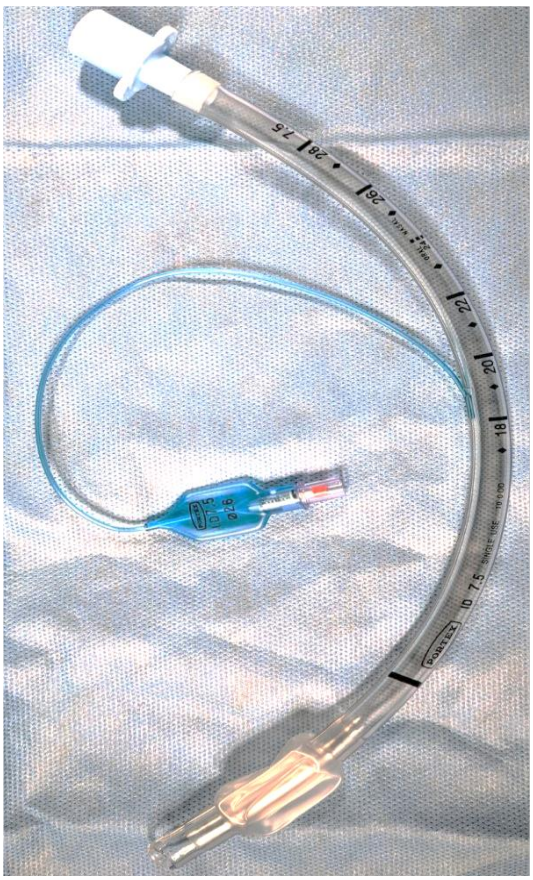
**(Dr. Smita Sonoli)**
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

**(Dr. Harsha Hegde)**
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

# ANNEXURE – IV – PHOTOGRAPHS

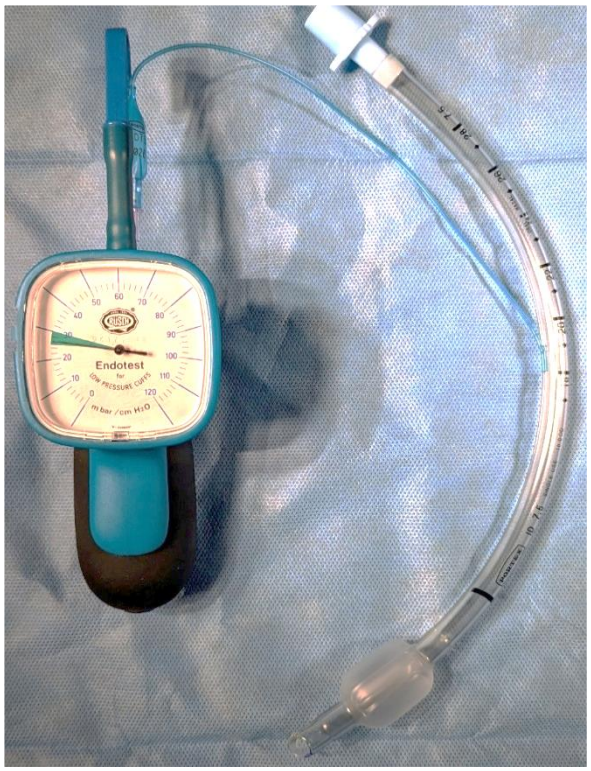

**Photograph 1**

Endotracheal tube cuff pressure monitoring device used to set and measure the intra-operative cuff pressure



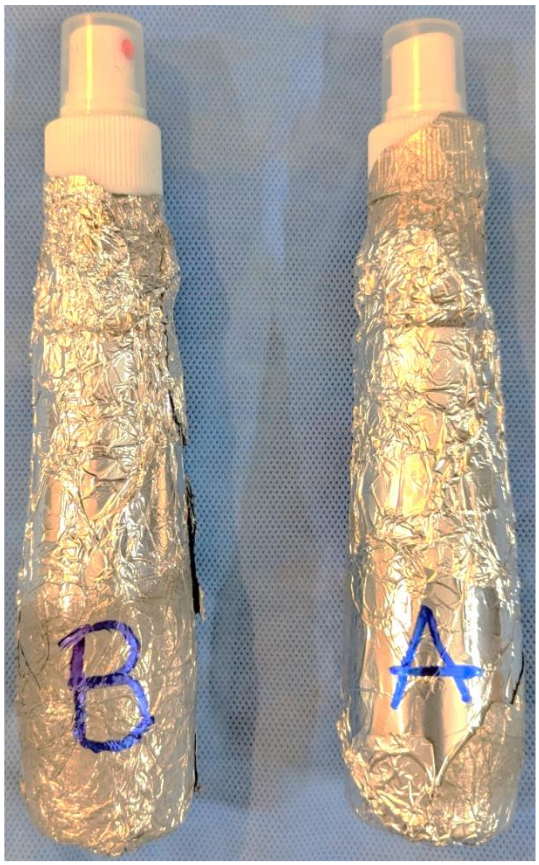
**Photograph 2**

Cuffed PVC (poly vinyl chloride) endotracheal tube




**Photograph 3**

Cuff pressure monitoring device attached to endotracheal tube and the cuff pressure set at 25 cm of water

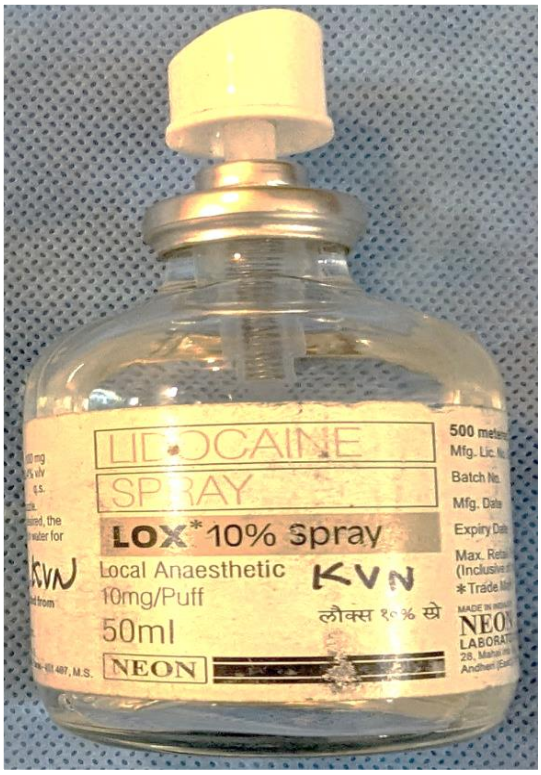



**Photograph 4**

Blinding of the spray device with respective study drug

Drugs Used to Spray on the endotracheal tube cuff


**Photograph 5**
0.15% Benzydamine hydrochloride [Alcohol free in brilliant blue FCF aqueous base] which contained 1.5 mg of Benzydamine Hydrochloride.




**Photograph 6**
10% Lignocaine Hydrochloride [Ethanol I.P. and flavouring base], which contained 100 mg of Lignocaine Hydrochloride


**Photograph 7**

Anaesthesia Work Station with Standard Monitor

# ANNEXURE – V - KEY TO MASTER CHART

| | | |
|---|---|---|
| ASA | - | American Society of Anaesthesiologists |
| M | - | Male |
| F | - | Female |
| HR | - | Heart Rate |
| SBP | - | Systolic Blood Pressure |
| DBP | - | Diastolic Blood Pressure |
| MAP | - | Mean Arterial Pressure |
| AE | - | After Extubation |
| POST | - | Post-Operative Sore Throat |
| HOV | - | Hoarseness of Voice |
| Min | - | Minute |
| H | - | Hour |

# ANNEXURE – VI - MASTER CHART

| | | | | 10% LIGNOCAINE HYDROCHLORIDE SPRAY - GROUP B | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.NO | AGE | SEX | ASA | HR | | | | | | | | | | | | SBP | | | | | | | | | | | | | |
| | | | | 10 min | 20 min | 30 min | 40 min | 50 min | 60 min | 70 min | 80 min | AE 0th H | AE 1st H | AE 6th H | AE 24H | 10 min | 20 min | 30 min | 40 min | 50 min | 60 min | 70 min | 80 min | AE 0th H | AE 1st H | AE 6th H | AE 24H | 10 min | 20 min | 30 min |
| 1 | 38 | M | I | 76 | 78 | 82 | 90 | 95 | 95 | 89 | 93 | 87 | 87 | 92 | 94 | 127 | 130 | 128 | 125 | 133 | 125 | 124 | 122 | 119 | 110 | 107 | 107 | 85 | 100 | 90 |
| 2 | 38 | F | I | 72 | 74 | 76 | 86 | 89 | 95 | 95 | 99 | 93 | 91 | 86 | 88 | 129 | 132 | 130 | 123 | 125 | 113 | 110 | 114 | 109 | 106 | 103 | 103 | 83 | 96 | 94 |
| 3 | 32 | F | I | 70 | 72 | 76 | 90 | 95 | 91 | 87 | 85 | 81 | 87 | 90 | 94 | 123 | 126 | 124 | 123 | 125 | 121 | 118 | 112 | 109 | 106 | 103 | 99 | 87 | 94 | 94 |
| 4 | 44 | F | II | 78 | 80 | 84 | 90 | 95 | 101 | 93 | 91 | 93 | 91 | 88 | 92 | 127 | 130 | 130 | 133 | 133 | 123 | 122 | 120 | 115 | 112 | 105 | 101 | 83 | 88 | 86 |
| 5 | 65 | M | II | 66 | 68 | 72 | 78 | 83 | 91 | 93 | 93 | 93 | 93 | 96 | 90 | 131 | 134 | 130 | 121 | 135 | 127 | 124 | 120 | 113 | 106 | 103 | 99 | 77 | 92 | 92 |
| 6 | 21 | F | I | 68 | 70 | 111 | 107 | 107 | 109 | 107 | 107 | 95 | 95 | 92 | 92 | 102 | 105 | 114 | 108 | 115 | 113 | 111 | 112 | 109 | 102 | 101 | 101 | 89 | 76 | 80 |
| 7 | 31 | M | I | 90 | 92 | 88 | 92 | 95 | 95 | 93 | 97 | 95 | 99 | 98 | 98 | 127 | 130 | 124 | 131 | 129 | 119 | 116 | 112 | 111 | 108 | 101 | 101 | 83 | 82 | 82 |
| 8 | 48 | M | II | 96 | 98 | 98 | 98 | 99 | 99 | 96 | 97 | 97 | 97 | 94 | 94 | 123 | 126 | 124 | 131 | 129 | 123 | 119 | 120 | 115 | 108 | 103 | 101 | 93 | 84 | 86 |
| 9 | 24 | M | I | 112 | 114 | 111 | 107 | 107 | 109 | 105 | 95 | 93 | 93 | 92 | 92 | 102 | 105 | 114 | 108 | 115 | 111 | 116 | 114 | 111 | 102 | 101 | 99 | 75 | 76 | 82 |
| 10 | 35 | M | I | 86 | 88 | 84 | 86 | 87 | 87 | 85 | 91 | 87 | 91 | 88 | 86 | 119 | 122 | 122 | 125 | 129 | 119 | 116 | 116 | 117 | 106 | 103 | 101 | 81 | 84 | 84 |
| 11 | 26 | F | I | 120 | 122 | 121 | 112 | 105 | 103 | 101 | 90 | 90 | 89 | 86 | 82 | 117 | 120 | 122 | 129 | 131 | 128 | 123 | 122 | 123 | 124 | 117 | 113 | 77 | 86 | 86 |
| 12 | 45 | M | II | 88 | 90 | 86 | 71 | 63 | 62 | 57 | 58 | 57 | 60 | 58 | 58 | 115 | 118 | 118 | 127 | 127 | 119 | 114 | 114 | 111 | 108 | 103 | 101 | 85 | 72 | 82 |
| 13 | 19 | M | I | 90 | 92 | 90 | 92 | 93 | 97 | 93 | 93 | 93 | 93 | 92 | 92 | 127 | 130 | 130 | 119 | 123 | 117 | 122 | 120 | 117 | 108 | 103 | 99 | 85 | 78 | 84 |
| 14 | 47 | F | II | 88 | 90 | 86 | 86 | 83 | 82 | 80 | 69 | 68 | 69 | 69 | 68 | 127 | 130 | 135 | 120 | 118 | 115 | 115 | 114 | 114 | 110 | 106 | 106 | 85 | 82 | 86 |
| 15 | 26 | F | I | 96 | 98 | 94 | 96 | 95 | 99 | 99 | 99 | 101 | 103 | 104 | 102 | 125 | 128 | 128 | 133 | 133 | 125 | 124 | 120 | 117 | 106 | 101 | 97 | 87 | 84 | 82 |
| 16 | 40 | M | II | 98 | 100 | 94 | 96 | 101 | 105 | 99 | 99 | 101 | 105 | 102 | 102 | 129 | 132 | 132 | 129 | 135 | 127 | 124 | 122 | 119 | 108 | 103 | 99 | 87 | 86 | 86 |
| 17 | 38 | M | II | 104 | 106 | 106 | 106 | 103 | 107 | 107 | 110 | 105 | 103 | 104 | 100 | 127 | 130 | 124 | 127 | 125 | 119 | 118 | 112 | 109 | 102 | 101 | 101 | 85 | 82 | 82 |
| 18 | 24 | F | I | 96 | 98 | 98 | 98 | 101 | 107 | 107 | 105 | 101 | 105 | 108 | 110 | 117 | 120 | 124 | 131 | 135 | 121 | 120 | 120 | 123 | 112 | 107 | 107 | 71 | 86 | 84 |
| 19 | 40 | F | II | 86 | 88 | 84 | 86 | 87 | 87 | 89 | 87 | 87 | 91 | 88 | 86 | 127 | 130 | 124 | 129 | 127 | 123 | 122 | 120 | 117 | 108 | 103 | 103 | 83 | 84 | 84 |
| 20 | 55 | M | II | 98 | 100 | 94 | 96 | 99 | 103 | 95 | 93 | 93 | 97 | 92 | 90 | 131 | 134 | 132 | 129 | 137 | 131 | 130 | 128 | 121 | 114 | 113 | 107 | 81 | 88 | 88 |
| 21 | 50 | M | II | 88 | 90 | 90 | 92 | 91 | 91 | 91 | 95 | 91 | 91 | 88 | 86 | 123 | 126 | 126 | 131 | 135 | 127 | 126 | 124 | 119 | 112 | 105 | 101 | 85 | 80 | 80 |
| 22 | 52 | F | II | 90 | 92 | 88 | 90 | 91 | 91 | 89 | 91 | 89 | 91 | 90 | 90 | 127 | 130 | 124 | 129 | 133 | 127 | 128 | 130 | 121 | 114 | 113 | 113 | 73 | 84 | 86 |
| 23 | 50 | F | II | 82 | 84 | 78 | 80 | 79 | 80 | 78 | 79 | 80 | 85 | 84 | 82 | 127 | 130 | 124 | 131 | 135 | 127 | 126 | 124 | 119 | 112 | 103 | 105 | 81 | 86 | 86 |
| 24 | 30 | F | I | 90 | 92 | 88 | 92 | 91 | 93 | 91 | 91 | 91 | 92 | 91 | 91 | 127 | 130 | 122 | 115 | 117 | 117 | 116 | 114 | 111 | 104 | 103 | 103 | 85 | 82 | 84 |
| 25 | 44 | F | II | 92 | 94 | 86 | 88 | 88 | 89 | 87 | 89 | 87 | 89 | 88 | 88 | 119 | 122 | 122 | 131 | 127 | 123 | 118 | 116 | 111 | 104 | 103 | 103 | 81 | 76 | 84 |
| 26 | 22 | F | I | 90 | 92 | 88 | 92 | 91 | 93 | 89 | 91 | 89 | 91 | 90 | 88 | 105 | 108 | 118 | 131 | 135 | 123 | 120 | 118 | 113 | 106 | 101 | 101 | 67 | 80 | 86 |
| 27 | 45 | M | II | 87 | 90 | 84 | 86 | 87 | 87 | 85 | 87 | 85 | 89 | 88 | 88 | 117 | 120 | 122 | 131 | 131 | 123 | 118 | 116 | 111 | 108 | 103 | 103 | 83 | 70 | 78 |
| 28 | 55 | F | II | 79 | 82 | 76 | 78 | 79 | 80 | 77 | 79 | 79 | 81 | 78 | 78 | 127 | 130 | 130 | 121 | 127 | 121 | 120 | 120 | 117 | 106 | 105 | 105 | 79 | 70 | 72 |
| 29 | 48 | M | I | 112 | 114 | 111 | 107 | 107 | 109 | 105 | 95 | 93 | 93 | 92 | 92 | 102 | 105 | 114 | 129 | 135 | 123 | 118 | 116 | 111 | 104 | 97 | 99 | 71 | 60 | 66 |
| 30 | 45 | F | I | 94 | 96 | 98 | 98 | 99 | 99 | 96 | 97 | 97 | 97 | 94 | 94 | 119 | 122 | 124 | 131 | 127 | 123 | 120 | 118 | 115 | 106 | 105 | 99 | 87 | 84 | 82 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DBP | | | | | | | | | MAP | | | | | | | | | | | | | POST | | | | HOV | | | | COUGH | | | |
| 50 min | 60 min | 70 min | 80 min | AE 0th H | AE 1st H | AE 6th H | AE 24H | 10 min | 20 min | 30 min | 40 min | 50 min | 60 min | 70 min | 80 min | AE 0th H | AE 1st H | AE 6th H | AE 24H | 0 HOUR | 1 HOUR | 6 HOUR | 24 HOUR | 0 HOUR | 1 HOUR | 6 HOR | 24 HOUR | 0 HOUR | 1 HOUR | 6 HOUR | 24 HOUR |
| 79 | 74 | 81 | 81 | 84 | 86 | 80 | 80 | 83 | 99 | 110 | 103 | 95 | 93 | 96 | 96 | 97 | 97 | 90 | 89 | 91 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 93 | 86 | 87 | 87 | 82 | 84 | 80 | 78 | 81 | 99 | 108 | 106 | 103 | 99 | 96 | 95 | 93 | 92 | 88 | 86 | 88 | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 91 | 84 | 87 | 87 | 86 | 80 | 76 | 74 | 73 | 99 | 105 | 104 | 102 | 97 | 98 | 98 | 95 | 89 | 86 | 83 | 82 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 89 | 82 | 85 | 83 | 82 | 78 | 78 | 76 | 77 | 98 | 102 | 101 | 104 | 99 | 98 | 96 | 95 | 90 | 89 | 85 | 85 | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 83 | 78 | 77 | 77 | 76 | 76 | 74 | 80 | 81 | 95 | 106 | 105 | 96 | 97 | 94 | 93 | 91 | 88 | 84 | 87 | 87 | 1 | 1 | 1 | 0 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| 83 | 88 | 97 | 91 | 88 | 91 | 90 | 82 | 85 | 94 | 86 | 92 | 92 | 97 | 102 | 98 | 96 | 97 | 94 | 88 | 90 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 83 | 88 | 81 | 81 | 82 | 80 | 80 | 78 | 77 | 98 | 98 | 96 | 99 | 101 | 94 | 93 | 92 | 90 | 89 | 85 | 85 | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 89 | 92 | 91 | 91 | 92 | 90 | 86 | 82 | 77 | 103 | 98 | 99 | 103 | 104 | 102 | 101 | 101 | 98 | 93 | 89 | 85 | 1 | 1 | 0 | 0 | 2 | 2 | 1 | 0 | 1 | 0 | 0 | 0 |
| 81 | 88 | 77 | 75 | 74 | 76 | 74 | 76 | 81 | 84 | 86 | 93 | 90 | 97 | 88 | 89 | 87 | 87 | 83 | 84 | 87 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2 | 1 | 0 |
| 87 | 94 | 89 | 83 | 80 | 80 | 78 | 74 | 73 | 94 | 97 | 97 | 100 | 105 | 99 | 94 | 92 | 92 | 87 | 83 | 82 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 83 | 90 | 83 | 79 | 76 | 76 | 72 | 74 | 73 | 91 | 97 | 98 | 99 | 103 | 98 | 94 | 91 | 91 | 89 | 88 | 86 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 85 | 92 | 87 | 85 | 84 | 84 | 82 | 78 | 75 | 95 | 87 | 94 | 99 | 103 | 98 | 95 | 94 | 93 | 90 | 86 | 84 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 91 | 84 | 83 | 83 | 84 | 84 | 82 | 78 | 73 | 99 | 95 | 100 | 101 | 97 | 94 | 96 | 96 | 95 | 90 | 86 | 82 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 85 | 90 | 87 | 85 | 84 | 86 | 82 | 74 | 77 | 99 | 98 | 103 | 97 | 99 | 96 | 95 | 94 | 95 | 91 | 84 | 87 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81 | 90 | 87 | 85 | 86 | 86 | 82 | 80 | 75 | 100 | 99 | 98 | 99 | 104 | 100 | 98 | 97 | 96 | 90 | 87 | 82 | 1 | 1 | 0 | 0 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 0 |
| 85 | 90 | 87 | 85 | 86 | 92 | 90 | 82 | 79 | 101 | 101 | 102 | 100 | 105 | 100 | 98 | 98 | 101 | 96 | 89 | 86 | 2 | 1 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 85 | 90 | 91 | 87 | 84 | 84 | 80 | 74 | 77 | 99 | 98 | 96 | 99 | 101 | 100 | 98 | 93 | 92 | 87 | 83 | 85 | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 85 | 74 | 71 | 71 | 70 | 68 | 72 | 74 | 75 | 87 | 97 | 98 | 101 | 94 | 88 | 88 | 87 | 86 | 85 | 85 | 86 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 85 | 90 | 87 | 83 | 82 | 80 | 78 | 74 | 73 | 98 | 99 | 98 | 100 | 102 | 99 | 96 | 95 | 92 | 88 | 83 | 83 | 2 | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 89 | 86 | 77 | 83 | 80 | 78 | 74 | 72 | 75 | 98 | 103 | 103 | 103 | 103 | 95 | 99 | 96 | 92 | 87 | 85 | 86 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| 85 | 92 | 89 | 85 | 84 | 82 | 80 | 82 | 75 | 98 | 95 | 96 | 101 | 106 | 102 | 99 | 97 | 94 | 90 | 89 | 84 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 89 | 78 | 71 | 71 | 72 | 70 | 74 | 72 | 77 | 91 | 99 | 99 | 103 | 96 | 90 | 90 | 91 | 87 | 87 | 85 | 89 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| 89 | 84 | 83 | 81 | 80 | 82 | 82 | 78 | 73 | 97 | 101 | 99 | 103 | 101 | 98 | 96 | 95 | 94 | 92 | 86 | 84 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 85 | 88 | 85 | 83 | 84 | 84 | 80 | 76 | 73 | 99 | 98 | 97 | 95 | 97 | 96 | 94 | 94 | 93 | 88 | 85 | 83 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 85 | 88 | 81 | 81 | 80 | 78 | 76 | 74 | 75 | 94 | 91 | 97 | 101 | 101 | 95 | 94 | 92 | 89 | 85 | 83 | 84 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 85 | 66 | 67 | 69 | 66 | 68 | 68 | 74 | 73 | 80 | 89 | 97 | 101 | 89 | 86 | 86 | 83 | 83 | 80 | 83 | 82 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 85 | 88 | 83 | 81 | 82 | 80 | 78 | 74 | 71 | 95 | 87 | 93 | 101 | 102 | 96 | 94 | 93 | 90 | 88 | 83 | 82 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 73 | 76 | 85 | 81 | 78 | 76 | 72 | 70 | 69 | 95 | 90 | 92 | 89 | 93 | 97 | 94 | 92 | 89 | 83 | 81 | 81 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 |
| 67 | 78 | 69 | 69 | 70 | 70 | 70 | 72 | 75 | 82 | 75 | 82 | 88 | 97 | 87 | 86 | 85 | 83 | 81 | 80 | 83 | 1 | 1 | 0 | 0 | 2 | 1 | 1 | 0 | 2 | 2 | 2 | 2 |
| 81 | 86 | 95 | 87 | 86 | 86 | 82 | 78 | 75 | 98 | 97 | 96 | 98 | 99 | 104 | 98 | 97 | 95 | 90 | 87 | 83 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |

**0.15% BENZYDAMINE HYDROCHLORIDE SPRAY - GROUP A**

| S.NO | AGE | SEX | ASA | HR | | | | | | | | | | | | SBP | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 10 min | 20 min | 30 min | 40 min | 50 min | 60 min | 70 min | 80 min | AE 0thH | AE 1st H | AE 6th H | AE 24H | 10 min | 20 min | 30 min | 40 min | 50 min | 60 min | 70 min | 80 min | AE 0thH | AE 1st H | AE 6th H | AE 24H | 10 min | 20 min | 30 min | 40 min |
| 1 | 32 | F | I | 99 | 101 | 93 | 92 | 95 | 96 | 96 | 96 | 95 | 100 | 101 | 100 | 126 | 129 | 137 | 144 | 152 | 159 | 158 | 150 | 149 | 146 | 142 | 135 | 78 | 83 | 86 | 91 |
| 2 | 38 | M | I | 97 | 99 | 97 | 96 | 97 | 98 | 102 | 100 | 97 | 98 | 99 | 102 | 128 | 131 | 137 | 146 | 152 | 157 | 150 | 146 | 149 | 138 | 138 | 129 | 72 | 79 | 82 | 87 |
| 3 | 45 | M | II | 93 | 95 | 93 | 92 | 93 | 94 | 92 | 92 | 95 | 94 | 95 | 92 | 126 | 129 | 137 | 148 | 150 | 155 | 148 | 150 | 155 | 142 | 134 | 127 | 82 | 83 | 90 | 93 |
| 4 | 46 | F | II | 89 | 91 | 89 | 88 | 91 | 92 | 92 | 90 | 87 | 86 | 91 | 90 | 122 | 125 | 133 | 142 | 150 | 155 | 150 | 146 | 149 | 140 | 140 | 137 | 76 | 77 | 80 | 87 |
| 5 | 48 | F | II | 95 | 97 | 93 | 92 | 95 | 96 | 102 | 108 | 103 | 104 | 105 | 104 | 126 | 129 | 133 | 140 | 148 | 159 | 152 | 148 | 145 | 142 | 138 | 131 | 78 | 89 | 92 | 97 |
| 6 | 19 | M | I | 99 | 101 | 95 | 98 | 99 | 94 | 100 | 98 | 97 | 98 | 99 | 102 | 122 | 125 | 133 | 140 | 148 | 153 | 148 | 150 | 151 | 146 | 138 | 131 | 76 | 91 | 94 | 97 |
| 7 | 35 | M | I | 93 | 95 | 101 | 100 | 101 | 96 | 98 | 98 | 97 | 98 | 99 | 102 | 118 | 121 | 129 | 138 | 146 | 157 | 158 | 152 | 149 | 140 | 136 | 129 | 86 | 83 | 84 | 91 |
| 8 | 46 | M | II | 95 | 97 | 99 | 98 | 99 | 94 | 96 | 96 | 95 | 96 | 101 | 104 | 124 | 127 | 137 | 144 | 152 | 159 | 154 | 152 | 151 | 140 | 140 | 137 | 82 | 81 | 82 | 91 |
| 9 | 26 | F | I | 89 | 91 | 91 | 92 | 95 | 88 | 90 | 94 | 93 | 94 | 95 | 98 | 120 | 123 | 135 | 144 | 152 | 159 | 152 | 148 | 151 | 148 | 148 | 139 | 82 | 75 | 78 | 87 |
| 10 | 32 | M | I | 87 | 89 | 87 | 88 | 91 | 94 | 94 | 92 | 91 | 96 | 101 | 100 | 122 | 125 | 135 | 142 | 148 | 161 | 154 | 152 | 151 | 146 | 144 | 135 | 82 | 87 | 88 | 93 |
| 11 | 28 | F | I | 83 | 85 | 85 | 88 | 93 | 94 | 94 | 94 | 93 | 98 | 99 | 102 | 118 | 121 | 127 | 138 | 146 | 157 | 152 | 156 | 155 | 144 | 140 | 131 | 88 | 81 | 84 | 89 |
| 12 | 23 | F | I | 85 | 87 | 87 | 88 | 91 | 94 | 94 | 90 | 89 | 94 | 99 | 102 | 116 | 119 | 131 | 140 | 152 | 157 | 152 | 150 | 147 | 136 | 132 | 125 | 76 | 87 | 88 | 95 |
| 13 | 19 | F | I | 87 | 89 | 89 | 88 | 89 | 92 | 100 | 96 | 93 | 98 | 97 | 96 | 118 | 121 | 127 | 136 | 146 | 157 | 158 | 154 | 153 | 144 | 140 | 133 | 86 | 77 | 80 | 89 |
| 14 | 40 | M | II | 89 | 91 | 89 | 90 | 93 | 86 | 92 | 90 | 89 | 90 | 92 | 90 | 124 | 127 | 133 | 140 | 148 | 161 | 154 | 152 | 151 | 142 | 138 | 137 | 82 | 85 | 86 | 93 |
| 15 | 20 | F | I | 91 | 93 | 91 | 92 | 95 | 88 | 90 | 90 | 93 | 94 | 95 | 94 | 126 | 129 | 137 | 144 | 152 | 163 | 154 | 150 | 149 | 146 | 138 | 131 | 84 | 89 | 90 | 97 |
| 16 | 31 | M | I | 93 | 95 | 93 | 94 | 97 | 90 | 90 | 90 | 89 | 90 | 95 | 98 | 120 | 123 | 137 | 148 | 154 | 157 | 150 | 152 | 149 | 140 | 136 | 129 | 80 | 89 | 96 | 101 |
| 17 | 39 | M | II | 95 | 97 | 97 | 98 | 101 | 98 | 98 | 98 | 97 | 96 | 97 | 98 | 122 | 125 | 131 | 138 | 144 | 155 | 150 | 146 | 145 | 134 | 128 | 119 | 72 | 83 | 84 | 89 |
| 18 | 36 | M | I | 89 | 91 | 91 | 94 | 97 | 98 | 98 | 96 | 93 | 94 | 95 | 94 | 126 | 129 | 135 | 140 | 148 | 161 | 150 | 148 | 151 | 140 | 136 | 129 | 84 | 93 | 94 | 97 |
| 19 | 40 | F | I | 79 | 81 | 83 | 86 | 91 | 86 | 86 | 86 | 85 | 86 | 87 | 86 | 124 | 127 | 131 | 140 | 148 | 161 | 154 | 150 | 147 | 142 | 136 | 129 | 80 | 91 | 94 | 97 |
| 20 | 28 | F | I | 81 | 83 | 85 | 88 | 93 | 96 | 96 | 94 | 91 | 92 | 91 | 88 | 118 | 121 | 127 | 134 | 144 | 157 | 158 | 154 | 151 | 140 | 132 | 131 | 90 | 85 | 88 | 95 |
| 21 | 18 | M | I | 83 | 85 | 89 | 94 | 97 | 100 | 100 | 98 | 95 | 94 | 95 | 90 | 124 | 127 | 131 | 138 | 146 | 159 | 158 | 160 | 155 | 144 | 140 | 133 | 88 | 87 | 88 | 91 |
| 22 | 30 | M | I | 87 | 89 | 91 | 92 | 99 | 100 | 98 | 96 | 93 | 92 | 91 | 88 | 116 | 119 | 127 | 136 | 146 | 159 | 160 | 156 | 151 | 142 | 138 | 129 | 84 | 83 | 86 | 93 |
| 23 | 29 | F | I | 85 | 87 | 89 | 94 | 99 | 94 | 94 | 94 | 91 | 92 | 89 | 88 | 120 | 123 | 129 | 134 | 142 | 155 | 156 | 160 | 155 | 144 | 140 | 137 | 84 | 89 | 92 | 99 |
| 24 | 28 | F | I | 89 | 91 | 91 | 92 | 95 | 98 | 98 | 96 | 93 | 92 | 93 | 92 | 122 | 125 | 133 | 140 | 146 | 159 | 160 | 162 | 159 | 148 | 142 | 135 | 86 | 85 | 88 | 95 |
| 25 | 50 | F | II | 93 | 95 | 97 | 100 | 95 | 90 | 90 | 94 | 91 | 92 | 93 | 90 | 120 | 123 | 129 | 138 | 146 | 159 | 150 | 146 | 141 | 130 | 132 | 129 | 86 | 83 | 84 | 89 |
| 26 | 55 | F | II | 95 | 97 | 97 | 100 | 101 | 96 | 96 | 94 | 93 | 92 | 93 | 94 | 114 | 117 | 125 | 136 | 144 | 157 | 158 | 154 | 151 | 146 | 140 | 137 | 86 | 81 | 84 | 91 |
| 27 | 48 | F | II | 97 | 99 | 97 | 96 | 97 | 98 | 98 | 96 | 93 | 92 | 99 | 100 | 118 | 121 | 127 | 134 | 144 | 157 | 158 | 156 | 155 | 144 | 140 | 133 | 76 | 95 | 96 | 101 |
| 28 | 52 | F | II | 95 | 97 | 97 | 98 | 99 | 94 | 94 | 94 | 91 | 96 | 101 | 98 | 122 | 125 | 131 | 140 | 148 | 161 | 156 | 152 | 149 | 140 | 140 | 139 | 88 | 87 | 88 | 95 |
| 29 | 58 | F | II | 95 | 97 | 97 | 98 | 99 | 94 | 96 | 94 | 97 | 96 | 101 | 98 | 124 | 127 | 131 | 138 | 148 | 161 | 156 | 150 | 149 | 140 | 134 | 133 | 84 | 89 | 92 | 99 |
| 30 | 38 | F | I | 87 | 89 | 89 | 88 | 91 | 96 | 96 | 94 | 93 | 92 | 97 | 100 | 120 | 123 | 131 | 140 | 148 | 161 | 156 | 152 | 151 | 146 | 146 | 135 | 86 | 87 | 90 | 95 |

| DBP | | | | | | | | MAP | | | | | | | | | | | | POST | | | | HOV | | | | COUGH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 min | 60 min | 70 min | 80 min | AE 0thH | AE 1st H | AE 6th H | AE 24H | 10 min | 20 min | 30 min | 40 min | 50 min | 60 min | 70 min | 80 min | AE 0thH | AE 1st H | AE 6th H | AE 24H | 0 HOUR | 1 HOUR | 6 HOUR | 24 HOUR | 0 HOUR | 1 HOUR | 6 HOUR | 24 HOUR | 0 HOUR | 1 HOUR | 6 HOUR | 24 HOUR |
| 95 | 100 | 100 | 94 | 92 | 94 | 91 | 86 | 94 | 98 | 103 | 108 | 114 | 120 | 119 | 113 | 111 | 112 | 108 | 102 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 95 | 98 | 92 | 88 | 86 | 88 | 91 | 90 | 91 | 96 | 101 | 106 | 114 | 118 | 111 | 107 | 107 | 105 | 107 | 103 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 95 | 98 | 100 | 98 | 96 | 92 | 91 | 90 | 97 | 98 | 106 | 111 | 113 | 117 | 116 | 115 | 116 | 109 | 105 | 102 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 93 | 98 | 98 | 92 | 86 | 88 | 91 | 90 | 92 | 93 | 98 | 105 | 112 | 117 | 115 | 110 | 107 | 106 | 107 | 105 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 101 | 106 | 98 | 94 | 90 | 92 | 97 | 92 | 94 | 102 | 106 | 111 | 117 | 124 | 116 | 112 | 108 | 109 | 111 | 105 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| 101 | 100 | 94 | 92 | 96 | 98 | 95 | 88 | 92 | 102 | 107 | 111 | 117 | 118 | 112 | 111 | 114 | 114 | 109 | 102 | 2 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 95 | 102 | 104 | 102 | 98 | 96 | 93 | 88 | 97 | 96 | 99 | 106 | 112 | 120 | 122 | 119 | 115 | 111 | 107 | 101 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 97 | 106 | 100 | 98 | 96 | 94 | 93 | 94 | 96 | 96 | 101 | 108 | 115 | 124 | 118 | 116 | 114 | 110 | 109 | 108 | 2 | 1 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 95 | 102 | 104 | 98 | 96 | 94 | 93 | 94 | 95 | 91 | 97 | 106 | 114 | 121 | 120 | 115 | 114 | 112 | 111 | 109 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 99 | 106 | 100 | 98 | 98 | 96 | 95 | 96 | 96 | 100 | 104 | 109 | 115 | 124 | 118 | 116 | 116 | 113 | 111 | 109 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 95 | 100 | 100 | 104 | 100 | 98 | 97 | 92 | 98 | 94 | 99 | 105 | 112 | 119 | 117 | 121 | 118 | 114 | 111 | 105 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 97 | 102 | 94 | 92 | 90 | 88 | 87 | 82 | 90 | 98 | 103 | 110 | 115 | 120 | 113 | 111 | 109 | 104 | 102 | 96 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 95 | 100 | 104 | 102 | 98 | 94 | 93 | 88 | 97 | 92 | 96 | 104 | 112 | 119 | 122 | 119 | 116 | 111 | 109 | 103 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 99 | 106 | 100 | 98 | 94 | 96 | 93 | 88 | 96 | 99 | 102 | 108 | 115 | 124 | 118 | 116 | 113 | 112 | 108 | 104 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 101 | 108 | 104 | 100 | 96 | 94 | 93 | 88 | 98 | 102 | 106 | 112 | 118 | 126 | 121 | 117 | 114 | 112 | 108 | 102 | 2 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 105 | 98 | 92 | 96 | 94 | 92 | 95 | 88 | 94 | 100 | 110 | 116 | 121 | 118 | 111 | 115 | 112 | 108 | 109 | 101 | 2 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 95 | 98 | 92 | 88 | 94 | 94 | 97 | 90 | 89 | 97 | 100 | 105 | 111 | 117 | 111 | 107 | 111 | 108 | 107 | 99 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 103 | 106 | 106 | 100 | 98 | 96 | 93 | 86 | 98 | 105 | 108 | 111 | 118 | 124 | 121 | 116 | 116 | 111 | 107 | 100 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 101 | 108 | 102 | 96 | 94 | 92 | 89 | 88 | 95 | 103 | 107 | 111 | 117 | 126 | 119 | 114 | 112 | 109 | 105 | 101 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 97 | 102 | 104 | 106 | 100 | 98 | 97 | 92 | 100 | 97 | 101 | 108 | 113 | 120 | 122 | 122 | 117 | 112 | 109 | 105 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 95 | 98 | 98 | 104 | 100 | 98 | 95 | 90 | 100 | 100 | 103 | 106 | 112 | 118 | 118 | 123 | 118 | 114 | 110 | 104 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 99 | 106 | 106 | 100 | 98 | 96 | 93 | 86 | 95 | 95 | 100 | 107 | 115 | 124 | 124 | 119 | 116 | 112 | 108 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 103 | 106 | 106 | 100 | 96 | 92 | 89 | 88 | 96 | 100 | 105 | 110 | 116 | 122 | 123 | 120 | 116 | 110 | 106 | 104 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 97 | 102 | 104 | 102 | 100 | 104 | 99 | 98 | 98 | 98 | 103 | 110 | 113 | 121 | 123 | 122 | 120 | 119 | 113 | 110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 93 | 100 | 104 | 102 | 98 | 96 | 99 | 98 | 98 | 96 | 99 | 105 | 111 | 120 | 119 | 117 | 112 | 108 | 110 | 108 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 99 | 106 | 104 | 102 | 102 | 96 | 95 | 90 | 96 | 93 | 98 | 106 | 114 | 123 | 122 | 119 | 118 | 113 | 110 | 105 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 105 | 100 | 94 | 92 | 90 | 94 | 97 | 92 | 90 | 104 | 107 | 112 | 118 | 119 | 115 | 113 | 112 | 111 | 111 | 105 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 97 | 100 | 96 | 104 | 100 | 102 | 99 | 96 | 100 | 100 | 103 | 110 | 114 | 120 | 116 | 120 | 116 | 115 | 113 | 110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 103 | 106 | 100 | 100 | 96 | 92 | 95 | 94 | 98 | 102 | 105 | 112 | 118 | 124 | 119 | 117 | 114 | 108 | 108 | 107 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 97 | 102 | 104 | 102 | 102 | 96 | 95 | 90 | 98 | 99 | 104 | 110 | 114 | 122 | 121 | 119 | 118 | 113 | 112 | 105 | 2 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |