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COMPARATIVE STUDY BETWEEN NEBULISATION WITH KETAMINE, LIGNOCAINE AND BUDESONIDE IN THE ATTENUATION OF POST-OPERATIVE SORE THROAT IN ELECTIVE SURGICAL CASES UNDER GENERAL ANAESTHESIA

Subha Teresa Jose Vazhakalayil
Affiliation: DR. D.Y. Patil Medical College, Hospital and Research Centre,
Dr. D.Y. Patil Vidyapeeth University, Pune, India

Corresponding Author:
Sanya Varma
Affiliation: Dr. D.Y. Patil Medical College, Hospital and Research Centre,
Dr. D.Y. Patil Vidyapeeth university, Pune, India

ABSTRACT:-

Background: Postoperative operative sore throat (POST) is one of the most reported complications after endotracheal intubation post General anaesthesia with an incidence of as high as 60% which may impact patient satisfaction and increase the cost of treatment. Pharmacological interventions are aimed at prevention, amelioration of symptoms and treatment of POST. Medications suggested for this purpose include corticosteroids, topical anaesthetic sprays, NSAIDs, NMDA receptor antagonists. Nebulization has several advantages over other drug delivery methods, including being safe, easy to use, requiring less medication to produce the desired effect, and having the added benefit of reaching the lower airways.

Purpose: To compare the effectiveness between nebulization with ketamine, lignocaine and budesonide in the attenuation of postoperative sore throat after oral endotracheal intubation. To assess the severity of POST and study the hemodynamic variations and side effects, if any.

Methods: This is a double-blinded, randomized control study conducted in a tertiary hospital with a sample size of 150 patients undergoing elective surgeries under general anaesthesia, from various surgical departments. The study was initiated after approval by the institutional Ethics Committee for a period of two years.

Results:There was a variation observed in the heart rate of all three groups. At 24 hours the mean heart rate was highest at 77.48±14.55 in the budesonide group followed by 76.10 ±14.31 in the lignocaine group and 70.82±11.04 in the ketamine group and this observation is statistically significant (p=0.05).
In the ketamine group at 0 hours interval, all patients (n=50) had grade-0 sore throat, at 2 hours 2

patients progressed to grade-II & 1 patient to grade-I sore throat, at 4 hours 1 patient of grade-I & grade-II each. In the later phase at 24 hours severity of the sore throat subsided again all patients (n=50) returned to grade- 0. In the lignocaine group, most of them (n=12) had severe grade (grade-III) sore throat and it subsided as time progressed. At 0 hour 47 patients had grade-0, 1 patient grade-1 and 2 patients grade-2 sore throat. The severity of sore throat in patients progressed at 2, 4 & 6 hours and then started to subside. At 24 hours all 50 patients belonged to grade-0 level sore throat in the budesonide group.

Conclusion: Sore throats were less common and less severe in Group K. With time, the frequency of postoperative problems such as nausea, vomiting, and hallucinations decreased. Budesonide nebulization was less likely to cause post-operative problems than lignocaine and ketamine. Budesonide nebulization experienced the least number of complications out of the three.

INTRODUCTION: –

General anaesthesia (GA) at its optimal level is crucial for uneventful endotracheal intubation. As part of the same, there exist procedures for safeguarding the airway from regurgitation and aspiration. Despite adequate precautions, a common consequence of GA is post-operative sore throat (POST) due to intubation. (1) An incidence of 12.1% to 70% is noted in general surgical cases while 100% is noted in maxillofacialsurgeries. (2)

The severity of this may range from Thorat irritation to incapacitating pain, difficulty in swallowing and transient voice changes. This side effect is noted by the patient as an unfavourable result affecting their satisfaction. This should be avoided to prevent detrimental effect on patient's rehabilitation and quality of life after being discharged from the hospital. (3)

POST is found to be secondary to pharyngolaryngeal mucosal damage either following laryngoscopy, insertion of a nasogastric tube, or oral suctioning. The shape and pressure of the cuff can also influence the perfusion to tracheal mucosal capillaries. Edema and mucosal lesions are noted when there is contact of the tube with the vocal cords and the posterior pharyngeal wall. (3,4,5) Nausea, vomiting, younger age group, females, and spring and winter seasons are other noted contributing factors due to tighter fitting tubes or latent inflammation of the throat. (6)

Among the non-pharmacological techniques are smaller endotracheal tubes, lubricating the tube with water-soluble jelly, cautious airway instrumentation, intubation following total relaxation, mild oesophageal suctioning, reducing intracuff pressure, and extubation following the tracheal cuff's full deflation. (7)

Pharmacological therapies include application of preoperative medications that can lower the inflammation and prevent onset of POST and among these are corticosteroids, nonsteroidal

anti-inflammatory drugs (NSAIDs), ketamine, α2-agonists, and local anaesthetics.

Nebulization has several advantages over other drug delivery methods, including being safe, easy to use, requiring less medication to produce the desired effect, and having the added benefit of reaching the lower airways; however, its main advantage over other methods (like intravenous, gargle, etc.) is that nebulization has a lower risk of side effects. The compressed air causes the liquid to nebulize, breaking it into droplets. Pneumatic nebulization produces large particles (10–25 micron) that primarily land in the throat and mouth and smaller particles (5–10 micron) that land in the area where the mouth and airway meet.

There are very few studies that have compared the incidence of POST between various general anaesthetic agents. This study aims to compare the effectiveness of nebulization with Ketamine, Lignocaine & Budesonide in the attenuation of postoperative sore throat after oral endotracheal intubation.

METHODOLOGY:

This is a double-blinded, randomized control study conducted in a tertiary hospital with a sample size of 150 patients undergoing elective surgeries under general anaesthesia, from various surgical departments. The study was initiated after approval by the institutional Ethics Committee for a period of two years.

Patients aged between 18-60 years of age, undergoing elective surgeries with ASA and patients with informed consent were included in the study while those such as not willing to participate in the study and below and above the age group, upper respiratory tract infection, patients requiring Ryle's tube insertion, MPC II-IV patients, known drug allergy, emergency procedures and enlisted patients who needed more than one intubation attempt or developed any intraoperative or postoperative complication were excluded from the study.

The study drugs that were used in the study were Inj. Ketamine, Inj.Preservative free 4% lignocaine and budesonide respules.

After acquiring the ethical committee clearance from the institution, patients were divided into 3 groups K, L, and B and each group contained 50 patients. The patients were allowed to the respective groups by lottery method, and nebulization was made ready by an anesthesia assistant according to the assigned group.

The anaesthesia assistant who prepared the solution did not take part in the subsequent analysis of these patients. Patients were also blinded as all the study preparations were colorless and tasteless. Each group received the following drugs in doses Group K - KETAMINE 50 mg (1ml) + Normal

saline (3ml); Group L - 4% PRESERVATIVE FREE LIGNOCAINE (20 mg)(1ml) + Normal Saline (3ml) and Group B - received BUDESONIDE 250 mcg (1ml) + Normal Saline (3ml)

Utilizing an oxygen-driven source attached to the wall, a nebulization mask was used to administer the medication for fifteen minutes. GA was induced with intravenous (IV) fentanyl 2 g/kg and IV propofol 2 mg/kg 15 minutes after nebulization was completed. Sch 2 mg/kg injection helped the patient feel more at ease.

A skilled anesthesiologist used a Macintosh blade (size 3 or 4) to do a quick and delicate laryngoscopy that took less than 15 seconds to ensure the least amount of trauma. For tracheal intubation, a sterile, single-lumen, cuffed polyvinyl chloride (PVC) endotracheal tube measuring 7–
7.5 mm for girls and 8–8.5 mm for males was utilized.

The cuff of the endotracheal tube was inflated with room air, till no audible air leakage was detected.Anesthesia was maintained using 33% oxygen in nitrous oxide and sevoflurane. For pain relief, paracetamol 1g IV was administered during surgery, followed by 6th hourly in the postoperative period. Ondansetron 4mg IV was given 30 minutes before the end of surgery and there after every eight hours post-operatively. Once the surgery was completed, the oropharynx was gently suctioned using a soft suction catheter, and reversal of the neuromuscular blockade was done with neostigmine 0.05mg/kg and glycopyrrolate 0.008mg/kg. After regaining complete consciousness, the patient was extubated.

During the post-operative phase in the post-anesthesia care unit (PACU), the investigator assessed side symptoms such as nausea, vomiting, hallucinations, and postoperative sore throat (POST) at 0,2, 4, 6, 12, and 24 hours following extubation.

Grading of POST was done using a four-point scale (0-3) where 1: no sore throat;2: mild sore throat(complains of sore throat only when asked); 3:moderate sore throat (complains of sore throat even without asking); 4: severe sore throat (with change of voice or hoarseness, also may be associated with throat pain). Even after 24 hours, if patients still complained of moderate or severe POST, lukewarm saline gargle as well as decongestants would be prescribed for them. If the symptoms persisted, an Oto- rhinolaryngology consultation would be ensured.

Haemodynamic variables such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial blood pressure (MABP) was also recorded at pre-nebulization,post-nebulization, post-induction, 0,2,4,6, 12 and 24 h after extubation.

Data was collected and tended in Microsoft Excel and SPSS software version 20 was used for analysis.

Quantitative data were presented as mean, standard deviation, frequency, and Percentages, and qualitative variables were analyzed using "ANOVA test" (standard normal variant) with 95% levelof significance. P value of <0.05 was accepted as statistically significant.

RESULTS :

In this study of 150 patients, age distribution among subjects was studied, and noted that the mean age group in K, L, and B were 39.74±13.08, 43.78±11.84, and 40.74 ± 12.95, respectively. The gender distribution amongst subjects in each group was compared and noted, with male predominance, 28 (56%) were males and 22 (44%) were females with the male to female ratio of 1.27:1 in the ketamine group, 26 (52%) males and 24 (48%) females in lignocaine group with the male to female ratio of 1.08:1 in lignocaine and 31 (62%) males and 19 (38%) females with the male to female ratio of 1.63:1in budesonide group.

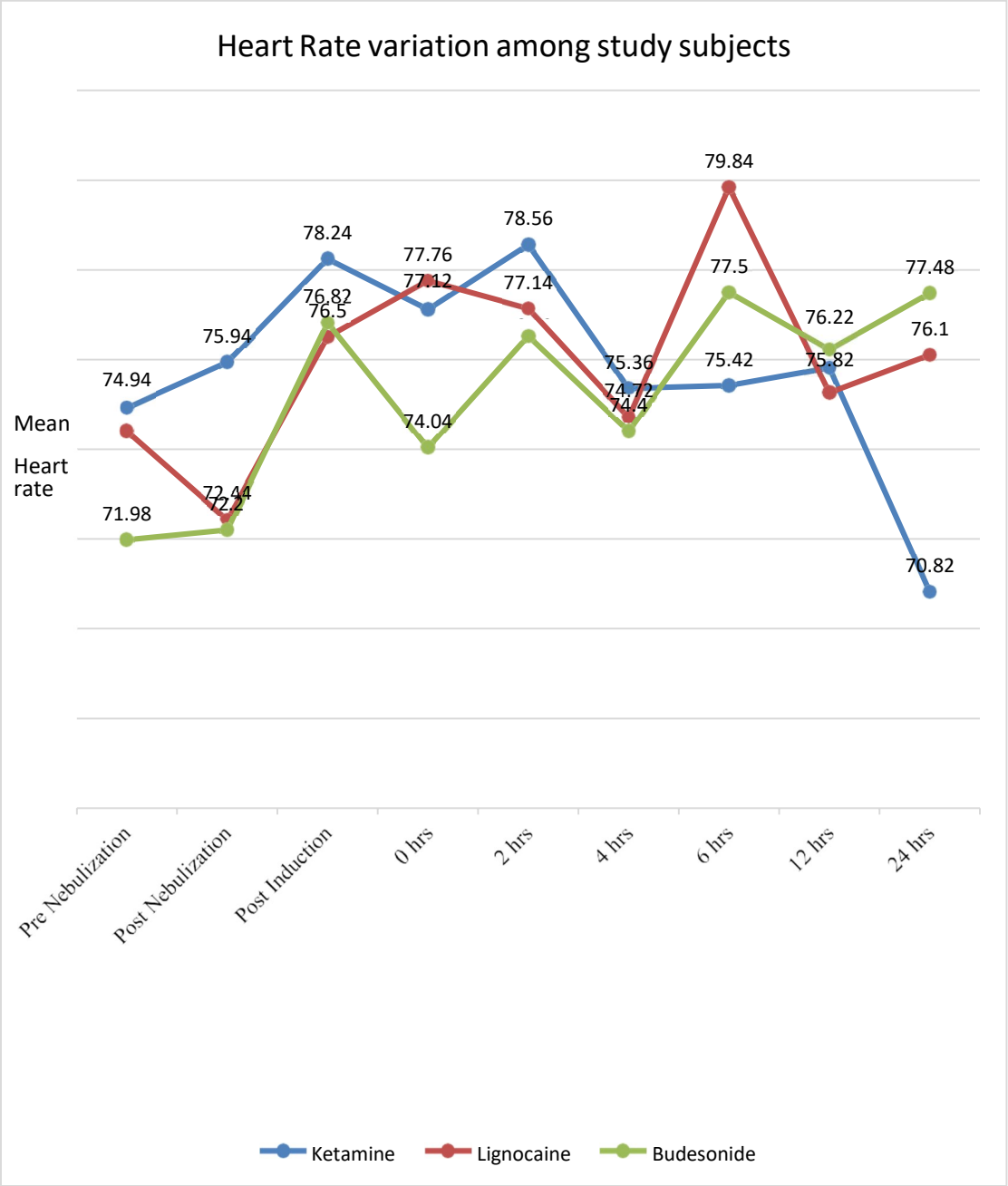
The ketamine group had the highest mean weight 75±12.44 (in kilograms), followed by the budesonide group at 72.36±13.07, and the lignocaine group at 70.58±12.60.

Within the ketamine group, the majority of patients had 23 (46%) ENT surgeries and 16 (32%) general surgeries. Whereas the majority of them in the budesonide group received ENT surgeries 23(46%), followed by 19 (38%) orthopedic surgeries, the majority of them in the lignocaine group underwent orthopedic surgeries, 25 (50%) and 22 (44%) ENT surgeries.

Minor variation was observed in the systolic blood pressure of all groups at different time intervals. The mean SBP was highest at 130.88 ±13.80 in the early phase (post-induction time) in the ketamine group, at 0 & 2 hours 127.80 ± 6.85 after induction in the lignocaine group, and in the later phase (12 hours) 128.08±6.15 in budesonide group.

There was a variation observed in the heart rate of all three groups. At 24 hours the mean heartrate was highest at 77.48±14.55 in the budesonide group followed by 76.10 ± 14.31 in the lignocaine group and 70.82±11.04 in the ketamine group and this observation is statisticallysignificant (p=0.05).

Graph 1: Comparison of changes in Heart Rate


Heart Rate variation among study subjects
Mean Heart rate
74.94
75.94
78.24
77.76
78.56
75.36
75.42
75.82
70.82
71.98
72.44
76.82
77.12
77.14
74.72
79.84
76.1
76.5
74.04
74.4
77.5
76.22
77.48
Pre Nebulization
Post Nebulization
Post Induction
0 hrs
2 hrs
4 hrs
6 hrs
12 hrs
24 hrs
Ketamine
Lignocaine
Budesonide

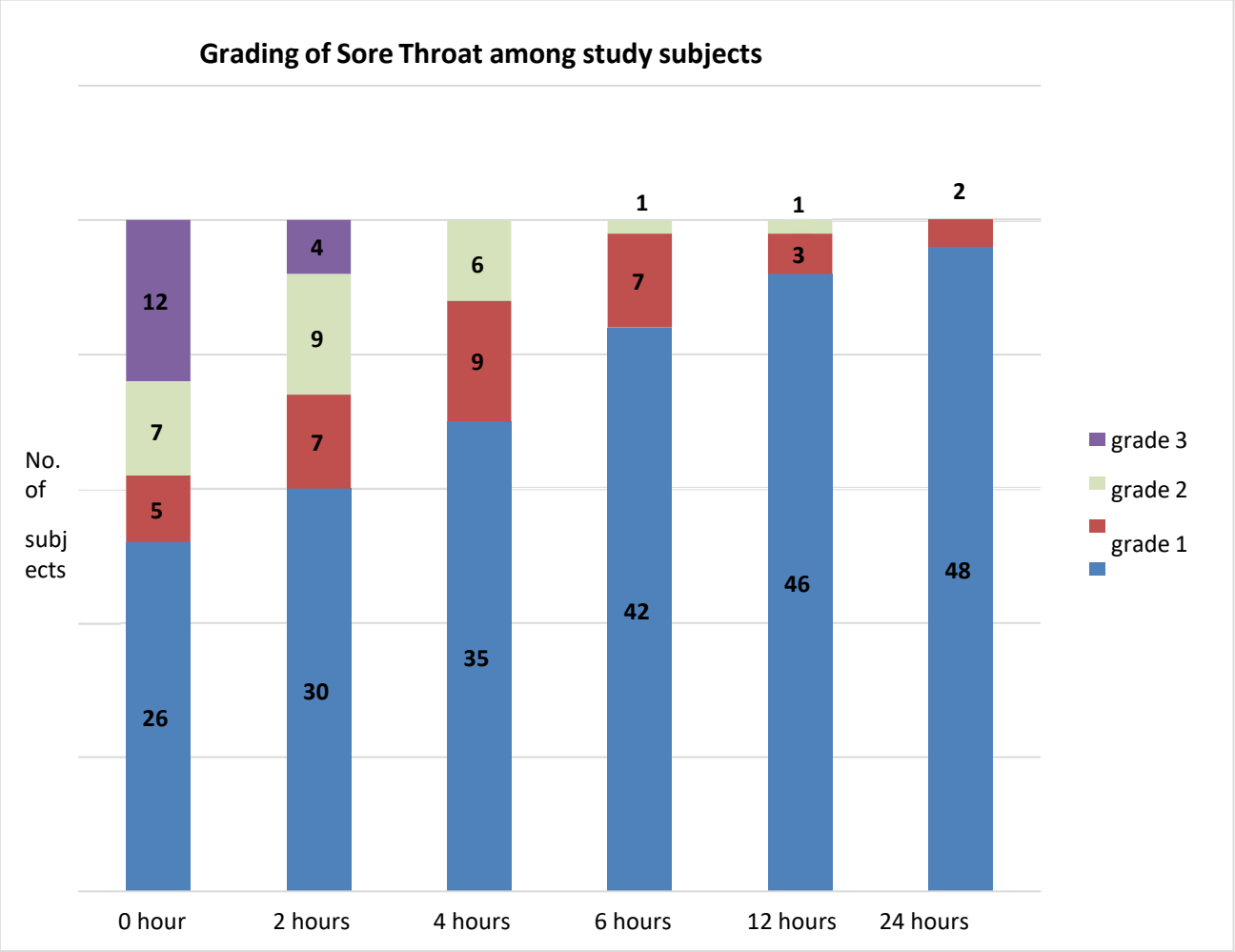
e mean diastolic blood pressure of all groups varied at different time intervals. It was highest at 70.12 ±12.40 before nebulization in the ketamine group, at 0, 2 & 4 hours after induction in the lignocaine group,and at 4 hours 71.58 ± 13.30 in the budesonide group.

The incidence of sore throat was highest in the early phase of post-induction time and it subsided as time progressed. More cases 24 were seen in the lignocaine group followed by 5 cases in the budesonide group and 4 cases in the ketamine group.

In the ketamine group at 0 hours interval, all patients (n=50) had grade-0 sore throat, at 2 hours 2 patients progressed to grade-II & 1 patient to grade-I sore throat, at 4 hours 1 patient of grade-I & grade-II each. In the later phase at 24 hours severity of the sore throat subsided again all patients (n=50) returned to grade- 0. In the lignocaine group, most of them (n=12) had severe grade (grade-III) sore throat and it subsided as time progressed. At 0 hour 47 patients had grade-0, 1 patient grade-1 and 2 patients grade-2 sore throat. The severity of sore throat in patients progressed at 2, 4 & 6 hours and then started to subside. At 24 hours all 50 patients belonged to grade-0 level sore throat in the budesonide group.

The ketamine group had the highest incidence of nausea (6 patients), followed by the lignocaine group (4 patients) and the budesonide group (3 patients). Early on, a greater number of individualshad nausea; as time went on, the nausea decreased. At 0 hours vomiting was most common in 6 patients in the ketamine group, followed by 3 patients in both lignocaine and budesonide groups. It subsides over time; at 12 & 24 hours none had vomiting in all groups. Hallucination was more common 8 patients in the ketamine group followed by 3 patients in both lignocaine & budesonide groups. In the later phase at 12 & 24 hours hallucination subsided in all patients.

Graph 2: Severity or Grading of Sore Throat among Lignocaine group.



In the lignocaine group, most of them (n=12) had severe grade (grade-III) sore throat and it subsided as time progressed.

Table 1: Severity or Grading of Sore Throat among Budesonide group.

Time Interval	Severity or Grading of Sore Throat			
	0	**1**	**2**	**3**
0 hour	47	1	2	0
2 hours	45	2	3	0
4 hours	46	3	1	0

6 hours	48	2	0	0
12 hours	49	1	0	0
24 hours	50	0	0	0

At 0 hour 47 patients had grade-0, 1 patient grade-1, 2 patients grade-2 sore throat. The severity of sore throat in patients progressed at 2,4 & 6 hours and then started to subside. At 24 hours all 50 patients belonged to grade-0 level sore throat in budesonide group.

Table 2: Incidence of Nausea among study subjects.

Post-Surgery time	GROUP-K	GROUP-L	GROUP-B
0 hours	6	4	3
2 hours	3	4	3
4 hours	4	3	2
6 hours	2	2	2
12 hours	0	1	0
24 hours	0	0	0

The incidence of nausea was highest in 6 patients in the ketamine group followed by 4 patients inlignocaine and 3 in budesonide group. More patients developed nausea in the early phase of time and as time progressed the nausea subsided.

Table 3: Severity or Grading of Sore Throat among ketamine group.

Time Interval	Severity or Grading of Sore Throat			
	0	**1**	**2**	**3**
0 hour	50	0	0	0
2 hours	47	1	2	0
4 hours	48	1	1	0
6 hours	49	1	0	0
12 hours	50	0	0	0
24 hours	50	0	0	0

In Ketamine group at 0 hours interval all patients(n=50) had grade-0 sore throat, at 2 hours 2 patients progressed to grade-2 & 1 patient to grade-1 sore throat, at 4 hours 1 patient of grade-1 & grade-2 each. In later phase at 24 hours severity of sore throat subsided, again all patients(n=50)returned to grade-0.

At 0 hours vomiting was most common in 6 patients in the ketamine group, followed by 3 patients in both lignocaine and budesonide groups. It subsides over time; at 12 & 24 hours none had vomiting in all groups.
Hallucination was more common in 8 patients in the ketamine group followed by 3 patients in both lignocaine & budesonide groups. In the later phase at 12 & 24 hours, hallucination subsided in all patients.**SCUSSION :**

Following endotracheal intubation, POST is a frequent complaint that results in discomfort and dissatisfaction with patient care. Previous research indicates that the incidence varied from 21% to 66%. It is brought on by trauma to the endotracheal tube cuff, pharyngeal mucosa irritation, and aseptic inflammation. To lessen POST, a variety of pharmacological and non-pharmacological treatments have been employed. (8,9,10)

This study compared the effects of preoperatively administered nebulized ketamine, lignocaine, and budesonide on the avoidance of postoperative sore throat in 150 patients undergoing various procedures under general anaesthesia.

The mean age of groups K, L, and B in our study was 39.74, 43.78, and 40.74. In contrast, the mean age of the ketamine, lignocaine, and budesonide groups in the Mehrotra et al. (11) study was 34.5, 38.9, and 36.5 years.

In all three categories of research participants, men outnumbered women. Ahuja et al. (12) and Mehrotra et al. reported similar findings, whereas Vaghela et al. (13) found that women made up the majority in the ketamine and lignocaine groups.

The highest weight (75 kg) was recorded in the ketamine group, followed by the lignocaine group(72.43 kg) in Prasant et al.'s (14) study. The mean weight of Group K was the highest, at 75 kg, followed by 72.36 kg in Group B and 70.58 kg in Group L.

Among all three groups most performed surgical intervention was ENT surgeries in group K (n=23)& group B (n=23) whereas, orthopedic surgeries were most common in group L (n=25). This contradicts the finding of an African study conducted by Gemechu et al, (15) they reported general surgery was the most common type among their study subjects.

Changes in HR, SBP, DBP, and MAP were comparable across all three groups in the current investigation at various time points. Ketamine elevates sympathetic tone, which initially results in greater HR and SBP rates than other groups, however these differences are not statistically significant. Group B had the greatest mean heart rate (77.48) in the later phase (after 24 hours), followed by Group L (76.10) and Group K (70.82). This difference is statistically significant. Prasant et al. (14) noted similar findings, with the ketamine group initially reporting higher rates ofHR and SBP. In comparison to the other groups, the lignocaine group showed a statistically significant decrease in HR, systolic, and diastolic blood pressure following nebulization and before induction.

33 people in the study group(22%) had sore throats overall. In patients who got lignocaine, the incidence and severity of sore throat at 0 hours postoperatively was higher. Additionally, we discovered that it was lower following ketamine nebulization in comparison to group B. After 24hours, it was discovered that ketamine and budesonide were superior to lignocaine. Studies on the incidence of sore throats following surgery are many. Shreesh Mehrotra and colleagues (2017) investigated the frequency of sore throat following surgery using ketamine, lignocaine, and budesonide nebulization in 120 patients receiving general anaesthesia.

They claimed that in the early postoperative phase, ketamine is more effective at reducing sore throats. The long-term results improved when ketamine and budesonide were used. These findings line up with what we investigated. Shivkumar Segaran et al. (16) conducted a study in 2016 on the frequency of postoperative sore throat in 80 patients following ketamine and magnesium sulphate nebulization before surgery. They observed that ketamine nebulization was superior to magnesiumsulphate nebulization in avoiding sore throat following surgery. These outcomes line up with what we found.

The incidence of post-operative complications like nausea, vomiting and hallucination were reduced with time. The incidence of nausea was reduced with budesonide than with Lignocaine and ketamine. Incidences of vomiting and hallucination were higher in ketamine group. Our findings are comparablewith Asnani et.al.(6) who concluded; incidence of nausea was higher in the ketamine then lignocaine group.

The limitation of the study was that the sample size in each group was small and to extrapolate and draw further conclusive evidence, patients were followed up only for 24 hours with no long-term effects known, ETT cuff pressure was not recorded which can be another cause of POST and evaluation of postoperative sore throat was primarily based on the patient's subjective feelings, and there is a lack of objective evaluation indicators. In this study, we did not measure blood concentration of ketamine, budesonide, and lignocaine hence rule out the contribution of the systemic effect of the drugs in results thereby the safety and dosage of the drugs used for

inhalation needed further investigation.

CONCLUSION:

This descriptive study that was conducted for a period of 18 months in a tertiary hospital found that the patients who got lignocaine had a higher incidence and severity of sore throat at 0 hours postoperatively, compared to group B. Sore throats were less common and less severe in Group K. With time, the frequency of postoperative problems such as nausea, vomiting, and hallucinations decreased. Budesonide nebulization was less likely to cause post-operative problems than lignocaine and ketamine. Budesonide nebulization experienced the least number of complications out of the three.

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