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POST- Post-Operative Sore Throat: Do I Spray or Nebulize?

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Abstract

Background- *Postoperative Sore Throat (POST) is an unpleasant complaint after endotracheal intubation. It can be prevented altogether with simple measures like either spray or nebulization with lignocaine.*

Methods- *In this prospective randomized study250 consenting patients (18-60 years, ASA I &II) were studied for POST after intubation. The two groups, group N and S received either preoperative nebulization with lignocaine 4% (1ml)in 4 ml of saline and 2 puffs of normal saline during intubation or nebulization with normal saline prior and lignocaine spray 10% (2 puffs) during intubation.*

Results- *Heart rate (HR) was consistently more in group N when observed at pre-nebulization (p=0.039), during nebulization (p= 0.022), on operation table (p=0.001), during induction (p<0.001), and at various intraoperative intervals. Mean Arterial Pressure (MAP) remained largely comparable in two groups (p=0.001). Oxygen saturation and sedation scores were similar across two groups. Postoperatively, HR (p<0.01) and MAP (p<0.05) varied significantly during study duration. SpO2 and sedation levels were comparable (p<0.05). Group N reported less severity of sore throat (p<0.05) at 2, 4, 6 hours postoperatively and both groups showed similar resolution of sore throat at 12 and 24 hours. The Pearson Chi-Square test value of 1.641 and 0.672 (p=0.650 and 0.715), indicated no statistically significant difference in sore throat severity between males and females respectively in Groups N and S.*

Conclusion- *Group N had lower incidence and severity of sore throat in the early postoperative period, and symptoms resolved by 12-24 hours. Heart rate and MAP were higher and sedation and saturation was maintained throughout.*

Keywords- *Postoperative sore throat (POST), Nebulization, Lignocaine spray*.

Introduction

Postoperative sore throat (POST) is a common outcome of endotracheal intubation[1]. Symptoms like pharyngeal dryness, throat pain, dysphagia, odynophagia or dysphonia[2] usually occur. Though these appear relatively minor complications the incidence of post- operative sore throat ranges from 12.1% to 70%[3] Factors that increase incidence of postoperative sore throat are, age, sex, smoking, intubation technique, mucosal trauma, erosion, inflammation, lack of airway humidity, length of surgery, tube size, cuff size, cuff pressure and design, intraoperative tube movement and suctioning[4,5,6]; mostly it resolves in a few days[7]

Practice of using smaller size of endotracheal tube, after lubrication with water soluble jelly, gentle and careful airway instrumentation, intubation after full relaxation of vocal cords, proper oral and pharyngeal suctioning, optimal and minimum intracuff pressure and extubation after fully deflating tracheal cuff[8] are accepted.

Pharmacological measures to decrease the incidence of postoperative sore throat include inhalation of steroids like beclomethasone [9], gargling with ketamine or aspirin, local spray or nebulization with ketamine, magnesium sulphate, lignocaine and intracuff administration of alkalinized lignocaine.[10]

Lignocaine spray or nebulization during flexible bronchoscopy has better patient compliance and decreased side-effects like cough and pain [11]. Nebulization causes deposition of the drug in the oral cavity, pharynx and the respiratory tract thus increasing the surface area of action with lesser amount of drug thus avoiding any systemic side-effects related to intravenous route. Lignocaine spray causes direct deposition of drug on the affected area but lesser surface area is anaesthetized. This study compares the efficacy of preoperative nebulization with lignocaine (1 ml of 4% lignocaine in 4ml saline) with lignocaine spray (10%) during intubation in patients undergoing general anesthesia with endotracheal intubation in terms of the incidence and severity of postoperative sore throat.

Methods

This prospective randomized double blind control study was conducted in a tertiary care hospital after permission from the Institutional Ethics Committee (IEC). Total 250 patients undergoing general anesthesia using endotracheal intubation were divided into 2 groups of 125 each; Group A (n=125) and Group B (n=125) Sample size was obtained by keeping prevalence of sore throat as 70% , and allowable error as 6% using the formula $4PQ/d^2$, (P= Prevalence, Q=100 – P, d = allowable error). During a period of 2 years, ASA 1 and ASA 2 patients, willing to participate in this study and giving written informed consent and between 18 years to 60 years were included in the study.

Patients with anticipated difficult intubation, history of recent or ongoing upper or lower respiratory tract diseases, those undergoing any airway related surgery, pregnant patients and thyroid surgery were excluded.

Pre-anesthetic checkup was done a day prior and patients were randomized into 2 groups- Group N and Group S using computer generated random numbers.

Patients were explained in the language understood by them, the procedure of anesthesia and the Ramsay Sedation score and that they will be enquired about the presence or absence of sore throat and its severity in the post-operative period.

Group N- (n=125) received preoperative nebulization with Lignocaine 4% (1ml)in 4 ml of saline 15 minutes prior to intubation and 2 puffs of Normal saline during intubation.

Group S – (n=125) received preoperative nebulization with Normal saline 15 minutes prior to intubation and Lignocaine spray 10% (2 puffs) during intubation. All monitors were attached to record baseline vital parameters. Patients were given nebulization with either Lignocaine 4 % (1ml) in 4ml of Normal saline or 5ml of Normal saline based on their group. After nebulization patients were premedicated with intravenous ondansetron 0.08mg/kg, glycopyrrolate 4mcg/kg , midazolam 0.02mg/kg and fentanyl 2mcg/kg and induced with propofol 2mg/kg body weight. Then laryngoscopy was done and the oropharynx was sprayed with 2 puffs of normal saline or lignocaine spray 10%, based on the group, and tracheal intubation was done with appropriate size of endotracheal tube. Intubation was facilitated with intermediate acting neuromuscular blocking agent atracurium 0.5mg/kg. Patients with more than 3 attempts were excluded from the study. General anesthesia was maintained with oxygen, nitrous oxide 50:50% and inhalational agent

sevoflurane 1-2% to provide 1-1.5 MAC. Neuromuscular blockade was provided with incremental doses of injection atracurium. Intraoperative monitoring included continuous ECG, noninvasive blood pressure, oxygen saturation and end tidal carbon dioxide monitoring before and during nebulization, after pre-medication, during induction, intubation, and recorded every 15, 30, 45, 60, 90, 120, 150, 180, 210, 240 minutes during anesthesia and immediately before and after extubation.

After completion of surgery with patient still adequately anaesthetized, the oropharynx was gently suctioned and inhalational agent was turned off. Inspiratory oxygen was gradually increased to 100%. Neuromuscular blockade was reversed using neostigmine 50mcg/kg and glycopyrrolate 8mcg/kg. On return of spontaneous ventilation, patient was extubated.

Sore throat assessment with vitals recording was done at following time intervals -after immediate recovery (0 hour) and at 2, 4, 6, 12, 24 post extubation. The postoperative sore throat was graded on a 4 point scale. For grading of sore throat[12]

0 - No sore throat

1- Mild (complains of itching ,dryness when asked)

2- Moderate (complains of sore throat on his or her own)

3- Severe (hoarseness present with pain)

Other side-effects were observed and noted. Ramsay sedation score[13]

1	Anxious and agitated or restless or both
2	Co-operative, oriented and tranquil
3	Responds to commands only
4	Brisk response to light glabellar tap or loud auditory stimulus
5	Sluggish response to light glabellar tap or loud auditory stimulus
6	No response to stimulus

Observations recorded were evaluated using appropriate statistical tests and data was analyzed by applying the required tests according whether the data is qualitative or quantitative.

FLOW CHART

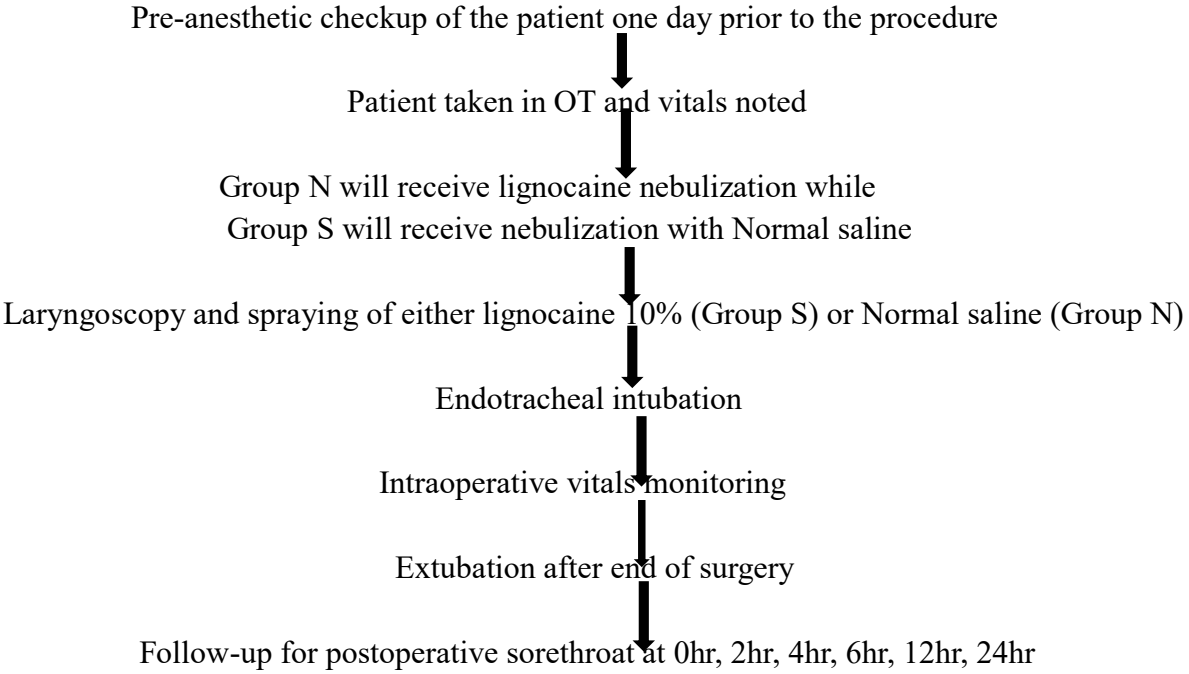

Fig. 1 Flow Chart Showing Different stages in the Study when Observations were recorded

Observation and Results-

Lignocaine is readily available, so we chose it for the present study; the aim was to find the incidence and severity of sore throat following its use either by nebulization or spray. The data was collected over a period of 18 months. Comparison of mean age between groups, N(nebulization) and S(spray), using independent T test shows mean age 33.38 years in group N was non-significantly different from that in group S (mean age 33.42 years of group S) Hence based on age, both the groups were comparable while performing comparative analysis. Sex distribution in the two groups, N and S, using chi square test, shows that there was no significant association. (p=0.507). There were 67.2% and 63.2% females in group N and Group S respectively and remaining were males equal to 32.8% and 36.8% in group N and Group S respectively. Hence based on sex distribution, both the groups were comparable.

On comparison of heart rate (Table-1), N group consistently exhibited higher heart rates than the S group at nearly all stages, indicating a significant difference in how these groups responded to the surgical and anaesthetic procedures. This pattern suggests that the conditions or interventions associated with each stage affected the groups differently, with the N group generally showing elevated heart rates.

Also, most stages showed no significant differences in MAP between the N and S groups, except for the intra-operative period at 180 minutes and post-extubation, where significant differences were observed. (Table-1)

This suggests that the NIBP differences between the groups are minimal during most stages of the surgical procedure, except at specific points where the N group shows higher MAP values

Overall, the N group consistently exhibited higher SpO2 levels than the S group during most stages, indicating better maintenance of oxygen saturation, although some stages, such as on the OT table, premedication, and certain intra-operative periods, did not show significant differences. (Table-1)

Table-1 Table showing Changes in Heart rate, Mean Arterial Pressure and SpO2 during study duration

Duration	GROUP	Mean HR	P Value	Mean MAP	P Value	Mean SpO2	P Value
Pre Nebulization	N	86.75	0.039	84.85	0.478	98.58	0.001
	S	83.98		84.01		98.26	
Nebulization	N	85.62	0.022	83.46	0.665	98.74	0.014
	S	82.74		82.98		98.50	
On OT table	N	87.22	0.001	82.92	0.656	98.90	0.169
	S	82.52		82.45		98.78	
Premedication	N	86.54	0.001	92.96	0.142	97.88	0.275
	S	80.64		82.22		98.98	
Induction	N	82.70	0.000	81.01	0.748	99.51	0.000
	S	78.09		80.66		99.22	
Postintubation	N	87.33	0.008	84.73	0.330	99.74	0.005
	S	84.06		85.75		99.56	
Intra-OP 15 min	N	82.73	0.000	81.15	0.608	99.87	0.390

	S	79.05		81.65		99.83	
Intra-OP_30 min	N	80.37	0.000	78.94	0.307	99.90	0.258
	S	76.72		79.97		99.85	
Intra-OP_45 min	N	79.14	0.003	78.32	0.768	99.92	0.035
	S	76.22		78.62		99.83	
Intra-OP_60 min	N	78.74	0.001	77.92	0.156	99.93	0.045
	S	75.64		89.21		99.85	
Intra-OP_90 min	N	77.74	0.018	77.38	0.877	99.93	0.019
	S	75.50		77.22		99.83	
Intra-OP_120 min	N	78.80	0.001	78.18	0.482	99.95	0.009
	S	75.41		77.39		99.84	
Intra-OP_150 min	N	77.12	0.140	77.15	0.980	99.96	0.366
	S	74.85		77.12		99.93	
Intra-OP_180 min	N	78.44	0.083	81.82	0.001	100.00	0.162
	S	75.59		75.30		99.94	
Intra-OP_210 min	N	77.29	0.322	80.27	0.931	100.00	0.229
	S	79.77		79.93		99.86	
Intra-OP_240 min	N	74.67	N/A	68.00	NA	100.00	NA
	S	-					
Before Extubation	N	90.45	0.000	87.65	0.119	99.78	0.030
	S	86.45		85.85		99.66	
Post Extubation	N	86.83	0.000	84.24	0.013	99.00	0.000
	S	82.22		81.57		98.68	

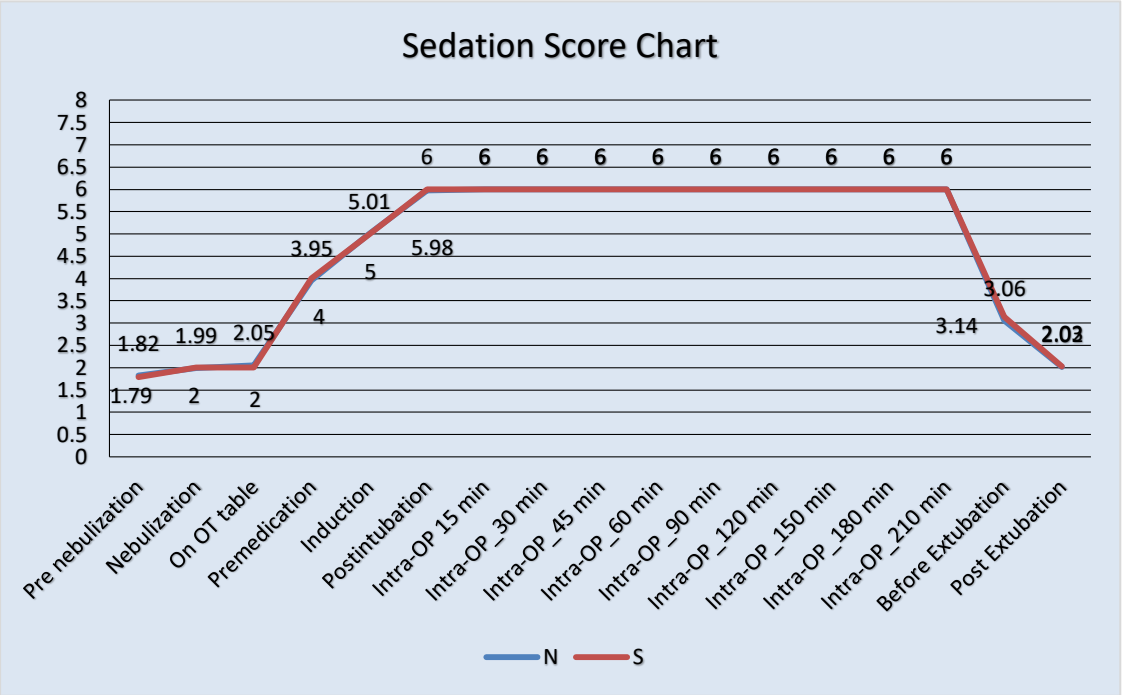

Fig 2: Mean Sedation Score Among two Groups at various Intra Operative periods

Figure-2 shows that there were no significant differences in mean sedation scores between groups N and S at any stage of the surgical procedure. Both groups exhibited similar levels of sedation throughout the process.

Table 2: Comparison of Mean HR and Mean MAP at various Post Extubation Periods

Duration	GROUP	N	Mean HR	Std. Dev	T Test	P Value	Result	Mean MAP	Std. Dev	T Test	P Value	Result
Post-Op 0 Hour	N	125	86.38	7.927	4.720	0.000	Sig	84.13	9.191	2.276	0.024	Sig
	S	125	81.66	7.885				81.66	7.935			
Post-Op 2 Hour	N	125	83.84	7.317	4.095	0.000	Sig	84.02	8.437	3.516	0.001	Sig
	S	125	80.24	6.564				80.51	7.280			
Post-Op 4 Hour	N	125	82.94	7.584	2.636	0.009	Sig	82.30	8.697	2.051	0.041	Sig
	S	125	80.68	5.835				80.22	7.206			
Post-Op 6 HR	N	125	82.83	7.657	1.788	0.075	Non-sig	81.71	8.355	1.713	0.088	Non-sig
	S	125	81.26	6.202				80.07	6.692			
Post-Op 12 HR	N	125	82.03	7.325	0.903	0.367	Non-sig	82.30	8.153	2.071	0.039	Sig
	S	125	81.21	7.102				80.34	6.813			
Post-Op 24 HR	N	125	81.34	7.188	0.463	0.644	Non-sig	82.40	8.280	1.937	0.054	Non-sig
	S	125	80.93	7.009				80.46	7.573			

Table-2 shows that significant differences in mean HR were observed between groups N and S at the 0-hour, 2-hour, and 4-hour postoperative intervals, with group N consistently exhibiting higher mean HRs than group S. However, no significant differences were found at the 6-hour, 12-hour, and 24-hour postoperative intervals. Also significant differences in mean MAP were observed between groups N and S at the 0-hour, 2-hour, 4-hour, and 12-hour postoperative intervals, with group N consistently exhibiting higher mean MAPs than group S as shown in Table-2.

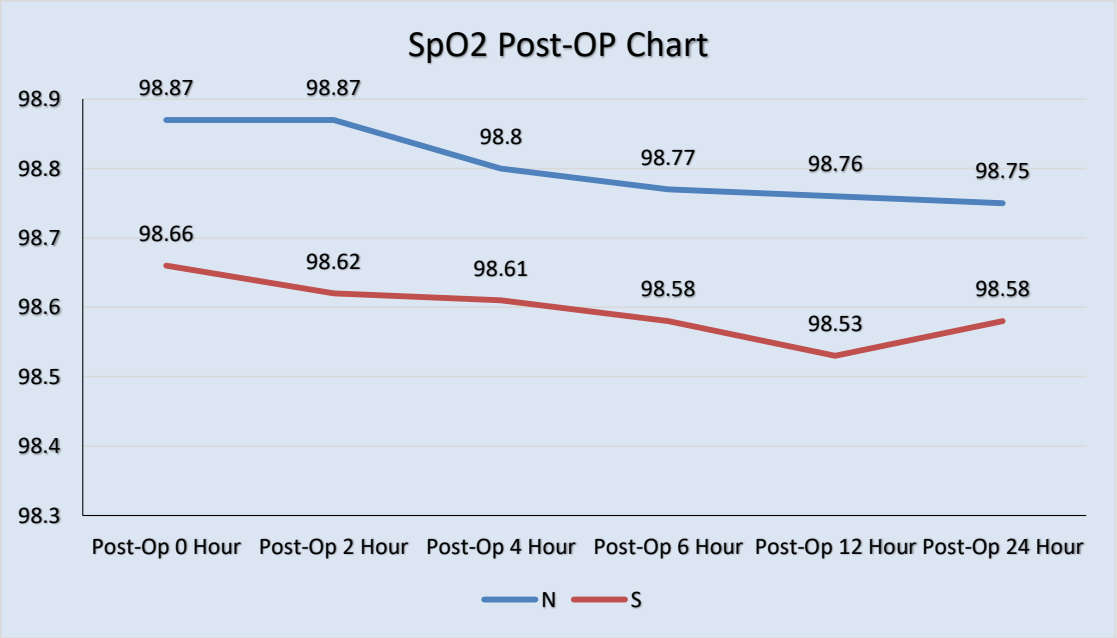

Fig 3: Mean SpO2 at various Post extubation periods

Figure-3- Based on the statistical analysis of SpO2 levels at various post-operative hours, significant differences were observed at 2 hours (p = 0.004), 4 hours (p = 0.031), 6 hours (p = 0.032), and 12 hours (p = 0.010) compared to baseline (0 hours). These findings indicate that SpO2 levels showed notable deviations during these time points post-operation. However, at 24 hours post-operation, the difference was not statistically significant (p = 0.054).

The analysis of mean Sedation Score data between groups N and S at various postoperative intervals revealed non-significant differences. No significant differences were observed at 0 hours (p = 0.496) and 2 hours (p = 0.318) between two study groups. Further at all post-operative period, no analysis was performed as mean value of two groups was exactly same with SD = 0.00.

Table 3: Association of Sore Throat Grades with Two Study Groups in Post-Operative Period

Sore Throat at 0 HR		GROUP		Total
		N	S	
Absent	Count	24	23	47
	%	19.2%	18.4%	18.8%
Mild	Count	85	89	174
	%	68.0%	71.2%	69.6%
Moderate	Count	15	13	28
	%	12.0%	10.4%	11.2%
Severe	Count	1	0	1
	%	0.8%	0.0%	0.4%
Total	Count	125	125	250
	%	100.0%	100.0%	100.0%
Pearson Chi-Square	Value	Df	P Value	Result
	1.256	3	0.740	Non-Sig

Sore Throat at 2 HR		GROUP		Total
		N	S	
Absent	Count	45	25	70
	%	36.0%	20.0%	28.0%
Mild	Count	78	97	175
	%	62.4%	77.6%	70.0%
Moderate	Count	2	3	5
	%	1.6%	2.4%	2.0%
	Count	125	125	250
	%	100.0%	100.0%	100.0%
Pearson Chi-Square	Value	df	P Value	Result
	7.977	2	0.019	Sig
Sore Throat at 4 HR		GROUP		Total
		N	S	
Absent	Count	87	60	147
	%	69.6%	48.0%	58.8%
Mild	Count	38	65	103
	%	30.4%	52.0%	41.2%
	Count	125	125	250
	%	100.0%	100.0%	100.0%
Pearson Chi-Square	Value	df	P Value	Result
	12.037	1	0.001	Sig
Sore Throat at 6 HR		GROUP		Total
		N	S	
Absent	Count	111	91	202
	%	88.8%	72.8%	80.8%
Mild	Count	14	34	48
	%	11.2%	27.2%	19.2%
	Count	125	125	250
	%	100.0%	100.0%	100.0%
Pearson Chi-Square	Value	df	P Value	Result
	10.314	1	0.001	Sig
Sore Throat at 12 HR		GROUP		Total
		N	S	
Absent	Count	122	121	243
	%	97.6%	96.8%	97.2%
Mild	Count	3	4	7
	%	2.4%	3.2%	2.8%
	Count	125	125	250
	%	100.0%	100.0%	100.0%
Pearson Chi-Square	Value	df	P Value	Result
	0.147	1	0.701	Non-Sig

The above table (Table-3) shows the association between sore throat grades at various hours post-operative. The Pearson Chi-Square value of 1.256 with a p-value of 0.740 indicates that there is no significant difference in the severity of sore throat between the groups just after extubation. At the 0 hour, the distribution of sore throat severity among the groups reveals that mild sore throat is

the most common, reported by 68.0% of Group N and 71.2% of Group S, with a combined total of 69.6%.

The Pearson Chi-Square test yielded a value of 7.977 and a p-value of 0.019, indicating a significant difference in the severity of sore throat between the groups at this time point. This result suggests that the severity of sore throat is significantly different across the groups after 2 hours.

The Pearson Chi-Square test produced a value of 12.037 with a p-value of 0.001, indicating a significant difference in sore throat severity between the groups at this time point.

At the 4-hour mark, the distribution of sore throat severity shows a clear pattern of improvement compared to earlier observations. In Group N, 69.6% of participants reported no sore throat, while in Group S, 48.0% reported the same, resulting in an overall total of 58.8% without sore throat. Mild sore throat was reported by 30.4% of Group N participants and 52.0% of Group S participants, totalling 41.2%.

The Pearson Chi-Square test yielded a value of 10.314 with a p-value of 0.001, indicating a significant difference in sore throat severity between the groups at this time point.

At the 6-hour mark, the distribution of sore throat severity shows a pronounced difference between the two groups. In Group N, 88.8% of participants reported that their sore throat was absent, whereas 72.8% of participants in Group S reported the same, leading to an overall total of 80.8% with no sore throat.

The Pearson Chi-Square test yielded a value of 0.147 with a p-value of 0.701, indicating that the difference in sore throat severity between the two groups at 12 hours is not statistically significant.

At the 12-hour mark, the distribution of sore throat severity shows a high rate of symptom resolution in both groups. In Group N, 97.6% of participants reported their sore throat as absent, while 96.8% of participants in Group S reported the same, leading to an overall total of 97.2% with no sore throat.

The Pearson Chi-Square test yielded a value of 1.004 with a p-value of 0.316, indicating that there is no statistically significant difference between the two groups regarding sore throat severity at 24 hours.

In Group N, 100% of participants reported their sore throat as absent, while 99.2% of participants in Group S reported the same, resulting in a total of 99.6% with no sore throat symptoms. Only 0.8% of Group S participants reported mild sore throat, leading to a total of 0.4% with mild symptoms.

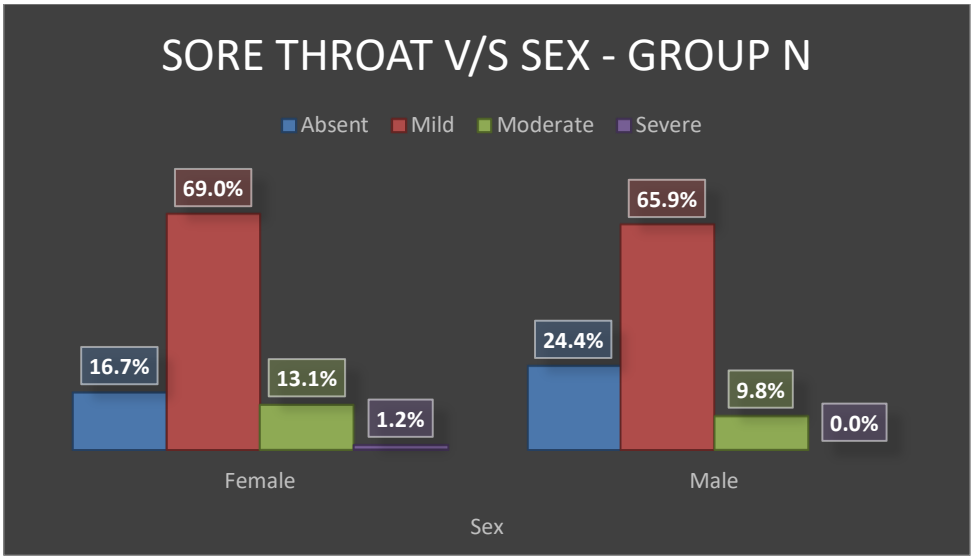

Fig 4: Distribution of Sore Throat Grades Among Sex Groups for Study Group N

The above figure shows the association between sore throat grades and sex group in post-operative stage for study group N, organized by severity and Sex group.

The incidence of post- operative sore throat was 80.8%.

The Pearson Chi-Square test yielded a value of 1.641 with a p-value of 0.650, indicating that there is no statistically significant difference in sore throat severity between males and females in Group N.

The distribution of sore throat among females, 16.7% reported their sore throat as absent, 69.0% as mild, 13.1% as moderate, and 1.2% as severe.

Among males, 24.4% reported their sore throat as absent, 65.9% as mild, 9.8% as moderate, and 0.0% as severe. Overall, 19.2% of the total participants reported their sore throat as absent, 68.0% as mild, 12.0% as moderate, and 0.8% as severe.

This suggests that the distribution of sore throat severity in the post operative is similar across sexes in this group.

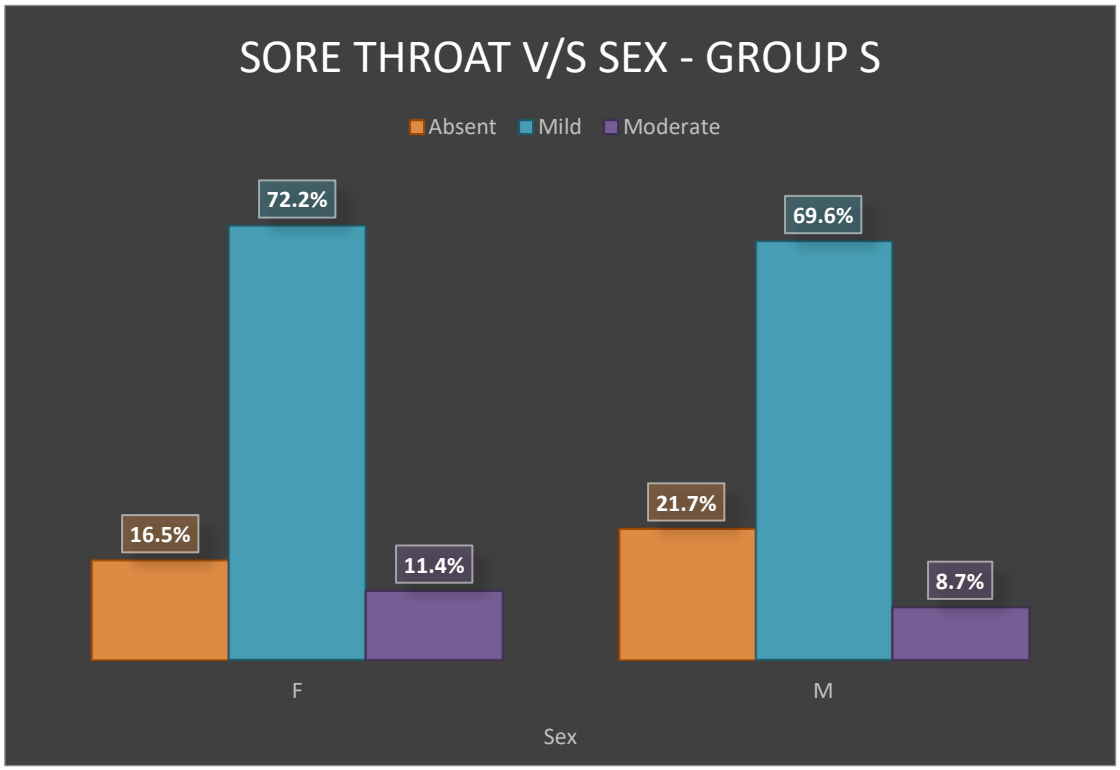

Fig 5: Distribution of Sore Throat Grades Among Sex Groups for Study Group S

The above table shows the association between sore throat grades and sex group in the post operative period for study group S, organized by severity and Sex group.

The incidence of post operative sore throat was 81.6%.

The Pearson Chi-Square test yielded a value of 0.672 with a p-value of 0.715. This result indicates that there is no statistically significant difference in sore throat severity between males and females in Group S.

The distribution of sore throat among females, 16.5% reported their sore throat as absent, 72.2% as mild, and 11.4% as moderate.

Among males, 21.7% reported their sore throat as absent, 69.6% as mild, and 8.7% as moderate.

Therefore, the distribution of sore throat severity in the post operative period is similar across sexes in this S group.

Discussion

In the context of the prevalence and severity of postoperative sore throat (POST), multiple studies, including ours, have provided valuable insights

Prevalence and Severity of POST

The present study and the study conducted by Ashis Ratna Bajracharya et al[14] both reported a notable incidence of POST in patients undergoing various surgical procedures. Bajracharya's study highlighted a 40% overall incidence of POST, with the highest occurrence observed at the 6th postoperative hour. This incidence gradually declined by the 12th and 24th postoperative hours, suggesting a temporal trend where sore throat symptoms lessen as time progresses post-surgery. The present study showed a similar pattern in the progression of sore throat severity over multiple postoperative time points, where mild sore throat was the most prevalent severity, and the incidence decreased over time.

At 0 hours post-extubation, Bajracharya's study reported 21% of patients experiencing a sore throat. This closely aligns with the present study's findings(table 11), where a combined 81.2% of patients in Group N (nebulization) and 81.6% in Group S (spray) reported mild to moderate sore throat severity immediately after extubation. Both studies therefore underscore that the peak incidence of sore throat occurs in the immediate hours following extubation and tends to decrease as the postoperative period extends, indicating the natural resolution of sore throat symptoms over time. The similar incidence patterns observed between the two studies highlight the consistent manifestation of POST, irrespective of different patient groups or clinical settings.

Influence of Sex on POST

The influence of sex on the prevalence of POST has been a subject of debate, with varying results observed in different studies. In Bajracharya's study,[14] the initial prevalence of POST was comparable between male and female patients; however, a higher incidence was noted among females at the 12th and 24th postoperative hours. This observation suggested that females might experience a more prolonged or severe manifestation of sore throat following surgical procedures.

In contrast, the present study did not observe a statistically significant difference in the severity of POST between male and female patients across both groups (Group N and Group S) Pearson Chi-Square tests yielded p-values of 0.650 and 0.715, respectively, indicating that gender did not significantly influence POST severity in our patient population. These findings suggest that while there might be some variation in POST incidence between sexes, as indicated by Bajracharya, the present study does not support the notion of a significant gender difference. Thus, the influence of sex on POST may vary depending on the specific patient demographics, surgical procedures, or clinical settings.

Impact of Body Mass Index (BMI) on POST

Bajracharya's study found a significant relationship between body mass index (BMI) and the incidence of POST. Bajracharya's study observed a higher incidence of POST among patients with a BMI greater than 30 kg/m², with no cases reported among underweight patients at 24 hours post-surgery. Similarly, the present study demonstrated that the incidence of POST increased with BMI, with obese patients (BMI > 30) showing a higher prevalence of sore throat compared to underweight patients.

This consistent finding across both studies reinforces the role of higher BMI as a potential risk factor for prolonged and more severe POST. The increased prevalence of POST among obese patients could be attributed to anatomical and physiological factors, such as reduced airway space and increased airway pressure during intubation, which may contribute to greater airway irritation and trauma, leading to a higher likelihood of developing a sore throat.

Intubation Duration and POST

The duration of intubation is another important factor influencing POST, as noted in both Bajracharya's study and the present study. Bajracharya's study found a markedly higher prevalence of POST among patients with longer intubation durations, with 51.5% of such patients experiencing POST compared to only 5.9% among those with shorter intubation periods. This suggests that prolonged intubation is a significant risk factor for developing a sore throat, possibly due to prolonged mechanical irritation and pressure on the tracheal mucosa.

In the present study, similar trends were observed, where longer intubation durations were associated with significant differences in mean heart rate (HR) and mean arterial pressure (MAP) at several postoperative intervals between groups N and S(table3,4). This finding implies that prolonged intubation may not only lead to an increased incidence of POST but also cause notable cardiovascular responses, which may correlate with the severity of sore throat. Both studies, therefore, indicate that extended intubation duration is a critical determinant of POST development, warranting strategies to minimize intubation time whenever clinically feasible.

Hemodynamic Parameters: Heart Rate (HR) and Mean Arterial Pressure (MAP)

The present study, alongside the studies by Amrita Roy[15] and Jin Young Lee et al[16], examined hemodynamic parameters, such as heart rate (HR) and mean arterial pressure (MAP), during different perioperative phases to assess their association with POST. Amrita Roy's study observed significant differences in HR between groups at various time points. For instance, at 2 minutes and 5 minutes after intubation, group B had significantly higher HR values (79.80 vs. 76.30 and 77.80 vs. 72.30, respectively), with p-values of 0.001 and 0.000. This suggests that specific interventions or conditions could substantially impact HR during and after surgery.

The present study found similar significant HR differences at several stages, including pre-nebulization, nebulization, and post-extubation, reflecting the influence of various interventions on hemodynamic responses. For example, pre-nebulization HR was significantly higher in Group N (86.75) compared to Group S (83.98) with a p-value of 0.039, and post-extubation HR at 0 hours was higher in Group N (86.38) compared to Group S (81.66) with a p-value of 0.000(table 4,7). Additionally, while Lee [16]et al. did not specifically examine HR and MAP, our study highlighted significant differences in these parameters between groups N and S at various surgical and post-extubation periods, indicating that different management strategies might affect hemodynamic stability and the incidence of POST.

Oxygen Saturation (SpO2) Levels

Oxygen saturation levels (SpO2) were measured in the present study and compared with findings from Jin Young Lee et al. Although Lee et al.'s study did not directly examine SpO2 levels, our study found significant differences in SpO2 levels between groups at several postoperative intervals. For example, Group N exhibited higher SpO2 levels (98.87 vs. 98.62) at the 2-hour postoperative mark, with a p-value of 0.004. This finding suggests that Group N might have experienced better oxygenation, which could be related to different anesthetic or procedural practices. Although direct comparisons with Lee et al.'s findings are not possible, both studies underscore the importance of monitoring oxygenation parameters to mitigate the risk of POST.

Incidence of Sore Throat and Cough

The incidence of sore throat and cough was a common focus in the present study, as well as in studies by Archana P. Vaghela et al[17]. and Soltani et al[18]. Vaghela et al.'s study reported a high incidence of sore throat shortly after surgery,

particularly in the lignocaine group, where 48% of participants reported sore throat at 1 hour post-surgery. In comparison, our study showed a 71.2% incidence of sore throat in the lignocaine spray group at 2 hours post-extubation, suggesting that while both studies found a significant incidence of sore throat shortly after surgery, the exact time points and percentages varied. Over time, both studies demonstrated a reduction in sore throat incidence, with Vaghela et al. reporting no participants experiencing sore throat at 24 hours and our study indicating only 0.8% with mild symptoms at 24 hours, confirming a trend of symptom resolution.

Regarding cough incidence, Vaghela et al[17] observed no significant difference between the lignocaine group and the comparison group at any postoperative interval ($p > 0.05$), which is consistent with our study, where no significant difference in cough incidence was observed between the two groups across all time points ($p > 0.05$). Similarly, for hoarseness of voice, both studies showed no statistically significant difference between the groups at any time interval, emphasizing the comparable efficacy of the interventions studied in minimizing this complication.

Demographic Parameters and Their Influence on POST

The present study and studies by Amrita Roy et al[15], Jin Young Lee, and others compared demographic parameters such as age, sex, height, and weight to identify potential influences on POST. In Amrita Roy's study, no significant differences were found in demographic parameters between groups A and B, with a p-value of 0.321 for age, indicating demographic comparability. In our study, similar findings were observed, with the mean ages of Group N (33.38 years) and Group S (33.42 years) showing no significant difference ($p = 0.980$). This suggests that demographic factors did not introduce bias in the studied populations, allowing for a more accurate assessment of the effects of different interventions on POST.

Conclusion

Based on the findings of this study, individualized care and tailored postoperative care plans would be beneficial for managing POST. Additional measures, such as humidification or specific analgesic protocols, may be considered for group S during early postoperative hours to manage sore throat more effectively. Enhanced monitoring protocols could be implemented for patients showing higher heart rates and mean arterial pressures during intraoperative and postoperative periods to manage potential cardiovascular risks. Future studies should explore the underlying reasons for the differences in cardiovascular responses and oxygen saturation between the two groups, potentially examining other contributing factors such as anesthesia technique, fluid management, or individual patient characteristics.

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