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Original Research Article

Comparative Evaluation of Magnesium Sulphate and Ketamine Gargles for Prevention of Post-operative Sore Throat Following ProSeal Laryngeal Mask Airway Insertion: A Prospective Randomized Study

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Abstract:

Background: Post-operative sore throat (POST) is a common complication following laryngeal mask airway (LMA) insertion, often leading to patient discomfort and dissatisfaction. Various interventions have been proposed to mitigate this issue, including gargling with substances such as magnesium sulphate and ketamine. In this prospective, randomized study, we aimed to compare the efficacy of magnesium sulphate and ketamine gargles in preventing POST following ProSeal Laryngeal Mask Airway (PLMA) insertion. This comparative evaluation provided valuable insights into optimizing patient comfort and satisfaction in the perioperative period.

Methods: We included seventy-five patients, aged 18-60, of any gender, with ASA I and II, scheduled for surgeries requiring general anesthesia with ProSeal laryngeal mask airway. Patients were randomly assigned to three groups: group-M (n=25) received magnesium sulphate gargle (1.2 g), group-K (n=25) received ketamine gargle (30 mg), and group-D (n=25) received dextrose gargle (20%). We recorded the number of attempts required for ProSeal insertion, nasogastric tube insertions, any blood staining of the ProSeal, post-operative sore throat incidence and severity at 0, 2, 4, and 24 hours, and any drug-related side effects.

Results: The overall incidence of sore throat at 0, 2, 4, and 24 hours post-operatively was 12%, 16%, 20%, and 8%, respectively, in group-M, 20%, 28%, 28%, and 12%, respectively, in group-K, and 24%, 36%, 32%, and 12%, respectively, in group-D. Compared to group-D, sore throat incidence was significantly lower in group-M at 2 hours (p=0.023) and 4 hours (p=0.031), but no significant difference was observed between group-D and group-K. The severity of sore throat was significantly reduced in group-M at 0 hours (p=0.004), 2 hours (p=0.001), and 4 hours (p=0.001) compared to group-D, and in group-K at 2 hours (p=0.002) and 4 hours (p=0.001). However, compared to group-K, the severity of sore throat in group-M was significantly lower at 0 hours (p=0.049) and 2 hours (p=0.018). No significant side effects were observed.

Conclusion: Magnesium sulphate gargling was more effective than ketamine gargling in reducing the incidence and severity of post-operative sore throat in patients undergoing general anesthesia with ProSeal laryngeal mask airway, without any observed side effects.

Keywords: Ketamine, Magnesium Sulphate, Gargles, Postoperative sore throat

Introduction

Post-operative sore throat (POST) is a common issue after general anaesthesia, even with supraglottic airway devices like the laryngeal mask airway (LMA)[1] and ProSeal laryngeal mask airway (PLMA)[2]. Various methods, both non-pharmacological and pharmacological, have been used to reduce POST incidence. Non-pharmacological approaches include using smaller tracheal tubes, careful airway management, minimizing laryngoscopy attempts, and gentle suctioning.[3] Pharmacological methods involve aspirin gargles,[4] benzydamine hydrochloride gargles,[5] and others.[6]

Research suggests N-Methyl-D-Aspartic acid (NMDA) receptors, present in both central and peripheral nerves, play a role in POST.[7] NMDA receptor antagonists like ketamine have been used as gargles or nebulizations to reduce POST after intubation.[8] Magnesium sulfate, another NMDA receptor antagonist, has shown promise as a gargle for POST reduction,[9] especially when compared

to ketamine, though this comparison was made with endotracheal tube patients.

With the increasing use of PLMA over endotracheal tubes, comparing the efficacy of magnesium sulfate and ketamine gargles for POST prevention following PLMA insertion becomes relevant.

This study aims to assess the incidence and severity of POST between these two treatments. Understanding their comparative effectiveness could offer insights into optimizing patient comfort and outcomes post-operatively.

Materials And Methods

This prospective randomized controlled study, conducted at our hospital after approval from the institutional ethical committee. The trial was registered in clinical trials registry of india (CTRI/2017/06/008871). The study enrolled patients aged 18 to 60, of both sexes, scheduled for elective surgery under general anesthesia with ProSeal laryngeal mask airway (PLMA) insertion.

Exclusion criteria included a history of pre-operative sore throat, asthma, COPD, oropharyngeal, head and neck surgeries, BMI > 30 kg/m2, full stomach, abdominal distension, gastroesophageal reflux disease, modified mallampatti class IV, allergies to study drugs, recent NSAID use, nausea, vomiting, or expected surgery duration exceeding 2 hours.

Sample size calculation was based on a prior study's findings,[9] indicating a minimum of 32 patients per group, totaling 96 patients. However, due to time constraints, a convenience sample of 25 patients was studied in each group.

Patients of inclusion criteria were randomized into three groups: Group **M** (magnesium sulfate gargle), Group **K** (ketamine gargle), and Group **D** (control). Randomization was achieved using computer-generated random numbers.

The study drug was prepared according to group allocation. For Group M (magnesium sulfate gargle), 1.2 g of magnesium sulfate was added to 24 ml of 20% dextrose water and 3.6 ml of normal saline (total volume 30 ml). Group K (ketamine gargle) received a preparation comprising 30 mg of ketamine in 24 ml of 20% dextrose water and 5.4 ml of normal saline (total volume 30 ml). Group D (control) received a solution containing 30 ml of 20% dextrose water.

The preparations were made by an investigator not involved in subsequent observations. The study drug solutions were handed over to the patients, who were instructed to perform gargles with two aliquots of 15 ml each for 30 seconds, with a 1-minute interval between gargles. This process ensured uniform administration of the study drugs across the groups.

PLMA insertion was performed by experienced personnel, with anesthesia induction following standard protocols. PLMA placement, nasogastric tube insertion via gastric port of PLMA, and intraoperative monitoring adhered to established guidelines.

Postoperative sore throat assessment occurred at 0, 2, 4, and 24 hours using a four-point scale(0-3) where 0 stood for no sore throat to 3 which stood for severe sore throat. Patients reporting throat pain received analgesics as needed, and any adverse events were recorded.

Primary outcome measures included the incidence and severity of post-operative sore throat, while secondary outcomes comprised oral/pharyngeal trauma and drug-related side effects. Statistical analysis utilized ANOVA, unpaired t-test, and Chi-square test with a significance level of $p < 0.05$, performed using SPSS version 17.0.

Results

Our study results revealed that both the groups were statistically insignificant and hence, comparable in terms of age, height, BMI, gender distribution, duration of surgery, ASA status, MMPC class, hemodynamic parameters, size of Proseal LMA used, number of attempts for Proseal and Nasogastric tube placement.

The overall incidence of sore throat at 0, 2, 4 & 24 hr post-operatively was 12%, 16%, 20% & 8% respectively in group M and was 20%, 28%, 28% & 12% respectively in group K and 24%, 36%, 32% & 12% respectively in group D.

Post-op Time	Group	Mild (%)	Moderate (%)	Severe (%)
0 hr	M	12%	0%	0%
	K	16%	4%	0%
	D	16%	8%	0%
2 hr	M	16%	0%	0%
	K	24%	4%	0%
	D	12%	20%	4% (1 patient)
4 hr	M	20%	0%	0%
	K	24%	4%	0%

	D	0%	24%	8% (2 patients)
24 hr	M	4%	4%	0%
	K	8%	4%	0%
	D	4%	8%	0%

The incidence of mild sore throat at 0, 2, 4 & 24 hr was 12%, 16%, 20% & 4% respectively in group M, was 16%, 24%, 24% & 8% respectively in group K and was 16%, 12%, 0% & 4% respectively in group D.

The incidence of moderate sore throat at 0, 2, 4 & 24 hr was 0%, 0%, 0% & 4% respectively in group M, was 4%, 4%, 4% & 4% respectively in group K and was 8%, 20%, 24% & 8% respectively in group D.

The incidence of severe sore throat at 0, 2, 4 & 24 hr was 0%, 4%, 8% & 0% respectively in group D. No patient had severe sore throat in group M and group K. The patients in group D having severe sore throat at 2 hr (1 patient) and 4 hr (2 patients) complained of throat pain.

Comparison	Time	Result
Group D vs Group M (sore throat)	2 hr	Statistically higher (p=0.023)
Group D vs Group M (sore throat)	4 hr	Statistically higher (p=0.031)
Side effects among groups	—	No significant difference (p=0.171)

Group D had a statistically higher incidence of sore throat at 2 hr (p=0.023) and at 4 hr (p=0.031) postoperatively as compared to group M. The incidence of side effects was statistically similar among the groups (p=0.171) as reported in the table.

Discussion:

Certainly! Here's the final summary with the additional point included:

The study investigated the effectiveness of magnesium sulphate and ketamine gargles in reducing the incidence and severity of postoperative sore throat (POST) after ProSeal laryngeal mask airway (PLMA) insertion. The primary outcome measured was the incidence of sore throat, while secondary outcomes included the severity of sore throat, oropharyngeal trauma, and side effects of the drugs.

The results indicated that magnesium gargle significantly reduced the incidence of sore throat at 2 and 4 hours post-PLMA insertion compared to the control group (p=0.023 and p=0.031, respectively). However, there was no significant difference between the ketamine gargle group and the control group. The smaller sample size in the ketamine group may have influenced this outcome.

The mechanism of action of magnesium involves blocking NMDA receptors, which are present in both the central nervous system and peripheral nerves. Experimental studies have shown that magnesium exerts its effects locally, attenuating inflammation and providing peripheral analgesia. Additionally, magnesium inhibits calcium entry into cells and blocks NMDA receptors, preventing central sensitization caused by peripheral nociceptive stimulation. The anti-inflammatory effects of magnesium include decreasing the release of inflammatory mediators such as histamine and leukotrienes.

Secondary outcomes revealed that both magnesium and ketamine gargles significantly reduced the severity of sore throat compared to the control group at various time points post-PLMA insertion. Magnesium was more effective in reducing sore throat severity than ketamine, with significant differences observed at 0, 2, and 4 hours post-insertion.

Ketamine, like magnesium, also blocks NMDA receptors and has demonstrated anti-inflammatory effects. Animal studies have shown ketamine's potential to attenuate inflammatory changes in conditions such as asthma. Ketamine gargle effectively reduced the severity of POST in this study, although the reduction in incidence was not statistically significant, possibly due to the small sample size.

Comparison with previous studies revealed similar findings regarding the reduction in sore throat severity with both magnesium and ketamine gargles. However, differences in study methodologies, including drug administration routes and doses, may account for variations in results. Studies using higher doses of ketamine or different drug administration methods have reported significant reductions in sore throat incidence, which were not observed in this study (Vanita Ahuja et al., 14).

The relatively lower dose of ketamine used in this study compared to previous studies could also be a contributing factor to the lesser reduction in the severity of postoperative sore throat (POST). Previous studies have utilized higher doses of ketamine, ranging from 40 mg to 50 mg, whereas in this study, a lower dose was administered, likely based on the patients' mean body weight. This dose

selection, which was lower than in previous studies, might not have been optimal for achieving the desired therapeutic effect through gargling, which is primarily a topical application method Vanita Ahuja et al., 14).

Additionally, while the total volume of the ketamine gargle was 30 ml, it was divided into two aliquots of 15 ml each in this study. While this division may have been intended to enhance drug distribution and efficacy, the relatively smaller volume of 15 ml per gargle might not have been sufficient to cover the entire oropharyngeal mucosa adequately, potentially impacting the drug's local effects (Vanita Ahuja et al., 14).

These factors, including the lower dose of ketamine and the division of the gargle volume, could have contributed to the observed differences in the efficacy of ketamine gargle in reducing the severity of POST compared to previous studies.

A comparison between magnesium sulphate and ketamine gargles showed that magnesium was more effective in reducing both the incidence and severity of sore throat at various time points post-PLMA insertion. (Teymourian et al.,19) found similar results, attributing magnesium's pre-emptive analgesic effect to its ability to block calcium entry into tracheal muscles, thereby reducing muscle contraction.

Regarding oropharyngeal trauma, there was no statistically significant difference among the groups, although fewer patients in the magnesium and ketamine groups experienced severe sore throat compared to the control group. This suggests that the anti-nociceptive and anti-inflammatory actions of magnesium and ketamine may have mitigated the severity of sore throat in patients who experienced trauma. Side effects of the drugs, including nausea, vomiting, and cough, were reported but did not differ significantly among the groups. These findings align with previous studies and suggest that both magnesium and ketamine gargles are well-tolerated options for reducing POST after PLMA insertion.

Conclusion:

In conclusion, magnesium sulphate and ketamine gargles effectively reduce the incidence and severity of sore throat following PLMA insertion. Magnesium appears to be more effective than ketamine in this regard, possibly due to its pre-emptive analgesic effect and anti-inflammatory properties. Further research with larger sample sizes and standardized methodologies may provide additional insights into the optimal use of these gargles for preventing POST.

Future research should focus on optimizing the dosage, administration, and duration of magnesium sulfate and ketamine gargles to maximize efficacy while minimizing side effects. Comparative studies against alternative interventions and mechanistic investigations into their anti-nociceptive and anti-inflammatory mechanisms can provide deeper insights. Longitudinal follow-up studies are needed to assess long-term effectiveness, while patient-centered outcomes research can prioritize patient preferences and satisfaction. Additionally, risk stratification, personalized medicine approaches, and translational research utilizing animal models can enhance treatment strategies. Economic evaluations should also be conducted to assess cost-effectiveness and resource utilization implications. Addressing these priorities can advance our understanding of POST management and improve perioperative care outcomes.

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