Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 11, 2023

Original research article

Changes in the intracuff pressure in disposable classic LMA filled with either air, saline or 2% lignocaine while using nitrous oxide anaesthesia: A prospective, randomised, double-blinded study

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Abstract

Introduction: Increase in cuff pressure is seen during nitrous oxide anaesthesia if air is used to inflate the cuff of LMA. This can lead to post-operative complications like sore throat, hoarseness and dysphagia. The aim of this study was to compare changes in the intracuff pressure in disposable LMA filled with Air, Saline or 2% Lignocaine in the cuff while using nitrous oxide anaesthesia and to assess postoperative pharyngolaryngeal complications.

Methods: This was a prospective, randomized comparative study conducted in a tertiary care hospital in Karnataka. 120 patients were randomized into three groups containing 40 patients each using computer generated random numbers and sealed envelope method. For subjects in Group A, air was injected into disposable LMA. For the subjects in Group S, Saline was injected, and for subjects in Group L, 2% Lignocaine was injected.

Results: The groups were comparable for demographic data, type of surgery, size of LMA, duration of anaesthesia, cuff volume and seal pressure. The mean cuff pressures at 30, 60, 90 and 120 minutes and at the end of surgery were significantly higher in group A and S as compared to group L (p<0.05).The cuff pressure increased from 70.42±8.3 cm H_2O to 98.31±4.66 cm H_2 O at 120 minutes in group A,whereas there was no significant increase in cuff pressure from baseline in group S and group L.

Conclusion: Intracuff pressure increases significantly within 15 minutes of nitrous oxide anaesthesia when air is used to inflate the cuff than saline or 2% Lignocaine. Pharyngeal complications like sore throat, dysphagia were seen only in air and saline group when compared to Lignocaine group.

Keywords: LMA, Intracuff pressure, Nitrous oxide, saline, 2% lignocaine

Introduction

Laryngeal mask airway (LMA) is useful for airway management during anaesthesia and resuscitation. Because of its ease of insertion and better airway seal, it is used as a rescue device during difficult or failed intubation [1]. Increase in cuff pressure is seen during nitrous oxide anaesthesia if air is used to inflate the cuff of LMA. This will lead to post-operative complications like sore throat, hoarseness and dysphagia [2, 3]. This increase in the pressure can be minimized by using agents other than air. There are several studies regarding monitoring of intracuff pressure in endotracheal tube using saline, nitrous oxide, O2 + N2 O mixture and assessing postoperative pharyngolaryngeal complications but hardly any studies regarding this with respect to Laryngeal Mask Airway [4]. Other than saline, Lignocaine is recently being studied for its role in preventing cough and postoperative sore throat [5]. Lignocaine prevents the entry of Nitrous oxide into the cuff and exerts a direct anaesthetic effect on the tracheal mucosa by permeating through the semipermeable cuff. The aim of this study was to compare changes in the intracuff pressure in disposable LMA filled with Air, Saline or Lignocaine in the cuff while using nitrous oxide anaesthesia and to asses postoperative pharyngolaryngeal complications.

Methodology

This was a prospective, randomized comparative study conducted in a tertiary care hospital in Karnataka. 120 patients were randomized into three groups containing 40 patients each using computer generated random numbers and sealed envelope method.

For subjects in Group A, air was injected into disposable LMA, for the subjects in

Group S, Saline was injected and for the subjects in Group L, Lignocaine was injected. After obtaining

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 11, 2023

institutional ethical committee clearance, patients aged between 18 to 60 years and belonging to ASA Physical status I & II undergoing elective surgery under general anaesthesia were included in the study. Written, informed consent of all the patients was obtained after explaining the procedure. All patients included in the study were made to undergo a thorough pre-operative assessment including detailed history, clinical examination and necessary investigations. Age, height, weight and ASA grade of the patients were recorded. Patients with history of sore throat in the last 6 weeks were excluded from the study. Patients were allocated into group A or group S by computer generated randomization table. Group A patients received air, Group S received saline and Group L received 2% Lignocaine in the disposable LMA cuff. Patients were received into Operation theatre, Intravenous (IV) line was secured using appropriate gauge cannula. Electrocardiogram (ECG), noninvasive blood pressure (NIBP), oxygen saturation (SPO2) and capnography were monitored. Patient were preoxygenated with 100% oxygen. Induction was achieved using Fentanyl 1-2 mcg/kg and propofol 2-3 mg/kg. When the depth of anaesthesia was adequate as assessed be relaxation of jaw, loss of eyelash reflex appropriate size LMA was inserted by an anaesthesiologist. Neuromuscular blocking agent was used if required. Cuff was filled with air, saline or Lignocaine until an absence of audible leak with peak airway pressure of < 20 cmH_2O was noted. After confirming proper placement of LMA by capnography and bilateral chest movement it was fixed. Anaesthesia was maintained using 35% oxygen, 65% nitrous oxide and an inhalational agent. Patient was ventilated with tidal volume 8- 10 ml/kg, I:E ratio 1:2, respiratory rate was adjusted to maintain
EtCO2 between 35-45 mmHg. Intracuff pressure was monitored using cuff pressure manometer at 0, 15, 30, 45, 60, 90, 120 mins and the corresponding airway pressures were recorded. At the end of surgery, the anaesthesiologist removed the LMA when patient was fully awake. Patients were monitored in post anaesthesia care unit for pharyngolaryngeal complications like sore throat, hoarseness, dysphagia for 1 hr, 2 hr and
24hrs.

Sore throat was graded as follows

- **Grade 0:** No sore throat
- **Grade 1:** Mild sore throat (less than with cold)
- **Grade 2:** Moderate sore throat (as with cold)
- **Grade 3:** Severe sore throat (more severe than with cold)

Hoarseness was graded as follows

- **Grade 0:** No hoarseness
- **Grade 1:** Mild hoarseness (noticed by patient only)
- **Grade 2:** Severe hoarseness (noticed by others)
- **Grade 3:** Aphonia (inability to speak)

Data obtained was analyzed using SPSS 16.0 version. Chi Square test and independent sample t test were used for ordinal and continual data respectively

Results

The groups were comparable for demographic data, type of surgery, size of LMA, duration of anaesthesia, cuff volume and seal pressure as shown in Table 1.

Table 1: Comparison of the three groups

	Group A	Group S	Group L	p
Age (yrs)	40.2±12.9	40.6±18.3	41.0±10.1	0.73
Weight (kg)	54.8±5.9	58.3±10.2	53.1±13.7	0.91
Size 3 LMA	18	14	20	0.13
Size 4 LMA	22	26	20	0.56
Cuff volume (ml)	17.3±5.6	21.5±7.5	20.8±3.4	0.23
Seal Pressure (cmH_2O)	21.60±3.7	18.7±2.2	18.2±3.1	0.003
Anaesthesia Duration (min)	70.0±56	70.5±22	69±23	0.72
Vt (ml)	505.0±35	486.25±37	502.4±75	0.81
Vte (ml)	472.0±37	445.75±35	476.87±53	0.88

The mean cuff pressures at 30, 60, 90 and 120 minutes and at the end of surgery were significantly higher in group A and S as compared to group L (p<0.05). The cuff pressure increased from 70.42±8.3 cm H_2O to 98.31±4.66 cm H_2O at 120 minutes in group A,whereas there was no significant increase in cuff pressure from baseline in group S and L (69.56±9.1 cm H_2O to 78.71±5.26 cm H_2O at 120 minutes and 72.23±9.2 cm H_2O to 79.12±3.55 cm H_2O at 120 minutes respectively) as shown in Figure 1.

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 11, 2023

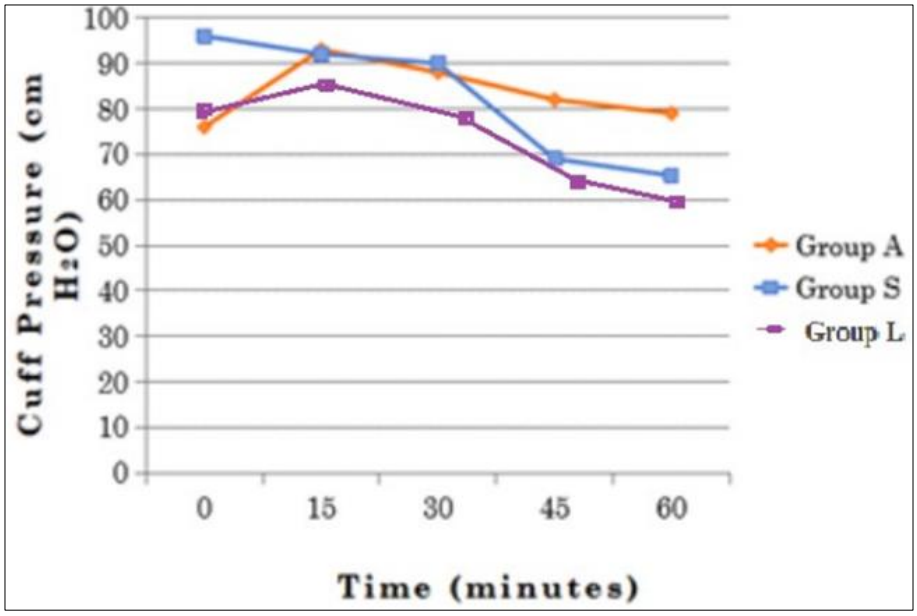

Fig 1: Cuff pressure between the groups

Intraoperative complications such as sore throat and dysphagia were found to be greater in Group A when compared to groups S and L as shown in Figure 2. The least pharnygeal complications were seen in Group L.

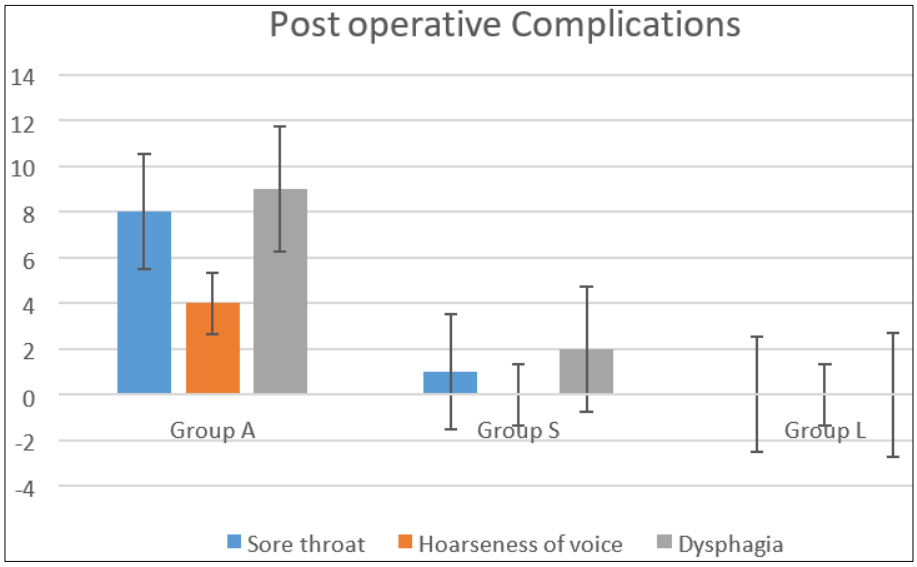

Fig 2: Postoperative complications between the groups

Discussion

In our study we found that intracuff pressure increases significantly within 15 minutes of nitrous oxide anaesthesia when air is used to inflate the cuff than saline or lignocaine. This is similar to a study by Edwin Seet *et al* where they used air in classic LMA and they concluded that monitoring of intracuff pressures and keeping it below 60 cm H_2O reduces postoperative pharyngolaryngeal complications by 70% [6]. The study conducted by Coorey *et al* concluded that LMA cuff filled with saline has stable intracuff pressure [4]. In another study conducted by NL Ahmad *et al* in 60 patients undergoing elective surgery; air and distilled water was used to fill endotracheal tube cuff. They found that when distilled water was used to fill the cuff, the rise in cuff pressure during nitrous oxide anaesthesia was lower than that of an air filled cuff [3]. In our study, pharyngeal complications like sore throat, dysphagia were found to be higher in air group when compared to saline or lignocaine group. This was found to be in agreement with a study conducted by Ali N P *et al* on 120 patients undergoing elective surgery. They used air, distilled water and 2% lignocaine to fill the endotracheal tube cuff and they concluded that lignocaine as cuff inflating agent reduces the incidence of post-operative sore throat and dysphagia [5]. Comparing 4% lignocaine and air in the endotracheal tube showed lesser incidence of sore throat in the lignocaine group in a study conducted

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by Manimala Rao *et al* [7]. Many other studies have provided evidence that Lignocaine-inflated tubes caused lesser tracheal mucosal damage due to direct contact of the local anesthetic solution to the tracheal mucosa which reduces the event of post-extubation laryngotracheal complications such as sore throat and hoarseness of voice [8]. Further, the reduction in complications could be attributed to the additional anti-inflammatory effect of lignocaine. Study conducted by Shroff P. P and Patil V. on efficacy of cuff inflation media to prevent postintubation related emergence phenomenon also showed 2%lignocaine and saline are better cuff inflation media [9].

During general anaesthesia, N2O is commonly used in conjunction with other gases. Nitrous oxide readily diffuses into the LMA cuff causing a rise in volume and cuff pressure during the course of surgery. This leads to various pharyngeal complications. Soares *et al* compared LMA unique and LMA supreme using air and saline in mannequins and found that no significant difference in intracuff pressure [10]. Two other studies also showed that maintaining low intracuff pressure (35±20 cm H_2O) and reducing intracuff pressure to the minimum required for an effective seal reduced postoperative pharyngolaryngeal complications [11, 12]. In another study done on 400 pediatric patients demonstrated that increase in the intracuff pressure in the LMA was closely related to the development of sore throat [13]. Our study also found that a smaller volume of saline and lignocaine was needed to maintain oropharyngeal seal without any detectable air leak.

Conclusion

Intracuff pressure increases significantly within 15 minutes of nitrous oxide anaesthesia when air is used to inflate the cuff than saline. During emergence from general anesthesia, coughing due to mucosal irritation can be detrimental to pain management. The tracheal mucosal irritation can lead to sore throat and hoarseness of voice which can make the postoperative period unpleasant. This study concludes that lignocaine is an ideal agent for LMA cuff inflation which can help minimise all these complications unlike air or saline.

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