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Intraoperative Evaluation of Effects of Different Gas Mixtures (Oxygen 100%, O_2 50%:N_2O 50%, Air on Cuff Pressure of PLMA (Proseal LMA)

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ABSTRACT

Introduction:- we study the intra operative evaluation of different gas mixture(oxygen 100%, O2 50%:N2O 50%, AIR on cuff pressure of PLMA.
Aims and Objectives:- To study intracuff pressure changes and the change in final volume of gas mixture during inflation and deflation during intraoperative period and postoperative complications.
Material and Methods:- This double blind, prospective Study was conducted in Department of Anaesthesiology, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala following approval from institutional ethical committee and written informed patient consent. The sample size of 120 patient aged 18 to 60 years, belonging to ASA physical status 1 and 2 undergoing surgery in general anesthesia with PLMA as airway device divided into three group on the basis of PMLA cuff gas mixture:-Group O - oxygen 100%, Group ON - Nitrous 50%: Oxygen 50%, Group A – Air.
Results and Conclusion:- Combination of N2O and O2 resulted in decreased intracuff pressure and air lead to a slight increase in intracuff pressure with O2 providing relatively stable cuff pressures.

Keywords:- PLMA,100% Oxygen, Air, Oxygen 50% N_2O 50%, Air.

INTRODUCTION

Supra glottic airway devices (SADs) are widely used in clinical practice nowadays in place of or as adjunct to endotracheal tube. Classic laryngeal mask airway (cLMA) was first SAD to be used followed by Proseal LMA and numerous other SADs.[1] Proseal laryngeal mask airway (PLMA) is a directional peri-laryngeal sealer [4-6]. The cuff of the Proseal LMA extends into the back of the mask which results an improved airway seal without compromising mucosal pressure. This special cuff presses firmly into the epiglottis tissue allowing an oropharyngeal seal (>30cmH2O) without increasing surrounding pharyngeal mucosal pressure. Inflating the cuff to an intracuff pressure of 60cmH2O (45mmHg) is recommended to prevent leak. [5, 7]

Proseal LMA cuff pressure changes variably during general anesthesia where oxygen and nitrous oxide gases are used in anesthetic gas mixture. It's silicon cuff allows diffusion of nitrous oxide, carbon dioxide and other gases depending on their solubility and partial pressure.[8] N_2O is an inhalational anesthetic that is frequently used in general anesthesia but it can diffuse into the cuff with resultant rise in intracuff pressure which can further lead to malposition, inadequate seal, contamination

of airway, decreased mucosal capillary perfusion pressure and pharyngolaryngeal morbidity including sore throat, nerve injury, dysphagia and dysphonia.[4,7,9,10] This can lead to increased postoperative morbidity and delay in hospital discharge.

Various methods are being used to prevent rise in intracuff pressure like inflating the cuff with different anesthetic gas mixtures, use of saline, deflating the cuff partially and regular intraoperative monitoring of cuff pressure with manometer, so that postoperative morbidity can be reduced.[11]

Thus, we have planned this study to determine an appropriate gas mixture for inflating the cuff which can give us stable intracuff pressures during intraoperative period, decreasing postoperative pharyngolaryngeal morbidity.

AIMS AND OBJECTIVES

AIM

To study the effect of various gas mixtures (O_2 100%, O_2 50%:N_2O 50%, Air) on cuff pressure of PLMA.

OBJECTIVES

1. To study intracuff pressure changes during intraoperative period.
2. To measure the change in final volume of gas mixture during inflation and deflation.
3. To study complications related to cuff pressure changes in postoperative period.

MATERIAL AND METHODS

PLACE OF STUDY

Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala.

Type of study: Double blind, prospective, randomized controlled trial.

SAMPLE SIZE: 120 patients undergoing surgery in general anesthesia with PLMA as airway device.

Group O - oxygen 100%.

Group ON - Nitrous 50%: Oxygen 50%

Group A - Air

INCLUSION CRITERIA:

1. ASA 1 and ASA II patients for surgery under general anesthesia with PLMA.
2. Age between 18 to 60 years.
3. BMI < 30.
4. Surgeries with duration of < 1 hour.

EXCLUSION CRITERIA:

1. Patients who refused to participate in study.
2. Patients with inadequate mouth opening.
3. Anticipated difficult airway.
4. Obese patients with BMI >30 Kg/m^2 .
5. Patients having increased risk of aspiration such as those with gastroesophageal reflux disease, hiatus hernia.
6. Patients with oropharyngeal pathology, cervical spine pathology and pregnancy.
7. Patients having history of recent upper respiratory infections.
8. Surgeries extending beyond 1 hour.

After getting approval from the Ethics Community of Maharishi Markandeshwar University. Preanesthetic checkup of patients was done including detailed history. Venturi mask tubing was attached to the fresh gas outlet of anesthesia work station for the desired gas composition of three different groups that are Group O, Group ON, and Group A. Then the other end of tubing was further attached to the 50 ml syringe via three-way assembly. We set the gases flow (100% O_2, Air, 50 %O_2:50% N_2O) at 5 lit/min and filled the syringe with respective gas mixture to inflate the cuff of Proseal LMA. An anaesthesiologist not involve in further study prepared the respective gas mixture in the syringe before induction.

We induced the anesthesia with inj. Midazolam 1 mg, inj. Fentanyl 2µg/kg, inj. Propofol 2 mg/kg, inj atracurium 0.5 mg/kg. Then after 3 minutes of giving inj atracurium, inserted PLMA, LMA cuff was inflated at a cuff pressure of 40cm H2O with the help of aneroid cuff pressure manometer attached to the pilot balloon. The inflated gas volume was assessed by chest expansion and capnography. Cuff

pressures was checked every 10 minutes for the entire duration of surgery until nitrous oxide is switched off and 100% oxygen is delivered to patient. After the patient regained spontaneous respiration, neuromuscular blockade was reversed with injection Myo Pyrolate. PLMA was removed in inflated condition when tidal volume achieved on CPAP PSV mode with PSV of 4 cm H_2O. The presence of blood stain on the cuff was noted. Gas from the PLMA cuff aspired and volume was noted down. Suctioning orally was avoided. Patient was transferred to post anesthesia care unit.

Postoperatively, sore throat, dysphonia and dysphagia was assessed by the questionnaire at 1, 2 and 24th hour postoperatively. Sore throat was defined as constant pain or discomfort in the throat independent of swallowing, dysphonia; as difficulty in speaking, and dysphagia; as difficulty or pain swallowing.

OBSERVATION AND RESULT

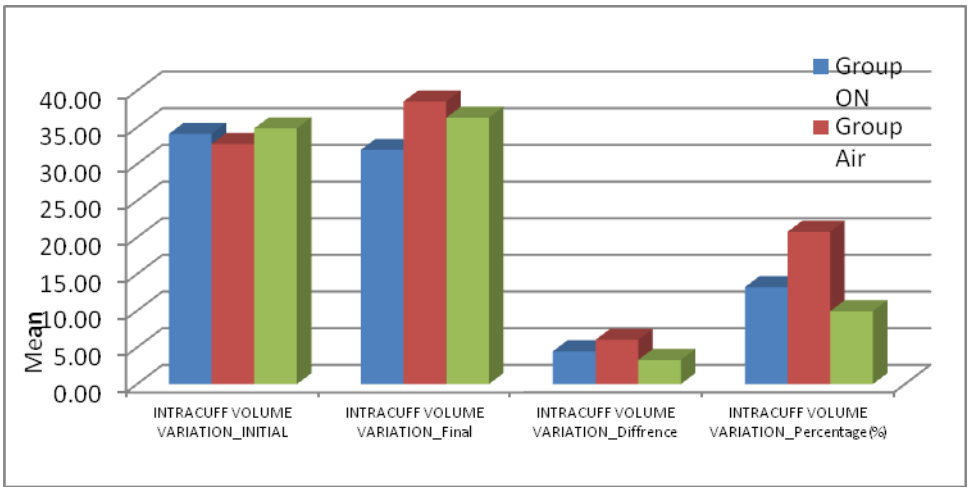


FIGURE 2: DISTRIBUTION INTERACUFF VOLUME VARIATION

Mean intracuff volume variation percentage% in group ON was 13.04± 8.04 in group Air 20.76±20.97 group Oxygen 9.33±14.47. There is no significant difference between in three groups. Significant statistical was seen in intracuff volume variation percentage % in group ON vs. Air (p-value=0.027) and group Air vs. Oxygen (p-value=0.001)

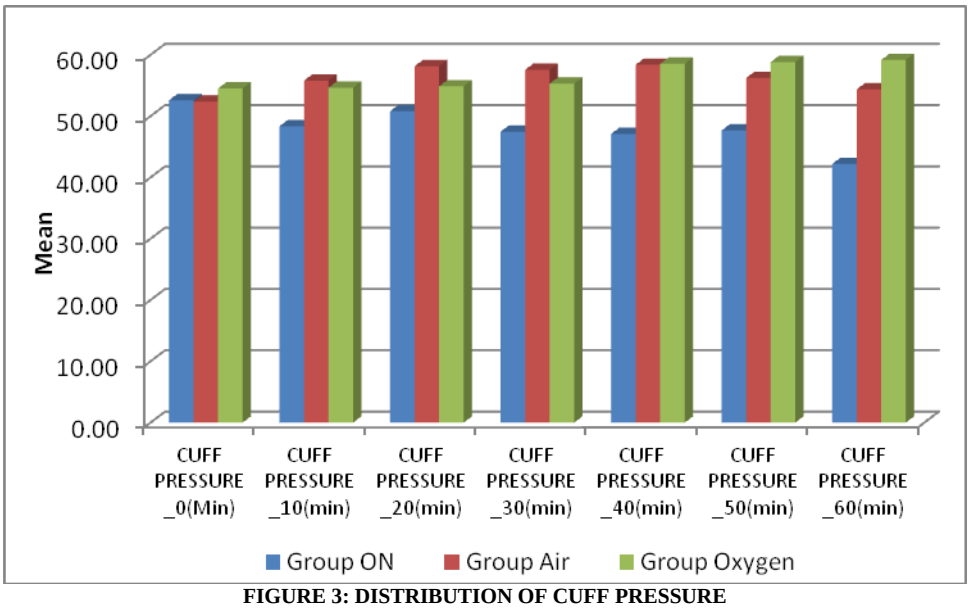


FIGURE 3: DISTRIBUTION OF CUFF PRESSURE

CUFF PRESSURE DISTRIBUTION

	Group ON		Group Air		Group Oxygen						
	Mean	SD	Mean	SD	Mean	SD	F	p-value	p-value	p-value	p-value
CUFF PRESSURE	52.60	4.71	52.38	6.88	54.53	6.38	1.522	0.223	0.868	0.158	0.115
CUFF PRESSURE	48.35	6.25	55.80	6.89	54.65	8.27	12.458	0.000	0.000	0.000	0.476
CUFF PRESSURE	50.80	9.61	58.15	7.58	54.63	9.29	6.866	0.002	0.000	0.056	0.078
CUFF PRESSURE	47.46	7.35	57.56	9.90	55.33	10.24	11.895	0.000	0.000	0.000	0.304
CUFF PRESSURE	47.10	7.50	58.38	8.91	58.55	12.14	9.576	0.000	0.000	0.000	0.956
CUFF PRESSURE	47.67	4.58	56.24	10.72	58.83	11.90	6.656	0.003	0.011	0.001	0.427
CUFF PRESSURE	42.20	4.78	54.38	6.94	59.17	14.17	9.200	0.001	0.003	0.000	0.194

The mean cuff pressure in group ON at 0 min was 52.60± 4.71 and main cuff pressure in group Air was 52.38± 6.88 while in group Oxygen the mean cuff pressure is 54.53±6.38. There was no significant difference between all three groups.

After 10 min the mean cuff pressure in group ON was 48.35± 6.25 and mean intracuff pressure in group Air was 55.80± 6.89 while in group Oxygen the mean intracuff pressure was 54.65±8.27. There

was no significant difference in cuff pressure between all three groups.

Significant statistical difference was seen in seen in cuff pressure in group ON vs Air(p-value=0.000) and ON vs Oxygen (p value=0.000)

After 20 min the mean cuff pressure in group ON 50.80 ± 9.61 and main cuff pressure in group Air was 58.15± 7.58 while in group Oxygen was 54.63±9.29. There was no significant difference between all three groups. Significant statistical was seen in cuff pressure in group ON vs Air (p value=0.000) and Air vs Oxygen (p value=0.017) and Air vs Oxygen (p value=0.050).

At 30 min the mean cuff pressure in group ON 47.46±7.35 and mean cuff pressure in group Air was 57.56± 9.90 while in group Oxygen, the cuff pressure was 55.33±10.24. There was no significant difference between all three groups. Significant statistical difference was seen in cuff pressure group ON vs Air (p value=0.000) and group ON vs Oxygen (p value=0.000)

After 40 min the mean cuff pressure in group ON is 47.10± 7.50 and mean cuff pressure in group Air was58.38±8.91 while in group Oxygen the cuff pressure was 58.55±12.14. There was no significant difference between all three groups. Significant statistical difference was seen in cuff pressure group ON vs Air (p-value=0.000) and group ON vs Oxygen (p value =0.000).

After 50 min the mean cuff pressure in group ON was 47.67± 4.58 and mean cuff pressure in group Air was 56.24± 10.72 while in group Oxygen the cuff pressure was 58.83±11.90. There was no significant difference between all three groups. Significant statistical difference was seen in cuff pressure in group ON vs Air (p value=0.011) and group ON vs Oxygen (p value=0.001)

After 60 min, the mean cuff pressure in group ON was 42.20± 4.78 and mean cuff pressure in group Air was 54.38±6.94 while in group Oxygen the cuff pressure was 59.17±14.17. There was no significant difference between all three groups. Significant statistical was seen in cuff pressure in group ON vs Air(p value=0.003) and group ON vs Oxygen (p value=0.000).

PHARYNGOLARYNGEALMORBIDITY

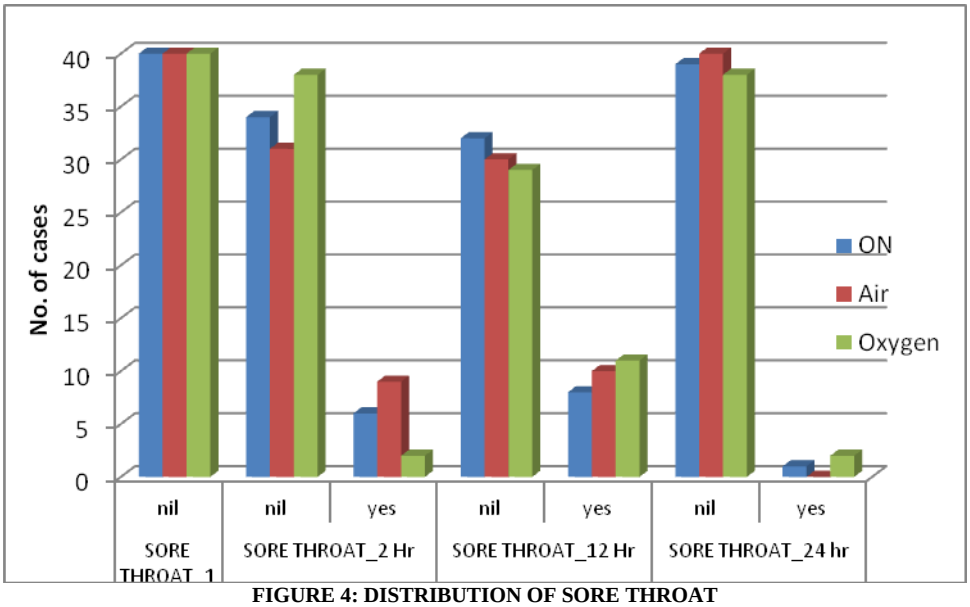
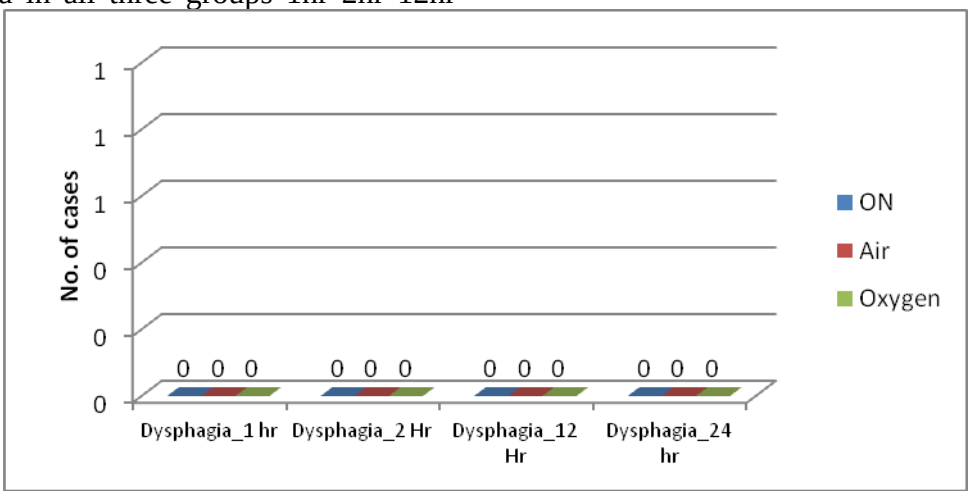


FIGURE 4: DISTRIBUTION OF SORE THROAT

No significant difference was seen in sore throat in all the three groups at 1hr 2hr 12 hr and 24 hour in post operative period

DYSPHAGIA

No significant difference was seen in dysphagia in all three groups 1hr 2hr 12hr and 24 hour in post operative period.



DYSPHAGIA

No significant difference was seen in dysphagia in all three groups 1hr 2hr 12hr and 24 hour in post operative period.

DYSPHONIA

No significant difference was seen in dysphonia all three groups 1hr 2hr 12hr and 24 hour in post operative period.

DISCUSSION

Different gas medias have been used to inflate the cuff of supraglottic airway devices. Air is most commonly used to inflate the cuff of Proseal LMA as its easy and quick. But its use has been associated with postoperative pharyngolaryngeal morbidities like sore throat, dysphagia and dysphonia. Therefore, we conducted this study using different gases available in operation theatre to inflate the cuff of SAD's. We had 120 patients divided in 3 groups of 40 each and used nitrous oxide, 100% oxygen and air respectively in each of the group. We found a significant difference between final intracuff volume in groups ON vs Air and ON vs oxygen. Significant difference was observed in intracuff volume variation in groups ON vs air and air vs 100% O_2. and intracuff pressure also changed significantly from 10 minutes onwards in all the three groups. It was found that intracuff pressure decreased in group ON making it favorable choice for inflating the cuff.

In our study the mean initial intracuff volume in ON group is 34.13 and final volume is 31.95. Final intracuff volume in group ON decreased in our study as seen in the study conducted by study Mona Sharma et al., [12]. Ranjana et al also reported a change in final intracuff volume in groups air, ON, AO. Similar to our study, Mitchell et al also observed a progressive decrease in intracuff volume in group NO[20]. Studies conducted by O'Kelly SW et al, Algren JT et al, Ong M et al also reported a decrease in cuff pressures when mixtures of oxygen, N_2O, isoflurane was used to inflate the cuff of Proseal LMA along with N_2O and isoflurane anaesthetic gas mixture[9].Though sore throat at 1 hour postoperatively was not there in our patients but it was present in few patients at 2, 12 and 24 hours but it was not statistically significant between all the groups. It was more in air and oxygen group in comparison to NO group. Bimla Sharma et al the reported incidence of sore throat with the PLMA is 14-23%[35,36,] and it was comparable between two groups. There was no significant difference in our patient in 1hr 2hr 12hr and 24 hour in incidence of postoperative dysphagia in our study. In contrast to our study, Ranjana Khetarpal et al reported a significant difference in dysphagia. There was no significant

difference in the incidence of dysphonia with none of our patients reporting the same at 1hr 2hr 12hr and 24hour postoperatively. Therefore, changes in cuff pressure were clinically related to a mild increase in the postoperative sore throat with no statistically significant increase in group Air. Though some patients in group ON and O_2 also reported sore throat. So, we can say that cuff pressure is not directly related to the incidence of sore throat.

CONCLUSION

We conclude that postoperative pharyngolaryngeal morbidity was not present significantly in our study in any of the groups and intracuff volume and pressure was not directly related to it. Combination of N_2O and O_2 resulted in decreased intracuff pressure and air lead to a slight increase with O_2 providing relatively stable cuff pressures.

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Conflict of Interest: None

Source of Funding: None

Ethical Approval: Approved

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