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A COMPARATIVE STUDY OF THE AIR-Q BLOCKER INTUBATING LARYNGEAL AIRWAY WITH THE PROSEAL LARYNGEAL MASK AIRWAY FOR OROPHARYNGEAL SEAL PRESSURE, EASE OF INSERTION AND HEMODYNAMIC VARIATIONS IN ELECTIVE PATIENTS UNDERGOING SURGERY IN GENERAL ANESTHESIA

Anaesthesiology

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ABSTRACT

Background: Airway management is the cornerstone of safe anesthetic practice. In recent anesthesia practice, supraglottic airway devices (SAD) play a major role in airway management. Proseal laryngeal mask airway (PLMA) is an established reusable second generation SAD, while Air-Q Blocker (AQB) is a relatively new supraglottic device, easy to insert because of its pre-shaped curve. The aim of this study is to compare AQB against PLMA in patients undergoing elective surgery under general anesthesia. **Materials and Methods:** Total One Hundred Ten patients (55 in each group) belonging to American Society of Anaesthesiologists ASA physical status I – II in the age group of 18 – 60 years of either sex posted for elective surgery under general anesthesia were recruited in the study. PLMA was inserted in Group A (n = 55) and AQB was inserted in Group B (n = 55) to secure the airway. The primary objective was oropharyngeal seal pressure. Secondarily, we sought to compare overall time of insertion, ease of insertion, hemodynamic variations and perioperative pharyngolaryngeal complications between the devices. **Results :** The Oropharyngeal seal pressures for AQB was lower (28.83 ± 2.77 cm of H2O) as compared to PLMA (32.84 ± 2.54 cm H2O) which was statistically significant ($p<0.001$). Insertion time was longer with PLMA than AQB (21.15 ± 1.66 and 19.28 ± 2.04 seconds, respectively ($p < 0.001$). Ease of insertion was better with AQB while success of insertion was better with PLMA. Failure of device insertion was seen in 2 cases of Group B, requiring replacement with endotracheal tube insertion. Ventilation was successful in all 55 patients with PLMA. Hemodynamic variations were comparable at all pre- and intra-operative intervals. Both the devices were comparable in terms of pharyngolaryngeal complications and airway trauma. **Conclusions:** The newer supraglottic device AQB is easy to insert and has an acceptable oropharyngeal sealing pressure, hence can be used for controlled ventilation for elective surgeries under general anesthesia.

KEYWORDS

Air-Q Blocker (AQB), Proseal laryngeal mask airway (PLMA), Oropharyngeal seal/ leak pressure (OLP), Elective surgery.

INTRODUCTION

Airway management is the cornerstone of safe anaesthetic practice. In recent anaesthesia practice supraglottic airway devices (SAD) play a major role in airway management. With the continuous evolution of SADs newer devices have been designed, which have improved safety and efficacy and have revolutionized airway management. Classic laryngeal mask airway (LMA) is an introductory type of SAD which was invented by Dr. Archie Brain in 1983 and has been used for many years. Supraglottic devices have number of advantages over endotracheal tube (ETT), as they do not require the use of laryngoscope for insertion, are less invasive, better tolerated with increased ease of placement and result in less hemodynamic variations and airway manipulation. Use of SADs in management of either anticipated or unanticipated difficult airway is highly recommended. It is also important to note that SADs are intermediate between a facemask and an endotracheal tube and they also act as an essential airway device to provide emergency airway and ventilation when routine mask ventilation and attempts to intubate fails. They provide hands free airway and easier placement even by the inexperienced personnel along with a relatively secured airway[1].

Chronologically, SADs have been classified into first and second generation. The second-generation supraglottic airway devices includes devices like Proseal Laryngeal Mask Airway (PLMA), I-gel, Air-Q blocker etc. all of which promise to overcome the limitations of endotracheal tube airway management[2]. These devices form a more effective seal than the classical/first generation laryngeal mask airway (LMA) and has a drainage tube that facilitates passage of a gastric tube. They provide protection against regurgitation, and prevents gastric insufflation at ideal placement conditions.

Of these, Air-Q® Blocker Intubating Laryngeal Airway (ILA™, Cookgas® LLC, Mercury Medical, Clearwater, FL, USA) which was introduced by Dr. Daniel J Cook in 2004 can be used either as an SAD or as a conduit for endotracheal intubation during general anaesthesia[3]. Its design includes a pre-curved shorter and wider airway tube, a removable 15mm circuit adapter with the integrated bite block which makes its insertion easier. Further the device has specifically integrated channel for placement of an orogastric tube (OGT) to suction, vent and to block the upper oesophagus. The keyhole-shaped airway outlet without grill and elevation ramp directs the endotracheal tube in the midline and towards the laryngeal inlet[12,13].

The other device is Proseal LMA (PLMA; Teleflex Medical Europe Ltd., Co Westmeath, Ireland), it is an established reusable second-generation SAD with a high oropharyngeal leak pressure (OLP). It was introduced by Dr. Archie Brain in 2000 and since has been in wide use for airway management under general anaesthesia with controlled as well as spontaneous ventilation. Proseal-LMA is double-lumen, double-cuff LMA. The double tube design separates the respiratory and the alimentary tract providing a separate passage for regurgitated fluids. Furthermore, the double cuff provides a better seal around the glottis and enables it to withstand a leak pressure of approximately 35 cm H_2O as against 25 cm offered by LMA classic. These properties increase the suitability to use Proseal LMA in patients who are more prone to aspiration of regurgitated fluids. With use of techniques such as using reusable metallic introducer or gum elastic bougie-guided insertion, correct positioning is almost guaranteed.

MATERIAL AND METHODS

Patients undergoing elective surgeries were randomly assigned to either of groups, Group A: was managed using Proseal LMA, while Group B was managed using Air-Q blocker.

During pre-anaesthetic visit, a detailed pre-anaesthetic examination including history, general examination, systemic examination was done. Airway assessment was done. Informed and written consent was obtained from each patient after the procedures were fully explained to patients in their own language. Age, sex, weight, height, BMI, ASA physical status, Diagnosis & Procedure were noted in all patients.

On arrival to the operation theatre, intravenous access was established using an 18-gauge i.v. cannula and a 10 ml/kg of intravenous Ringer Lactate was initiated, multipara monitor was attached and baseline parameters were recorded. All patients were pre medicated with Inj. Glycopyrrolate 0.2 mg and Inj. Midazolam 0.02 mg/kg intravenously,

10 minutes before induction.

Standard anaesthesia plan for induction and maintenance was followed. Preoxygenation was done for 3 minutes through facemask and closed circuit with 0_2 flow 6 litres/min using the anaesthesia work station. Induction of general anaesthesia was done in supine position with fentanyl (2 µg/kg) and propofol (2-2.5 mg/kg) intravenously till the loss of verbal contact with the patient. Neuromuscular blockade was achieved with succinylcholine 1.5 mg/kg intravenously. The device was inserted after adequate jaw relaxation and fixed after confirmation of proper placement. The size of the airway device was chosen according to the manufacturer's instructions depending upon the weight of the patient.

All SADs were tested for leaks and lubricated on back surface of cuff before insertion. After adequate preparation, Air-Q blocker was inserted as per the manufacturer and literature recommendation. The Proseal LMA was inserted using the metallic introducer. The cuff of Air-Q intubating laryngeal airway was inflated with 15-20 cc of air and that of Proseal LMA with 25-30 cc of air according to the size to an intra-cuff pressure of maximum 60 cm H_2O. Correct placement was confirmed by absence of audible air leak with bilateral rise of the chest wall on auscultation and square wave capnography.

Ease of device insertion for both devices was assessed during the first attempt. Ease of device insertion was graded using a 3 point scoring system (1= No resistance to insert, 2= Resistance to insertion and 3= Difficult to insert).

The number of attempts taken to insert the device was recorded. Failure of device insertion was defined by any of the following criteria : 2 unsuccessful attempts or massive air leak, ineffective ventilation. In the event of failure to establish an effective airway even after 2 attempts, the device was removed and airway was secured with appropriate size endotracheal tube and the case was excluded from the study.

After SAD placement, an OGT was passed through the drain tube of both the devices with maximum two attempts, and aspiration of gastric contents or epigastric auscultation was done to confirm the correct placement of OGT. Ease of OGT insertion was graded as Easy/ Difficult to insert/ Impossible to insert.

After positioning and fixing the SAD, lungs were ventilated with volume control mode of ventilation and after 5 minutes of established airway, OLP was determined by transiently stopping the ventilation and closing the adjustable pressure limiting valve upto 30 cm H2O and a fixed fresh gas flow of 3 litres/min. The OLP was the pressure in the circuit when the pressure manometer dial reached its stability or when there was audible air leak from the throat noted.

Haemodynamic variables such as heart rate, systolic blood pressure, diastolic blood pressure, SpO2 and EtCO2 were monitored at different intervals throughout the procedure.

At the completion of surgery and after returning of spontaneous respiration, reversal agent was given and after fulfilling the criteria for extubation , device was deflated, removed and checked for the presence of blood stain or any secretion. Post-operatively, the anaesthesiologist blinded to the allocation group assessed the patient for sore throat, dysphagia, dysphonia, nausea/vomiting and hoarseness at 30 minutes, 1 hour and 24 hours thereafter. Device was checked for any blood stain to assess any trauma during insertion.

All data was collected and summarized in excel chart and subjected to statistical analysis. The data was expressed as mean and standard deviation (SD) or median, range and percentage as appropriate. All categorical data was compared by using chi square test. Continuous variables in two groups will be compared by t- test. The p-value <0.05 will be considered as significant. The statistical analysis was done using SPSS 21.0 version (Chicago, Inc., USA) windows software.

RESULTS

In Group A, majority of the patients were aged between 31 & 50 years (65.4%), followed by 21-30 years (23.6%), while the remaining were aged 51 to 60 years (10.9%). On the other hand, in Group B majority of the patients were aged between 31 & 50 years (52.7%), followed by 21-30 years (25.5%), 51-60 years (18.2%) and ≤20 years (3.6%). On comparing statistically, no significant difference was observed between the two groups with respect to age.

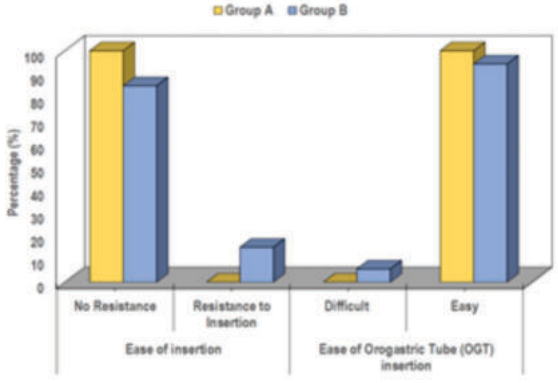
In both the groups, majority of the patients were Female (Group A: 80.0%; Group B: 81.8%). On comparing statistically, gender distribution between both the groups was similar.

With respect to Number of Insertion Attempts, single attempt was required in a majority of patients in both the groups (Group A: 94.5%; Group B: 89.1%). Two attempts were required only in 3 patients (5.5%) in group A and in 4 patients (7.3%) in Group B, while in the remaining 2 patients (3.6%) in Group B SAD (Air-Q Blocker) insertion failed.

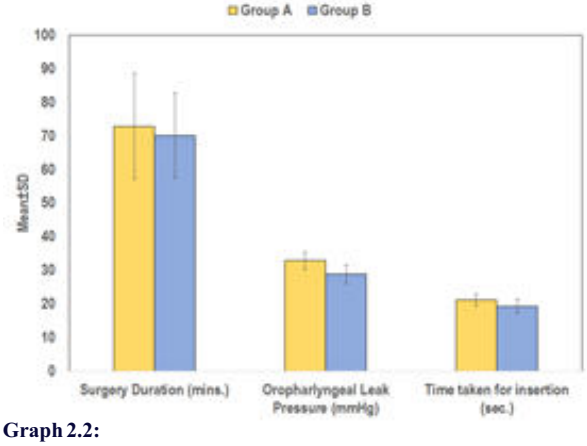
As per the study protocol, the 2 patients in whom device failure occurred, were excluded from further study.

Table 2: Intergroup Comparison Of Pre-operative Findings

SN		Group A (n=55)		Group B (n=53)		Chi-sq. Test	
		No	%	No	%		
1	Ease of insertion						
	No Resistance	55	100.0	45	84.9	$\chi2$= 8.966; p= 0.003	
	Resistance to insertion	0	0.0	8	15.1		
2	Ease of Orogastric Tube (OGT) insertion						
	Easy	55	100.0	50	90.9	$\chi2$= 3.202 p= 0.074	
	Difficult	0	0.0	3	5.5		
		Mean	SD	Mean	SD	Student's t-test	'p'
3	Oropharlyngeal Seal/ Leak Pressure (cm H_2O)	32.84	2.54	28.83	2.77	7.830	<0.001
4	Time taken for insertion (sec.)	21.15	1.66	19.28	2.04	5.210	<0.001



Graph 2.1:



Graph 2.2:

With respect to Ease of Insertion, all the cases in Group A (100.0%) had 'No resistance to insertion'. On the other hand, in Group B majority of the cases had 'No resistance to insertion' (84.9%) while the remaining

had 'Resistance to insertion' (15.1%). Statistically, this difference was significant. Passage of orogastric tube (OGT) was easy in majority of patients in both the groups (Group A: 100.0% *vs.* Group B: 94.3%) and only 3 cases in Group B (5.7%) had difficult passage. On comparing statistically, both the groups were comparable with respect to passage of orogastric tube (OGT). Though Duration of surgery was shorter in Group B as compared to Group A (70.09±12.68 *vs.* 72.91±15.63 minutes), statistically this difference was not significant. Group B as compared to Group A had lower Oropharyngeal leak pressure (28.83±2.77 *vs*. 32.84±2.54 mmHg) and Time for Insertion (19.28±2.04 *vs.* 21.15±1.66 seconds), on comparing statistically OLP and Time for Insertion were both significantly different between the two groups. Hemodynamic parameters were comparable at all pre- & intra- operative observation intervals.

DISCUSSION

In the present study, the age of population ranged between 18 and 60 years, the mean age of patients in Group A was 37.93±9.06 years and in Group B was 39.64±11.82 years. In a study by Gupta *et al.*[15] comparing Proseal LMA and Air Q-Blocker among 88 patients (44 patients in each group) also reported similar findings, the age of patients managed with Air Q-Blocker was higher as compared to those who were managed by Proseal LMA (41.89±11.59 *vs*. 38.07±9.95 years respectively), but were statistically comparable. In another study by Moorthy *et al.* also reported age of the study population to be comparable between patients managed by Air Q-Blocker and Proseal LMA (39.4±12.27 *vs.* 37.45±12.72 years respectively).

In the present study, though an overall female preponderance was observed, with 80.91% of the population being female, which resulted in a majority of population in both the groups being females (Group A: 80.0%; Group B: 81.8%), statistically, gender was comparable between the two groups.

In the present study, device was successfully inserted in 1st attempt in a majority of patients in both the groups (Group A: 94.5%; Group B: 89.1%). 2nd insertion attempt was only needed in 3 patients (5.5%) in Proseal LMA group, as compared to 4 patients (7.3%) in Air Q-Blocker group. Moreover, in 2 patients (3.6%) in Air Q-Blocker group, device insertion was not successful even at 2nd attempt and were considered as 'Device Failure'. In these 2 patients the device was replaced with endotracheal intubation.

Similar findings were reported in a study conducted by Galgon *et al.* (2012) also reported a similar trend in their study, while the proportion of patients with successful device insertion in 1st attempt was higher in Proseal LMA group as compared to AQB group (98% *vs.* 88% respectively), followed by patients with successful insertion in 2nd attempt (0% *vs.* 12%) and patients with insertion in 3rd attempt (2% *vs.* 0%), statistically the groups were comparable with respect to insertion attempts. In another study comparing AQB and Proseal LMA from North Indian city of Chandigarh, Jindal *et al.* (2021)[14] also reported findings similar to the present study, where 95.5% of the patients managed with Proseal LMA had a successful insertion in 1st attempt as compared to 90.7% of patients managed with AQB.

Nevertheless, in a study conducted by Gupta *et al.* (2019)[15], they reported successful insertion in 1st attempt in 77.27% in AQB group and 93.18% in Proseal LMA, followed by 13.64% and 6.82% patients in AQB and Proseal LMA group respectively required 2nd attempt. In their study too, similar to the present study 2 patients (4.55%) in AQB group, required >2 attempts. In another study by Youssef *et al.* successful insertion of the device in 1st attempt was 90.0% in patients managed by Air Q-Blocker and 83.3% of patients in Proseal LMA, yet they too found the devices to be similar in terms of attempts required for successful insertion.

Though, number of attempts for successful insertion time in most of the contemporary studies was similar to the present study, there seems to be some variations in the proportion of patients with respect to insertion attempts required for successful insertion, which can be contributed to various factors ranging from clinical protocols and operators' practice with either of the devices to patients' condition and analgesia or anaesthesia agent used. For bye, the devices can be said to require similar insertion attempts.

In the present study the insertion time required for a successful insertion was significantly lower in Air Q-Blocker as compared to Proseal LMA (19.28±2.04 *vs.* 21.15±1.66 seconds respectively). Galgon *et al.*[16] also reported a significantly lesser time required for insertion of AQB as compared to Proseal LMA (20±14 *vs.* 28±11 seconds, respectively). Jindal *et al.*[14] also reported a similar finding to the present study, they reported that insertion time was lower in AQB as compared to Proseal LMA (16.4±3.4 *vs*. 18.1±3.3 seconds, respectively). Youssef *et al.* (2014) also reported a significantly lesser time was required for insertion of AQB as compared to Proseal LMA (18.37±3.77 vs. 23.43±3.54 seconds). Gupta *et al*. reported contradictory findings to the present study, they reported that PLMA required significantly lesser time for insertion as compared to AQB (18.66±3.14 vs. 25.59±5.71 seconds).

In the present study, OLP was significantly higher in Proseal LMA as compared to AQB (32.84±2.54 *vs.* 28.83±2.77 mmHg respectively). This finding of the present study is also supported by various contemporary studies. Youssef *et al.*[17] reported that the airway seal pressure in Proseal LMA group was be higher as compared to AQB (23.3±3.86 *vs.* 22.4±1.27 cmH_2O respectively).

Though, Gupta *et al.*[18.] reported contradicting findings to the present study, they measured OLP in their study which was significantly lower in PLMA as compared to AQB (29.41±2.14 *vs.* 31.5±2.41 cmH_2O). Galgon *et al.*[16.] also reported contradictory findings from the present study, the OLP in AQB was only marginally higher in AQB group as compared to PLMA and were comparable between the groups.

In the present study, hemodynamic parameters were comparable at all pre- & intra- operative observation intervals, which is also similar to most of the contemporary literature. One of the main reasons for this is the fact that though airway management is an essential part of the surgery, the supraglottic airway devices are relatively better tolerated by the patients and result in lesser hemodynamic variations.

Though the findings of the present study with respect to the airway parameters are very similar to most of the contemporary studies, some contradictions and variations are a result of difference in sample size and different surgeries that have been included in each surgery. However, from a clinical perspective, the findings do not translate into better efficacy of either of the devices when compared heads-on, while AQB might not be as easy to insert and require more number of attempts for insertion, AQB makes up for these limitations in terms of insertion time, as it requires lesser time for insertion compared to Proseal LMA. For bye, the time of insertion which has been reported to be significantly lower in AQB statistically, it too does not translates into any significantly different clinical efficacy of the device, as this difference in insertion time is almost similar and equal clinically.

CONCLUSION

Present study highlights that Proseal LMA and AQB are both comparable in their clinical efficacy, one of the most important factors influencing the preferred use of either of the device can be either attributed to the choice of anaesthesiologist or availability of the device in the given region. Another reason that can also be considered while choosing between either of the devices is the cost of the device itself. It is recommended that further cohort studies should be planned with a larger sample size and taking into consideration various types of surgeries to further enhance and support the findings of the present study, or to be able to predict superiority of either device.

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