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Original Article

Comparison of Blockbuster LMA with Air Q LMA for Success of Blind Tracheal Intubation in Patients Undergoing General Anesthesia

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ABSTRACT

Background: Blockbuster Laryngeal mask airway (LMA) is a device gaining popularity in airway management, and advantageous in ventilation and intubation. Air Q LMA is a supraglottic airway device with a shorter and wider breathing tube designed for ventilation as well as intubation in difficult airway. We aimed to evaluate the success of tracheal intubation using these devices.

Methods: Overall 80 participants aged 18-60 years with ASA I and II were randomized into Group A (Air Q LMA) and Group B (Blockbuster LMA) using computer generated random numbers. The objectives of our study were to evaluate first pass successful intubation, ease, time and attempts taken for device insertion, oropharyngeal leak pressure, time for LMA removal and post operative complications. Association between variables were assessed with chi square test and unpaired t test.

Result: There was a statistically significant difference in the first pass successful intubation between the groups which was higher in Group B (90%) than Group A (60%) ($P<0.001$), the overall successful intubation was more in Group B 97.5% compared to Group A 85%. The device insertion was easy in 85% patients in Group A and 95% patients in Group B. The time taken for introduction of Air Q was longer (38.15±4.92 sec) when compared with blockbuster LMA (26.25±4.44 sec), ($P<0.001$). Mean Oropharyngeal leak pressure of blockbuster LMA (32.40±3.99cmH_2O) was greater than Air Q LMA (29.10±2.61 cmH_2O), ($P<0.001$).

Conclusion: Blockbuster LMA provides greater success of blind tracheal intubation when compared to air Q LMA.

Keywords: Blockbuster LMA, AIR Q LMA, general anesthesia, oropharyngeal leak pressure

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INTRODUCTION

Supraglottic airway devices (SAD) have become the first choice of airway management in various types of surgeries. Laryngeal mask airways (LMA) play a significant role in managing difficult airways as recommended by AIDAA difficult airway guidelines and are preferred devices for elective and emergency airway management.[1] Blockbuster LMA (Tuoren medical instrument co ltd, Chang yuan city, China) introduced in 2012 by Professor Ming Tian, is designed to provide high airway seal pressures and increased green channel for intubation.[2] Air Q LMA (Cook gas LLC, Mercury Medical, Clearwater, FL, USA) introduced by Daniel Cook in 2005 is a supraglottic airway device with shorter and wider breathing tube designed for ventilation as well as intubation in anticipated as well as unanticipated difficult airway.[3] The design of both these LMAs provide an unobstructed pathway for passage of endotracheal tube by providing favorable alignment with the glottic inlet.

As many newer gadgets get invented, it is obligatory to estimate their performance and safety in relation to existing devices. Many authors have studied regarding the utility of blockbuster LMA and Air Q LMA separately.[4,5] However there is a paucity in the literature in regards to comparing the above devices in regards to success of endotracheal intubation. Hence the purpose of conducting this study was to know the efficacy of blockbuster and air Q LMA for successful first pass tracheal intubation, ease, time and attempts taken for LMA insertion, postoperative complications. Because of the shorter, preformed curvature of blockbuster LMA and availability of a designated endotracheal tube[6]; oropharyngeal leak pressure and LMA

removal time along with we hypothesized that blockbuster LMA would achieve a higher successful blind tracheal intubation.

METHODS

Ethical clearance for the study was obtained from the Institute's Ethics board (SNMC/IECHSR/2018-19/A-33/1.2) on human subject research of S. Nijalingappa Medical College and HSK hospital and Research Centre Bagalkot Karnataka (Chairperson- Dr.S.L. Hoti Scientist-Director grade scientist ICMR-NITN, Belgaum) on 13th February 2020. Before participating in the study, all participants provided written informed consent for their inclusion. The study adhered to the guidelines set forth in the Declaration of Helsinki.

Patients of American Society of Anesthesiologists (ASA) I and II of age group 20 to 60 years and modified Mallampati classification (MPC) of I, II, III, scheduled to undergo surgeries under general anesthesia from November 2019 to June 2021 were enrolled in the study. Patients who refused to participate and those with MPC IV, mouth opening <2cm, restricted neck movements, BMI≥30, pregnant woman, URTI, anticipated difficult airway patients and patients with risk of regurgitation were ruled out from the study.

Overall, 80 patients were equally divided into Group A (Air Q LMA) and Group B (Blockbuster LMA), based on computer generated random number tables. Device assigned was revealed to the anesthesiologist before the induction. We used reusable Blockbuster LMA and disposable Air Q LMA in respective groups. Parker flexi tip endotracheal tube was used for intubation in both the groups. The groups were different in terms of LMAs used for the conduit of intubation. An anesthesiologist with experience of 25 successful insertions and intubations with both the devices, performed the blind tracheal intubation in both the groups. Figure 1

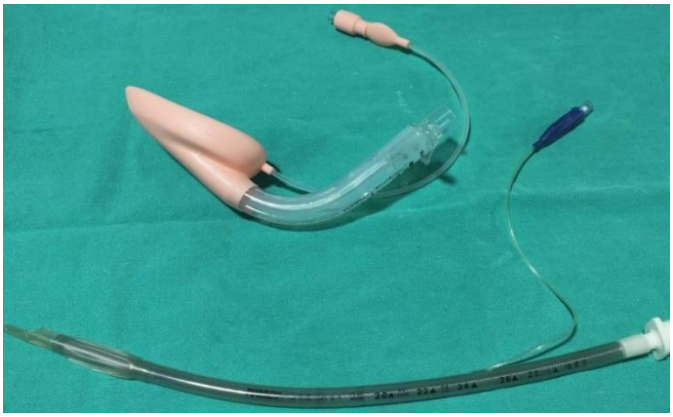

Figure 1. Blockbuster LMA and Parker flexi tip tube

Nil by mouth (NBM) 6 hours was ensured. A 20G intravenous cannula was secured and 10ml/kg of crystalloids was infused once the patient was shifted to the theatre. Standard multichannel monitoring such as non-invasive blood pressure (NIBP), electrocardiography (ECG) and pulse oximetry (SPO_2), end-tidal carbon dioxide ($ETCO_2$) was attached, and baseline parameters were noted. Premedication in the form of ondansetron 4 mg, glycopyrrolate 0.2 mg, midazolam 0.02 $mgkg^{-1}$ fentanyl 2 $mcgkg^{-1}$ was administered.

Designated LMA size for insertion was chosen based on body weight as per manufacturer's recommendations. In group B Blockbuster LMA size 3 was inserted for 30-50kg patients and size 4 for 50-70 kg patients. Similarly for group A Air Q LMA size 2.5 was chosen for 30-50kg patients and size 3.5 was taken for 50-70 kg patients. Preoxygenation for three minutes with 100% O_2 and a fresh gas flow 8 $Lmin^{-1}$was performed. Induction was done using Propofol 2 $mgkg^{-1}$ and ability of mask ventilation noted. Vecuronium 0.1 $mgkg^{-1}$ was administered and intermittent positive pressure ventilation (IPPV) continued for 3minutes following which either of the device was inserted in sniffing position by applying gentle pressure sliding down the palate till resistance encountered. Once inserted adequacy of ventilation was noted. The insertion attempt was considered successful when IPPV produced bilateral equal air entry and end tidal carbon dioxide waveforms ($ETCO_2$). The total attempts required for successful LMA introduction were noted and restricted to three. Time required for the same was calculated from the interval when the device passed through the mouth till ventilation achieved with $ETCO_2$ waveform. The ease of LMA insertion was evaluated with a scale of 1-4 [1-no resistance, 2-mild resistance, 3-moderate resistance,4-inability to place the device]. LMA cuff was then inflated up to an inflation pressure of 60 cmH_2O using a pressure manometer. The devices were then connected to the breathing circuit and IPPV was carried out using O_2 and sevoflurane admixture for an end-tidal expiratory agent concentration of 2.5%. Adequacy of ventilation was assessed using bilateral equal air entry and IPPV to achieve the tidal volume of more than 5 ml/kg, square wave capnograph. Oropharyngeal sealing pressure was measured in apnea with an expiratory valve closed up to 30 cm H_2O and fresh gas flow of 3$Lmin^{-1}$ until stability was seen on the pressure gauge.

Then intubation was then carried out. We used a Parker flexi tip endotracheal tube for blind tracheal intubation through both the devices because it has a soft, flexible, curved tip and a posterior facing bevel which aids it to glide along irregular surfaces and least resistant areas thus accelerating the intubation process thereby causing less airway trauma. Moreover, several studies have proven that there is a higher incidence of successful blind intubation through Air Q LMA in the presence of a parker flexi tip tube.[7]

Time for successful tracheal intubation through LMA was calculated from the insertion of the tube through the green channel till ventilation was achieved with $ETCO_2$. Intubation was considered a success when ventilation produced a capnography waveform. Total attempts needed for successful intubation were recorded. If intubation was not successful in the first attempt endotracheal tube was withdrawn and a second attempt was made with external laryngeal manipulation or jaw thrust in both groups. The total number of attempts required for intubation was limited to 2. If Intubation was unsuccessful in spite of 2 attempts, a 3rd attempt of intubation was followed using a conventional laryngoscope. After successful intubation, LMA was deflated and gradually removed using a stabilizing rod, and the time required for the same was noted. Intubation was considered a failure when we could not intubate after 2 attempts or if the tube got dislodged while removing LMA. Time for LMA removal was taken from disconnecting the breathing circuit till the $ETCO_2$ reading was noticed. After removal, devices were looked over for blood staining to exclude airway injury. Hemodynamic parameters-pulse rate, mean arterial pressure and oxygen saturation was monitored throughout the anesthetic procedure. Adverse events

like nausea, vomiting, sore throat, and hoarseness of voice were noted.

Sample size calculation was done employing open epi software version 2.3.1. According to the study conducted by and Yunluo et al and Siamdoust et al[8] the Success rate of air Q intubation was 63% and the success rate of blockbuster intubation was 90.5%. Considering the incidence of successful intubation as the prime objective at a 95% confidence level and 80% power of study sample size was calculated to be 40 in each group.

The statistical analysis was conducted using IBM SPSS version 22. The Kolmogorov–Smirnov test was utilized to assess whether the datasets deviated from a normal distribution. The Chi-Square Test was employed to estimate the association between variables. Quantitative data was presented as mean ± standard deviation. An unpaired t-test was performed to compare variables. A significance level of $p<0.05$ was considered statistically significant.

RESULT

We evaluated 80 patients to determine their eligibility for the study. Out of these 80 participants, all of them successfully completed the study and were included in the analysis. Their demographic characteristics were comparable as shown in Table 1.

Table 1. Demographic characteristics of all patients

	Group A	Group B	*P*-value
Age(years)(mean ±SD)	32.90± 8.51	33.73± 9.44	0.683
Weight (kg)(mean ±SD)	55.50± 9.98	52.28± 7.49	0.106
Height (cm)(mean ±SD)	160.78± 5.91	161.65 ±9.56	0.624
BMI(kgm^{-2})(mean ±SD)	21.53 ±4.02	20.16± 3.33	0.100
Gender			
Male	22	23	0.915
Female	18	17	0.906
ASA			
I	25	22	0.753
II	15	18	0.719
MPC			
I	8	10	0.756
II	25	20	0.594
III	7	10	0.632

ASA: American Society of Anaesthesiologists; MPC-Mallampati Classification.

With the exception of 6 patients in group A who required a second attempt due to having a large tongue volume, both devices were successfully inserted in all the patients. Both Air Q and blockbuster LMA were easily inserted in all participants (Table 2). A statistically significant difference was noted between the time required for LMA insertion in both groups. Air Q took a relatively longer time that is (38.15±4.92 sec) than blockbuster LMA (26.25±4.44 sec) ($p<0.001$). The oropharyngeal sealing pressure was 29.10±2.61cm of H_2O in Group A and 32.40±3.99 cm of H_2O in Group B ($p<0.0001$) as depicted in Figure 2.

The first-pass intubation success was higher in Group B 90% (37/40) when compared to Group A 60% (24/40) $P<0.001$(Figure 3). Intubation success in second attempt was 25% (10/40) in Group A and 7.5% (3/40) in Group B. However, in 6 patients of Group A and 1 patient in Group B blind intubation could not be performed and hence laryngoscope intubation was performed. However, a statistically significant difference in the overall success rate of intubation between the groups i.e., 85% in Group A and 100% in Group B $p<0.001$ was observed.

Table 2. Characteristics of LMA insertion and tracheal intubation

Variables	Group A	Group B	*P* value
Time for LMA insertion(sec)	38.15±4.92	26.25±4.44	<0.001
Ease of LMA insertion (Grade1)	34(85%)	38(95%)	0.136
Oropharyngeal sealing pressure(cmH_2O)	29.10±2.61	32.40±3.99	<0.001
Time for intubation(sec)	26.85±2.39	29.15±2.79	0.001
First pass successful intubation (%)	24/40(60%)	36/40(90%)	<0.001
Second successful intubation (%)	10/40(25%)	3/40(7.5%)	<0.01
Overall success (%)	34/40(85%)	39/40(97.5%)	<0.001
Time for LMA removal(sec)	22.05±3.34	20.80±3.23	0.093

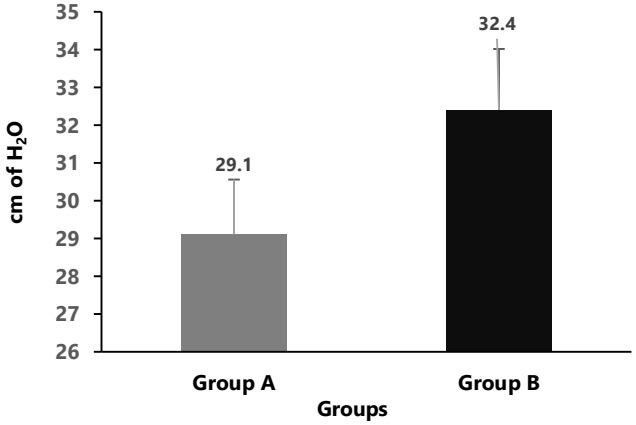

Figure 2. Showing a comparison of Oropharyngeal leak pressure between Group A and Group B

LMA removal time was significantly less in Group B 20.8±3.23sec than in Group A 22.05±3. 34sec, $P<0.001$. Six patients of Group A developed complications like sore throat (3/40); hoarseness of voice (2/40) and 1 patient has blood staining on the device. However, in Group B only 3 patients developed only hoarseness of voice and 2 patients developed sore threat (Table 3).

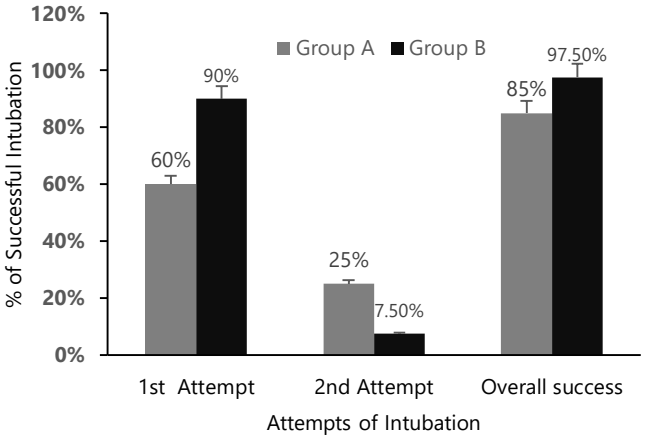

Figure 3. Successful intubation of Group A and Group B

Table 3. Comparison of complications between the groups

Complications	Group A	Group B	*P* Value
Sore throat (%)	7.5% (3/40)	5% (2/40)	0.775
Hoarseness (%)	5% (2/40)	7.5% (3/40)	0.775
Blood staining	2.5% (1/40)	0	0.528
Total	15% (6/40)	12.5% (5/40)	0.845

DISCUSSION

LMAs play a significant part in airway management as they don't require extensive skill or training in their utility. Intubation with the use of a conventional laryngoscope triggers the adverse hemodynamic stress response, which may prove deleterious in cardiac-compromised patients hence the utility of LMA as a conduit of blind endotracheal intubation is gaining popularity. Our study compared two such devices blockbuster LMA and Air Q LMA for blind intubation.

Yunlo et al conducted a study comparing blockbuster LMA with proseal LMA for blind tracheal intubation and they obtained a higher overall successful intubation with blockbuster LMA (90%) which corresponds to our first pass successful intubation however our total incidence of successful intubation was much higher (97.5%) than Yunlo et al probably because of the different age group of participants considered for the study they included elderly individuals while we included adult patients. Our oropharyngeal sealing pressure of blockbuster LMA was homogenous with the above study. They also found that blockbuster LMA had fewer complications alike us.

Sayed et al[8] studied the success of intubation between Air Q LMA and Fastrack LMA and inferred that the device insertion and intubation took longer in Air Q LMA consistent with our study. They stated that successful intubation through Air Q LMA was 95.5% in contrast to our results; we however could not obtain such high intubation success with Air Q LMA probably because of the need for adequate learning experience for its use.

The study by Endigeri et.al[9] also investigated blockbuster LMA and Fastrack LMA and found the first pass successful intubation with blockbuster LMA was 90% and the overall success rate was 96.6% which was in correspondence with our study. The oropharyngeal pressure of Blockbuster was found to be 33.7±1.8 cm H_2O again similar to our sealing pressure. Singh[10] also found that tracheal intubation was higher in Blockbuster which was indistinguishable from our study. Gao et al[11] conducted a study comparing blockbuster LMA and supreme LMA and inferred that the blockbuster LMA was easily inserted and had oropharyngeal sealing pressure of 30±4.2 cmH_2O almost identical to our study.

The reasoning for greater first pass successful intubation through blockbuster LMA can be credited to, the short airway channel that is better lined up with the pharynx, the specifically designed Parker flex tube that makes its way to the less resistant areas thereby overcoming the impingement on the anterior tracheal wall and lastly, the 30° angle of emergence of the tube while exiting LMA enhances the success of intubation.

Gupta R et al[12] studied Air Q and extrapolated that Air Q insertion requires a longer time similar to what we encountered. This could be attributed to the hyper-curved airway tube that makes it more flexible thus affecting the ease of placement. Our oropharyngeal sealing pressure of Air Q was similar to the sealing pressure of Air Q LMA obtained by Damodaran et al.[13] Jindal et al[14].In the study conducted by Attarde et al[15] utilizing air Q LMA as an intubation conduit, the first pass successful intubation was approximately 58% which is in correspondence to our study. However, Malhotra et al [16] studied the success of tracheal intubation through Air-Q using PVC tracheal tube and reinforced tube and they found that the success rate after 3 attempts was more with Air-Q (96.6%) than ILMA (91.6%). We differ from Malhotra et al as we did not achieve such high incidence of intubation with air Q (85%) this difference could be mostly because of operator factors and different types of tracheal tubes used. The explanation for such a low success rate of blind tracheal intubation using Air Q is probably because of its poor structural design, lack of a designated endotracheal tube, and the need for a very long learning curve for improved outcomes.

Although the sample size estimated was sufficient; a higher number of patients may be required to validate the outcome. As blinding could not be done there is a possibility of observer bias. The criteria used to define the ease of device insertion were subjective. A comparison of intubation success was not done in patients with difficult airways. We did not do a fibreoptic glottic opening score in patients whose intubation failed.

CONCLUSION

Blockbuster LMA is easy to insert, provides greater oropharyngeal seal pressure, and has greater success of blind tracheal intubation when compared to air Q LMA.

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CONFLICT OF INTEREST

The author declares there is no conflict of interest.

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