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ENDOTRACHEAL INTUBATION WITH SEMI RIGID CERVICAL COLLAR: COMPARISON OF AIR Q AND BLOCKBUSTER INTUBATING LARYNGEAL MASK AIRWAY

Anaesthesiology

Dr. Dushyant Vaidya	M.D, Anaesthesiologist
Dr. Jinesha Chauhan	M.D, Anaesthesiologist
Dr. Kinna Shah*	M.D, Anaesthesia, Associate Professor, Dr M K Shah medical Collage & Research Institute, Chandkheda, Ahmedabad, Gujarat, India *Corresponding Author

ABSTRACT

Endotracheal intubation with semi rigid cervical collar: Comparison of Air Q and Blockbuster Intubating Laryngeal Mask Airway **Objective:** To compare the Blockbuster LMA with Air-Q laryngeal airway in terms of first-attempt success rate of blind tracheal intubation in patients undergoing elective cervical spine surgery with semi-rigid cervical collar in place under general anaesthesia. **Methods:** 60 patients of either sex, aged between 18 and 65 years, and weight between 40 to 70 kg, ASA physical status I - II, with cervical spine pathology, requiring elective surgical correction with a cervical spine immobilization, were enrolled in the present study : Group B (Blockbuster LMA) and Group A (Air-Q) by sealed envelope technique. The insertion of supraglottic airway device (SAD), ease of SAD insertion [easy, moderate (minimal resistance), difficult (significant resistance) or impossible], time for endotracheal intubation and bronchospasm, failure to insert device; and post-operatively such as sore throat, throat pain, dysphagia and hoarseness (immediately and after 24 hrs.) were compared between the two groups using Fisher's Exact test. **Results:** The SAD insertion first attempt success rate was significantly high in Group B (27/30) than Group A (20/30). There was significant increase in no. of attempts (I/II/III) required for endotracheal tube (ET) insertion in Group A: 20/7/3) compared with Group B: 27/3/0. The first attempt success rate of intubation in Group B was 90% compared to 66.67% in Group A, which was significant. **Conclusion.** BlockBuster LMA provides higher 1st attempt success rates of intubation. It is a viable option for a solitary attempt to intubate the cervical spine.

KEYWORDS

Intubating Laryngeal mask, Blockbuster LMA, Air Q, cervical spine surgery

INTRODUCTION

Surgical correction remains the mainstay treatment for complex cervical spine pathology and requires general anesthesia with endotracheal intubation. Cervical spine immobilization can be done either by manual in-line stabilization (MILS) or by using cervical collar. A semi-rigid cervical collar is usually applied for stabilisation of the cervical spine. [1, 4]

The collar restricts the neck movements, precluding a sniffing position, and decreases mouthopening, [6-10] compounding to poor glottic visualisation [11]leading to difficult intubation.

The use of supraglottic airway devices that allow blind tracheal intubation has been suggested as an alternative method in the Advanced Trauma Life Support (ATLS) textbook, of the American College of Surgeons. [12, 13]

Viewing the larynx and cervical spine movements are not required for ILMA placement and subsequent intubation.[14] It ensures predictable ventilation even between intubating attempts and can be used as conduit for tracheal intubation.[15]

The Intubating Laryngeal Mask Airway is a possible technique for intubation in patients with a semi-rigid [16]/rigid cervical collar.[7]Air-Q, also known as the Intubating Laryngeal Airway™ has short, wide, rigid breathing tube. [17]

A newer LMA, Tuorens BlockBuster® LMA has been gaining popularity to provide increased safety and quality of anaesthesia.[18]

Our aim was to compare the Blockbuster LMA with Air-Q laryngeal airway in terms of first-attempt success rate of blind tracheal intubation in patients undergoing cervical spine surgery with semi-rigid cervical collar in place under general anaesthesia.

OBJECTIVE:

To compare the Blockbuster LMA with Air-Q laryngeal airway in terms of first-attempt success rate of blind tracheal intubation in patients undergoing elective cervical spine surgery with semi-rigid cervical collar in place under general anaesthesia.

MATERIAL AND METHOD

After Institutional ethics committee approval (5844), written informed consent was taken from all the 60 patients of either sex, aged between 18 to 65 years, with cervical spine pathology undergoing elective cervical spine surgery under general anesthesia requiring tracheal intubation for prospective, comparative, randomized, single blinded study. Exclusion criteria included Mallampati scores 3 or 4, morbid obesity, respiratory tract (or pharynx, larynx) pathology, limited mouth opening (interdental gap < 2 cm), risk of regurgitation or aspiration, pregnant patients, reactive airway disease, cardiac disorders, allergic to the drugs used. The patients were randomized into two groups of 30 each based on the supraglottic airway device used for endotracheal intubation: Group B (Blockbuster LMA) and Group A (Air-Q ILA) by sealed envelope technique. Patients in OT, the IV line was established with 18 G cannula in an upper extremity vein and RL was started . An electrocardiograph, pulse oximeter, capnograph and noninvasive blood pressure monitor was applied for continuous recording. The patients were positioned supine with head and neck in a neutral position by applying semi-rigid cervical collar. Envelope was opened just prior to induction. Patients were induced with routine method. Blockbuster Size 3 or 4 with cuffed PVC ETT of size 7 or 7.5mm ID respectively or Reusable Air-Q size 3.5 with cuffed PVC ETT of size 7.0mm ID were used.

Maximum three attempts with same method were made to insert SAD. If ventilation was inadequate in third attempt, the device was removed and direct laryngoscopic intubation was done. A cuffed PVC ETT of adequate size according to the device used was inserted through either of the device after lubrication with a water soluble lubricant until resistance was achieved. Then the cuff of the ETT was inflated and the intubation was confirmed 'successful' by checking for ventilation and monitoring three end tidal CO_2 waveform. If a second attempt was required, ETT was inserted in reverse curvature where the ETT was inserted with its natural curve directed opposite to the curvature of ILMA. If the patient was still unable to intubate after the third attempt, then it was termed as Intubation Failure. Device was removed in such cases and intubation was done by direct laryngoscopy. Both the cuff (LMA and ETT) were deflated and using the stabilizer, the device was removed. The ETT tube cuff was inflated after confirming bilateral air entry by auscultation and ETT fixed accordingly. The semi-rigid collar was removed after fixation of ETT. Parameters for stress response HR, SBP, MAP and DBP were noted at baseline, post-induction, just after the SAD insertion and then 1, 2, 3, 4, 5, 7, 10 and 15 mins post-SAD insertion. Neuromuscular blockade was reversed with Inj. Glycopyrrolate 0.01 mg/kg and Inj. Neostigmine 0.05 mg/kg.

Statistical Analysis:
Statistical analysis was carried out using Microsoft Excel 2013 (for T test), www.socscistatistics.com (for Chi-square test and Z-test for 2 population proportions), and www.danielsoper.com (for Fisher's Exact test). Probability was considered to be significant if p<0.05.

RESULTS:
The demographic profile of both the groups were comparable with no significant difference between them (p>0.05) as shown in Table 1.The medium sized semi-rigid cervical collar fitted in all the patients enrolled in our study. As shown in Table 2, the SAD insertion first attempt success rate was significantly more in Group B (27/30) (90%) than Group A (20/30) (66.67%) with (p-0.02852). The Blockbuster was easy to insert in 27/30 (90%) patients of group B, compared to Air-Q which was easy to insert in 19/30 (63.33%) patients of group A (p-0.0147). The first attempt success rate of intubation in Group B was 90% compared to 66.67% in Group A, which was significant (p-0.02852). Blockbuster ILMA was hemodynamically more stable compared to Air-Q. (Table 2, 3, 4, 5)

Table. 1 Demographic Data

Demographic Data	Group A	Group B	p value
Age (yrs.)	37.13±11.63	37.83±12.58	0.82
Sex (M:F)	17:13	15:15	0.6048
Weight (kg)	60.3±5.24	59.03±5.8	0.38
Thyromental distance (cm)	7.09±0.23	7.08±0.08	0.88
MPG grade (I:II)	14:16	15:15	0.7961
Neck Circumference (cm)	33.83±1.06	33.54±0.84	0.25

The demographic profile of both the groups was comparable as shown in the table above.

Table .2 No. of attempts for successful SAD insertion, SAD insertion time (sec), Ease of SAD insertion, No. of attempts for successful ET intubation, ET intubation time (sec) and complications.

Observations		Group A	Group B	p value
No. of attempts for successful SAD insertion	1st attempt	20/30 (66.67%)	27/30 (90%)	0.02852 *
	2nd attempt	7/30 (23.33%)	3/30 (10%)	0.1645
	3rd attempt	3/30 (10%)	0/30 (0%)	0.0751
	Overall attempts (I/II/III)	20/7/3	27/3/0	0.0486*
SAD insertion time (sec)		32.67±6.22	26.1±5.16	0.00004 *
Ease of SAD insertion	Easy	19/30 (63.33%)	27/30 (90%)	0.0147*
	Moderate	8/30 (26.67%)	3/30 (10%)	0.0949
	Difficult	3/30 (10%)	0/30 (0%)	0.0751
	Overall Ease (Easy/Moderate/Difficult)	19/8/3	27/3/0	0.0378*
No. of attempts for successful ET intubation	1st attempt	20/30 (66.67%)	27/30 (90%)	0.02852 *
	2nd attempt	7/30 (23.33%)	3/30 (10%)	0.1645
	3rd attempt	3/30 (10%)	0/30 (0%)	0.0751
	Overall attempts(I/II/III)	20/7/3	27/3/0	0.0486*
ET intubation time (sec)		16.93±9.10	12.13±3.94	0.01034 *
Complications	Throat Pain	3/30 (10%)	2/30 (6.67%)	0.6384
	Esophageal intubations	5/30 (16.67%)	1/30 (3.33%)	0.0854

*indicates p value<0.05, which is significant. Continuous data are expressed as (Mean ±S.D.)

Table 3. Comparison of Heart Rate at different time intervals

HR decreases from baseline after induction in both the groups and then increases just after SAD insertion, and returns to baseline at 5th min in Group B and 7th min in Group A as shown in Table 3.

Table 4. Comparison of Systolic Blood Pressure at different time intervals

Systolic Blood Pressure	Group A		Group B		p value
	Mean	S.D	Mean	S.D	
Baseline	124.2	10.74	122.6	11.48	0.5795
Post induction	112.53	10.74	111.33	10.44	0.6624#$
Just after SAD insertion	133.4	11.03	121.13	11.66	0.0001*#
1 min	141.4	10.2	130.27	11.82	0.0003*#$
2 min	139	9.75	129.93	8.76	0.0004*#$
3 min	135.53	9.08	126.07	9.09	0.0002*#$
4 min	131.53	8.58	124.53	8.94	0.003*#$
5 min	126.73	8.21	121.53	9.59	0.0279*#
7 min	122.47	7.62	119.87	8.8	0.2263$
10 min	119.87	7.68	116.93	9.54	0.1947#$
15 min	118.6	7.72	116.47	5.93	0.2351#$

*indicates p value<0.05, which is significant. #indicates significant difference in SBP compared to baseline p<0.05 in Group A. $indicates significant difference in SBP compared to baseline p<0.05 in Group B.

Table 5. Comparison of Diastolic Blood Pressure at different time intervals

Diastolic Blood Pressure	Group A		Group B		p value
	Mean	S.D	Mean	S.D	
Baseline	79.33	9	79.6	8.46	0.9063
Post induction	74.4	8.14	75.07	7.46	0.7421#$
Just after SAD insertion	82.93	9.52	78.47	7.29	0.0459*#
1 min	87.47	8.77	83.13	7.27	0.0417*#$
2 min	89.2	8.21	85	7.35	0.0413*#$
3 min	85.87	7.52	82	7.28	0.0476*#$
4 min	85.13	6.82	81.53	7.1	0.0499*#$
5 min	83.73	6.74	79.8	7.8	0.041*#
7 min	79.27	7.8	79.67	6.85	0.8336
10 min	79.47	6.79	79.4	6.83	0.9699
15 min	78.4	6.69	79.33	5.79	0.5656

DBP decreases from baseline after induction in both the groups and then increases just after SAD insertion, and returns to baseline at 5th min in Group B and 7th min in Group A.

Table 6. Comparison of Mean Arterial Pressure at different time intervals

Mean Arterial Pressure	Group A		Group B		p value
	Mean	S.D	Mean	S.D	
Baseline	94.27	9.37	93.93	9.14	0.8895
Post induction	87.1	7.8	87.1	8.14	1#$
Just after SAD insertion	99.7	8.41	92.73	8.38	0.0021*#
1 min	105.47	7.99	98.87	8.4	0.0028*#$
2 min	105.83	7.48	100.03	7.14	0.0032*#$
3 min	102.43	6.92	96.7	7.28	0.0028*#$
4 min	100.57	6.5	95.93	7.23	0.0115*#$
5 min	98.1	6.57	93.73	8.06	0.025*#
7 min	93.63	7.38	93.1	7.04	0.7756
10 min	93	6.6	91.93	7.37	0.5571$
15 min	91.7	6.55	91.7	5.44	1#$

MAP decreases from baseline after induction in both the groups and then increases just after SAD insertion, and returns to baseline at 5th min in Group B and 7th min in Group A.

DISCUSSION
There are two standard methods for immobilization of cervical spine--hard or soft neck collar or MILS (Manual in line stabilization). MILS is recommended for cervical spine immobilization but impairs glottis visualization. [19, 20]

Cervical collar is a major contributing factor to the deterioration in the view obtained at laryngoscopy. Application of cervical collars may reduce mouth opening and limits cervical spine movements making tracheal intubation difficult with a standard laryngoscope. [21] ILMA (Intubating Laryngeal Mask Airway) offers a new approach for ET intubation..

A study reported 92.6% tracheal intubation rate on the first attempt with the use of I-LMA in the operating room in patients with unstable cervical spines that were immobilized with rigid Philadelphia collars.[7] Shavit found that in the presence of manual in-line stabilization of the neck in manikin, novice intubator's had a higher success rate in establishing a definitive airway with the I-LMA than with DL (93.1% vs. 62%). [22]

Intubating laryngeal mask airway (ILMA) insertion took longer time (30 s vs. 22 s), with ILMA was worse in collared patients compared to patients without collar. [7]

Komatsu et al[7] suggested that, due to the ease of training, ILMAs a reasonable alternative for facilitating intubation with overall intubation success rate. Interestingly, there is no scientific evidence supporting better clinical outcomes in patients with C spine disease intubated by FOB with other airway devices. [1,23]

Kellar and colleague [24] demonstrated that insertion of ILMA provides a more effective seal than the LMA.

In study conducted by Wang et al, the Group B (Blockbuster ILMA) demonstrated higher seal pressures than Group F (Fastrach ILMA).[25] The present study demonstrated 100% overall success rate of SAD insertion in both type of devices, which was similar to various previously conducted studies. [26,27]

However, the no. of attempts (I/II/III) required for successful SAD insertion was significantly more in group A (20/7/3) than group B (27/3/0) with (p-0.0486). Third attempt was required in 3/30 patients in group A. This may be because the Blockbuster is relatively flexible than Air-Q and that the ventilation was relatively inadequate in Air-Q group due to its improper placement owing to the larger cuff size(Fig. 1). Perimeter (cm) and Area (cm^2) of cuff of Blockbuster LMA were found to be ~24.14cm and 41.89cm^2 respectively and that of Air-Q LMA were ~28.93cm and 58.07cm^2 respectively as shown in Fig. 1. The relative ease of insertion of Blockbuster may be due to its smaller triangular bowl cuff size (Fig.1) and relative flexibility compared to Air-Q.

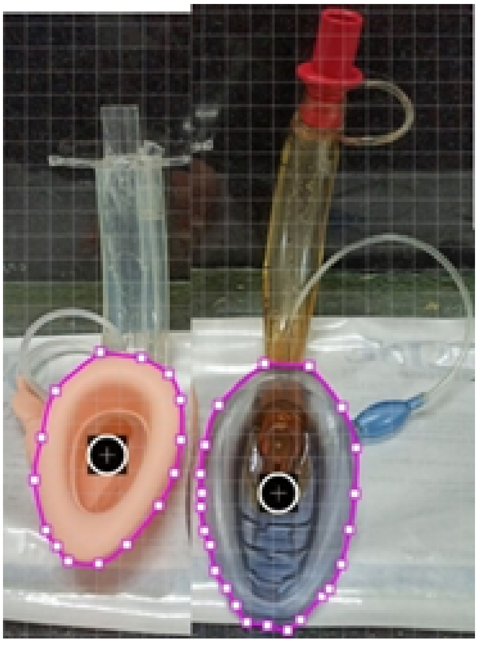

Fig.1 Blockbuster LMA size-3.0 (left) and Air-Q LMA size-3.5 (right) used for calculating Perimeter and Area of their cuffs in Sketch And Calc Android mobile application.

However, there was significant increase in no. of attempts (I/II/III) required for ET intubation in Group A (20/7/3) compared to Group B (27/3/0) with p-0.0486. The first attempt success rate of intubation in Group B was 90% (27/30), similar to Yunluo et al.[29]

The HR was significantly increased just after SAD insertion to 4th min, and returned to baseline at 5th min after Blockbuster insertion. The hemodynamic data were comparatively stable in Group B as the Blockbuster LMA was relatively easy to insert than Air-Q. Similar hemodynamic response is found comparable with other study. [30]

Kahl and colleagues have shown a useful tool in high-risk patients with lesser cardiovascular and endocrine stress response associated with tracheal intubation through ILMA as compared to that via DLS. [31]

Our findings were in contrast with Kihara et al, [12] who showed that during insertion/ intubation of ILMA there was no significant increase in MAP, and significant changes in HR. 3/30 (10%) patients in group A and 2/30 (6.67%) patients in group B complained of throat pain in postoperative period, which was relieved by routine analgesic and anti-inflammatory drug regime in post-operative period.

Incidence of esophageal intubation was observed more with Air-Q group and PVC in our study as also observed by Kundra et al.[32]

We had chosen PVC tube because of easy availability, cheaper, disposable. Higher first pass success rate, noted with both LMA was due to expertise in insertion and maneuvers, as we routinely use these two ILMA in non-cervical spine surgeries also.

Lu et al. concluded that the overall success rates of intubation with normal and reverse groups were not different (96.7% and 94.2% respectively). [33] Successful intubation at the first attempt was higher in the reverse group than in the normal group (86.7% vs 75.0%, P=0.033) in our study.

Swati Chhatrapati et al [34] found that first attempt success rate in reverse group (26 patients, 86.7%) was higher than normal group (22 patients, 73.3%) (P>0.05), our results were comparable to them. Lu and colleagues and Ye. L [33, 35] demonstrated that first attempt success rate in reverse group was higher than in normal group.

CONCLUSION

BlockBuster LMA provides higher 1st attempt success rate of blind tracheal intubation, is easier to insert due to smaller cuff size, fitting easily in oral cavity, has higher 1st attempt success rate of insertion and has better hemodynamic stability compared to Air-Q LMA. Fewer complications like throat pain and esophageal intubation were comparable in both the devices.

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