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Original Research Article

TO COMPARE TIME TAKEN, NO. OF ATTEMPTS, POSTOPERATIVE COMPLICATIONS AND MANOEUVRES USED DURING INSERTION THROUGH BLOCKBUSTER LMA OF POLYVINYL CHLORIDE ENDOTRACHEAL TUBE, MICROCUFF ENDOTRACHEAL TUBE AND BLOCKBUSTER ENDOTRACHEAL TUBE

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Abstract

Background: Airway management is the most essential skill that an anesthesiologist has to acquire. The most definite way of securing an airway is by endotracheal intubation. The study was conducted to compare time taken, no. of attempts, post op complications and manoeuvres used during insertion of Polyvinyl BLOCKBUSTER LMA of Polyvinyl Chloride Endotracheal Tube, Microcuff Endotracheal Tube and BLOCKBUSTER Endotracheal Tube. **Materials and Methods:** In this study 90 female patients were randomly allocated to the following three groups of 30 patients each. Group-A: Patients received general anesthesia and airway protection with PVC endotracheal tube through Block Buster LMA, Group-B: Patients received general anesthesia and airway protection with Micro-Cuff endotracheal tube through Block Buster LMA and Group-C: Patients received general anesthesia and airway protection with Block Buster endotracheal tube. The results were tabulated and statistically analysed using SPSS (Statistical Package for Social Sciences) Software version 15.0. P <0.05 was considered as significant. **Results:** No significant differences in demographic data. Intubation in first attempt in 73% patients in group A (PVC tube) and 80% patients in group B (MC tube) and 90% patients in group C (BB tube). The time taken for insertion was not same in all three groups. It was significantly less with the BLOCKBUSTER tube-14.60±6.29seconds, followed by the Micro-cuff endotracheal tube-20.10±7.54 seconds and last by the PVC tube32.26±16.40 seconds. Post-op complications like sore throat, hoarseness and nausea were significantly less with the BLOCKBUSTER tube followed by the Micro-cuff endotracheal tube and last by the PVC tube. **Conclusion:** The attempt and time taken to blind intubation was less in the Blockbuster tube and postop complications like nausea, sore throat and hoarseness were also less in the Blockbuster tube insertion. The study concluded that, PVC tube and Micro-cuff adult endotracheal tubes are a feasible option for blind intubation via Blockbuster LMA in patients with normal airways.

INTRODUCTION

Airway management is the most essential skill that an anesthesiologist has to acquire. The most definite way of securing an airway is by endotracheal intubation. Today we have far advanced from the conventional old red rubber tube. Today there is a whole range of gadgets and accessories that help in endotracheal intubation.[1] Endotracheal intubation is the definitive airway for ventilation and to prevent aspiration, during general anaesthesia. With invention of supraglottic devices in 1981 marked a paradigm shift, changing the focus of airway management, from intubation to oxygenation and ventilation. Among all of the gadgets, the most handy and acclaimed is the Laryngeal Mask Airway (LMA). Laryngeal Mask Airway is a bridge between endotracheal intubation and bag and mask ventilation. Supraglottic airway devices (SADs) have been widely used as an alternative to tracheal intubation during general anaesthesia. It was first introduced by Dr. Archie Brain in UK.[1,2] Since its

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invention, the classical LMA has undergone many modifications. Today various LMAs are available that can also help in Ryle's tube insertion, intubation via LMA, deep extubation, adjunct in difficult airway, and for spontaneous ventilation in short procedures.[2] An intubating LMA is a supraglottic airway device that allows the passage of an endotracheal tube through it. There have been many modifications of the original classical Fastrach LMA.[3] One of the newer modifications is the BLOCKBUSTER LMA.[4] It was invented by Prof. MingTian, the president of Chinese Difficult Airway Society and is being increasingly used for cases of difficult intubation.[4] They claim that the LMA has better hypolarynx ventilation and provides a better green channel for intubation via the LMA. Because of the make of the LMA, it is claimed to produce lesser post intubation tachyphonia and reduced aspiration risk due to the gastric port.[4] A silicone wire reinforced tube with a Touhy-tip named as the BLOCKBUSTERTM tube, is recommended for intubation via the BLOCKBUSTERTM LMA. This tube has a soft, flexible, blunt edge that causes less mucosal damage during blind intubation. The LMA can be used as a rescue device for unanticipated difficult intubation and may also be used as an adjunct for LMA guided intubation. It can be used for both blind intubation and also for fiberoptic guided intubation.[5] MICROCUFF Adult Endotracheal Tubes feature an advanced micro-thin polyurethane cuff, virtually eliminating the formation of channels typically found in PVC cuffs. This provides a superior tracheal seal proven to reduce leakage of potentially infectious secretions.[6] Manufacturers introduced a high-volume low pressure (HVLP) PVC-cuffed ETT in the 1970s, which has become the standard ETT in use today. Desirable characteristics of PVC include that it is transparent, nontoxic, and inexpensive and conforms to the patient's anatomy at body temperature.[7,8] The study was conducted to compare time taken, no. of attempts, post op complications and manoeuvres used during insertion through BLOCKBUSTER LMA of Polyvinyl Chloride Endotracheal Tube, Microcuff Endotracheal Tube and BLOCKBUSTER Endotracheal Tube.

MATERIALS AND METHODS

This study was conducted as a prospective randomized case-controlled study done on 90 adult female patients. The study was conducted for 1-year duration i.e. from July 2020 to June 2021. Study group was included all eligible patients & they were allotted into all three groups randomly. Study was conducted in these patients after explaining the procedure details to family members of the patients. This was conducted in the department of anaesthesiology and critical care, government medical college & attached hospitals, Kota (Raj). Patients with ASA grade I & II, female sex, MPG score I & II, weight between 30kg – 70kg, duration of surgery <3 hours were included in the study. Patients with ASA grade III & IV, patients with loose dentures, MPG score III &IV, patients weighing <30kg or >70kg, history of obstructive sleep apnea, renal, cardiac, pulmonary diseases and known gastrointestinal reflux diseases, history of allergy to one or more drugs and latex, Duration of surgery >3hrs were excluded from the study. In this study patients were randomly allocated to the following three groups of 30 patients each.

- Group-A: Patients received general anesthesia and airway protection with PVC endotracheal tube through Block Buster LMA.
- Group-B: Patients received general anesthesia and airway protection with Micro-Cuff endotracheal tube through Block Buster LMA.
- Group-C: Patients received general anesthesia and airway protection with Block Buster endotracheal tube through Block Buster LMA.

Study Procedure: Approval of the Ethical Committee of Government Medical College & attached Hospitals, Kota was obtained for surgery, anaesthesiology and this study. This study was conducted on 90 adult patients of female sex. All patients were scheduled for surgery of duration <3 hours. Written consent was obtained from all participating patients and their attendants for inclusion in the study. The patient was weighed and the size of LMA to be used was determined.

Preoperative Assessment: Complete medical history and physical examination including vital signs and airway assessment for all patients was done. Patients were kept nil per orally for 8 hrs.

Preanaesthetic Medication and Preoxygenation: In operative room Inj. glycopyrrolate 0.2 mg, inj. midazolam 1 mg and fentanyl 2mcg/kg intravenously were given 5 minutes before induction as premedication. All patients were preoxygenated with 100% oxygen for 3 minutes.

Clinical Monitoring: Monitoring equipments was attached to the patient including 5 leads ECG, non-invasive blood pressure, pulse-oximetry, ETCO2, heart rate, systolic, diastolic and mean arterial pressure was recorded at the baseline, and every 5 min thereafter.

Anaesthesia Induction

- Induction of anaesthesia was done slowly with propofol 2-2.5mg/kg and neuromuscular blockade will be achieved with succinyl choline 1.5 mg/kg.

Intubation

- The type of tube to be used was selected using the sealed envelope method.
- Group A was to be intubated with PVC tube and was named the PVC group (n=30) while Group B was to be intubated with the Micro cuff tube and was named the MC group (n=30) and Group C was to be intubated with the BLOCKBUSTER™ tube and was named the BB group (n=30).
- An LMA BLOCK-BUSTER of appropriate size (3 OR 4) was introduced into the patient and cuff

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was inflated with appropriate amount of air (max 30mL). Correct placement of laryngeal mask was confirmed with chest inflation, the presence of equal bilateral air entry, a square wave capnography and no oropharyngeal leak with peak airway pressures ≥20 cm H2O.

- If any one of the above criteria were not met, the LMA was repositioned, removed and reinserted or changed to a different size. If ventilation continued to be a problem, patient was excluded from the study. After successful placement of the LMA, anaesthesia was maintained with 1-2% sevoflurane.
- A lubricated endotracheal tube, a polyvinyl chloride endotracheal tube or a BLOCKBUSTER tube, or a Microcuff tube was inserted via the laryngeal mask airway, and the patient was intubated. Correct placement of endotracheal tube in the trachea was confirmed with equal bilateral air entry and capnograph tracing.
- When intubation was successful, the laryngeal mask airway was removed and the connector was placed at the machine end of the tube and the tube was connected to the anesthesia machine.
- The ease of tracheal intubation was judged by the time taken to intubate the trachea (time from disconnection of the breathing circuit from the LMA-BLOCKBUSTER to confirmation of tracheal tube placement by auscultation and display of a square-wave capnography trace) and the number of attempts to achieve successful intubation.
- In each patient, intubation through LMA-BLOCKBUSTER was limited to three attempts.
- Intubation was considered successful on the first attempt if tracheal tube could be passed without any resistance through the LMA-BLOCKBUSTER.
- If resistance was encountered, according to the length at which resistance was encountered, different maneuvers was used including twisting of the tracheal tube or/and Chandy's maneuver to align the bevel and this was considered second attempt.
- If still intubation was not successful, up and-down movement of the tracheal tube was tried and this was considered as third attempt.
- Following successful tracheal intubation, the LMA was removed using the standard technique and the stabilizing rod.
- All maneuvers used were recorded as well as the number of attempts required for successful intubation.

Maintenance of anaesthesia

Low flow O2 with any inhalational agent and NDMR (non-depolarizing muscle relaxant) + IPPV (intermittent positive pressure ventilation).

End of surgery

At the end of the operation, anaesthetic agents were discontinued, and proper oral suctioning was done allowing smooth recovery of consciousness.

Reversal: Inj. Neostigmine 0.04-0.08 mg/kg iv +Inj. Glycopyrrolate 0.004-0.008 mg / kg iv.

Extubation: Vitals noted (5 min before and 5 min after).

Post anaesthesia care unit: The patient was shifted to post-operative ward after full recovery and was followed up for 24 hours.

Post-operative complications: Post-operative complications like sore throat, nausea and hoarseness were recorded in the immediate post-operative period, one hour after extubation, 4 hours after extubation and 8 hours after extubation.

Statistical Analysis: The results was tabulated and statistically analysed using SPSS (Statistical Package for Social Sciences) Software version 15.0, Chi-square test was used for qualitative data (ASA grade, weight, MPG, Mouth opening), and quantitative data (heart rate, SBP, DBP, Mean blood pressure, was compared using paired t test within the group against baseline values, and between two groups unpaired-t test was used.

One-way ANOVA test was used for three group comparisons of continuous variables; $P > 0.05$ will be considered insignificant, $P < 0.05$ as significant and highly significant if $P < 0.001$.

RESULTS

The mean age of patients in group A was 35.33±8.81 yrs and in group B was 34.5±9.01yrs and in group C was 33.06±12.10 yrs. Maximum patients were in between 20 and 30 years age. All three groups were comparable with regard to age of patients.

In group A mean weight was 53.86±6.67kgs and in group B, it was 53.86±6.13 kgs and in group C was 51.6±5.61 kgs. The majority of patients were in between 40 and 50 kg weight in all three groups. All three groups were comparable with regard to weight of patients.

In group A mean ASA was 1.33±0.47 and in group B, it was 1.3±0.46 and in group C was 1.33±0.47. All three groups were comparable with regard to ASA Grade of patients.

In group A mean MPG was 1.5±0.5 and in group B, it was 1.43±0.5 and in group C was 1.46±0.5. All three groups were comparable with regard to MPG Grade of patients.

In group A mean mouth opening was 3.56±0.50 cms and in group B, it was 3.7±0.59 cms and in group C was 3.6±0.62 cms. All three groups were comparable with regard to Mouth opening of patients.

In group A the mean LMA size was 3.53±0.50 cm and in group B, it was 3.46±0.50 and in group C was 3.5±0.50. All three groups were comparable with regard to size of LMA.

In group A the mean duration of surgery was 85.5±27.33 minutes and in group B, it was 86.16±27.28 minutes and in group C was 85.66±25.21 minutes. All three groups were comparable with regard to duration of surgery.

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The table exhibits that LMA was inserted in first attempt in 83% patients in group A and 77% patients in group B and 87% in group C. On analysing the data statistically, the p value was calculated as 0.5961, hence the difference was statistically insignificant.

The table exhibits intubation in first attempt in 73 patients in group A and 80% patients in group B and 90% in group C. On analysing the data statistically, the p value was calculated as 0.2033 hence the difference was statistically insignificant.

For Group A (PVC tube):30% patients required some manoeuvers for successful intubation. For Group B(MC tube): 20% patients required some manoeuvers for successful intubation. For Group C (BB tube): 10% patients required manoeuvres for successful intubation.

Immediately after extubation, 36% of Group A (PVC tube) patients complained of sore throat, 44% complained of hoarseness of voice and 30% complained of nausea. 27% of Group B (MC tube) patients complained of sore throat, 30% complained of hoarseness of voice and 12% complained of nausea. In Group C (BB tube) 20% patient complained of sore throat,20% complained of hoarseness of voice and 10% complained of nausea.

After 1 hour of extubation, 30% of Group A (PVC tube) patients complained of sore throat, 33% complained of hoarseness of voice and 7% complained of nausea. 13% of Group B (MC tube) patients complained of sore throat and 17% complained of hoarseness of voice while in Group C (BB tube) only 7% patient complained of sore throat while no patient had hoarseness and nausea.

After 4 hour of extubation, 17% of Group A (PVC tube) patients complained of sore throat, and 17% complained of hoarseness of voice. 7% of Group B (MC tube) patients complained of sore throat and 7% complained of hoarseness of voice while in Group C (BB tube) no patient had sore throat and hoarseness.

After 8 hour of extubation, 3% of Group A (PVC tube) patients complained of sore throat, and 3% complained of hoarseness of voice while in Group B (MC tube) and in Group C (BB tube) no patient had sore throat and hoarseness.

Table 1: LMA size wise distribution of patients (Mean±SD)

LMA Size	Group A (PVC Tube)		Group B (Micro Cuff Tube)		Group C (Block Buster Tube)	
	No. of Patients	%	No. of Patients	%	No. of Patients	%
3	14	47	16	53	15	50
4	16	53	14	47	15	50
Total	30	100	30	100	30	100
Mean± SD	3.53±0.50		3.46±0.50		3.5±0.50	
P value	0.8789					

Table 2: Duration of surgery (Minutes)

Duration of Surgery (minutes)	Group A (PVC Tube)	%	Group B (Micro Cuff Tube)	%	Group C (Block Buster Tube)	%
45-85 minutes	14	47	17	57	15	50
86-125 minutes	15	50	12	40	13	43
126-140 minutes	1	3	1	3	2	7
Mean SD	85.5±27.33		86.16±27.28		85.66±25.21	
P value	0.9949 (Not significant)					

Table 3: Number of attempts for LMA Insertion (Mean±SD)

No. of attempt	Group A (PVC Tube)		Group B (Micro Cuff Tube)		Group C (Block Buster Tube)	
	No. of Patients	%	No. of Patients	%	No. of Patients	%
1st	25	83	23	77	26	87
2nd	5	17	7	23	4	13
Total	30	100	30	100	30	100
Mean± SD	1.16±0.37		1.23±0.43		1.13±0.34	
P value	0.5961					

Table 4: Number of attempts for Intubation (Mean±SD)

Attempt	Group A (PVC Tube)		Group B (Micro Cuff Tube)		Group C (Block Buster Tube)	
	No. of Patients	%	No. of Patients	%	No. of Patients	%
1	22	73	24	80	27	90
2	6	20	4	13	3	10
3	2	7	2	7	0	0
Total	30	100	30	100	30	100
Mean± SD	1.33±0.606		1.26±0.58		1.1±0.30	
P value	0.2033					

Table 5: Manoeuvres Used for intubation (Mean±SD)

	Group A (PVC Tube)	%	Group B (Micro Cuff Tube)	%	Group C (Block Buster Tube)	%
Jaw Thrust	2	7	1	3	2	7
Chandy's	3	10	2	7	1	3
Combined Jaw Thrust and Chandy's	4	13	3	10	0	0

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Table 6: Post-Op Complications. (A) Immediate:

IMMEDIATE			
Complications	**Group A(PVC)**	**Group B(MC)**	**Group C(BB)**
Sore throat	11(36%)	8(27%)	6(20%)
Hoarseness	14(44%)	9(30%)	6(20%)
Nausea	9(30%)	4(12%)	3(10%)
p value	0.0400(significant)		
B. After 1 hour:			
After 1 Hour			
Complication	**Group A(PVC)**	**Group B(MC)**	**Group C(BB)**
Sore throat	9(30%)	4(13%)	2(7%)
Hoarseness	10(33%)	5(17%)	0%
Nausea	2(7%)	0%	0%
P-value	0.1041(Not significant)		
C. After 4 hour:			
4 Hour			
Complication	**Group A(PVC)**	**Group B(MC)**	**Group C(BB)**
Sore throat	5(17%)	2(7%)	0%
Hoarseness	5(17%)	2(7%)	0%
Nausea	0%	0%	0%
D. After 8 hour:			
8 Hour			
Complication	**Group A(PVC)**	**Group B(MC)**	**Group C(BB)**
Sore throat	1(3%)	0%	0%
Hoarseness	1(3%)	0%	0%
Nausea	0%	0%	0%
P-value	0.4823(Not significant)		

DISCUSSION

An intubating LMA is a supraglottic airway device that allows the passage of an endotracheal tube through it. There have been many modifications of the original classical Fastrach LMA.[3] One of the newer modifications is the Blockbuster LMA.[4]

The three groups of patients were comparable in all demographical aspects.

Intubation in first attempt in 73% patients in group A (PVC tube) and 80% patients in group B (MC tube) and 90% patients in group C (BB tube). In second attempt in 20% patients in group A (PVC tube) and 13% patients in group B (Micro-Cuff tube) and 10% patients in group C (Block Buster tube). In third attempt in 7% patients in group A (PVC tube) and 7% patients in group B (Micro-Cuff tube) and group C (Block Buster tube) patients not required third attempt.

The attempts taken for PVC tube insertion was more, which is consistent with the results shown in studies by Sharma MU, Gombar S et al,[9] 2013 ie.96% patients were successfully intubated (90% in the 1st attempt, 5% in the 2nd attempt, and 1% in the 3rd attempt). In group II (wire reinforced et tube), the success rate was 97% (95% in 1st attempt and 2% in 2nd attempt).

Sreeramalu SK, Prabhu JP et al,[10] 2014 showed successful tracheal intubation in first attempt was lower in Group E (PVC tube) patients (15/30) compared to Group I (Fasttrach TM silicone wire reinforced tube) patients (21/30) which was statistically significant.

Shah VR, Bhosle GP, Mehta T et al,[11] 2014 showed the first attempt success rate as 86.25% with FTST (Fasttrach TM silicone wire reinforced tube) compared to 82.14% with PVCT.

The difficulties due to the PVC tube was probably due to the more obtuse angle of the tip of the PVC tube at which it exits the LMA, compared to the pliable BLOCKBUSTER tube, resulting in increased impingement of the tip of PVC tube on the anterior part of larynx. The difficulties due to the PVC tube was probably due to the large volume of cuff and thicker membrane of cuff compared to Micro-cuff endotracheal tube. The difficulties due to the Micro-cuff tube are probably due to the more obtuse angle of the tip of the Micro-cuff tube at which it exits the LMA, compared to the pliable BLOCKBUSTER tube, resulting in increased impingement of the tip of Micro-cuff tube on the anterior part of larynx.

The ease of insertion was compared by the time taken for intubation for each tube. On an average, the PVC tube took 32.26±16.40 seconds compared to 20.10±7.54 seconds taken by the Micro-cuff endotracheal tube and 14.60±6.29 seconds taken by the BLOCKBUSTER tube. The time taken for PVC tube insertion is longer, which is consistent with the results shown in studies by Sharma MU, Gombar S et al,[9] 2013 and Shah VR, Bhosle GP, Mehta T et al,[11] 2014 ie.for intubation of FTST through ILMA.

Studies by Sharma MU, Gombar S et al,[9] 2013 showed time taken for tracheal intubation were significantly greater in group I (PVC tube) than group II (Fasttrach TM silicone wire reinforced tube) (14.71±6.21 seconds and 10.04±4.49 seconds, respectively (P<0.001).

But the time taken in studies by Shah VR, Bhosle GP, Mehta T et al,[11] 2014ie.were much lesser (22.42 ± 8.5 sec) than obtained in this study.

The longer time could have been due to the relative inexperience with the new equipment. Another reason for longer intubation time could probably be that, in this study, no manoeuvers were used for

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intubation during the first attempt, in contrast to many other studies, where many maneuvers were used singly or in combination even for the first attempt.

The number of attempts required for successful intubation was also significantly higher for the PVC group in comparison to Micro-cuff tube group and Block-buster tube group which is also consistent with the other studies. In this study, the PVC tube was inserted with the natural curve facing forward, while in the study by Joo HS, Rose DK et al,[12] 1998 i.e. they inserted the PVC tube with the curve facing backwards.

Of the cases of successful intubation, 30% in Group A (PVC tube) required some manoeuvers for successful intubation, while only 10% required any manoeuvers in Group C (BB tube). This observation is consistent with the other studies by Sharma MU, Gombar S et al,[9] 2013 ie. manoeuvres required to accomplish successful endotracheal intubation, however, were significantly greater in group I (PVC tube) 28% than in group II (Fasttrach TM silicone wire reinforced tube) 3% respectively (P<0.05) and studies by Sreeramalu SK, Prabhu JP et al,[10] 2014 showed maneuvering of ILMA was required more in Group E (PVC tube) patients (15/30) compared to Group I (Fasttrach TM silicone wire reinforced tube)patients (9/30).

Studies by Khatkhedkar S, Bakshi S et al,[13] 2015 ie. maneuvers required to accomplish successful endotracheal Intubation was 21.05% in group I (Fasttrach TM silicone wire reinforced tube) and 45.94% in group II (PVC tube) respectively (p<0.05). In this study 20% in Group B(MC tube) required some maneuvers for successful intubation which is more than Group C (BB tube) and lesser than Group A (PVC tube).

In this study also patients in the PVC group had significant sore throat and hoarseness for up to 4 hrs post extubation. The incidence of sore throat and hoarseness in immediate extubation period was not found to be significant. After 1 hour of extubation, 30% of Group A (PVC tube) patients complained of sore throat and 33% complained of hoarseness of voice. 13% of Group B (MC tube) patients complained of sore throat and 17% complained of hoarseness of voice while in Group C (BB tube) only 7% patient complained of sore throat while no patient had hoarseness. At 8 hours post extubation, only 3% patients in Group A (PVC tube) had complaints of sore throat and hoarseness while no patient in Group B (MC tube) and Group C (BB tube) had post op sore throat from the first hour post-surgery.

Sreeramalu SK, Prabhu JP et al,[10] 2014 ie. described higher rates of sore throat in PVC group of patients in her study. The incidence of sore throat was significantly higher in Group E (PVC)(12/30) patients compared to Group I (Fastrach silicon wire reinforced tube) (2/30) patients (p value-0.002).

CONCLUSION

The attempt and time taken to blind intubation was less in the Blockbuster tube and postop complications like nausea, sore throat and hoarseness were also less in the Blockbuster tube insertion. The study concluded that, PVC tube and Micro-cuff adult endotracheal tubes are a feasible option for blind intubation via Blockbuster LMA in patients with normal airways.

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