Fibre optic assessment of laryngeal mask airway placement- A randomised comparative study between flexible LMA and classic LMA

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Abstract

Background and objective: The laryngeal mask airway (LMA) is used as an alternative to endotracheal intubation in elective surgeries. Malpositioning can lead to hypoventilation, gastric insufflation, regurgitation and aspiration. This study is designed to assess and compare proper placement of classic LMA (cLMA) and flexible LMA (FLMA) using clinical criteria and fibreoptic assessment.

Methodology: 200 consented adult patients (cLMA -100, FLMA -100), of American society of anaesthesia physical status I and II undergoing elective surgery under general anaesthesia were included in the study. LMA was inserted by standard technique after induction with fentanyl and propofol. Position was confirmed by clinical criteria and fibre optic assessment (grade 1 to 5). LMA was removed and looked for any blood on it after surgery. Malpositioning, failure and complications of LMA placement were noted.

Results: Demographic characteristics were comparable between the two groups. Number of insertion attempts were similar in both the groups (P=0.224). Mean time taken for insertion was significantly longer with flexible LMA (cLMA - 14.13 ± 8.00, FLMA - 23.39 ± 17.56). Clinical criteria of proper placement were fulfilled in all patients in both the groups. Fibreoptic grading of glottic view between the two groups were similar (P=0.731) Hemodynamic response to LMA insertion, incidence of leak (cLMA 6%, FLMA 4%, P = 0.748) and blood on LMA (cLMA 2%, FLMA 3%, P=0.765) were similar in two groups.

Conclusion: Flexible LMA requires more time for insertion compared to classic LMA. However the final cuff position of flexible LMA is similar to classic LMA, hence can be considered for various head and neck surgeries.

Key Words: Laryngeal,LMA, Glottic, Hemodynamic Process

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Introduction

The laryngeal mask airway (LMA) was designed in 1981 by Dr. Archie Brain of the United Kingdom and introduced into clinical practice in 19881. The original version was called classic LMA (cLMA) and was meant to be used as a supraglottic device in elective surgeries as an alternative to endotracheal tube. Though a very useful device cLMA has various limitations. These include malpositioning and inability to protect the airway against aspiration2-4. Various modifications have been made to the cLMA for specific functional objectives leading to development of intubating LMA (ILMA), ProSeal LMA (PLMA) and flexible LMA (FLMA).

Flexible laryngeal mask airway was introduced in 19925. It consists of a classic LMA cuff connected to a flexible wire reinforced tube which is longer and narrower than the airway tube of the cLMA6. This design allows the tube to be moved without displacing the cuff making it a useful device for various head and neck surgeries. We presume that, due to this inherent nature of design, the insertion and proper placement of FLMA is difficult compared to cLMA. Reinforced flexible laryngeal mask airway is shown to provide smoother emergence from anesthesia than tracheal intubation without compromising safety6.

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Hence this study was conducted with the objectives to fibre optically assess and grade the anatomic position of the laryngeal mask airway, placed after induction of general anaesthesia, to clinically assess the proper position of laryngeal mask airway, to compare fibre optic grading of positioning of classic LMA with flexible LMA and To assess the malpositioning, failure and complications of LMA placement.

Material and methods

This study was conducted among 200 patients posted for elective surgery under general anaesthesia in K.S.Hegde Charitable Hospital, Deralakatte, Mangalore. The study was conducted for a period of 2 years (October 2010 to June 2012).
Inclusion criteria: Adult patients aged 18 to 60yrs with ASA physical status I and II and Patients undergoing surgery under general anaesthesia in supine position or lithotomy position.
Exclusion criteria: Patients undergoing oral, head and neck, and neurosurgeries, Patients with predicted difficult airway. (restricted mouth opening), Edentulous patients, Patients with history of significant cardiac, respiratory, renal, hepatic, or central nervous system diseases, Patients with high risk of aspiration and Patients with morbid obesity.
Study Design: Prospective Randomized controlled trial
Sampling: Patients were randomly assigned into either group 1 or group 2 by closed envelop method.
Sample size: Group 1: 100 patients in whom classic LMA was used, Group 2: 100 patients in whom flexible LMA was used. Calculation was done by considering the results from Pothmann W et al7 study. Sample size of 100 in each group was obtained, calculated using N-master software.
Method of collection of data: Data was collected using structured questionnaire consisting of demographic profile, clinical profile and operative profile. Standard preoperative and intraoperative measures were taken in all the patients.
Preoperative baseline value of heart rate, blood pressure and oxygen saturation was recorded and crystalloid infusion was started. Patient was placed in 'sniffing' position. LMA of appropriate size (selected according to weight of the patient) was chosen. The cuff of the LMA was fully deflated and lubricated on its posterior surface. LMA was inserted using the standard technique. The LMA was pressed against the hard palate and gently guided along the pharyngeal curve using the index finger. The LMA was pushed into final position with the other hand until resistance was felt and cuff inflated with appropriate volume of air. Proper positioning and airway patency was confirmed by (a) Chest movement with manual ventilation and observation of airway pressure (b) Reservoir bag refill during expiration (c) Absence of leak with positive pressure ventilation (d) Square wave capnograph.
LMA was re-inserted if the positioning is not satisfactory as indicated by clinical criteria before Fibreoptic assessment. Fibreoptic bronchoscope was inserted through the swivel connector while continuing ventilation. The larynx was visualized with the tip of the fiberscope just proximal to the aperture bars in classic LMA and at the tip of LMA in flexible LMA. Heart rate, blood pressure and oxygen saturation was monitored continuously. Need for more than two attempts at insertion were considered as failure and the subject was excluded from the study. At the end of the surgery, LMA was removed when the patient is awake. LMA was inspected for presence of blood after its removal (surrogate marker of airway trauma). The amount of blood on LMA was quantified by observer 2 as: 1 - No blood seen, 2 - Trace amount of blood seen and 3 - Significant amount of blood seen.
Statistical Methods: Descriptive and inferential statistical analysis was carried out in the present study. Results on continuous measurements were represented as Mean ± SD (Min-Max) and results on categorical measurements are presented in number (%). Significance was assessed at 5 % level of significance. Student t test (two tailed, independent) was used to find the significance of study parameters on continuous scale between two groups. Chi-square/ Fisher Exact test was used to find the significance of study parameters on categorical scale between two or more groups.

Results

Table 1: Profile of subject's comparison between two groups

		Classic LMA		Flexible LMA		P value
		Number	%	Number	%	
Age		30.81±10.54		32.35±10.90		0.311
Gender	Male	47	47.0	45	45.0	0.776
	Female	53	53.0	55	55.0	
ASA	Grade I	81	81.0	84	84.0	0.576
	Grade II	19	19.0	16	16.0	
Weight		52.12±5.53		52.78±5.78		0.4103

Mean age of subjects in Classic LMA group was 30.81±10.54 years and in Flexible LMA group was 32.35±10.90 years. There was no significant difference in mean age between two groups. Similarly there was no significant difference in gender distribution, ASA grade distribution b/w 2 groups. Mean weight of subjects in Classic LMA group was 52.12±5.53 Kgs and in Flexible LMA group was 52.78±5.78 Kgs. There was no significant difference in weight distribution between two groups (Table 1).

Table 2: Outcome parameters comparison between two groups

		Classic LMA		Flexible LMA		P value
		Number	%	Number	%	
Insertion attempts	1	83	83.0	75	75.0	0.165
	2	17	17.0	25	25.0	
Leak	Absent	94	94.0	96	96.0	0.516
	Present	6	6.0	4	4.0	
Fibreoptic grading of glottic view	Grade 1	25	25.0	24	24.0	0.869
	Grade 2	50	50.0	44	44.0	0.395
	Grade 3	20	20.0	25	25.0	0.397
	Grade 4	5	5.0	7	7.0	0.551
Time taken for LMA		14.13±8.00		23.39±17.56		<0.001*

Number of insertion attempts in Classic LMA group was 1attempt in 83% and 2 attempts in 17% and in Flexible LMA, 1 attempt in 75% and 2 attempts in 25%.

There was no significant difference in number of attempts b/w 2 groups. Incidence of leak in Classic LMA group was 6% and in Flexible LMA was 4%. There was no significant difference in incidence of leak b/w 2 groups. Fibreoptic grading of glottic view in Classic LMA group was Grade 1 in 25%, Grade 2 in 50%, Grade 3 in 20% and Grade 4 in 5%. In Flexible LMA group, Grade 1 in 24%, Grade 2 in 44%, Grade 3 in 25% and Grade 4 in 7%. There was no significant difference in Fibreoptic grading of glottic view between two groups. Mean time taken for LMA in Classic LMA group was 14.13±8.00 and in Flexible LMA was 23.39±17.56. There was significant difference in Time taken for LMA b/w 2 groups (Table 2).

Table 3: Complications distribution comparison between two groups

		Classic LMA		Flexible LMA		P value
		Number	%	Number	%	
Bronchospasm	Absent	99	99.0	98	98.0	0.560
	Present	1	1.0	2	2.0	
Blood tinge on LMA after extubation	No blood	83	83.0	84	84.0	0.517
	Blood tinge	16	16.0	13	13.0	
	Significant amount of blood	1	1.0	3	3.0	

Incidence of Bronchospasm in Classic LMA group was 1% and in Flexible LMA group was 2%. There was no significant difference in Bronchospasm between two groups. In Classic LMA group, 83% had no blood, 16% had blood tinge and 1% had significant amount of blood and in Flexible LMA group, 84% had no blood, 13% had blood tinge and 3% had significant amount of blood. There was no significant difference in Blood tinge on LMA after extubation b/w two groups (Table 3).

In the study the study there was no significant difference in mean HR, SBP, DBP and SpO2 between two groups at all the intervals of follow-up.

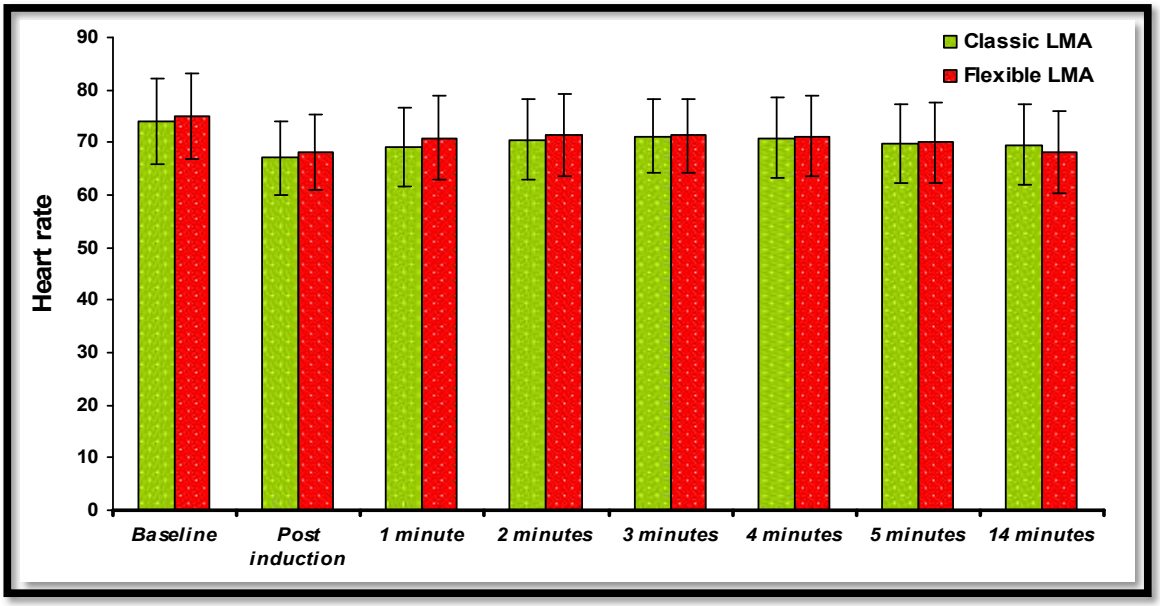

Fig.1: Heart rate comparison between two groups at various intervals of follow-up

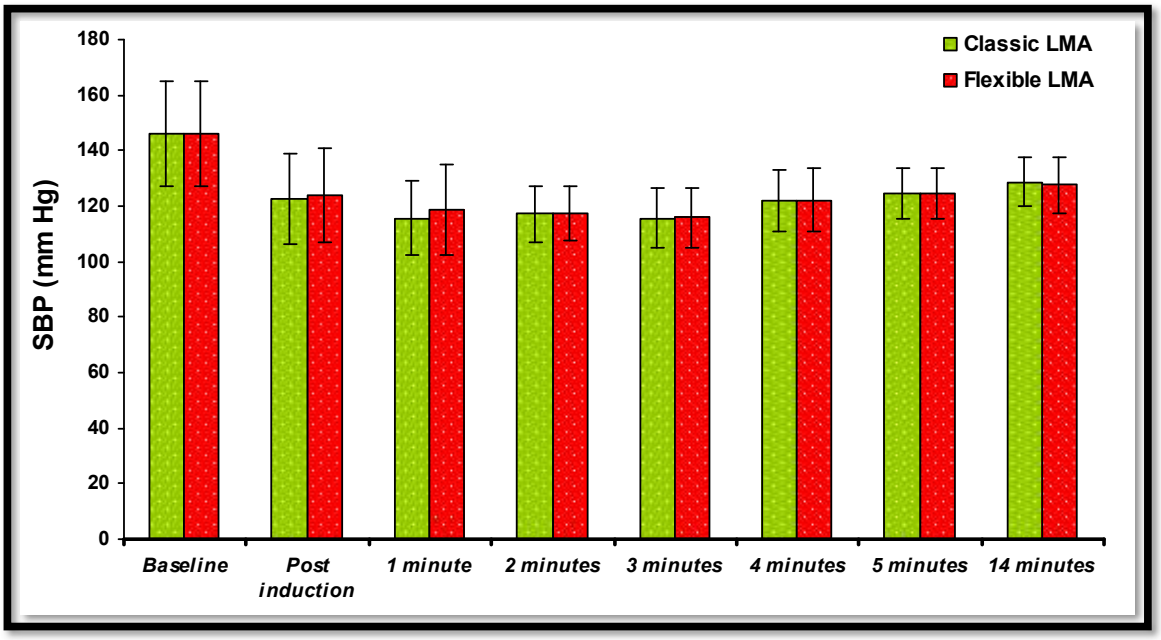

Fig.2: SBP comparison between two groups at various intervals of follow-up

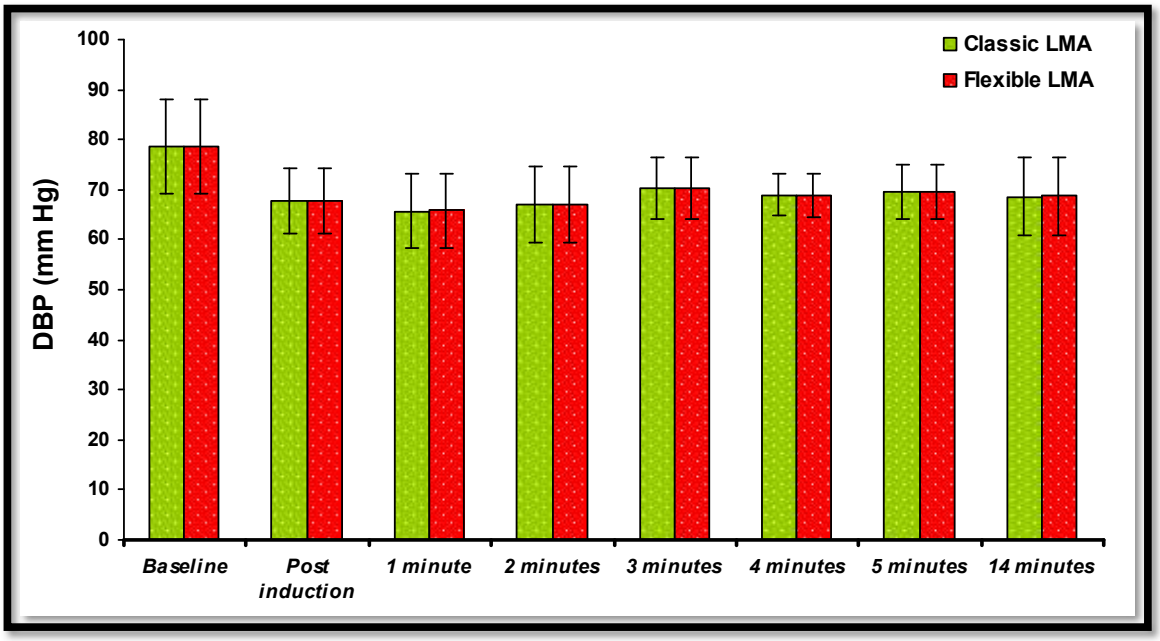

Fig.3: DBP comparison between two groups at various intervals of follow-up

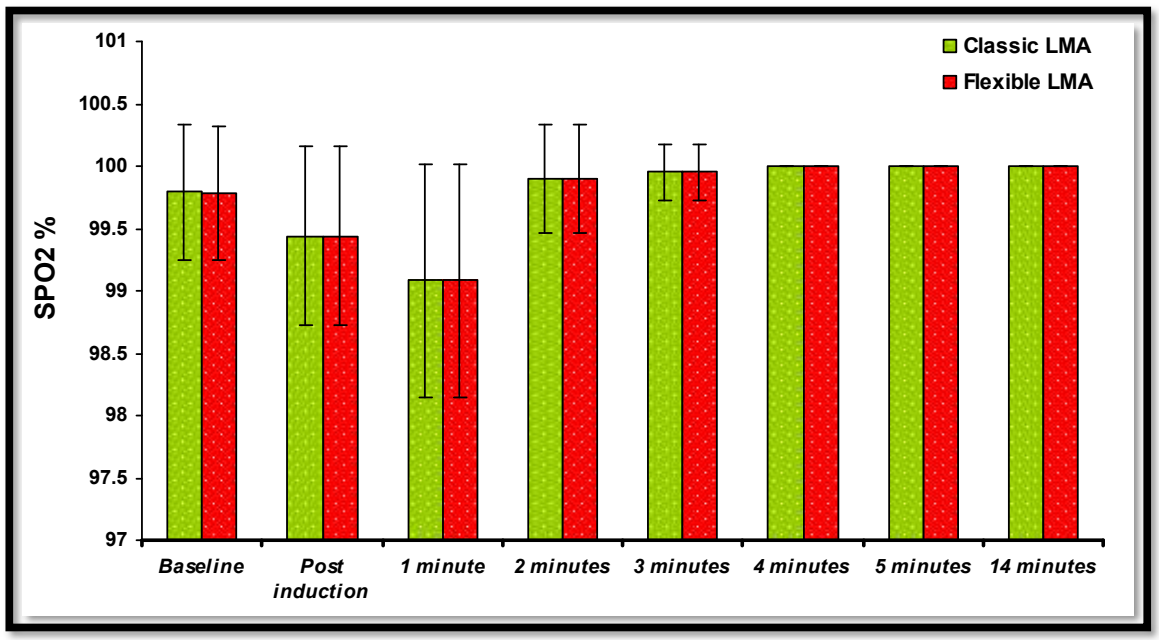

Fig.4: SpO2 comparison between two groups at various intervals of follow-up

Discussion

LMA provides an airway intermediate between the facemask and tracheal tube in terms of anatomic position, invasiveness, and security. It was introduced as a safe alternative to endotracheal intubation. Flexible LMA is a modification of classic LMA, with the classic LMA cuff connected to a longer, narrower reinforced airway tube. Malpositioning of LMA can lead to hypoventilation, gastric insufflation and aspiration8.

The mean age of patients in the study was 30.81years (group 1) and 32.35years (group 2). Weight of the patients ranged from 35 to 64 kg with an average of 53.28 kg. Both males and females were adequately represented. 82.5% of the patients belonged to ASA physical status 1, and 17.5% of the patients ASA physical status 2.

Priya V and collegues9 conducted a study to compare conditions for LMA insertion, after induction of anaesthesia with either inhalation of sevoflurane or intravenous propofol. They concluded that propofol is better than sevoflurane for LMA insertion using the loss of eye lash reflex as the end point of induction. In our study, we used only propofol for insertion of LMA. After induction with propofol 2mg/kg, additional doses of propofol were given when jaw relaxation was inadequate. In our study 27 patients required additional dose (20 – 30mg) of propofol to achieve adequate jaw relaxation.

Both classic and flexible LMA were inserted by standard method in the present study. This was similar to a study conducted Kini G and co-workers10 to compare the ease of insertion of classic LMA by standard technique and laryngoscopic aided insertion. Fibreoptic assessment was done to assess cuff position. They concluded that there was no difference in the ease of insertion of LMA by both techniques. Our study was to compare the placement of classic LMA and flexible LMA and all insertions were made without using laryngoscope.

Choo et al11 observed that "The LMA Flexible was more difficult to insert compared with standard LMA Classic because pressure cannot be directly transmitted along the soft flexometallic stem". Consistent with their statement, in the study second attempt for insertion was required more in patients in whom flexible LMA was used, when compared to classic LMA. This was because of difficulty in insertion of flexible LMA due to its floppy nature, which does not allow force to be transmitted down the tube. Average time taken for insertion of flexible LMA (23.39s) was significantly more than time taken for classic LMA insertion (14.13s).

In the present study clinical criteria of placement was satisfactory in 75 patients with flexible LMA after first attempt of insertion. 4 patients had leak, in 26 patients bilateral chest expansion was absent. Even after second attempt of insertion FLMA positioning was unsatisfactory in 5 patients and hence was excluded from further analysis. In classic LMA group, clinical criteria were satisfactory in 83 patients after first attempt, 6 patients had leak and clinically satisfactory placement was seen in all patients after second attempt.

Fibreoptic glottic grading was statistically similar in both the groups (P value = 0.731). Grade 3 (n=25) and 4 (n=7) views were more with flexible LMA, but it was statistically insignificant. Grade 5 view was not seen in any of the patients.

Our findings of fibre optic grading of glottic view of LMA placement were similar to those of Brimacombe J and Keller C12 whose study showed that cLMA and FLMA perform similarly in terms of ease of insertion and final mask position which was assessed fibre optically. Similar findings were seen in another study conducted by Keller and collegues13, on variation of cuff position (assessed fibre optically) with different head and neck positions for standard LMA and flexible LMA.

O.V. Ajuzieogu14 showed that the hemodynamic response to LMA insertion is less and is short lived than that observed during laryngoscopy and intubation. The LMA is desirable in conditions where a pressor response will be deleterious. In the present study, however the comparison was between classic LMA and flexible LMA. There was no endotracheal group. The hemodynamic response to insertion of LMA was similar in both the groups in our study.

Significant amount of blood was noticed on flexible LMA in 3 patients and 1 patient in classic LMA group. Out of this, FLMA was successfully inserted on second attempt in 2 patients. Hence airway trauma can be due to repeated attempts of insertion. Bronchospasm was noted in 2 (2%) patients with flexible LMA and 1 patient with classic LMA. First patient had history of bronchial asthma and in second patient, LMA was inserted on second attempt and significant amount of blood was seen on LMA after its removal.

Limitations of our study

Fibreoptic assessment of LMA position was not done in the end of surgery. It would have reflected intra

operative stability of the LMA. However, clinical parameters of proper placement were not altered during the surgery.

Oropharyngeal leak pressure was not monitored.

Conclusion

From the study it can be concluded that flexible LMA requires longer duration for insertion compared to classic LMA. However the final cuff position of flexible LMA was similar to that of classic LMA as assessed by fibre optic bronchoscopy.

In view of proper placement of flexible LMA in majority of patients, it can be considered for various head and neck surgeries, where there is no risk of aspiration. It has the unique advantage of stability due to its inherent design factor.

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