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Original Research Article

Comparision of Hemodynamic Effect Inendotracheal Tube and Supraglotticdevice in Elective Surgery

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Abstract

Introduction: *Insertion of the laryngeal mask airway after induction of anaesthesia has been described to cause less haemodynamic changes than tracheal intubation*

Aim: *The purpose of the study was to compare hemodynamic response during insertion of Supraglottic device (laryngeal mask airway) and cuffed endo-tracheal tube.*

Materials and Methods: *This was a randomized double blinded prospective study of 60 patient of age group of 17-60 years and ASA I and II who were posted for elective surgeries requiring general anaesthesia. Patients were randomly allocated into two groups (n=30) Group "A" and "B" comprising of 40 patients each.Group A – included patients who were intubated with endotracheal tube.Group B – included patients in whom supraglottic device (LMA) was inserted. Patients were continuously monitored in the intra –operative period for the following parameters Pulse rate, percentage saturation of oxygen (SPO2), Non – invasive blood pressure (NIBP), Mean arterial pressure (MAP), Rate pressure product (RPP) and ECG.*

Results: *The rise in mean pulse rate in ETT group higher – following laryngoscopy and intubation, than supraglottic device group. All the groups were associated with significant increase in mean arterial but in LMA group this rise was significant. Similarily the rate pressure product was significantly raised in group A as compared to group B.*

Conclusion: *There was significant rise in mean pulse rate, mean arterial pressure, rate pressure product in group A during insertion of the endotracheal tube after two, five minutes than the LMA group. A significantly higher numbers of attempts were required for LMA as compared to endotracheal intubation there was a significant increase in the incidence of post-operative cough and sore-throat in the endotracheal group as compared to the LMA group B.*

Keywords: *Mean pulse rate, LMA, rate pressure product, hemodynamic.*

Introduction

Airway management is of utmost importance during delivery of general anaesthesia. Patients who have been anaesthetized are unable to maintain an adequate airway on their own and artificial airway maintenance devices are employed.[1] Though intubation has many advantages including provision of a reliable airway, prevention of aspiration and delivery of anaesthetic gases, it is not without complications. These can be seen during insertion, after insertion and during extubation and they include airway trauma, physiological reflexes like hypoxia, tachycardia and hypertension, malposition, laryngospasm, narrowing and increased airway resistance as well as negative pressure pulmonary edema.[1-2] The supraglottic devices offers a much less invasive way of maintaining the airway.

Laryngoscopy and tracheal intubation or supraglottic device insertion are noxious stimuli which provoke a transient but marked sympathetic response. In susceptible patients particularly those with systemic hypertension, coronary heart disease, cerebrovascular disease and intracranial aneurysm, even these transient changes can result in potentially deleterious effects like left ventricular failure, arrhythmias, myocardial ischaemia, cerebral haemorrhage and rupture of cerebral aneurysm.[3-6] Insertion of thelaryngeal mask airway after induction of anaesthesia has beendescribed to cause less haemodynamic changes than trachealintubation.[8] The purpose of the present study was to compare hemodynamic responseduring insertion of Supraglottic device (laryngeal mask airway) and cuffed endo-tracheal tube.

Material and Methods

This was a randomized study of 60 patient ofage group of 17-60 yearsand ASA I and II who were posted for elective surgeries requiring general anaesthesia, in department of Anaesthesiology of a tertiary care hospital for period of 1 yr (JULY 2017 to AUG 2018).

After obtaining approval from institute research and ethical committee and written consent from patient's parent, this study was undertaken.

I. Inclusion Criteria

1. ASA grade I and II
2. Age group 17- 60 years of elective procedures.

II. Exclusion Criteria

1. Not giving consent
2. Obese
3. Pregnancy
4. Difficult intubation (mallampatti III &IV)
5. History of respiratory problems.
6. History of angina, palpitations, syncopal attack.
7. Cardiac and renal problems.
8. Gastric outlet obstruction.

Selection of group

Patients were randomly assigned to two demographically indentical groups (with respect to age, weight, sex and height): Group "A" and "B" comprising of40 patients each.

- Group A – included patients who were intubated withendotracheal tube.
- Group B – included patients in whom supraglottic device (LMA) was inserted.

Preanesthetic check-up was done in the previous evening. Pre-medication was done overnight with Tab. Ranitidine hydrochloride 150mg and Tab. Alprazolam 0.5mg.A 18 or 20-guage intravenous catheter was inserted in the operating room and an infusion of crystalloid lactated ringer's solution was started.Standard monitoring of vital signs (PR, ECG, NIBP, SPO2) was instituted and baseline reading was recorded Patients were premedicated with inj. Midazolam (0.1mg/kg) and inj. Glycopyrrolate (0.004 mg/kg) IV at least15 minutes before induction. All patients were induced with a dose (2mg/kg) of 1% propofol IV after adequate preoxygenation with 100 % O2 for 3minutes.

- Group A– Patients intubated with the appropriate sizedcuffed endotracheal tube after relaxation of larynx by succinylcholine (1.5 mg/kg) under direct laryngoscopy.
- Group B– Appropiate size laryngeal mask airway inserted by standard technique of digital insertion after adequate jawrelaxation by succinylcholine (1.5 mg/kg) without laryngoscopy

Maintenance of anaesthesia was similar in both groups, with Isoflurane 0.5%, Nitrous Oxide in oxygen (2:1) andintermittent doses of vecuronium as muscle relaxant inclosed circuit with a circle absorber and IPPV.

Patients were continuously monitored in the intra –operative period for the following parameters

Pulse rate, percentage saturation of oxygen (SPO2), Non – invasive blood pressure (NIBP), Mean arterial pressure (MAP), Rate pressure product (RPP) andECG were monitored.

1. Before induction which reflected baseline values- BL
2. At induction – A_{IND}.
3. Just after endo- tracheal intubation, Supraglottic (LMA) –A_{INST}
4. 2 minutes after endo- tracheal intubation, Supraglottic(LMA) insertion – A_2
5. 5minutes after endo- tracheal intubation, Supraglottic(LMA) insetion – A_5
6. 10 minutes after endo- tracheal intubation, SupraglotticLMA) insertion – A_{10}

Intraoperative and postoperative complications (Upto 24 hrs) due to use of Supraglottic device (LMA) or endotracheal tube.

Statistics

The data generated was statistically analyzed. The tools employed for statistical analysis are: Mean, Standard deviation, students t test, Chi-square test. The description of the data was done in the form of mean± SD for quantitative data. For quantitative data Student's t-test was used to compare between two groups. The Chi-square test was used to compare the intubation scores.

Significant figures

- Significant p < 0.05
- Strongly significant p < 0.01
- Not significant P>0.05

Results

After statistical analysis using chi square test, there was no statistical difference (p>0.05) found between the groups and the sex distribution between the two groups were comparable (Table 1)

Table 1: Sex distribution

Groups	Male(n)	Female(n)	P value
GROUP A	21	19	0.386
GROUP B	21	19	

Table 2: Ageand weight distribution

GROUPS	AGE(Mean±S.D)	WEIGHT (Mean±S.D)
GROUP A	34.63 ±7.41	48.00 ±7.6
GROUP B	33.18 ± 7.24	47.03 ± 7.8
P value	0.94(NS)	0.86(NS)

Table 3: Oxygen Saturation (SPO2) - (Mean ± SD)

GROUPS	Before induction BL	Induction AIND	Instrumentation AINST	After instrumentation A2	A5	A10
GROUP A(ETT)	99.77 ± 0.41	98.60 ± 1.05	98.35 ± 0.94	99.42 ± 0.71	99.62 ± 0.56	99.68 ± 0.50
GROUP B(Supraglottic device)	99.77 ± 0.45	98.68 ± 0.98	98.48 ±0.94	99.37 ± 0.68	99.24 ± 0.60	99.13 ± 0.93

There is no significant change in percentage saturation of oxygen (SPO2) in the two groups at any stage of time (p> 0.05).

Table 4: Pulse Rate (Beats/Mins)- Mean ± S.D.

GROUPS	Before induction BL	Induction AIND	Instrumentation AINST	After instrumentation A2	A5	A10
GROUP A(ETT)	86.76 ±13.4	91.8 ± 29.76	120.87 ± 14.71	134.66 ± 14.71	111.33 ± 10.7	95.83 ± 9.1
GROUP B(Supraglottic device)	84.20 ± 10.23	86.77 ± 8.81	99.07* ± 10.56	109.4* ± 11.11	90.10 ± 8.80	84.8 ±7.42

There were significant rise in mean pulse rate (*) within thegroup A during laryngoscopy and intubation, at two, five, tenminutes as compared to baseline values.

Also significant rise in mean pulse rate (*) seen in Group B duringinsertion and at two minute after insertion as compared to baseline values.

Table 5: Systolic Blood Pressure in mm of Hg (Mean ± S.D)

GROUPS	Before induction	Induction	Instrumentation	After instrumentation		
	BL	AIND	AINST	Two minutes A2	Five Minutes A5	Ten Minutes A10
GROUP A(ETT)	121.93 ±4.59	115.83 ±7.86	144.33 ±8.40	161.90 ± 6.58	136.73 ±7.79	124.64 ±5.06
GROUP B (Supraglottic device)	123.46 ±3.2	121.7 ± 3.78	134.33 ±4.54	146.04 ±4.84	138.73 ±3.2	123.80 ±4.2

*p < 0.05 (statistically significant) – For intra group comparison.
♯ p < 0.05 (Statistically significant) – For inter group comparison

Table 6: Diastolic Blood Pressure in mm of Hg (Mean ± S.D)

GROUPS	Before induction	Induction	Instrumentation	After instrumentation		
	BL	AIND	AINST	Two minutes A2	Five Minutes A5	Ten Minutes A10
GROUP A (ETT)	82.67± 4.01	79.73± 4.32	98.33 ±5.55	103.2± 5.21	92.33± 3.90	85.53± 4.2
GROUP B(Supraglottic device)	81.06± 3.2	80.03± 2.85	84.33 ±2.97	85.86± 3.71	82.07± 2.85	79.67± 2.63

*p < 0.05 (statistically significant) – For intra group comparison.
♯ p < 0.05 (Statistically significant) – For inter group comparison.

Table 7: Mean Atrial Pressure in mm of Hg (Mean ± S.D.)

GROUPS	Before induction	Induction	Instrumentation	After instrumentation		
	BL	AIND	AINST	Two minutes A2	Five Minutes A5	Ten Minutes A10
GROUP A(ETT)	95.47 ±4.03	91.40 ± 4.76	113.17 ±5.13	122.4 ± 4.64	106.73 ±3.75	98.23 ±3.62
GROUP B (Supraglottic device)	94.87 ±3.05	92.86 ±2.65	97.43 ±2.61	99.67 ± 2.50	95.86 ± 2.53	89.66 ± 2.63

*p < 0.05 (statistically significant) – For intra group comparison.
♯ p < 0.05 (Statistically significant) – For inter group comparison.

Significant rise in mean atrial pressure (*) within the group Aduring laryngoscopy and intubation, at two, five, ten minutes ascompared to baseline values.

Significant rise in mean atrial pressure (*) seen in Group B duringsupraglottic insertion and at two minute after insertion ascompared to base line values.

Table 8: Rate Pressure Product (RPP) in mm of Hg (Mean ± S.D.)

GROUPS	Before induction	Induction	Instrumentation	After instrumentation		
	BL	AIND	AINST	Two minutes A2	Five Minutes A5	Ten Minutes A10
GROUP A (ETT)	10582.13 ± 1040.88	10628.00 ± 955.30	16448.67 ± 1677.12	18810.8 ± 1767.88	15231.26 ± 1493.66	11943.6 ± 838.57
GROUP B (Supraglotticdevice)	10393.00 ± 567.98	10399.27 ± 654.30	12376.4 ± 945.69	14003.2 ± 682.79	11242.06 ± 576.69	10388.4 ± 377.02

*p < 0.05 (statistically significant) – For intra group comparison.
♯ p < 0.05 (Statistically significant) – For inter group comparison.

Significant rise (*) in RPP within the group A duringlaryngoscopy and intubation, at two, five, ten minutes ascompared to baseline values.
significant rise (*) in RPP seen in Group B during supraglotticinsertion and at two minute after insertion as compared to baseline values.
In none of the group study groups ECG abnormality in the form ofectopics, rhythm disturbances or any significant ST changes were observed.
Significant increase (♯) in the incidence of cough and sore throatwere observed in the endo-tracheal group as compared to thesupraglottic group.

Discussion

In the present study, 80 cases were selected and randomly assigned to demographically two identical groups of 40 each and perioperative and post-operative responses to laryngoscopy & intubation with ETT and supraglottic deviceinsertion were compared. Patients were comparable demographically in allthe two groups with respect to age, weight and sex. Oxygenation through the Endotrachaeal tube (ETT), Supraglottic device (LMA) were adequate inboth the groups. None of the patients had an episode ofdesaturation (SPO2 < 95 %) at any stage in both the groups during our study, as shown in Table –3. Hence this table suggests that ETT & supraglottic device group doesn't hinder the ventilation. It also implies that LMA dose into interfere with the process of controlled ventilation and function ofendotracheal tube to maintain oxygenation in preserved. This study co-relates with the study done by Berry A., Verghese C.et al (1994).[7] The variation in mean pulse rate atinduction, instrumentation, two minutes, five minutes andten minutes after instrumentation as compared to baselinepre-induction values in all groups were in Table-4.

i. At instrumentation :

- There is a significant rise in mean pulse rate in all thetwo groups as compared to the baseline values.

ii. At five minutes after instrumentation:

- There is decrease in mean pulse rate at five minutes following laryngoscopy and intubation in group A (ETT) and also in Group B (LMA), but still this value were significantly higher than baseline pre-inductionvalue.
- A decrease in mean pulse rate at five minutesfollowing Supraglottic device (LMA) insertion wasalso observed in group B and this value werecomparable to baseline value.

iii.At ten minutes after instrumentation:

- Although the mean pulse rate decreased in the groupendotracheal and supraglottic device, this value wasstill significantly high as compared to baselinevalues.
- Mean pulse rate was comparable to baseline valuesin the LMA groups and was significantly less than endotracheal tube at ten minutes after instrumentation.

In this study we found that all the groups were associated with significant increase in mean pulse rate. This table also shows as the rise in mean pulserate in ETT group higher– following laryngoscopy and intubation, at two minutes, five minutes and ten minutes following intubation, but in supraglottic device group this rise in mean pulse rate was significant during supraglottic insertion at two minutes, which stabilized at five minutes and maintained throughout the procedure. This finding of our study are in accordance with Holden et al[8], Lamb et al[9], Whitford et al [10], Duman et al[11], Fox et al (1997)[12] and Shribman (1987)[13].

Wilson et all in 1992 conclude from his study on 100 patients regarding supraglottic (LMA) insertion that there is only significant rise of mean pulse rate at one minute after insertionand after that the increase in mean pulse rate is not significant. My study also signifies that there is only significant rise in mean pulse rate after LMA insertion as similar with Wilson et al concluded and after there is no significant rise.

All the groups were associated with significant increase inmean arterial pressure during instrumentation and after two andfive minutes after instrumentation as shown in table-7. But in LMA group this rise was significant at LMA insertion and at two minute following insertion which stabilized towards baseline values atfive minutes and maintain till the end of the surgery and also during extubation and emergence. These finding of our studiesare in accordance withForbes and dally (1970)[14], Holden et al[15], whit Ford et al[16]. Croak et al (1994) compared the pressure response to Supraglottic insertion (LMA) and endotracheal intubation in 200 patients and found that:

- MAP change is more in cases of endotracheal intubationgroup than Supraglottic (LMA) group during instrumentationand at two, five and ten minutes after that manoeuvre.

- Rise of MAP is only significant at two and five minutes after LMA insertion which is less than that of endotrachealintubation response.

This is also similar to my findings as written above.

Increases in heart rate and blood pressure from sympathetic stimulation during anaesthesia have great potential for exceeding the limits of that oxygen supply in myocardium. If we are to avoid unidentified periods of intraoperative ischemia a simple means of assessing myocardial oxygenation is clearly needed. Unfortunately, neither MVO2 nor biochemical evidence of myocardial ischemia (lactate production) is readily available in the opening room. The possible usefulness of rate-pressure product assuch a practical monitor came from cardiology. In 10 normal excercising subjects, Nelson et al reported in 1974- that MVO2 correlated best with the product of heart rate and bloodpressure.

In our study the rate pressure product was significantly rise group A as compared to group B .But in group B patients there was minimum increased in rate pressureproduct from the base line limit during LMA insertion and two minutes following instrumentation, but it came near to the baseline limit after five minutes of LMA insertion. More number of attempts were required for Supraglottic insertion (LMA) than for endotracheal intubation thusdemon strating that a regular practice is required for proper useand insertion of LMA. The findings of the study are similar to Reinhat (1992)[17], Walker (1992) [18]. There was significant increase in the incidence ofcough and sore-throat was observed post-operatively in theendo-tracheal group as compared to LMA group. The findings of the study are similar to Burgard, Mollhoff & Prien (1996) [19]& Dasey & Mansour (1989) [20].

The technique of insertion of LMA is absolutely different from that of inserting an endo-tracheal tube. It involvesno use of laryngoscopy as vocal cords do not need to bevisualized and LMA doesn't enter into trachea but instead sits onthe hypo pharynx when positioned correctly. So, considering these, the pressure responses to LMA insertion were expected to be different from that of laryngoscopy and tracheal intubation. We believe that not performing laryngoscopy during insertion of LMA is one major reason for the observed attenuated pressure responses to LMA, apart from other reason like no direct laryngeal stimulation. The mechanical stimulation by pressure of laryngoscope on the soft tissue is the major factor in producing stress response to laryngoscopy and tracheal intubation.[21] The haemodynamic changes in the LMA group tookabout 3 minutes to return to pre insertion values while it took about 5 minutes for the changes to return to pre intubation valuesin the ETT group. Several other studies have demonstrated that the haemodynamic response to LMA is short lived compared tothat to ETT.[22-24] The greater and more persistent changes in cardiovascular parameters seen with ETT as compared to LMA insertion probably reflect higher catecholamine levels in the ETTgroup as seen in previous studies.[25-27] The LMA offers additional advantages during emergence from anaesthesia and it is not accompanied by complication like coughing. Tracheal extubation, however, causes a marked increase in IOP, coughing and breath holding[21].

Conclusion

The findings of the study were:

- There was significant rise in mean pulse rate observed in group A during insertion of the endotracheal tube andafter two, five minutes following insertion. In Group B (LMA) patients the mean pulse rate significantly riseduring insertion of the LMA and after two minutes following insertion as compared to pre-induction value. However the rise is less than that of group A patients. But attenuation of the rise in the pulse rate was observedin group B patients five minutes after LMA insertion.

- The significant increase in MAP is also seen in group Aand group B patients during instrumentation and aftertwo minutes following instrumentation and after two minutes following instrumentation which is less in group B (supraglottic device) and the response in group Bpatients was attenuated after five minutes.
- A significant difference in RPP was also observed in Group A (ETT) during laryngoscopy and intubation andafter two and five minutes following intubation.
- The difference in RPP during insertion of the LMA wasobscured after five minutes of insertion and come nearerto the base line after five minutes.
- A significantly higher numbers of attempts were required for LMA as compared to endotracheal intubation, thus demonstrating that a trick-on-hand is required for the use of these supraglottic instruments.
- There was a significant increase in the incidence of post-operative cough and sore-throat in the endotracheal group as compared to the LMA groupB.

Thus it may be concluded that use of supraglottic airway device offers more favorable hemodynamicst ability as compared to endotracheal tube and is associated with less postoperative complication as it isminimally invasive to the airway and it may be consideras an important adjunct in minimizing the pressure responses to laryngoscopy and intubation. Interestingly the supraglottic device that can be most easily placed, hasthe maximum hemodynamic response. Hence properselection of the cases and diligent surveillance can alsoensure freedom from potentially dangerous complication due to reflex aspiration associated with the use of LMA.

Limitations

This study was conducted on healthy, normotensive patients with normal airways. It is therefore not known how the changeswould have been in hypertensive patients.

- Patients, who were enrolled in this study, were all successfully intubated in the first attempt. Perhaps the haemodynamic parameters would show a different picture in patients with difficult intubation.
- In this study, intermittent recording of the haemodynamics was used, due to the available resources. This could mean that the maximal change could have been missed especially within th efirst minute of intubation.
- Randomization was done but double blinding was not possible due to our theatre setup. This could mean that an element of observation bias was not completely removed from the study.

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