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Comparative Study of Hemodynamic Responses to Airway Maintenance Devices: Proseal LMA V/S IGEL Airway

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Abstract

Hemodynamic stress responses to tracheal intubation can precipitate adverse cardiovascular events in patients. In principal, techniques that avoid or minimise oropharyngolaryngeal stimulation might attenuate the hemodynamic stress response or reduce the incident of airway morbidity. We compared hemodynamic responses in 60 anaesthetized, paralyzed ASA-I and ASA-II patients among two airway maintenance devices: Proseal LMA (PLMA) and IGEL airway. Mean duration of insertion in each case of both groups was noted. Patients monitoring done for pulse rate, NIBP, ECG and SPO2 intraoperativly. Mean duration of insertion was significantly shorter in IGEL airway than PLMA. Changes in mean pulse rate were comparable in both groups. In mean arterial pressure, changes were significantly higher in group-I than group-II. No significant complication was noted in either group. It was concluded that IGEL is a better alternative airway maintenance device than PLMA because of ease of insertion and maintenance of hemodynamic stability.

Keywords- Proseal LMA, I-GEL, Hemodynemic responses.

INTRODUCTION

Management of airway, breathing and circulation has always remained a challenge to science, especially in anaesthesia. Most vital element in providing functional respiration is the airway. Inability to successfully manage very difficult airway is responsible for vast majority of death attributable to anaesthesia. Tracheal intubation is usually carried out under direct vision by direct laryngoscopy which may lead to reflex cardiovascular responses mainly in the form of hypertension, tachycardia and dysrythmias. These conditions may cause left ventricular failure, myocardial ischemia or cerebral hemorrhage in the presence of coronary or cerebral athroma or hypertension[1].

Supraglottic airway maintenance devices have become a popular fixture in airway management that fills the gap between tracheal intubation and facemask. These devices sit outside the trachea yet provide a fixed and gas tight means of airway. Laryngeal mask airway (LMA), the first successful supraglottic airway devices, invented by Archie Brain, became available in 1989. Following this additional devices were added to LMA family to satisfy specific needs, as the time went on[2,3].

In 2000, Archie Brain introduced the proseal laryngeal mask airway (PLMA) with its improved feature features. PLMA has a modified cuff to improve the seal around the glottis and a drain tube to provide a bypass channel for regurgitated gastric contents. Its seal is more effective than that of classic LMA[3,4,5,6].

Fig.1 Proseal LMA

Most recent development in supraglottic airway devices, The I-GEL, developed by Mohammad Aslam Nasir, is a truly anatomical device[2]. The soft non inflatable cuff fits snugly on to the perilaryngeal structure, mirroring the shape of these framework. It create a sufficient seal for both spontaneously breathing as well as mechanically ventilated patients.

Recent studies show that I-GEL airway is better alternative device compared to PLMA for ease of insertion and maintenance of anaesthesia[2,3].

Fig.2 IGEL Airway

In the present study we compared the hemodynamic stability and ease of insertion for both PLMA and IGEL airways.

MATERIAL AND METHODS

This clinical comparative study was conducted on 60 patients of either sex ranging from 18 to 55 yrs, belonging to ASA grade I and II scheduled to undergo elective surgical procedure under General Anaesthesia. The study was conducted in the Department of Anaesthesiology, UPRIMS&R, Saifai, Etawah, UP, after approval of ethical committee clearance.

Patients were allocated randomly into two groups as group-I PLMA and group-II IGEL. All patients were examined to assess their pre-operative condition. Patients (1) having difficult airway (2) with history of esophageal reflux or respiratory or neurological disease (3) scheduled for head and neck surgery (4) refuse to give consent; were excluded from the study.

After obtaining informed consent, all patients pre-medicated with Diazepam 10 mg and Ranitidine 150 mg orally night before the surgery. Patients were again given Fentanyl 1 µg/kg IV and Glycopyrrolate 0.2 mg IV before induction. Pre-operative heart rates, non-invasive blood pressure (both systolic and diastolic) were measured. After adequate pre-oxygenation, patients were given Vecuronium Bromide (0.1 mg/kg IV) immediately followed by Thiopentone Sodium (5 mg/kg IV). Patients were ventilated using Bain's Co-axial circuit with 100% oxygen for 2 minutes.

Following this, in group-I, the airway was secured with PLMA while in group-II it was secured using an IGEL airway. Anaesthesia was maintained with 60% nitrous oxide and isoflurane in 40% oxygen. Neuromuscular blockade was produced using vecuronium IV in incremental doses. All parameters were measured immediately before induction, after induction and at regular intervals throughout surgery.

Both the groups were compared using unpaired Student 't' test with regard to mean pulse rate and mean arterial pressure. Data were presented as mean ± SD. Significance was assigned at the level 0.05 or less.

RESULTS

There were no statically significant differences (Table-1) between two groups with respect of age, sex, weight, ASA grade and the duration of surgery. Difference between the two groups with regard to mean duration of insertion was much significant indicating shorter time required for insertion of IGEL airway than PLMA

Table-1 Demographic profile and insertion data

	Group-1	Group-2	P-Value
No of Cases	30	30	
Age (Yrs) (meanS±D)	31.1±11.1	28.1±10.0	>0.05
Weight (Kg) (meanS±D)	51.4±6.7	47.9±7.7	>0.05
Sex (M:F)	5:27	5:25	>0.05
ASA Grade (1:2)	11:23	9:03	>0.05
Duration of Surgery (Mins) (MeanS±D)	61±3	58.4±7	>0.05
Duration of Insertion (Sec) (mean±SD)	11.7±3.0	9.6±2.2	0.004

Mean pulse rates were compared at different times (Table-2) in both groups. At all these points mean pulse rates were comparable and there were no statically significant difference between the groups.

Table-2

Comparison of Pulse Rate (Mean±SD) (Beats/Min) of Both Groups at Different Times

	Group-1	Group-2	P-Value
Baseline	83.0±4.0	84.2±4.4	0.290
After Premedication	84.5±3.5	84.6±3.9	0.940
After Induction	84.7±3.4	84.4±4.0	0.780
Post Insertion 1 min	84.6±3.7	84.5±3.8	0.940

5 min	84.6±3.5	84.2±3.3	0.600
10 min	84.0±3.4	84.2±3.5	0.770
15 min	84.2±3.7	83.8±3.8	0.636
30 min	83.8±3.7	83.9±4.0	0.829

Mean arterial pressures were compared at different times (Table-3) in both groups. Changes were significant at 5, 10 and 15 minutes with MAP being higher in group-1 than the group-2.

Table-3 Comparison of Mean Arterial Pressure (Mean±Sd) (Mmhg) of Both Groups at Different Times

	Group-1	**Group-2**	**P-Value**
Baseline	91.8±2.3	91.4±2.1	0.398
After Premedication	93.4±2.5	92.5±2.1	0.068
After Induction	93.6±2.4	92.6±2.2	0.104
Post Insertion 1 min	94.0±3.0	93.1±2.4	0.308
5 min	94.9±2.8	92.9±2.5	0.005
10 min	94.7±2.5	93.1±2.4	0.014
15 min	95.2±2.7	93.1±2.2	0.002
30 min	94.4±2.9	93.2±2.5	0.100

No significant complications were noted in any groups. No patient developed hypotension, bradycardia, tachycardia, cyanosis or bruising, edema on throat examination of both groups.

DISCUSSION

I-gel airway is found to be easier to insert when compared to PLMA[7]. I-gel is also found to produce less hemodynamic changes than PLMA[7]. P.M. Bodrick et al[8] studied 100 ASA grade I and II spontaneously breathing patient aged 16-65yrs, weighing 35-75kg using LMA in a variety of general surgery, gestourinary surgery, gynecological surgery and orthopedic surgery with standard anaesthesia techniques followed by airway securation with an LMA. Clinically satisfactory airway was obtained in 98 patients without need to support jaw, extend the head or to handle the patient in anyway. The LMA passed easily without introducer in 92 patients. Insertion was successful in first attempt in 80%, in second attempt in 70% of remaining 20 patients, in third attempt in 4 of the remainder and LMA was replaced with a Guedel oropharyngeal airway in the other two patients and in the other 10 patients, severe airway obstruction, coughing and laryngospasm occurred. In 8 patients the leak was large enough to make ventilation insufficient, two patient had temporary stridor on removal which quickly settled of all, 12 patients had a temporary sore throat in postoperative period excellent airway patency was obtained in 98% patients.

In our study, a PLMA was used in a total of 30 patients and all insertions were made by a consultant anaesthetists out of which three patients required double attempatients for securing airway and other two patients required endotracheal tube due to failure of securing airway with PLMA even after two attempatients because of smaller size of device.

Tae-Hyung Han et al studied 1067 ASA I and II patients aged 19-40 years weighing 34-84kg undergoing elective caesarean section using LMA[9]. The patients were fasted for six hours and given ranitidine, sodium citrate, immediately before surgery. A rapid sequence induction with Inj. Thiopentone 3-4mg/kg i.v. Inj. Suxamethonium 1.5mg/kg i.v. and single handed cricoid pressure by an assistant was done. Anaesthesia was maintained with N_2O + 50% O_2 and volatile agent enflurane 1-1.5% or isoflurane 0.5-1.5% LMA No. 3 for patient <45kg No. 4 for patient >45kg was introduced and cuff inflated according to manufacturer advise. An effective airway was obtained in 99% patients, 98% at the first attempt and 1% at the second or third attempt. Air leakage or partial airway obstruction occur in 21% patients and 0.7% patients required intubation. Incidence of hypoxia (SPO_2 <90%) aspiration regurgitation, laryngospasm, bronchospasm or gastric insufflations was not noted in any patients. surgical condition were satisfactory and APGAR scores were >7 after 5 min. The LMA was effective and probably safe for elective caesarean section in healthy selected patients when

managed by experienced LMA users. In our study also there were no incidence of aspiration regurgitation, laryngospasm, bronchospasm in all insertions of PLMA

N. M. Wharton et al evaluated performance of I-gel supraglottic airway device in manikins and anaesthetized patients when used by novices medical students, non anaesthetist physicians and allowed health professional all unfamiliar with the I-gel[10]. 50 I-gel were placed in manikins. 80% (44/50) were placed on first attempt with median insertion time of 14 sec (range 7-45). I-gel were placed in 40 healthy anaesthetized patients success on first attempt was 82.5% (33/40) and on the second attempt 15%(6/40) after three attempatients there were no failures median insertion time was 17.4sec (range 7-197) median airway seal was 20cmH_2O (13-40) one case of regurgitation and partial aspiration occurred.

In our study all insertions were made by a consultant anaesthetist and mean duration of insertion for I-gel was 9.6sec.

Parul Jindal et al[7] have done a study to evaluate and compare the hemodynamic changes during insertion of supraglottic devices LMA, SLIPA or I-gel8. This prospective study was conducted on 75 patients of either sex, 20-70 years, ASA I and II scheduled to undergo elective surgical procedures under general anaesthesia. All three supraglottic devices were introduced using standard techniques by a single anaesthesiologist who had considerable experience in all three techniques. No. of intubation attempatients was similar among all groups but intubation time was significantly longer in LMA group (7.68 + 6.9) while compared to I-gel (3.48 + 1.41) and SLIPA (5.16 + 0.68).It was observed that I-gel produced less hemodynamic changes than SLIPA. In our study also I-gel has taken lesser mean insertion time (9.63sec) than PLMA (11.73) sec and produced less changes in MAP than PLMA.

Ishwarsingh et al studied comparison of clinical performance of I-gel with LMA proseal in elective surgeries[11]. 60ASA gr-I and II adult patients were randomly assigned into two groups. Group –I (n=30) for I-gel and group P (n=30) for LMA proseal. The success rate of first attempt of insertion and ease of gastric tube placement was more with group I (P >0.05). Blood staining of device and tongue, lip and dental trauma was more with group P (P > 0.05) there was no evidence of bronchospasm, laryngospasm, regurgitation, aspiration or hoarseness in either group. This study resembles our study and the results of the study are also comparable.

A preliminary study was conducted for I-gel airway device by Ashish Kannaujia et al [12]. This study was conducted on 50 consecutive patients of ASA physical status I-II to determine the ease of insertion time to achieve effective airway, oropharyngyeal pressure and airway stability on head and neck movement. The success rate at first attempt was 90% with a median insertion time of 11 sec (range 8-45). Five patients needed second attempt while none needed 3rd attempt. In our study, out of 30

patients using I-gel only two patients required second attempt and other two patients required endotracheal tube due to failure to secure airway with I-gel even after second attempt.

Bimla Sharma et al conducted a randomized prospective comparative study of proseal LMA versus tracheal tube in Laparosocpic cholecystatomy[13]. In this study success rate of first attempt at insertion was higher for tracheal tube but not significant P(<0.05). The PLMA group was associated with better hemodynamic profile (P <0.05) than tracheal tube group.

CONCLUSION

We conclude that IGEL airway attenuates the hemodynamic stress response to insertion and easy to insert compared with the PLMA. The IGEL airway may be preferable to PLMA in high risk cardiac patients and difficult in difficult airway management

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