COMPARISON BETWEEN INDUCTION WITH ETOMIDATE, PROPOFOL AND THIOPENTONE TO FACILITATE i-gel (SUPRAGLOTTIC AIRWAY DEVICE) INSERTION IN ELECTIVE SHORT SURGICAL PROCEDURES

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ABSTRACT

BACKGROUND

An ideal induction agent provides rapid and smooth onset of action, intraoperative amnesia and analgesia and optimal surgical conditions and adequate muscle relaxation with rapid recovery. Supraglottic airway devices are the most preferred technique of airway management for day care surgery. Etomidate, Propofol and Thiopentone with fentanyl provides optimal condition for supraglottic airway device insertion.

The aim of this study was to compare the success rate of introducing i-gel (Supraglottic Airway Device) with induction agent etomidate, propofol and thiopentone in patients undergoing elective short surgical procedures.

MATERIALS AND METHODS

In a prospective, randomized, double blind study 90 patients scheduled for elective surgeries were assigned to one of three groups (n = 30).

RESULTS

The age and body weight of patients in three group were statistically analysed by analysis of variance test (Fisher test) found comparable between groups. The overall assessment of i-gel insertion was excellent in 50% Group-I, 67% in Group-II and 48% in Group-III ($p< 0.05$), which was statistically significant. Incidence of adverse response to airway manipulation in etomidate and thiopentone group was significantly higher than that of propofol group.

CONCLUSION

Propofol provides best conditions for i-gel insertion compared to etomidate and thiopentone. Propofol was associated with highest incidence hypotension and apnoea during induction, etomidate had least. Recovery in propofol and etomidate group was comparable whereas in thiopentone group recovery was significantly prolonged.

KEYWORDS

Supraglottic Airway Device, Induction Agent, Day Care Surgery.

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BACKGROUND

An ideal induction agent should have a rapid and smooth onset of action that provides intraoperative amnesia & analgesia, provide optimal surgical conditions and adequate muscle relaxation with rapid recovery and have no adverse effects in the postoperative period[1] Satisfactory insertion of any airway device requires sufficient depth of anaesthesia for suppression of airway reflexes for which Etomidate, Propofol and Thiopentone with aid of adjuvant drugs like midazolam and Fentanyl are highly effective.[2,3,4,5,6] LMA is the most preferred technique of airway management for day care surgery as it is more practical than facemask and less invasive than endotracheal tube.[7,8]

i-gel (Intersurgical Ltd., Wokingham, Berkshire, UK) is cuff-less supraglottic airway device, made up of gel like thermoplastic elastomer, has anatomically designed mask that allows easy, quick insertion and accurate placement over laryngeal framework to provide a reliable perilaryngeal seal with minimal distortion and least trauma. It also has a port for nasogastric tube placement.[9,10]

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MATERIALS AND METHODS

This prospective, randomized, double blind study was conducted in S.C.B. Medical College & Hospital, Cuttack. After approval from institutional ethical committee and informed written consent from the patient, 90 ASA I-II physical status patients of either sex, between age 20-50 years, weight 30-60 kg, MPS grade 1 and 2 scheduled for elective surgeries were selected for the study. Patients with known difficult airway, mouth opening less than 2.5cm, cervical spine disease, high risk of aspiration, planed operation more than 4 hours, upper respiratory tract infection in previous one week, obese and pregnant patients were excluded from the study. Patients with planned short surgical procedures like D&C, cone biopsy, fibroadenoma excision, herniorrhaphy, hydrocele excision, implant removal, lymph node biopsy, lipoma excision, skin grafting, and contracture release was recruited for the study.

Patients were randomized using a random number generator to one of three study groups to receive the following induction agent in a double-blind manner. Group I (n=30) received etomidate, Group II (n=30) received Propofol and Group III (N=30) received thiopentone as inducing agent. For blinding the induction sequence was conducted using two pre-prepared syringes. Syringe 1 contained fentanyl 1 mic/kg and Syringe 2 contained etomidate, Propofol or thiopentone. Opaque tape was applied to syringe 2 to disguise the colour of the induction. The coded test syringes were prepared by anaesthesia technician who did not take part in the study. Injection of all syringes was performed behind a drape so that all anaesthesiologists were blinded to the induction agent administered. All patients were received inj. glycopyrrolate 4 mcg/kg, inj. ranitidine 50 mg and metoclopramide 10 mg intravenous 45 minutes before surgery. In the pre-operative room midazolam 0.01 mg/kg was given as premedication. In the operating room, patients received all standard anaesthetic monitors and all baseline parameters including heart rate, blood pressure and oxygen saturation were recorded.

All patients received inj. fentanyl 2 mic/kg and then pre-oxygenated for 3 minutes. Anaesthesia was induced by etomidate 0.2 mg/kg in Group I, Propofol 2.5 mg/kg in Group II and with thiopentone 5 mg/kg in Group III. Appropriate sized i-gel was lubricated with water soluble jelly, once adequate depth was achieved (loss of eye lash reflex, relaxed jaw muscles), i-gel of appropriate size was inserted using standard guidelines and technique. Anaesthesia was maintained with O_2 & N_2O in 1:1 and Isoflurane 0.6-1%. All data were collected by anaesthesia resident who was blinded to type of induction agent given to the patient. Heart rate, Blood pressure, SPO2 and ETCO2 were recorded in all the three groups as baseline, after premedication, after induction, after LMA insertion, at 1 minutes, at 3 minutes and 5 minutes after insertion of i-gel then every 5 minutes till the end of surgery.

Adverse response to airway manipulation, ease of i-gel insertion, jaw relaxation, overall assessment of condition for i-gel insertion, side effects of induction and postoperative recovery was assessed in all the patients.

RESULTS

90 patients of either sex were randomly assigned into three groups. Group I (n=30) receiving Etomidate, Group II (n=30) receiving Propofol and Group III (N=30) receiving Thiopentone as inducing agent. The observations were compiled, and the results were analysed statistically. The observations are tabulated as demographic variables, hemodynamic variables, incidence of adverse event to i-gel insertion and overall assessment of i-gel insertion.

Group (n=30)	Age (yr.) (mean ± SD)	Weight(Kg.) (mean ± SD)	Male/Female	P Value
I (Etomidate)	28.46 ± 7.0	53 ± 5.6	17/13	p>0.05
II (Propofol)	29.8 ± 7.2	52.6 ± 6.6	16/14	
III (Thiopentone)	30.1 ± 7.2	53.3 ± 5.9	18/12	

Table 1. Demographic Variables

Statistical analysis using Chi Square test (χ^2), shows no statistical difference (p>0.05) found between the groups with respect to sex (table-1). The age and body weight of patients in three group were statistically analysed by Analysis of variance test (Fisher test) found comparable between groups.

Incidence of adverse response to airway manipulation in etomidate and thiopentone group was significantly higher than that of propofol group (table-2 & fig-1). The incidence of coughing and limb movement was significantly higher in etomidate and propofol group than thiopentone group. Incidence of laryngospasm was significantly higher in thiopentone group compared to other two groups.

	Group I	Group II	Group III	p value		
	No. (%)	No. (%)	No. (%)	GI v GII	GII v GIII	GI v GIII
Inadequate Jaw Relaxation	13 (43)	8 (47)	16 (53)	0.17	0.035*	0.48
Gagging	4 (13)	2 (7)	8 (27)	0.38	0.037*	0.19
Coughing	6 (20)	8 (27)	2 (7)	0.54	0.037*	0.12
Limb movement	10 (33)	8 (270	2 (7)	0.62	0.037*	0.0098*
Laryngospasm	0	0	3 (10)	_	0.057	0.057

Table 2. Incidence of Adverse Response to Airway Manipulation

The overall assessment of i-gel insertion was excellent in 50% Group-I, 67% in Group-II and 48% in Group-III (p< 0.05), which was statistically significant (table-3 & fig-1). The assessment was satisfactory in 40% Group-I, 30% in Group-II and 36% in Group-III (p>0.05), which was statistically insignificant.

Assessment	Group I	Group II	Group III	p value		
	No. (%)	No. (%)	No. (%)	GI v GII	GII v GII	GI v GIII
Excellent	15 (50)	20 (67)	14 (48)	0.19	0.11	0.79
Satisfactory	12 (40)	9 (30)	11 (36)	0.41	0.58	0.79
Poor	3 (10)	1 (3)	5 (16)	0.3	0.085	0.44

Table 3. Overall Assessment of i-gel Insertion by Using 3-Point Scale

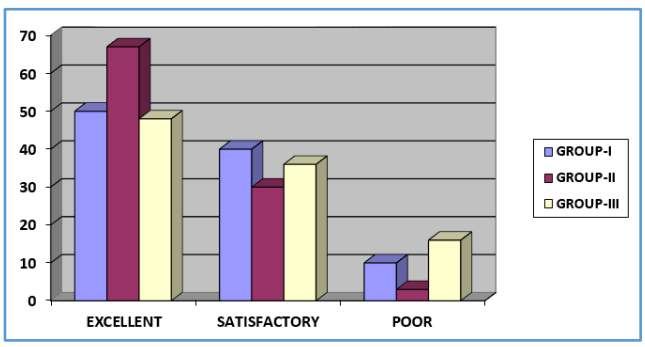

Figure 1. Assessment of i-gel insertion

The heart rate among the groups were compared by unpaired t-test at baseline, after premedication, after induction, just after i-gel insertion and at 1,3 and 5 minutes after i-gel insertion (fig-2). After anaesthetic induction, HR decreased significantly from the preinduction level (*P* < 0.05) in the propofol and etomidate groups. Compared to the baseline level, HR decreased throughout in the propofol group. After i-gel insertion, HR increased in the etomidate group. No patient was treated for bradycardia.

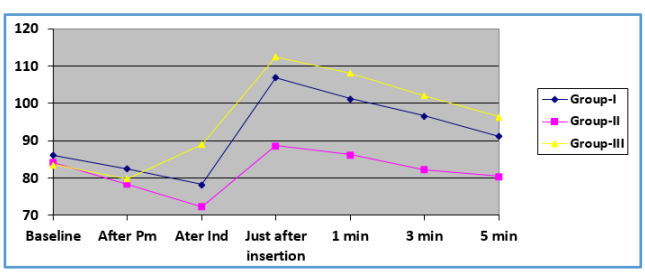

Figure 2. Trend Showing Changes in Heart Rate between Different Groups

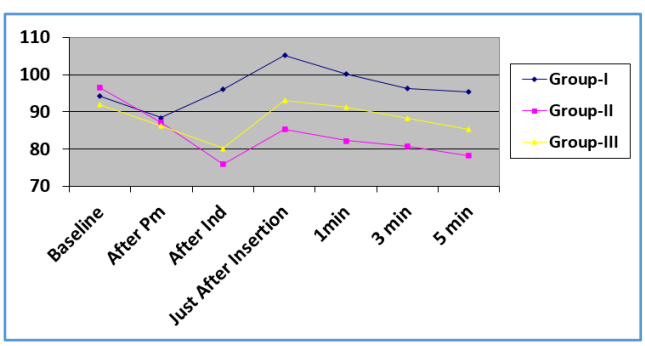

Figure 3. Trend Showing Changes in Mean Arteria Pressure between Different Groups

The mean arterial pressure (MAP) among the groups were compared by unpaired t- test at base line, after premedication, after induction, just after i-gel insertion and at 1,3 and 5 minutes following i-gel insertion. Control MAP were comparable between groups. MAP changes differed between groups. MAP differed between the propofol and etomidate groups. MAP varied with time and the time-group interaction was also significant, so the effect of time on each factor was evaluated separately. After anaesthetic induction, the decrease in MAP was significant (P <0.05) in all groups. Compared to the baseline level, MAP values decreased throughout the investigation in the propofol group whereas MAP increased after i-gel insertion in the thiopentone and etomidate groups.

Parameter	Group-I (n=30)	Group-II (n=30)	Group-III (n=30)
Incidence of hypotension	2 (6%)	12 (40%)	8 (27%)
Incidence of apnoea	2 (6%)	10 (30%)	6 (20%)
Incidence of PONV.	2 (6%)	1 (3%)	7 (24%)

Table 4. Comparison Side Effect of Induction Agent

DISCUSSION

It is widely accepted that propofol is well suited for insertion for LMA because of its greater depressant effect on airway reflexes than etomidate and thiopentone. But is it causes hypotension and apnoea during induction and good medium for bacterial growth. Therefore, further studies were conducted with thiopentone and etomidate in an attempt to find suitable alternative to propofol in relation to ease of insertion of LMA and haemodynamic stability. Thiopentone is associated with a higher incidence of gagging on LMA insertion.[4] This is mostly because, thiopentone increases airway irritability due to its relatively greater depressant effect on sympathetic arch than the parasympathetic arch. Therefore, successful insertion with thiopentone would require either adequate reflex suppression with use of additional agents or a deeper plane of anaesthesia.[3]

Smooth and successful insertion of a supraglottic airway device during induction requires a proper mouth opening and efforts to minimize airway reflexes such as gagging, coughing, or laryngospasm. Hung *et al* has shown that as an induction agent to facilitate insertion of LMA, etomidate alone was far from perfect.

The concurrent use of 2 microg/kg of fentanyl with etomidate significantly reduce the occurrence of airway reflexes in response to LMA insertion and increase the success rate of insertion. However, concurrent use of 1 mg/kg succinylcholine with etomidate provide better results in terms of shortened time for the LMA insertion, jaw relaxation, and the success rate of LMA insertion than that of fentanyl.[6]

In the present study any occurrence of adverse response to i-gel insertion like inadequate jaw relaxation, gagging, coughing, limb movement and laryngospasm were noted in all 90 patients. These responses were graded as mild, moderate and severe depending upon duration of untoward reflexes. Overall ease of insertion of i-gel classified as Excellent, satisfactory and Poor on a three-point scale. Excellent is absence of adverse response, satisfactory is mild response not affecting the ease of insertion of i-gel and poor if patient demonstrate moderate to severe adverse response to i-gel insertion and if additional anaesthetic agent e.g. increasing concentration of isoflurane is required to deepen the anaesthetic level. The magnitude of cardiovascular changes observed in 90 elective normotensive patients who underwent various surgical procedure using i-gel for maintenance for airway maintenance. The effect was observed at 1 min, 3min, 5min of i-gel insertion. The demographic data such as age, body weight and sex were comparable in both groups (Table-1). Our study compares the success rates of introducing i-gel with induction agent etomidate, propofol and thiopentone to assess which agent is more suitable for i-gel insertion. In our study, premedication and the anaesthetic technique kept constant to exclude the variation in the adverse response to i-gel insertion and in cardiovascular responses due to effect of varieties of drugs or technique. Hypoxia and hypercarbia were avoided. The changes in the haemodynamic parameters were noted and compared.

There was an increase in heart rate (HR) immediately after i-gel insertion and at 1 minutes in all three Groups, which was statistically significant in Group-I and Group-II ($p<0.05$) and highly significant in Group-III ($p< 0.001$). At 3 minutes HR goes below baseline in Group-II and it remains above baseline in Group-I and Group-III at 3 and 5 minutes. Control HR was comparable between groups. HR changes differed between groups (Figure-2). HR differed significantly between the thiopentone and propofol groups. After anaesthetic induction, HR decreased significantly from the pre-induction level ($P < 0.05$) in the propofol and etomidate groups. Compared to the baseline level HR decreased throughout the investigation in the propofol group. After i-gel insertion, HR increased in the etomidate group.

In our study HR increased after i-gel insertion in all the three groups. In Group-I (Etomidate) the change was significant ($p<0.05$) immediately after and at 1 minutes after i-gel insertion. It remains above baseline at 3 and 5 minutes. Whereas in Group II (Propofol) similar increase in pulse rate were seen immediately after and at 1 minutes following i-gel insertion but it reduces to base line at 3 minutes. In Group III (Thiopentone) increase in HR is highly significant just after i-gel insertion ($p<0.001$) and remains high even at 5 minutes.

The control mean arterial pressure (MAP) was comparable between groups. After anaesthetic induction, the decrease in MAP was significant ($P <0.05$) in all groups. Compared to the baseline level, MAP values decreased throughout the investigation in the propofol group whereas MAP increased after i-gel insertion in the thiopentone and etomidate groups. In our study MAP rise persisted till 5 minutes in Group I ($p<0.001$) and in Group III ($p<0.05$). Although the rise was not significant in Group II. This variation of

MAP in the study conducted by Bapat *et al* probably due the inclusion of both normotensive and hypertensive patients where as we have included only normotensive patients in our study. Incidence of adverse response to airway manipulation in etomidate and thiopentone group was significantly higher than that of propofol group. The incidence of coughing and limb movement was significantly higher in etomidate and propofol group than thiopentone group. Incidence of laryngospasm was significantly higher in thiopentone group compared to other two groups.

In our study the overall assessment of i-gel insertion was excellent in 50% Group-I, 67% in Group-II and 48% in Group-III ($p< 0.05$), which was statistically significant. The assessment was satisfactory in 40% Group-I, 30% in Group-II and 36% in Group-III ($p>0.05$), which was statistically insignificant. Bapat *et al (*1996) found that there was no significant difference in the overall assessment of LMA insertion in either the propofol or the thiopentone group. They were almost similar to each other and superior condition LMA insertion was observed in both these groups. But our study does not coincide with them as we got significantly higher percentage of patients in propofol group with excellent assessment this difference may be due to the difference in the supraglottic device, as they have LMA and we have studied with i-gel. Priya *et al* (2002) compare propofol versus sevoflurane for laryngeal mask airway insertion. Excellent conditions for the LMA insertion were obtained in a significantly greater number of patients in Group P (64%) than in Group S (32%) ($p=0.02$). The mean score for conditions for LMA insertion was significantly better in Group P ($p=0.012$).72% patients in Group P had full jaw opening when compared to 44% patients in Group S ($p=0.047$).

Sinha et al (2010) conducted a study on comparison of propofol (1%) with admixture (1:1) of thiopentone (1.25%) and propofol (0.5%) for laryngeal mask airway insertion in children. In admixture group excellent condition was seen in 68% of patients compared to 53% in case of propofol group. Satisfactory condition obtained in 15% of admixture group compared to 30% in case of propofol group.

Elvan *et al* (2002) conducted a study on intubating conditions for direct laryngoscopy comparing propofol, etomidate and thiopentone with remifentanil without muscle relaxant.

Clinically acceptable intubating conditions were observed in 93.3%, 66.7%, and 40.0% of patients in

propofol, thiopentone and etomidate, respectively. Overall conditions at intubation were significantly ($P < 0.05$) better, and the frequency of excellent conditions was significantly ($P < 0.05$) higher in the propofol group compared with the thiopentone and etomidate groups. But in our study, we compare success rate of supraglottic airway device insertion.[11] From our observations we interpret that Propofol provides higher percentage of excellent condition for i-gel insertion with fewer side effect during airway manipulation compared to etomidate and thiopentone.

CONCLUSION

Results suggest that not all induction agents provide ideal conditions for supraglottic airway device insertion and that propofol is superior to thiopentone and etomidate when combined with fentanyl. But propofol decreased arterial blood pressure during induction of anaesthesia to a greater extent. Since a hypnotic agent having minimal effects on cardiovascular function can be advantageous for patients in whom a decrease in arterial pressure may not be well tolerated, etomidate with adjuvants like fentanyl and midazolam is safer alternative to Propofol.

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