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I Gel Versus Endotracheal Tube for Pediatric day Care Surgeries

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Abstract

Background: The I-gel TM (Intersurgical, Wokingham, UK) is a novel second generation supraglottic airway device with a non inflatable cuff, made up of a unique soft gel like material (Styrene Ethylene Butadiene Styrene). The device is transparent and latex free. It is easy to insert and has minimal tissue compression. An integrated gastricchannel is provided for passage of gastric drainage tube to empty the stomach. *Objectives:* The aim of the present study wasto compare the efficacy of I-gel with Endotracheal tube in airway management in children. *Materials and methods:* This study was conducted at tertiary referral centre for new born and children with Children of age 2 to 6 years, weighing 10 to 18 kg, ASA Grade I-II posted for elective day care procedures. *Results:* Males were predominant in both the groups. Insertion and ease of placement was successful in first attempt in 86.66% of patients in Group I as compared to 80% in Group II (ET). 13.33% of patients in Group I (3 out of 30) required adjustment like jaw thrust, neck extension or reinsertion because of forward displacement. One patient had been recorded in Group I (I- gel) as failure because of inadequate ventilation and required endotracheal intubation. 20% in Group II required second attempt for ET tube placement because of early learning curve of anaesthesia trainees in the teaching institute. There was a significant rise in HR & BP in Group II during laryngoscopy and intubation and at the time of extubation. Airway related adverse events (coughing, breathholding, laryngospasm) were more in Group II when compared to Group I. *Conclusion:* The I-gel is ease of insertion, success rates, minimal hemodynamic perturbations and minimum perioperative adverse effects.

Keywords: Pediatric Airway Management; I-gel; Endotracheal Intubation; Supraglottic Airway Devices (SAD).

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Introduction

The boundaries of day-care surgery are redefined exponentially with time. The rapidly changing financial situation in the world has led to the increase in the incidence of ambulatory surgery. The advances in surgery, anaesthesia and pain management have allowed huge expansion of this modality of care with a consequent reduction in the need for hospitalization. Though data are not available for India, there is huge potential in view of a massive population of 1.2 billion and recent huge expansion in the private sector has created an opportunity for expansion in day care surgery in India.

Advances in drugs, techniques and devices is transforming the quality and efficacy of daycare

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anaesthesia by reducing perioperative adverse events and facilitating efficient pediatric airway management for disposition or discharge of the patient on the same day of surgery [1].

The endotracheal tube remains the gold standard for the secured airway but supraglottic airway devices (SAD) are an evolving future and may cause less laryngeal irritation than endotracheal tubes and has advantage of placing without visualisation of the airway (Brimacombe, 1995) [2].

I gel device which was first demonstrated in 2007 in UK, provides a good anatomical seal of the pharyngeal, laryngeal and perilaryngeal structures. This device is easy to use and has low pharyngolaryngeal morbidity.

Materials and Methods

This study was conducted at Niloufer hospital, a tertiary referral centre for new born and children with over 3000 pediatric surgeries per annum. Children of age 2 to 6 years, weighing 10 to 18 kg, ASA Grade I-II posted for elective day care procedures such as herniotomy, hydrocoele & hypospadias repairs, Orchiopexy etc., with surgery duration less than one hour were included in the study done over a period of three months. They were randomly divided into two groups of 30 each. Airway management included I-gel in Group I patients and Endotracheal tube in Group II. The airway management was done in all patients by the postgraduate trainees with two years experience under the supervision of senior faculty.

Patients with anticipated difficult airway, upper respiratory tractinfection, emergency surgeries, ASA Grade III/IV, oropharyngeal pathology and full stomach patients were excluded from the study. Informed and written consent was obtained from parents.

All patients were premedicated with midazolam inj. 0.05 mg/kg intravenously. Anaesthesia was induced with intravenous fentanyl 2 µg/kg and propofol 3 mg/kg with atracurium 0.5 mg/kg. Muscle relaxant was used in all surgical procedures as part of a balanced anaesthesia technique and controlled ventilation for uniformity and also to decrease airway traumatism related to device insertion. However muscle relaxation is not routinely recommended when using I-gel. Standard monitoring for all patients included ECG, pulse oximetry, capnometry and non invasive blood pressure measurement.

Correct placement of the device was assessed by visible chest expansion on manual ventilation, absence of audible leak and good tidal volume ventilation, bilateral air entry and square shaped capnograph.

Anaesthesia was maintained with O_2 and N_2O (50:50) and sevoflurane 1%-2% using Jackson Ree's modified circuit and controlled ventilation. At the end of surgery stomach was aspirated with the help of gastric tube and neuromuscular block was reversed. Extubation was done when the patient was fully awake.

During the insertion of I-gel and ETT the following parameters were noted. Ease of insertion and number of attempts required for placement of the device.

The ease of device insertion was recorded as

1. Very Easy : No resistance to insertion in the pharynx in a single manoeuvre

2. Easy : When insertion into the pharynx required manoeuvre like jaw thrust

3. Difficult : When more than two manoeuvres were needed like device rotation and jaw thrust.

Failure of device was considered when inadequate ventilation with two attempts needing an alternate SAD device or endotracheal intubation.

Hemodynamic variations such as heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) as well as oxygen saturation (SpO_2) and $EtCO_2$, were recorded before and during induction and later every 5, 10, 15, 20, 30 minutes of surgery, during removal and in the postoperative period for 30 min. Airway related complications like coughing, breath holding, hypoxemia, laryngospasm and bronchospasm were noted.

The stastical software of Microsoft word and excel have been used to generate graphs, tables, etc. Results on continuous measurements are presented as Mean±SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. p value <0.05 was considered significant

Results

Table 1: Demographic data

Variables		Group-I	Group-II	P value
Age (years)		2.54+1.26	2.68+1.30	>0.05
Weight (kg)		10.2+2.30	9.82+2.52	>0.05
Sex	Male	23	24	>0.05
	Female	7	6	>0.05
		ASA grade		
I		28	27	>0.05
II		2	3	>0.05

Table 2: Insertion Characteristics

		Group-I	Percentage	Group-II	Percentage
No of attempts for insertion	First attempt	26	86.66%	24	80%
	Second attempt	3	13.33%	6	20%
	Failure	1	3.33%	0	-
Ease of Insertion	Very easy	26	86.66%	23	76.66%
	Easy	3	10%	5	16.66%
	Difficult	1	3.33%	2	6.66%

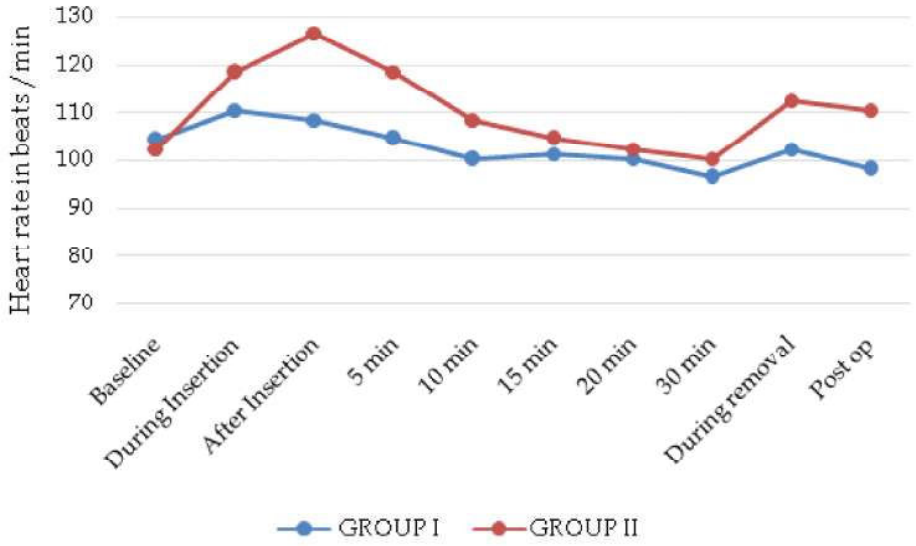

Fig. 1: Heart rate in comparison in both groups

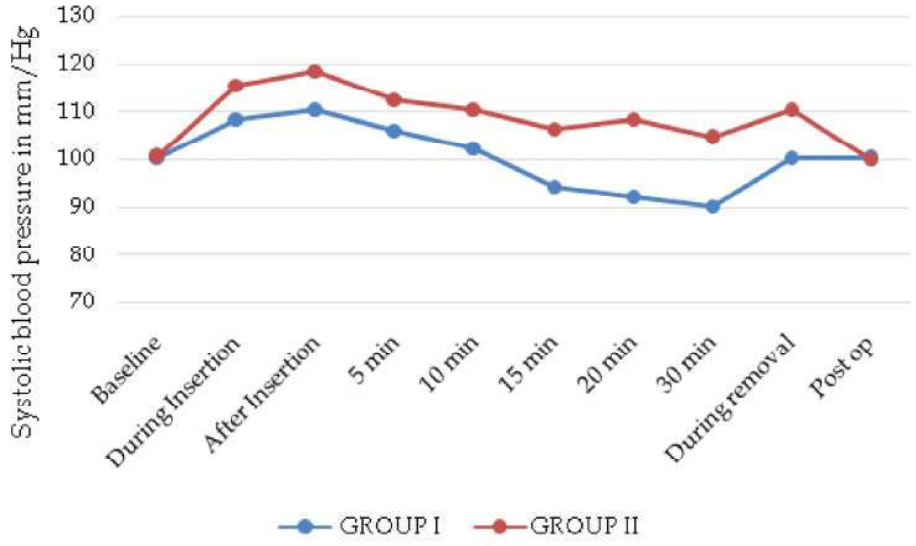

Fig. 2: Systolic Blood pressure in comparison in both groups

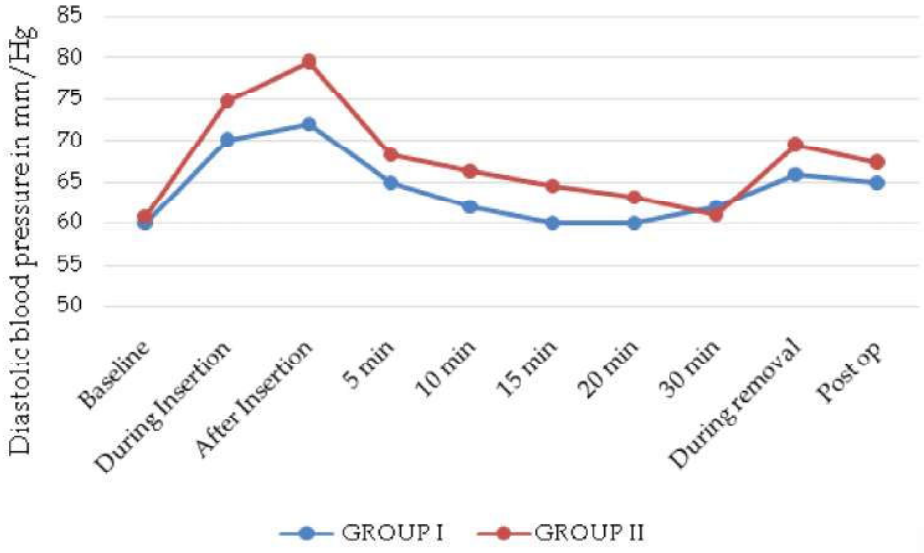

Fig 3: Diastolic Blood pressure in comparison in both groups

Table 4: Postoperative Airway Complications

	Group-I	Percentage	Group -II	Percentage
Coughing	2	6.66%	5	15%
Breath holding	1	3.33%	1	3.33%
O2 desaturation	-		1	3.33%
Laryngospasm	-		1	3.33%
Bronchospasm	-		-	

Demographic data (Table 1) like age, sex, weight, ASA status were comparable in both the groups. Males were predominant in both the groups.

We studied 47 male and 13 female patients of age 2-6 years weighing 10-18 kg with a mean age group of 2.54±1.26 in Group I and 2.68±1.30 yrs in Group II. I - gel sizes of 1.5 (ideal for infants 5-12 kg) and 2.0 (ideal for small paediatric 10-25 kg) were used according to manufacturer's recommendations.

Insertion and ease of placement was successful in first attempt in 86.66% of patients in Group I as compared to 80% in Group II (ET). 13.33% of patients in Group I (3 out of 30) required adjustment like jaw thrust, neck extension or reinsertion because of forward displacement. One patient had been recorded in Group I (I-gel) as failure because of inadequate ventilation and required endotracheal intubation. 20% in Group II required second attempt for ET tube placement because of early learning curve of anaesthesia trainees by same resident in our teaching institute.

The MAP and HR did not significantly differ from the base line values at any point of measurement in Group I patients during insertion or at the time of removal when compared to Group II patients as shown in Figure 1 to 3. There was a significant rise in HR & BP in Group II during laryngoscopy and intubation and at the time of extubation.

Airway related adverse events (coughing, breathholding, laryngospasm) were more in Group II when compared to Group I as shown in Table 4.

Discussion

The major responsibility of the anaesthesiologist is to provide adequate ventilation to the patient because airway related problems are still the most common cause of anaesthesia related morbidity and mortality. Though the tracheal intubation is the gold standard for maintaining a patent airway during anaesthesia, laryngoscopy and endotracheal intubation produce hemodynamically detrimental reflex sympathetic stimulation or response which may be detrimental in decompensated states. Pediatric respiratory adverse events often occur due to respiratory tract reactivity secondary to mechanical or chemical stimulation perioperatively [4].

Supraglottic airway devices like Laryngeal mask airway (LMA) and I- gel are less invasive compared

to endotracheal tube and has the advantage of ease of insertion without the use of direct laryngoscopy resulting in minimal hemodynamic responses and significant reduced incidence of postoperative respiratory complications [5]. Advantages of supraglottic airway devices over endotracheal tube include less incidence of sore throat and is less stimulating especially in a reactive airway [6]. The I-gel with a noninflatable cuff provides a secure airway rapidly, more protection against gastric insufflation with an inlet for gastric tube and minimal postoperative complications [7].

I-gel is very easy to insert without the use of laryngoscopy and especially useful for trainees as it has a fast learning curve and a low failure rate is [8,9]. Further endotracheal tube needs experience to master the art of tracheal intubation. In our study the success rate of insertion at first attempt was very high (86.66%) with only one failure requiring use of endotracheal tube secondary to misfit of device with considerable audible leak and inadequate tidal volume ventilation and. Lopez et al., Beringer et al., also confirm the ease of insertion with I-gel and successful maintenance of the device [2,8].

In our study there were minimal hemodynamic changes at insertion, intraoperative and immediate postoperative periods compared to children with endotracheal intubation.

Ismail et al. [10], measured Intraocular pressure (IOP), hemodynamic responses in 60 patients divided into three groups constituting LMA, I-gel, Endotracheal tube and they concluded that I-gel insertion provided a better stability of IOP and hemodynamic system when compared with LMA or E.T tube insertion. Our result was also similar with that of Ismail et al,.

Anjana Das [11] has proved that I-gel was more easily inserted than LMA-ProSeal (90% vs. 83.33% respectively). I-gel insertion time was shorter than PLMA (14.9 vs. 20.0 sec respectively) and was statistically significant. Hemodynamics (HR, BP) were less altered in I-gel than PLMA and the results were statistically significant ($p < 0.05$). The enhanced hemodynamic response in the PLMA group compared to the I gel group may be due to pressure exerted on the wall of the pharynx by the cuff of the airway device and further Shanmugavelu G et al. [12] in their study demonstrated that I- gel effectively confirms the perilaryngeal anatomy despite lack of inflatable cuff and produce less sympathetic response [14].

Thus I-gel is ideal for patients requiring minimal alteration in hemodynamics during the perioperative period.

Tait et al. [13], have demonstrated that the ability of the laryngeal mask airway to maintain a stable airway without stimulating the larynx and trachea can decrease the incidence of respiratory adverse events in children more so in children with recent or active URIs [11]. In our study postoperative complications like coughing, desaturation, breath holding and laryngospasm were less in the I-gel group compared to the endotracheal tube and observations are similar with that of Tait et al.

Conclusions

The I-gel is an innovative reliable supraglottic airway device with favourable characterstics regarding ease of insertion, success rates, minimal hemodynamic perturbations and perioperative respiratory adverse events when compared with endotracheal tube in pediatric airway management.

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