

# Comparison of Laryngeal Mask Airway Supreme, i-gel™ and Ambu Auragain in Children for Airway Management

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## Abstract

**Background and Aims:** This was a prospective, randomised study performed on 180 children of ASA I/II, aged 5-14 years, planned for elective surgery and requiring general Anaesthesia in the Department of Anaesthesiology, critical care, Pain and Palliative Medicine, Dr Sushila Tiwari Government Medical College, Haldwani. To compare the performance of three airway devices, the laryngeal mask airway supreme, i-gel™ and Ambu Auragain in children for airway management.

**Methods:** children were randomized into three groups (60 each): Group S (LMA Supreme), Group I (i-gel) and Group A (Ambu Auragain). The primary outcome was the insertion time. We also assessed the number of insertion attempts, ease of insertion, haemodynamic parameters and complications. Intergroup differences were compared using one-way analysis of variance (ANOVA) post - hoc correction for continuous data and Kruskal Wallis test for categorical variables.

**Results:** Demographic data did not differ between the three groups. Insertion time for i-gel (18.5 (18-20) sec) was shorter than for the LMA Supreme (22 (20-22) sec) and Ambu Auragain (20.5 (19-23) sec) (P = 0.02). There were no differences in the number of attempts, ease of insertion, haemodynamic parameters and complications between all three groups.

**Conclusion:** LMA Supreme, Ambu Auragain and i-gel provided a similar performance of airway management in children. The success rate of insertion and ease of intubation of LMA Supreme, Ambu Auragain and i-gel were comparable. i-gel has a lesser time of insertion than LMA Supreme and Ambu Auragain.

**Keywords:** Laryngeal mask airway, Supreme, Ambu auragain, i-gel™, children.

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## 1. Introduction

For the Anaesthesiologists and critical care providers, airway management remains one of the most challenging tasks, whether it is adult or paediatric patients. One should also consider the uniqueness of paediatric airway management. Dr Archie Brain developed an airway device that was less stressful to the patient as compared to

tracheal intubation, and as safe as facemask and airway. He hoped that his device would benefit for cases where mask ventilation and intubation was particularly difficult. Thus it gives anaesthesiologists a safer alternative to complex intubation, especially in emergency scenarios. [1]

Supraglottic airway devices (SADs) are the part of routine and emergency paediatric airway management, including use in the difficult airway management and neonatal resuscitation [2]. First-generation devices are simple airway tubes attached to a mask that rests over the glottic opening (e.g. LMA classic, flexible, cobra PLA). A second-generation device has a gastric access channel that allows for gastric venting and gastric tube placement (LMA Proseal, supreme, i-gel™, Ambu Auragain).

Introduction of LMA (laryngeal mask airway) was one such advancement. Laryngeal mask airway (LMA) offers several advantages, including ease of placement, lower drug requirement, reduced haemodynamic response, reduced intracranial and intraocular tension, smoother emergence and a lower incidence of airway trauma and complication.

LMA Supreme is a single-use supraglottic airway device, easy insertion without the need for digital or introducer tool guidance. It forms two seals: one at the upper oesophageal sphincter and the other over the glottic opening. It also has a fixation tab; a rectangular structure which projects over the patient's upper lip. LMA supreme designed to facilitate easy insertion and fixation [3].

i-gel™ is a soft, gel-like, non-inflatable cuff, made of thermoplastic elastomer. It has widened, flattened stem with a rigid bite-block that acts as a buccal stabiliser to reduce axial rotation and malpositioning. It has oesophageal vent through which a gastric tube can be passed [4-6].

Ambu Aura Gain is a newly introduced supraglottic airway device. It is anatomically curved with integrated gastric access and can use as a conduit for direct endotracheal intubation assisted by a flexible scope. [7]

## 2. METHODS

After ethical committee Clearance 180 ASA grade I/II patients aged between 5-14 years children undergoing surgery of duration 1-2 hours under general anaesthesia with controlled ventilation included in the study. Patients randomly divided into three equal groups: Group S – (LMA supreme, n=60), Group I- (i-gel™, n=60) and Group A- (Ambu Auragain, n=60). Randomization procedure done by using closed envelopes method. All patients were pre-medicated with injection Glycopyrrolate (0.01mg/kg) i.v., Tramadol (1.5mg/kg)i.v., injection ranitidine (1mg/kg) i.v. All the patients were pre oxygenated with O<sub>2</sub> via facemask for 3 min. General Anaesthesia (GA) was induced with injection propofol 2mg/kg i.v., injection succinylcholine 1.5mg/kg i.v. and were manual ventilation done.

Once the adequate depth of anaesthesia achieved either of LMA supreme or i-gel™ or Ambu AuraGain

appropriate for weight inserted. The selection of the SAD size based on the children's actual body weight (size 2 for 10–20 kg, size 2.5 for 20–30 kg). The device insertion technique was based on manufacturer recommendations. Once in place, the cuff was inflated according to the size of the SAD, as per the manufacturer's instruction manual (2.0 size: 10 ml, and 2.5 sizes: 14 ml). Correct placement of LMA confirmed by bilateral symmetrical chest expansion on manual ventilation and square waveform on capnography. After fixing the device, patient's lungs were ventilated with a tidal volume of 8-10ml/kg and anaesthesia maintained with 50% Oxygen, 50% Nitrous oxide and sevoflurane (1-3%) and injection rocuronium (0.8mg/kg).

Haemodynamic parameters- Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), Mean arterial pressure (MAP), arterial oxygen saturation (Spo<sub>2</sub>), end-tidal CO<sub>2</sub> (ETCO<sub>2</sub>) monitored.

At the end of the surgical procedure, anaesthesia reversed with a standard dose of Neostigmine (0.05mg/kg) and Glycopyrrolate (0.2mg/1mg Neostigmine), and the device removed. The tip of the LMA examined for the presence of blood. In the evening of the same postoperative day, we recorded any discomfort while swallowing water or food, sore throat and hoarseness if present.

More than three attempts taken as a failure and the child were intubated by conventional laryngoscope with ET tube, and surgery performed.

We analysed data using IBM SPSS Statistics 24 software. Continuous numerical variables presented as mean (SD) or Median (IQR) and intergroup differences were compared using one-way analysis of variance (ANOVA) with posthoc correction. Categorical variables were presented as a ratio or as n (%), and between-group differences compared using the Kruskal-Wallis test. P<0.05 were considered statistically significant.

## 3. Results

Demographic data did not differ between the three groups. Males were predominant in our study (Table 1). Insertion success rate was similar in all three groups. Insertion time for the i-gel (18.5 (18-20) sec) was shorter than for the LMA Supreme (22 (20-22) sec) and Ambu Auragain (20.5 (19-23) sec) (P = 0.02) and there were no differences in number of attempts, ease of insertion (Table 2), haemodynamic parameters (Table 3, 4), other parameters (Table 5, 6) and complications between all three groups. This study demonstrated that all three supraglottic airway devices provided almost similar performance for airway management in children, best being i-gel.

**Table 1: Demographic characteristics of three groups**

Patient characteristics	Group S	Group A	Group I	P Value
Age (Yrs)	8.98±3.40	9.52±3.44	9.40±3.13	P > 0.05
Weight (kg)	26.02±12.48	27.18±13.09	27.03±12.25	P > 0.05
Height (cm)	124.08±20.27	126.55±21.37	124.88±21.04	P > 0.05
Sex (M/F)	45/15	48/12	45/15	P>0.05

Data presented as mean ±SD or (range) or number of patients  
Group S- Supreme, Group A- Ambu Auragain, Group I- i gel™

**Table 2: Clinical performance of all three Supraglottic airway devices**

Parameters	Group S	Group A	Group I	P Value
Number of attempts (1/2)	54/6	56/4	56/4	0.73
Time of insertion of SAD	20 (20-22)	20.5 (19-23)	18.5 (18-20)	0.02
Ease of insertion (1/2)	54/6	54/6	56/4	0.76
<b>Complication</b>				
Sore throat	1	4	2	0.35
Dysphagia	1	3	2	0.61
Hoarseness	2	1	3	0.61
Blood stained	3	2	1	0.61

Values expressed as mean ±SD, median (IQR) or a number of patients.  
Ease of insertion of the device as grade 1=no resistance, 2=mild resistance

**Table 3: Comparison of Heart rate at different period of time between the three groups**

Heart rate	Group S (n=60)	Group A (n=60)	Group I (n=60)	P value
Baseline	107.03±12.15	105.45±12.25	106.38±10.21	0.75
After induction	111.08±11.76	108.97±11.99	109.68±10.07	0.58
After intubation	115.50±11.43	113.57±11.85	113.77±10.07	0.58
At 1 minutes	113.45±11.47	110.85±11.73	111.70±10.26	0.43
At 3 minutes	111.92±11.26	109.75±11.62	110.25±10.02	0.53
At 5 minutes	109.57±11.48	107.63±12.16	108.23±9.75	0.62
At 10 minutes	107.12±12.03	105.65±12.20	106.55±9.90	0.78
At 15 minutes	106.40±12.09	104.83±12.29	106.02±10.01	0.74

**Table 4: Comparison of BP at different period of time between the three groups**

Blood Pressure		Group S	Group A	Group I	P Value
Baseline	SBP	98.28±7.08	98.60±7.01	99.10±7.47	0.82
	DBP	54.45±4.06	54.98±3.52	54.67±3.81	0.74
	MAP	68.90±4.28	69.48±4.34	69.25±4.24	0.75
After induction	SBP	99.35±6.95	99.50±6.99	100.37±7.53	0.70
	DBP	54.10±4.08	54.77±3.69	54.37±3.92	0.64
	MAP	69.12±4.29	69.55±4.43	69.53±4.47	0.83
After intubation	SBP	101.83±6.79	101.88±6.88	102.57±7.59	0.82
	DBP	55.80±4.08	56.42±3.82	55.98±3.74	0.67
	MAP	70.90±4.19	71.40±4.43	71.40±4.42	0.76
At 1 min	SBP	100.33±6.77	100.27±6.76	101.10±7.37	0.77
	DBP	54.52±3.98	55.25±3.74	54.70±3.70	0.55
	MAP	69.68±4.25	70.23±4.34	70.10±4.33	0.76
At 3 min	SBP	99.13±6.68	99.33±6.96	99.93±7.39	0.81
	DBP	53.38±3.79	54.10±3.93	53.40±3.61	0.49
	MAP	68.67±4.25	69.45±4.97	68.97±4.29	0.63
At 5min	SBP	99.48±6.90	99.23±6.76	100.25±7.24	0.71
	DBP	52.48±3.49	52.98±3.57	52.48±3.13	0.65
	MAP	68.18±4.04	68.55±4.15	68.43±3.96	0.88
At 10min	SBP	100.08±6.01	100.37±5.75	101.67±6.36	0.31
	DBP	51.78±2.85	52.28±3.01	51.67±2.68	0.45
	MAP	67.87±3.29	68.28±3.57	68.43±3.53	0.65
At 15min	SBP	100.20±5.90	100.40±5.69	101.62±6.88	0.39
	DBP	51.30±2.36	51.43±2.35	51.23±2.06	0.88
	MAP	67.88±2.99	67.75±3.08	68.03±3.19	0.88

**Table 5: Comparison of SPO<sub>2</sub> at different period of time between the three groups**

SPO <sub>2</sub>	Group S (n=60)	Group A (n=60)	Group I (n=60)	P value
Baseline	98.68±1.04	98.88±0.84	98.92±0.94	0.35
After induction	98.98±0.77	99.07±0.78	99.10±0.73	0.68
After intubation	98.40±0.64	98.60±0.58	98.60±0.74	0.16
At 1 minute	98.88±0.69	98.90±0.66	98.98±0.70	0.69
At 3 minutes	98.87±0.65	98.98±0.59	98.93±0.68	0.61
At 5 minutes	98.93±0.68	99.05±0.65	98.98±0.74	0.65
At 10 minutes	99.13±0.81	99.07±0.82	98.97±0.80	0.53
At 15 minutes	99.15±0.75	99.25±0.71	99.20±0.73	0.75

**Table 6: Comparison of ETCO<sub>2</sub> at different period of time between the three groups**

ETCO <sub>2</sub>	Group S (n=60)	Group A (n=60)	Group I (n=60)	P value
Baseline	36.62±2.08	37.20±1.78	37.23±1.64	0.12
After induction	36.92±1.85	37.37±1.65	37.43±1.38	0.17
After intubation	37.15±1.76	37.58±1.73	37.78±1.40	0.10
At 1 minute	37.32±1.57	37.80±1.64	37.68±1.44	0.21
At 3 minutes	37.62±1.63	37.95±1.69	37.88±1.48	0.07
At 5 minutes	38.04±2.24	38.17±2.18	38.53±1.89	0.06
At 10 minutes	37.47±2.36	37.92±2.25	38.25±2.18	0.16
At 15 minutes	37.35±1.89	37.70±1.83	37.82±1.69	0.34

### 3. Discussion

There were various studies on the safety and efficacy of airway maintenance when using supraglottic airway devices on children as anatomy and physiology of children differ from adults. So, we conducted a clinical study comparing safety and efficacy of the three supraglottic devices LMA Supreme, i-gel™ and Ambu AuraGain in anaesthetised patients on mechanical ventilation undergoing elective surgical procedures.

LMA Supreme was successfully inserted on the first attempt in 90% of patients, while in i-gel™ and Ambu Auragain, it was 93.3% of patients (p=0.73). All three groups are comparable and statistically not significant in our study, so all three SGA are equally efficacious. Lee *et al*[8] compared i-gel™ and Laryngeal Mask Airway Supreme during general anaesthesia in 60 infants in which 100% insertion success rate during 1st attempt with i-gel™ and 96% with supreme (p=1.00), which is not comparable with our study but the difference is statistically not significant.

A study by Jagannathan *et al*[9] compared Ambu Auragain and LMA Supreme in children with a success rate of insertion on 1st attempt at 96% and 100% respectively (p=0.5). However, it is not comparable with our study, and the difference is statistically not significant. In our study 2nd attempt was successful in 10% patients in LMA-supreme, while in i-gel™ and Ambu Auragain it was successful in 6.7% patients (p=0.73). A study conducted by Jagannathan *et al*[9] 2<sup>nd</sup> attempt was successful in 2% patient in LMA supreme and 2% patient in Ambu Auragain (p=0.5). Although it is not comparable with our study and difference is statistically not significant.

90% of children had no resistance during insertion of LMA Supreme and Ambu Auragain while in i-gel™, 93% of children have no resistance during insertion. There was moderate resistance during insertion in 10% of children in LMA supreme and LMA Auragain while in 6.67% children in i-gel™ respectively (p=0.7). A study conducted by Arslan *et al*[10] compared LMA Proseal and LMA Supreme in children. In LMA Proseal they did not have resistance while insertion and in LMA Supreme, 93% of children had no resistance but in 6.67% of children had moderate resistance (p=0.2). Although it is not comparable with our study and the difference is statistically not significant. Jagannathan *et al*[9] compared LMA Ambu Auragain and supreme in children, no resistance was seen in 76% of children in LMA Ambu Auragain and 90% children in LMA supreme (p=0.09). It is comparable with LMA supreme with our study but not comparable with LMA Ambu Auragain. 22% of children had moderate resistance in LMA Ambu Auragain and 8% children in supreme. 2% of children in both LMA Ambu Auragain and supreme had severe resistance, respectively. The difference is statistically, not significant.

The median time for effective placement of device was lowest for i-gel™, i.e. 18.5 seconds (range 18- 20 secs), followed by 20.5 secs for Ambu Auragain (range 19- 23 secs). LMA Supreme had the maximum median insertion time of 22 secs (range 20-22 secs) of all the three devices. Statistical significance was seen between effective insertion time of all the three devices (p=0.02).

Mihara *et al*[11] compared the clinical performance of i-gel™ and Ambu Auragain in children with insertion time 17.1±4.5sec and 21.3±6.5sec

respectively for i-gel™ and Auragain ( $p < 0.001$ ) which is comparable with our study and statically significant. In Jagannathan *et al*[9] the insertion time for LMA Ambu Auragain and LMA Supreme were 13 (12 to 15) and 13 (12 to 14) sec respectively, which is not comparable with our study.

We also compared systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate, SPO<sub>2</sub> and ETCO<sub>2</sub> between the three groups at different time intervals, i.e. Baseline, Induction, intubation, 1 min, 3 mins, 5 mins, 10 mins and 15mins after induction. We found all the three groups were comparable to the parameters as mentioned above, and the results were statistically insignificant.

The fact that all three are Supraglottic devices sit in the hypopharynx and stimulate the stretch receptors, which are present above the vocal cords. Hence, changes in the blood pressure and the heart rate at different time intervals were comparable between the three groups. SBP mean value was 100.33±6.77 for LMA Supreme, 100.27±6.76 for Ambu Auragain, 101.10±7.37 for i-gel™ ( $p=0.77$ ) and DBP mean value was 53.38±3.79 for LMA Supreme, 54.10±3.93 for Ambu Auragain, 53.40±3.61 for i-gel™ ( $p=0.49$ ), respectively which were comparable and statistically not significant. In our study, the MAP mean value was 68.67±4.25 for LMA supreme, 68.28±3.57 for LMA Auragain and 68.43±3.53 for i-gel™ ( $p=0.65$ ) which was statistically not significant. It was comparable to the study conducted by Gu *et al*. [12] had 69.14±7.21 for LMA supreme, 70.98±5.67 for

LMA AuraOnce and 69.98±7.51 for i-gel™ ( $p=0.269$ ). Heart rate mean value in our study was 109.57±11.48 for LMA Supreme, 107.63±12.16 for LMA Auragain and 110.25±10.02 for i-gel™ (0.78) respectively, which are statistically not significant. A study by Gu *et al*. [12] had 114.97±5.35 for LMA supreme, 114.64±6.62 for LMA AuraOnce and 112.96±7.31 for i-gel™ ( $P=0.148$ ) which were comparable with our result but statistically not significant. In our study, the SPO<sub>2</sub> mean value was 99.15±0.75 for LMA supreme, 99.25±0.71 for LMA Auragain and 99.20±0.73 for i-gel™ ( $p=0.75$ ). Similar result found in a study conducted by Arslan *et al*. [10] SpO<sub>2</sub> 99.9±4.3 for LMA Proseal and 99.9±0.3 for supreme ( $p=0.7$ ). The mean value of ETCO<sub>2</sub> for LMA Supreme was 37.35±1.89, 37.70±1.83 for LMA Auragain and 37.82±1.69 for i-gel™ ( $p=0.34$ ) respectively, which were comparable and statistically not significant. In a study by Arslan *et al*. [10] had ETCO<sub>2</sub> 40±5.2 for Proseal and 40.5±4.5 for Supreme ( $p=0.7$ ), which is comparable with our study but statistically not significant.

Incidence of sore throat was seen in 1.6%, 6.6% and 3.3% patients with LMA Supreme, Auragain and i-

gel™ ( $p=0.35$ ) respectively. In Gu *et al*. [12] study the incidence of sore throat was 16.1%, 3.1% and 18.7% for LMA supreme, AuraOnce and i-gel™ ( $p=0.12$ ). Incidence of sore throat with i-gel™ was comparable but not with LMA Supreme, and the difference is statistically not significant. In our study incidence of dysphagia was seen in 1.6%, 5%, 3.33% patients with LMA Supreme, Auragain and i-gel™ respectively ( $p=0.61$ ). Hoarseness of voice was seen in 3.3%, 1.67% and 5% ( $p=0.61$ ) patients with LMA Supreme, Ambu AuraGain and i-gel™ insertion respectively in our study. A study conducted by Gu *et al*. [12] 3.1%, 9.3% and 3.2% ( $p=0.614$ ) Hoarseness were noted in patient with LMA Supreme, AuraOnce and i-gel™. The study was comparable with LMA Supreme but not with i-gel™.

Blood-stained on LMA was seen in 5 %, 3.3% and 1.67% patient in LMA Supreme, Auragain and i-gel™ respectively ( $p=0.61$ ). Gu *et al*[12] did a study had 3.2%, 3.1% and 0% in LMA supreme, AuraOnce and i-gel™ ( $p=0.7$ ). Incidence of blood-stained in LMA Supreme and i-gel™ noted in our study was not comparable with the study done by Gu *et al*. [12] There was no incidence of aspiration, bronchospasm and Laryngospasm in our study. Majority of the patients from our study did not have postoperative complications which could be due to the high success rate in first insertion attempts and results were comparable in all the three groups.

#### 4. Conclusion

This study demonstrated that LMA Supreme, Ambu Auragain and i-gel provided a similar performance of airway management in children. Success rate of insertion of LMA Supreme, Ambu Auragain and i-gel were comparable and ease of intubation was also comparable. In terms of total time taken for insertion, i-gel has lesser time of insertion than LMA Supreme and Ambu Auragain. All three LMA Supreme, Ambu Auragain and i-gel are equally efficacious in children for securing airway in controlled ventilation. i-gel requires less manipulation, no cuff inflation and hence securing an airway is rapid with i-gel in most of the children.

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