

# Comparative Evaluation of I Gel and Cuffed ET Tube for Anesthesia in Abdominal Surgery

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## Abstract

**Background:** This study aims to test and compare Endo tracheal tube and i-gel in terms of their: Efficacy: Difference in the leak fraction between two airway devices before and after pneumoperitoneum with different tidal volumes and comparison of oropharyngeal leak pressure. Ease of insertion: Number of attempts required for optimal positioning. **Subjects and Methods:** Sixty patients, ASA I–II, were randomly selected to the study. Standard anaesthetic technique was used for all patients. The i-gel was then inserted. The lungs were ventilated at three different tidal volumes (6, 8 and 10 ml kg<sup>-1</sup>) using volume controlled ventilation (VCV). The leak volume was calculated as the difference between the inspired and expired tidal volumes. The leak fraction was also calculated as the leak volume divided by the inspired tidal volume. These observations were recorded with every tidal volume before and after pneumoperitoneum with the i-gel and the conventional tracheal tube. **Results:** We found oropharyngeal leak pressure for i gel as 26cm of H<sub>2</sub>O and there was no leak in endotracheal tube group even at 40 cm of H<sub>2</sub>O peak air way pressure. Before and after pneumoperitoneum there was no statistically significant difference in leak fraction or leak volume between i-gel and tracheal tube at tidal volume 6ml kg<sup>-1</sup>. At 8 and 10 ml kg<sup>-1</sup> there was statistically significant difference between i-gel and tracheal tube both before and after pneumoperitoneum. **Conclusion:** In our study we found that i-gel airway can be used safely and effectively during volume controlled ventilation with low and moderate tidal volumes.

**Keywords:** I-gel; Leak fraction; Pneumoperitoneum; Cholecystectomy.

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## Introduction

Safe and effective airway management is the foundation of quality anaesthetic practice. Supraglottic airway devices have revolutionized airway management since the invention of the LMA Classic (LMA North America Inc., California, USA) by Dr Archie Brain in 1988. They fill a niche between the face mask and the endotracheal tube in terms of both anatomical position and degree of invasiveness. The ease of insertion, safety and the global increase in the number of day care surgeries have led to their increased use in routine anaesthetic practice.

Since the introduction of the LMA Classic, several laryngeal masks have been introduced which differ in shape, stiffness, cuff properties and constituent material. The Ambu Aura 40 (Ambu A/S, Copenhagen, Denmark) laryngeal mask and the I-gel (Intersurgical Ltd, Wokingham, U.K.) are two such devices. Apart from being used to maintain the airway routinely during an anaesthetic, laryngeal masks have now come to play an important role in the management of difficult airways and in emergent situations such as cardio-pulmonary resuscitation.

The i-gel (Intersurgical Ltd., Wokingham, UK) is a new supraglottic airway device (SAD) made of thermoplastic elastomer which is soft, gel-like and transparent. Studies on Cadaver showed that i-gels effectively conformed to the per-

laryngeal anatomy and consistently achieved proper positioning for supraglottic ventilation.<sup>[1]</sup> Manikins studies and patients have shown that the insertion of the i-gel was significantly easier when compared with insertion of other SADs.<sup>[2-3]</sup> Few studies had been done to evaluate the use of i-gel during controlled ventilation but they did not evaluate its use during procedures with airway pressure more than 25 cm H<sub>2</sub>O.<sup>[4]</sup>

Our study was designed to evaluate the i-gel sealing pressure and as effective airway as cuffed tracheal tube during volume controlled ventilation in elective abdominal surgery. This study aims to test and compare cuffed endotracheal tube and i-gel in terms of their:

Efficacy: Difference in the leak fraction between two airway devices before and after pneumoperitoneum with different tidal volumes and comparison of oropharyngeal leak pressure. Ease of insertion: Number of attempts required for optimal positioning.

## Subjects and Methods

The study was conducted at Govt. Medical College, Bettiah. The study was approved by the institutional research committee. In this randomised case-control study 60 patients of ASA 1 and 2, participated with BMI <35kg/m<sup>2</sup>, between 18 and 60 years posted for elective surgery. The

sample size was determined by considering a difference in the leak fraction more than 20% for the i-gel when compared to tracheal tube to be significant. They were randomized into two groups of equal number for the use of either i-gel or endo tracheal tube for the maintenance of airway during the anaesthesia.

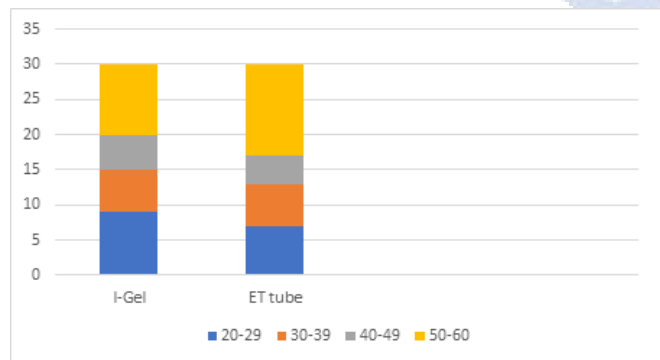
**Results**

After induction of anaesthesia by a suitable intravenous induction agent and after achieving adequate anaesthetic depth, the randomly chosen, appropriately sized airway device was inserted and connected to the breathing circuit.

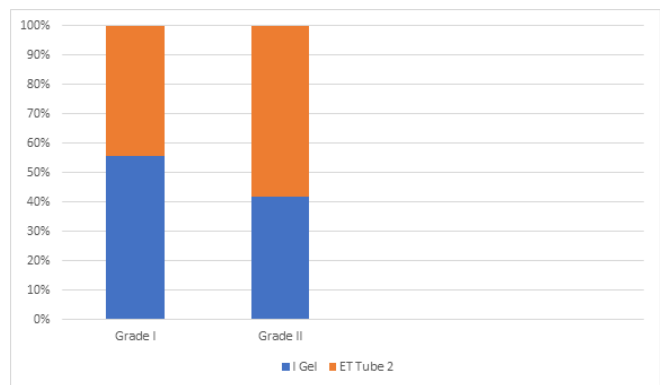
**The following parameters were then studied:**

1. Number of attempts for correct positioning of the device.
2. Oropharyngeal leak pressure
3. Leak volume and leak fraction

The 60 patients participating in the study were distributed equally amongst the group (I Gel and ET Tube). Comparison of the number of patients in different age intervals revealed 9, 6, 5, and 10 subjects were in the age range of 20-29, 30-39, 40-49 and 50-60 respectively for the I-Gel group. The same for the ET Tube group was 7, 6, 4, and 13. [Figure 1] the mean age for the I-Gel group was 40.2±13 and for the ET Tube group it was 42.9±12.



**Figure 1: Comparison of subjects in age range based on group**



**Figure 2:**

Comparison of the subjects in ASA Group showed, 20

participating subjects were ASA Grade I in I Gel Group and , 16 participating subjects were ASA Grade I in ET Tube Group. 10 participating subjects were ASA Grade II in I Gel Group and , 14 participating subjects were ASA Grade II in ET Tube Group. [Figure 2]

The airway characteristics of the patients studied i.e. mouth opening, thyromental distance and the Mallampati score were also noted and statistically analysed, the results were not statistically significant. [Table 1]

**Table 1: Airway characteristics of the patients**

		I Gel	ET Tube
Mouth opening	5 cm	4	6
	>5 cm	26	24
Thyromental distance	6 cm	4	3
	>6cm	26	27
Mallampati grade	1	3	2
	2	27	28

**Discussion**

Laryngeal masks have played an important role in airway management since the introduction of the LMA Classic in 1988. Since then, several laryngeal masks varying in their shape, stiffness, cuff properties and clinical applications have come into existence. In addition to their use during routine anesthetics, they have also been recommended for use in difficult airway scenarios and in cardio-pulmonary resuscitation.<sup>[5,6]</sup>

Supra glottic airway devices have several advantages including lower incidence of sore throat,<sup>[7]</sup> less hemodynamic upset during induction and maintenance of anaesthesia and better oxygenation during emergence.<sup>[8-10]</sup> I-gel is a relatively new disposable supraglottic airway device that has no inflatable cuff. It has an integral bite block, wide bore lumen, and an additional distal lumen that allows for the passage of a gastric tube. These features may give the i-gel an advantage over the LMA and even the Pro-Seal LMA.

There was too much debate among anesthesiologists about using these devices during procedures requiring positive pressure ventilation. During high tidal volume ventilation and laparoscopic procedures peak airway pressure rises and exceeds airway sealing (leak) pressure leading to increase in leak volume and fraction. These findings explain difficulties in maintaining optimum ventilation

We analyzed 60 patients undergoing elective laparoscopic cholecystectomy. They were randomized into two groups of equal numbers using the chit-in-a-box method for the use of either i-gel or endotracheal tube for the maintenance of airway during the anesthesia.

Both groups were comparable in terms of age, sex and ASA status. Height, weight and BMI were also statistically comparable. The airway characteristics of all patients studied in terms of mouth opening, thyromental distance and the Mallampati scores were also comparable

**Ease of Insertion**

After induction of anesthesia, the randomly chosen device (i

gel or endotracheal tube) of appropriate size was inserted and the number of attempts needed for proper positioning of the device was noted. In our study we did not find any significant difference between two and number of attempts require to secure i-gel in our study is comparable to other international studies.<sup>[11]</sup>

### **Oropharyngeal Leak Pressure (OPLP)**

The oropharyngeal leak pressure is the airway pressure at which gases begins to leak around the cuff of the laryngeal mask airway device.

Uppalet al.<sup>[4]</sup> found leak pressure for i-gel 28 (20–35) cm H<sub>2</sub>O by both auscultation and manometer stabilization methods. In our study we concluded that airway leak pressure for i-gel was 26 cm H<sub>2</sub>O. Ishwar et al.<sup>[11]</sup> concluded that airway leak pressure for i-gel was 25.27 cm H<sub>2</sub>O using same methods.

Lu et al.<sup>[12]</sup> compared Pro-Seal laryngeal mask airway (PLMA) with Classic laryngeal mask airway (LMA) for positive pressure ventilation during laparoscopic cholecystectomy. They concluded that PLMA is more effective ventilator device for laparoscopic cholecystectomy than classic LMA. This was attributed to higher leak pressure due to large cuff size (leak pressure was 29± 6 cm H<sub>2</sub>O). We thought that i-gel could be used during such procedures but unfortunately during our study we found leak pressure for i-gel was 26 cm H<sub>2</sub>O which is less than peak pressure during pneumoperitoneum especially at moderate and high tidal volumes.<sup>[13]</sup> In our study we found oropharyngeal leak pressure more than 40 cm of H<sub>2</sub>O for endotracheal tube. We did not correlate anatomical position of i-gel with clinically evident leaks by using fiberoptic bronchoscope.<sup>[14]</sup>

### **Leak fraction and leak volume**

Before and after pneumoperitoneum there was no statistically significant difference in leak fraction or leak volume between i-gel and tracheal tube at tidal volume 6ml kg<sup>-1</sup>. At 8 and 10 ml kg<sup>-1</sup> there was statistically significant difference between i-gel and tracheal tube both before and after pneumoperitoneum.

### **Conclusion**

Our study supports the use of i-gel during VCV in elective laparoscopic cholecystectomy using low to moderate tidal volumes provided that peak airway pressure not more than

device leak pressure. Although leak volume was significant, ventilation and oxygenation were optimal in most cases. Tracheal tube should be inserted if failed ventilation and oxygenation.

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