ORIGINAL ARTICLE

COMPARISON BETWEEN POLY VINYL CHLORIDE (PVC) TUBE AND INTUBATING LARYNGEAL MASK AIRWAY (ILMA) TUBE FOR INTUBATION THROUGH INTUBATING LARYNGEAL MASK AIRWAY (ILMA / LMA-FASTRACH) IN MALLAMPATI (MP) 3 AND 4 PATIENTS

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ABSTRACT: Two groups of 30 patients of ASA 1 and 2 were randomly selected to compare intubation success rates through intubating laryngeal mask airway (ILMA) using conventional polyvinyl chloride (PVC) endotracheal (ET) tube (Group E) and the ET tube provided with ILMA set (Group I) in Mallampati (MP) 3 and 4 patients. Successful intubation in first attempt in Group E patients 15/30 (50%) was less compared to 21/30 (70%) in Group I patients. Incidence of sore throat was higher in Group E patients 12/30 (40%) compared to Group I patients 2/30 (6.67%). Time taken for intubation was longer with PVC tube compared to ILMA tube. Trauma and pilot balloon entanglement was observed with PVC tube. Incidence of esophageal intubation was high in patients intubated with ILMA tube. ILMA tube is economical than conventional PVC tube. ILMA is one of the techniques to manage difficult intubation and not a solution in all difficult intubations.

KEYWORDS: Intubating laryngeal mask airway (ILMA), polyvinyl chloride tube, ILMA tube, Mallampati 3 and 4.

INTRODUCTION: Failed or difficult tracheal intubation is the most important cause of mortality and morbidity in anaesthesia.[1] The intubating laryngeal mask airway (ILMA) is used in the management of difficult intubation.[2,3,4,5]The re usuable, Fastrach TM silicone wire reinforced tube was designed for tracheal intubation through ILMA.[6] A polyvinyl chloride (PVC) conventional endotracheal (ET) tube is disposable and readily available. Successful tracheal intubation via the ILMA using the conventional PVC tube has been reported by many authors.[7,8,9,10,11,12,13,14,15,16,17,18,22]

The purpose of this study was to compare the intubation success rates through ILMA using conventional PVC tube and the ET tube provided with ILMA set for intubation in Mallampati (MP) 3 and 4 patients and ease of intubation will be correlated with cost effectiveness between the two tubes.

METHODS: After obtaining approval from the institutional ethical committee and written informed consent, 60 patients of ASA grade I and II of either sex aged between 18 and 60 years with Mallampati (MP) 3 and 4 scheduled for elective surgery were included in this study.[19]

Unwilling patients, ASA grade III and IV, MP 1 and 2, history of regurgitation and aspiration (previous upper GIT surgery, known or symptomatic hiatus hernia, oesophageal reflux,

peptic ulceration), morbidly obese patients, patients scheduled for emergency surgery, patients with limited mouth opening (interdental distance <2 cms) and patients with loose dentures were excluded from the study.

Two groups of 30 patients each were randomly divided into:

Group E - In whom patients were intubated using conventional polyvinyl chloride endotracheal tube (Portex TM Smiths Medical International Ltd, UK) for intubation through ILMA.

Group I - In whom patients were intubated using endotracheal tube provided in ILMA set (Fasttrach TM silicone wire reinforced tube, Laryngeal Mask Company, UK) for intubation through ILMA.

All patients were kept fasting overnight and were pre medicated with tablet alprazolam (0.25 mg) and ranitidine (150 mg). In the operating room standard monitoring was performed and anaesthetic management was standardized. All patients were pre oxygenated with 100% oxygen for 3 minutes. Later induced with IV propofol (2-3 mg/kg) and IV fentanyl (2-3 mcg/kg). After confirmation of airway through chest rise by face mask ventilation, IV vecuronium (0.1 mg/kg) was administered for muscle relaxation. After 3 minutes ILMA was inserted with head neck in neutral position and cuff inflated. Patient's lung ventilated with ILMA.

Proper placement of ILMA in continuity to glottis opening was confirmed by monitoring of airway pressure (<=20 cms of water), adequate chest rise, pattern of end tidal carbon dioxide on monitor and by appreciating least resistance in reservoir bag so to facilitate ease of intubation. If adequate ventilation was not attained, ILMA was maintained by Chandy's maneuvers involving two steps (First step - rotating device in sagittal plane, Second step - lifting away from posterior pharyngeal wall). Anaesthesia was maintained with volatile anaesthetics and 100% oxygen during intubation attempts. After lubrication, tracheal tube was inserted into ILMA. If resistance was encountered during insertion, Chandy's maneuver was performed and further advancement attempted.

Intubation attempt was considered failure if insertion of tracheal tube was not possible. Oesophageal intubation was considered if no chest rise was seen on ventilation and no capnographic tracing was seen on the monitor after insertion of tracheal tube without resistance. Following each failed or oesophageal intubation, position of ILMA was adjusted if necessary.

Intubation attempt was considered successful if positive capnographic tracing was obtained and chest rise seen on ventilation after insertion of tracheal tube without resistance. In each patient, intubation attempts were limited to three. If intubation failed with ILMA, intubation was performed using direct laryngoscopy with McCoy blade or by using bougie or by using fibreoptic.

ILMA intubations were performed by anesthesiologists who had inserted ILMA on more than 10 occasions before the study. All patients were adequately ventilated and oxygenated throughout the study. The time taken for intubation through ILMA, number of attempts required for intubation and incidence of sore throat and trauma was observed between the two groups.

Statistical analysis was done using Chi-square test and test was considered significant if p value is <0.05.

RESULTS: Patients age, gender and Mallampati scores were comparable between the two groups [Table 1].

Successful intubation of patients was lower in Group E (PVC tube) patients (25/30, 83.34%) than Group I (ILMA tube) patients (28/30, 93.34%). Successful tracheal intubation in first attempt was lower in Group E patients (15/30) compared to Group I patients (21/30) which was statistically significant (p value - 0.049) [Diagram 1 and 2].

Time taken for intubation was higher in Group E patients (15.2+/- 4.1 seconds) compared to Group I patients (12.3 +/- 3.1 seconds). Maneuvering of ILMA was required more in Group E patients (15/30) compared to Group I patients (9/30) [Table 2].

Incidence of sore throat was significantly higher in Group E (12/30) patients compared to Group I (2/30) patients (p value - 0.002). Trauma to oral cavity (observed as blood on ET tube) and pilot balloon entanglement was observed in Group E patients. Oesophageal intubation was seen in Group I patients [Table 3].

DISCUSSION: Endotracheal tube provided in ILMA set is straight, soft wire reinforced silicone tube with full silicone distal inch terminating in a touhy like tip.[6]

ILMA intubation success rate as reported by Brain et al is 99.3%. No classification of difficult airway was used in their study. Our study involved Mallampati classification of airway involving MP 3 and 4 patients with success rate of 93.34%.[7, 19]

Intubation success using PVC tube was less (83.35%) compared to ILMA tube (93.34%). This can be attributed to the impingement of the tip of ET tube on tubercle of epiglottis. An important factor that determines the success of tracheal intubation is the angle at which tracheal tube emerges from distal aperture of ILMA. The PVC tube has a steep curvature and exit ILMA with angle >45 degree. ET tube provided in ILMA set emerges at 35 degrees [Picture 1].[7, 11, 12, and 15]

PVC tracheal tube is stiff and emerges from ILMA with distal end pointing too anteriorly to enter the glottis leading to increased incidence of failed intubation. Time for intubation was higher with conventional PVC ET tube as observed because of the stiffness of the tube.[12,14,21]

Cost of normal single use conventional PVC (Portex ET tube) is around Rs.180 per tube. Cost incurred for purchasing reusable (multiple use) ILMA tube is Rs.3900, recommended for thirty uses costing Rs.130 per use, making ILMA tube economical than PVC tube.

Joo et al found that PVC endotracheal tube exerts 7-10 times higher forces and pressures than the silicone and armored ET tubes. Incidence of sore throat was higher with PVC tubes in our study too. High incidence of oesophageal intubation was observed with ILMA tube in our study as also observed by Kundra et al.[12,20]

Higher success of intubation with ILMA was noted when least resistance is felt in reservoir bag, maximum chest expansion is seen and optimum end tidal carbon dioxide (ETCO2) is observed on monitor during maneuvering of ILMA.[12,14,17,21]

The limitations of our study is, it lacked blinding and a small study group. Lack of visualization of position of ILMA and the exact reason for unsuccessful passage of tracheal tube was not clear with ILMA. LMA CTrach inserts like the LMA Fastrach and has built in fibreoptics with a video screen that affords direct view of larynx. Success rate of intubation can probably increase with LMA CTrach in difficult intubations.

CONCLUSION: Intubation through ILMA can be accomplished by both PVC and ILMA tubes. Intubation through PVC tube is more traumatic, requires more duration and associated with post-operative sore throat. Intubation with ILMA tube is economical, faster with less incidence of sore throat. Incidence of oesophageal intubation is more with ILMA tube. ILMA is one of the techniques to manage difficult intubation and not a solution in all difficult intubations.

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Group	Age (in years)	Male: Female ratio	MP3: MP4 ratio
Group E (PVC)	37.5 +/- 17.5	18: 12	24: 6
Group I (ILMA)	42 +/- 18	16: 14	22: 8

Table 1: Characteristics of patients chosen for study

PVC – polyvinyl chloride tube, ILMA – intubating laryngeal mask airway tube, $p>0.05$.

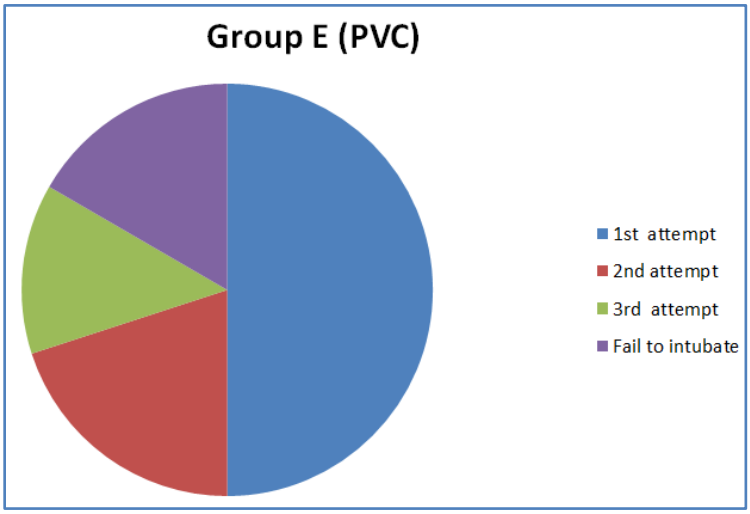

Diagram 1: Pie chart on intubation attempts required with PVC tube through ILMA

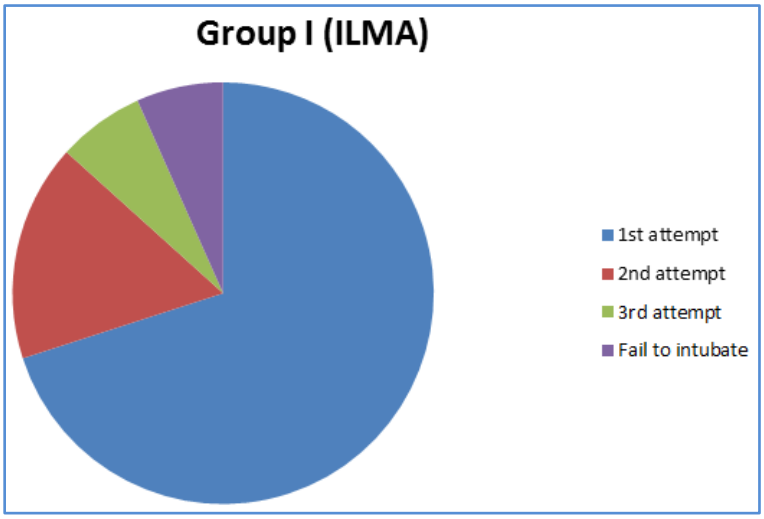

Diagram 2: Pie chart on intubation attempts required with ILMA tube through ILMA

Group	Time for ET tube insertion	Maneuvering required (percentage)
Group E (PVC)	15.2 +/- 4.1 seconds	15/30 (50%)
Group I (ILMA)	12.3 +/- 3.1 seconds	9/30 (30%)

Table 2: Time and Maneuvering required for intubation

PVC – polyvinyl chloride tube, ILMA – intubating laryngeal mask airway tube, p>0.05

	Group E (PVC tube)	Group I (ILMA tube)
Incidence of sore throat #	12 / 30	2 / 30
Trauma to oral cavity	3 / 30	-------
Pilot balloon entanglement	2 / 30	-------
Oesophageal intubation	--------	7 / 30

Table 3: Complications observed with both the groups

PVC – polyvinyl chloride tube, ILMA – intubating laryngeal mask airway tube, # p=0.002

Picture 1(a): PVC tube exit ILMA with angle >45 degree

Picture 1(b): ET tube provided in ILMA set emerges at 35 degrees through ILMA

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