INTRODUCTION

Flexion of the neck and extension at the atlantoaxial joint is required to visualize the larynx during laryngoscopy. Assuming this position for intubation may end up with cervical spine movement which is undesirable in patients with unstable cervical spine. There is no consensus or guidelines available suggesting the best method for securing the airway in patients with unstable cervical spine. Different techniques and equipments have been tried for maintenance of airway in these type of patients.1-4 Endotracheal intubation with specially designed silicone wire reinforced tube using Fastrach intubating laryngeal mask airway (FT-LMA) may offer a safer and better option for securing airway in such patients. FT-LMA tube is reusable and expensive with a low volume and high pressure cuff, which is not suitable for prolonged intubation, if required. However, when endotracheal tubes of different types were tried for endotracheal intubation through FT-LMA can exert vastly different forces and pressures on distal structures. The design of FT-LMA also prevents different types of endotracheal tubes from retaining the curvature while passing through its shaft. Flexible fiberoptic bronchoscopy is considered to be the best technique for endotracheal intubation in patients with unstable cervical spine but with some limitations.5 Availability of expertise of flexible fiberoptic laryngoscope and expensive equipment is an issue especially in developing countries. In order to avoid the above problems, the search for alternative techniques will continue.

The purpose of this study was to evaluate the success of alternative technique of endotracheal intubation in patients with unstable cervical spine with Philadelphia collar in place.

METHODOLOGY

This observational study was carried out at the Department of Anaesthesia, College of Medicine, King Saud University, Riyadh, Saudi Arabia, from June 2009 to June 2012. Adult (> 18 years) patients of either gender, ASA-II and III with unstable cervical spine electively scheduled for cervical spine decompression and fixation more than one level (below cervical level-4) were included in the study with patients consent.
Patients with anticipated difficult endotracheal intubation (Mallampati 3-4, short and bulky neck), mouth opening less than 25 mm with Philadelphia collar in place, body mass index more than 27 and known case of COPD/ischaemic heart disease on pre-operative evaluation were excluded for evaluation. After placing the patient in supine position on operating table monitors were attached and intravenous access was achieved. All patients were pre-oxygenated with 100% oxygen. Anaesthesia was induced with fentanyl two microgram per kilogram followed by titrating induction dose of propofol, when apnoea occurs FT-LMA was inserted. Correct position of FT-LMA was confirmed by bilateral chest movement, end-tidal CO₂, auscultation of chest on bag ventilation. FT-ILMA manipulations (pulling back, pushing down or side to side movement) was done when required for correct positioning of FT-LMA. Once the position of FT-LMA was confirmed atracurium 0.5 mg kg⁻¹ was given and lung was ventilated for 5 minutes with pure oxygen and sevoflurane as an inhalational agent. Soft straight end of adult size gum elastic bogie (Eschmann Tracheal Tube Introducer, Portex Sims, Kent, UK) was gently passed blindly through FT-LMA until it touches the carina and/or stops passing further beyond 40 cms, otherwise it was considered to be in oesophagus, then FT-LMA was removed on bogie. Reinforced silicone endotracheal tube was rail road on the bogie upto 27 cms with the bevel facing posterior. The bogie was pulled out and anaesthesia circuit was attached, endotracheal tube was pulled back and position was confirmed with ETCO₂, bilateral chest movement and auscultation on bag ventilation. All procedures were performed by the author who was having experience in more than 10 years with a male to female ratio of 7:3. All patients were ASA physical status of II and III. The mean time taken from the insertion of gum elastic bogie to the endotracheal intubation was 38.9 ± 1.20 seconds. The success rate of endotracheal intubation in first attempt in 23 patients was 23/26 (88.4%) and in 2 patients 2/26 (7.6%) trachea was intubated after manipulation of FT-LMA in second attempt. In one difficult patient (3.84%) trachea was finally intubated using fiberoptic bronchoscope through FT-LMA. The ease of insertion of FT-LMA in all patients with Philadelphia collar in place was mean 46.7 ± 2.59 on VAS of 0-100. The success rate of insertion of FT-LMA was 100% in first attempt with moderate difficulty. The author who performed the whole procedure rated the ease of endotracheal intubation as mean of 46.5 ± 2.66 on VAS scale of 0 – 100. Oxygen saturation was maintained at more than 90% in all patients except one case in which the patient transiently desaturated to 80%. No other complications were noted intra-operatively and post-operatively. The clinical and demographic data is given in Table I.

Table I: Demographic and clinical data studied in 26 patients, data reported as mean (SD) and percentages (%).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Clinical data</th>
<th>Remarks/percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years (mean)</td>
<td>59.3 ± 2.93</td>
<td></td>
</tr>
<tr>
<td>Gender (M:F)</td>
<td>7:3</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>64.60 ± 2.32</td>
<td></td>
</tr>
<tr>
<td>Ease of FT-LMA insertion (VAS 0-100)</td>
<td>46.7 ± 2.59</td>
<td>Mild to moderate difficulty</td>
</tr>
<tr>
<td>Overall success rate of FT-LMA insertion</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Overall ease of endotracheal intubation (VAS 0-100)</td>
<td>46.5 ± 2.66</td>
<td></td>
</tr>
<tr>
<td>Maximum time taken for intubation (seconds)</td>
<td>38.9 ± 1.20</td>
<td></td>
</tr>
<tr>
<td>Success rate of intubation attempts (n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One</td>
<td>23/26</td>
<td>88.4%</td>
</tr>
<tr>
<td>Two</td>
<td>2/26</td>
<td>7.6%</td>
</tr>
<tr>
<td>Failed</td>
<td>0/26</td>
<td>3.84%</td>
</tr>
<tr>
<td>Overall</td>
<td>25/26</td>
<td>96.15%</td>
</tr>
</tbody>
</table>

VAS = Visual analogue scale; 0-40 easy, 41-75 mild to moderate difficulty, 76-100 extreme difficulty

RESULTS

Seventy six patients were scheduled for cervical spine decompression and fixation in 3 years. Only 26 patients met the inclusion criteria, whose mean age was 59.3 ± 2.9 years with a male to female ratio of 7:3. All patients were monitored and evaluated as mean ± SD.

DISCUSSION

There is a lack of recommendations and guidelines for maintenance of airway in patients with unstable cervical spine and still remains a subject of debate. Stiff collars are usually applied for the stabilization of cervical spine. Maintenance of airway, mask ventilation and endotracheal intubation in patients having unstable cervical spine with Philadelphia collar around the neck is a challenge for the anaesthetist and is considered difficult. Philadelphia collar around the neck restricts the neck movement, limits the mouth opening and makes the mask ventilation, laryngoscopy and endotracheal intubation difficult. FT-LMA has been suggested as a device to be considered in event of failure of endotracheal intubation. The insertion of FT-LMA is difficult in patients with cervical collar in place. Inadequate mouth
opening is one of the major factors for difficulty in insertion of FT-LMA. Mouth opening of more than 20 mm is enough for the correct placement of FT-LMA in neutral neck position.12

Wakeling and Nightingale evaluated the ease of insertion and endotracheal intubation through the FT-LMA in healthy patients whose necks were immobilized with a stfnck cervical collar.13 They found it difficult to insert the LMA-Fastrach because of limited mouth opening and difficulty in ventilation and intubation which could be due to change in upper airway anatomy. Komatsu et al. found that FT-LMA insertion took longer in patients wearing Philadelphia collar.14 They did not find any significant difference in success rate of endotracheal intubation in patients with or without collar suggesting that Philadelphia collar in place did not change the upper airway anatomy when positioned properly. In our patients the placement of the FT-LMA was successful in all patients with mild to moderate difficulty (VAS 25-70). Adequate ventilation was established via the FT-LMA in all patients and no immediate adverse events were noticed.

The insertion of FT-LMA is considered to be a reliable device for securing airway and ventilation without significant movement of cervical spine.9,14 Blind tracheal intubation via an FT-LMA is independent of factors used to predict difficult intubation, does not requiring to visualize the larynx during intubation and consequently there is negligible cervical spine movement.14 As a routine reusable reinforced FT-LMA silicone tube is used for blind intubation through FT-LMA. This tube is expensive and is not always available in all centres. FT-LMA tube is having low volume and high pressure cuff and is also not suitable for patients who may require prolong ventilation postoperatively in ICU. In literature, it has been shown that the success rate of intubation was comparable when endotracheal tubes of different types were used instead of FT-LMA tube.15,16 However, problems associated with passage of non-conventional tubes through the rigid metallic FT-LMA tube is an issue. Silicone tubes collapse15 and PVC tubes theoretically require extra force and exertion of excessive pressures on structures and can potentially damage the laryngeal inlet structures.11 The fiberoptic technique (FOB) with some limitations is still considered to be the gold standard for securing airway.5 The success of FOB depends upon individual expertise, patient co-operation and availability of equipment especially in developing countries. FOB techniques is frequently impractical in patients with severe unstable cervical spine.18 Several airway devices and modified techniques were suggested to facilitate intubations through FT-LMA using AEC airway exchange catheters, stylets, intubation guide and trachlight etc.1-4

In order to avoid the problems associated with FT-LMA tube and other endotracheal tubes, we have evaluated the alternative technique for ventilation and intubation using FT-LMA. In this technique FT-LMA was inserted after induction of anaesthesia while avoiding the mask ventilation. The ease of FT-LMA insertion and success rate of endotracheal intubation after passing gum elastic bogie through FT-LMA was studied. The total time taken for intubation was little bit longer as compared to Komatsu et al. group of patients (38 seconds vs. 31 seconds).14 The more likely explanation is that intubation was performed in two steps. The reported overall success rate of blind intubation via FT-LMA ranges from 90 – 100%.19,20 In the present study, the success rate of intubation was about 88.4% (23/26) in the first attempt and (2/26) 7.6% in the second attempt. The overall success rate of endotracheal intubation with the above technique was 96%. The authors were unable to pass bogie and intubate one patient with the described technique. In that patient the trachea was intubated using FOB which was also found to be difficult. The failure to intubate that patient could be due to the altered upper airway anatomy and / or inappropriate size of FT-LMA.

The principal factor that determines the success rate of adequate ventilation and intubation via FT-LMA is appropriate alignment of FT-LMA aperture and glottis.8,21 The success rate of entering the endotracheal tube/bogie into trachea through FT-LMA depends upon the angle of emergence through the aperture and its soft blunt Malleable tip of the device. In this study, the soft straight end of bogie emerges at an angle of 30 degree (Figure 1) to the plain of FT-LMA which was 5 degree less (30° vs. 35°) to that determined by Brain et al.12 The advantage of this emergence angle of gum elastic bogie is that it facilitates smooth entry of bogie into trachea without negotiating the anterior structures of glottis. The success rate of endotracheal intubation was also comparable to the results as reported by Brain et al. with FT-LMA tube.

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Figure 1: Emergence angle formed by the tracheal tubes on existing from the distal aperture of intubating laryngeal mask airway (FT-LMA).
The main limitation of the study was that it was not a randomized controlled trial evaluating the different techniques of intubation in patients with unstable cervical spine with stiff collar around the neck. The VAS used for ease of FT-LMA insertion and endotracheal intubation is of more subjective value and has been used in other studies as well. This is not the first report describing the facilitation of endotracheal intubation using FT-LMA. However, this report is unique in a way of introducing a different intubation technique via FT-LMA which can be considered in an area where lack of equipment and expertise is an issue.

CONCLUSION

This described technique was found safe and reliable for achieving adequate ventilation and intubation in patients with unstable cervical spine for elective cervical spine decompression wearing Philadelphia collar. The operator should gain good experience for insertion of FT-LMA in collared patients before trying the described technique of endotracheal intubation.

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REFERENCES