**INTRODUCTION:**

General anesthesia with endotracheal tube intubation is a standard method of airway protection during various surgeries. An endotracheal tube after intubation, cuff of tube is inflated. Although various cuff inflation techniques are used, there is no standard technique in the literature addressing the method of cuff inflation or cuff pressure maintenance in anesthetic practice.

The goal in using cuffed endotracheal tubes is to achieve a seal between the cuff and trachea with a pressure great enough to prevent aspiration but also be low enough to allow perfusion of the tracheal mucosa. Although various cuff inflation techniques are used, there is no standard technique in the literature addressing the method of cuff inflation or cuff pressure maintenance in anesthetic practice.

The endotracheal tube cuff pressure must be high enough to seal the trachea to prevent micro or frank aspiration but also be low enough to allow perfusion of the tracheal mucosa. Although various cuff inflation techniques are used, there is no standard technique in the literature addressing the method of cuff inflation or cuff pressure maintenance in anesthetic practice.

**AIM:**

To correlate estimation techniques and direct cuff pressure measurement technique in assessing endotracheal tube cuff pressures.

**CONCLUSION:**

The direct cuff pressure measurement technique resulted in normal range cuff pressures when compared to other four estimation techniques. Thus, direct cuff pressure measurement with anaeroid manometer is the safest and simple method to be used to inflate the endotracheal tube cuff and prevent very high or low intracuff pressures. Endotracheal tube cuff pressure monitoring should be practiced routinely in regular anesthesia practice.

**KEYWORDS:** Endotracheal Cuff Pressure, Estimation Techniques, Manometer

**METHODOLOGY:**

Patients included in the study were 144 adults of ASA I & II, III grade, scheduled for elective surgery under general anesthesia. Patients undergoing head and neck surgery and thoracic cavity, emergency surgeries, patients with laryngeal disease or laryngeal surgery, anaesthesia maintain on nitrous oxide were excluded from the study.

Standard anaesthesia protocol was followed. Patients were induced with Fentanyl-Propofol- Atracurium sequence. Endotracheal intubation was performed with high volume, low pressure cuffed Portex endotracheal tube no. 6.5, 7, 7.5, 8, 8.5 mm ID accordingly to patients. At intubation the endotracheal tube cuff was inflated with some amount of air with 10ml leur lock syringe to create an intra-cuff pressure for proper seal by the anaesthesia provider. Endotracheal tube cuff is inflated accordingly by anaesthesia provider by using their estimation techniques such as direct cuff pressure measurement technique (Group A), minimal leak technique (Group B), minimal occlusive volume technique (Group C), palpation of pilot balloon (Group D), and predetermined volume technique (Group E).

Endotracheal tube intra-cuff pressure was measured with an anaeroid manometer immediately after intubation and then recorded and the volume used to inflate the endotracheal tube cuff is asked to anaesthesia provider and then recorded. Endotracheal tube intra-cuff pressure was measured are informed to anaesthesia provider and changes which they made later are not included in the study.

**RESULTS:**

Correlation between demographic data and measured cuff pressure are statistically comparable. The manometric pressure (cm H2O) attained at the endotracheal tube cuff was 29.9±4.33, 37.32±16.40, 27.8±6.16, 37.32±16.40 cmH2O for group A, Group B and Group C, respectively. This difference was statistically significant amongst all the five groups with a p value <0.05 using Fisher’s exact test. Direct cuff pressure measurement (Group A) shows cuff pressures of 29.9±4 (mean ± SD) which is in normal range (25-40cmH2O). Whereas other estimation techniques like Minimal leak test (Group B), Minimal occlusive volume test (Group C), Palpation of pilot balloon (Group D), Predicted volume test (Group E), the pressures recorded are 37.32±16.40, 37.86±16.13, 46.21±16.94, 45.19±16.61 cmH2O respectively, which are either too low pressures or too high pressures when compared to normal range pressures.
Comparison of Cuff Pressure (cm of H2O) with Estimation Technique

<table>
<thead>
<tr>
<th>Estimation technique</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Quartile Range</th>
<th>F-value</th>
<th>P-value</th>
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</thead>
<tbody>
<tr>
<td>A. Direct Cuff Measurement</td>
<td>37</td>
<td>29.19</td>
<td>3.00</td>
<td>4.33</td>
<td>0.00</td>
<td>9.04</td>
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<tr>
<td>B. Minimal Leak Test</td>
<td>41</td>
<td>37.32</td>
<td>4.00</td>
<td>16.40</td>
<td>20.00</td>
<td>&lt;.0001</td>
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<tr>
<td>C. Minimal Oclusive Volume Test</td>
<td>28</td>
<td>37.86</td>
<td>4.00</td>
<td>16.13</td>
<td>15.00</td>
<td></td>
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<tr>
<td>D. Palpation of Pilot Balloon</td>
<td>58</td>
<td>46.21</td>
<td>5.00</td>
<td>16.94</td>
<td>30.00</td>
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<tr>
<td>E. Pre-determine Volume Test</td>
<td>53</td>
<td>45.19</td>
<td>4.00</td>
<td>16.61</td>
<td>25.00</td>
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</tr>
</tbody>
</table>

Measured Cuff Pressure (cm of H2O)

DISCUSSION:
Although various cuff inflation techniques are used, there is no standard technique in the literature addressing the method of cuff inflation. Overinflation and under inflation of endotracheal cuff, prevented by different inflation techniques has been met with varying success. Some studies showed no correlation between years in practice or number of intubations performed yearly to the ability to properly inflate ET tube cuffs or detect overinflation. Cuff pressures attained by minimal leak test, and minimal occlusive volume techniques are below 20cmH2O, where there is increased risk of micro aspiration. The endotracheal cuff pressure achieved by direct cuff pressure measurement technique was within normal range (25-40cmH2O) when compared to the other four estimation techniques. Based on studies regarding ideal cuff pressures Nordin et al, Seegobin et al, Brimacombe, we have taken ideal cuff pressure 25-40cmH2O, at this pressure it is proved safe for tracheal mucosa.

In our study, Volume used to inflate the endotracheal tube using direct cuff pressure measurement technique required lesser volume of air when compared to other estimation techniques. A positive correlation is seen between measured cuff pressure and volume of air used and it was statistically significant (p=0.05). There is no particular volume to attain normal cuff pressure (25-40cmH2O) and the cuff volume varied according to tube size and patient morphology. Increase in the volume of air, lead to increase in cuff pressure.

Sengupta P et al studied the endotracheal tube cuff pressure and the volume required to produce an appropriate cuff pressure in three hospitals, concluded that there is no correlation between cuff pressure and volume. Therefore, measuring cuff pressure appears preferable to injecting a given volume of air. According to Ganner C, Trivedi, Lomholt et al, endotracheal tube cuff pressures should be routinely monitored with aneroid manometer. According to our study also, the direct cuff pressure measurement technique should be used to inflate the endotracheal tube cuff and cuff pressure monitoring should be practiced routinely in regular anaesthesia practice. Although the type of manometer used in this study is one of the most convenient and common tool in literatures, the set and measured endotracheal tube cuff pressures are only accurate to within 1 cmH2O. Smaller variation of cuff pressure can't be detected by this device but it may be of less clinical relevance.

CONCLUSION:
Our study results show that the direct cuff pressure measurement technique resulted in adequate manometric cuff pressure (25-40 cmH2O) and hence may be associated with lesser airway morbidity. Thus direct cuff pressure measurement technique should be used to inflate the endotracheal tube cuff and cuff pressure monitoring should be practiced routinely in regular anaesthesia practice.

REFERENCES: