LIDOCAINE AS ENDOTRACHEAL CUFF INFLATING AGENT

Ali NP¹, Tauhid-ul-Mulck M², Noor MM³, Mollick MT⁴, Ahmed M⁵, Chowdhury MRA⁶

Abstract
A prospective study was carried on 120 patients undergoing surgical operations lasting less than 90 minutes. The incidence of postoperative sore throat, dysphasia and hoarseness of voice with 2% lidocaine (Group L) as endotracheal cuff inflating agent was compared with that with distilled water (Group D) and air (Group A). Seventy two percent of lidocaine group in comparison to 60% distilled water group and 37% air group experienced none of the above complications during the entire study period. Only 5% in lidocaine group had sore throat after 22-24 hours compared to 20% in the distilled water group and 45% in the air group. Twenty three percent complained of dysphasia in both lidocaine and distilled water group after 1-3 hours compared to 45% in air group. After 22-24 hours it completely resolved in lidocaine group compared to 20% persisting in the other two groups. Twenty three percent complained of hoarseness in lidocaine group as compared to 35% and 55% in distilled water and air groups respectively after 1-3 hours. This completely resolved in lidocaine group but persisted in 20% and 45% in the distilled water and air group respectively after 22-24 hours. The results showed an advantage in using lidocaine as an endotracheal tube cuff inflating agent in reducing postoperative sore throat, dysphasia and hoarseness in comparison to distilled water and air.

Key Words: Lidocain, Endotracheal tube (ETT) cuff inflating agent.

Introduction
Postoperative sore throat, dysphasia and hoarseness are undesired and neglected occurrences after general anaesthesia with endotracheal intubation. Though a minor complication, any one of these may be troublesome, and can make the patient feeling uncomfortable. Evidence of these complications following general anaesthesia has been found to be 80-90% in most quoted studies. Contributory mechanisms have included: (a) trauma to the tonsillar pillars, pharynx, tongue, larynx and trachea¹, (b) drying out of mucosal membrane in the trachea with endotracheal intubation or the upper airway following anaesthesia by mask, (c) involvement of cuff-tracheal surface contact area that have the largest cuff tracheal surface contact upon inflation², (d) infection, (e) type of cuff, cuff pressure and inflating agent of the cuff. Drying effects of anaesthetic gases and anti-sialagogue effects of anticholinergic drugs may also play a role³. The highest incidence of sore throat and other airway related symptoms tend to occur in patients who have undergone tracheal intubation⁴.

There are different methods for prevention of intubation related sore throat, but none have been totally successful. Many pharmacological interventions have been suggested, and one of these is the use of different forms of lidocaine through different routes. A comparison between intubation with dry tubes or a tube lubricated with jelly suggested that the use of lubricants containing local anaesthetics might be beneficial. The tracheal tube material may also be a cause of sore throat. Traditionally endotracheal tubes have been made of red rubber or latex, which can be cleaned and sterilized for reuse. However, these materials are opaque and inadequate cleaning is always apparent from superficial examination. Sterility does not prevent postoperative sore throat by 100%, but severity and incidence may be reduced. Currently plastics [polyvinyl chloride (PVC) and more recently polyurethane] and to a lesser degree, silicone rubber have replaced red rubber and latex as primary materials, because they are non-irritant. They are also cheap to produce to allow single patient use and can be sterilized more reliably during manufacture. The red rubber had a low residual volume, high-pressure cuff and the exertion of this high pressure on the tracheal mucosa was thought to be damaging⁵. Modern disposable tube cuffs may be made from a thin inelastic material (PVC) which when inflated would have a larger than required volume to effect a seal. In situ there is a large area of contact between the cuff and tracheal wall before the material is fully stretched. When a thin walled low pressure, high volume cuff was used, blood flow did not cease until cuff pressures were in the range of 80-120 mm of Hg⁶. From all these information, it is evident that the incidence and severity of postoperative sore throat may be significantly reduced by the use of PVC endotracheal tube with a high volume, low pressure cuff of adequate size. The cuff has to be filled up to a certain pressure, which has to be maintained, to avoid vascular and tracheal mucosal damage. Filling the cuff with saline, distilled water, or lidocaine will prevent N₂O diffusion. Lidocaine, being a

local anaesthetic may have an additional advantage. Hence, a prospective comparative study was carried out to reveal incidence of postoperative complications.

**Materials and Methods**

This prospective study was carried out at the Department of Anaesthesiology and Intensive Care Unit (ICU), Combined Military Hospital, Dhaka Cantonment from August to September 2005. Formal approval was obtained and informed consent was also taken from each of the study subject.

One hundred and twenty patients were included in this study. Patients were randomly divided into three groups (each of 40 patients) by card sampling method. In group A, air was used to fill the endotracheal tube cuff. In group D, distilled water was used to fill the tube cuff and in group L, 2% lidocaine was used to fill the cuff tube. A fresh sterile endotracheal tube (Rusch; 7.5 mm in women, 8.0 mm in men) of high volume and low pressure was used in all the cases. Cases requiring more than one attempt at intubation or those found to be difficult were excluded from the study. Patients having a history of sore throat in the last 6 weeks, smokers and tobacco chewers and patients having nasogastric tubes in-situ were excluded from the study. The participants were all of ASA grade I or II undergoing general endotracheal anaesthesia for abdominal surgery of duration of less than 90 minutes duration of operation.

All patients underwent a prescribed anaesthetic protocol. Induction was accomplished with 3 to 6 mg/kg of thiopental sodium followed by 1.5 mg/kg of succinylcholine for intubation. Prior to intubation, ventilation was controlled with 100% oxygen via facemask. Maintenance anaesthesia included 35% \( \text{O}_2/65\%\text{ N}_2\text{O} \), halothane, opioid and vecuronium as muscle relaxant. At the conclusion of surgery, muscle relaxation was antagonized with neostigmine and atropine.

The Endotracheal tube (ETT) cuffs of the lidocaine group were prefilled with 8 ml of 2% lidocaine for 90 minutes prior to intubation to enhance diffusion of lidocaine across the cuff. All cuffs were evacuated to sub-atmospheric pressure prior to intubation. Following intubation, the ETT cuffs were inflated with air or distilled water or lidocaine as appropriate until no leak was heard. The volume of lidocaine used never exceeded 5mg/kg, so as to protect the patient from local anaesthetic toxicity, if the cuff ruptured.

Postoperatively, patients were directly asked about the presence of sore throat, cough, difficulty in deglutition and change of voice (hoarseness of voice). Verbal rating scale was used on the three groups of patients to assess the presence and severity of sore throat at two intervals, 1 to 3 hours postoperatively and 22 to 24 hours postoperatively. Data were collected in a specially designed 'data sheet'. Findings were analyzed using relevant statistical tests. Data of the present study were analyzed in the light of comparison among three groups and within groups as appropriate. All results were expressed as Mean ± SD, values were considered significant if \( p<0.05 \) and presented in tabular and graphical forms.

**Results**

Patient characteristics are shown in Table I. Mean ages of group-A were 45±7.6 years, group D was 43.88±6.5 years and group L was 44±6.6 years. Mean body weight of group A was 70±15.9 kg group D was 72±16.6 kg and group L was 73±18.7 kg. Sex ratio (male : female) of group A was 11:29, group D was 17:23 and group L was 19:21. The ASA grade ratio was 32:8 in group A, 32:8 in group D and 36:4 in group L. There were no significant \( (p>0.05) \) difference observed among the three groups.

The frequencies of hoarseness of voice, dysphasia and sore throat after 1-3 hours were lowest in the lidocaine group but there was no comment on dysphasia or hoarseness in comparison to the 20% persisted in the other two groups. Bennet et al13 observed statistical significance between air and saline groups for hoarseness and sore throat.

**Table-I :** Patient Characteristics.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Group A (n=40)</th>
<th>Group D (n=40)</th>
<th>Group L (n=40)</th>
<th>Statistical Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>45±7.6</td>
<td>43.88±6.5</td>
<td>44±6.6</td>
<td>NS</td>
</tr>
<tr>
<td>(Mean ± SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (Male: Female)</td>
<td>11:29</td>
<td>17:23</td>
<td>19:21</td>
<td>NS</td>
</tr>
<tr>
<td>Body weight in kg</td>
<td>70±15.9</td>
<td>72±16.6</td>
<td>73±18.7</td>
<td>NS</td>
</tr>
<tr>
<td>(Mean ± SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASA grade 1 : II</td>
<td>32:8</td>
<td>32:8</td>
<td>36:4</td>
<td>NS</td>
</tr>
</tbody>
</table>

NS: Not significant \( p>0.05 \) (among three groups) for Age and Body wt; analysis done by ANOVA.

NS: Not significant \( p>0.05 \) (among three groups) for Sex and ASA; analysis done by chi-squared test.

O₂/65% N₂O, halothane, opioid and vecuronium as muscle relaxant. At the conclusion of surgery, muscle relaxation was antagonized with neostigmine and atropine.

The Endotracheal tube (ETT) cuffs of the lidocaine group were prefilled with 8 ml of 2% lidocaine for 90 minutes prior to intubation to enhance diffusion of lidocaine across the cuff. All cuffs were evacuated to sub-atmospheric pressure prior to intubation. Following

**Table-II :** Comparison of sore throat in different groups.

<table>
<thead>
<tr>
<th></th>
<th>Group A (n=40)</th>
<th>Group D (n=40)</th>
<th>Group L (n=40)</th>
<th>( p ) value</th>
<th>Statistical Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sore throat After 1-3 hours</td>
<td>25 (63%)</td>
<td>16 (40%)</td>
<td>11 (28%)</td>
<td>0.544</td>
<td>NS</td>
</tr>
<tr>
<td>Sore throat After 22-24 hours</td>
<td>18 (45%)</td>
<td>08 (20%)</td>
<td>02 (5%)</td>
<td>0.023</td>
<td>Sig</td>
</tr>
</tbody>
</table>

Sig: Significant \( p<0.05 \) (among three groups); analysis done by chi-squared test.

NS: Not Significant \( p>0.05 \) (among three groups); analysis done by chi-squared test.

**Table-III :** Comparison of dysphasia in different groups.

<table>
<thead>
<tr>
<th></th>
<th>Group A (n=40)</th>
<th>Group D (n=40)</th>
<th>Group L (n=40)</th>
<th>( p ) value</th>
<th>Statistical Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysphasia After 1-3 hours</td>
<td>21 (45%)</td>
<td>9 (23%)</td>
<td>9 (23%)</td>
<td>0.021</td>
<td>Sig</td>
</tr>
<tr>
<td>Dysphasia After 22-24 hours</td>
<td>08 (20%)</td>
<td>8 (20%)</td>
<td>0 (0%)</td>
<td>0.016</td>
<td>Sig</td>
</tr>
</tbody>
</table>

Data are in numbers with percentages in parenthesis.

Sig: Significant \( p<0.05 \) (among three groups); analysis done by chi-squared test.
Hoarseness of voice and dysphasia were significantly absent after 22-24 hours in the lidocaine group. Seventy two percent of the lidocaine group (29 of 40) in comparison to 60% of the distilled water and 37% of the air group experienced no sore throat during the entire study period (p < 0.05). Only 5% in the lidocaine group had sore throat after 22-24 hours compared to 20% in the distilled water group and 45% in the air group (Table II). Dysphasia was observed in 23% of cases of both lidocaine and distilled water group after 1 to 3 hours, whereas that was present in 45% of members of air group. After 22-24 hours, it completely resolved in the lidocaine group in comparison to the 20% persisted in the other two groups (Table III). Twenty three percent complained of hoarseness in the lidocaine group as compared to 35% and 53% in the distilled water and air groups respectively after 1-3 hours. This completely disappeared in the lidocaine group but persisted in 20% and 45% in the other groups after 22-24 hours (Table IV).

Discussion

Proposed aetiologies of postoperative sore throat include intubation trauma, mucosal dehydration or oedema, pharyngeal airways, and succinylcholine. Excessive hours (Table IV). This completely disappeared in the lidocaine group but two percent of the lidocaine group (29 of 40) in air group experienced no sore throat during the entire study period (p < 0.05). Only 5% in the lidocaine group had sore throat after 22-24 hours compared to 20% in the distilled water group and 45% in the air group (Table II). Dysphasia was observed in 23% of cases of both lidocaine and distilled water group after 1 to 3 hours, whereas that was present in 45% of members of air group. After 22-24 hours, it completely resolved in the lidocaine group in comparison to the 20% persisted in the other two groups (Table III).

Table - IV : Comparison of hoarseness in different groups.

<table>
<thead>
<tr>
<th></th>
<th>Group A (n=40)</th>
<th>Group D (n=40)</th>
<th>Group L (n=40)</th>
<th>p value</th>
<th>Statistical Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoarseness After 1-3 hrs</td>
<td>21 (53%)</td>
<td>14 (35%)</td>
<td>9 (23%)</td>
<td>0.011</td>
<td>Sig</td>
</tr>
<tr>
<td>Hoarseness After 2-24 hrs</td>
<td>18 (45%)</td>
<td>08 (20%)</td>
<td>0 (0%)</td>
<td>0.042</td>
<td>Sig</td>
</tr>
</tbody>
</table>

Postoperative sore throat, dysphasia and hoarseness may be due to the continued local anaesthetic action of lidocaine on the tracheal mucosa. The results of this study show that using lidocaine as cuff inflating agent reduced the incidence postoperative sore throat, dysphasia and hoarseness in comparison to distilled water and air. It is proposed that the difference was produced by the continual local anaesthetic action of lidocaine on the tracheal mucosa.

Conclusion

Postoperative sore throat, dysphasia and hoarseness may be one of the minor complications after general anaesthesia, but it can create an uncomfortable situation for both the patient and the anaesthesiologist. Many methods have been advocated in prevention of these complications, none

JAFMC Bangladesh. Vol 5, No 1 (June) 2009
that using intra-cuff lidocaine to some extent can be
effective in controlling these complications.

References
   of Anaesthesia 1978; 58: 587.
2. Loeser EA, Orr DL, Bennet GM, Stanely TH. Endotracheal tube cuff
design and postoperative sore throat. Anaesthesiology 1976; 45: 684.
3. Loeser EA, Machin R, Colley J, Orr D, Bennet GM, Stanely TH. Post
   operative sore throat- importance of endotracheal tube conformity
5. McHardy FE, Chung F. Postoperative sore throat: cause, prevention
7. Nordin U, Lindholm CE, Wolgast M. Blood flow in the rabbit tracheal
   mucosa under normal conditions and under the influence of tracheal
8. Monroe MC, Gravenstrin N, Saga-Rumlley S. Postoperative sore
   throat: effects of oropharyngeal airway in orotracheally intubated
9. Seltosbin RD, Van Hasselt GL. Endotracheal cuff pressure and
   tracheal mucosal blood flow: endoscopic study of effects of four large
10. Nordin U: The trachea and cuff induced tracheal injury. An
    experimental study on causative factors and prevention. Acta
11. Navarro RM, Baughman VL. Lidocaine in the endotracheal tube cuff
    reduces postoperative sore throat. Journal of Clinical Anesthesia
    severity after use of lidocaine, saline, or air to inflate the endotracheal
    tube cuff. AANA Journal 1999; 67; 49.
13. Bennett MH, Isert PR, Cumming RG. Postoperative sore throat and
    hoarseness following tracheal intubation using air or saline to inflate
    the cuff- a randomized controlled trial. Anaesth Intensive Care 2000; Aug;
14. Soltani HA, Aghadavoudi O. The effect of different lidocaine
    application methods on postoperative cough and sore throat. Journal of
15. Stanley TH, Foote JL, Liu WS. A simple pressure relief valve to
    prevent increases in endotracheal tube cuff and volume in intubated
16. Patel RI, Ott TH, Epstein BS. Effects of nitrous oxide on pressure
    changes of tracheal tube cuffs following inflation with air and saline.
    Anaesthesia 1983; 38: 44-5.

JAFMC Bangladesh. Vol 5, No 1 (June) 2009