Jurnalul Român de Anestezie Terapie Intensivă 2013 Vol.20 Nr.2, 94-98

Effect of trolley height on the management of difficult airway; a manikin study*

A. Jayakumar, B. Ateleanu, A.R. Wilkes, I. Hodzovic

Department of Anaesthetics, Intensive Care and Pain Medicine, School of Medicine, Cardiff University, Heath Park, Cardiff CF14 4XN, UK

Abstract

Background. Traditionally it has been accepted that the patient’s face should be at the level between xiphisternum and umbilicus of the anaesthetist during intubation. However we noticed wide variation in the adoption of this guidance. We could not find any studies looking at the effect of the height of the trolley on the technique of laryngoscopy. We decided to evaluate the effect of trolley height on the time taken, success rate, posture adopted and perception of difficulty in placement of a tracheal tube introducer in the trachea of a manikin set to simulate difficult intubating conditions.

Methods. Forty eight anaesthetists were invited to participate in a randomised crossover manikin study, designed to evaluate the effect of the trolley height on the speed and success rate of tracheal tube introducer placement. The manikin, set to simulate difficult airway, was placed on a trolley adjusted to represent four trolley heights as determined by the level of the manikin’s face in relation to the anaesthetist’s body landmarks.

Results. Height of the trolley had a minimal effect on the speed (p = 0.046) but not on the success rate (p = 0.14) of placing a tracheal tube introducer. There was a significant effect of height of trolley on perception of difficulty (p = 0.01). Moreover, anaesthetists tended to adopt a poor posture which was exaggerated when the trolley height was lower.

Conclusion. We conclude that adjusting the trolley height before laryngoscopy appears to improve the intubating conditions and may have beneficial effect on anaesthetist’s posture during intubation.

Keywords: height of trolley, difficult intubation, body posture

Introduction

Standard textbooks advise that the plane of the patient’s face should be at a level between the xiphisternum and umbilicus of the anaesthetist, the laryngoscope handle should be held in a way to exert axial forces and levering of teeth should be minimal [1-3]. It has been shown that experienced anaesthetists tended to adopt a more erect posture during laryngoscopy [4, 5]. Even though textbooks describe the optimal position of the patient’s face in relation to the anaesthetist, we noticed wide variation in the adoption of this guidance. We could not find any studies looking at the effect of the height of the trolley on the technique of laryngoscopy.

We decided to evaluate the effect of trolley height on the time taken, success rate, posture adopted and perception of difficulty in placement of a tracheal tube introducer in the trachea of a manikin set to simulate difficult intubating conditions.

Methods

The Local Research Ethics Committee considered this study and decided that it did not require formal ethics committee review. Forty-eight anaesthetists, with more than 2 years of anaesthetic experience, were
invited to take part in this randomised cross-over study. All agreed to participate and written informed consent was obtained. A Laerdal Airway Management Trainer was set to simulate a grade III laryngoscopic view [6] using a rigid cervical collar and head band (Figure 1); an adjustable height trolley (Huntleigh Nesbitt Evans 42010) and Eschmann tracheal tube introducer were used (Reusable guide – ‘bougie’, Smiths Medical International, Hythe, United Kingdom). We tested four trolley heights: the plane of manikin’s face was adjusted to the level of anaesthetist’s body landmark to create four trolley positions: position one – anaesthetist’s preferred position; position two – 2 cm above xiphisternum; position three – midpoint between umbilicus and xiphisternum; position four – at the level of anterior superior iliac spines. Our primary outcome was the time taken for tracheal introducer placement. Our secondary outcome measures were success rate for tracheal placement, perceived difficulty of placement (Visual Analogue Scale: 0 mm = extremely easy, 100 mm = extremely difficult) and posture of the anaesthetist based on increasing eye to laryngoscope handle distance (posture 1-5) (Figure 2).

Fig. 1. Manikin set to simulate grade III laryngeal view

Fig. 2. Photographs of a best-fit body posture used to evaluating anaesthetist’s body position during laryngoscopy guide
Statistics and sample size

The results of the study were analysed using repeated measures ANOVA for normally distributed continuous data, Cochran Q, Friedman test and Chi-squared test for categorical and ordinal data as appropriate. Results were analysed using SPSS v16 (SPSS Inc, Chicago, IL, USA). We used SD = 15 seconds [7], power of 95% and significance level of p < 0.01. For the clinically important difference of 10 seconds we required 41 anaesthetists. We invited 48 anaesthetists to take part for ease of randomisation and to allow for dropouts.

Results

A total of 48 anaesthetists (ten consultants, 38 trainees) took part in the study. Mean (SD) number of years of anaesthetic experience for the volunteers was 7.6 (4.4) years.

Participating anaesthetists reported no change in the laryngeal view during laryngoscopy with the change in the trolley height.

Ninety percent (43/48) of anaesthetists stated that their preferred patient position was between the xiphisternum and umbilicus.

The height of trolley had a significant effect on time to tracheal introducer placement (p = 0.046) (Table 1). There was no effect of height of trolley over the success or failure of tracheal introducer (p = 0.145) placement. There was a significant effect of perception of difficulty as the height of the trolley was lowered (p = 0.01).

Table 1. Effect of trolley height on time taken to tracheal introducer placement, success rate and perception of difficulty of use

<table>
<thead>
<tr>
<th>Height of patient trolley</th>
<th>n = 48</th>
<th>position 1</th>
<th>position 2</th>
<th>position 3</th>
<th>position 4</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (s)</td>
<td>22 (11)</td>
<td>22 (11)</td>
<td>21 (8)</td>
<td>24 (13)</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>Failure rate</td>
<td>5 (10%)</td>
<td>5 (10%)</td>
<td>6 (12%)</td>
<td>11 (23%)</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>VAS score</td>
<td>44 (23)</td>
<td>44 (22)</td>
<td>53 (28)</td>
<td>59 (23)</td>
<td>0.01</td>
<td></td>
</tr>
</tbody>
</table>

Position 1 – anaesthetist’s preferred position; position 2 – 2 cm above xiphisternum; position 3 – midpoint between umbilicus and xiphisternum; position 4 – at the level of anterior superior iliac spines. Values are number (percent) and mean (SD) as appropriate. VAS = Visual Analogue Scale: 0 mm = extremely easy, 100 mm = extremely difficult

Our results show that anaesthetists tended to adopt a poor posture with eyes close to the laryngoscope handle (postures one and two, Figure 2). Poor posture was further exaggerated when the trolley was placed at the level of the anterior superior iliac spines. This was, however, no significant effect of the trolley height on the anaesthetist’s body position (p = 0.97, Chi-squared test).

Discussion

This study found that the time to introducer placement was only minimally affected by trolley height (p = 0.046), with the largest mean difference between the various postures of 2 s (about 10%). The incidence of oesophageal placement was higher (though not statistically significant, p = 0.096) when the trolley position was at the iliac spine level (11/48 (23%)) than when the trolley height was between the xiphisternum and umbilicus (6/48 (12%)). We found that anaesthetists tended to adopt a poor posture even when the trolley was placed at their preferred height. This poor posture was further exaggerated when the trolley position was at the iliac spine level. We observed that anaesthetists tended to hyperextend their necks during laryngoscopy when the trolley height position was at the iliac spine level. It appears that in addition to the improved body posture during laryngoscopy, correct trolley height may have an added benefit of improving our chances of successful management of difficult airway.

In a separate study (unpublished data), we observed body posture of 120 anaesthetists performing laryngoscopy in the anaesthetic room. There was significant effect of experience of anaesthetists on body posture (p = 0.001). We found that anaesthetists with more than four years experience were more likely to adopt erect or almost erect body posture during laryngoscopy. It appears that with experience we acquire body posture that is less likely to cause harm.

Recent articles on the cervical disc problems amongst anaesthetists [8, 9] emphasized potential harmful effect of a poor body posture on our health. We observed that many anaesthetists do not adjust the trolley height or think of their posture during laryngoscopy. Anaesthetists are exposed to many situations associated with possible poor body posture during the
working day such as intravenous cannulation, writing anaesthetic records, ventilating patients with badly positioned breathing bag etc. The risk of spinal problems due to poor posture in anaesthetists is not well recognised. It is left to us to take this occupational hazard more seriously.

Applicability of our results is affected by our manakin arrangement being the representation of patients with grade 3 laryngeal view. The use of manikins, however, allowed for constant testing conditions making the cross-over study design more robust. This set up also allowed for our hypothesis to be tested by a large number of clinicians. In addition, it is highly unlikely that the ethical approval would be given to a study that requires 48 anaesthetists to perform four laryngoscopies in each patient.

Even though our anaesthetists perceived an increase in difficulty as the height of the trolley was reduced, reported grade of view at laryngoscopy did not change with the change of trolley height. Perhaps using a percentage of glottic opening score [10, 11] would have provided more sensitive measure of the change in laryngeal view and give a better idea about correlation between the perceived difficulty and view obtained during laryngoscopy.

**Conclusion**

It appears that correct trolley height may have an added benefit of improving our chances of successful management of difficult airway as it improves anaesthetist’s perception of ease of intubation. In addition, anaesthetists are exposed to many situations associated with possible poor body posture during the working day such as intravenous cannulation, writing anaesthetic records, ventilating patients with badly positioned breathing bag, etc. The risk of spinal problems due to poor posture in anaesthetists is not well recognised. It is left to us to take this occupational hazard more seriously. More emphasis should be paid to posture when teaching the art of laryngoscopy to trainee anaesthetists.

**Acknowledgements**

No external funding

**Conflict of interest**

Nothing to declare

**References**


**Influența înălțimii suportului târgii asupra managementului căii aeriene dificile; un studiu pe manechin**

**Rezumat**

Scop. A fost acceptat în mod tradițional faptul că fața pacientului ar trebui să fie situată, pe parcursul intubației oro-tracheale, la un nivel aflat între xifoidul și umbilicul medicului anestezist. Nu am putut evidenția studii care să urmărească efectul înălțimii suportului târgii asupra tehnicii de laringoscopie. Am decis astfel să evaluăm influența acestui nivel a târgii asupra timpului necesar, ratei de succes, posturii adoptate și a percepției dificultății, de către medicul anestezist, în cursul manoperei de amplasare a unui ghid pentru sonda tracheală (bujiu), în trachea unui manechin programat să simuleze condițiile de intubație dificilă.

**Material și metodă.** Patruzece și opt de anestezistii au fost invitați să participe într-un studiu randomizat pe manechin conceput astfel încât să poată evalua efectul înălțimii târgii asupra vitezii și a ratei de succes în cursul plasării ghidului de sondă tracheală. Manechinul programat să simuleze calea aeriană dificilă a fost plasat pe o târgă al cărei cadru mobil s-a ajustat ca înălțime, astfel încât să poată realiza 4 niveluri de înălțime în funcție de raportul dorit între fața manechinului și reperele corporale (anatomice) ale anestezistului.

**Rezultate.** Înălțimea suportului târgii a avut efect minimal asupra vitezii (p = 0,046) dar nu și asupra ratei de succes (p = 0,14) în cursul manoperei de plasare a ghidului pentru sonda tracheală. Înălțimea suportului târgii a exercitat un efect semnificativ asupra percepției
dificultății manoperei (p = 0,01). Mai mult decât atât, anestezistii au tins să adopte o postură inadecvată, care a fost mai accentuată când înălțimea târgii a fost mai redusă.

**Concluzii.** Manopera de ajustare a înălțimii suportului târgii înainte de laringoscopie pare să îmbunătățească condițiile de intubăție și poate avea efecte benefice asupra posturii anestezistului pe parcursul intubației oro-traheale.

**Cuvinte cheie:** înălțimea suportului târgii, intubație dificilă, postură corporală