Effect of laryngoscopy on middle ear pressure during anaesthesia induction

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Abstract: Aims: The procedure of laryngoscopic orotracheal intubation (LOTI) has many impacts on several parts of the body. But its effect on middle ear pressure (MEP) is not known well. The purpose of this study is to evaluate the MEP changes subsequent to insertion of endotracheal tube with laryngoscope. Subjects and methods: 44 patients were included in this study with a normal physical examination of ear, nose and throat. A standard general anaesthesia induction without any inhaler agent was performed to all patients. The MEP measurements for both ears were applied under 1 minute; before induction (BI) and after intubation (AI) with a middle ear analyzer. Also hemodynamic parameters were recorded before induction and after intubation. Results: Of the 44 patients were 25 women and 19 men with a 43.5±15.1 mean age. A statistically significant rise in MEP was seen in all patients subsequent to insertion of endotracheal tube (P<0.05). Mean right MEPs were BI: -9.5 and AI: 18.5 daPa. Also mean left MEPs were BI: -21.7 and AI: 29.1 daPa. The amount of increases in left and right MEPs were 50 daPa and 27 daPa, respectively. 20% increase in systolic blood pressure and 19% increase in diastolic blood pressure were determined after intubation. The mean heart rate was 76/min before intubation, whereas it was 102/min after intubation with a 34% increase. Conclusion: In this study bilateral significant increases in MEP were determined subsequent to LOTI. Possible factors affecting MEP may be auditory tube, size and type of the blades, drugs and face masking time. But on the other hand in our opinion cardiovascular and haemodynamic response to LOTI has the most impact over the middle ear mucosa with mucosal venous congestion.

Keywords: Middle ear pressure, laryngoscopy, intubation, endotracheal tube, adult

Introduction

Laryngoscopic orotracheal intubation (LOTI) has several side effects during anaesthesia management as a time-limited procedure. After laryngotracheal irritation rapid sympathetic discharge leads to a prominent cardiovascular response with hypertension and tachycardia [1]. Otherwise performing LOTI can cause changes in intraocular and intracranial pressure [2, 3]. These stress responses can be very diverse in relation to the patient health status and presence of coexisting diseases [4]. Increase in middle ear pressure (MEP) may cause some undesirable clinical outcomes. MEP changes may lead postoperative intractable nausea and vomiting [5]. Furthermore rupture of membranes, and even facial nerve damages may occur as a result of significant and longterm increases in MEP [6, 7].

The effect of LOTI on MEP isn’t known sufficiently like its other effects. In this study it was aimed to determine the effect of LOTI on MEP during anaesthesia induction.

Subjects and methods

The study was performed on 44 adult American Society of Anaesthesiologists’ (ASA) classification I-II patients aged between 18 to 60 years after obtaining approval of the ethics committee of the institution. Patients were included into the study after a normal otomicroscopic examination for both ears and a normal airway evaluation. Exclusion criteria for participants
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Table 1. Middle ear pressure changes with statistical analysis

<table>
<thead>
<tr>
<th>Time</th>
<th>Right</th>
<th>Left</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before induction</td>
<td>-9.52±28.3</td>
<td>-21.75±59.55</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>After intubation</td>
<td>18.59±87.35</td>
<td>29.14±32.7</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td></td>
<td>&lt;0.05*</td>
<td>&lt;0.001*</td>
<td></td>
</tr>
</tbody>
</table>

Paired t-test was used to compare right and left middle ear pressures (MEP) in different times. All values are given as mean±standard deviation. *P<0.05 were considered statistically significant.

Results

Of 44 patients were 19 males (43.2%) and 25 females (56.8%). The average age was 43.5±15.1 years with range between 19-60 years. The mean weight was 73.53±12.76/kg.

Statistical analyzes were performed for both middle ears before and after intubation and also for difference between the two middle ears.

After intubation a significant increase was observed for both MEPs and the increase was higher in the left MEP (29.1 daPa) than the right MEP (18.5 daPa). The BI – AI comparison was statistically significant for both ears (P<0.05). The amount of increases in left and right MEPs were respectively 50 daPa and 27 daPa. Comparison of MEP between the both ears was not significantly different before and after intubation (P>0.05) (Table 1).

Changes in haemodynamic values such as heart rate and blood pressure were similar with MEP increases. A close relationship was obtained between haemodynamic parameters and MEP response. But statistical analysis of the haemodynamic parameters was not significant (P>0.05). Before intubation mean systolic blood pressure was 121 mmHg for all patients and mean diastolic blood pressure was 71 mmHg. After intubation mean systolic blood pressure was 146 mmHg and mean diastolic pressure was 85 mmHg (Table 2).

Approximately 20% increase in systolic blood pressure and 19% increase in diastolic blood pressure were detected after intubation. The mean heart rate was 76/min before intubation, whereas it was 102/min after intubation with a 34% increase.

Discussion

Airway manipulations such as laryngoscopy, endotracheal intubation and insertion of airway devices, may lead to multiple side effects even in experienced hands. These complications can occur early and late period of the procedure. Most of them related to the trauma of the devices to the tissues such as the eyes, facial
soft tissues, tooth, cervical spine, larynx and pharynx. Other the most known complications are periglottic edema, laryngeal function abnormalities and infections those can be seen after extubation [8]. While there are many reports related to the these adverse situations, our study is the first to investigate the effect of LOTI on MEP during general anesthesia induction. Our estimation before starting the study was to detect an increase in the MEP during anesthesia induction. The results and statistical analysis were found in line with the expectations. Pressure increases started with induction of anesthesia and reached the highest values after intubation. Hereafter the possible factors those affect the MEP will be discussed. Likely factors include; effect of ET, increase in the pressure of the mucosal veins due to venous congestion, effect of inhaler agents and transmucosal gas exchange. Although the mechanisms responsible for increases in the MEP are not exact, some factors may provide critical perspectives. These factors are associated with manipulation of the laryngoscope in the airway and insertion of the endotracheal tube into the trachea. In addition to these, ventilation time with mask and induction drugs may have low-level roles in MEP increases.

According to Benumof, a procedure with six components is needed for ‘best attempt’ respectively; experienced expert, relaxed muscles, most suitable position of airway, external laryngeal assistance, blade with appropriate size and type [9]. Even if the togetherness of all these components is present, a rise may occur in the MEP during laryngoscopy or after endotracheal intubation. LOTI leads to intense changes in cardiovascular and haemodynamic status due to tissue irritation in supraglottic region and the trachea. Also procedures in the airway generate hypertension and tachycardia as a result of the response of the cardioaccelerator nerves and sympathetic ganglia [10, 11]. On the other hand the effects of LOTI occur in the brain with changes in electroencephalo-
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haemodynamic and also in the MEP. In addition to this aspect tracheal tube placement is more irritant than mechanical pressure of the laryngoscope [18]. Its effect on the haemodynamic response may be more compared to the blades effect. To minimize the effect of the tracheal tube placement, 7.5 mm and 8.0 mm tubes were used in the study.

The duration of masking may have an effect on increase with air pressure degree. Lin et al study give some idea about pressure severity [19]. They have measured MEP with AT function under different air pressures with continuous positive airflow pressure mask. They have found a direct proportional relationship with air pressure and MEP increase. In another article no apparent impact on MEP was found among different airway devices [20]. But studies are needed about face masking time effect on MEP which is 3-5 minutes.

Theoretically, a gas exchange across the tympanic membrane is likely, but in an experimental study it was found that its level could be negligible [21].

In conclusion, pressure changes in the middle ear seen in this study were probably the result of cardiovascular and haemodynamic response to LOTI over the middle ear mucosa with mucosal venous congestion.

Disclosure of conflict of interest

None.

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References

[18] Takahashi S, Mizutani T, Miyabe M, Toyooka H. Hemodynamic responses to tracheal intubation...
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