# Videolaryngoscopy versus direct laryngoscopy in without muscle relaxation intubation conditions in tympanomastoidectomy: A randomized, prospective clinical study

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**Abstract**

**Aim:** The aim of this study was to compare the effects of direct laryngoscopy and videolaryngoscopy on the intubation conditions and hemodynamic responses, in the patients scheduled for tympanoplasty and mastoidectomy operation and intubated without muscle relaxation.

**Material and Methods:** This randomized, prospective study was performed in 62 patients aged 18-65 years with ASA (American Society of Anesthesiologists) I-II and Mallampati score I-II and scheduled for elective tympanoplasty and mastoidectomy with general anesthesia. The patients were divided into two groups as the direct laryngoscopy group (Group D) and the videolaryngoscopy group (Group V). The induction of anesthesia was performed with 1 mg / kg lidocaine, 3 μg / kg remifentanil and 2.5 mg / kg propofol for both groups. Hemodynamic responses (heart rate, systolic arterial pressure, diastolic arterial pressure, and mean arterial pressure), number of intubation attempts, duration of laryngoscopy, duration of intubation, intubation conditions (degree of coughing, jaw relaxation, ease of laryngoscopy and position of vocal cords), and postoperative hoarseness and sore throat were evaluated.

**Results:** Hemodynamic responses to intubation were similar in both groups. There were no statistically significant differences between the groups in terms of the number of intubation attempts and the duration of laryngoscopy. The duration of intubation was significantly longer in Group V (29.19 sec) than in Group D (22.19 sec). Intubation conditions showed no significant difference between the groups.

**Conclusion:** In patients without intubation difficulty, McGrath® MAC video laryngoscope showed no superiority in intubation conditions compared with Macintosh direct laryngoscope, during intubation without muscle relaxants; the effects on hemodynamic responses were also similar.

**Keywords:** Intubation Without Muscle Relaxants; Laryngoscopy; Hemodynamic Responses; Videolaryngoscopy.

## INTRODUCTION

Laryngoscopy and endotracheal intubation create a reflex sympathetic response to mechanical stimulation of the larynx and trachea. This response increases the plasma catecholamine concentration and could cause tachycardia, hypertension, arrhythmias, and myocardial ischemia, especially in patients with low cardiac reserve. Various factors such as patient characteristics, use of opioids in induction, and the type of intubation device used may also cause changes in the hemodynamic response. Compatibility of the mouth and pharynx axes is required to see the glottis with a Macintosh laryngoscope,

but this manipulation is not required with the McGrath® MAC videolaryngoscope (1). Videolaryngoscopy reduces the stimulation of the oropharyngeal and laryngeal structures and may reduce hemodynamic changes. It has been reported that videolaryngoscopy leads to weaker hemodynamic stress response during intubation (2).

The effect of videolaryngoscopy on hemodynamics and intubation conditions is poorly understood in patients who are intubated without muscle relaxants.

In our study, we aimed to compare the effects of McGrath® MAC videolaryngoscope with the effects of Macintosh

direct laryngoscope on intubation conditions and hemodynamic responses in patients who were planned to undergo tympanoplasty and mastoidectomy surgery and who were intubated with propofol and remifentanil without muscle relaxant.

## MATERIAL and METHODS

This study was carried out after the approval of Inonu University School of Medicine Clinical Research Ethics Committee (2015/127). Patients were informed before the study and written and verbal consents were received. This study was performed with 62 patients aged 18-65 years with ASA (American Society of Anesthesiologists) I-II and Mallampati score I-II and scheduled for elective tympanoplasty and mastoidectomy. Patients with a baseline heart rate (HR) of 60< beats per minute (bpm) and systolic arterial pressure (SAP) <100 mmHg, those with cardiovascular, pulmonary, or neuromuscular disease, those who use drugs that affect the neuromuscular junction, those who are pregnant or allergic to drugs used during induction (lidocaine, remifentanil, and propofol), and those with gastroesophageal reflux and delayed gastric emptying were excluded from the study.

Patients were randomly divided into two groups. Patients intubated with McGrath® MAC video laryngoscope were group V (n = 30), and patients intubated with Macintosh direct laryngoscope were group D (n = 30). Patients were taken to the operation room and standard DII lead electrocardiography (ECG) was recorded. Measurements of baseline HR, SAP, diastolic arterial pressure (DAP), mean arterial pressure (MAP) and peripheral oxygen saturation ($SpO_2$) were noted.

The vascular access was established with a 20-gauge intravenous catheter from the dorsal surface of the hand. Preoxygenation was performed for 3 minutes with 100% $O_2$. In all cases, anesthesia was induced with intravenous 1 mg/kg lidocaine, 3 µg/kg of remifentanil (given for 60 seconds, waited for 90 seconds), and 2.5 mg/kg propofol (given at 30 seconds). After ventilation for 60 seconds with mask, all endotracheal intubations were performed by the same person who had received 3 years of anesthesiology training. Trachea was intubated with size 8.5 mm and 7.5 mm endotracheal tubes in male and female patients, respectively. Both groups were provided anesthesia maintenance with 1.5-2% sevoflurane and 50% $O_2$ + 50% air and 0.25 µg/kg/min remifentanil.

For the evaluation of hemodynamic responses; the SAP, DAP, MAP, and SpO2 values were recorded, before induction (baseline), after induction, and after intubation (at 1 min, 3 min, 5 min, and every 5 min after 5 min). Intubation conditions, duration of laryngoscopy, duration of intubation, number of intubation attempts, complications, and side effects such as postoperative nausea, vomiting, sore throat, laryngospasm, and hoarseness were recorded. The intubation conditions of the patients were evaluated according to the Helbo-Hansen Raulo intubation scoring criteria (3) (Table1).

**Table 1. Scoring criteria for intubation conditions**

| Score | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Jaw relaxation | Complete | Slight | Stiff | Rigid |
| Ease of laryngoscopy | Easy | Fair | Difficult | Impossible |
| Position of vocal cords | Open | Moving | Closing | Closed |
| Degree of coughing, | None | Slight | Moderate | Severe |
| Mobilization | None | Slight | Moderate | Severe |
| (3-4: Excellent, 5-8: Good, 9-12: Poor, 13-16: Bad ) | | | | |

The time from the termination of the mask ventilation to the appearance of the vocal cords was evaluated as 'duration of laryngoscopy'. After insertion of the endotracheal tube, the time until the detection of the exhaled carbon dioxide ($ETCO_2$) value was evaluated as the 'duration of intubation'. The number of intubation attempts (patients who cannot be intubated after the third attempt were excluded from the study) noted. In addition, the complications during intubation (bleeding, laceration, tooth damage, etc.) and the response to inflation of the balloon of the endotracheal tube were noted.

All of the patients were extubated at the end of the operation and taken to the postoperative care unit. Side effects such as nausea, vomiting, sore throat, laryngospasm, and hoarseness were recorded before leaving the postoperative care unit. Patients were referred to the relevant clinics after at least 30 minutes of follow-up in the postoperative care unit.

Statistical analyses were performed with 'SPSS 22.0 for Windows' and the significance level was set as p<0.05. The data was presented as median (min-max), mean (standard deviation), and number (rate). Shapiro-Wilk test was used for testing the normal distribution of numerical variables. Groups were compared using one of the following statistical tests, which ever appropriate: Mann-Whitney U test, Independent Samples t test, Pearson Chi-Square test, Fisher's exact test.

## RESULTS

The demographic characteristics of the patients were similar (p > 0.05) (Table 2).

**Table 2. Demographic characteristics of groups and ASA scores (Mean± SD or number)**

| | Group D (Direct laryngoscopy) n=31 | Group V (Videolaryngoscopy) n=31 | p |
|---|---|---|---|
| Age (years) | 34.32±11.68 | 32.45±10.60 | 0.079 |
| Sex (Female/Male) | 14/17 | 17/14 | 0.611 |
| Height (cm) | 167.25±8.96 | 169.74±9.67 | 0.809 |
| Weight (kg) | 66.19±10.33 | 67.25±11.46 | 0.702 |
| ASA (I/II) | 26/5 | 26/5 | 1.000 |

There were no differences between the SAP, DAP, MAP, or SpO$_2$ values that were recorded before induction (baseline), after induction, and after intubation (at 1 min, 3 min, 5 min, and every 5 min after 5 min) (p>0.05).

Number of intubation attempts and duration of laryngoscopy were not statistically different between the groups (p> 0.05) and duration of intubation was significantly longer in Group V (p <0.05) (Table 3).

No significant difference was found between intubation scoring parameters of the groups (p>0.05) (Table 4).

There was no significant difference between the groups in terms of nausea, vomiting, sore throat, and hoarseness after extubation (p>0.05).

During the study, the patients did not experience any respiratory or hemodynamic complications and no additional intervention was needed.

| Table 3. Comparison of the groups in terms of the number of intubation attempts, duration of laryngoscopy, duration of intubation, classification of Cormack-Lehane, and Mallampati (Mean or number) | | | |
|---|---|---|---|
| | Group D (n=31) | Group V (n=31) | p |
| Number of intubation attempts (I/II/III/Other)(n) | 30/1/0/0 | 30/1/0/0 | 1.000 |
| Duration of laryngoscopy (sec) | 4.87 | 5.29 | 0.460 |
| Duration of intubation (sec) | 22.19 | 29.19 | <0.001 |
| Mallampati score (I/II/III/IV)(n) | 22/8/1/0 | 25/5/1/0 | 0.643 |

| Table 4. Comparison of intubation scoring parameters according to groups (number) | | | |
|---|---|---|---|
| | Group D (n=31) | Group V (n=31) | p |
| Degree of coughing (I/II/III/IV)(n) | 20/6/3/2 | 24/3/2/2 | 0.668 |
| Mobilization (I/II/III/IV)(n) | 19/7/3/2 | 24/5/1/1 | 0.523 |
| Jaw relaxation (I/II/III/IV)(n) | 28/2/1/0 | 28/3/0/0 | 0.549 |
| Ease of laryngoscopy (I/II/III/IV)(n) | 24/6/1/0 | 28/3/0/0 | 0.315 |
| Position of vocal cords (I/II/III/IV)(n) | 26/4/1/0 | 31/0/0/0 | 0.066 |

## DISCUSSION

This randomized, prospective study compared McGRATH® MAC videolaryngoscopy with Macintosh direct laryngoscopy in tympanoplasty and mastoidectomy operations where muscle relaxant-free intubation was applied. Both methods showed similar hemodynamic changes in the early postoperative period. However, McGRATH® MAC video laryngoscopy has been observed to significantly extend the duration of intubation.

In previous studies, videolaryngoscopy was reported to be much more successful in terms of intubation conditions than Macintosh direct laryngoscopy. In a study by Van Zundert et al., direct laryngoscopy was compared with three types of video laryngoscopies: GlideScope Ranger, Storz V-Mac and McGrath, in elective surgery cases. In

this study, it was shown that glottis views were better in VL than in DL. In the same study, the intubation times were measured as 34 sec in the GlideScope Ranger, 18 sec in the Storz V-Mac, and 38 sec in the McGrath series-5 (4). Despite improved laryngoscopic imaging with video laryngoscopy, prolonged durations of intubation have been reported (4,5). In our study, the number of intubation attempts and the duration of laryngoscopy were the same in both groups, but the duration of intubation was significantly longer in the videolaryngoscopy group (Group V: 29.19 sec and Group D: 22.19 sec).This finding is consistent with the previous studies. Possible reasons for this situation could be the use of hard stylet, loss of vision in the camera lens due to secretions and evaporation, loss of depth perception, two-dimensional imaging, and manipulations of the larynx for better vision (5). In addition, the passage of the tube through the oral cavity and oropharynx to the larynx is a "blind spot" during videolaryngoscopy, and that could lead to prolongation of the duration of intubation (6).

Choi et al. did not find any difference in intubation success between GlideScope and direct laryngoscopy. However, they found that the use of videolaryngoscopy was associated with more successful outcomes in patients with difficult airways (7). In our study, patients without difficult airway markers were selected for the study and there was no difference in intubation success between the two groups.

Direct laryngoscopy with Macintosh and Miller blades requires the oral, pharyngeal, and laryngeal structures to be aligned to facilitate the direct appearance of the glottis. Videolaryngoscopy reduces the lifting force required to see the glottis and allows the airway anatomy and vocal cords to be seen more clearly without the patient's neck folded to back. Videolaryngoscopy has been shown to result in less sympathetic and sympathoadrenal responses thanks to less mechanical stimulation in pharyngeal structures, which may be associated with a decrease in hemodynamic response (1). The magnitude of hemodynamic response to intubation is increased by laryngoscopy force and duration. These changes are usually transient and may return to control levels within five minutes, but in cardiac patients may cause myocardial ischemia (1). In a study that VL and DL were compared in terms of hemodynamics and bispectrality index (BIS) changes, Nishikawa et al. found that there was significant increases in both systolic blood pressure and heart rate after laryngoscopy in the DL while there was no increase in the VL group (2). Gölboyu et al. aimed to compare the McGrath 5 videolaryngoscopy with the Macintosh laryngoscopy, in terms of the effects on intubation success and hemodynamic response. They reported that McGrath videolaryngoscopy provided better glottis view; less facilitating maneuver was used for successful intubation, fewer intubation-related complications were experienced, and no significant difference was found between the two groups in terms of hemodynamic response (8). In another study, Xue et al. compared the Macintosh blade direct laryngoscopy with

VL in terms of hemodynamic response to orotracheal intubation in 57 patients who underwent elective plastic surgery and found no significant difference between the two groups (9). In similar study, Sarkılar G at al. compared the hemodynamic responses to endotracheal intubation performed with direct and video laryngoscope in patients scheduled for cardiac surgery and were similar between the groups at all-time points of measurement (10). Similar to these studies, we did not find any difference between the groups in terms of hemodynamics. This may be due to the facts that our patients were 18-65 years old and ASA I - II, and there was no patient with difficult airways. In addition, remifentanil doses of 3µg/kg, which we used in our study, may have suppressed hemodynamic responses in both groups.

## CONCLUSION

The effects of using McGrath® MAC videolaryngoscopy and Macintosh direct laryngoscopy on intubation conditions and hemodynamic responses were compared during muscle relaxant-free intubation of tympanoplasty and mastoidectomy patients. Hemodynamic responses were similar in the early post-intubation period. The McGrath® MAC videolaryngoscopy provided better view of the glottis, however it led to significantly increased duration of intubation.

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