

The Advantages of Video Laryngoscopy Compared to Standard Laryngoscopy on Intubation Time and the Quality of Intubating Conditions- A Pilot Study

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Abstract

Introduction: Orotracheal intubation using standard (direct) laryngoscopy (SL) with Macintosh blade laryngoscope represents gold standard for airway management. With medicine development, there has been a progression in laryngoscopy technique, using video laryngoscope (VL).

Aim: The aim of this study was to compare the intubation time and intubation conditions with standard in relation to video laryngoscopy.

Material and Methods: The study included 30 patients, both genders, age > 18 years, ASA score I-III. In 15 patients laryngoscopy was performed with standard laryngoscope (Macintosh blade) while in 15 patients video laryngoscope was used. During the intubation, intubation time was measured, as well as quality of intubation conditions, which were divided to excellent, good and bad.

Results: With standard laryngoscopy used in 15 patients, average intubation time was 42.67 seconds. In fifteen patients intubated with video laryngoscopy the average time was 37.20 seconds. Statistically data analyzing with Student's t-test showed that there was not statistically significance in intubation time between these two groups ($p = 0.0364533309$, $p > 0.01$). Analyzing the intubation conditions, our results were: ten patients (66.67%) intubated with standard laryngoscopy technique had excellent intubation conditions, five patients (33.33%) had good, while none of the patients (0%) had bad intubation conditions. In the group of patients intubated with video laryngoscopy identical results were obtained. Analyzing data by Chi-square test, the coefficient of significance was $p = 1$ ($p > 0.01$), which is showed that also there was no statistically significance.

Conclusion: This study did not prove superiority of video laryngoscopy over standard laryngoscopy regarding to intubation time and intubation conditions. Video laryngoscopy is a new method which should find it's place in clinical practice in the aim of shortening the intubation time, but not to suppress standard laryngoscopy.

Keywords: Standard Laryngoscopy; Video Laryngoscopy; Intubation Time; Intubation Conditions

Introduction

Laryngoscopy is a method of using laryngoscope for visualization of laryngeal structures under direct vision in service of facilitating endotracheal intubation (EI). Described by Richard Levitan, the procedure includes four key steps: patient positioning and preparing, epiglottoscopy (identification and visualization of epiglottis), exposure of the larynx and placement of endotracheal tube [1].

Endotracheal intubation is a widespread method during induction the patients in general anesthesia for performing elective and emergency procedures. Endotracheal tube is a plastic “catheter” that is introduced into trachea during intubation to ensure the patency of upper airway, allowing removal of secretion from respiratory tract, tracheobronchial toilet and maintaining the adequate air passage. Adult endotracheal tube on its lower part has a “cuff” that prevents air leakage and allows the use of ET for mechanical ventilation. Cuff is very similar to balloon that serves for insufflation. Once insufflated, there is no other flow through trachea except the one through ET. Carefully insufflation is necessary, because excessive one would cause pressure on trachea and potential damage of tracheal mucosa, whereas insufficient would allow displacement of ET and air leakage [2].

The gold standard for airway management and placement of ET is standard or direct laryngoscopy (SL) using Macintosh laryngoscopic blade [3]. Special training and experience is needed for laryngoscopy with this instrument and it is often performed by anesthesiologist as well as the specialist of emergency medicine. With the development of medicine and technique it was concluded that in patients with difficult airway due to anatomical malformations, comorbidity and etc. a laryngoscope with an integrated camera with illumination - a video laryngoscope (VL) could be used, whereby it is possible to directly visualize the epiglottis, the position of vocal cords, thus achieving a better and more precise intubation [4]. In this way, there were the solution for patients with difficult airway, particularly in securing airway after several attempts of unsuccessful intubation with SL, as well as the teaching practice in airway management.

Aim of the Study

The aim of this study was to compare the intubation time and intubation conditions with standard in relation to video laryngoscopy.

Materials and Methods

The study was conducted at the Clinic for Anesthesia and Intensive therapy at the Clinical Center Nis in the period February - March 2018. Written informed consent was obtained before surgery from all patients. A total of 30 patients with ASA classes I-III, ages > 18 years, both genders, who underwent for various elective surgery procedures were included in this prospective, randomized control study. All procedures were performed in general endotracheal anesthesia. The pre-anesthetic was performed in all patients and included: complete blood analyzes (not older than one month), electrolyte status, urine analyzes, screening of coagulation, determining of the blood type and Rh factor, chest X-ray, ECG and examination and approval of the internal medicine specialist. After this examination the patients received the approval of anesthesiologist for performing the surgical procedure in general endotracheal anesthesia.

On the day of surgery patient were hydrated with various types of solutions (normal saline, Ringer’s solution, Hartmann’s solution, 5% glucose). The routine monitoring was used: non-invasive measurement of systolic and diastolic blood pressures, mean arterial pressure (placed on the opposite arm from the one on which intravenous line was placed), monitoring of standard ECG leads, pulse frequency and pulse oximetry.

Patients were pre-oxygenated for 3 minutes with 100% oxygen and for induction of anesthesia an opioid analgesic fentanyl at doses 1 - 3 mcg/kg and propofol 1.5 - 2 mg/kg were used. For neuromuscular relaxation rocuronium-bromide at a dosage 0.6mg/kg was used. Patients were ventilated with 100% oxygen on the mask and after 120 seconds the intubation was performed. In 15 patients laryngoscopy was performed using standard Macintosh blade (size 4, KaWe-Germany) while in other 15 a video laryngoscope was used (McGrath[®]MAC, Aircraft Medical Ltd.10 Edinburgh, United Kingdom, with plastic blade, for single use, size 4, with a curved blade and angle of 60°, 110 mm x 12 mm x 15 mm, with integrated video camera and LCD monitor). Patients were randomly selected for one of these two methods, without taking into account factors that may influence the possibility of difficult airway management (neck length, tireomental distance, protrusion of upper teeth, history of obstructive sleep apnea (OSA), limited neck mobility, etc). The intubation time (expressed in seconds), was measured. This was the time from the removal of oxygen mask until the moment of appearance of capnography waveform on

the anesthesia machine monitor, which would indicate a successful intubation. During laryngoscopy the quality of intubation conditions were estimated, which were divided into excellent, good and bad. The laryngoscopy was evaluated as easy, favorable and difficult. Easy laryngoscopy implied good relaxation of lower jaw and the absence of resistance with introducing the laryngoscopic blade, which was considered as eligibility criteria. A favorable laryngoscopy considered incomplete relaxation of lower jaw and/or slight resistance during introduction the laryngoscopic blade, which was the parameter for good intubation conditions. Difficult laryngoscopy signified no relaxation of lower jaw and significant resistance during introduction of laryngoscope, which was considered as a poor criteria. Another parameter that qualified intubation conditions was the position of vocal cords: abducted, intermediate position or adducted. The position of vocal cords was qualified as excellent, good and bad. The third criteria for evaluating the intubation conditions was react to cuff insufflation. If the reaction was not present it was evaluated as excellent, if there was a light reaction (1 - 2 reactions during manipulation or light movements no longer than 5 seconds) the third criteria was considered as good. More than two contractions or movements longer than 5 seconds were evaluated as bad. Intubation conditions were rated as excellent, if each of these three parameters was rated as "outstanding", as good- if two parameters were rated as "excellent" and least one as "good". The intubation conditions were evaluated as bad if at least one parameter was evaluated as such [5]. Clinically acceptable intubation condition included the first two groups (excellent and good), while the clinically unacceptable were assessed as bad (Table 1). Anesthesia was maintained with inhalation anesthetic sevoflurane (Sevorane®) in a mixture with oxygen and air at concentrations 0.6 - 2.5 vol% depending on the hemodynamic stability of the patient. During the surgical procedure the vital parameters were maintained at physiological levels and all medication were recorded in anesthesia list. Reversal of neuromuscular blockade was done with prostigmine at dose 0.05mg/kg and for neutralizing the unwanted muscarinic effects atropine was used at dose 0.015 mg/kg. Extubation was performed after returning of upper airway reflexes. No one patient had complication such as cough, excitation, vomiting during extubation. All patients were monitored immediately after intervention at recovery room. The data were statistically processed using Student's t-test and hi-square test in Microsoft Office Excel 2007 and the results are presented with tables and graphs.

Intubation conditions	Clinically acceptable conditions		Clinically unacceptable conditions
	Excellent	Good	Bad
Predictors	Excellent	Good	Bad
Laryngoscopy	Easy	Favorable	Difficult
Vocal cord position	Abducted	Intermediate position	Adducted
Reaction to endotracheal tube insertion or cuff insufflation	No	Light	Sustained

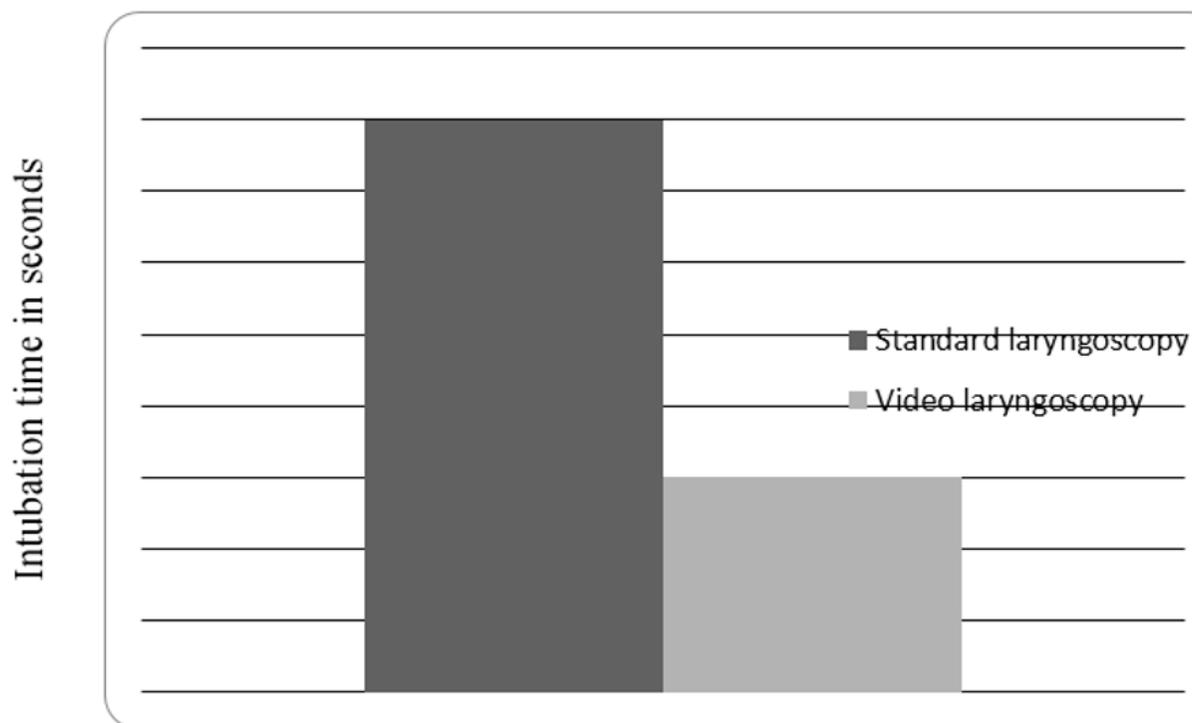
Table 1: Classification of intubation conditions during laryngoscopy.

Results and Discussion

In the group of patients where standard laryngoscopy (SL) was performed, time for securing the airway ranged from a minimum of 20 seconds to a maximum of 65 seconds with average time of 62.74 seconds. In the group where video laryngoscopy (VL) was used, a minimum time for securing the airway was 18 seconds, maximum 72 seconds, with average time of 37.20 seconds (Graph 1). By analyzing the obtained data and using Student's t-test in Microsoft Office Excel 2007 program, calculated $p = 0.3645$ ($p > 0.01$), which suggests that the result were not statistically significant and there is no difference in intubation time between these two groups. By analyzing the intubation conditions, which were ranged as excellent, good and bad, the following results were obtained: 10 patients in SL group (66.67%) had excellent intubation conditions, 5 patients (33.33%) had good, while none (0%) of patients in these group had bad intubation conditions. In VL group, 10 of 15 patients had excellent conditions (66.67%), 5 (33.33%) had good a none (0%) had bad intubation conditions (Table 2). Analyzing these results using Chi-square test, the coefficient of significance $p = 1$ ($p < 0.01$) was obtained, so there was no statistical significance between these two groups.

Intubation conditions	Excellent	Good	Bad	Total
Laryngoscopy				
Standard laryngoscopy	10 (66,67%)	5 (33,33%)	0 (0%)	15 (100%)
Video laryngoscopy	10 (66,67%)	5 (33,33%)	0 (0%)	15 (100%)

Table 2: Quality of intubation conditions.



Graph 1: Comparison of the average intubation time.

Tracheal intubation using SL is a routine procedure for anesthesiologist in everyday clinical practice and a viewing angle during this maneuver is 15°. Because in some cases the view of oropharyngeal structures can be difficult, the use of VL has been suggested as one of the rescue maneuver after failed intubation. Previous researches in this area has shown different results using these two types of laryngoscope.

It is considered that good laryngeal exposition is crucial for the success of intubation, and that during direct laryngoscope the oral, pharyngeal and laryngeal axes should be in a straight line, which is not necessary during video laryngoscopy [6,7]. Nonpensa, *et al.* in their study which included 67 patients who, following unsuccessful intubation attempts with SL, were intubated with VL (six patient were excluded from the study because of the lack of criteria) showed that 58 (95%) of the remaining 61 patients were successfully intubated

with VL. This showed a significant improvement in quality of intubation with VL [8]. The study Mosier, *et al.* indicates a significant reduction (from 12.5% to 1.3% in sample of 236 patients) in percentage of unsuccessful intubation using VL [9]. Also, Lakticowa., *et al.* showed a higher succession rate using VL in urgent EI [10] and the time for vocal cord visualization was shorter using this device, also in urgent situations [11].

Most of the intubations are still performed using SL, which remains the gold standard in airway management in operating rooms, intensive care units and emergency medical care in United States (90%) [12]. The question is whether VL has an impact on post-intubation conditions. Researches until today indicates that SL retains its place in practice according to mentioned post-intubation conditions and there is no statistical significant difference between severe hypoxemia, cardiac arrest and injury of upper airway during intubation with SL and VL [13].

Martens and de Waal did not show in their study any advantage using a VL over a SL in airway management [14]. Their results are similar with the ones obtained by Choi., *et al.* which indicate that use of VL can provide quick and good visualization of vocal cords but the process of intubation was more difficult over the SL method [15]. One of possible explanation is significant hand-eye discordance using VL as well as non-familiarity with this device. One of additional limitations using VL is blurred camera of VL with secretions, blood and vomitus in upper airway which may even obstruct the camera [16].

In our study, we did not detect a statistical significance neither in intubation time or in the intubation conditions regarding VL over SL. According to our results, study performed in China in 2017 [17] showed that VL even reduces the success of the first intubation attempt and the quality of intubation conditions in medically trained persons. These results could be explained with the fact that after years of using SL with Macintosh blade, medical personnel is more familiar with its use comparing to VL.

Conclusion

Video laryngoscopy is a new, superior method that today finds its place mainly in anticipated an unanticipated difficult airway management. Our study did not show the superiority of VL over SL, neither in terms of intubation time or in the quality of intubating conditions. There is a need for further studies about the advantages of VL over a SL, which would include a greater number of patients in order to make relevant conclusions. It is important to have VL for easy and quick visualization of laryngeal structures in the aim for possibly shorten the intubation time and in service of comfort and patient safety.

Conflict of Interest

There is no any financial interest or any conflict of interest.

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