Video Assisted Laryngoscope versus Conventional Macintosh for Pediatric Intubation by Beginner Anesthesiologists

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ABSTRACT

Background: Tracheal intubation is most usually facilitated by the use of a conventional Macintosh laryngoscope. Video and indirect laryngoscopes are becoming more significant tools in the management of the airways in children.
Objective: To compare the time of intubation, the number of tries, and the success rate of pediatric intubation by beginner anesthesiologists using a video laryngoscope versus conventional Macintosh laryngoscope.

Patients and Methods: This prospective randomized, single-blind clinical was conducted at Zagazig University Hospitals on 52 children aged from 2-6 years who were undergoing elective surgeries. VL Group: (n; 26 patients) intubation using video assisted laryngoscopy (Hugemed type). ML Group: (n; 26 patients) intubation using conventional Macintosh laryngoscope. Duration of intubation, number of trial, hemodynamic response as well as oxygen saturation were recorded at different intervals (base line, after induction, during intubation, after intubation) with assessment of complications.

Results: As regard the efficacy and the safety of intubation those patients in ML group had lower intubation time than VL group. There was statistical difference as regard complications of endotracheal intubation as trauma, which was higher in ML group.

Conclusion: With the use of a video-aided laryngoscope, it is possible to safely and under supervision to insert an airway into a patient with a difficult airway.

Keywords: Conventional Macintosh, Pediatric Intubation, Video Assisted Laryngoscope.

INTRODUCTION

In order for anesthesia and cardiac resuscitation to be successful, airway management must take place, whether or not tracheal intubation is used. As a result, it may pose a difficulty to less-experienced anesthesiologists, airway obstruction causes fast desaturation in infants and children because their airways are very different from adult ones [(1)].

Patients requiring neuromuscular paralysis and positive pressure ventilation often have tracheal intubation performed in the operating room after anesthesia has been initiated [(2)]. Anesthesiologists face unique challenges while managing an infant or child's airway [(3)].

A wide range of factors influence upper airway space, causing difficulties with mask breathing, obstructing spontaneous ventilation, and making laryngoscope use become harder. It is also possible for upper airway obstruction to occur because of hypnotic, sedative, and anesthetic medication use [(4)].

Tracheal intubation is most usually facilitated by the use of a conventional Macintosh laryngoscope [(5)]. Inexperienced medical workers may find it challenging, however it is estimated that 47 intubation attempts yield a success rate of 90% [(6)].

"Can't intubate can't ventilate" was the most common primary airway difficulty reported by patients who had complicated, delayed or unsuccessful intubation [(7)]. Indirect laryngoscopes come in a variety of shapes and sizes. Prototypes and examples of pediatric products are available from a number of companies. On the market now are the new McGrath pediatric size 2 video laryngoscope, Truview, Storz video laryngoscope (Glide Scope), Airtraq, Pentax AWS [(8)].

Video laryngoscopes, as well as indirect laryngoscopes are becoming increasingly significant in the management of airways in children. Attaching a camera to the blade's tip may provide a better view of the glottis in both normal and troublesome pediatric airways [(9)].

Laryngoscopes that use a magnifying mirror, a light source, and a guide are known as video laryngoscopes/indirect laryngoscopes. Pediatric anesthesia is more challenging for the teacher and learner to see eye-to-eye using a conventional Macintosh laryngoscope. As a result, an indirect

Received: 22/08/2021
Accepted: 11/10/2021

laryngoscope or video-laryngoscope might be particularly effective for training in these individuals because of its great view and remote screen [10].

This study was designed to compare the duration and ease of intubation, the number of attempts, and the success rate of pediatric intubation by beginner anesthesiologists using a video laryngoscope versus conventional Macintosh laryngoscope.

PATIENTS AND METHODS

At Zagazig University Hospitals we conducted this investigation as a prospective randomized, single-blind clinical trial.

Ethical considerations:

As long as all parents of participants signed informed consent forms and submitted them to Zagazig University's Research Ethics Committee, the study was allowed (ZU-IRB#6237).

We followed the World Medical Association's ethical code for human experimentation, the Helsinki Declaration.

Fifty-two patients undergoing elective surgery have been selected. ASA physical status I or II or Mallampati I and II patients (**Figure 1**) between the ages of 2 to 6 years of both sexes were all included in the study population. Using a computer-generated randomization table, each patient was assigned to one of two management groups.

VL Group: (n; 26 patients) intubation using video assisted laryngoscopy (Hugemed type), and **ML Group:** (n; 26 patients) intubation using conventional Macintosh laryngoscope

Refusal by parents, those at risk for stomach aspiration like those with obstructions in the intestines, the presence of any pathology in the head or neck area, or children with substantial oral/upper airway deformities were all considered exclusion criteria.

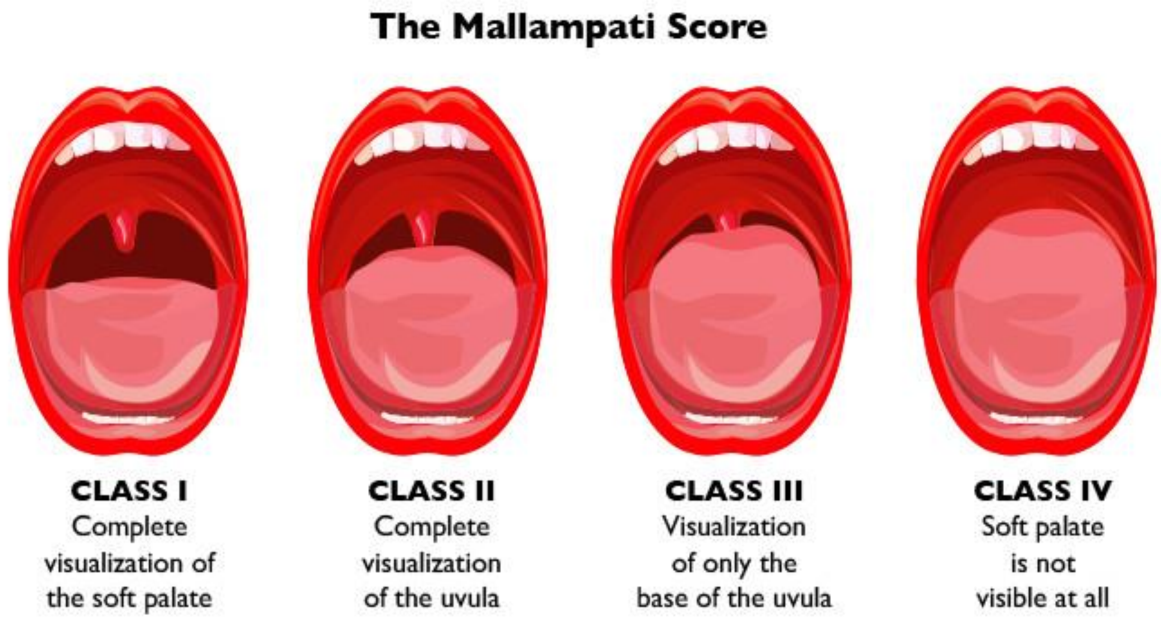

Figure (1): Mallampati score

Process:

All participating children's parents were questioned before to surgery. The study's objectives and outcomes were re-emphasized. Inquiry into the patient's medical and surgical history, as well as their age. Clinical examination. Laboratory tests like; complete blood picture (CBC) as well as coagulation profile (PT, PTT, INR). Pre-operations fasting (six hrs for meal that are solid, four hrs for milk, and two hours for clear fluids and water).

Atropine 0.01 mg/kg I.M and ketamine 3 mg/kg I.M were the pre-medications. All children were subjected to regular monitoring upon arrival in the operating room, including mean arterial blood pressure (MAP), heart rate (HR), respiratory rate, and oxygen saturation (SpO_2) through pulse oximetry on the right hand. Baseline data were recorded for all of the patients. Tube preparation 4+age/4 for tube diameter and 12+age/2 for tube length. Preparation of both laryngoscope, video laryngoscope and conventional Macintosh. Inhalational induction was done with sevoflurane (MAC; 5-6%) then I.V. line was inserted. Induction was preceded by 3 minutes of pre-oxygenation with 100% oxygen. Induction with IV propofol 2 mg/Kg and rocuronium 0.5 mg/Kg was given. After induction, intubation was done by the beginner anesthesiologists under supervision of the senior staff.

After intubation, the patient was ventilated (tidal volume 6-8 ml/kg and I:E 1:2). Ventilator parameters were adjusted to keep end tidal CO_2 at 35 – 40 mm Hg by Capnometry. Maintenance of anesthesia was done with sevoflurane inhalation based on MAC (2%) and neuromuscular blockade rocuronium 0.2 mg/kg. At the end of surgical procedure, sevoflurane discontinued and muscle relaxant was reversed by slowly I.V neostigmine (0.03-0.07 mg/kg) and atropine sulphate 0.02 mg then tracheal extubation was achieved when extubation criteria were met (ability to follow commands, opening the eyes, stable hemodynamic status, spontaneous breathing, regular respiratory rate, adequate tidal volume).

Data collection:

- **Patient characteristics**: ASA physical status, sex and age.
- **Intubation**: **Duration of intubation**: A successful intubation takes between the moment of endotracheal tube (ETT) insertion is confirmed in seconds after the laryngoscope blade has been put into the mouth. End-tidal carbon dioxide increases saturation of peripheral oxygen (SpO_2).
- **Number of attempts**: the attempts of intubation were conducted.
- **Ease of intubation**: ease of intubation may be excellent, good, fair and poor.

Ease of intubation	Maneuvers needed to guide endotracheal tube to glottis
Easy	Need to adjust force on laryngoscope ±
Moderate difficulty	External manipulations or neck movements required, in addition to (a)
Major difficulty	Need to use Magill's forceps ± need to adjust force on laryngoscope, external manipulations or neck movements
Impossible intubation	Require other techniques like fiberoptic intubation or intubation via laryngeal mask airway

- **Success rate: rate of successful intubation was calculated.**
- **Rate of failure defined as intubation after more than 2 attempts.**
- **Hemodynamic response**: heart rate, noninvasive mean arterial pressure.
- **Oxygen saturation** was documented at different intervals (at base line, after induction, during intubation, after intubation).
- **Complications** during intubation such as hypoxemia, change in blood pressure or heart rate (>20% increase or decrease in base line readings of the patients) and airway trauma as: Injuries to the pharyngeal, laryngeal or oral structures, including laceration and perforation, can be evaluated visually or laryngoscopically.

Statistical Analysis

In order to analyze the data acquired, it was loaded into a computer and run via the Statistical Package for the Social Sciences, version 25. (SPSS). Tables and graphs were used to present the findings. The Shapiro–Wilk test was used to examine the distribution properties of variables as well as the homogeneity of variance. The quantitative data was reported in the form of the mean, median, standard deviation, and range. The frequency and proportions of qualitative data were used to present the information. For quantitative independent data, the student's t test (T) and the Mann-Whitney test (MW) were employed to examine the data as needed. To examine qualitatively independent data, researchers employed the Pearson Chi-Square Test. P value equals or less than 0.05 was considered significant.

RESULTS

Age, gender, and ASA classification did not differ statistically significantly between the groups examined **(Table 1).**

Table (1): A comparison of demographic data between the groups investigated

Parameter	Groups		P
	VL group	ML group	
	N=26 (%)	N=26 (%)	
Gender:			
Male Female	13 (50) 13 (50)	14 (53.8) 12 (46.2)	0.781
Age (year):			
Mean ± SD Median (Range)	5.85 ± 2.78 6 (2 – 12)	6.73 ± 3.08 6 (2 – 12)	0.318
ASA:			
I **II**	17 (65.4) 9 (34.6)	18 (69.2) 8 (30.8)	0.678

There was a statistically significant difference in intubation time amongst the groups investigated, with the VL group taking significantly longer than the other groups **(Table 2).**

Table (2): Intubation time was compared between the two groups studied

Parameter	Groups		P
	VL group	ML group	
Intubation time (seconds)			
Mean ± SD	42.12 ± 2.67	34.12 ± 4.09	<0.001**

When it comes to the number of attempts to intubate, oxygen saturation before, after, during and after induction, there was no statistically significant difference between the examined groups (non-significantly higher in ML group) **(Table 3).**

Table (3): Differences in number of attempts, oxygen saturation over time between the two groups analyzed

Parameter	Groups		P
	VL group	ML group	
	N= (%)	N= (%)	
Number of attempts			
Once Twice Thrice	22 (86.4) 2 (7.7) 2 (7.7)	20 (76.9) 2 (7.7) 4 (15.4)	0.41
Oxygen saturation	**Mean ± SD**	**Mean ± SD**	
Before induction	97.73 ± 0.78	97.85 ± 1.01	0.646
After induction	98.77 ± 0.65	99.12 ± 0.91	0.121
During intubation	96.26 ± 1.95	96.96 ± 1.04	0.118
After intubation	99.08 ± 0.89	99.46 ± 0.71	0.091

Oxygen saturation improved in both groups after intubation, yet despite the fact that the two groups had no statistically significant differences **(Table 4)**.

Table (4): Change of oxygen saturation in ML, VL groups over time

ML group Oxygen saturation	**Mean ± SD**	**P1**	**P2**	**P3**
Before induction	97.85 ± 1.01			
After induction	99.12 ± 0.91	<0.001**		
During intubation	96.96 ± 1.04	<0.001**	<0.001**	
After intubation	99.46 ± 0.71	<0.001**	0.036*	<0.001**
VL group Oxygen saturation				
Before induction	97.73 ± 0.78			
After induction	98.77 ± 0.65	<0.001**		
During intubation	96.26 ± 1.95	0.001**	<0.001**	
After intubation	99.08 ± 0.89	<0.001**	0.212	<0.001**

ML conventional Machintoch laryngoscope
VL video assisted laryngoscopy
P1 the difference between oxygen saturation before intubation and oxygen saturation at each point of time
P2 the difference between oxygen saturation after induction and oxygen saturation at each point of time
P3 the difference between oxygen saturation during intubation and oxygen saturation at each point of time

Patients in the VL group had a lower heart rate and mean arterial blood pressure than those in the ML group in this study **(Figure 2, 3).**

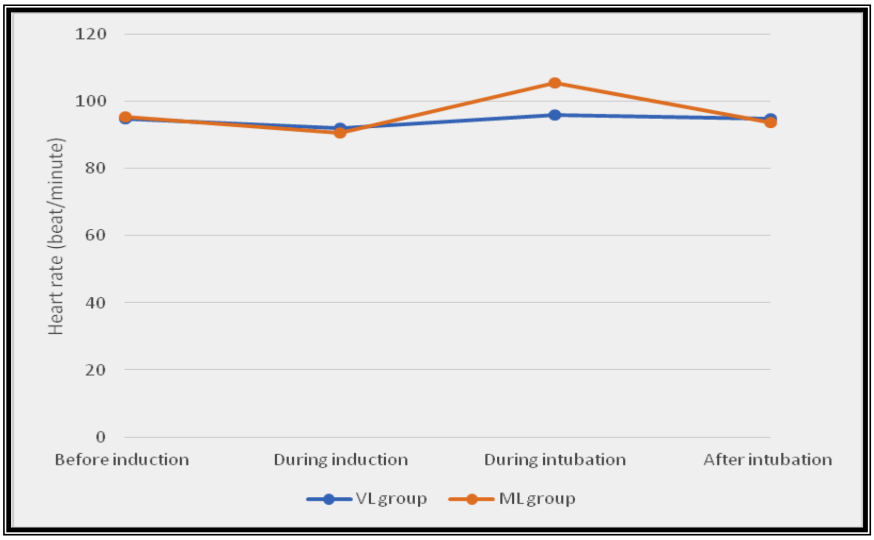

Figure (2): Multiple line graph showing heart rate among the studied groups over time

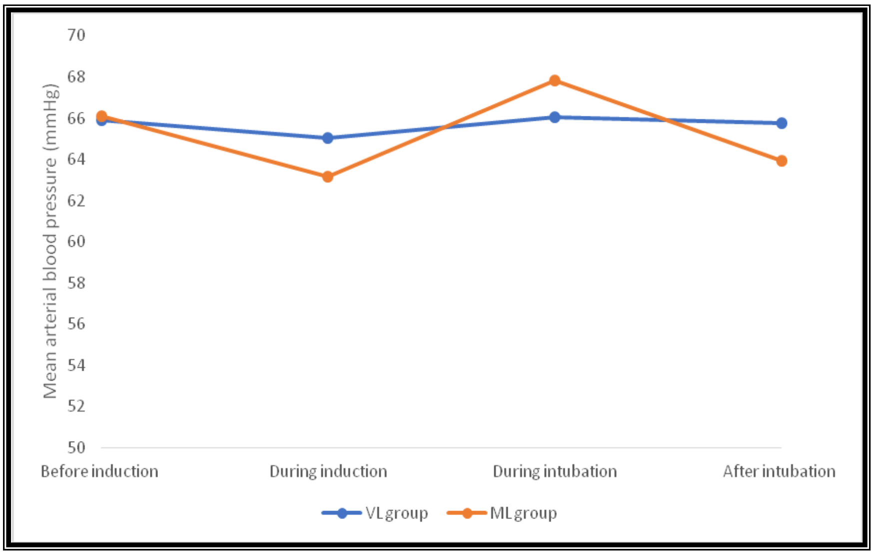

Figure (3): Multiple line graph showing mean arterial blood pressure among the studied groups over time

In terms of complications, there was no statistical difference between the groups tested **(Table 5).**

Table (5): Comparison between the studied groups regarding complications

Parameter	Groups		p
	VL group	ML group	
	N= (%)	N= (%)	
Complications			
None Trauma	26 (100) 0 (0)	24 (92.3) 2 (7.7)	0.49

DISCUSSION

Anesthesia-induced tracheal intubation is frequently performed in the operating room to ensure a safe airway for patients who require neuromuscular paralysis and positive-pressure breathing [(2)]**.** Direct or video laryngoscopes are becoming more important instruments for the management of the airways in children. By putting a video camera at the tip of the blade into children's normal and troublesome airways, an expanded view of the glottis can be acquired [(9)]**.**

By analyzing this study's findings, this study found that the patients in the VL and ML groups had significantly different intubation times.

A statistical difference in intubation issues, such as airway trauma, was found, despite the fact that there was no statistical difference in the number of attempts.

Children who participated in this study were found to have higher heart rates and blood pressures in the ML group. After intubation, there was no statistically significant difference in oxygen saturation between the VL and ML groups, however both groups had an increase in oxygen saturation. When it came to age, gender, or ASA categorization, there was no statistically significant difference in our study.

Our results are in agreement with **Abdelgadir *et al.*** [(11)] who studied 803 youngsters ranging in age from 28 days to 18 years old for their research.

A statistically significant difference in intubation time was seen between the groups in our study. The difference between a direct laryngoscope and a video assisted laryngoscope was extremely considerable, with the video assisted laryngoscope having a much higher degree of accuracy than the direct laryngoscope does. This is in agreement with **Ali** [(12)] who found that intubation time is longer in intubation using video assisted laryngoscope than direct laryngoscope in his study on 798 children (p < 0.00001).

When it came to intubation attempts, our study found no statistically significant difference between the two groups. This is in disagreement with **Ambrosio *et al.*** [(13)] who found that direct laryngoscope had significantly higher success rate of intubation than video assisted laryngoscope (p value was 0.0117) in their study on 44 children. With direct laryngoscope, number of patient failed to be intubated at first attempt was 6 of 22 and with video assisted laryngoscope, number of patients failed to be intubated at first attempts was 14 of 22.

Complications (Trauma) were found to be statistically indistinguishable between study groups in our investigation. A video group had no evidence of trauma compared to the direct group, which only had two children with signs of trauma. This is in agreement with **Abdelgadir *et al.*** [(11)]. According to the researchers, there was very little incidence of trauma to the airway or mouth cavity in either group. In their study on 244 children. During the intubation process, two children in the direct group showed signs of trauma; no children in the video laryngoscope group showed signs of trauma.

For the mean arterial blood pressure pre-induction, there were no statistically significant differences between the two research groups. After induction or after intubation, there was statistically significant difference between the studied groups regarding mean arterial blood pressure during intubation (significantly higher in Macintosh group) (p <0.05). When we compared the change in mean arterial blood pressure in VL group over time, we found that there was significant change in mean arterial blood pressure (MAP) before induction and MAP after induction (p<0.001) and there was non-significant change in MAP before induction, during intubation and after intubation (p3 0.05), but there was statistically significant change in MAP after induction and MAP during intubation and after intubation (p <0.001), but there was non-significant change in MAP after induction and after intubation (p 0.05). When we compared the change in mean arterial blood pressure in ML group over time, there was significant change in MAP before induction and MAP after induction, and during intubation. There was non-significant change in MAP before induction and after intubation, but there was significant change in MAP after induction and MAP during intubation. There was non-significant change after induction and after intubation, but there was significant increase in MAP after induction and that after intubation.

This is in agreement with **Riad *et al.*** [(14)] who found that systolic blood pressure, diastolic blood pressure and mean arterial blood pressure were not significantly different between the two groups (p=0.86, 0.67, and 0.72. respectively).

In our study, there was statistically non-significant difference between the studied groups regarding heart rate before induction, after induction or after intubation. But there was statistically significant difference between the studied groups regarding heart rate during intubation (significantly higher in ML) (p 0.001).When we compared the change in heart rate in VL group over time, there was significant change in heart rate before induction and heart rate after induction, but there was non-significant change in heart rate before induction and heart rate during intubation and after intubation. Moreover, there was significant change in heart rate after induction and heart rate during intubation and after intubation, but there was non-significant change in heart rate after induction and that after intubation. Then, we compared the change in heart rate in ML group over time, there was significant change in heart rate before induction and heart rate after induction, during intubation and after intubation. And there was significant change in heart rate after induction and heart rate during intubation and after intubation. Also there was significant increase in heart rate during induction and that after intubation.

This is in disagreement with **Inal *et al.*** **[15]** who found that the heart change before and after intubation in the direct laryngoscope group was significantly lower than that in video assisted laryngoscope group (p<0.001).

we studied the change in oxygen saturation in ML group over time, we found that there was significant change in oxygen saturation before induction and oxygen saturation after induction, during intubation and after intubation, there was significant change in oxygen saturation after induction and oxygen saturation during intubation and after intubation and there was significant increase in oxygen saturation after induction and that after intubation.

This is in agreement with **Inal *et al.*** **[15], Kim *et al.*** **[16], Nileshwar *et al.*** **[17] and Vlatten *et al.*** **[18]** who found that in terms of oxygen saturation, there was no statistically significant difference between the groups studied. In **Inal *et al.*** **[15]** study for the direct laryngoscopy group, the lowest reported oxygen saturation throughout intubation attempts was 99.4±0.6 percent (mean± SD) against 97.6±2.4 percent (mean± SD) for the indirect laryngoscopy group. An oxygen saturation of less than 90 percent was characterized as "desaturation" in the study. **Kim *et al.*** **[16]** found just one case of desaturation to less than 95% for indirect laryngoscopy, whereas no cases of desaturation for direct laryngoscopy were found, and **Nileshwar *et al.*** **[17]** reported four cases in the indirect laryngoscopy, or video laryngoscopy group. **Vlatten *et al.*** **[9]** and **Vlatten *et al.*** **[18]** during intubation, oxygen saturation did not fall below 94% in any of the children studied.

CONCLUSION

The use of VL is superior to Ml for beginner anesthetist in pediatrics as it is done under supervision, less trauma, and higher success rate.

Financial support and sponsorship: Nil.

Conflict of interest: Nil.

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