*Research Article*

# The Performance of multi view scope for tracheal intubation of pediatric patients (randomized controlled trial)

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## Abstract

**Introduction:** Pediatric endotracheal intubation (ETI) offers unique challenges not seen in the adult patient. There are many important anatomical, physiological and pathological differences between them. The glottic opening in a child is small and lies further anterior making direct visualization and successful placement more difficult. **Aim of the work:** This randomized controlled equivalent trial was designed to evaluate and compare the performance of MVS VL as a new tool versus the traditional machintosh DL for intubation of pediatric patients. **Patients and Methods:** One hundred children from 3 to 12 years of both gender, ASA I and II scheduled to undergo elective surgical operation under general anesthesia were divided into two equal groups each group 50 patients according to sample size, group (A) intubation was done by MultiViewScope (MVS) and group (B) intubation was done by direct laryngeoscope .It was a prospective randomizied controlled equivelant study on pediatric patients. **Results:** Our results revealed that there was no statistically significant differences between both groups either in heamodynamic response, oxygen saturation or complications during procedure and post operative but the main statistically significance difference was in hemodynamic parametrs inside the same group and between two groups mainly in PT, TTBV, TTI, glottic view and success rate. **Discussion:** As regard times till intubation especially TTI which was our primary outcome, our study results revealed that there was highly statistically significant difference between two groups which was longer with MVS than direct laryngeoscope and this prolonged time to intubation appeared to have no real clinical significance and this prolongation due to lack of training in usage of such new devices as we usually use direct laryngeoscope more than indirect one in our routine. Therefore our learning curve raised with time in our study as we got used to deal with MVS. **We Recommend:** We recommend to use DL in patient with Mallampati I and II.
We recommend good training and workshops using VLs on manikain for ordinary intubation and difficult intubation before trial in patients.

**KeyWords: ASA:** American society of anaethesiology, **BP:** blood pressue, **ET:** endotracheal, **DL:** direct laryngeoscope, **MVS:** multi view scope, **TTI:** time to intubate

## Introduction

Pediatric endotracheal intubation (ETI) offers unique challenges not seen in the adult patient. There are many important anatomical, physiological and pathological differences between them. The glottic opening in a child is small and lies further anterior making direct visualization and successful placement more difficult (Heinrich et al., 2012).

The first anatomical difference between the pediatric and adult patient becomes important when positioning the child prior to or immediately after the induction of anesthesia. The head of a pediatric patient is larger relative to body size, with a prominent occiput. This predisposes to airway obstruction in asleep children, because the neck is in flexed position when they lie on a flat surface. The larger occiput combined with a shorter neck makes laryngoscopy relatively more difficult by providing obstacles to the alignment of the oral, laryngeal, and tracheal axes (Carr et al., 2001).

The tongue is larger and the mandible shorter in the young child. In infancy, the child is an obligate nasal breather until 5 months of age. Prominent adenoids and tonsils are frequently found in preschool age children (Sunder et al., 2012).

These factors all contribute to loss of upper airway space which can lead to difficulty with mask ventilation, obstruction during sponta-

neous ventilation, and can make laryngoscopy more difficult. In addition, sedatives, hypnotic, and anesthetic drugs cause loss of tone of upper airway muscles which can itself result in potential upper airway obstruction.
The hypopharynx of the pediatric patient is relatively shorter in height and narrower in width. The cricoid ring is located approximately at the level of the C4 vertebrae at birth, C5 at age 6, and C6 as adults. Vocal cords are not typically found at a right angle (90°) to the trachea.

**Aim of the Work**
This randomized controlled equivalent trial was designed to evaluate and compare the performance of MVS VL as a new tool versus the traditional machintosh DL for intubation of pediatric patients.

MVS VL was designed in an attempt to increase the success rate for intubation of pediatric patients by maximizing the glottic view which made the intubation procedure easier than using standerd machintosh DL.

**Primary Outcome:**
To evaluate the Mean time needed for successful intubation using MVS vs Machintosh (1,2,3) DL.
**Secondry Outcomes:**
1. To study the heamodynamic response during procedure.
2. Glottic view in the MVS versus DL.
3. Incidence of any complications related to the procedure.

## Patients and Methods
One hundred children from 3 to 12 years of both gender, ASA I and II scheduled to undergo elective surgical operation under general anesthesia were divided into two equal groups each group 50 patients according to sample size, group (A) intubation was done by Multi ViewScope (MVS) and group (B) intubation was done by direct laryngeoscope .It was a prospective randomizied controlled equivelant study on pediatric patients.

**Preoperative Assessment:**
Beside preoperative routine assessment, Assessment of airway by Mallampati grade (Mallampati et al., 1985) which was the indicator used in our study to exclude difficult intubation was done as follow:

- **Class I:** Visualization of the soft palate, fauces; uvula, anterior and the posterior pillars.
- **Class II:** Visualization of the soft palate, fauces and uvula.
- **Class III:** Visualization of soft palate and base of uvula. In Samsoon and Young's modification (Samsoon and Young, 1987) of the Mallampati classification, a IV class was added
- **Class IV:** Only hard palate is visible. Soft palate is not visible at all.

**The following parameters were assessed and recorded in both groups:**
**Heamodynamic parameters (heart rate, SBP & DBP) and oxygen saturation:** before induction of anesthesia, after induction &before intubation , after intubation was successfully done and each minute till 5 minutes later.
**Times untill intubation was done:**
Time for positioning of the device, time to best view and time to intubate in seconds.
**Intubating conditioning in both groups:**
Insertion into oropharynx, Correct positioning for intubation, Visibility, Glottic view and Advancement of ETT.
**Success Rate:**

- First order success (succeded from the first attempt ).Second order success (succeded fromthe second attempt ).

**Complications**:
During procedure as lip, dental, mucosal, pharyngeal, laryngeal injury or desaturation.
**Anesthetic Technique:**
The anesthetic machine was checked and all patients were connected to standerd monitoring using electrocardiogram (ECG), non invasive arterial blood pressure, pulse oximetry and skin temperature probe.

General anesthesia was induced in patients aged from 3 to 6 years by inhalational anesthesia using sevoflurane 4- 8% after pre oxygenation by 100% oxygen for 3 minutes using face mask and after the anesthesia was deepened, an IV line was inserted and patient received intravenous atropine at a dose of 0.01mg/kg, fentanyl 1-2 mug/kg, propofol 1-2 mg/kg. In patients aged from 6 to 12 years IV line was inserted before induction and patient received atropine, fentanyle and propofol at the same dose like above after pre-oxygenation with high flow oxygen for 3 minutes. ETI was facilitated by IV atracurium at a dose of 0.5 mg/kg using either MVS or DL and the anesthesia was maintained by isoflurane 1-2% and the minta-inance dose of atracurium 0.1 mg/kg according to operative duration.

**Technique of intubation:**

According to methods used for ETT, Patients were randomly classified into 2 groups using computer generated table numbers, each group contained 50 patients.

**Group (A) who underwent intubation by MultiViewScope (MVS) videolaryngeoscope (VL) StyletScope set:**

After we prepared our equipment (MVS) by connecting the monitor screen with the stylet scope part, putting the $O_2$-port which reduce fogging and the Gauze & suction catheter was prepared. the ETT must be prepared by age according to previously mentioned equation and the stylet scope was attached to the video monitor handle .

With the patient s head in neutral position. Lightly, open his/her mouth, and lift the lower jaw forward with left (non – dominant) hand and hold the scope in right (dominant) hand and isert into the mouth.

Do not rotate Scope first, but advance Scope slowly with looking up at the tongue, When the posterior wall of the pharynx approaches, rotate the scope slowly. The epiglottis or the arytenoid comes into the view at an expectedly shallow position. When the orientation is not determined, return rotation and reconfirm the uvula and airway manuvers such as anterior laryngeal pressure, neck extension/flexion, or both, were allowed to improve the laryngeal grade of view or passage of tracheal tube during tracheal intubation. these manoeuvers were performed only when suboptimal laryngeal view or resistance to tracheal tube passage was encountered.

The epiglottis is usually located in front of uvula. then pass under the epiglottis and confirm the arytenoid. After the arytenoid region is confirmed, advance scope straight through the glottis. When the tube point was confirmed completely cleared the glottis, freeze the right hand to fix the scope and then moved the left hand from patient s mandible to the ETT, and advance the tube and firmly maintain the tube by left hand, pull out the scope.

During this and till the ETI was done the stop watch must be set from the beginning of procedure till the end to calculate the Time for positioning the device, Time to best view and intubation time which are the most parameters we assessed in this study.

Insertion of MVS-SC into oropharynx with redirection of it till the best view obtained on the monitor screen like above then advancement of ETT was done **(fig. 1)**.

## Results

**Table (1): showed Characteristics of patients, ASA classifications, Mallampati score and surgical procedure enrolled in each study group:**

| | Multiview scope (n=50) | Direct laryngoscope (n=50) | Test statistic | p value |
|---|---|---|---|---|
| **Age (year)**<br>Mean±SD<br>(Range) | 6±2.8<br>(2-10) | 6.5±2.9<br>(1-12) | t<br>-0.990 | 0.324 |
| **Gender (female, male)**<br>Male<br>Female | 34 (68%)<br>16 (32%) | 30 (60%)<br>20 (40%) | $\chi^2$<br>0.694 | 0.405 |
| **ASA classification**<br>ASA I | 50 (100%) | 50 (100%) | | … |
| **Mallampati score**<br>Class 1<br>Class 2 | 41 (82%)<br>9 (18%) | 47 (94%)<br>3 (6%) | $\chi^2$<br>8.696 | 0.065 |
| Height (cm) | 115.5±17.2<br>(92-145) | 120.1±16.7<br>(93-150) | t<br>-1.379 | 0.171 |
| Weight (kg) | 21.5±7<br>(12-35) | 23±7.9<br>(11-42) | t<br>-1.014 | 0.313 |
| **Surgical Procedure** | | | | |
| ENT surgery | 4 (8%) | 4 (8%) | Fisher's<br>6.88 | 0.205 |
| General surgery | 32 (64%) | 31 (62%) | | |
| Ophthalmology surgery | 2 (4%) | 9 (18%) | | |
| Orthopedic surgery | 5 (10%) | 3 (6%) | | |
| Plastic surgery | 1 (2%) | 0 (0%) | | |
| Urology | 6 (12%) | 3 (6%) | | |

**1- Heamodynamic parameters in the studied groups:**

There was a state of heamodynamic stability in the two groups throughout the study period although there were some statistical significant differences inside the same group that observed in some times that didn't affect clinical stability and didn't need any interference.

**2. Times until intubation in both groups:**

**a. Time needed for positioning of the device (PT) (sec.):**

**Group A (MVS):** The mean time for positioning of the device was (28.6±5.7 sec.) and the range between (20-40 sec.).

**Group B (DL):** The mean time for positioning of the device was (12.8±4.5 sec.) and the range between (10-20 sec.).

***As regard comparison between the studied groups***, There was highly statistical significant difference was observed between both groups with the p value <0.001*.

**b. Time to best view (TTBV) (TBV) (sec):**

**Group A (MVS):** The mean time to best view (TTBV) was (64.8±7.4 sec.) and the range between (50-80 sec.).

**Group B (DL):** The mean time to best view (TTBV) was (25.2±6.8 sec.) and the range between (20 – 40 sec.).

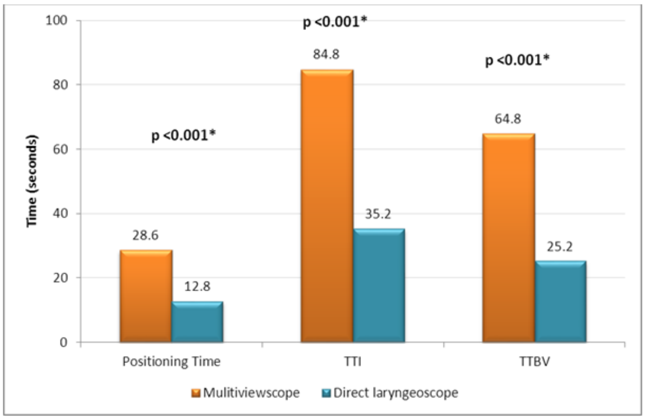
***As regard comparison between the studied groups***, There was highly statistical significant difference was observed between both groups with the p value <0.001*.

**c. Time to intubate (TTI) (IT) (sec.):**

**Group A (MVS):** The mean time to intubate (TTI) was (84.8±7.4sec.) and the range between (70-100sec.).

**Group B (DL):** The mean time to intubate (TTI) was (35.2±6.8sec.) and the range between (30 – 50sec.).

***As regard comparison between the studied groups***, There was highly statistical significant difference was observed between both groups with the p value <0.001*.




**(Fig. 2):** Time for positioning of device, TTI (time to intubate) and TTBV (time to best view)

**3. Glottic view:**

**Group A (MVS):**

**Grade 1:** the laryngeal view grade 1 was seen in 42 patients which equal to 84%.

**Grade 2:** the laryngeal view grade 2 was seen in 8 patients which equal to16%.

**Grade 3:** the laryngeal view grade 3 was not seen with any patients.

**Grade 4:** the laryngeal view grade 4 was not seen with any patients.

**Group B (DL)**:

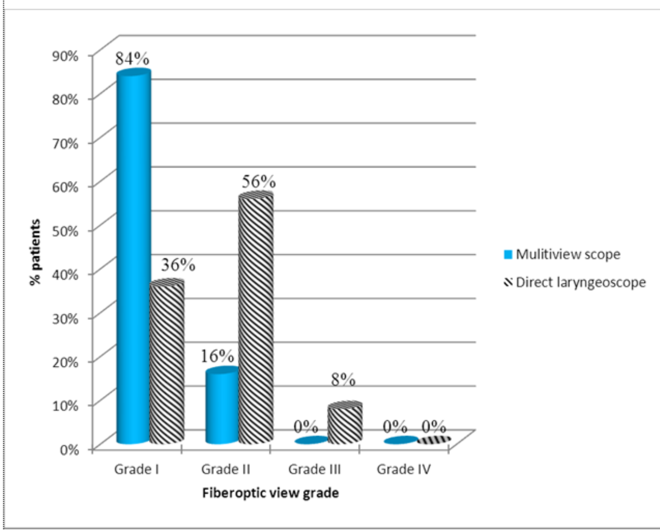
**Grade 1:** the laryngeal view grade 1 was seen in 18 patients which equal to 36%.

**Grade 2:** the laryngeal view grade 2 was seen in 28 patients which equal to 56%.

**Grade 3:** the laryngeal view grade 3 was seen in 4 patients which equal to 8%.

**Grade 4:** the laryngeal view grade 4 was not seen with any patient.

***As regard comparison between the studied groups***, There was highly statistical significant difference was observed between both groups with the p value <0.001*.




**(Fig. 3):** Glottic view grading

## Discussion

In our study, one hundred children from 3 to 12 years of both gender, ASA I scheduled to undergo elective surgical operation under general anaesthesia were divided into two equal groups 50 patients in each group (group (A) intubation was done by MultiViewScope (MVS)) and (group (B) intubation was done by direct laryngeoscope). We study the heamo-dynamic response to laryngeoscopy and intu-bation, times until intubation which included PT(positioning time), TTI (time to intubate) and TTBV (time to best view) also we study intu-bating conditioning, success rate and compl-ications .

Our results revealed that there was no statistically significant differences between both groups either in heamodynamic response, oxygen saturation or complications during procedure and post operative but the main statistically significance difference was in hemodynamic parametrs inside the same group and between two groups mainly in PT,TTBV, TTI, glottic view and success rate.

As regard heamodynamic response, our study showed that HR,SBP and DBP were not comparable between both groups from baseline which was prior to anesthetic induction till 5 min after endotracheal intubation but the statistically significant difference appeared to be inside the same group because of steps of anesthesia, laryngeoscopy and intubation which affect HR,SBP and DBP.

Our study showed statistically significant decrease in HR, SBP and DBP intragroup just after induction of anesthesia prior to ETI and this was because of the effect of anesthetic agents and analgesia used in induction which lead to loss of consciousness and cardiovascular depression and therefore lead to this significant decrease after that these parametres started to significantly increase again and this was because the effect of laryngeoscopy and intu-bation as a stress response of these maneuvers despite the use of fentanyl and propofol as induction agents then there was statistically gradual decrease in these parameters till 5 minutes after intubation and became near to baseline readings and this happened due to the stress response was attenuated by maintaince of anesthesia.

Stress response from laryngoscopy and endo-tracheal intubation results in sympathetic stimulation that leads to tachycardia more than surgical stimulation itself. Direct laryngoscopy involves stretching the oropharyngeal tissues in an attempt to straighten the angle between the mouth and the glottic opening, and this stretch can cause pain and trigger a stress response (Kitamura et al., 2001).

Both laryngoscopy and intubation separately result in sympathetic stimulation, but the catecholamine rise with intubation exceeds that with laryngoscopy alone. (Amit et al., 2016) recorded that various anesthetic agents, adju-vants and analgesics have been used to blunt the level of stimulation and the stress response to the manipulation and stimulation of airway during laryngoscopy and intubation. (Vipul et al., 2016 and Surekha et al., 2016)

As regard times till intubation especially TTI which was our primary outcome, our study results revealed that there was highly statis-tically significant difference between two groups which was longer with MVS than direct laryngeoscope and this prolonged time to intubation appeared to have no real clinical significance and this prolongation due to lack of training in usage of such new devices as we usually use direct laryngeoscope more than indirect one in our routine. Therefore our learning curve raised with time in our study as we got used to deal with MVS.

Our results are similar to those obtained in other studies comparing different types of VL with DL Weiss et al., 2001 who used VL in teaching tracheal intubation in pediatric patients reported comparable difference as regard TTI between both of them whatever the type of VL and how long it took in seconds, also Kaplan et al., 2006 who used a new VL as an aid to intubation and teaching.

Our results in both studied groups were in agreement with Vlatten et al., 2012 who com-pared the STORZ video laryngeoscope and standard direct laryngeoscopy for intubation of pediatric patients resulted in TTI was prolonged with STORZ in comparison with DL, However the glottic view was better with the VL than that with DL. This prolonged time may be due to lack of experience dealing with new VL device and may be also due to malposition, oral secretion, or bleeding may obscure the lens of video laryngeoscope thus obstructing the glottis view.

Also, Teoh et al., 2009 reported that the Airway Scope required pre-loading the disposable blade with the tracheal intubation and suction catheter followed by assembly of the blade to the handle, and application of anti-fogg solution to the exterior surface of the tip of the blade to prevent fogging. These preparatory steps perhaps make it less ideal than the C-MAC in routine and emergency use. On the other hand MVS did not need all these preparatory steps which made it much better than other VLs as it has $O_2$ port which used as anti- fogg and make the field more clear and make intubation easier.
According to study of Ali et al., 2013 who compared the efficacy of pediatric Airtraq with conventional laryngeoscope in children and found that this tybe of video assisted larynx-geoscope also improve the glottic view and documented cormack and lehane (C and L) grade I in most cases in comparison with DL which C and L was grade II in most of cases.

On the other hand, Kim et al., 2011 compared glottis visualization between VLs and DLs and investigated the outcome of glottis visualization in terms of the C & L (Cormack and Lehane) grade. The pooled result failed to show an increase in the C & L grade I view by using VLs.

## Conclusion

From this research, we can conclude that MVS (stylet scope) is not superior to DL in ordinary intubating condition, it should be reserved if there is anticipated difficult intubation or intubation was failed by DL.

## Recommendation

- We recommened to use DL in patient with Mallampati I and II.
- We recommend good training and work-shops using VLs on manikain for ordinary intubation and difficult intubation before trial in patients.

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