Original Article

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Truview Videolaryngoscopy and Mcgrath Videolaryngoscopy with Direct Laryngoscopy in Paediatric Airway Management - A Randomised Comparative Study

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Abstract

Background: Videolaryngoscopes were developed mainly to manage difficult airway intubation. They also gained a great deal of attention recently as a new airway system for use in paediatric airway management. **Subjects and Methods:**183 children of bodyweight 10 – 30 kgs under ASA Physical Status Class I & II with normal airway undergoing general anaesthesia requiring endotracheal intubation were included in the study. Based on the laryngoscope used, they were divided into three groups (Truview Group- TV, McGrath Group – MC, Macintosh Group - DL) of 61 children each. Time to intubation, number of attempts, intubation conditions were recorded. **Results:** The mean POGO score was significantly higher in Group TV (99.18±4.48) than Group MC (95.5±9) and Group DL (71±23.79). Group MC had improved glottic opening score than Group DL. Time Taken for intubation (in seconds) was significantly longer in the Group TV (40.15±9.93) than Group MC (27.2±4.996) and Group DL (17.23±2.88). Time to intubation was significantly longer in Group MC then Group DL. **Conclusion:** Though the Videolaryngoscopes offer excellent glottic visualization when compared to the conventional laryngoscope, the time taken for intubation is significantly prolonged with the videolaryngoscopes in the Paediatric population.

Keywords: Airway Management, Endotracheal Intubation, Indirect Laryngoscopy, Videolaryngoscopy, Paediatrics.

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Introduction

Intubation period is considered one of the greatest anaesthetic risks in paediatric age groups, as they are more prone to rapid desaturation, owing to decreased oxygen reserve and increased oxygen consumption.[1] Hypoxia is the main reason for perioperative mortality and morbidity in children, and failure to identify and control airway issues is the most common cause of hypoxia. The frequency (Cormack Lehane grade III and IV) of difficult laryngoscopy is 1.35 percent.[2,3]

The most widely used device for endotracheal intubation is direct laryngoscopy. It is a challenging technical ability with a complex learning curve that involves the acquisition and maintenance of training, experience, and daily practise. In order to align the airway axes (oral-pharyngeal-laryngeal) for glottic visualisation, Direct Laryngoscopy requires a direct sightline. The incidence of difficult laryngoscopy is higher in infants than in older children due to the anatomical differences in the airway.

Videolaryngoscopy is commonly used for predicted difficult airways and as rescue tools in difficult or failed direct laryngoscopy cases with a higher intubation success rate. Videolaryngoscopes used in the paediatric population were introduced as down-size from their primary adult version. In this study, the intubating conditions were compared with paediatric Truview Videolaryngoscopy and McGrath Videolaryngoscopy with the convention.[4]

In order to achieve an enhanced Cormack & Lehane level of complexity, the Truview PCD videolaryngoscope includes optics that refract the line of vision. For this the tip of the blade is 46^{o} angulated to provide the larynx with a more anterior view.[5] The addition of oxygen during the intubation procedure via the unique oxygen port on the Truview PCD

blades serves to slow the rate of desaturation, prevents the accumulation of mist and secretions on the lenses and ensures clear visualization.

The McGrath MAC Video Laryngoscope blends the popular Macintosh approach with line-of-sight video from its portrait display.[6] This gives both a direct view of the glottis and an indirect view of the show on the monitor. The McGrath MAC blades are disposable and available for single use only. They are made up of fog-free medical-grade optical polymer.

In this study we compare the intubating conditions and time taken to intubation with Paediatric Truview Videolaryngoscopy and McGrath Videolaryngoscopy with the conventional Macintosh laryngoscope.

Subjects and Methods

In this randomized comparative study 183 children aged 2 to10 years weighing 10 to 30 kgs of ASA Physical Status I & II, were randomised based on computer software and allocated into three groups of 61 children each. Institutional review board approved this study. Inclusion criteria: children who underwent elective surgery under general anaesthesia involving endotracheal intubation. GROUP DL – Endotracheal Intubation done with Direct Macintosh Laryngoscope. GROUP TV –Truview videolaryngoscope. GROUP MC – McGrath MAC Videolaryngoscope. Children with Congenital faciomaxillary anomalies, Head & Neck pathology with malformations, Hemodynamic instability and children undergoing Emergency surgery with risk of aspiration were excluded.

Parents of the children enrolled in the study were informed about the content and purpose of the study and an informed written consent was obtained. Parents were instructed about the Fasting guidelines.

Anaesthesia machine checkout was carried out according to the ASA guidelines. After shifting inside the theatre, IV access was secured with 22 G IV cannula and 1 % dextrose in Ringer Lactate was used for IV infusion. After connecting the monitors, baseline Heart Rate, Blood Pressure, SpO2 were noted. The children were premedicated with Inj.Glycopyrrolate at a dose of 0.04 mg/kg, Inj.Midazolam 0.02 mg/kg, Inj.Fentanyl 2 μg/kg. Preoxygenation was done with 100 % oxygen with either of the circuits based on the weight of the children. Anaesthesia was induced with Inj. Thiopentone at 5 mg/kg. After ensuring adequate bag mask ventilation, loading dose of Inj. Atracurium 0.5 mg/kg was given. After mask ventilation for 3 minutes, endotracheal intubation was done with either of the three laryngoscopes according to the group allocated. Anaesthesia was controlled with Oxygen, Nitrous oxide, Sevoflurane and Inj. Atracurium after successful intubation and confirmation of the location of ETT by capnograph.

Glottic view at laryngoscopy was scored by Cormack Lehane (CL) grading and POGO (Percentage Of Glottic Opening) score. The POGO score represents the linear span from the anterior commissure to the interarytenoid notch.[7]

Time taken for intubation was identified as the time taken from the first attempt to insert the laryngoscope blade into the evidence of proper placement of the ETT by capnography.

The number of successful intubation attempts will be noted. After three intubation or intubation attempts taking more than 90 seconds with the assigned blade, patients were intubated using the Macintosh blade or mask ventilated to recover from muscle relaxation. Patients will be ventilated with 100% oxygen between attempts at laryngoscopy and intubation so that no patient was allowed to desaturate below 95%.

Any lifting force required to improve glottis visualization was recorded. Number of operators and number of alternative techniques were also noted. Degree of difficulty at intubation was graded according to Aldet's Intubation Difficulty Score based on the obtained variables. Any complications like oral or pharyngeal bleeding, dental damage and desaturation were noted.

Data were analyzed using SPSS version 21.0. The difference in the mean values between group TV, group MC and group DL was tested by t-test to find the statistical significance. Unpaired t test, ANOVA and Pearson chi square tests were used. The calculated values will be compared with the table values for the corresponding degrees of freedom at 5% or 0.05 level of significance (p values) i.e. $p< 0.05$ significant.

Results

Children in all the three groups were comparable with respect to their baseline demographic variables. They are listed in [Table 1].

Table 1: Demographic data

	Group	Mean ± SD	P value
AGE	Group DL	6.7 ±2.27	0.403
	Group TV	6.2±2.03	
	Group MC	6.57±2.02	
WEIGHT	Group DL	18.655±5.83	0.822
	Group TV	18.11±5.02	
	Group MC	18.65±5.6	

The mean POGO score (in percentage) in Group DL was 71±23.79, Group TV 99.18±4.48 and in Group MC, it was 95.5±9. POGO score. Among the three classes, laryngoscopic views evaluated by Cormack Lehane grading is significant. (p value = 0.00834).

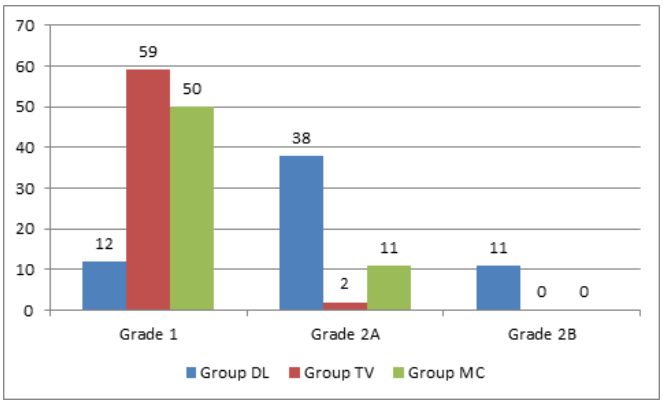

Figure 1: Laryngoscopy grade

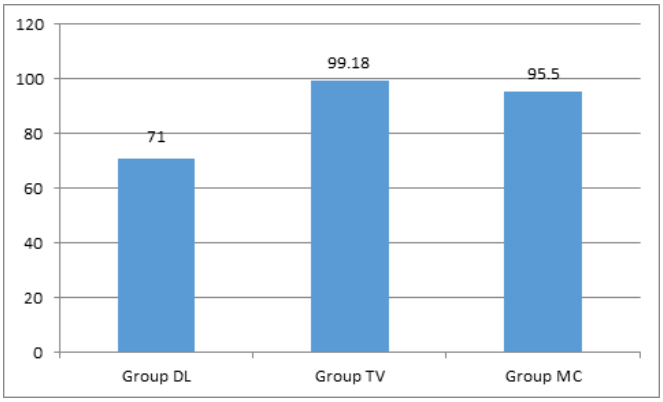

Figure 2: POCO scoring

Time taken for intubation was longer in the Group TV than Group MC and Group DL. The difference between Group MC and Group DL was statistically significant. (p value 0.0001).

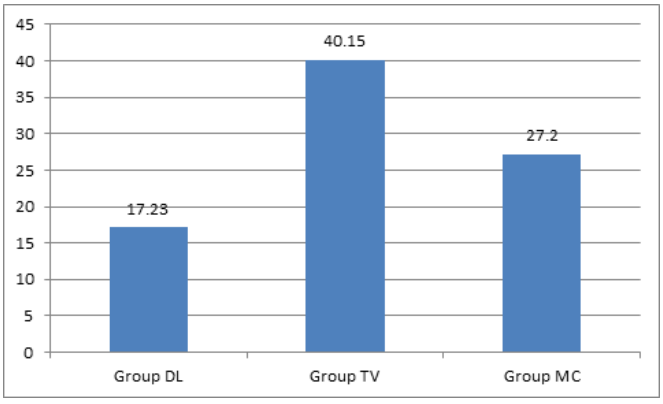

Figure 3: Time taken for intubation

The number of attempts at laryngoscopy, the need for Optimal External Laryngeal Manipulation, Intubation difficulty between the three groups were not statistically significant. No complications were noted in either of the three groups studied.

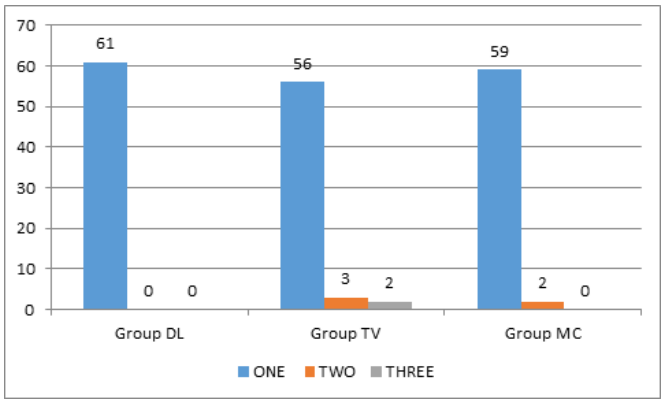

Figure 4: Number of attempts

Discussion

Videolaryngoscopy has been developed mainly to facilitate difficult airway intubation. There are only limited number of studies demonstrating the efficacy in normal airways and in paediatric population. As children are not small adults and the anatomical differences between the infants, children and adults can make even the normal paediatric airway difficult, adequate experience and appropriate instrument is necessary for airway management in the paediatric age group. Evidence supporting the use of videolaryngoscope in normal and difficult airway of the paediatric population has been gaining support in the recent years.[8,9]

We found that the Glottic visualisation as measured by POGO score was significantly higher with the Truview and McGrath when compared to the Macintosh group (99% vs 95% vs 71 %). Cormack Lehane grading was significantly better in Group TV and Group MC in comparison to Group DL (p - 0.00834). Similar findings have been obtained in the research conducted by Ranju Singh et al,[10] Lukasz Szarpak et al,[11] Suman Arora M et al,[12] and R.M.Khan et al,[13] where they found out that the glottic view obtained with Truview was superior to that of Macintosh laryngoscope. Kim J et al,[14] had similar results with respect to Mcgrath videolaryngoscope. But study conducted by Riveros et al,[15] found that the glottic view obtained with Truview was comparable with direct laryngoscope.

In our study, the Time taken for intubation was significantly prolonged with Truview (40 seconds) when compared to the

Mcgrath (27 seconds) and Direct laryngoscope (17 seconds). The results obtained in our study are in line with the study conducted by Ranju Singh et al28 where the time taken to intubate the trachea with Truview videolaryngoscope (19.2 seconds) was more as compared to Macintosh laryngoscopes (10.1 seconds), which was statistically significant (7-9 seconds more with Truview PCD). Similar results were obtained in the studies comducted by Giraudan et al, Haitham Mutlak et al, Cakirca M et al and Riveros et al.[16–18] The results obtained by KimJ et al showed that the median time to intubation did not differ between the McGrath group and the Macintosh group (25.0 vs. 26.0,), contradictory to our results.

No episodes of desaturation and complications like bleeding and dental trauma were recorded in our study. The number of attempts, success rate and ease of intubation as calculated with Intubation Difficulty Score did not vary significantly between the groups. Cakirca, M et al also found that the number of attempts for intubation was similar in all 3 groups. Suman Arora et al also observed that The IDS score was low and comparable between the two laryngoscopes. But study by Kim J et al showed that the IDS was lower in the McGrath group than in the Macintosh group p = 0.018. The success rate of intubation did not vary significantly between the groups.

The key difference in the concept of direct and indirect laryngoscopes lies in the fact that while the view of the cords is much better with the videolaryngoscopes, the method of intubation is considered to be relatively difficult. Direct laryngoscopy produces a real image of the cords by aligning the laryngeal axis with the line of view by sniffing location, while indirect laryngoscopes produce a simulated image of the cords that is taken by a video camera connected to it. It is also difficult to achieve endotracheal intubation due to the divergent anatomical and optical axes, and better hand eye coordination is required to overcome the parallax.

The use of the stylus to guide the endotracheal tube to the cords and the learning curve to improve the coordination of the hand eye might explain the longer time needed for intubation with the Truview PCD. McGrath videolaryngoscope has the advantage that it retains the traditional laryngoscopy skills for the shape of its blades are similar to the conventional laryngoscope.

Our study had some limitations. As evident, it was not possible to blind. the intubating anaesthetist for the laryngoscopist. In addition, intubation was performed by three different anaesthesiologists. Though skilled and experienced, interpersonal variations cannot be ruled out. Both the videolaryngoscopes used were non-channelled based on the availability in our institute.

Conclusion

Though the Videolaryngoscopes offer excellent glottic visualization when compared to the conventional laryngoscope, the time taken for intubation is significantly prolonged with the videolaryngoscopes in the Paediatric population. With this advantage of providing better glottis visualization than the Direct laryngoscope, the Videolaryngoscopes can be used as an effective tool in the management of Paediatric difficult Airway.

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