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Original Research Article

Comparison of McGrath Video Laryngoscope versus BPL Video Laryngoscope for Endotracheal Intubation in Children (1-5 years): A Prospective Randomised Comparative Study

Panchal Niyanta A.[1], Lalchandani Kavita S.[2], Syed Afroza N.[3], Kotecha Hetal G.[4], Patel Azarabegum A.[5], Nayani Nimisha L.[6]

[1]Junior Resident, Department of Anesthesia, Baroda Medical College and SSG Hospital
[2]Associate Professor, Department of Anesthesia, Baroda Medical College and SSG Hospital
[3]Assistant Professor, Department of Anesthesia, Baroda Medical College and SSG Hospital
[4]Senior Resident, Department of Anesthesia, Baroda Medical College and SSG Hospital
[5]Junior Resident, Department of Anesthesia, Baroda Medical College and SSG Hospital
[6]Junior Resident, Department of Anesthesia, Baroda Medical College and SSG Hospital

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Corresponding author: Dr. Kavita S. Lalchandani
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Abstract

Introduction: Pediatric patients, because of their anatomical differences in airway compare to adult pose many challenges during endotracheal intubation. Routinely we perform conventional laryngoscopy in the sniffing position which aligns the 3 axis (oral, pharyngeal, laryngeal). Vocal cord visualization may become difficult with this technique. To overcome this issues, different video laryngoscope are available. They utilize indirect laryngoscopy via a camera to improve glottic visualization eliminating the need of aligning the 3 axis in a straight line possible in neutral position. So, less force is required to visualize the structures, thereby, decreasing the stress response and local tissue injury. Our aim of the study was to compare two different video laryngoscope BPL & McGrath in term of intubation time, POGO grading & hemodynamic parameters.

Method: After ethical approval total 60 patients of 1 -5 years age, belonging to ASA grade I&II posted for elective surgery were taken. They were randomly divided into 2 groups, group B (N=30) intubation done by BPL video laryngoscope & Group M (N=30) intubation done by McGrath video laryngoscope.

Results: Mean time for intubation in group B 9.67 was sec & group M was 15.93 sec ($p < 0.001$) which was highly significant. POGO grading was better in group B compared to group M.

Conclusion: The BPL VLS provides better glottic view with less intubation time compared to McGrath VLS.

Keywords: Video Laryngoscope, BPL; Mcgrath; Paediatric Endotracheal Intubation.

Introduction

Airway management and tracheal intubation are everyday challenges for pediatric patients. We routinely perform conventional method for endotracheal intubation, which is associated with adverse events such as desaturation, prolonged time for intubation,

stress response, bronchospasm, and laryngospasm. In paediatric patients, failure or taking too much time to intubate in a difficult airway can easily lead to oxygen desaturation due to the patient's low functional residual capacity, which may cause further complications such as bradycardia or even worse, cardiac arrest.[1-6] To overcome these issues, different video laryngoscopes are available, which utilize indirect laryngoscopy via a camera to improve glottic visualization eliminating the need of aligning the 3 axes in a straight line. Less force is required to visualize the structures, thereby, decreasing the stress response and local tissue injury. Learning curve is also faster with video laryngoscopy.[7-15] Currently, the following video laryngoscopes are commercially available with paediatric blades: Glidescope, McGrath video laryngoscope, True-view VL, C-MAC VL, Airtraq VL- channelled blade and BPL videolaryngoscope.

McGrath videolaryngoscope having high resolution camera. It is small in size measuring 180mm x 68mm x 110mm and 200gm in weight, with power supply of 250 minutes without battery. It has high intensity LED light source, high resolution CMOS camera with 2.5" LCD colour display. Disposable blades are available in different sizes and are made of fog free medical grade optical polymer for single use. Paediatric blade is useful for intubation in children.

BPL video laryngoscope has 180-degree screen rotation colour display with both channelled and non-channelled blades of different sizes (7 sizes) for single use.

The Characteristics of BPL VL are as follows: It has power supply of >130 minutes without battery, High resolution CMOS camera with 4'' LCD colour display CMOS camera, High-definition anti fog lens and integrated LED light source for high performance visualisation. Paediatric blades are useful for intubation in children more than 1 year of age.

BPL does not require a large mandibular space to align the direction of its line of vision with the laryngeal axis because of its steeply curved blade, whereas the McGrath requires a certain area of mandibular space. Thus, we decided to compare the efficacy and usability of the McGrath, and BPL video laryngoscopes in paediatric patients. So, our primary objective was to compare McGrath video laryngoscope with BPL Video laryngoscope in terms of intubation time while secondary objective was to evaluate POGO score, no. of attempts, haemodynamic and complications.

Materials and Methods

After taking Scientific and Ethical Research Committee approval, this prospective randomised single blind control study was carried out in the department of anaesthesiology, Government Medical College and SSG Hospital, Vadodara. The study was registered in the clinical trial registry of India before enrolment of cases (CTRI NO. – CTRI/2022/04/041807)**.** Total 60 paediatric patients of either sex, between the age group of 1-5 years, belonging to ASA status I and II, scheduled for elective surgical procedures under general anaesthesia with endotracheal intubation were taken for the study. Patients with anticipated difficult airway, Mallampatti grade III & IV, abnormal airway anatomy were excluded from study.

Patients were kept nil by mouth (NBM) for 6 hours and informed written consent was taken from the patient's guardian (attached separately). All the patients were randomly divided into two groups using sealed envelope method. Group M (N=30) - In which McGrath video laryngoscope was used for endotracheal intubation, Group B(N=30)- In which BPL Video laryngoscope was used for endotracheal intubation.

Cylinders and circuits were checked, airway equipment and drugs were kept ready before induction. For McGrath video laryngoscope, pediatric non-channelled blade no. 1or 2 (depending on age and weight of the patient) was mounted on the handle containing battery. The performance of the device was checked by watching the clarity of the image on monitor. For BPL video laryngoscope, Pediatric non channelled blade no. 1or 2 (depending on age and weight of the patient) was mounted on the handle containing battery. The performance of the device was checked by watching the clarity of the image on monitor.

After taking patient inside the operation theatre, multipara monitor was attached and baseline vital parameters were noted. As premedication Inj. Glycopyrrolate 5mcg/kg IV (5 minutes before induction), Inj. Fentanyl 1mcg/kg IV (5 minutes before induction) and Inj. Ondansetron 0.1 mg/kg IV (5 minutes before induction) were given. All patients were induced with 100% O2 with 6 litres/min flow using Jackson-Rees circuit. Inj. Ketamine 1- 2 mg/kg IV till loss of eye lash reflex was given, then). Inj. Atracurium 0.3-0.5 mg/kg IV was given. Controlled positive pressure mask ventilation was done after achieving apnoea by the patients on their own and was made as uniform as possible with the help of capnography (35-45 cm H2O). Intubation was carried out in neutral position.

In Group M McGrath Video laryngoscopy was used and in group B BPL video laryngoscope was used. The BPL video laryngoscope or McGrath video laryngoscope with paediatric blade (no. 1 or No. 2 depending on age and weight of the patient) was advanced from the centre of tongue towards the glottis by viewing on the screen of the monitor attached on handle so that it barely lifted the epiglottis with the tip of the blade. Optimization manoeuvres required to perform intubation was noted like BURP (backward, upward, rightward pressure). once the glottic view was visible - time of glottic exposure and POGO grading was noted. Endotracheal tube was advanced into the trachea from the side of the mouth with preloaded stylet, under direct observation on the screen. Now the endotracheal tube was advanced into the glottis under direct vision. If impingement of the tube occurred, then manipulation maneuverers were required in the form of rotation of tube clockwise or anticlockwise rotation, slight withdrawal or advancement of scope or external laryngeal pressure was applied. After tube is inserted and cuff disappeared, the device was removed from the mouth and the tube was attached to the anaesthesia breathing circuit and tracheal intubation was confirmed with bilateral equal air entry and capnography appearing on the multipara monitor. Total time to intubation was then noted. Maximum 2 attempts with the selected laryngoscope were allowed. Failed intubation was defined as an attempt in which patient could not be intubated even with optimization manoeuvres or > 120 secs required to perform the procedures. In case of failure, the patient were excluded from the study.

Patients were maintained with O_2, sevoflurane and Atracurium 0.08- 0.1 mg/kg. At the end of surgery Sevoflurane was discontinued before 10 mins and patients were ventilated with 100% oxygen. Reversal of residual neuromuscular block were done using Inj. Neostigmine - 50 mcg/kg and Inj. Glycopyrrolate 10mcg/kg IV. Extubation was done once patients start spontaneous breathing. Patients were shifted to post anaesthesia care unit (PACU). Parameters like glottic exposure time, intubation time, POGO score, no. of attempt of intubation, optimization manoeuvres like BURP, external pressure required or not, vital parameters and perioperative complication were monitored.

Statically analysis was carried out using MedCalc software and data was prepared in Mean $\pm$ SD form. Parametric data was analysed using student‘t’ test and non-parametric data by Chi square test. Significance of student‘t’ test was judged by P value. P value > 0.05 not significant, P value < 0.05 -significant and P value < 0.001 was considered as highly significant.

Result and Discussion

Laryngoscopy has come a long way since the advent of the first laryngoscope some 120 years ago. Commonly used laryngoscope required for tracheal intubation is the one described by Macintosh in 1943.Though

direct laryngoscopy remains the gold standard for this purpose, this needs morning sniffing position just to align the oral, pharyngeal and laryngeal axis in a single line for proper visualization of glottis and results in noxious stimulation like rise in pulse and blood pressure. [11-14]

Video laryngoscope has the advantage that there is no need for morning sniffing position and intubation can be done in a neutral position which can be beneficial in patients with cervical spine injuries. There is no need to apply force in vallecula for the view of glottis and thus, the chances of noxious stimulation gets reduced, so does the less chances of haemodynamic disturbances. It offers indirect (on screen) and superior visualisation of glottic structures as the lens of the camera is closer to the glottic opening. An increased viewing angle, from 15 to 80 degrees not only gives better image quality but helps in teaching and research and allows documentation of images for clinical review [1-5].

Video laryngoscopes are best for oral intubation and require some mouth opening. Often the issues with them are fogging and blood and secretions obscuring the view. They all have a learning curve and provide an excellent view of the glottis, but having trouble advancing the tube into the trachea [6-10].

Gen Owada *et al* compared the Airtraq, McGrath, and Macintosh laryngoscopes for difficult paediatric intubation shows result that, the successful intubation rates of the Airtraq®, McGrath®, and Macintosh laryngoscopes were 100%, 72%, and 45%, respectively. The risk ratio of the success rates of Airtraq® compared with McGrath® and Macintosh laryngoscopes were 1.40 (95% CI; 1.19–1.64, $P < 0.001$) and 2.22 (95% CI; 1.68–2.94, $P < 0.001$), respectively. The modified Cormack Lehane grade and percentage of the glottic opening score were better for the Airtraq® than for the other devices We undertook this study to evaluate and compare the efficacy of McGrath video laryngoscope and BPL video laryngoscope with a paediatric blade for glottic exposure time, intubation time, number of attempts of device insertion, quality of visualization in terms of Cormack and Lehane grading, optimization manoeuvres and complications in paediatrics patients in the age group of 1-5 years.

Kyong Yi *et al*. compared McGrath, Pentax, and Macintosh laryngoscope in normal and cervical immobilized manikin" and found that, intubation time and success rate during first attempt were not significantly different between the 3 groups in normal airway manikin while in the cervical immobilized manikin, the intubation time was shorter ($p=0.012$), and the success rate with the first attempt was significantly higher($p < 0.001$) and concluded in their study that McGrath VL and Pentax AWS did not show clinically significant decrease in intubation time. However, they achieved higher first attempt success rate, easier intubation and better glottis view compared with Macintosh laryngoscope by novices in a cervical immobilized manikin model.

Our primary objective was to compare McGrath video laryngoscope with BPL Video laryngoscope in terms of intubation time while secondary objective was to evaluate POGO score, no. of attempts, haemodynamic and complications.

A total of 60 paediatric patients of either gender, between age 1-5 years, belonging to ASA physical status I and II, who were scheduled for elective surgeries under general anaesthesia were enrolled. They were randomly divided into two groups of 30 each. Group M (n=30): In which McGrath Video laryngoscope was used as an intubating device. Group B (n=30): In which BPL Video

laryngoscope was used as an intubating device.

The Demographic data like age, sex, ASA grading were comparable in both the groups.

Table 1: Glottic exposure time and pogo score.

Glottic Exposure Time		Group M Mean ±SD (SEC)	Group B Mean ±SD (SEC)	P Value
		9.16 ± 1.733	5.10 ± 1.137	< 0.001
Pogo Score	**Grade I**	28/30 (93.33%)	26/30(86.66%)	> 0.1
	Grade II	2/30 (6.66%)	4/30 (13.33%)	> 0.1
	Grade III	0	0	

Table no. 1 shows that Glottic exposure time in Group M was 9.16 ± 1,733 sec and in Group B, it was 5.10 ± 1.13 sec. The difference between glottic exposure time in two groups was statistically significant (p = < 0.001). POGO score in grade I that means 100% visualisation of glottic aperture is 2/30 (93.33%) in group M and 26/30 (86.66%) in group B. In grade II that means 50% visualisation of glottic aperture is 2/30 (6.66%) in group M and 4/30 (13.33%) in group B. POGO score is statically not significant (P > 0.1).

In our study, we found that BPL videolaryngoscope does not require a large mandibular space to align the direction of its line of vision with the laryngeal axis because of its steeply curved blade, whereas the McGrath requires a certain area of mandibular space. This factor helped in reducing the glottic exposure time while using BPL videolaryngoscope.

Table 2: Variables

Variables		**Group M Mean ± SD**	**Group B Mean ± SD**	**P Value**
Intubation Time		15.93 ± 3.04	9.677 ± 1.42	< 0.001
Attempt of device insertion	**First attempt**	25/30 (83.33%)	28/30(93.33%)	0.232
	Second attempt	5/30 (16.66%)	2/30(6.66 %)	0.231
BURP		7/30 (23.33%)	5/30(16.66%)	0.523
External Pressure		3/30 (10%)	2/30 (6.66%)	0.642

Table no. 2 shows that intubation time was comparable in both groups. In Group M, intubation time was 15.93 ± 3.04 sec and in Group B, it was 9.677 ±1.42 sec. The difference between intubation time in two groups was statistically significant (p = < 0.001).

We observed in our study that BPL videolaryngoscope having steeper blade, better antifogging system and better camera resolution compared to McGrath videolaryngoscope. All these factors contribute in shorter intubation time while doing intubation using BPL videolaryngoscope in children aged 1-5 years of age. In children there are many anatomical challenges like larger tongue, epiglottis is floppy and omega shape and vocal cords are anteriorly placed compared to adult. Qualities of BPL videolaryngoscope helps to overcome these challenges compared to McGrath videolaryngoscope. That explain shorter intubation time in BPL videolaryngoscope compared McGrath videolaryngoscope

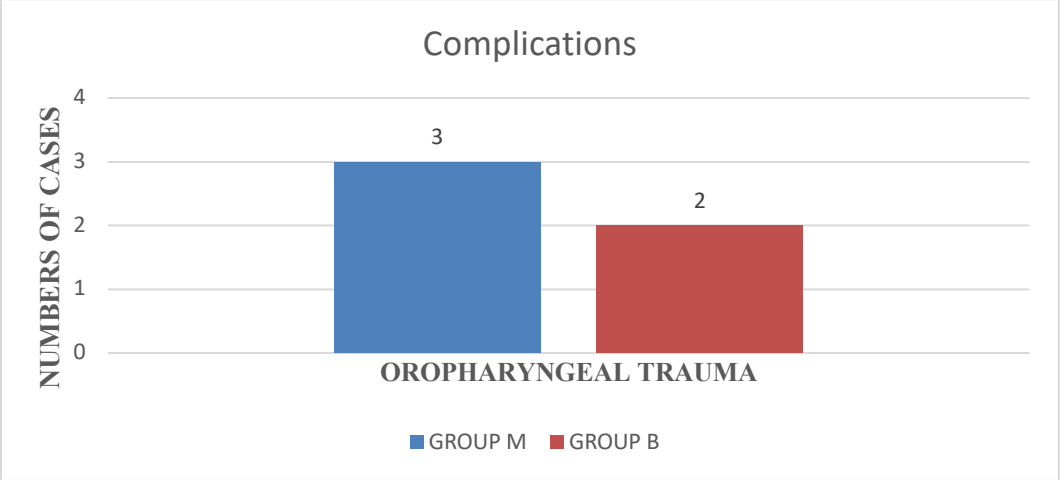
Number of Attempts of device insertion with McGrath video laryngoscope and BPL videolaryngoscope were lesser in Group B as compared to Group M. Intubation was done in first attempt in 25/30 (83.33%) patients in Group M and 28/30 (81.81%) patients in Group B. Second

attempt of intubation was required in 5/30 (16.66%) patients in Group M and 2/30 (6.66%) patients in Group B. The difference between both the groups was statistically not significant (p > 0.05).

BURP and external pressure required during intubation were lesser with group B compared to group M. BURP required in group M 7/30 (23.33%) and 5/30 (16.66%) in group B. External pressure required in group M 3/30 (10%) and 2/30(6.66%) in group B. The difference between two groups were statistically not significant (p->0.05).

Vital parameters like mean Pulse, mean MAP, Spo2 values were comparable in both the groups. The end tidal co2 was comparable in both groups with P value >0.05.

Complications



Graph 1

Graph no. 1 shows that 3 patients in group M and 2 patients in group B had oropharyngeal trauma postoperatively. No other complications like oesophageal intubations, bronchospasm and sore throat were observed in both the groups.

Conclusion

We conclude from our study that in anatomically normal airways in age group of 1 - 5 years, BPL video laryngoscope is equally useful as McGrath video laryngoscope with less time for intubation and less incidence of trauma.

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