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Title- Endotracheal intubation in Cleft surgeries: A Comparison between Macintosh Laryngoscope and McGrath Mac Videolaryngoscope

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Abstract

Background: In recent anaesthesia practice, videolaryngoscopy is gradually replacing conventional Macintosh laryngoscopy in adult and paediatric patients particularly in difficult intubation scenario. In this study, we compared McGrath Mac videolaryngoscope and conventional Macintosh laryngoscope for laryngoscopy and endotracheal intubation in cleft lip and palate surgeries.

Aim: To compare and assess the ease of placement of endotracheal tube in cleft lip and palate surgeries using McGrath Mac videolaryngoscope and Macintosh laryngoscope.

Methods: Sixty children less than 5 years of age, belonging to ASA (American Society of Anesthesiologists) I and II category, who were posted for cleft lip and palate repair were included in the study. They were randomly divided into two groups of 30 each. In group I, Macintosh laryngoscope was used for laryngoscopy and endotracheal intubation and in Group II, McGrath Mac videolaryngoscope was used. Parameters like range of visibility of

vocal cords (Cormack Lehane in Group I vs Fremantle score in Group II), requirement of external laryngeal manipulation (ELM), time taken for intubation and haemodynamic changes were assessed.

Results: The time taken for endotracheal intubation was significantly higher in Group II (20.10±2.83s in Group I vs 24.57±3.52s in Group II, p<0.001). Requirement of ELM was significantly higher in Group I (24/30 vs 2/30, p < 0.001). The heart rates recorded at 1 min, 3 mins and 5 mins of laryngoscopy were significantly higher in Group I (139.7±12.06, 128.47±9.1, 119.37±8.96 vs 125.90±12.24, 120.00±8.35 and 113.03±9.76 in Group II respectively). Cormack Lehane gradings were comparable in both the groups.

Conclusion: Laryngoscopy with McGrath VL significantly prolongs intubation time compared to conventional Macintosh laryngoscope in cleft lip and palate surgeries. The requirement for external laryngeal manipulation was less with McGrath VL and also less tachycardia was observed with McGrath VL than Macintosh laryngoscope.

Keywords: McGrath laryngoscope, Macintosh laryngoscope, videolaryngoscopy, endotracheal intubation, cleft lip, cleft palate.

Introduction

Endotracheal intubation maintains a clear airway in paediatric patients and also protects the airway in patients with altered mental status. The unique anatomical features like large head relative to their torso, large tongue, high and anterior larynx (C3-C4), long & stiff epiglottis that flops posteriorly, narrowest part of upper airway at the level of the cricoid contribute to the difficult airway in infants and young children than in adults.[1] As a result, various complications can arise during pediatric endotracheal intubation such as inability to ventilate or intubate causing hypoxia, pharyngeal and laryngeal injuries and airway oedema which may be due to multiple attempts. [2]To prevent these complications, strategies like minimizing the number of direct laryngoscopy attempts and early conversion to videolaryngoscopy have been adopted by anesthesiologists.[3]

Videolaryngoscopes ease tracheal intubation by providing better view of glottis and direct observation of the tracheal tube during passage through the vocal cords. McGrath VL combines direct and videolaryngoscopy into a single device designed to handle unique challenges of airway management. It uses a video camera embedded into a camera stick for tracheal intubation and it has a slim, disposable, transparent, regularly shaped blade which is similar to the Macintosh blade. The McGrath VL has a wide LCD screen attached to the handle and the screen has greater proximity to the axis of the blade. These features of McGrath VL make tracheal intubation easier and faster.[6, 7, 8].

Cleft lip and palate surgeries are surgically corrected in infancy and early childhood as there is a need to enable proper feeding, reduce difficulty in phonation and complications like sinusitis and respiratory tract infections. These children pose an airway challenge with difficulty in intubation in around 5-10% of cases.[5] Till now we could not identify any study which assessed the ease of intubation with videolaryngoscopes in children with cleft lip or palate. Therefore, we decided to compare the efficacy of McGrath VL with conventional Macintosh laryngoscope for endotracheal intubation in cleft lip and palate corrective surgeries.

Materials and methods

This study was done by the department of anesthesiology and critical care over a period of one year. Children less than 5 years of age belonging to ASA I and ASA II category, posted for elective correction of cleft lip and palate surgeries were included in the study. Informed consent from the parents of all the children and institutional ethics committee clearance were obtained before starting the study. Children with associated syndromes, congenital heart diseases, and dentofacial anomalies were excluded from this study. A total of 60 children were taken based on the inclusion and exclusion criteria at the power of 90. The children were randomly divided into two groups of 30 each using computer generated random numbers. In Group I, endotracheal intubation was done with MacIntosh laryngoscope and in Group II, with McGrath VL.

On the day of surgery, the children were shifted to the operating room (OR) and intravenous access was secured with a 22G or 24G IV cannula and Ringer's lactate infusion was started. Standard monitoring was done with Electrocardiogram (ECG), pulse oximetry, heart rate (HR), non-invasive blood pressure (NIBP), main stream End tidal carbon dioxide (ETCO2) and respiratory rate. Children in both the groups were pre-oxygenated for 3 minutes and were induced with Inj. Fentanyl 2µg/Kg, Inj. Glycopyrrolate 10µg/Kg, Inj. Midazolam 30µg/Kg and Inj. Propofol 2mg/Kg and muscle relaxation was obtained with Inj. Atracurium 0.5mg/Kg.

Laryngoscopy and endotracheal intubation was done by an experienced anaesthesiologist who was well versed with McGrath VL. In Group I, laryngoscopy was done with Macintosh laryngoscope using number 1 or 2 size blade and in Group II, laryngoscopy was done with McGrath VL (Figure -2) using number 1 or 2 size blade. Intubation was done with an appropriate sized cuffed oral RAE tube in both the groups. External laryngeal manipulation was applied if required in both the groups. The time taken for laryngoscopy and endotracheal intubation (defined in our study as the time taken from laryngoscopy to the appearance of EtCO2 trace in the main stream capnograph) were noted. The range of visibility of vocal cords as observed by Cormack Lehane (CL) grading in Group I and Fremantle scoring in Group II were recorded. The CL grade corresponding to the Fremantle score in Group II was noted based on the study by O'Loughlin et al (Figure 1)[4]. External laryngeal manipulation if applied, for optimal visualization of the larynx was also recorded. The vital parameters like heart rate (HR) and mean arterial blood pressure (MAP) were recorded before induction and at 1 minute, 3 minutes and 5 minutes after intubation.

After securing the airway, a throat pack was placed. Anaesthesia was maintained with 1 MAC Sevoflurane in O2-air mixture (FiO2 0.5). Muscle relaxation was maintained with intermittent bolus injections of Atracurium 0.1mg/Kg. At the end of the surgery, Paracetamol rectal suppository 15mg/Kg was placed. Throat pack was removed, thorough oral suctioning was done and neuromuscular blockade was reversed with Inj. Neostigmine 50µg/Kg and Inj. Glycopyrrolate 10µg/Kg and trachea was extubated.

Statistical analysis

The data collected were analyzed using SPSS for windows, version 17. Student T-test was applied for comparing parametric variables between the two groups. Pearson Chi Square test

was applied for comparing the qualitative data between the two groups. 'p' value less than 0.05 was accepted to be statistically significant.

Results

The demographic data like age, sex, weight and type of surgery were comparable in both the groups and the differences were not statistically significant (Table-1). The duration of laryngoscopy and endotracheal intubation was significantly higher in Group II (24.57±3.52 seconds) than in Group I (20.10±2.83 seconds) (p< 0.0001). ELM was required in 24 out of 30 patients in Group I while only 2 out of 30 patients required it in Group II (p< 0.0001). CL grades of Group I and corresponding adjusted CL grades (obtained from Fremantle score) of Group II were comparable (Table-2.) The pre-induction HR (Table -3) and MAP (Table-4) of both groups were similar without any statistically significant difference. The mean HR at 1min, 3min and 5min after induction in Group I were 139.7±12.06, 128.47±9.1, 119.37±8.96 respectively while in Group II, they were 125.90±12.24, 120.00±8.35 and 113.03±9.76 respectively. These differences were found to be statistically significant.(Table-3) There were no statistically significant differences in MAP values at all the above time points between both the groups. (Table-4)

Table 1- Demographic data

(*Mean ± standard deviation)

Variables		Group I (n=30)	Group II (n=30)	P value
Age(in years)*		1.4970±1.08789	1.4277±1.16263	0.8
Sex (M:F)		14:16	16:14	0.6
Weight(kg)*		8.750±2.5789	8.300±1.9809	0.4
Type of surgery	Cleft lip	12	13	0.5
	Cleft palate	18	16	
	REV Cleft lip	0	1	

Table 2- External Laryngeal Manipulation and Duration of Intubation

(*Mean ± standard deviation)

Variables	Group I (n=30)	Group II (n=30)	P value
External Laryngeal Manipulation	24	2	0.0001
Duration of Intubation(seconds)	20.10±2.383	24.57±3.520	0.0001

Table 3- Hemodynamics- Heart rate (beats/minute)
(*Mean ± standard deviation)

Variables	Group I (n=30) (Mean)	Group II (n=30) (Mean)	P value
Pre induction*	116.80±10.213	112.57±10.963	0.12
1 min*	139.70±12.006	125.90±12.246	0.0001
3 min*	128.47±9.104	120.00±8.358	0.0001
5 min*	119.37±8.962	113.03±9.768	0.01

Table 4- Hemodynamics –Mean Arterial Pressure (mm Hg)
(*Mean ± standard deviation)

Variables	Group I (n=30) (Mean)	Group II (n=30) (mean)	P value
Preinduction*	71.80±5.616	73.67±5.862	0.2
1 min*	84.90±5.791	82.03±5.708	0.05
3 min*	79.40±4.399	77.50±4.297	0.09
5 min*	72.57±3.928	72.43±4.508	0.09

Table 5 - Cormack Lehane grading

Variables	Group I (n=30)	Group II (n=30)	P value
Cormack Lehane grade I	19	20	0.4
Cormack Lehane grade II A	9	10	0.2
Cormack Lehane grade II B	2	0	0.5

Discussion

Our study was the first to compare the efficacy of McGrath VL and Macintosh laryngoscope in children with cleft lip and palate. We found that the use of a McGrath VL to perform tracheal intubation in cleft lip and palate leads to a longer time to intubate when compared to Macintosh laryngoscope. Our observations were similar to the study done by Thion LA et al.[16]

We also noted that the glottic views were comparable with McGrath VL and Macintosh laryngoscope, similar to the study done by Kurt Ruetzler et al.[18] Several studies have evaluated the efficacy of McGrath VL and Macintosh laryngoscope and have yielded different results.[10-17] Some studies have indicated that the glottic view was better with the McGrath VL than the Macintosh laryngoscope[9] while in others, no significant difference was noted with respect to glottic view, between the two laryngoscopes.[12]

The difficulty in the placement of the laryngoscope blade in cleft lip patients is due to cleft alveolus, protruding maxilla and high vaulted arch, because of loss of leverage which leads to obstruction of the view needed for normal intubation.[21] The difficulty in laryngoscopy and intubation seen in cleft palate patients can be due to a larger width of the cleft at the hard palate level [24]. Airway and respiratory complications occurring in cleft repair are often due to intubation, ET tube-related problems, laryngeal and bronchospasm, desaturation and aspiration.[21]

It becomes a great challenge to intubate these patients when compared with others due to the above mentioned anatomic variation. According to Basnet et al.., if tracheal intubation fails with Macintosh laryngoscopy, early conversion to videolaryngoscopy may be attempted in order to have successful intubation with less morbidity.[13] In our study, the time taken to intubate with McGrath VL was significantly longer than that with Macintosh laryngoscope. Children have relatively higher oxygen consumption and less functional residual capacity than adults leading to a lower apnoea time; hence oxygen desaturation occurs more rapidly during intubation.[22] So videolaryngoscopy is cautiously recommended in children, especially those who may not endure long-duration apnoea.[11] The guidelines recommended by Neonatal Resuscitation Program limits the intubation attempt to less than 30 seconds supported by stable oxygen saturation and heart rate and there is an increased morbidity rate when intubation attempt is prolonged after this limit.[19] In our study the time taken to intubate was 24.57±3.52 seconds in group II patients (McGrath VL) and in group I patients (Macintosh laryngoscope) it was 20.10±2.83s seconds, both being in recommended limits.

The use of external laryngeal manipulation facilitates the laryngeal exposure by improving the alignment of the larynx with the line of vision, effectively elevating the epiglottis and reducing the anterior tilt of the larynx.[25] The need for external laryngeal manipulation at intubation was less in group II (McGrath VL) which could be attributed to better glottic view than in Group I (Macintosh laryngoscope). Similar findings were observed in the study done by Bakshi SG et al.[20]

In our study, the mean HR at 1min, 3min and 5min after induction in Group I (Macintosh laryngoscope) was significantly higher than Group II (McGrath VL). The mean arterial pressure after induction were similar in both the groups. Laryngoscopy with McGrath VL caused less surge in patient's HR in response to intubation when compared with Macintosh laryngoscope. This could be due to the alignment of the pharyngeal and oral axes which does not need to be forced when using the McGrath VL.[23] However, in a study conducted by Jimenez et al, the authors reported that the McGrath VL led to a significant increase in systolic arterial blood pressure and heart rate.[2]

Limitations of this study:
Though we did this study in cleft surgeries, we excluded patients with syndromes who would have been more challenging to intubate due to associated craniofacial anomalies.

Conclusion

From this study, it has been shown that time to intubate is longer when performed with McGrath Mac videolaryngoscope in comparison to Macintosh laryngoscope. The need for external laryngeal manipulation was less in McGrath VL and tachycardia was less with usage of McGrath VL than with Macintosh laryngoscope. McGrath VL could be considered as a safe and effective alternative to Macintosh laryngoscope, for intubation in children with cleft lip/palate.

Conflicts of interest: NIL

Funding: NIL

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Figure 1- Cormack Lehane grading for the Fremantle score
Figure 2- McGrath Mac video laryngoscope