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COMPARISON OF HAEMODYNAMIC PARAMETERS DURING INTUBATION USING MACINTOSH LARYNGOSCOPE, MCCOY LARYNGOSCOPE AND C-MAC VIDEO LARYNGOSCOPE IN CHILDREN.

Anaesthesiology

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KEYWORDS

INTRODUCTION-

In paediatric airway management, both knowledge and training are mandatory for safer outcomes.[1] Haemodynamic response to laryngoscopy and tracheal intubation has a profound influence on the circulatory system. This response manifests as tachycardia, hypertension, dysrhythmias and it may have deleterious respiratory, neurological and cardiovascular effects. Apnoea threshold is low in children due to higher oxygen consumption, so intubation time should be further minimized.[2]

Glottic view during laryngoscopy can be classified using Cormack-Lehane grading. Glottic view can be altered by modification of intubating instruments and external laryngeal manipulation, which can make easy intubation, decrease the number of attempts and the intubation time.[3]

Tracheal intubation using direct laryngoscopy (Macintosh) is successful in most of the patients, but the incidence of problems encountered is difficult to ascertain, as it depends on both definition and patient selection.[4]

The McCoy blade invented in the early 1990s is modification of Macintosh blade (with hinged tip). When blade is inserted into the vallecula, elevation of the tip acts on the hypo-epiglottic ligaments and lifts the epiglottis out of the view to expose more of glottis, while decreasing the overall movement. Thus, the reflex haemodynamic response is blunted significantly.[5]

Introduction of Videolaryngoscope in 2002, it has been observed that Videolaryngoscope provide a better laryngeal view than direct laryngoscopy in children.[1]

C-MAC Video laryngoscope is inserted in midline in the oral cavity, with a Video camera lens at the blade tip capturing it and projecting into a monitor. The placement of the camera on the distal tip of the blade allows the laryngoscopist to "see around the corner" of the oral and pharyngeal axis, providing a better view than direct visualization and less response on haemodynamic parameters.[6,7,8]

We hypothesized that Intubation using videolaryngoscope is superior to curved laryngoscope and flexible tip laryngoscope for maintaining haemodynamic parameters in children of 5-12 yr of age undergoing general anaesthesia.

METHODS AND MATERIALS - Prospective Interventional Randomized Comparative Study After obtaining the hospital ethics committee approval and written informed consent taken from parents / guardian.

Total 120 children were randomly allocated into three groups by a computer-generated random number table.
Group ML = Laryngoscopy using Macintosh laryngoscope. (n=40)
Group McL=Laryngoscopy using McCoy laryngoscope. (n=40)
Group VL =Laryngoscopy using Videolaryngoscope (C-MAC). (n=40)

Inclusion Criteria

Age of 5-12 yr of either sex in patients undergoing elective surgery under general Anaesthesia, ASA grade I and II, Adequate mouth opening.

Exclusion Criteria.

Syndromic child, Anticipated difficult airway, Heart disease, Reactive airway disease.

Preoperative Preparation

Before surgery, all patients fasted and restricted from fluid 6 hr pre-operatively. Premedication done with syrup Triclofos sodium according to body weight, 2 hr before induction. An intravenous cannula was inserted and crystalloid infusion was started at the rate of 4-5 ml/kg/hr. Inj. Glycopyrrolate 0.2mg was given pre-operatively. Patients were shifted to OT by random selection from all three groups.

Anaesthesia Technique

The patient was shifted to the operation theatre and standard monitors were attached. Basal parameters such as heart rate, blood pressure, SpO2 and ECG were recorded, after a stabilization period of 3 min as baseline reading.

Induction And Maintenance

All children were preoxygenated for 5 min with 100% O2 using Ayer's T –piece/ Mapelson D circuit according to age and weight of the patient. Inj Fentanyl 1 µgm/kg, Inj Propofol 1.5-2.5 mg/kg IV was given until loss of verbal command and maintained with 50% O2+ 50% N2O and Isoflurane attached to the patient. Heart rate, systolic BP, diastolic BP, MAP, ECG, SpO2 were monitored simultaneously. Once assisted ventilation was possible, Inj Vecuronium 0.1mg/kg was given intravenously. Child was manually ventilated for 3min with monitoring of vital parameters.
Group ML Laryngoscopy was performed by Macintosh laryngoscope size 2 blade.
Group McL Laryngoscopy was performed by McCoy laryngoscope size 2 blade.
Group VL C-MAC videolaryngoscope was inserted through midline and the tongue was depressed along with lifting of epiglottis with C-MAC blade, with a videocamera at the tip of blade, allowing whole laryngeal image projection to an external monitor.

In all three groups after visualization of vocal cords cuffed endotracheal tube with stylet of appropriate size was introduced into the trachea, followed by cuff inflation. Primary outcome was noted at baseline, at intubation and post intubation at 1, 3, 5 minutes. Secondary outcome ie, change of blade (to larger blade) were mentioned.

After intubation patient was put on controlled ventilation. The patient was ventilated with the tidal volume of 8 ml/kg, adjusting the respiratory rate to maintain the end tidal carbon dioxide of 30-35 mm Hg with Closed Circuit using low flow technique. Anaesthesia was maintained on O2: N2O (33%:67%) with Isoflurane (0.8 %). Top up doses of intravenous Injection Vecuronium bromide 0.01mg/kg was given whenever needed. Intra-operative monitoring was continued every 5 minutes throughout the operation.

Reversal -After completion of surgery, all the patients was given 100% Oxygen during emergence from Anaesthesia and after suction, neuromuscular blockade was reversed with intravenous Injection Neostigmine (0.05 mg/kg) and Injection Glycopyrrolate (0.01 mg/kg). Trachea was then extubated and patient was oxygenated by facemask. Post-operative pulse, blood pressure, SpO2 and ECG were monitored. Then patient was shifted to postoperative recovery room for further monitoring.

The Cormack- Lehane Grade Is Defined As Follows:

Grade I- Complete visualization of the vocal cords.
Grade II- Visualization of the inferior portion of the glottis.
Grade III- Visualization of only the epiglottis.
Grade IV- Non visualized epiglottis

No changes in the study design were done after the commencement of the study. No dropouts from the study population occurred during the course of the study.

RESULTS -

We found that group VL shows minimum change in haemodynamic parameters, mean baseline Heart rate was 99.25±10.91, which was increased to 105.32±10.63 at intubation, 104.42±10.08 at 1 min post intubation and came to baseline at 3 min of post intubation. Group ML shows maximum change haemodynamic parameters, mean baseline 95.95±9.24, that was increased to 118.9±9.18 at intubation, 113.45±9.17 at 1 min and came to baseline at 3min post intubation. In group VL mean Systolic BP, Diastolic BP and MAP at baseline 106.48±9.6, 63.42±9.59, 77.77±9.12, that shows minimum increase to 111.88±15.51, 61.92±8.83, 78.58±9.98 at intubation, whereas group ML mean Systolic BP, Diastolic BP and MAP at baseline 106.75±13.42, 65.15±11.73, 79.02±11.63, that showed maximum increase to 128.22±14.63, 75.92±11.14, 93.35±11.45 and came to baseline at 1min post intubation. Group VL shows Cormack- Lehane grading 1 in 90% patients whereas group ML & McL in 75% of patients. Intubation time was maximum with group VL 21.50±0.93 sec, group McL 18.00±6.40 sec and minimum with group ML 16.48±1.62 and found to be statistically significant P value of 0.001 with easy as grade of ease of intubation.

Group ML and McL 85%, 92.5% patients had attempt 1, while 100% patients in group had attempt 1. Assistance required as BURP was used in 7.5% of patients in group ML & McL, wereas none of the patients required BURP in group VL. Overall success rate was 100% in each group and no oesophageal or failed intubation was observed in any of the groups.

DISCUSSION-

Heart Rate

The mean Heart rate at intubation in Group ML 118.9±9.18, McL 111.62±10.72 and VL 105.32±10.63 was found to be statistically significant with P value of 0.001.

The mean Heart rate at 1 minute post intubation in group ML 123.45±9.17, group McL 103.8±11.5 and group VL 104.42±10.48 observed to be statistically significant with P value of 0.001.The mean Heart rate at baseline, at 3 minutes and 5 minutes post intubation were comparable among all three groups. Further the analysis showed that there was a significant mean difference at intubation between ML and McL (P value=0.005), ML and VL (P value=0.001) and McL and VL (P value=0.018). And at 1 min, there was a significant mean difference between ML & McL (P value=0.001) and ML & VL (P value=0001). Rise of Heart rate came back to basal level at 3min post intubation in all three groups. Group VL is more haemodynamically stable than ML and McL group.

Sachidananda R, G Umesh et al concluded that Laryngoscope design, duration of Laryngoscopy & Intubation and the forces applied on the laryngoscope all contribute to hemodynamic fluctuations. McCoy blade and videolaryngoscopes where laryngoscopy and intubation can be performed without the aid of stylets provide better attenuation of hemodynamic response compared to intubation using the Macintosh laryngoscope.[17]

Paul A, Nathroy A. concluded in their study that HR, SBP, DBP, and MAP all did rise in both the group following laryngoscopy and intubation but changes with McCoy laryngoscope were less and statistically significant when compared to Macintosh laryngoscopes.[18]

Systolic Blood Pressure

The mean systolic blood pressure at intubation in group ML 128±14.63, McL 120.85±10.62 and VL 111.88±15.51, observed to have significant difference with P value of 0.001. The mean systolic blood pressure at baseline, 1 minute, 3minutes and 5 minutes post intubation were comparable among the three groups.Further analysis showed a significant mean difference at intubation between ML,& McL P value of 0.047, ML & VL P value of 0.001 and McL & VL P value of 0.012.

Aggarawal H et al aimed at comparing the McCoy and C-MAC video laryngoscope with conventional Macintosh laryngoscope for hemodynamic responses of orotracheal intubation among adults receiving general anaesthesia for elective surgeries and found that he McCoy laryngoscope provided better attenuation of hemodynamic responses to laryngoscopy and intubation than the Macintosh and C-Mac video laryngoscope whereas more appearance of Cormack and Lehane score Class I was seen with the C-MAC video laryngoscope. Furthermore, the time taken for intubation was the longest with the C-MAC video laryngoscope.

Diastolic Blood Pressure

The mean Diastolic blood pressure at intubation in group ML 75.92±11.14, McL 68.98±11.2 and VL 61.92±8.8, observed to have significant difference with Pvalue 0f 0.001. The mean Diastolic blood pressure at baseline, 1 minute, 3 minutes and 5 minutes post intubation were comparable among three groups.

Further analysis showed a significant mean difference at intubation between ML & McL P value of 0.001 and McL & VL P value of 0.017.

Mean Arterial Pressure

The mean arterial pressure at intubation in group ML 93±11.45, McL 86.12±9.44 and VL 78.58±9.98, observed to have significant difference with P value of 0.001. The mean arterial pressure at baseline, 1 min, 3 min, 5 min post intubation were comparable among three groups.

Further analysis showed that there was a significant mean difference at intubation between ML & McL P value of 0.006, ML & VL P value of 0.001 and McL & VL P value of 0.004.

Vaswani J, Mallik c et al compared the stress response of laryngoscopy using Macintosh and McCoy type blade and found that both groups are comparable in terms of baseline haemodynamic parameters. Post laryngoscopy and intubation till 2 minutes, Heart rate & mean arterial pressure were significantly higher with Macintosh group compared to McCoy group.[2]

Cormack- Lehane Grading

The Cormack-Lehane Grading in the group ML & McL, 75% had C-L grade 1 & 25% had C-L grade 2, group VL had 90% C-L grade 1 and only 10% had grade 2. We found that glottic visualisation is best achieved with video laryngoscopy.

Kiliscaslan A, Topal A et al found that The Cormack and Lehane score was III in 41 patients, and IV in one patient, with the Macintosh laryngoscope, while Cormack and Lehane score was I in 27 patients, II in 14 and III in one with CMAC. Tracheal intubation with CMAC was successful on the first attempt in 36 patients (86%), and on the second attempt in 6 patients (14%). No complications were observed other than minor damage (blood on blade) in 8 patients (19%).[8]

Ease Of Intubation

Ease of intubation: This was graded as follows: Grade 1: Intubation easy Grade 2: Intubation requiring an increased anterior lifting force and assistance to pull the right corner of the mouth upwards to increase space Grade 3: Intubation requiring multiple attempts and a curved stylet Grade 4: Failure to intubate with the assigned laryngoscope.[3] In this study Grade 1 was considered easy & Grade 2, 3 & 4 were considered difficult.

We found that all patients in our study had grade 1 as grade for ease of intubation.

Intubation Time

The mean intubation in our study of group ML is 16.48±1.62 seconds, group McL is 18.00±6.40 seconds and group VL is 21.5±0.93 seconds. It was observed that intubation time is maximum in VL group and minimum with ML group.

In a study Sinha R, Sharma A et al found that time for intubation with C-MAC was 24.5 seconds.[1]

Vaswani J, Mallik c et al found that laryngoscopy time with Macintosh blade is 19.55 seconds and with McCoy blade is 16.2 seconds.[2]

In this study mean intubation time when compared between the three

groups shows statistically significant difference P value 0.001. Mean intubation time between ML& McL P value of 0.004, ML & McL P value of 0.001 and between McL & VL Pvalue of 0.001.

Intubation Attempt

In this study, it was observed that under the group ML & McL , 85%,92.5% patients had attempt 1, while 15%, 7.5% had attempt 2. On the other hand group VL had 100% patients were intubated in attempt. Eisenberg AM, Green-Hopkins I et al found no difference between DL & VAL with regard to first pass intubation success rate, complication rate or rate of successful intubation by ED provider.[12]

Yildrium et al studied the intubation success rates of emergency medical technicians using a Macintosh laryngoscope (ML), McCoy laryngoscope (MCL), and C MAC D-Blade (CMDB) video laryngoscope on manikin models with immobilized cervical spines. The CMDB and MCL success rates were significantly higher than the ML rates in all scenario models ($p < 0.05$). The CMDB intubation duration was significantly shorter when compared with ML and provide an easier, faster intubation then ML & McL.

Assistance Required

In this study all patients were intubated with appropriate sized cuffed endotracheal tube with stylet and it was observed that in the group ML & McL 7.5% of patients used BURP, whereas in group VL none of the patients required BURP.

Vaswani J, Mallik c et al found BURP manoeuvre was never required with McCoy blade but with Macintosh blade it was required in 36.7% of patients ($p<0.01$).[2]

CONCLUSION-

We conclude that Videolaryngoscope (C-MAC) in children had minimum haemodynamic response during laryngoscopy as compared to Macintosh and McCoy laryngoscope. Videolaryngoscope provides better glottic visualisation, ease of intubation with maximum first attempt intubation without any assistance in form of BURP, but intubation time was prolonged as compared to Macintosh and McCoy laryngoscope Thus, we recommend use of videolaryngoscope should be known to all and available as an alternative to Macintosh and McCoy laryngoscope for airway management of all children, having either normal or unpredicted difficult airway in operation theatres.

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