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COMPARISON OF VIDEOLARYNGOSCOPE VERSUS MACINTOSH LARYNGOSCOPE FOR ELECTIVE TRACHEAL INTUBATION IN INFANTS – A RANDOMISED INTERVENTIONAL STUDY

Anaesthesiology

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ABSTRACT

Background and Aims: Airways of pediatrics patients differ from adult in numerous ways.Oral, pharyngeal and laryngeal axes alignment is required for successful conventional direct laryngoscopy and intubation. Videolaryngoscopes improve ease of intubation and is associated with decreased movement of cervical spine by obviating the need for aligning line of sight with glottis.This study was designed to compare Tuoren videolaryngoscope versus Macintosh laryngoscope in elective tracheal intubation in infants. **Material and Methods:** 132 infants of American Society of Anesthesiologist grading I and II ,without anticipated difficult laryngoscopy were registered for this prospective randomised clinical trial. They were allocated into either groups- Group A(n=66) infants were intubated with size 1 Tuoren videolaryngoscope and Group B(n=66) infants were intubated with direct laryngoscope with size 1 Macintosh blade. The primary objective was to compare time taken for intubation.Secondary objectives included comparison of first attempt success rate, Ease of Intubation score, Intubation Difficulty Score and complications in both groups. **Results:** Time taken for intubation was 24.15 ±2.13 s in Group A and 24.62 ±2.27 s in Group B ($p = 0.226$) and first attempt success rate were comparable in both the groups whereas glottic visualisation ($p<0.001$), Intubation Difficulty Score ($p < 0.001$) and ease of intubation ($p = 0.490$) were better with video laryngoscope. **Conclusion:** The performance of Tuoren Videolaryngoscope and Macintosh laryngoscope was similar in terms of time taken for intubation and first attempt success rate though better glottic visualisation, ease of intubation and lower intubation difficulty score was achieved with Tuoren videolaryngoscope.

KEYWORDS

Airway, Infants, Intubation, Macintosh Laryngoscope, Tuoren Video Laryngoscope.

INTRODUCTION

Tracheal intubation is an essential skill in management of perioperative airway in pediatric anesthesia.[1] Successful intubation requires adequate visualisation of airway and related structures thus avoiding prolongation and repeated attempts in securing the definitive airway.[2]

Airways of pediatrics patients differ from adult in number of ways and most unfamiliar airway is encountered in neonates and infants under 1 year of age. The head of pediatric patient is relatively large to the body, with prominent occiput. Size of the tongue is also larger compared to mandible. Larynx is relatively higher in neck in children. The epiglottis is omega shaped, anterior angulation of vocal cords present. Pediatric airway is funnel shaped and narrowest part is found at level of cricoid.[3]

Airway and respiratory complications are most common causes of morbidity during general anesthesia in children. Alignment of oral, pharyngeal and laryngeal axes is required for quick and successful conventional direct laryngoscopy and intubation. Sometimes, even in expert hands, direct laryngoscopy is not ideal for visualisation of larynx in children with anatomic anomalies such as Pierre Robin Syndrome.

Videolaryngoscopes and optical laryngoscopes have been developed and they improve ease of intubation as they require decreased movement of cervical spine by eliminating the need for direct line of sight to visuaise airway structures.Videolaryngoscopy has the potential to facilitate successful endotracheal intuabtion and decrease adverse consequences of delay in airway stabilisation.[4]

Studies are now being conducted comparing video laryngoscopy with direct laryngoscopy. In this study, we aim at comparing time taken for intubation with video laryngoscope versus Macintosh laryngoscope in infants, first attempt success rate, ease of intubation score, intubation difficulty score, hemodynamic changes during intubation and cases associated with airway trauma.

MATERIALAND METHODOLOGY

Approval from Institutional ethics committee was obtained for conducting this hospital based randomised prospective interventional study in a tertiary care centre, in the year 2022. This study was also registered with clinicaltrials.gov prior to patient enrollment. Pediatric patients of age less than 1 year, ASA grade I and II who were undergoing elective pediatric surgery requiring endotracheal intubation were enrolled after receiving consent from parents/ care givers. Patients with history of difficult intubation, airway related conditions such as trismus, trauma or mass were excluded. Infants with risk of gastric aspiration and upper respiratory tract infection were also excluded.

The sample size was calculated at 95% confidence interval (CI) and 80% power expecting minimum detectable difference in time taken for intubation in both groups to be 25.03 ± 2.34 s. 132 patients were recruited and they were randomly allocated into one of the following groups. In group A, patients were intubated with tuoren videolaryngoscope using size 1 blade and with Macintosh laryngoscope using size 1 blade in group B. Randomisation was done by opaque sealed envelope method. Allocation was conducted by a person not involved directly in the research to avoid selection bias.The primary objective of present study was to compare time taken for intubation and the secondary objectives were included comparison of first attempt success rate, Ease of Intubation score, Intubation Difficulty Score [5], Pogo score [6] and complications in both groups.

All subjects were subjected to standard pre- anaesthetic check ups before the surgery. On arrival in OT, multipara check up monitoring including heart rate, SpO2, systolic blood pressure, diastolic blood

pressure, mean blood pressure, respiratory rate were recorded. Patient was pre medicated with inj. Glycopyrrolate 0.005mg/kg i/v + inj. Midazolam 0.05mg/kg + inj. Fentanyl 2µg/kg i/v. Calculated volume of intravenous fluid was started through already secured inravenous canula.

After pre-oxygenation with 100% oxygen for 3 minutes , anaesthesia was induced with inj. Thiopentone sodium 5mg/kg i/v slowly and intubation was facilitated with inj. Atracurium 0.5mg/kg i/v and then,after induction hemodynamic data (SBP, DBP, MAP, HR) and SPO2 were noted as baseline . Group A underwent endotracheal intubation with Tuoren videolaryngoscope size 1 blade and group B underwent endotracheal intubation with Macintosh laryngoscope size 1.An experienced anesthesiologist who has performed at least 25 uncuffed (Klabusayová et al., 2021)tube intubations with each device carried out all the intubation. Time taken from introduction of blade across teeth to passage of endotracheal tube beyond glottis and time taken for intubation i.e time from introduction of blade and appearance of EtCO2 graph were recorded, number of intubation attempts, ease of intubation, intubation difficulty score ,pogo score, airway trauma during intubation, hemnodynamic data (SBP, DBP, MAP, HR) immediately after intubation (T0) noted.

Anesthesia was maintained with 40% oxygen + 60 % nitrous oxide and Inj. Atracurium 0.1 mg/kg and sevoflurane 1-2 %. Hemodynamic data (SBP, DBP, MAP, HR) at 1,3,5,7,10 min after intubation (T1, T2, T3, T4, T5)were noted. At the end of surgery reversal of residual neuromuscular blockade was done with inj. Neostigmine (0.05 mg/kg) and inj. Glycopyrrolate (0.01 mg/kg) and patient was extubated after satisfying extubation criteria and shifted to recovery room.

Data was entered at the end of study using Microsoft excel and was analysed using SPSS statistical software (version 22). Nomimal or categorical variables were sumarised as frequency and percentage and were analysed using Chi square/ Fischer exact as applicable. Continuous variables were summarized as mean and standard deviation and were analysed using independent sample t test for comparison between two groups. A p value ≤ 0.05 was taken as statistically significant. All statistical analyses was done using Epi info version 7.2.1.0 statistical software.

RESULTS

132 infants were enrolled in the study (66 in each group) undergoing elective surgeries requiring endotracheal intubation. Patients in group A were intubated with Tuoren videolaryngoscope (size 1 blade) and in group B patients were intubated with Macintosh laryngoscope (size 1 blade).

Both the groups were comparable in terms of baseline characteristics such as age, weight, gender, ASA grade. (Table1).

Table 1 : Baseline characteristics

BASELINE CHARACTERISTICS	GROUP A	GROUP B	P value
Age (MEAN ± S.D) in months	3.6 ± 3.85	3.15 ± 4.02	0.198
Weight (MEAN ± S.D) in kg	4.85 ± 2.39	4.27 ± 2.20	0.153
Gender	Male - 71.2% Female-28.8%	Male - 63.6% Female – 36.4%	0.458
ASA	ASA I – 93.9% ASA II – 6.1%	ASA I – 95.5% ASA II – 4.5%	0.676

S.D = Standard deviation, ASA = American Society of Anesthesiology

The time taken for passage of laryngoscope blade through incisors and visualisation of passage of endotracheal tube through glottis 20.38 ± 2.13 s for group A and 20.86 ± 2.26 s for group B was comparable with p = 0.211.

Similarly time taken for intubation i.e time taken from introduction of blade through incisors until appearance of EtCO2 tracing 24.15 ± 2.13 and 24.62 ± 2.27 for group A and B respectively was comparable which was evident from p- value = 0.226 (Table2). All patients were successfully intubated in first attempt in both the groups (100% vs 100%) .

Table 2 : Time taken for tracheal intubation between study groups

	Group A (N = 66)	Group B (N = 66)	P value
Time till ET passes the glottis in seconds (mean ± SD)	20.38 ± 2.13	20.86 ± 2.26	0.211
Time taken for intubation in seconds (until the appearance of EtCO2 trace) (mean ± SD)	24.15 ± 2.13	24.62 ± 2.27	0.226

ET = Endotracheal tube, SD = Standard deviation

For glottic visualisation Cormack Lehane (CL) grading and Percentage of glottic opening (POGO) score were used. CL grade I was obtained in 95.5% patients in group A as compared to 59.1% in group B (p < 0.001) . Similarly mean POGO score was statistically higher in group A in comparison with group B which was evident from chi square test = 19.488 with 2 degrees of freedom and p < 0.001

Ease of intubation was determined using 5 point Likert scale. Ease of intubation was better with Tuoren videolaryngoscope grade 1 in 9.1% as compared to 4.5 % with Macintosh laryngoscope (Table3).

Table 3: Ease of Intubation

Grade	Ease of Intubation	Group A	Group B
I	Very easy	9.1 %	4.5%
II	Easy	90.9%	95.5%
III	Don't know	-	-
IV	Difficult	-	-
V	Very difficult	-	-

Chi square = 0.477 with 1 degree of freedom ; p = 0.490

Intubation Difficulty Score uses 7 parameters for determining difficulty during intubation. In group A 95.5 % patients have IDS of 0 as compared to 39 subjects in group B as evident from Chi square test of 22.820 with 1 degree of freedom and p < 0.001 (Table4)

Table 4: Intubation Difficulty Score (5)

Parameter	Scoring
Number of intubation attempts	Each supplementary attempt adds 1 point
Number of operators	Each additional operator adds 1 point
Alternative technique used	Adds 1 point
Glottis exposure (CL grade)	Grade minus one (CL 1=0, CL 2=1, CL 3=2,CL 4=3)
Lifting force applied	Normal= 0 , increased= 1
External pressure applied	No= 0 , Yes= 1
Vocal cord postion at intubation	Adducted= 0, abducted= 1

None of the alternative techniques was used in the study. There were no complications such as airway injury, oesophageal intubation, desaturation in both groups.

DISCUSSION

Performing rapid intubation impeccably is one of the most intense procedures required by an anesthesiologist (7).Airway management is complicated in neonates and infants. They desaturate with in few minutes due to smaller total lung capacity and higher oxygen consumption rate inspite of proper pre-oxygenation before intubation.(8)

Direct laryngoscopy has been conventional technique for tracheal intubation. Nowadays, new approaches like fiberoptic laryngoscopes, video laryngoscopes have emerged. Videolaryngoscope offer many advantages over conventional laryngoscopy as less lifting force and decreased cervical manipulation is required with videolaryngoscopy since it has eliminated the need to align oral, laryngeal and pharyngeal axes to achieve line of sight. Videolaryngscopy allows others to view screen, help facilitate endotracheal intubation, provides official records and shortens endotracheal intubation learning curve in novices.

This prospective randomised controlled study was aimed to compare time taken for intubation with Tuoren videolaryngoscopy and Macintosh laryngoscopy in 132 infants in elective surgeries. 132 infants of ASA I and ASA II were recruited into two groups (66 each). In group A patients were intubated with Tuoren videolaryngoscope and

in group B patients were intubated with Macintosh laryngoscope.

This study has shown that time taken for intubation and first attempt intubation success rate were similar in both study groups. In group A mean intubation time was 24.15 ± 2.13 seconds while in group B it was 24.62 ± 2.27 seconds (p value = 0.226)

These findings are similar to study conducted by Manov ManirajanPrasanna Udupi Bidkar, Ranjith Kumar et al (2020) [9] on 78 subjects in which intubation time was 25.03 ± 1.42 seconds with Macintosh laryngoscope. There was no statistically significant difference between the two groups.

The results of this study are also in concordance with that of Guen Seok Choi, Eun – Ha Lee, Chae Seong lim(2011) [7] who found out that there was no difference in time required for successful tracheal intubation using GlideVideolaryngoscope (18.2 ± 5.0 seconds) and Macintosh laryngoscope (18.6 ± 5.1 seconds)

Likewise N. Jagannathan, J. Hajduk, L. Sohn, A. Huang et al (2017) [10] observed median difference between intubation time of 5 seconds between videolaryngoscopy group and direct laryngoscopy group which was less than their defined equivalence time of 10 seconds.

In this study belonging to both the group was successfully intubated in first attempt.

This result is comparable with findings of N. Jagannathan, J. Hadjuk, L.Sohn et al (2017) [10] who also observed no difference in number of attempts in endotracheal intubation with King Vision blade videolaryngoscope and Millr direct laryngoscope.

Similar findings were also observed by Manov Manirajan, Prasama Udupi Bidkar, Ranjith kumar et al (2020) [9] in their study using King vision videolaryngoscope and conventional Macintosh laryngoscope. In this study better POGO score and CL grade were observed with Tuoren videolaryngoscope in comparison with Macintosh laryngoscope.

This corroborates with findings of Manov Manirajan, Prasanna Udupi Bidkar, Ranjith Kumar et al (2020) [9] who observed POGO score and CL grade were statistically significantly higher in videolaryngoscope group as commpared to Macintosh group.

Comparable results were noted by Guen Seok Choi, Eun –He Lee, Chae Seong Lim (2011) [7] who observed significant increase in POGO score when using Videolaryngoscope as compared to conventional laryngoscope.

Better IDS and ease of intubation was observed in group A (Tuoren videolaryngoscope) with respect to that observed in group B (Macintosh laryngoscope). This was largely due to better laryngoscopic view and less manipulations required during videolaryngoscope.

These findings are in consistent with that observed by Manov Manirajan, Prasanna Udupi Bidkar, Ranjith Kumar et al (2020) [9],they stated with King Vision Videolaryngoscope better ease of intubation and lower IDS was obtained, therefore videolaryngoscope can act as potential alternative to direct laryngoscope for intubation in infants where direct laryngoscopy guided glottic view is poor with higher CL grades and poor POGO score.

Vital parameters variations were not statistically significant between two groups. Our findings are in concordance with study conducted by Shirley Joseph, George, Bindu et al(2019) [8]compared hemodynamic response to endotracheal intubation using King Vision Videolaryngoscope and Macintosh laryngoscope in adults and concluded that videolaryngoscope is an alternative to conventional laryngoscope for reducing hemodynamic stress response during endotracheal intubation.

Similarly C. H. Maharaj, D. O'Croinin, G. Curley, B. H. Harte et al (2006) [11] didn't find any statistically significant difference in circulatory response between videolaryngoscope and Macintosh laryngoscope.

There are few limitation in our study. First, study was not intended to find out which laryngoscopy performs well when encountering an anticipated dificult airway. Second , all tracheal intubations were performed by experienced anaesthesiologists in all patients in both groups. As a consequence of which results can not be generalized to trainees.

CONCLUSION

It was concluded that performance of Tuoren Videolaryngoscope was comparable in terms of time taken for intubation and first attempt success rate though glottic visualisation, ease of intubation and lower Intubation difficulty score was obtained with Tuoren video laryngoscope in infants undergoing elective tracheal intubation.

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Conflicts Of Interest
There are no conflicts of interest.

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