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A COMPARATIVE STUDY OF GLOTTIC VISUALIZATION AND EASE OF INTUBATION WITH DIFFERENT HEIGHTS OF OPERATING TABLES

Anaesthesiology

Dr. Saheel Satish Borse MBBS, MD, Senior Resident, Dr. R.N. Cooper Hospital, Mumbai

Dr. Manali Nadkarni MBBS, MD, Additional Professor, Seth GSMC and KEM Hospital, Mumbai

Dr. Sridivya Vemulapalli MBBS, MD, Senior Resident, Seth GSMC and KEM Hospital, Mumbai.

ABSTRACT

Background and Aim: Management of airway is one of the most important responsibilities of an anaesthesiologist as it has to be secured, preserved and protected during induction, maintenance and recovery from anaesthesia. Studies have shown that the workload of the anaesthesiologist is maximum at the time of intubation. Ergonomics play an important role in making things easy during intubation as it is associated with complications ranging from milder ones like post operative sore throat, damage to lips, teeth to severe life-threatening complications like failure to ventilate and intubate. Newly promoted trainee anaesthesiologists and tend to look closely into the mouth while intubating and in an attempt to do so end up stooping. Constant following of such practices results in back problems in the future as the back undergoes a lot of strain. The purpose of this study was to analyze the effect of table height on direct laryngoscopic view and subsequently ease of intubation. **Methodology:** After obtaining Institutional Review Board approval, a total of 100 patients were divided randomly into 2 groups of 50 each, and patients were intubated with the operating table height set at the umbilicus of the anaesthesiologist in one group and the operating table set at the level of 4th intercostal space of the anaesthesiologist. Visualization of the laryngeal inlet (CL grading), ease of intubation and need for external laryngeal manipulation were the parameters observed. **Results:** Demographic data showed that all patients posted in the study were comparable at baseline. CL grade scores were better with the higher table height ($p = 0.028$) and need for External Laryngeal Manipulation was reduced at a higher table height ($p = 0.014$). Ease of intubation was not affected by the table height ($p = 0.766$). **Conclusion:** From this study it is evident that there was an improvement in the CL grading when the table height is set at the 4th intercostal space and the need for External Laryngeal Manipulation is reduced.

KEYWORDS

4th intercostal space, airway management, ease of intubation, ergonomics, table height.

INTRODUCTION

Being one of the most important responsibilities during induction, maintenance and recovery from anaesthesia, airway management is of the utmost importance to an anaesthesiologist. Literature points out that most anaesthesia mishaps occur at the time of induction (2). Among the various methods available viz. orotracheal intubation using conventional direct laryngoscopy, lighted stylet, intubating LMA, fiber optic endoscopic nasotracheal intubation, etc. orotracheal intubation is the most common method used to secure and maintain the airway for patients undergoing surgery under general anaesthesia. It has been found that operating table height can influence task performance (3) (4) and using an adjustable operating table is associated with ergonomic benefits (5). Endotracheal intubation is associated with various complications such as sore throat, damage to lips, teeth, gums, along with life threatening complications such as failure to ventilate-intubate. It has been said that, the patient's face should be placed at a height around the anaesthesiologist's xiphoid process for comfortable intubation without requiring the anaesthesiologist to be his/her back (6) (7) (8). Aim of this study was to understand the effects of different table heights on visualization of the glottis by evaluating the laryngoscopic view and its subsequent effect on the ease of intubation.

MATERIALS AND METHODOLOGY

The study was conducted after getting ethics committee approval. After obtaining a written informed consent, a detailed routine pre-anaesthetic check-up was performed a day prior to the surgery; where the airway was assessed using Mallampati Scale (9), Inter-incisor gap, jaw slide and normalcy of neck movements, along with review of routine laboratory investigations. All these findings were then recorded on the case record form. Patients between the age of 18 & 60 years of age of either gender and belonging to ASA Grade I & II who were undergoing elective surgeries requiring endotracheal intubation were included in the study. Patients who were unwilling to be a part of the study, pregnant women, those with anticipated difficult intubation and those requiring more than 1 attempt for intubation were excluded from the study.

A total of 100 patients were selected for the study and then divided into 2 groups of 50 each using sealed envelopes, which were opened on the day of the surgery and the patients were allotted either of the following groups –

Group A being the group where the height of the operating table was set at the level of the umbilicus of the anaesthesiologist.

Group B being the group where the height of the operating table was set at the level of 4th intercostal space of the anaesthesiologist.

In the operating room, all ASA standard monitors were attached for monitoring and intravenous access was secured. The table height was then adjusted according to the group allocated to the patient by the sealed envelope allotted. A head ring was placed under the head of the patient to obtain the classical sniffing position. The patient was pre-oxygenated with 100% oxygen for 3 min. Patient was premedicated with fentanyl 2 µg/kg intravenously and midazolam 0.01-0.02 mg/kg intravenously & was induced with 1-3 mg/kg of propofol intravenously, as routinely practiced. Feasibility of ventilation with a face mask was checked prior to injection of non-depolarizing muscle relaxant. After ventilation was confirmed, 1 mg/kg of rocuronium was administered intravenously and the patient was ventilated for 1.5 min with 100% O2. The laryngoscopy and intubation were carried out using MacIntosh laryngoscope blade, by an experienced anaesthesiologist having at least 2 years of experience. CL grading (10), ease of intubation (11) and the need for external laryngeal manipulation were the parameters studied. After 1 failed attempt at intubation or desaturation to below 95%, intubation was carried out as per the convenience of the anaesthesiologist and such subjects were excluded from the study.

Sample Size

The primary objective of the study was to compare and evaluate the laryngoscopic view at 2 different table heights.

In a study by Lee et al [56], there was no intubation discomfort in 42.5% patients at umbilicus level and 70% at nipple level.

Using formula for sample size calculation for comparing proportions in independent groups, Sample size $n = (Z_{\alpha/2}+Z_{\beta})^2*(p_1(1-p_1)+p_2(1-p_2))/(p_1-p_2)^2$, where $Z\alpha/2$ was the critical value of the normal distribution at $\alpha/2$ (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), Z_{β} was the critical value of the normal

distribution at β (e.g. for a power of 80%, β is 0.2 and the critical is 0.84) and p1 and p2 were the expected sample proportions of the two groups. Online sample size calculator which was available at https://www.stat.ubc.ca/~rollin/stats/ssize/b2.html was used to do further calculations, using p1 = 0.425 and p2 = 0.7, 80% power and alpha error of 5%. The output for sample size obtained was 50.

Thus,
Sample size = 50 in each group

Thus, for the study 50 patients were enrolled in each group. The total sample size in the study was 50 x 2 = 100.

Analysis
100 eligible patients were enrolled in the study and were divided into two groups (Group A and Group B) of 50 each, randomly. No patients were excluded from the study.

Data from the case record forms was entered in a Microsoft excel sheet and analyzed using SPSS version 21 software. Descriptive statistics were assessed and are represented as Mean ± SD or median (interquartile range), frequencies and percentages. Association of categorical variables such as gender, proportion of patients with intubation discomfort, etc. were assessed using Chi square test Or Fisher exact test. Comparison of quantitative variables like age, weight, height, BMI, ASA score, visualization of laryngeal inlet CL grading, ease of intubation grading, etc. between two groups was evaluated using unpaired t test for data which was normally distributed or Mann Whitney test for data which was not normally distributed. Level of significance in the study was considered at <0.05.

Table 1. Demographic Data

Sr.No	Variable		Group A	Group B	p Value
1	Age	Mean ± SD	36.88±10.832	38.28±12.8	0.556
		Median ± (IQR)	38.00 (26 - 45)	38.50 (26.50 - 49.25)	0.644
2	Height	Mean ± SD	159.74±7.216	160.96 ±7.219	0.400
		Median ± (IQR)	160 (154 - 164.25)	159.50 (155 - 167)	0.550
3	Weight	Mean ± SD	63.24±10.47	63.56±8.43	0.867
		Median ± (IQR)	61.50 (53.0 - 72.0)	64 (58 - 69.25)	0.689
4	BMI (kg/m2)	Mean ± SD	24.67±2.67	24.5±2.67	0.768
		Median ± (IQR)	24.49 (22.28 - 25.35)	24.86 (22.46 - 26.38)	0.931
5	Gender	Males	17 (34%)	19 (38%)	0.677
		Females	33 (66%)	31 (62%)	

RESULTS
On analyzing the demographic data between the 2 groups (Table 1), there was no statistical significance between the 2 groups.

Table 2. Distribution of Patients Based on Mouth Opening

Variable		Group A	Group B	p Value
Mouth Opening	2.5 fingers	7 (14%)	6 (12%)	0.955
	3 fingers	32 (64%)	33 (66%)	
	>3 fingers	11 (22%)	11 (22%)	
Total		50 (100%)	50 (100%)	

Majority (65%) of the patients in our study had a mouth opening of 3 fingers, 22% patients had a mouth opening of >3 fingers and the remaining 13% had a mouth opening of less than 2.5 fingers (Table 2). With no statistically significant difference in distribution between both groups (p=0.955).

Table 3. Distribution of Patients Based on Inter Incisor Distance

Variable		Group A	Group B	p Value
Inter incisor distance	5.5 cms	10(20%)	4(8%)	0.158
	6 cms	27(54%)	27(54%)	
	More than 6 cms	13(26%)	19(38%)	
Total		50 (100%)	50 (100%)	

Majority of the patients in our study had an inter incisor distance of 6 cms, 32% had a inter incisor distance of more than 6 cms and only 14% of the patients had an inter incisor of 5.5 cms (Table 3), with no statistically significant difference between both groups (p=0.158).

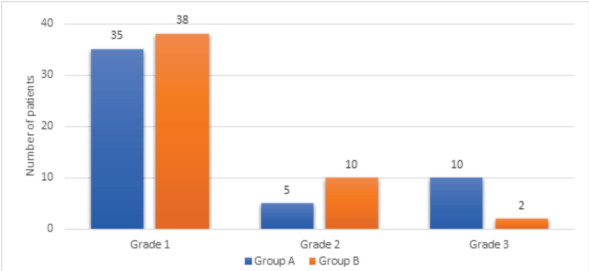

Chart 1. Distribution of patients based on CL grade

On assessing CL grades, we found that CL grade 1 in Group B (76%) was marginally greater than the one observed in Group A (70%). CL grade 3 was observed in 10 (20%) of the patients in Group A and the same in Group B was observed in only 2 (4%) of the patients (Chart 1). This finding is statistically significant as the p value is slightly less than 0.05 (p=0.028).

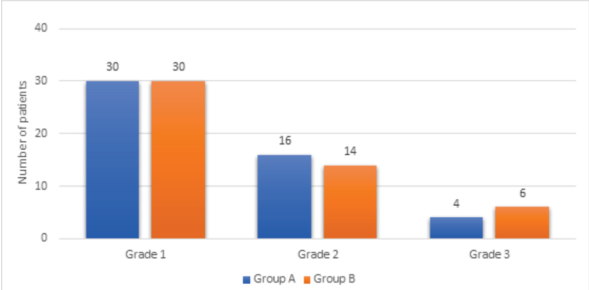

Chart 2. Distribution of patients based on ease of intubation

Majority of the patients in our study had an easy intubation (Chart 2), except for 10 patients, 6 of which were in Group B, which needed the use of a stylet (Grade 3). However overall, this difference was insignificant (p=0.766).

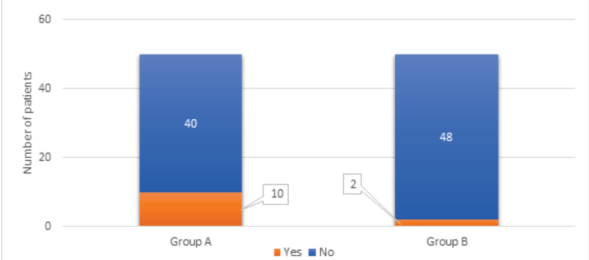

Chart 3. Need for External Laryngeal Manipulation

The need for External Laryngeal Manipulation was reduced in Group B as compared to Group A (Chart 3). This difference was statistically significant (p=0.014).

DISCUSSION
Glottic visualization is the key to a successful direct laryngoscopy and intubation. Optimization of the patient position relative to the intubating anaesthesiologist is a key factor determining the glottic visualization and subsequently the success of intubation. The forward movement, closer to the patients mouth in an attempt to get a clear glottic vision, has been found to be deleterious as it reduced the binocular vision (12). Trainee anaesthesiologists are given explicit instructions to correct trolley height and should be taught to intubate with a straight back as stooping may not only impair the alignment of the axis but also lead to back problems in the future.

This study was performed to assess the effect of intubating table height on the glottic visualization by direct laryngoscopy and ease of intubation. In our study we used CL grading as an indicator for glottic visualization and compared the grading between 2 groups, one where the operating table height was at the level of the umbilicus and the other at the level of the 4th intercostal space of the anaesthesiologist. The results showed that a higher table height had slightly better CL grades (p=0.028). On comparing the ease of intubation scores between the

two groups, our study revealed that increasing the table height did not significantly change the intubation dynamics (p=0.766). However, further results from our study revealed that the need for External Laryngeal Manipulation was reduced on higher table heights (p=0.014). Thus, the need for assistance was reduced making intubation relatively easy at a higher operating table height. In our study, we found that a higher table height did lead to better CL grades, which supports our hypothesis.

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