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REVIEW ARTICLE

COMPARISON OF EASE OF ENDOTRACHEAL INTUBATION AND LARYNGEAL VIEW BETWEEN "SNIFFING" AND "RAMPED" POSITIONS- A PROSPECTIVE STUDY

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ABSTRACT

Background and Aims: Optimal head and neck positioning is very important for successful endotracheal intubation in patients with a difficult airway. Our study aims to investigate whether the use of ramped position can help decrease the incidence of unanticipated difficult airway. Our primary objective is to compare ease of endotracheal intubation between standard and ramped positions. Our secondary objective is to compare the laryngeal view between standard and ramped positions. ***Methods:*** This is a prospective study conducted in 150 patients belonging to American Society of Anaesthesiologists physical status (ASA PS) I, III, III between the age group of 18-60 years who underwent elective surgery under general anaesthesia (GA). Airway assessment was done preoperatively and patients with Airway Difficulty Score (ADS) less than 8 were selected for the study. Group R was placed in ramped position and Group S was placed in sniffing morning air/standard position. Both groups were assessed intraoperatively for ease of intubation and laryngeal view. Statistical analysis was done using Statistical Packages for the Social Sciences (SPSS) 11.0 software. ***Results:*** Time taken for intubation was more in ramped position than standard position (P=0.006). Number of first attempts was more in standard position compared to ramped position and second and third attempts were more in ramped position than standard position (P =0.003). Better laryngeal view was obtained in standard position than ramped position (P=0.032). ***Conclusion:*** Ramped position required more time to intubate, more attempts at intubation and showed more difficult laryngeal views compared to standard position.

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INTRODUCTION

The "sniffing morning air" position has been considered the ideal position of the head and neck for successful direct laryngoscopy (Adnet, 2001). Sniffing morning air position is lower cervical flexion and altanto-occipital extension (Miller's Anesthesia, 2015). Another position that help facilitate ventilation and visualization of the glottis for intubation in both obese and non-obese patients is the ramp position. Ramp position consists of shoulder and head elevation (Lee, 2015; Collins, 2004; Rao, 2008). Through this study we aim to find out whether ramped position can help decrease the incidence of unanticipated difficult airway and whether it can replace "sniffing morning air" position as the standard method of intubation.

METHODS

Approval for this study was provided by the Institutional Review Board (IRB No.: 10/2017/13) on October 2017. This is a prospective study conducted in our institute from 2018-2019, among patients with ASA-PS I,II, III in the age group of 18 to 60 years, scheduled to undergo oncosurgeries under GA. Exclusion criteria were patients who require rapid sequence intubation, unstable cervical spine and anticipated difficult airway. Sample size was calculated based on the article by Lee et al. (2015), with 80% power and 5% level of significance. The estimated sample size is 150 (75 in each group).

Preoperative airway assessment was performed with patients in sitting position by an attending anaesthesiologist. The ADS was calculated on the basis of table 1. The total airway difficulty score is 15. Difficult intubation is more than or equal to eight (Lee, 2015). Difficult airway cart was kept ready. Timer on the monitor was used to assess time taken for intubation. Time taken to intubate is from insertion of laryngoscope till insertion of endotracheal tube (ETT). The study population matched with respect to age, sex, body mass index (BMI) and ASA PS. All patients were monitored using standard ASA monitors and standard intubation protocol followed. First 75 patients were placed in ramped position (Group R) ie patients were made to lie on a ramp made of folded blankets on a flat operating table (Fig 1). By adding or removing blankets we ensured that the patient's head is above the shoulders and the external auditory meatus and the sternal notch are in the same horizontal plane. This was assessed by using a long ruler. Next 75 patients were placed in standard position (Group S) ie patient was placed on a flat operating table with a eight centimetre high pillow under their heads to elevate the occiput (Fig 2). Laryngoscopy was performed with Mac Intosh laryngoscope. First laryngoscopy was performed by resident with 1 year experience. First attempt was done by using a stylet for ETT placement. If first attempt fails, a second attempt was done using modified bimanual laryngoscopy. Modified bimanual laryngoscopy was obtained by guiding the hand of anaesthesia technician placed over the patient's thyroid cartilage to achieve the best laryngeal view with the needed pressure and direction[3]. Capnography was used to confirm successful placement of endotracheal tube. After two failed attempts at laryngoscopy and tracheal intubation, patients were intubated by the consultant at the respective table with more than five years of experience. In between attempts oxygenation was maintained. Failed endotracheal intubation by direct laryngoscopy is defined as the need for an alternative technique or an additional operator after 2 direct endotracheal intubation attempts by resident and attempt by consultant failed to achieve a successful intubation[3]. Modified CL classification was used to evaluate laryngeal view with direct laryngoscopy (Table 2).

Statistical analysis: Data was entered in Microsoft Excel. Statistical analysis was done using SPSS 11.0 software. Frequencies and percentages were used to represent categorical variables. Mean and standard deviation were used to represent continuous variables. Results with P value < 0.05 were considered to be statistically significant. The association between categorical variables and response variables (ease of intubation) was assessed using Chi-square/ Fisher's exact test and the association between continuous variables and the response variable was assessed using student's t test.

RESULTS

The two groups were similar with respect to age, ASA, BMI, neck circumference and gender distribution (P =0.8). Both groups were comparable in terms of distribution of type of surgeries and calculated ADS.

Table 1. Airway Difficulty Score

	1	2	3
THYROMENTAL DISTANCE	>6 CM	5-6 CM	<5 CM
MALLAMPATI SCORE	CLASS 1	CLASS II	CLASS III
MOUTH OPENING	4 CM	2-3 CM	1 CM
NECK MOBILITY	NORMAL	REDUCED	FIXED FLEXION
UPPER INCISORS	ABSENT	NORMAL	PROMINENT

The mean time required to in tubate in Group S was 18.41 seconds but in Group R was 22.93 seconds as shown in table 3(fig 3). Time taken for 3rd end-tidal carbon dioxide (EtCO2) curve appearance was 37.13 sec in Group S and 42.15 seconds in Group R as shown in table 3. Intubation in ramp position takes 4.52 seconds more than in standard position. This was statistically significant (P=.006).

Table 2 Modified Cormack Lehane Classification

Grade	Cormack Lehane grading
1	Most of cords visible
2a	Posterior cord visible
2b	Only arytenoids visible
3a	Epiglottis visible and liftable
3b	Epiglottis adherent to pharynx
4	No laryngeal structures seen

Table 3. Comparison of groups based on time taken for intubation

		Count	Mean (seconds)	Standard Deviation	P-value
Time taken for intubation (in seconds)	Standard	75	18.41	7.064	.006
	Ramp	75	22.93	12.057	
Time taken for 3rd etco2 curve (in seconds)	Standard	75	37.13	7.157	.002
	Ramp	75	42.15	11.926	

In Group S, patients with CL grade 1, 2a, 2b and 3a were 77.3%, 10.7%, 10.7% and 1.3% respectively as shown in table 4. In Group R, patients with CL grade 1, 2a, 2b and 3a were 57.3%, 24%, 12% and 6.7% as shown in table 4(fig 4). Difficult grades of laryngoscopy view were seen more in Group R. This was statistically significant (P= 0.032). Ramp worsens laryngoscopic view in normal patients. Hence a technique useful in one subset of population is not necessarily useful in everyone. In Group S, patients intubated in 1st, 2nd and 3rd attempt were 93.3%, 5.3% and 1.3% respectively as shown in table 5(fig 5). In Group R, patients intubated in 1st, 2nd and 3rd attempt were 73.3%, 21.3%, 5.3% as shown in table 5. More patients were intubated in 1st attempt in S group. 2nd and 3rd attempts were more in R group.

DISCUSSION

This is the first study done till date aimed at an attempt to find an alternative position for intubation in normal individuals. 'Sniffing morning air' position has long been the time tested standard method of intubation. However we, as practicing anaesthesiologists have many times come across unanticipated airway difficulties using the standard method of intubation. This study was done to overcome this problem of unanticipated airway difficulty in normal airway individuals. Ramped position has always been a favourite position for intubation in obese and difficult airway patients. Ramping improves visualization of laryngeal inlet in patients undergoing endotracheal intubation. In our oncology practice set up we come across many unanticipated difficult intubation such as post radiotherapy patients, patients with previous airway surgeries coming for other oncosurgeries, distorted airway. We wanted to find out if routine ramp position will reduce incidence of unanticipated airway difficulty. Collins et al [4]study in 2004 showed that blankets arranged underneath a morbidly obese (BMI 40 kg/m2) patient's upper body and head for acheiving horizontal alignment between the external auditory meatus and the sternal notch, significantly improved laryngoscopic view compared to a separate, similar group of morbidly obese patients whose head was supported only by a 7 cm cushion. In our study BMI was not taken as criteria for inclusion. Since obesity is an indication for ramping, we have sub group analysed our patients based on BMI.

Although our study included patients with BMI>30, they were equally distributed in both groups (P =1). For analysis, the study population was divided into 2 groups based on BMI: BMI<30 and BMI>30. In a study done in 2008 by Rao et al[5], they flexed the operation theatre table at the trunk-thigh hinge and raised the trunk portion of the table to yield results similar to the folded blanket technique in ease of intubation in patients with BMI 30 kg/m2. Troop[6] described in his study the use of a precut foam cushion to achieve the HELP (head elevated laryngoscopy position) position.

Table 4. Comparison of groups based on Cormack Lehane grading

			CORMACK LEHANE GRADING				Total	P-value
			1	2a	2b	3a		
Group	STANDARD	Count	58	8	8	1	75	0.032
		% within Group	77.3%	10.7%	10.7%	1.3%	100.0%	
	RAMP	Count	43	18	9	5	75	
		% within Group	57.3%	24.0%	12.0%	6.7%	100.0%	
Total		Count	101	26	17	6	150	
		% within Group	67.3%	17.3%	11.3%	4.0%	100.0%	

Table 5. Comparison of groups based on endotracheal intubation attempts

			ENDOTRACHEAL INTUBATION ATTEMPTS			Total	P-value
			1	2	3		
Group	STANDARD	Count	70	4	1	75	0.003
		% within Group	93.3%	5.3%	1.3%	100.0%	
	RAMP	Count	55	16	4	75	
		% within Group	73.3%	21.3%	5.3%	100.0%	
Total		Count	125	20	5	150	
		% within Group	83.3%	13.3%	3.3%	100.0%	

P value <0.05 is significant

Levitan et al [7] coined the term HELP position to improve laryngeal exposure during laryngoscopy in morbidly obese patients. Rich[7] used a ready to use elevation pillow along with a standard intubation pillow to provide a better position than use of a standard intubation pillow alone in morbidly obese individuals. Other innovative methods that have been described include use of an inflatable head and shoulder elevator [8]or multiple irrigation bags and pillows[8]. In all the methods used the aim of the laryngoscopist was optimal visualization of larynx by aligning oral, pharyngeal and laryngeal axes for ease of intubation. In our study we used blankets as it was easily available, cheap and reusable.

Fig. 1. Ramped position used in study

Fig 2. sniffing position used in the study

Although initially positioning the patient onto the blankets so as to achieve the optimum position was tedious and time consuming, it got easier with each case. We also noticed that in poorly built patients multiple blankets were not needed to achieve the optimal position. Even one blanket caused hindrance to the study by flexing the neck even though the optimal position was achieved. Hence external alignment (patient's sternal notch and external auditory meatus are aligned horizontally) does not necessarily align the internal axis (ie oral, pharyngeal and laryngeal) in all patients.

We also noticed that once intubated, removal of blankets required atleast two assistants - one to lift the patient's head and shoulders and the second person to pull out the blankets. In 2011 Lebowitz et al[9] showed that elevation of shoulder and head improved laryngoscopic view for tracheal intubation in non-obese as well as obese individuals by using each patient as his/her own control. However in our study ramp position showed higher grade of CL grading, more attempts at intubation and more time to intubate. However we did not do both positions in the same individual due to ethical concerns. In our study, we sought to determine whether the "ramp" position could be used as an alternative to standard position in patients in whom we are not anticipating a difficult airway and hence decrease the incidence of unanticipated difficult airway. However our results concluded that sniffing position was still the standard position of intubation which was contradictory to the study done by Lee et al[3] which had shown that ramped position was superior to standard position for getting a better laryngeal view and endotracheal intubation in patients with expected difficult intubation. Laryngoscopy time is very important as it determines the stress response in patients.

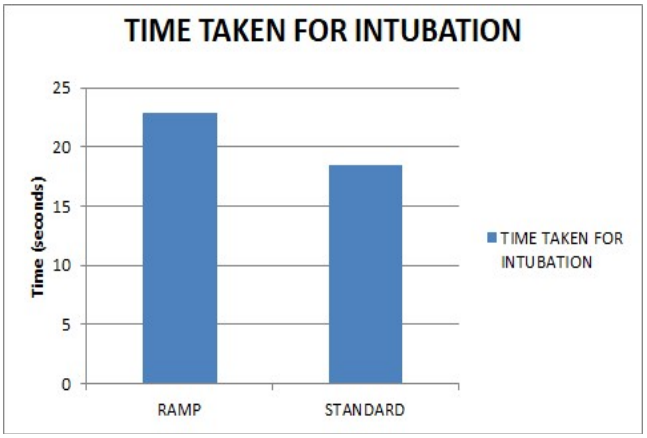

Fig 3. Comparison of groups based on time taken for intubation

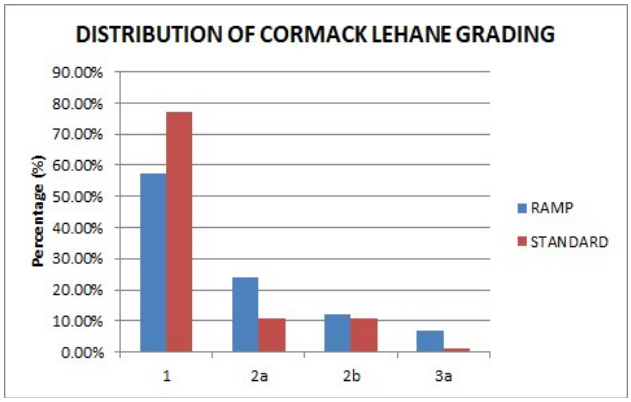

Fig 4. Comparison of groups based on Cormack Lehane grading

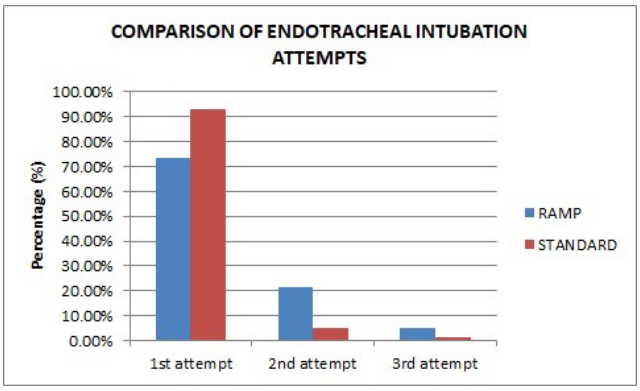

Fig 5. Comparison of groups intubation based on endotracheal attempts

This is even more important in patients with ischemic heart disease. Increase in laryngoscopy time leads to increase in stress response and subsequent cardiovascular complications. . Hence according to our study standard position is better as intubation time taken is less and laryngeal view is better. Also operation theatre is a place where there is high productive pressure. Time is money. Every minute lost is loss of precious operation time. Ramp position requires time for positioning, more time for intubation and also time for removing blankets after surgery. Hence standard position which is time tested is superior to ramp position in routine anaesthetic practice.

Limitations in the study: CL classification has limited reproducibility, with poor intraobserver reliability and a fair inter-observer reliability[10,11]. Each patient underwent either ramp or standard position. Laryngoscopies in both standard and ramp position in the same patient may be needed for assessing which position gave a better laryngeal view. Due to ethical concerns associated with this approach, we could not perform repetitive laryngoscopy in the same patient. Ramped position using blankets was a tedious process and required more than two assistants to lift the patient in order to remove blankets after intubation. Ramp alignment could also be subjected to interpersonal variation. Optimum position varies from person to person.

CONCLUSION

Ramped position require more endotracheal intubation attempts and laryngoscopy time, resulting in more stress response and cardiovascular complications. In this study, patients who had no anticipated airway difficulty, ramped position worsened laryngoscopic view. Difficult grades of CL grading corresponded with more attempts of endotracheal intubation. Obese patients did not require more intubation attempts nor had more difficult CL grades compared to non-obese. Ramp usage should be discouraged in thin patients as it makes intubation more difficult. Routine ramp use cannot be advised in patients with normal airway as it causes unnecessary time delay.

Highlighted key points

- Ramped position require more endotracheal intubation attempts and laryngoscopy time than sniffing position.
- In patients who had no anticipated airway difficulty, ramped position worsened laryngoscopic view.
- Ramp is discouraged in thin patients as it makes intubation more difficult.
- Ramp is not advised in patients with normal airway as it causes unnecessary time delay.

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Conflicts of interest: *There are no conflicts of interest*

List of Abbreviations

Abbreviation	Definition
ASA PS	American Society of Anaesthesiologists physical status
GA	General Anaesthesia
ADS	Airway Difficulty Score
SPSS	Statistical Packages for the Social Sciences
IRB	Institutional Review Board
ETT	Endotracheal Tube
BMI	Body Mass Index
CL	Cormack Lehane
HELP	head elevated laryngoscopy position
EtCO2	end-tidal carbon dioxide

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