

Comparison of Airway Indices, Body Mass Index (BMI), Cormack - Lehane Grading and Difficulty with Mask Ventilation and Intubation in Snorers and Non Snorers

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ABSTRACT

Introduction: Difficulties with tracheal intubation significantly contribute to morbidity and mortality associated with anaesthesia. Snoring is increasingly prevalent in the community and patients who snore face a potential problem for securing airway because of narrow space between the base of the tongue and the posterior pharyngeal wall, and hence are also more prone to airway collapse under anaesthesia. Study aimed to compare body mass index (BMI), various airway parameters, Difficulty in Bag Mask Ventilation (DMV), Cormack - Lehane grading and ease of intubation by Intubation Difficulty Scale (IDS) score among snorers and non snorers.

Material and Methods: It is a prospective study conducted at Nizam's Institute of Medical Sciences from October 2013 to April 2014. 67 snorers and 67 non snorers were recruited based on the history given by them, their spouse or close relatives. During the pre-anaesthetic check-up (PAC), history of snoring, diabetes and hypertension along with various parameters such as age, sex, weight, height, BMI, mouth opening, thyromental distance, sternomental distance, neck circumference, modified Mallampati grade and neck extension were noted. Difficulty in bag mask ventilation (DMV) was noted. Glottic visualization was assessed based on Cormack - Lehane classification and difficulty in intubation assessed based on the Intubation Difficulty Scale (IDS) score.

Results: The incidence of snoring increased significantly with age, neck circumference and obesity (BMI in snorers was significantly higher when compared with non snorers). The incidence of snoring was significantly higher in males (p 0.005), hypertensive and diabetic population. It was significantly difficult to perform bag and mask ventilation in snorers. Out of the 134 patients 51 patients belonged to the higher Modified Mallampati Class (III - IV). Of them 35 were snorers and only 16 of them were non snorers. There were 6 patients who had a MMG IV and all of them were snorers. Among the 134 patients in the study group 37 of them had a CLG 3/4. Of them 33 of them were snorers and only 4 of them were non snorers. The degree of glottic visualisation which is one of the predictors of ease of intubation was much better in non snorers (p 0.001). Difficulty in intubation, given by the IDS was compared using the Mann-Whitney Test and it was found to be significantly difficult (p 0.001) to intubate a patient with history of snoring.

Conclusion: A simple history of snoring can alert us to a probable difficulty with bag and mask ventilation and intubation.

Keywords: Snoring and Airway Parameters, Snoring and Intubation Difficulty, Snoring and Cormack - Lehane Grading.

INTRODUCTION

Difficulties with tracheal intubation significantly contribute to morbidity and mortality associated with anaesthesia. Airway management is one of the greatest concerns of anaesthesiologists and difficult intubation, is an event not easy to predict before induction of anaesthesia. 'Difficult airway' is one in which there is a problem in establishing or maintaining gas exchange via a mask, an artificial airway or both.¹ Recognizing before induction of anaesthesia, the potential for a difficult airway (DA) is invaluable.

Snoring is increasingly prevalent in the community and patients who snore have serious implications related to difficulty in securing an airway. The mechanism of snoring has been related to increased upper airway collapsibility and reduction of upper airway size, alterations in craniofacial structure and enlargement of surrounding soft tissue structures i.e., tongue and lateral pharyngeal wall. The relationship between night time snoring and increase in Cormack - Lehane grading is established.²

Here we focussed on the utility of individual upper airway evaluation by physical examination and it's usefulness in predicting a difficult airway among people who snore. We hypothesized that simple history of snoring in pre-anaesthetic evaluation along with airway morphology may predict difficult airway.

MATERIAL AND METHODS

This was a prospective study conducted between October 2013 and April 2014 at Nizam's Institute of Medical Sciences, in patients of either sex and sixty seven snorers and sixty seven non-snorers were recruited in this observational study.

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They were assigned to be either snorers or non snorers based on the history given by them, their spouse or close relatives. Those patients scheduled for elective surgical procedures requiring general anesthesia and endotracheal intubation were recruited for the study. Institutional ethics committee approval was taken and informed consent was obtained.

Assuming difficult grading (CLG 3-4) of 10% in non snorers and trying to find an increase in at least 30% of grading 3-4 in snorers the estimated sample size with a power of at least 80% is 62 in each group. We however have included 67 patients in each group of snorers and non snorers respectively.

Inclusion criteria: All patients were adults between the age group of 18 to 70 years, belonging to ASA I and ASA II of either gender.

Exclusion criteria: Patients belonging to ASA III and IV, patients having history of reactive airway, airway distortion, neck mass, risk of pulmonary aspiration, cervical spine pathology, raised intracranial tension, gastro-esophageal reflux disease and pregnant population.

A detailed pre-operative assessment with respect to history and examination was performed. During the pre-anaesthetic check-up (PAC), history of snoring, diabetes and hypertension along with various parameters such as age, sex, weight(kg), height(cm), body mass index (BMI – Kg/m²) were noted. The following airway assessment measurements were assessed and noted - mouth opening (cm), thyromental distance (cm), sternomental distance (cm), neck circumference (cm), neck extension, modified Mallampati grade.

Mouth opening - it is measured as the inter incisors distance, i.e. the distance between the upper and lower incisors after the patient opens his mouth to the maximum.

Thyro mental distance - It is defined as the distance from the mentum to the thyroid notch while the patient's neck is fully extended.

Sterno mental distance - it's the distance from the suprasternal notch to the mentum. It is measured with the head fully extended on the neck with the mouth closed.

Neck circumference - It is the circumference of the neck at the level of thyroid cartilage.

Neck extension - The amplitude of head and neck movement was graded as more than 35° and less than 35°. For this, the patient was asked to hold the head erect, facing directly to the front and then asked to extend the head maximally. The angle traversed by the occlusal surface of the upper teeth was estimated.

Modified Mallampati grading - The Mallampati classification correlates tongue size to pharyngeal size. This test is performed with the patient in the sitting position, head in a neutral position, the mouth wide open and the tongue protruding to its maximum.

Difficulty in bag mask ventilation (DMV) – Bag mask ventilation was considered difficult if the anaesthesia provider required to use two hands for holding the mask,

with an assistant for bagging and/or when an airway was used to assist in ventilation.

A single investigator performed laryngoscopy in all the cases and the investigator was blinded to the history of snoring. Glottic visualization was assessed based on Cormack - Lehane classification and difficulty in intubation assessed based on the Intubation Difficulty Scale (IDS) score (as developed by F Adnet et al. in 1997)

Intubation Difficulty Scale (IDS) score

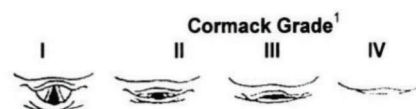
Intubation Difficulty Scale

Parameter	Score
Number of Attempts >1	N ₁
Number of Operators >1	N ₂
Number of Alternative Techniques	N ₃
Cormack Grade - 1	N ₄
Lifting Force Required	
Normal	N ₅ =0
Increased	N ₅ =1
Laryngeal Pressure	
Not applied	N ₆ =0
Applied	N ₆ =1
Vocal Cord Mobility	
Abduction	N ₇ =0
Adduction	N ₇ =1
TOTAL: IDS = SUM OF SCORES	N ₁ -N ₇

IDS Score	Degree of Difficulty
0	Easy
0 < IDS ≤ 5	Slight Difficulty
5 < IDS	Moderate to Major Difficulty
IDS = ∞	Impossible intubation

Rules for Calculating IDS Score:

N ₁	Every additional attempt adds 1 pt.
N ₂	Each additional operator adds 1 pt.
N ₃	Each alternative technique adds 1 point: Repositioning of the patient, change of materials (blade, ET tube, addition of a stylette), change in approach (nasotracheal/orotracheal) or use of another technique (fibroscopy, intubation through a laryngeal mask).
N ₄	Apply Cormack grade for 1st oral attempt. For successful blind intubation N ₄ = 0.
N ₆	Sellick's maneuver adds no points.
Impossible intubation:	IDS takes the value attained before abandonment of intubation attempts.



¹ Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. *Anaesthesia* 1984;39:1105-1111.

Anaesthetic management

All the patients were premedicated with Alprazolam 0.5 mg and Ranitidine 150 mg night before and on the morning of surgery. In the operating room, baseline HR, SBP, DBP and SpO₂ were monitored. Premedication with fentanyl 2ug/kg intravenously prior to induction was done. All

the patients were preoxygenated with 100% oxygen for 3 minutes. Induction was done with inj. Thiopentone 4 mg/kg intravenously or till the loss of eyelash reflex. After checking adequacy of mask ventilation, inj. atracurium 0.5 mg/kg was given intravenously for muscle relaxation. Patients were manually ventilated for 3 minutes with 50% nitrous oxide in oxygen and isoflurane 1 to 2% and then intubated. If Difficulty with Bag Mask Ventilation was encountered appropriate remedial measures were taken and the same was noted. The initial direct laryngoscopy was performed in all cases with use of a Macintosh number 3-laryngoscope blade for the sake of consistency of the technique. If the operator encountered difficulty with the Macintosh blade, the intubating technique was modified as necessary. Glottic visualization was assessed by using Cormack - Lehane classification and intubation difficulty was assessed with Intubation Difficulty Scale (IDS) score.

STATISTICAL ANALYSIS

Descriptive statistics were calculated for continuous variables as mean, standard deviation (mean \pm SD), median and interquartile range (IQR) and for categorical variables as frequency distribution and percentage (n [%]). Student's paired t- test for continuous variables distributed normally, marginal homogeneity test for ordered categorical variables and Chi square test and Fisher Exact test when the expected cell values were less than 5 were used. $P < 0.05$ was regarded as statistically significant. Statistical analysis was carried out using SPSS Version 17 statistical software.

RESULTS

The mean age of snorers was 49.90 yrs while that of non snorers was 42.42 yrs. The incidence of snoring increased significantly (p 0.019) with age (table-1).

The neck circumference in snorers was significantly more (p< 0.001) when compared with non snorers. The mean neck circumference of snorers was 39.30 cm while in non snorers it was 33.96 cm.

Patients who were obese and had a higher BMI were more likely to be snorers. The mean BMI of snorers was 27.63 while that of non snorers was 22.38. This showed that obese patients had a higher incidence of snoring.

Among snorers 48 (71.6%) were male and 19 (28.4%) were female. The incidence of snoring was significantly higher (p 0.005) in males (table-2).

Among hypertensives, 15 (35.7%) were non snorers and 27 (64.3%) were snorers. The incidence of snoring was higher in patients who were hypertensive. Among patients suffering from diabetes mellitus, 3 (17.6%) were non snorers and 14 (82.4%) were snorers. The incidence of snoring was significantly higher in the diabetic population. The results

Variable	Non snorers Mean \pm SD	Snorers Mean \pm SD	p value
Age (yrs)	42.42 \pm 14.691	49.90 \pm 11.363	0.019
Weight (kg)	56.88 \pm 11.153	71.45 \pm 13.661	0.405
Height(cm)	159.07 \pm 9.004	161.51 \pm 8.123	0.364
BMI (Kg/m ²)	22.38 \pm 3.431	27.63 \pm 6.244	< 0.001
TMD (cm)	6.87 \pm 1.428	6.84 \pm 1.702	0.076
SMD (cm)	15.81 \pm 2.935	16.00 \pm 2.875	0.768
NC (cm)	33.96 \pm 3.843	39.30 \pm 3.081	< 0.001
IDS score	1.61 \pm 1.424	3.81 \pm 1.932	0.016

BMI - Body mass index, TMD - Thyro mental distance, SMD - Sterno mental distance, NC - Neck circumference, IDS score - Intubation Difficulty Scale score

Table-1: Demographic variables

Variable	Non snorers (%)	Snorers (%)	p value
Sex			
Female	35 (52.2%)	19 (28.4%)	0.005
Male	32 (47.8%)	48 (71.6%)	
Hypertension			
Yes	15 (35.7%)	27 (64.3%)	0.025
No	52 (56.5%)	40 (43.5%)	
Diabetes Mellitus			
Yes	03(17.6%)	14(82.4%)	0.004
No	64(54.7%)	53(45.3%)	
Neck Extension			
>35°	67 (52.3%)	61 (47.7%)	0.012
<35°	00 (0.0%)	06 (100.0%)	
Difficulty in bag and mask ventilation			
Easy	64 (95.5%)	36 (53.7%)	< 0.001
Difficult	03 (4.5%)	31 (46.3%)	

Table-2: Comparison of patient characteristics

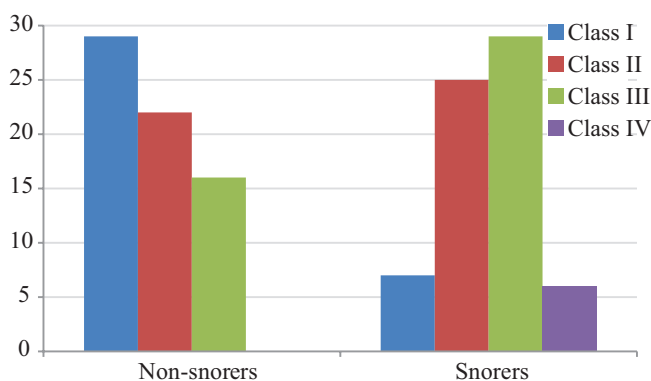


Figure-1: Modified Mallampati Classification in Non Snorers and Snorers

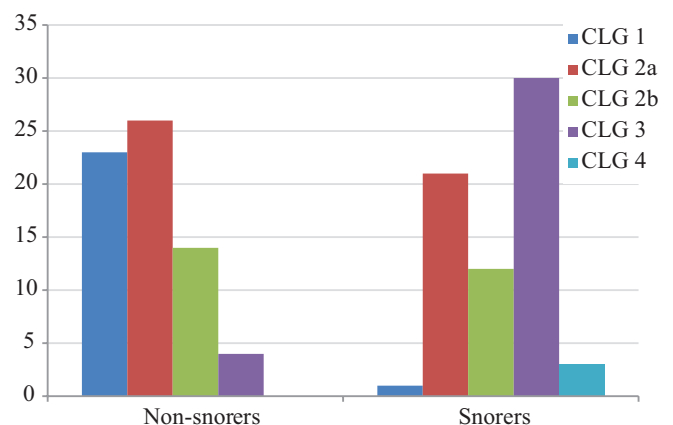


Figure-2: Cormack - Lehane Grading in Non Snorers and Snorers

showed that snoring was more prevalent among patients who were hypertensive ($p < 0.025$) and diabetic ($p 0.004$).

There were only 6 patients who had limitation of neck extension at the atlanto-occipital joint and all of them (100%) were snorers.

Difficulty in Bag Mask Ventilation was encountered in 3 (4.5%) of non-snorers and 31 (46.3%) of snorers. It was significantly difficult to perform bag and mask ventilation in snorers.

Out of the 134 patients 51 patients belonged to the higher Modified Mallampati Class (III - IV). Of them 35 were snorers and only 16 of them were non snorers. There were 6 patients who had a MMG IV and all of them were snorers (figure-1).

Among the 134 patients in the study group 37 of them had a CLG 3/4. Of them 33 of them were snorers and only 4 of them were non snorers. The degree of glottic visualisation which is one of the predictors of ease of intubation was much better in non snorers ($p 0.001$) (figure-2).

Difficulty in intubation, given by the IDS score was compared using the Mann-Whitney Test and it was found to be significantly difficult ($p 0.001$) to intubate a patient with history of snoring. The mean IDS score was 1.61 in non snorers while it was 3.81 among snorers.

Median and IQR for IDS score and CLG

The median IDS score was 4 [2-5] in snorers and 2 [0-3] in non snorers.

The median CLG was 3 [2-4] in snorers and 2 [1-3] in non snorers.

DISCUSSION

The present study compared and evaluated the various airway parameters, BMI, Cormack - Lehane grade and difficulty in intubation using IDS score among snorers and non snorers and the results showed that neck circumference and BMI, were higher in snorers. The visualisation of glottis was poorer in snorers as indicated by Cormack - Lehane grade and also intubation was more difficult among snorers. This is in agreement with Ali Dabbagh et al. who found that people who snore have a higher Cormack - Lehane grade.²

In our study we found that males had a higher incidence of snoring. A significant proportion of difficult tracheal intubations has been found in males,³ attributed to differences in neck fat deposition between the sexes.⁴

Among the airway parameters our study found a significant difference in the neck circumference. Snorers had a larger neck circumference compared to non snorers. An increased fat deposition around the neck is found in snorers. Helene Gonzalez et al. also found that increasing neck circumference was associated with difficult intubation.⁵

Prakash et al. found that TMD in the difficult laryngoscopy group was significantly shorter (6.0 ± 1.0 cm) compared with that in the easy (6.6 ± 0.9 cm) laryngoscopy group.⁶ In our study we did not find any significant difference in TMD between snorers and non snorers.

In our study there was an increased difficulty in bag and mask ventilation among snorers ($p < 0.001$). There was increased

usage of both the hands, use of an assistant for bagging, and also we required to use an airway more frequently in snorers. Being able to do bag and mask ventilation is a primary and vital step for anaesthesia providers. Snorers have a huge jaw, short neck which make it difficult for us to ventilate them. Prerena et al.⁷ also found that snoring was the only independent risk factor for difficulty in bag and mask ventilation.

The results also showed that snoring was more prevalent among patients who were hypertensive ($p < 0.025$) and diabetic ($p 0.004$). Prakash et al. also found diabetes to be associated with difficult laryngoscopy.⁶ Although this study does not associate snoring with diabetes and hypertension, our study found a relationship between snoring - diabetes and hypertension.

During the pre-anaesthetic examination the modified Mallampati classification aids us in assessing the airway. Our study found a higher MPG class III - IV among snorers. Prakash et al. found that MMC class 3 and 4, range of neck movement $< 80^\circ$, IID ≤ 3.5 cm and snoring were independently related to difficult laryngoscopy.⁶ Brodsky et al. found that a Mallampati score of III or IV was a risk factor for difficult intubation in obese patients.⁸ Juvin et al. also found that an increased Mallampati score was associated with difficult intubation.⁹

The view that we get on performing a laryngoscopy gives us an idea of the ease of intubation. Our study found a significant difference in the CLG ($p < 0.001$) between snorers and non snorers. Snorers had a higher incidence of CLG 3,4 as also found by Ali Dabbagh et al.²

In our study the IDS score was more among snorers ($p < 0.001$). They required more than one operator, external laryngeal manipulation, and use of increased force during laryngoscopy compared to non-snorers.

In our study higher BMI was associated with increased incidence of snoring and also snorers were more prone for difficult intubation. BMI > 26 kg/m² and abnormal atlanto-occipital extension grading were independent risk factors for DI. We had only 6 patients with limited atlanto-occipital extension ($< 35^\circ$) and all of them (100%) gave history of snoring. It is important to consider the independent risk factors for DI, as it can be prevented or anticipated by the BMI or atlanto-occipital extension grading. Consequently, these two criteria should be included in the preoperative assessment to detect DI scenario. Obesity has been found to be a risk factor for difficult intubation.^{3,10}

The incidence of DI is 1-10%, and DI leading to inability to intubate occurs in 0.04% of population.¹¹ Importantly, one third of deaths attributable solely to anaesthesia are related to DI and failed intubation itself. Higher DI rates were reported in obese patients (15.5%) as compared to 2.2% in non-obese patients, together with high risk of desaturation in obese with difficult airway maintenance.⁹ Difficult endotracheal intubation is more common in emergency rooms (3-3.5%) than in operating rooms (1.15-3.8%).¹²

We found snoring to be an independent risk factor for difficult laryngoscopy, as supported by Prakash et al. who found

that Snoring occurs more frequently in males, overweight patients, worsens with age and is associated with obstructive sleep apnoea which possibly explains its association with difficult laryngoscopy.⁶

CONCLUSION

The patients with history of snoring had a larger neck circumference, higher BMI. They also belonged to a higher MMG class III – IV, higher CLG and had higher IDS score. Along with other airway parameters a simple history of snoring can add to the anticipation of a difficult airway. Hence the history of snoring itself should alert us to be ready to deal with difficulty in ventilation and intubation.

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