

# **Assessment of Neck Circumference and Inter Incisor Gap Ratio as A Predictor of Difficult Laryngoscopy in Limited Cervical Extension Patients: An Observational Study**

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## **ABSTRACT**

Difficulty in airway management is a major cause of morbidity and mortality in anesthetic practice. The ability to identify patients at risk of difficult tracheal intubation is important

especially in patients with apparently normal airways. The importance of preoperative prediction of a difficult airway is obvious, as 85% of all mistakes regarding airway management result in permanent cerebral damage and up to 30% of all anaesthetic deaths can be attributed to the management of difficult airways. In patients with limited cervical extension, the intubation will turn out to be even more difficult as we cannot make the neck extension in these scenarios, visualization of glottis will be very difficult and it will ultimately result in complications. Thorough preoperative assessment is essential to identify the patients at risk of difficult intubation so that proper management can be planned beforehand. As there is no preoperative assessment criteria or tool to predict the difficulty in these limited cervical extension patients, the purpose of the present study was to evaluate the accuracy of the Neck circumference to Inter incisor gap ratio in predicting the difficulty of laryngoscopy in limited cervical extension patients.

#### **OBJECTIVES OF THE STUDY:**

The aim of the study is to compare the ability to predict difficult of laryngoscopy in limited cervical extension patients from the following preoperative airway predictive indices ,i.e, Neck circumference(NC),Inter incisor gap(IIG), Neck circumference to Inter incisor gap ratio (RNIIG).

#### **MATERIALS & METHODS:**

A prospective observational study was conducted after Institution Ethics committee approval in Nizam's Institute of Medical Sciences, Punjagutta, Hyderabad, Telangana. The study was conducted on a sample of 140 adult ASA grade 1&2 patients of age 18-70 years, of both sexes undergoing elective surgery under general anesthesia. Patients with pediatrics age group below 18 years,C spine fracture, connective tissue disorders affecting spine, facial fracture, obvious abnormality of airway as in burn contracture, syndromic patients and pregnantfemales were excluded.

#### **RESULTS:**

The incidence of difficult intubation increased parallel to an increase in age, Neck Circumference, MPG, Increase in neck circumference to Inter incisor gap ratio , decrease in TMD,IIG. RNIIG has good predicting ability (r value of 0.789 which states strong correlation according to spearman correlation),with AUROC of 0.930.

## CONCLUSION

Slim, young patients having adequate mouth opening, MPG and thin neck had better laryngoscopic view. Patients having high NCTMD and RNIIG faced difficulty in intubation. RNIIG yielded moderate to high sensitivity, specificity, and negative predictive value. We conclude that combination of factors will help predict difficult intubation more efficiently than any single factor. Ratio of Neck circumference to Inter incisor gap (RNIIG) is a useful bedside screening test for preoperative prediction of difficult laryngoscopy in limited cervical extension patients.

**Keywords: Laryngoscopy, NICTMD, RNIIG, Neck Circumference**

## INTRODUCTION

Difficulty in airway management is a major cause of morbidity and mortality in anaesthetic practice. The ability to identify patients at risk of difficult tracheal intubation is important, the incidence of Cormack and Lehane grade II and III patients requiring multiple attempts, blades or both is relatively high (1-18%) during intubation. The incidence of failed endotracheal intubation is 0.05-0.35%, whereas that for cannot ventilate, cannot intubate is around 0.0001-0.02%. Several preoperative airway assessment tests may be used to predict difficult intubations but sensitivity and positive predictive value of these individual signs are low (33%-71%) while false positive results are high. The importance of preoperative prediction of a difficult airway is obvious<sup>1</sup>

Difficult laryngoscopy is described in 1.5%–13% of patients.<sup>1</sup> Difficult airway is a potentially catastrophic incident. It was found out that a model including TMD, STMD, RHTMD and NC had a significant predictive accuracy for difficult laryngoscopy.<sup>2</sup> The ability to predict a difficult tracheal intubation permits anaesthesiologists to take precautions to decrease the risk.

Intubation has been difficult in patients with limited cervical extension patients. Neck circumference to inter incisor gap ratio has been found out to predict the difficulty of intubation in patients who have cervical spondylosis, with the ratio of  $\geq 9.5$  suggests that the intubation is going to be difficult.<sup>(3)</sup> Many studies have been done on airway

parameters to predict the possibility of difficult intubation for example is Ratio of neck circumference to thyro mental distance ( RNTMD ) as a predictor in case of Obese patients (4)

Many parameters were found to be useful for predicting difficult intubation but not a single parameter proved to be efficacious, hence some score have been introduced in which a study done by wanderley proved that Wilson score has better sensitivity but has a poor specificity in his study(5)

Thorough preoperative assessment is essential to identify the patients at risk of difficult intubation so that proper management can be planned beforehand .Inter Incisor Gap is also taken as a predictor of difficult laryngoscopy and also it indirectly correlates with atlanto occipital extension .Studies have been done as a practice guidelines as a means to follow in case of unanticipated difficult

intubation by Society of Anesthesiologists to prevent failure of intubation.

Many scores have been introduced to predict difficult laryngoscopy of among them history of failed intubation or laryngoscopy has been proved its efficiency and it has been introduced as a component in score for predicting difficult intubation by Ganzouri (6).Based on the studies done previously guidelines have been formed and recommended to follow to avoid failure of intubation in both anticipated ,unanticipated cases and introduced into the practice(7).Wilson has introduced a score which could predict the difficulty of intubation pre operatively (8).

Mallampati test was too insensitive and not specific enough for routine use (table VII). Protrusion of the mandible was also too insensitive for routine use. Thyromental distance was more specific but not more sensitive than the modified Mallampati test but sterno mental distance was found to be good predictor in a study done by savva et al (9).Cormack lehane grading which is viewed during laryngoscopy can be taken as indicator for degree of easeness of intubating the patient ( 10) .

Preoperative evaluation is important in the detection of patients at risk for difficult tracheal intubation.In patients with limited cervical extension Intubation will be difficult as we cannot keep the patient in sniffing position as in patients who have normal cervical extension,which would result in unanticipated difficult intubation if not assessed pre operatively.In case of cervical neck extension limitation patients where the usual sniffing position is not possible to keep, focus is put on the predictors which can predict the difficulty in laryngoscopy pre-operatively (11).Very few studies were done previously to indicate the difficulty of laryngoscopy in limited cervical extension patients. Neck circumference , Inter incisor gap,Thyro mental distance , degree of cervical extension are often used for this purpose, but its value as an indicator for difficult intubation is questionable when used as a single parameter. The purpose of the present study was to evaluate the accuracy of the ratio of neck circumference to inter incisor gap ratio in predicting the difficulty of intubation in limited cervical extension patients.

### **Aim & Objective of the study**

The aim of the study is to evaluate the ability to predict difficult of laryngoscopy in

limited cervical extension patients from the following preoperative airway predictive indices, Ratio of Neck circumference to inter incisor gap ratio (RNIIG), Modified Mallampati test (MMT), Thyromental distance (TMD), Neck circumference (NC). RNIIG has the better predictive ability for prediction of difficult of laryngoscopy in limited cervical extension patients.

## MATERIALS AND METHODS

### PROCEDURE

After taking IEC (Institutional Ethics Committee) approval, written informed consent of the patient was taken. Patient's height, weight were taken. Following airway parameters were taken with patient in sitting position

- a. Inter incisor distance (IID in cm) was measured.
- b. Modified Mallampati grading (MPG in cm) with patient sitting and head in neutral position
- c. Thyromental distance (TMD in cm) was measured from thyroid notch to the chin with a scale with neck extended .
- d. Slux: maximum protrusion of lower jaw from upper jaw will be taken pre operatively.
- e. Neck circumference is measured with measuring tape at the level of thyroid notch.

All the patients will be pre medicated with Rantac 150 mg on the night before and on the morning of surgery . In the operating theatre , basic monitors were connected to the patient and baseline values were noted for each patient . IV access was secured to start IV fluids appropriately . patient was pre medicated with glycopyrrolate 10 micrograms per kg .After preoxygenation with 100% oxygen by face mask for 3-5 mins , induction of anesthesia was done using thiopentone (5mg/kg) .

After confirming mask ventilation and difficulty of mask ventilation was noted down and if unable to perform bag and mask ventilation patient was waken up , If we were able to perform bag and mask ventilation IV muscle relaxant was given to achieve neuromuscular blockade . Intubation was performed with conventional laryngoscope , later intubated with appropriate endotracheal tube and laryngoscope utilized for this was noted down. Intubation was performed in neutral position. If we were not able to perform intubation with conventional laryngoscope then high generation devices were used to perform the procedure and intubation performed .

Cormack lehanegrading , any use of airway assist devices like bougie / stylet , duration required to perform laryngoscopy and Difficulty level according to IDS score were noted down.In case any use of Video laryngoscopes for intubation is taken for use then a score of 2 was added to IDS and then total IDS was noted down .Intubation Difficulty score

may be defined as a measure of the degree of divergence from a predefined “ideal” intubation

#### *DATA RECORDING AND STATISTICAL ANALYSIS:*

All the data was collected, tabulated and checked for correctness and consistency.Descriptive and inferential statistical analysis has been carried out in the present study. The Statistical software namely SPSS 22.0, and R environment ver.3.2.2 were usedfor the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

#### **RESULTS**

Total 143 patients were recruited for the study who underwent elective surgery under general anaesthesia. The data was collected, tabulated ,analysed and following observation were made.

All patients had successful intubation and there were no failed intubations. Difficult intubation defined as IDS of 6 or more was found in 56 patients (39%).

As the patients were intubated in neutral position , classical sniffing position was not used to intubate the patient and because not all the patients were intubated by same anesthesiologist, all the patients had increased IDS score comparatively . based on the observations we got from this study, purposely we took IDS of greater than 7 as the cut off mark to divide the observations we got and assess the difficulty of laryngoscopy.

#### *DEMOGRAPHIC DATA:*

Table 1: Age distribution of patients studied

Age in years	No. of patients	%
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11-20	11	7.7
21-30	19	13.3
31-40	28	19.6
41-50	32	22.4
51-60	29	20.3
>60	24	16.8
Total	143	100.0

As seen in the above table, more number of patients were in the age group 41-50 years and 51 to 60 years with 32 and 29 respectively. The other patients in the age group 11-20 years, 21 to 30 years and 31 to 40 years were 11 (7.7%), 19 (13.3%) and 28 (19.6%) respectively. About 24 patients were in age group 60-70 years.

**Table 2:** Gender distribution of patients studied

Below table shows the number of patients that were recruited based on gender.

Gender	No. of patients	%
Female	45	31.5
Male	98	68.5
Total	143	100.0



Out of total 143 patients 69% were males and 31% were females.

Table 3:-NC/TMD/IIG/MPG distribution of patients studied

	No. of patients (n=143)	%
NC		
<40	75	52.4
>40	68	47.6
TMD		
<8	44	30.8
>8	99	69.2
IIG		
<5	25	17.5
>5	118	82.5
MPG		
0	1	0.7
1	18	12.6
2	71	49.7
3	47	32.9
4	6	4.2

- Regarding MPG grade, most of our patients had 2-3 grade. About 71 patients (49.7%) had MPG 2 and 47 pts (32.9%), had MPG 3 .
- The remaining 18 pts (12.6%) had MPG grade 1 and 6 pts (4.2%) had MPG 4.

No patients presented with MPG 0

Table 4: IDS distribution of patients studied

Majority of the patients (90) had IDS range 4-6 followed by 36 patients (25.2%) IDS range 7-10. The remaining 17 patients (11.9%) had IDS 1-3. No patient in our study had zero IDS

IDS	No. of patients	%
0	0	0.0
1-3	17	11.9
4-6	90	62.9
7-10	36	25.2
Total	143	100.0

As seen in the below table, In our study, CL grade increased from 1 to 4 grade parallel with increase in age. Thus Younger patients had significant better glottis view than elderly pts. ( $p < 0.001$ )

Patients with  $16.00 \pm 1.41$ ,  $30.81 \pm 15.65$ ,  $47.88 \pm 11.64$ ,  $51.09 \pm 11.49$  and  $50.83 \pm 14.96$  yrs in age had CL class 1,2a, 2b, 3 and 4 respectively.

Regarding weight: the CL grade was better in lean pts .

Patients weighing  $50.50 \pm 12.02$  and  $62.88 \pm 8.86$  kgs had class 1 and 2a respectively. While  $72.93 \pm 9.37$ ,  $77.28 \pm 10.27$  and  $75.50 \pm 8.57$ kg pts had class 2b, 3 and 4 respectively.

Difficulty of glottic view was observed with increase in height. Patients with height of  $165.50 \pm 19.09$ ,  $172.75 \pm 7.86$ ,  $170.95 \pm 7.27$ ,  $172.57 \pm 6.07$  and  $172.00 \pm 6.48$  cm had CL class 1,2a, 2b, 3 and 4 respectively

CL grade was 1,2a,2b,3 and 4 in pts having cervical extension angle of  $60.00 \pm 0.00$ ,  $54.38 \pm 8.30$ ,  $51.40 \pm 8.54$ ,  $43.37 \pm 10.44$  and  $31.67 \pm 4.08$  respectively.

Table 5:-Comparison of baseline clinical variables according to CL CLASS of PATIENTS STUDIED

Variables	CL Class					Total	P value
	Class I	Class 2a	Class 2b	Class 3	Class 4		
Age in years	16.00±1.41	30.81±15.65	47.88±11.64	51.09±11.49	50.83±14.96	44.77±15.19	<0.001**
Weight (kg)	50.50±12.02	62.88±8.86	72.93±9.37	77.28±10.27	75.50±8.57	71.87±11.13	<0.001**
Height (cm)	165.50±19.09	172.75±7.86	170.95±7.27	172.57±6.07	172.00±6.48	171.84±7.16	0.491
Cervical EX	60.00±0.00	54.38±8.30	51.40±8.54	43.37±10.44	31.67±4.08	48.78±10.60	<0.001**
UCE	40.00±7.07	34.14±10.70	27.96±9.07	20.88±8.54	10.00±0.00	26.87±10.82	<0.001**

Table 6: Comparison of clinical variables according to CL CLASS of PATIENTS STUDIED

Variables	CL Class					Total	P value
	Class I	Class 2a	Class 2b	Class 3	Class 4		
CF	60.00±0.00	58.13±5.35	57.19±6.48	51.72±7.98	45.83±7.36	55.20±7.51	<0.001**
NC	34.50±2.12	36.84±2.45	39.13±2.64	42.08±2.93	41.42±2.40	39.60±3.36	<0.001**
TMD	7.75±0.35	8.00±0.38	7.99±0.48	7.74±0.55	7.17±0.52	7.87±0.51	<0.001**
IIG	5.75±0.35	5.78±0.47	5.60±0.51	4.87±0.61	4.25±0.27	5.35±0.68	<0.001**
MPG	1.00±0.00	1.63±0.61	2.14±0.55	2.78±0.55	3.50±0.55	2.27±0.76	<0.001**
NC IIG	6.00±0.00	6.40±0.75	7.03±0.83	8.70±1.23	9.74±0.99	7.53±1.41	<0.001**
NC TMD	4.45±0.07	4.59±0.35	4.89±0.43	5.37±0.40	5.82±0.62	5.29±3.39	<0.001**
IDS	2.00±0.00	3.81±0.86	4.82±0.85	6.96±1.01	8.33±0.52	5.39±1.67	<0.001**

-Patients with Neck circumference < 40 cm had better glottic view(1-2 class) than NC > 40 CM. (3-4

class) (P<0.001) and CL class was 1,2a, 2b in pts of NC of 34.50±2.12, 36.84±2.45, 39.13±2.64 cm respectively).

-Patients with NC of 42.08±2.93, 41.42±2.40 cm were having class 3 and 4 respectively.

-Patients with TMD of 7.17±0.52 had CL class4 while pts with TMD of 7.75±0.35, 8.00±0.38, 7.99±0.48 and 7.74±0.55 cm had CL class 1, 2a, 2b and 3 respectively

-CL grade was better in pts having adequate IIG (P<0.001)

(patients having IIG of  $5.75\pm 0.35$ ,  $5.78\pm 0.47$  and  $5.60\pm 0.51$  presented with CL class 1, 2a, 2b respectively.

-Patients had poor CL grade with restricted IIG .CL was class 3 and 4 in pts of IIG  $4.87\pm 0.61$  and  $4.25\pm 0.27$  cm respectively . Increase in MPG was associated with increase in CL grade ( $P<0.001$ ).

-The CL class observed was 1,2a, 2b, 3 and 4 in MPG of  $1.00\pm 0.00$ ,  $1.63\pm 0.61$ ,  $2.14\pm 0.55$ ,  $2.78\pm 0.55$ ,  $3.50\pm 0.55$  respectively

-Increase in NCIIG correlated to difficulty in glottic view ( $p<0.001$ ),CL grade. increased from 1,2,2b,3to 4 classfor NCIIG from  $6.00\pm 0.00$ ,  $6.40\pm 0.75$ ,  $7.03\pm 0.83$ ,  $8.70\pm 1.23$  and  $9.74\pm 0.99$  respectively.

-Similarly increase in NCTMD also correlated with difficulty in glottis view,

-Patients with NCTMD of  $4.45\pm 0.07$ ,  $4.59\pm 0.35$ ,  $4.89\pm 0.43$ ,  $5.37\pm 0.40$  and  $5.82\pm 0.62$  had CL class of 1,2A, 2B, 3 and 4 respectively

-IDS is strongly linked with CL class , ( $p<0.001$ ) with increasing class parallel to Increase in IDS.

Patients had CL class 1,2a, 2b, 3 and 4 with IDS of  $2.00\pm 0.00$ ,  $3.81\pm 0.86$ ,  $4.82\pm 0.85$ ,  $6.96\pm 1.01$  and  $8.33\pm 0.52$  respectively

Table 7: Spearman Correlation

Spearman Correlation	r value
IDS vs CF	-0.485
IDS vs NC	0.634
IDS vs TMD	-0.330
IDS vs IIG	-0.694
IDS vs MPG	0.737
IDS vs NC IIG	0.780
IDS vs NC TMD	0.710

r values ranges

- 0.00-0.10 Negligible correlation
- 0.10-0.39 Weak correlation
- 0.40-0.69 Moderate correlation
- 0.70-0.89 Strong correlation
- 0.90-1.00 Very strong correlation

From the above table we can say that NCIIG ration has a strong correlation with IDS.

As the NCIIG is increased the difficulty of intubation also increases.

Table 8: ROC curve analysis

Variables	ROC results to predict Mortality				Cut-off	AUROC	SE	P value
	Sensitivity	Specificity	LR+	LR-				
NC/IIG	84.21	87.90	6.96	0.18	>8.6	0.930	0.0236	<0.001**
NC/TMD	89.47	77.42	3.96	0.14	>5.25	0.884	0.0319	<0.001**

From the above analysis with the division of IDS scores into two groups with demarcating value

of IDS  $\geq 7$  , we got the cut off value of NCIIG as  $> 8.6$  which states that the ratio more than 8.6 indicates, that intubation can be anticipated with increased difficulty with P value of ,0.001. and sensitivity of 84.21 , specificity of 89.47.

## DISCUSSION

Airway management is one of the greatest concerns for anaesthetists. Airway assessment consists of taking a medical history, performing a physical examination, reviewing the clinical records and carrying out additional tests. Difficult endotracheal intubation under general anaesthesia can cause failed intubation, which can lead to complications, more pronounced in case of unanticipated difficult airway. The preoperative airway assessment is to estimate this risk of difficult airway and to transform an unanticipated into an anticipated difficult airway in most of the cases. Accordingly, many national airway guidelines emphasize the importance of a thorough and skilled assessment of all patients undergoing anesthesia<sup>12, 13</sup>

The incidence of difficult laryngoscopy and intubation in various settings has ranged widely, from 1 to 15% . Patients limited neck extension have a higher incidence of difficult laryngoscopy due to improper alignment of oral, pharyngeal, and laryngeal axis than in normal neck extension pts.. This large proportion of unexpected difficult airways and significantly increases the morbidity and mortality rates <sup>(14)</sup>. Therefore, identifying a more reliable optimal predictor of difficult laryngoscopy in these patients undergoing general anesthesia is desirable. There are many preoperative airway assessment tests performed at the bedside in seconds such as inter incisor gap (IIG), Mallampati grading (MPG), head and neck movement (HNM), horizontal length of mandible (HLM), Sternomental distance

(SMD), and Thyromental distance (TMD) which may be used to predict difficult intubations in the general population. But Sensitivity and positive predictive value (PPV) of these individual tests are low while false positive (FP) results are high. In pts with limited neck extension, these tests sensitivity is too low due to high incidence of difficult airway. Few studies have used modifications to bedside tests to improved predictive values. Liaskou et al(2) found out a model including TMD, STMD, RHTMD and NC had a significant predictive accuracy for difficult laryngoscopy. Adnet et al used the Nintubation difficulty scale to assess the airway management in this study as it provides an objective method that is inclusive of all measures taken to manage the airway and not just the glottis view. Another example includes the ratio of NC/IIG ratio (RNIIG) IIG reflects cranio-cervical extension, which is restricted in cervical spondylosis patients<sup>15,16</sup> and could predict difficult airway better than TMD. Therefore, our hypothesis was that the NC/IIG ratio (RNIIG) would be more useful than the previously reported indices for identifying difficult intubation in patients with limited neck extension. This study was conducted in a group of 143 patients of ASA physical status 1 or 2.

Our data demonstrated that male gender, increasing weight, height and age were associated with difficult laryngoscopy. Regarding gender, we had 68.5% males and 31.5% females. A significant proportion of difficult intubation has been found in males attributed to difference in neck fat deposition between sexes<sup>[17][18]</sup>. The incidence of difficult intubation increased parallel to an increase in age, ( $p < 0.001$ ) similar to Al Ramadhani S et al study. Osteoarthritic changes, associated with decreased thyromental distance, cervical spine movement, interincisor distance, and grade of dentition, may be responsible for age-related increases in difficult laryngoscopy.

Increase in weight of the patients was also associated with increase in CL grade. ( $p < 0.001$ )

This is similar to Harsha et al<sup>19</sup> study who had difficulty in intubation with increasing weight.

CL grade also increased parallel to increase in height of the patients.

In our study we found out that neck circumference has a positive correlation with the difficulty of laryngoscopy. Pts with thin neck of NC < 40 cm had CL view 1-2 grade and Pts with NC > 40 cm had 3-4 CL grade. Our study is similar to Liaskou Chara et al<sup>2</sup> study and Gonzalez et al<sup>20</sup> study who found that NC > 43 cm was independently correlated with difficult intubation in all populations.

We noticed significantly better laryngoscopic view in Pts having more IIG and less MPG ( $p < 0.001$ ). Poor mouth opening was associated with difficult intubation similar to the studies done by Sharma<sup>21</sup>. Previous studies have suggested that using a single screening test for difficult intubations only provides limited accuracy. However, combinations of tests may increase the accuracy of diagnosis. Calder et al (6) performed a study on IDD and found that

The mean IDD increases by 18 mm between the flexion and full extension positions, the IDs measured at each position were. Significantly different from one another at the 5% significance level. He also stated that there is restriction of mouth opening or inter incisor gap when the patient is put in neutral position and therefore can result in difficulty of intubation.

We also found that Our patients with higher NCTMD had difficult laryngoscopy.( $p < 0.001$ ). NCIIG is a new predictor of difficult laryngoscopy in patients with limited neck extension ,it includes two indicators: IIG and NC, representing oropharyngeal cavity volume, craniocervical extension and laryngeal cavity volume we found Increase in NCIIG correlated with difficult laryngoscopy, ( $p < 0.001$ ). yongzhengetal<sup>3</sup> also noted increase in difficult laryngoscopy parallel to increase in NCIIG ratio . They found RNIIG  $\geq 9.5$  exhibited largest area under the ROC curve.RNIIG has the highest sensitivity (88.6%; 95% CI 78.1–99.1) and negative predictive value (96.6%;95% CI 94.0–99.2), confirming its better predictive ability.

We used the analysis of ROC curves to assess and compare the Overall performance of the predictive tests. In our study we took a value IDS  $>7$  to Define the difficulty rather than the standard IDS $>5$  as there is no neck extension even a slight difficulty turned out greater IDS .In our study the Area under ROC Curve (AUROC) of NCIIG was 0.930 and the study showed a association between NCIIG and IDSS (P value , 0.001) sensitivity-84.21,specificity-87.90, which shows that it has a good discriminatory ability for predicting difficult intubation (IDSS $>7$ ) compared to other parameters in patients with limited cervical extension.Results from our study has shown that Ratio of NC to IIG of greater than 8.6 has better predictive ability for difficult intubation with sensitivity of 84.21 , specificity 87.20 with  $p < 0.001$ . It was also shown that IDS Vs NCIIG has a correlation of 0.78 which suggests strong correlation between IDS and NCIIG. Our results suggest that RNIIG may be a useful bedside screening test for preoperative prediction of difficult laryngoscopy in patients who have limited cervical extension.

### **LIMITATIONS:**

The limitations of the study include-

- 1) Individual variations in recording Mallampati score and thyromental distance.
- 2) All patients were not intubated with same anesthesiologist.
- 3) IDS score may vary with experience of anesthesiologist.
- 4) Using aid of Video laryngoscope as first choice by some anesthesiologists would result in

increased IDS score .

Additionally, the results of this study conducted in an Indian population, may not stand true for other populations because of well-known ethnic variations, where a reassessment may be required.

## **CONCLUSION**

Slim, young pts having adequate mouth opening, MPG and thin neck had better laryngoscopic view . Patients having high NCTMD and RNIIG faced difficulty in intubation. RNIIG yielded moderate to high sensitivity, specificity, and negative predictive value. We conclude that combination of factors will help predict difficult intubation more efficiently than any single factor. Ratio of Neck circumference to Inter incisor gap (RNIIG) is a useful bedside screening test for preoperative prediction of difficult laryngoscopy in limited cervical extension patients.

## **Acknowledgment**

The author is thankful to Department of Anesthesiology for providing all the facilities to carry out this work.

## **Conflict of Interest**

None

## **Funding Support**

Nil

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