

## Can Bedside Assessment Tests Predict Difficult Intubation in Oral Cancer Surgery Patients: A Prospective Observational Study

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### Abstract

**Background:** We evaluated usefulness of Mallampati test, Inter incisor distance, Thyromental distance and Sternomental distance in predicting difficult intubation in oral cancer surgery patients. **Methods:** Preoperatively, assessment of airway predictors was done in 111 patients undergoing oral cancer surgery. Difficult intubation was defined as Cormark and Lehane grading of grade 3 & 4. **Results:** Incidence of difficult intubation was found to be 18% patients. By using Receiver operating characteristic analysis, Inter incisor distance < 2.55 cm, Thyromental distance < 8.75 cm were found to be the cut off points of difficult intubation. Sensitivity and specificity for predicting difficult intubation by Interincisor distance was 60% and 78% respectively with a positive predictive value of 39% and with higher negative predictive value of 89%. AUC (area under curve) with 95% confident interval showed 0.69% for Inter incisor distance, 0.64% for Thyromental distance and 0.57% with Sternomental distance. **Conclusions:** Inter incisor distance and Mallampati grading was a better predictor compared to other parameters and Sternomental distance showed the least significance in predicting a difficult airway in oral cancer surgery patients.

**Keywords:** Oral cancer surgery; Difficult intubation; Bedside assessment test; Mallampatti grading; Inter incisor distance.

### How to cite this article:

Sumitha CS, Kavitha Lakshman, Mamatha HS. Can Bedside Assessment Tests Predict Difficult Intubation in Oral Cancer Surgery Patients: A Prospective Observational Study. Indian J Anesth Analg. 2019;6(4):1207-1213

### Introduction

Oral cancer is among the top three types of cancers in India [1]. In India, 20 per 100000 population are affected by oral cancer which accounts for about 30% of all types of cancer [2]. Different methods have been done to predict difficult intubation for patients posted for various surgeries. Identifying patients who are at risk of difficult intubation

helps anesthesiologist in planning management of airway. Multiple studies have been done to assess the usefulness of bed side screening test in patients posted for general surgeries. But there has been a paucity in studies conducted for patients posted for oral cancer cases. These patients already present with underlying pathology in the oral-pharyngeal cavity which can increase the chance of difficult mask ventilation and intubation.

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**Received on** 27.04.2019, **Accepted on** 08.06.2019



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The main objective of the study was to determine the incidence of difficult intubation in patients posted for elective oral cancer surgery. The second aim of the study was to assess the usefulness of bedside test to predict difficult intubation in these set of patients.

### Methods

We prospectively analysed the data of 111 patients scheduled for oral cancer surgery for airway management during the perioperative period at our institution. After ethical committee approval, we prospectively studied the patients from September 2018-January 2019. Informed consent was obtained from all the patients before the surgery. Out of the 111 patients, 4 cases were electively planned for fibre optic intubation. All adult patients who were posted for benign or malignant disease were included in the study. Patients who were tracheostomised were excluded from the study. All cases were managed by an anaesthetic consultant or specialist registrars with at least 3 years of anaesthesia experience.

Preoperatively, data were collected on patients characteristics followed by airway examination. Bedside assessments which was included were- Modified Mallampatti score (3, 4), Inter incisor distance (IID), Thyromental distance (TMD) and Sternomental distance (SMD). With patient in sitting position at the eye level of anesthesiologist, Mallampati grade was assessed with mouth opened as wide as possible with tongue protruding. IID was measured with mouth fully opened without

use of any accessory muscles. In edentulous patients, inter gingival distance was used as inter incisor distance. TMD, SMD was measured along a straight line from the lower border of mandibular mentum to thyroid notch and sternal notch with head in extended position without using accessory muscle. After keeping patients nil per oral for 8 hours, patients were premedicated with glycopyrrolate and midazolam. Patients were pre oxygenated and induced with fentanyl (1-2 mcg/kg), propofol (2 mg /kg) and after check ventilation, succinylcholine (1.5-2 mg /kg) was given. Laryngoscopic view was graded according to Cormark and Lahenes (5) laryngoscopic grading. Mallampati grades were classified as lower grade (Grade 1 & 2) and higher grade (Grade 3, 4). Cormark and Lahene grading were also classified as Lower grade (Grade 1, 2) and Higher grade (grade 3, 4) respectively.

### Results

In this study, data from 111 patients scheduled for oral cancer surgeries were analyzed.

Demographic profile and airway characteristics of the study population are presented in table 1 and table 2.

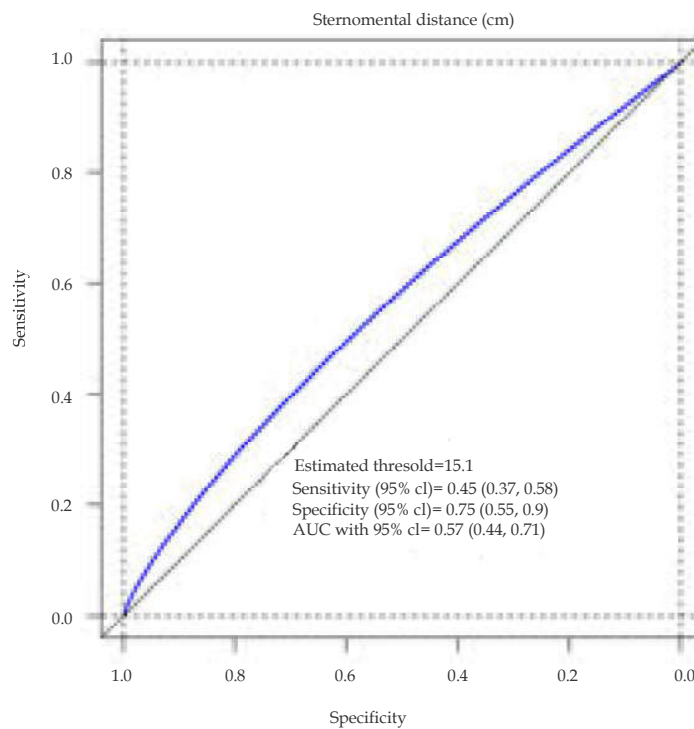
*Table 1:* All most equal number of males and females participated in this study. About 37 patients (33.33%) and 14 patients (12.61%) had Mallampati grade 3 & 4 respectively.

**Table 1:** Qualitative Variables (Frequency & Percentage)

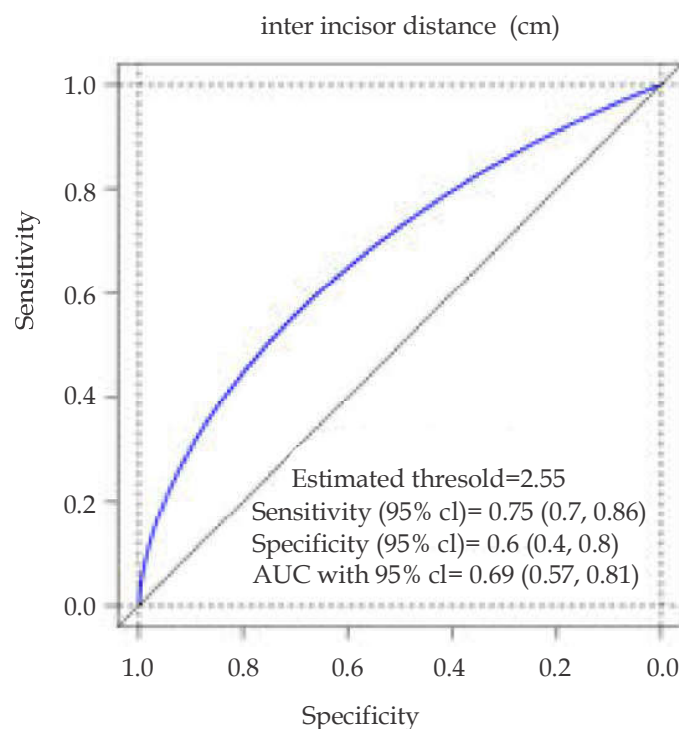
Variables	Levels	Frequency	Percentage
sex	female	58	52.25
	male	53	47.75
Mallampati grade	1	1	0.9
	2	59	53.15
	3	37	33.33
	4	14	12.61
Cormark Lahene Grading of Laryngoscopy	1	50	47.17
	2	36	33.96
	3	19	17.92
	4	1	0.94
Mallampatti grade	higher grade	51	45.95
	Lower grade	60	54.05
Cormark Lahene Grading	higher grade	20	18.87
	lower grade	86	81.13

*Table 2:* The mean age and weight of the patients were  $53.21 \pm 12.86$ ,  $54.05 \pm 11.0$  respectively. Mean inter incisor distance was  $3.16 \pm 1.75$  cm. Mean Sterno' mental distance was  $15.63 \pm 2.32$  cm. Mean Thyro mental distance was  $8.67 \pm 1.59$  cm.

*Table 3:* Quantitative analysis in this table shows inter incisor distance of  $2.62 \pm 0.93$  had higher grades of Cormark Lahene grading under direct laryngoscopy and  $3.41 \pm 1.83$  had lower Grades of laryngoscopic findings which was found to be significant.



**Graph 1:**



**Graph 2:**

*Table 4:* Sensitivity and specificity for predicting difficult intubation by IID was 60% and 78% respectively with a positive predictive value of 39% and with higher negative predictive value of 89%.

*Table 5:* Sensitivity of predicting difficult intubation by Sternomental distance was 25% and specificity of 52%. The positive predictive value was found to be only 11% and higher negative predictive value of 75%.

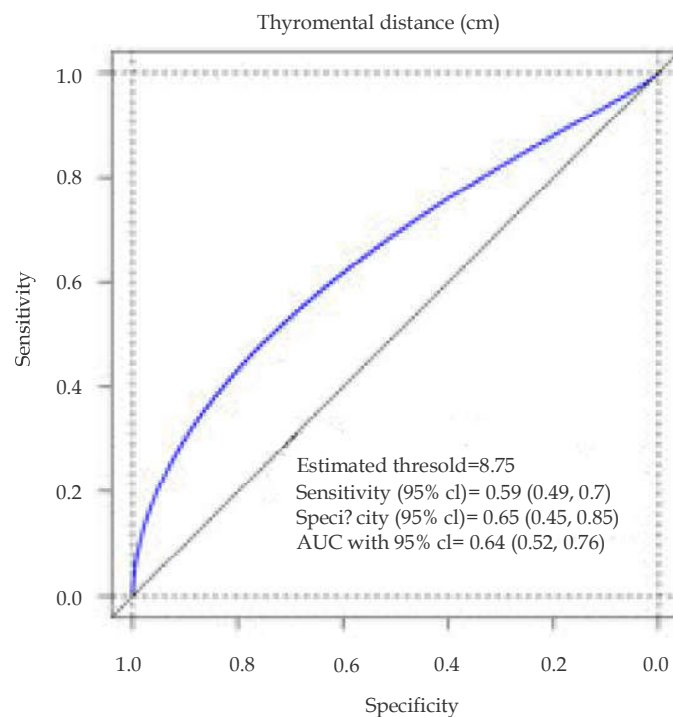
**Table 2:** Quantitative Variables

	N	Mean	Sd	Median	Iqr	Min	Max
Age	111	53.21	12.86	56	21	28	85
Weight	111	54.05	11.04	53	13.5	30	100
Inter Incisor Distance cm	111	3.16	1.75	3	1.9	-3	15.2
Sternomental distance cm	111	15.63	2.32	16	2.5	7	22
Thyromental Distance cm	111	8.67	1.59	9	1.5	4	16

**Table 3:** CL grade vs other predictors

Summary: Quantitative

Variable	Group	N	mean	SD	Test stat	P.value
Age	Higher Grade	20	51.5	12.81	t stat= 0.68	0.5
	Lower Grade	86	53.67	12.89		
Weight (kg)	Higher Grade	20	60.7	13.78	t stat=2.56	0.017
	Lower Grade	86	52.35	10.04		
Inter Incisor Distance (cm)	Higher Grade	20	2.62	0.93	T stat= -2.75	0.008
	Lower Grade	86	3.41	1.83		
Sternomental Distance	Higher Grade	20	16	1.69	t stat= 1.16	0.254
	Lower Grade	86	15.47	2.38		
Thyromental Distance	Higher Grade	20	8.12	1.13	t stat= -2.2	0.034
	Lower Grade	86	8.81	1.67		



**Graph 3:**

Table 6: Sensitivity of predicting higher Cormark Lahene grading with Thyromental distance was 65% and specificity of 59%. The positive predictive value was found to be only 27% and negative predictive value of 88%.

Table 7: Odds ratio was 5.289 and 5.323 of interincisor distance and mallampati grade.

AUC (Area under curve) with 95% confident interval showed 0.69% for Inter incisor distance, 0.64% for Thyromental distance and 0.57% with Sternomental distance.

Table 4: Epi test: CL grading vs Inter Incisor Distance

Point estimates and 95 % CIs:	
Apparent prevalence	0.29 (0.21, 0.39)
True prevalence	0.19 (0.12, 0.28)
Sensitivity	0.60 (0.36, 0.81)
Specificity	0.78 (0.68, 0.86)
Positive predictive value	0.39 (0.22, 0.58)
Negative predictive value	0.89 (0.80, 0.95)
Positive likelihood ratio	2.72 (1.59, 4.63)
Negative likelihood ratio	0.51 (0.30, 0.89)

Table 5: Epi test: CL grading vs Sternomental distance

Point estimates and 95 % CIs:	
Apparent prevalence	0.43 (0.34, 0.53)
True prevalence	0.19 (0.12, 0.28)
Sensitivity	0.25 (0.09, 0.49)
Specificity	0.52 (0.41, 0.63)
Positive predictive value	0.11 (0.04, 0.24)
Negative predictive value	0.75 (0.62, 0.85)
Positive likelihood ratio	0.52 (0.24, 1.16)
Negative likelihood ratio	1.43 (1.04, 1.98)

Table 6: Epi test: CL grading vs Thyromental distance

Point estimates and 95 % CIs:	
Apparent prevalence	0.45 (0.36, 0.55)
True prevalence	0.19 (0.12, 0.28)
Sensitivity	0.65 (0.41, 0.85)
Specificity	0.59 (0.48, 0.70)
Positive predictive value	0.27 (0.15, 0.42)
Negative predictive value	0.88 (0.77, 0.95)
Positive likelihood ratio	1.60 (1.06, 2.41)
Negative likelihood ratio	0.59 (0.32, 1.10)

Table 7: Complete Contingency Table

Variables	Levels	Lower Grade	Higher Grade	chi. square	p value	OR. CI
Inter incisor distance	Above threshold	67 (89.3)	8 (10.7)	9.511	0.002	1
	Below threshold	19 (61.3)	12 (38.7)			
Sternomental distance	Above threshold	45 (75)	15 (25)	2.536	0.111	5.289 (1.889, 14.808)
	Below threshold	41(89.1)	5 (10.9)			
Thyromental distance	Above threshold	51 (87.9)	7 (12.1)	2.949	0.086	1
	Below threshold	35 (72.9)	13 (27.1)			
Mallampati grade	Lower grade	55 (91.7)	5 (8.3)	8.5	0.004	1
	Higher grade	31 (77.4)	15 (32.6)			

## Discussion

Difficult intubation is one of the most feared complication faced by anesthesiologist while managing airway during general anesthesia. It can be due to variety of factors which include patient factors, clinical condition of the patient and the experience of the anesthesiologist managing the case. Clinical bedside assessments can be done prior to surgery, to predict a difficult airway. Multiple studies which have been done prior, to determine which bedside assessment test can be of a better predictor to anesthesiologist. But, there are only few studies in literature that assess the usefulness of these bedside test in oral cancer surgeries.

India has worlds highest number (nearly 20%) of Oral cancers with an estimate of 1% of population having oral premalignant lesions [6]. Approximately 95% of oral cancers occur in people older than 40 years, with an average age at diagnosis of approximately 60 years [7]. This study has been done to find usefulness of these clinical bedside tests as a predictor test in these set of patients. For a predictor test to be clinically useful, it should have very high sensitivity with minimal false negative results reducing the incidence of unexpected difficult intubation for an unprepared anesthesiologist.

In our study, percentage of difficult intubation was found to be 18% (20/106) which was higher compared to studies done on general population [8,9]. The increase in percentage of difficult intubation in our study might due to the different set of population being taken up, the factors being distortion of airway due to tumor, history of surgery, radiation, oral submucosal fibrosis etc. In our study, as the grade of Mallampati grade increased, higher the chance of difficult intubation was seen with significant p value < 0.05 and Odds ratio of 5.32 (CI of 1.765-16.049) which was significant compared to retrospective study done by Healy et al (10) where the odds ratio was found to be 1.62.

By using Receiver operating characteristic analysis, inter incisor distance <2.55 cm, Thyromental distance <8.75 cm were found to be the cut off points of difficult intubation. Inter incisor distance < 4 cm is associated with difficult intubation [11]. The mean inter incisor distance in our study was  $3.16 \pm 1.75$  cm which was less compared to study done by Wilson et al. [12] where mean was of  $3.8 \pm 0.7$  cm in difficult intubation cases. This difference in Inter incisor distance could be due to painful conditions in oral cancer cases.

The sensitivity and specificity of predicting difficult intubation was 60% and 78% with positive predictive value of 39% and negative predictive value of 89% with odds ratio of 5.28. Sensitivity to predict difficult intubation by IID was better in comparison to study done by Cattano *et al.* [13]. It was found that sensitivity, specificity and negative predictive value was similar to study done by Khan *et al.* [8] with lesser positive predictive value.

Thyromental distance showed a sensitivity of 65% and specificity of 59% with PPV of 27% and a NPV of 88%. Sensitivity and PPV of our study was higher compared to study done by cattono *et al.* [13, 14,15] but lesser compared to study done by Patel [9] and Khan [8]. Sensitivity of predicting difficult intubation by Sternomental distance was 25% and specificity of 52% which was least among all. The positive predictive value was found to be only 11%. Sensitivity and specificity was less compared to other studies [8,9,15].

## Conclusion

In conclusion, we found that Inter incisor distance and Mallampati grading was a better predictor compared to other parameters and Sternomental distance showed the least significance in predicting a difficult airway in oral cancer surgery patients. We recommend usage of combination of these test and other predictors in further studies as multiple factors contribute to difficult airway in oral cancer surgery.

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