

■ **Original Article**

## **Comparison of modified mallampati test between sitting and supine positions for prediction of difficult intubation**

S Khatiwada<sup>1</sup>, B Bhattarai<sup>1</sup>, K Pokharel<sup>1</sup>, R Acharya<sup>2</sup>, A Ghimire<sup>1</sup>, DD Baral<sup>3</sup>

<sup>1</sup>Department of Anaesthesiology and Critical Care, BPKIHS, Nepal

<sup>2</sup>Lecturer, Department of Otolaryngology and H.N.S., Nobel Medical College, Biratnagar, Nepal

<sup>3</sup>SPH&CM, BPKIHS, Dharan, Nepal

### **Abstract**

**Background:** Modified Mallampati test is a standard method of assessing the airway for predicting potentially difficult laryngoscopy and intubation. This test requires the patient to be in sitting position for airway evaluation. Although applicable to the majority of patients, airway evaluation in sitting position may not always be convenient or advisable. **Objectives:** To compare modified Mallampati grades between sitting and supine position and to find out their correlation to Cormack and Lehane laryngoscopy grade. **Materials:** This prospective study was conducted in 215, ASA I and II patients undergoing various routine surgical procedures under general anaesthesia, in BPKIHS, Dharan over a period of 3 months. The airway assessment was done using modified Mallampati grade in sitting and supine positions. Mallampati grade of III or IV was defined as the predictor of difficult airway. The laryngoscopy grade was assessed using the Cormack and Lehane grading scale. Grade III or IV of Cormack and Lehane grades was defined as the difficult laryngoscopy and assumed as the predictor of difficult intubation. Statistical measures including sensitivity, specificity, positive and negative predictive values and accuracy were used for comparing the two positions for predicting difficult or ease of intubation. **Results:** Out of 215 patients, majority 146(68%) were females. Mallampati grade III or IV was observed in more patients in supine position compared to sitting position (48.3% vs. 35.8%,  $p = 0.008$ ). Difficult laryngoscopy was observed in 13(6%) patients. Sensitivity of modified Mallampati test was 77% in both the positions. Predictive value of Mallampati grading for difficult intubation were 13% and 10% and for easy intubation were 96% and 97% respectively in sitting and supine position. Specificity and accuracy of modified Mallampati test were both 67% in sitting position, where as they were 54% and 55% respectively in supine position. **Conclusion:** Modified Mallampati grade significantly worsens in supine position compared to sitting. However, airway evaluation in both the positions almost equally predicts for difficult intubation.

**Keywords:** bedridden patients, difficult intubation, emergency intubation, modified mallampati grade, sitting position, supine position.

### **Introduction**

Airway evaluation is of paramount importance for safe perioperative care.<sup>1</sup> Prior anticipation of difficult airway helps in overall preparation and in application of alternative approaches for airway maintenance and thereby minimizes catastrophic events.

Several bedside tests are being used for assessment and prediction of difficult airway in anaesthesia practice. Modified Mallampati test (MMT) in sitting position is commonly used and is a standard method of assessing the airway and for predicting potentially difficult intubation.<sup>2, 3, 4</sup> Although applicable to the majority of patients, airway evaluation in sitting position may not be always convenient or advisable. Elderly or very sick patients or patients with prolapsed disc

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Address for correspondence:  
Dr Shindhu Khatiwada, Assistant Professor  
Department of Anaesthesiology and Critical Care  
BPKIHS, Dharan  
Email: drsindhukhatiwada@yahoo.com

and fracture spine may not be able to sit up for assessment.

The feasibility of Mallampati assessment in sitting position in patients requiring emergency intubation has also been questioned due to difficulty in getting patients cooperation and critical illness those patients have.<sup>5</sup> A modification of the test, to allow it to be done in supine position, has been suggested as an alternative approach. Not only for the patient, airway evaluation in supine position on the operating table, will be more convenient even for the examiner.

Literature on airway assessment in supine position is limited and has not shown consistent results regarding Mallampati score in sitting and supine positions.<sup>6,7</sup> This prospective study was therefore designed and conducted to compare airway assessment with MMT in sitting and supine positions and their correlation to Cormack and Lehane (C-L) laryngoscopy grade<sup>8</sup> as the primary objective. The applicability of MMT in supine position for prediction of difficult airway was also studied as a secondary objective.

**Methods**

After obtaining approval from the institutional ethics committee and informed consent from each patient, 215 patients of ASA physical status I and II, aged 18-65 yrs, scheduled to undergo various routine surgical procedures under general anaesthesia were enrolled for our study over a period of 3 months. Patients with upper airway pathology that could alter the Mallampati class, cervical spine fracture, prolapsed disc, diabetes or pregnancy were excluded.

All the assessment was done by the principal investigator in the preoperative patient holding area. The airway class was assessed according to Samson and Young modification of Mallampati’s classification in 2 different positions, with the patient’s head in neutral, mouth fully open, tongue maximally protruded, and without phonation. First the observation was made in sitting position and the examiner eye to eye contact with the patient. The airway assessment was again repeated after laying the patient supine and the

examiner looking vertically downward. Mallampati grade of III or IV was defined as the predictor of difficult airway.

After induction of general anaesthesia and administration of muscle relaxant, laryngoscopy was done using Macintosh blade-3 by co-investigators. The principal investigator was not involved in the laryngoscopy. The laryngoscopy grade was assessed by the C-L grading scale. Grade III or IV was defined as the difficult laryngoscopy and assumed as a predictor of difficult intubation.

Statistical analysis was done using SPSS version-15. The continuous variables (age, weight, height and body mass index) are presented as mean ±SD. The z test was used to find out the significant difference in Mallampati grades between sitting and supine positions. Chi square test was used to compare the Mallampati grades in sitting and supine position with C-L laryngoscopy grade. A p value of < 0.05 was considered statistically significant. Statistical measures including sensitivity, specificity, positive predictive values, negative predictive values and accuracy were used and calculated for comparing the two positions for predicting difficult or ease of intubation. The values are presented as number or percentage.

**Results**

Out of the 242 patients enrolled, 27 patients did not meet the inclusion criteria and were excluded. Out of 215, majority of our patients 146 (68%) were females. The mean age, weight, height and body mass index of our patients were 36.7±14.8 yr, 53.1±9.5 kg, 157.5±6.3 cm and 21.3±3.5 kgm<sup>-2</sup> respectively. Mallampati grade III or IV was observed in 77 (35.8%) patients in sitting position and 104 (48.3%) patients in supine position (p = 0.008). Comparison of the MMT in sitting and supine position and C-L grading of laryngoscopic view is shown in Table-1. Difficult laryngoscopy was observed in 13(6%) patients. Comparison of various statistical parameters for predicting difficult or ease of intubation between sitting and supine position is shown in Table 2.

**Table 1:** Comparison of MMT in sitting and supine position with C-L grading

	MMT	C-L grade I, II	C-L grade III, IV	RR(95%CI)	P- value
Sitting	I, II (n=138)	135	3	1.12 (1.03-1.23)	0.002
	III, IV (n=77)	67	10		
Supine	I, II (n=111)	108	3	1.08 (1.0-1.15)	0.032
	III, IV (n=104)	94	10		

**Table 2:** Comparison of statistical parameters between sitting and supine positions

Statistical measures	MMT (sitting)	MMT (supine)
True positive (TP): Difficult intubation that had been predicted to be difficult.	10	10
False positive (FP): Easy intubation that had been predicted to be difficult.	67	94
True negative (TN): Easy intubation that had been predicted to be easy.	135	108
False negative (FN): Difficult intubation that had been predicted to be easy.	3	3
Sensitivity: Percentage of correctly predicted difficult intubations as a proportion of all intubations that were truly difficult, i.e., TP/ (TP + FN).	77%	77%
Specificity: Percentage of correctly predicted easy intubations as a proportion of all intubations that were truly easy = TN/ (TN + FP).	67%	54%
Positive predictive value (PPV): Percentage of correctly predicted difficult intubations as a proportion of all predicted difficult intubations = TP/ (TP + FP).	13%	10%
Negative predictive value (NPV): Percentage of correctly predicted easy intubations as a proportion of all predicted easy intubations = TN/ (TN + FN).	96%	97%
Accuracy: Percentage of correct results (both TP and TN) as a proportion of all intubations = (TP+TN)/ (TP+TN+FP+FN).	67%	55%

### Discussion

MMT test is a common and popularly used technique for predicting difficult airway.<sup>4, 9</sup> However, its requirement of sitting position limits its applicability in bedridden and majority of patients requiring emergency intubation.<sup>5</sup>

We performed airway assessment using MMT in sitting and supine position and compared with C-L laryngoscopy grade. We found that the change in

posture from sitting to supine position significantly worsened the Mallampati grade in 27(13%) patients. Our finding is consistent with most other studies.<sup>6,7,10</sup> However, in contrast, Amadasun et al<sup>11</sup> reported improved Mallampati score on assumption of the supine position from sitting. It is interesting if racial variation has any role to play for this finding.

Despite positional variation in Mallampati grade, we found that the airway assessment using MMT in supine position almost equally predicts difficult intubation as in sitting position. Significant correlation of modified Mallampati class in supine position with laryngoscopy grade was also found by Kim et al<sup>12</sup>. They suggested that assessment of Mallampati classification in supine position can be used as one of the predicting factors for difficult intubation.

A total of 13 (6%) patients in our study had difficult laryngoscopy, which is comparable to the previous incidences of 5% and 7% as found by Koh et al and Ezri et al.<sup>13, 14</sup> Out of these, 10 patients each in sitting and supine position were predicted for difficult intubation during airway assessment with MMT. We failed to predict difficult intubation in 3 (23%) patients in both positions. Similar true positive and false negative values in both the position resulted in a sensitivity of 77% in our study.

Sixty-seven and 94 patients predicted to have difficulty in sitting and supine position were intubated easily. Only 3 patients had difficult laryngoscopy amongst those (138 in sitting and 111 in supine) predicted for easy intubation.

Specificity was higher (67%) in sitting position compared to supine (54%), which was also true in similar study done by Bindra et al.<sup>10</sup> However, the individual values of specificity are less in the present study compared to the previous studies.<sup>15, 16</sup> Both original and modified Mallampati test in most of the studies, is known to have low sensitivity and high specificity.<sup>9</sup>

Predictive value for difficult intubation was 13% and 10% and for easy intubation was 96% and 97% respectively in sitting and supine position in our study. Comparable predictive values between sitting and supine positions were also found by Bindra et al.<sup>17</sup> Although failed to detect significant difference to the Mallampati class assigned, Tham et al<sup>6</sup> concluded that supine position did not worsen the predictive power

of the Mallampati class.

We found that the accuracy of MMT was more in sitting than in supine position (67% vs. 55%). Mallampati test is known to have poor to good accuracy for predicting difficult airway.<sup>9</sup>

Preoperative airway evaluation primarily aims at detecting as many patients with difficult airways as possible. This is necessary for minimizing the risk of unanticipated difficult or failed intubations. Difficult intubation can be better predicted by the sensitivity of a test. Our study showed similar sensitivity in both the sitting and supine position. Further, the predictive values for difficult intubation in both the positions were comparable. These findings show that the evaluation of an airway in supine position with MMT is an equally good alternative to sitting position for predicting difficult airway.

Laryngoscopic view being assessed by more than one co-investigator, order of posture being not randomized and relatively small sample size for the type of study are the main limitations of our study.

### **Conclusion**

Modified Mallampati grade significantly worsens in supine position compared to sitting. However, airway evaluation in both the positions almost equally predicts for difficult intubation. Airway assessment using MMT in supine position can be routinely applied in bedridden patients and in patients requiring emergency intubation.

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