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Effect of posture on mouth opening and modified Mallampati classification for airway assessment

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Abstract
Several bedside airway assessment methods have been proposed for preoperatively identifying patients who are difficult to intubate. To date, the Mallampati grading remains a time-tested technique for difficult airway assessment. Both Mallampati and the further modification by Samsoon and Young assessed patients in the seated position. During clinical practice, situations may arise where it may not be feasible for the patient to sit up for airway assessment. The aim of our prospective study was to determine whether there was any difference between the sitting and supine positions for the assessment of Mallampati grade. Eighty adult patients of American Society of Anesthesiologists (ASA) physical status I and II, aged 18–65 years, admitted to our neurosurgical ward were enrolled and assessed for airway. Our study revealed that change in posture produced a significant change in the mouth openings and Mallampati grades of the patients. This change was always toward a higher grade when the patient was turned supine from the sitting position.

Key words Mallampati grade · Mouth opening · Position · Supine · Sitting

Management of the airway is central to the practice of anesthesia. Published morbidity and mortality data demonstrate that airway difficulties and mismanagement are responsible for a significant proportion of adverse anesthetic outcomes in clinical practice [1–3]. Anesthesiologists must have the ability to recognize those patients who may present with a difficult airway and they should be able to formulate a plan of action to deal with any such problem. Several bedside airway assessment methods have been proposed for preoperatively identifying patients who will be difficult to intubate. Ideally, the method should be comprehensive and accurate, as well as simple and clinically applicable on a day-to-day basis. To date, the Mallampati grading remains a time-tested technique for difficult airway assessment [4,5]. For elicitation of this clinical sign, the patient remains seated with his or her head in the neutral position, opens the mouth as widely as possible, and protrudes the tongue to the maximum extent. The Mallampati classification, with its three classes, is based on the extent to which the base of tongue is able to mask the visibility of pharyngeal structures, including the soft palate, uvula, and faucial pillars. Samsoon and Young [6] modified the Mallampati classification to include a fourth class, representing an extreme form of Mallampati's class III, in which the soft palate is totally masked by the tongue. In this "class IV," only the hard palate is visible.

In clinical practice, situations may arise where it may not be feasible for the patient to sit up for airway assessment, e.g., when there are cervical spine injuries or a disk prolapse. There is a paucity of literature regarding the applicability of the Mallampati classification in patients who are bedridden for any cause. Previous studies done in this regard failed to reveal any significant differences in the Mallampati scores in the sitting and supine positions [7]. Our day to day clinical experience, however, points to differences in Mallampati grade assignments in the sitting and supine postures. The aim of this prospective, preliminary study was to determine whether there was any difference between the sitting and supine positions for the assessment of Mallampati grade.

After we had obtained institutional ethics committee approval and gained informed consent, 80 adult patients, American Society of Anesthesiologists (ASA) physical status I and II, aged 18–65 years, admitted to our neurosurgical ward were enrolled. The airway was assessed at the time of the preoperative visit according to the

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method described by Mallampati with the modification of Samsoon and Young [6].

A standard airway assessment protocol was followed for all patients. First, the observation was made with the patient in the sitting position. In the sitting position, the patient sat upright with the head in the neutral position, the mouth opened maximally, and the tongue protruded maximally. The observer was seated opposite the patient at eye level. Next, using a measuring scale, the interincisor distance was noted. The patient was then turned supine. In the supine position, the patient's head was placed on a 10-cm-high pillow, and the observer assessed the airway by looking vertically downwards. The interincisor gap was again noted. The same observer performed assessments in all patients in both sitting and supine postures, to avoid any interobserver variability of the Mallampati test. We defined Mallampati grades I and II as predictors of easy intubation, and grades III and IV as difficult airway. Any change from an easy grade to difficult grade was considered clinically significant.

Statistical analysis was done using STATA 9.0 software (TX, USA). The descriptive statistics of quantitative covariants—age, weight, height, and body-mass index (BMI) are reported as means (±SD), whereas categorical variables, such as sex, are reported in percentages. Mc Nemar's χ^2 test was used to analyze the differences between Mallampati grades in the sitting and supine positions. A paired *t*-test was applied to detect significant differences in observations of mouth opening between the two positions. Kappa statistics were obtained to find out the agreement between ratings of patients in the sitting and supine positions. A *P* value of less than 0.05 was considered significant.

Eighty patients were enrolled in our study and none were excluded from the final analysis. The mean age of the patients was 40 (18) years, mean weight was 59.21 (11.7) kg, height was 163 (14) cm, and BMI was 22.6 (4.9) $kg \cdot m^{-2}$. The male-to-female ratio was 5:3. Mallampati grades in the two positions are tabulated in Table 1. The mean mouth opening in the two positions for the four Mallampati grades was found to be 3.9 (0.4) cm in the sitting position (95% confidence interval, 3.8–4.0) and 3.8 (0.4) in the supine position (95% confidence interval, 3.7–3.9; $P < 0.0001$).

Our study revealed that posture produced a significant change in the Mallampati grades of the patients ($P < 0.0001$). This change was always towards a higher grade when the patient was turned supine from the sitting position. The mouth opening decreased from the sitting to the supine position, but the change was not clinically relevant (difference of 0.1 cm). In neurosurgical practice, we come across patients with such conditions as cord injury, disk prolapse, and cervical spine disease who cannot sit, and need to be assessed in the supine position. To date, there are no proposed modifications of the original Mallampati classification for airway assessment in the supine position. Tham et al. [7] described a small, nonsignificant change in the Mallampati scores of ASA I-II patients when assessed in the sitting and supine positions. They concluded that performing the Mallampati test with the patient supine was unlikely to make much difference to the class assigned, but that the supine position did not worsen the predictive power of the Mallampati test. In contrast, we observed a significant change in the Mallampati grade in our patients when they were assessed in the sitting and supine positions. However, as we did not assess the Cormack-Lehane grade, it is difficult to correlate the change in Mallampati grade with difficult intubation. Interobserver variability was ruled out, as a single observer performed all the assessments. Gradual experience with grading in the supine posture and its correlation with difficulty in intubation may aid a practitioner in the long run, especially in dealing with bedridden patients.

A limitation to this study was that the laryngoscopic view was not assessed. As our study was conducted in the ward, Cormack-Lehane assessment was not possible. Knowledge about the direct laryngoscopic view would have helped us judge whether the grade assignment in the supine position was reliable in terms of predicting difficult intubation.

Further studies are needed to correlate the modified Mallampati grade in the supine posture with that in the sitting position, and also to examine the modified Mal-

Table 1. Mallampati grades in sitting and supine positions

	Supine position			
Sitting position	I ($n = 17$)	II ($n = 35$)	III ($n = 16$)	IV ($n = 12$)
I ($n = 30$)	17	13	0	0
II ($n = 29$)	0	22	7	0
III ($n = 16$)	0	0	9	7
IV ($n = 5$)	0	0	0	5

$P < 0.0001$ sitting vs supine
n, number of patients

lampati grade in the supine posture in relation to the Cormack-Lehane grading.

References

1. Keenan RL, Boyan CP. Cardiac arrest due to anesthesia: a study of incidence and causes. JAMA. 1985;253:2373–7.
2. Caplan RA, Posner KL, Ward RJ, Cheney FW. Adverse respiratory events in anesthesia: a closed claims analysis. Anesthesiology. 1990;72:828–33.
3. Cheney FW, Posner KL, Caplan RA. Adverse respiratory events infrequently leading to malpractice suits: a closed claims analysis. Anesthesiology. 1991;75:932–9.
4. Mallampati SR. Clinical sign to predict difficult tracheal intubation (hypothesis). Can Anaesth Soc J. 1983;30:316–7.
5. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D. A clinical sign to predict difficult tracheal intubation: a prospective study. Can Anaesth Soc J. 1985;32:429–34.
6. Samsoon GL, Young JR. Difficult tracheal intubation: a retrospective study. Anaesthesia. 1987;42:487–90.
7. Tham EJ, Gildersleve CD, Sanders LD, Mapleson WW, Vaughan RS. Effects of posture, phonation and observer on Mallampati classification. Br J Anaesth. 1992;68:32–8.