Hyomental Distance in Neutral and Extension as a Clinically Reliable Predictor of Difficult Airway

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Abstract

Aims: This study was been done with a purpose to evaluating the benifit of the Hyomental Distance [Hmd] neutral and extended position for predicting accurately difficult visualization of the larynx (DVL) in normal looking patients. *Settings and Design:* 198 normal looking patients ASA status I and II , scheduled to undergo general anesthesia and intubation were assessed. Each patient underwent a preanaesthetic assessment. *Patients and Methods:* A scale was used on the surface of the skin nearest to the hyoid bone, and the leanth from the nearest point mentum to the hyoid bone was measured and it was explained as the Hyo-mental distance at neutral position. After IV induction and paralysis, vocal cords visualisation was done and assessed by using Cormach and Lehane (C&L) classification. *Statistical Analysis:* was done using students't' test and chi-square test. *Results:* The highest specificity of Hmd at the straight (neutral) position 98.89 % and Hmd at the head extension had a specificity of 95.56%. *Conclusion:* Hyo-mental Distance in straight and extended position are clinically reliable predictor of Dvl, because of their high specificity and negative predictive value .

Introduction

Difficult visualization of larynx [Dvl] is one of the major cause of difficult intubation in most patients [1]. Therefore, preanaesthetic evaluation of all the patients at risk of difficult laryngoscopy is very important in using a safer strategies for the induction and intubation in anaesthesia.

When recognized before induction, all the difficult airways can be mannaged by the use of special intubation techniques. If it is not recognized before intubation attempts, the results can be bad and dangerous as spontaneous respiratory would have been not there because of muscle relaxants.

The hyo-mental distance (Hmd) has been used to assess the mandibular space or area, but the Hmd singly was shown to have only a modest degree of diagnostic accuracy [2]. Turkan investigated the age and sex-related changes in the morphometric measurements of the airway in patients and cadavers. HMD was the only variable not affected by age [2]. Suyama found that Mallampati test was the best predictor of a difficult airway. However, HMD less than 3.0 cm was also a good predictor [3].

Takenaka et al. demonstrated that hyo-mental distance ratio was a good predictor of a reduced occipitoatlantoaxial complex extension capacity [4].

There are various reports which investigated diagnostic usefulness of Hmd. None of the study has quantified its diagnostic importance for predicting Dvl. Therefore, this study has been done with a purpose to assess the usefulness of the Hmd for accurately predicting Dvl in apparently normal patients.

Patients and Methods

Ethical Committee permission was obtained before the study. Informed written consent taken from the patients. A total of 198 patients aged above 18 years, ASA status I and II, requiring general

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anesthesia with intubation was included. Pregnant women, mouth opening <3cm, neck swellings, abnormality anatomicaly, surgery in head and neck area, maxillo-facial fracture or tumors, teeth which are loose were excluded from the study.

Each patient underwent a preanaesthetic assessment. Intraoperatively, patients were put on supine. They were told to look forward, keep the head in the straight position and to keep the mouth closed and not to make any movements. A plastic scale was pressed on the skin surface just above the hyoid bone, and the leangth from the of the mentum to the hyoid bone was measured and it was explained as the Hyo-mental distance in the straight position (Hmdn).

The patients were told to extend their head to the maximum, with precaution of not to lift the the shoulders while extending the head. The Hyo-mental distance was measured in this position, and this was defined as the Hyo-mental distance at head extension (Hmde).

Total cutoffs used for calculation of the sensitivity and specificity in our study were:

- Hmd at the maximum extension of ≤ 5.3 cm
- Hmd in the stright position > 5.5 cm

After preoxygenation, patients were induced using IV anaesthetic agent and paralysed using suxamethonium to help for good intubation. Direct laryngoscopy was done after good relaxation. Sniffing position on a ring or pillow and an relevant size Macintosh blade was used by a consultant anaesthesiology consultant. Vocal cord visualisation was assessed and by using modified Cormach and Lehane classification.

External laryngeal pressure was allowded once evaluation was done, to facalitate placement of tracheal tube. Cormack and Lehane grades 3 and 4 was explained as difficult visualization of larynx (Dvl) in this study. The positive predictive value, negative predictive value, sensitivity and specificity values of each tests was calculated.

Results

The statistical analysis was done using students 't' test and chi-square test . This was study done on a total of 198 patients with a patient ratio 102 male and 96 female. We have seen that there is slight more number of male patients .

The sensitivity of Hmd in the straight or neutral position for assessing Dvl was 0% and specificity was 98.89%. The test has a positive predictive value of 0% and negative predictive value of 90.82%. (Table 1).

The sensitivity of Hmd at the extreme or maximum of head extension for predicting difficult visualization of the larynx was 11.11% and specificity was 95.56%. The test has a positive predictive value of 20% and negative predictive value of 91.49%(Table 2).

In this study, sensitivity of all the predictors was less. Sensitivity of Hmd at the maximum of Head extension was 11.11 % and sensitivity of Hmd in the straight position for predicting difficult visualization of the larynx was 0%. In contrast, the specificity in our study was comparatively high. The highest specificity of Hmd at the neutral position 98.89% and Hmd at the extreme of head extension had a specificity of 95.56 .

Table 1: Diagnostic value of Hmd in the neutral or straight position for predicting difficult visualization of the larynx

HMD in the Neutral Position		Difficult visualization of the larynx		Total
		Yes	No	
HMD in the neutral position	Yes	0	2	2
>5.5cm	No	18	178	196
Grand Total		18	180	198

Table 2: Diagnostic value of Hmd at the extreme or maximum of head extension for predicting difficult visualization of the larynx

HMD at the extreme of head extension		Difficult visualization of the larynx		Total
		Yes	No	
HMD at the extreme of head	Yes	2	8	10
extension ≤5.3cm	No	16	172	188
Grand Total		18	180	198

Discussion

Dvl is most common cause for difficulty during intubation in many patients. Therefore, preanaesthetic recognition of the patients at risk for difficult laryngoscopy is very important in using safe methods for the induction and intubation in anaesthesia. When recognized before induction, all the difficult airways can be secured by the selected use of specialized tracheal intubation techniques. Many predictions are available, which one can be used for examination still a debateable subject.

Radiological studies have shown that the Hmd increased while extending the head at the atlantooccipital joint complex and stayed throughout the period of head extension in subaxial regions [4,5]. This shows that hyoid bone moves along with cervical spine while moving the head. As a result, the Hmd at extension is more correlating with the atlantooccipital joint complex capacity to extend inspite of extensive degree of subaxial extension [4]. In addition, the Hmd in neutral and extension is comfortable and fast to examine near bedside does not need any special equipment and it is found to be better than measurement of the atlantooccipital joint complex extension angle using a goggles-mounted goniometer [6].

During intubation, forms a almost line from the mouth to the vocal cord depending completly on the extension capacity of the atlantooccipital joint complex [6,7]. The angle needed to see the vocal cords for direct laryngoscopic visualisation was to be minimum of 12° [8].

In our study, we placed all the patients in the supine position while measuring for benefit of recording. Huh et al reported 12.2% incidence of DVL in 213 apparently normal patients undergoing general anaesthesia with tracheal intubation [9]. It will be correct to assess the airway in the position in which oral intubation is being performed [9]. Since the hyoid bone is moves, the probability of change in the location and structure due to the effect of gravitation should be taken into consideration. Sutthiprapaporn et al [10] showed that the hyoid bone moves 6.7 ± 4.4 mm with the change in the position from sleeping supine to upright position. There is major variation between persons in the hyoid bone movement, anatomical variation regarding the hyoid bone will be better predicted when measurement taken during supine , than in the any other position.

Our technique will be very benifical in the intensivecare units or in wards, where anaesthesiologists come across patients sleeping in the beds and will require intubation. All these patients would be connected monitors, cannulas, and drain. thus, many persons and good amount of time will be necessary to maintain the patients in that position for airway evaluation. Third, this technique will be beneficial for the patients not able to sit on the bed or be able to hold the head due to low conscious level.

There are many limits in our study pattern. First, inter person variability which depended on the participation of each patient and their understanding of our explanation. Second, although Dvl is a main thing in finding or examining difficult intubation, Dvl is not equal to difficult intubation as to do intubation there are lot of other technique used .

Conclusion

We showed that Hyo-mental Distance in neutral and extension are practically reliable predictor of Dvl, because of their high specificity and negative predictive value. Because of the sensitivity being low and positive predictive value also low with this study we suggest combination of other technique for evaluation including the Hyo-mental Distance in neutral and extension and other airway predictors. We also recommend performing the airway prediction tests in combination, other than using one of them alone.

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