Validity of Airway Assessment of the Thyromental Distance and Mallampati Test for Predicting Difficult Intubation

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Abstract

Unanticipated difficult tracheal intubation is a significant source of morbidity and mortality in anesthetized patients. A number of modules have been developed to predict difficult airways, but they are often complex in nature. Aim of this study to determine the accuracy of the modified Mallampati test for predicting difficult tracheal intubation before induction of anesthesia by using the Mallampati scores and other parameters such as BMI, difficult mask ventilation.

Fifty adult patients were prospectively analyzed of the American Society of Anesthesiologists (ASA) class I or II. All adult patients (> 18 years) presenting for any type of non-emergency surgical procedures under general anesthesia that required endotracheal intubation were enrolled. Mallampati test was performed prior to anesthesia. Following induction of anesthesia, the anesthesiologist was described the laryngoscopic view using the Cormack-Lehane scale. Classe 3 or 4 of the Mallampati test were considered as a predictor of difficult intubation. Grades 3 or 4 of the Cormack-Lehane classifications of the laryngoscopic view were defined as impaired glottic exposure.

A purposive (non-probability) samples of (50) patients enrolled in this study conducted in a Specialized Surgeries Hospital "Gazi AL-Harrery Hospital" in Baghdad city, 12 had difficult intubation (24%) and 38 had easy intubation (76%). The sensitivity of the Mallampati classifications in four grades shown a significant difference but the specificity was found to be the highest in the grades 2. The Mallampati test is of limited value in predicting difficult intubation when was used as a single examination, also observed other parameters which had effect on the difficulty of intubation like obesity, thyromental distance, mouth opening, presence of receding mandible, cervical mobility and other deformities.

Keywords: Mallampati test, Difficult intubation, Airway assessment.

صلاحية تقييم الممرات الهوائية عن طريق المسافة الهرمية واختبار مالامباتي لصعوبة الانببة الرغامية المتوقعة

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الخلاصة

تعتبر صعوبة الأنببة الرغامية الغير متوقعة مصدرا مهما لزيادة نسبة الاعتلال والوفيات لدى المرضى الذين يخضعون للتخدير. تم تطوير عدد من الأنماط التي تساعد على التنبؤ بوجود صعوبة الأنببة في الممرات الهواية، لكنها غالبا ما تكون معقدة في طبيعتها. الهدف من هذه الدراسة هو تحديد دقة اختبار مالامباتي المعدل الذي يفيد التنبؤ بالأنببة الرغامية الصعبة قبل إعطاء التخدير للمرضى عن طريق استخدام اختبار المالامباتي مع عدة معايير أخرى مثل مؤشر كتلة الجسم وصعوبة استخدام قناع التهوية.

تم اختيار خمسين مريضا بالغا للدراسة من الدرجتين الأولى والثاني حسب تصنيف الجمعية الأمريكية للتخدير (ASA). تم تسجيل جميع المرضى البالغين (> 18 عامًا) الذين يخضعون لأي نوع من العمليات الجراحية غير الطارئة تحت التخدير العام الذي يتطلب التنبيب الرغامي. تم إجراء اختبار مالامباتي قبل التخدير. بعد إعطاء التخدير للمرضى يبدأ طبيب التخدير بوصف عرض منظار الحذجرة باستخدام مقياس Cormack-Lehane. تعتبر الفئة 3 او 4 من اختبار المالامباتي مؤشرا على التنبيب المعب. تم تحديد الفئة 3 و 4 من مقياس Cormack-Lehane الخاص بالتنظير الحذجري على انها ضعف اظهار النجرة. الصعب. تم تحديد الفئة 3 و 4 من مقياس Cormack-Lehane الخاص بالتنظير الحذجري على انها ضعف اظهار النجرة. العينات المستهدفة (الغير مرجحة) من المرضى (الخمسين) تم تسجيلهم في هذه الدراسة وقد خضعوا للعمليات في مستشفى الجراحات التخصصية (مستشفى غازي الحريري) في مدينة بغداد، 12 مريض كان لديهم صعوبة التنبيب (24%) و 38 مريض كان التنبيب لديهم سهل (76%). أظهرت حساسية تصنيفات مالامباتي في أربعة فئات فرقًا كبيرًا، ولكن تبين أن الخصوصية هي الأعلى في الفئة 2. يعتبر اختبار مالامباتي ذا قيمة محدودة في التنبؤ بالتنبيب الصعب عند استخدامه كاختبار فردي، كما ان هناك معايير أخرى لوحظ انها قد تؤثر على صعوبة الأنبية مثل السمنة، مسافة الغذة الدرقية، فتحة الفم، وجود الخصوصية هي الأعلى في الفئة 2. يعتبر اختبار مالامباتي ذا قيمة محدودة في التنبؤ بالتنبيب الصعب عند استخدامه كاختبار فردي، كما ان هناك معايير أخرى لوحظ انها قد تؤثر على صعوبة الأنبية مثل السمنة، مسافة الغذة الدرقية، فتحة الفم، وجود تراجع في عظم الفك السفلي، حركة العنق وتشو هات أخرى.

Introduction

The term 'airway' in its day-to-day usage refers to the upper airway, which may be defined as the extra-pulmonary air passage, consisting of the nasal and oral cavities, pharynx, larynx, trachea and large bronchi. Difficult airway is one in which there is a problem in establishing or maintaining gas exchange via a mask, an artificial airway or both that recognized before anesthesia. The potential for a difficult airway (DA) in designated 'Difficult airway clinics' allows time for optimal preparation, proper selection of equipment, technique and participation of personnel experienced in DA management [1]. Respiratory events are the most common anaesthetic related injuries following dental damage and there are three main causes of respiratory related injuries which are inadequate ventilation, esophageal intubation and difficult tracheal intubation. Difficult tracheal intubation accounts for 17% of the respiratory related

injuries and resulted in significant morbidity and mortality. In fact, up to 28% of all anesthesia related deaths are secondary to the inability to mask ventilate or intubate Also, data published by the American Society of Anesthesiologists (ASA) showed that, difficult intubation, inadequate ventilation and esophageal intubation were the principal factors responsible for death or brain damage [3]. Prediction of difficult airways will provide an effective preoperative anaesthetic plan and safe intubation, which will decrease complications and mortality rates [4].

Mallampati classifications, thyromental distance, mouth opening, neck circumference are some preoperative tests that can be done to predict the difficult airways. There are several studies question the accuracy of these predictive tests; however, they are not adequate as the only predictor when used for predicting difficult airways [4].

The Mallampati test is one of the most frequently used clinical scoring system to predict difficult intubation and the ease of tracheal intubation is determined by many factors, with the laryngoscopic view being the most important one [5].



The Mallampati Scale

Mallampati test: The Mallampati classifications correlate tongue size to pharyngeal size and this test is performed with the patient in the sitting position, head in a neutral position, the mouth wide open and the tongue protruding to its maximum [2].

Patients and Method

This study was conducted in a Specialized Surgeries Hospital "Gazi AL-Harrery Hospital" in Baghdad city during 2017-2018. 50 patients (18- 60 years) who underwent general anesthesia for non-emergency surgery and required endotracheal intubation were enrolled in this study. Males were twenty-eight (28), and females were twenty-two (22).

The patient consents were taken to enter the study protocol. Information were collected by the anesthesiologists on a standard form, which includes age, sex, weight, height, BMI, Mallampati classification as modified by Samsoon and Young was performed with the patient in the sitting position with the head in extension, mouth fully opened, tongue out, and without phonation. Whenever possible, the thyromental distance, was measured with the patient in sitting position and head extension, mouth opening measured as the interincisor distance, presence of receding mandible, cervical mobility, macroglossia, beard, and lack of teeth. Patients were also, asked whether they had habitual snorers or not (almost every night or every night), without asking for the snoring loudness. Registered the difficult mask ventilation according to some information (leak in face mask, 2 hand mask ventilation technique, beard, receding mandibular, large cheeks, lack of teeth) and Cor-mack grade "views were obtained by direct laryngoscopy.

The excluded cases were the patients who underwent a regional anesthesia. Those patients who underwent general anesthesia without tracheal intubation (face mask ventilation, laryngeal mask) in addition to patients underwent emergency surgery, those indicated for rapid sequence induction and scheduled for fiber optic tracheal intubation. All patients with ASA class higher than II, incapability of the patient in opening the mouth, abnormalities of the face, mouth, pharynx and airway, pregnancy, urgency and a wake intubation, patient >60 years and less than 18 years were excluded from the study.

The Mallampati classes were assessed before prescribing any drugs. After induction of anesthesia, the laryngoscope view was evaluated by a person blinded to the patient's Mallampati or pharyngeal view.

Mallampati test (MMT): The oropharyngeal view is graded into four different classes:

- Class I soft palate, fauces, uvula, and pillars visible
- Class II soft palate, fauces, and uvula visible
- Class III soft palate and base of the uvula visible
- Class IV soft palate not visible at all. [19]

Cormack-Lehane system (Laryngoscopic Views): is graded into four different classes:

• Grade 1: Full view of the vocal cords.

- Grade 2: Only the posterior glottic structures/cartilages are visible.
- Grade 3: Only the epiglottis is visible.
- Grade 4: Neither the epiglottis nor the glottic structures are visible, only the soft palate.[20]

Difficult tracheal intubation (DTI) was defined as a proper insertion of the endotracheal tube with conventional laryngoscopy requiring more than two attempts or lasting more than 10 min, or requiring an alternate technique (bougie, videolaryngoscope ,Laryngeal Mask , fiberoptic)

Data that collected concerning tracheal intubation were use of paralyzing agent, characterization of tracheal intubation (easy, difficult, impossible), and grading of the best laryngoscopic view according to the Cor-mack grade.

The patients were classified while they were seated upright, with mouths maximally opened, tongues protruded, and without phonation. A modified Mallampati score class of 3 and 4 were considered as predictive of difficult laryngoscopy and designated as "difficult" while grades I and II were classified as easy intubation.

Results

A total of (50) patients (18-60 years) were enrolled in this study, patient information were summarized in table (1) which showed that 21-30 years were 5 cases, 31-40 years patient were 15 cases, 41-50 years were 30 cases and the mean were (39.2800), std. deviation were (0.67763) and variance were (0.459), and table (2) which showed the number of cases according to gender, that (28) of patients were males and (22) of patients were females.

The study found that (23) patients (46%) had over weight and (19) obese patients (38%), while (8) patients only (16%) had normal weight according to body mas index (table 3). The study also found that (28) patients (56%) had easy intubation and (22) patients (44%) had difficult intubation in Mallampati test, while (42) patients (84%) had easy intubation and (8) patients (16%) only had difficult intubation in cor-mack test (table 4).

This study also showed the mean (2.3400) and Std. deviation (.91718) for Mallampati test (p. values= 0.005) and the mean of cor-mack test is (1.7800) and Std. deviation (.70826) (p. values= 0.001) (table 5). In comparison between difficult and easy intubation according to Mallampati test and cor-mack test, Cormack grade 4 was not observed in any patient and receding mandible (table 6).

The study also showed (43) patients (86%) had easy mask ventilation and (7) patients (14%) only had difficult mask ventilation (table 7).

No.	Age	Frequency	Percentile (%)	Mean	Std. Deviation	Variance	
1.	21-30	5	10				
2.	31-40	15	30		.67763	.459	
3.	41-50	30	60	39.2800			
	Total	50	100				
X^2 obs. = v42.5000 df = 1 X^2 crit. = 3.841							
	P < 0.						
N	Mean = 39.2800 Std. Deviation = .94847				Variance = .900		

 Table 1: Mean age group +/- std. their frequency and percentage

 Table 2:
 distribution of gender

No.	Gender	F	Percentage(%)	Mean	Std. Deviation	Variance
1.	Male	28	56			
2.	Female	22	44	1.4400	.50143	.251
Total	-	50	100			

Table 3: The distribution of cases according to BMI.

No.	Body mass index	Frequency	%	Mean	Std. Deviation	Variance
1.	Normal weight (18.6-24.9)	8	16			
2.	Over weight (25-29.9)	23	46	2 2200	70926	.502
3.	Obese (30- 40)	19	38	2.2200	.70820	
Tota	1	50	100			

Table 4: Distribution of cases according to Mallampati teat and cor-mack grade

	Mallampati grades									
S. A.	Easy intubation i		Diff intub	Difficult intubation		Easy intubation		Difficult intubation		Total
	Grade 1	Grade 2	Grade 3	Grade 4		Grade 1	Grade 2	Grade 3	Grade 4	
Frequency	10	18	17	5	50	19	23	8	0	50
Percentage %	20	36	34	10	100	38	46	16	0	100

Table 5: shown the mean \pm Std. deviation for Mallampati test and cor-mack test.

	Mean	Std. Deviation	Variance	X ² obs.	df.	X ² Crit.	Sig	P values
Mallampati Grade	2.3400	.91718	.841	9.040 ^a	3	7.814	S.	0.005
Cormack Grade	1.7800	.70826	.502	7.240 ^b	2	5.99	S.	0.001
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 12.5.								
b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 16.7.								

		(Cor-mack gra	ade				
Mallampati	NL 50	Ea	asy	Difficult	Total (%)			
grades	110.=50	Grade 1	Grade 2	Grade 3				
		No. = 19	No. = 23	No. = 8	50 (100)			
Ι	Easy	11.4	6.2	2	19.6 (39.2)			
II	No.=38	5.2	10.4	3	8.21 (16.42)			
III	Difficult	3.4	5.3	2	8.72 (17.44)			
IV	No.=12	0	1.1	1	2.1 (4.2)			
	Lower jaw protrusion grade							
A	Easy	14	9	1	24 (48)			
В	Difficult	5	9	5	19 (38)			
C		0	5	2	7 (14)			

Table 6: Difficult and easy intubation according to Mallampati test, cor-mack test and receding mandible.

Table 7: Difficult mask ventilation and difficult tracheal intubation.

S A	Difficult mask ventilation		Total	Tracheal i	Total	
5. A.	Easy	Difficult	Total	Easy	Difficult	Total
Frequency	y 43 7		50	38	12	50
Percentage %	86	14	100%	76	24	100%

Discussion

Ability to evaluate and manage the airway and keep it open in critical situations has always been of great importance for the physicians of all eras [9, 10]. Expertise in airway management is necessary for anesthesiologists and inability to maintain a patent airway may be life threatening [11, 12].

"No intubate-no ventilate" is the most frightening complication of anesthesia practice [11,14]. The original and modified Mallampati test is routinely used to predict difficult intubation, but there is controversy regarding its validity [3]. The original Mallampati test uses three classes (Class1–faucial pillars, soft palate and uvula could be visualized, Class 2 –faucial pillars and soft palate could be visualized but the uvula was masked by the base of the tongue, Class 3 – only soft palate could be visualized) [3]. The modification of (Samsoon and Young, 1987) (MMT) describes four classes (class 4 only hard palate visualize) and we used the last one, this scoring system is usually referred to when talking about the Mallampati test [15].

Mallampati *et al.* suggested that using a simple scaling which is based on the ability to see the orogharyngeal statures, difficult intubation could be predicted [3].

This study showed (56%) patients were predicted easy intubation that disagree with (Khatiwada S., *et al.*, 2012) [6], who reported (67%) cases but was agree with (Bindra A. *et al.*, 2010) [7] and (Adamus *et al.*, 2011) [16], who reported a sensitivity for the modified Mallampati classification in predicting cases of a difficult airway. This study found that (44%) of patients were with easy intubation that disagreed with (Khatiwada S. *et al*, 2012) [6], who reported (10%) cases but was similar with (Kim *et al.*, 1997) [17].

The study also showed that (14%) of patients had difficult mask ventilation which disagreed with (Khan ZH *et al.*, 2003) [8], who recorded (37.2%) patients had difficult mask ventilation. This study reflects a direct relationship between difficult intubation and Mallampati scores that, the patient with higher Mallampati scores was the greater for the likelihood of difficult intubation (Ambesh S. P. *et al.*, 2013) [18]. Comparison between easy and difficult intubation according to Mallampati test were found by (Bindra A. *et al.*, 2010) [7].

Conclusion

The thyromental distance, anatomical abnormality, and cervical mobility (M-TAC) scoring system has provided a higher sensitivity and specificity in predicting difficult endotracheal intubation in comparison with Mallampati classification.

Recommendation

Further study on that comparation between Mallampati grade with tongue protruding and non is needed and It should going research that comparative between Mallampati grade with sitting position and supine position.

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