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Research Article

Quantitative Compliance Based Classification of Submental Sign or Javid Sign

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Abstract

Prediction of difficult intubation is still a dilemma. Despite various predictors of difficult airway reported and discussed in the literature, no definite test exists to prevent mortality and morbidity related to difficult airway. Using a combination of different predictors of difficult intubation is logical to help minimizing this difficulty and establishing a safe anesthesia.

Detection and presentation of any novel predictor can be helpful in achieving this goal.

"Submental Sign" or "Javid Sign" a new predictor of difficult intubation, was reported by MJ Javid in 2011, but **qualitative characteristic** of this predictor was the most considerable drawback for using Submental Sign as an accurate predictor.

The goal of this study is quantitative classification of Submental Sign or Javid classification to overcome false positive and false negative results of Submental Sign.

In this article a novel scale is introduced for evaluating submental compressibility quantitatively.

Keywords: Difficult intubation; Difficult airway; Predicting difficult airway; Submental sign; Javid Sign; Airway compliance

Abbreviations: C-L: Cormack-Lehane; SMS: Submental Sign; SCS: Submental Compressibility Scale; CM: Centimeter; mm: Milimeter

Introduction

Predicting difficult intubation is still an unsolved dilemma. Capability of the anesthetist to predict difficult airway, reduces the risk of morbidity and mortality considerably [1]. Among various predictors of difficult airway, none of them has been reliable enough to prevent mortality and morbidity related to difficult intubation [2]. Using a combination of different predictors of difficult intubation is logical to help minimizing this difficulty and establishing a safe anesthesia [3].

Detection and presentation of any novel predictor can be helpful in achieving this goal.

Simplicity of a diagnostic criterion as a predictor of difficult airway is of great importance to make it popular for clinical use.

The goal of this report is to present a simple scale for quantification of submental sign and introduce this sign as an easy practical bedside predictor of difficult airway.

Materials & Methods

Submental Compliance Scale (SCS) or Javid scale, is a novel device consists of a horizontal piece calibrated in centimeter and a sliding vertical piece. The compliance or compressibility of submental area is measured with SCS quantitatively.

Technique of Examination

Examination of the submental area performs in a supine position and neutral position of the head. While the horizontal piece is pushing forward into the submental space, at the point that horizontal piece stops against a resistance, the vertical piece is sliding forward to touch the mandible. The cross point of the vertical and horizontal pieces shows the submental compressibility (compliance) in Cm or mm.

Evaluation of 5000 patients, ASA physical status I and II patients (2363 men [47.3%] and 2637 women [52.7%]) with a mean age of 40.54 ± 14 years, without past history of muscu-

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loskeletal or neurological disorders and head and neck tumors or radiation history, scheduled for elective surgeries and 10 referral patients (with no past history as mentioned above) with the history of failed intubation, showed that different ranges of submental compliance are indicative of different grades of laryngoscopic view.

Statistical Analysis

We used SPSS version 18.

Correlation between continuous variables was assessed by Pearson or Spearman's rho Correlation when appropriate.

The comparison of continuous variable in two categorical variables was done by t test.

Significant level was set at $p<0.05$.

Results and Discussion

Prediction of difficult intubation is still challenging. Various predictors of difficult airway reported and discussed in the literature have not been reliable enough to prevent mortality and morbidity related to difficult airway. Using a combination of different predictors of difficult intubation is logical to help minimizing this difficulty and establishing a safe anesthesia [3].

Detection and presentation of any novel predictor can be helpful in achieving a safe anesthesia and preventing mortality and morbidity.

Assessment of the compliance of submandibular area, as a qualitative predictor of difficult airway has been mentioned by Greenland in 2008 [4].

Table 1: No significant difference between male and female (p=0.6).

Sex		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	2363	47.3	47.3	47.3
	Female	2637	52.7	52.7	100.0
	Total	5000	100.0	100.0	

Table 2: No significant correlation between SMC and age and weight.

		Age	Weight	SMC (cm)
N	Valid	5000	5000	4993
	Missing	0	0	7
Mean		40.54	69.70	2.1309
Median		40.00	70.00	2.2000
Std. Deviation		14.550	12.784	.57456
Minimum		16	48	.00
Maximum		69	130	3.20
Percentiles	25	28.00	59.00	1.8000
	50	40.00	70.00	2.2000
	75	53.00	81.00	2.6000

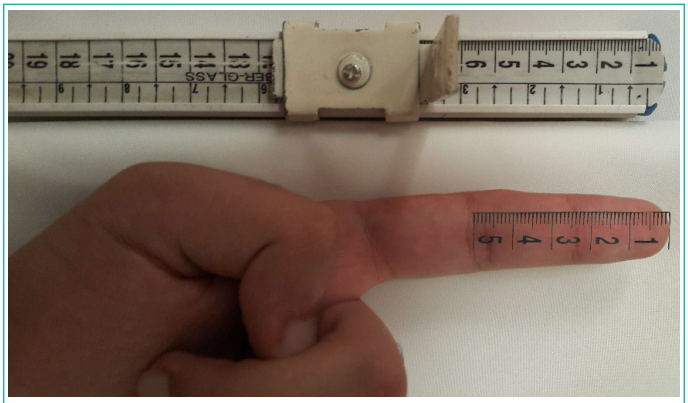

Figure 1: Submental Scale.

Table 3: Grading of intubation.

Grade of Intubation			Frequency	Percent	Valid Percent	Cumulative Percent
		I	3398	67.9	67.9	67.9
E		IIa	768	15.4	15.4	83.3
R		IIb	576	11.5	11.5	94.8
D		IIIa	156	3.1	3.1	98
		IIIb	89	1.8	1.8	99.7
NI		IV	13	0.3	0.3	100.0
		Total	5000	100.0	100.0	

E: Easy Intubation; R: Restricted Intubation; D: Difficult intubation; NI: Non-Intubating; Significant negative correlation between SMC and grade of intubation. ($r= -0.792$, $p<0.001$).

Table 4: Feasibility of intubation based on the novel Javid classification of submental sign.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	E	4173	83.5	83.5	83.5
	R	711	14.2	14.2	97.7
	D	103	2.1	2.1	99.7
	NI	13	0.3	0.3	100.0
	Total	5000	100.0	100.0	

Feasibility of intubation based on the novel Javid classification of submental sign. E: Easy Intubation; R: Restricted Intubation; D: Difficult intubation; NI: Non-Intubating.

Soft tissue abnormality of upper airway may be responsible for some unexpected, life-threatening difficult intubation and ventilation [5].

Based on focusing on relation between airway soft tissue compliance and difficulty in tracheal intubation, "Submental sign or Javid sign" as an easy and practical sign to predict difficult airway, with advantages of to be easy to remember, suitable to perform on obtunded and noncooperative patients and suitable to use in emergency ward, was reported in 2011 [5].

A simple look at submental area and touching submental space has an outstanding advantage of saving a life or prevention of morbidity.

Submental Sign (SMS) is defined as palpation of a noncompliant (non-compressible) bulk in submental area [5].

Submental space is actually the space between mentum and hyoid bone.

In normal patients, submental space consists of a thin layer of adipose tissue with a deep curve, which is easily compressible in palpation and the hyoid bone and laryngeal cartilages are sharply palpable, but when the submental sign is positive, submental space consists of a noncompliant, bulky tissue and the hyoid bone and laryngeal cartilages are not easily palpable [5]."

Submental Sign or Javid Sign was reported in 2011, as a qualitative sign [5]. Qualitative characteristic of this predictor was the most considerable drawback for using Submental Sign.

Primary classification of the Submental sign, reported in 2011, is as below: [5}

1. Type A or moderate positive submental sign defined as a bulky noncompliant submental space with direct laryngoscopic view of Cormack Lehane grade III.

2. Type B or severe positive submental sign defined as a bulky bulged noncompliant submental space with a direct laryngoscopic view of CormackLehane grade IV.

In above classification false positive and false negative results made the predictor less reliable.

Quantitative estimation of submental compliance and determining the normal and pathological range of submental compliance seemed necessary to reduce the false positive and false negative results.

In order to achieving this goal a novel simple scale was designed and used to estimate submental compliance quantitatively (in centimeter or millimeter) (Figure 1).

Submental Compliance Scale (SCS) or Javid scale, is a novel device consists of a horizontal piece calibrated in centimeter and a sliding vertical piece. While the horizontal piece is pushing forward into the submental space and the sliding piece touches the mandible, the cross point of the vertical and horizontal pieces shows the submental compressibility (compliance) in centimeter (Figure 2 & 3).

Figure 2 shows using SCS in a referral patient with the history of a failed intubation (Figure 2 & 3).

Submental scale is a simple device to assemble and practical to use.

The advantage of the scale is that in the absence of the device your finger or your pen is the best substitute to estimate submental compressibility. Your finger is always in access. Indeed, your finger plays the role of horizontal piece and any other tool such as a pen or abaisse-langue and so on acts as the vertical piece.

Evaluation of 5000 patients, ASA physical status I and II, including 2363 men [47.3%] and 2637 women [52.7%]) with a mean age of 40.54 ± 14 years, without past history of musculoskeletal or neurological disorders and head and neck tumors or radiation history, scheduled for elective surgeries and 10 referral patients (with no past history as mentioned above) with the history of failed intubation, showed that different ranges of submental compliance are indicative of different grades of laryngoscopic view [6] [E, R, D & NI] as it is describing:

• 3 Cm - 1.7 Cm (±0.2); (normal range of submental compliance); indicative of a straightforward tracheal intubation with or without airway manipulation, laryngoscopic view of grade I & IIa [6] **(Easy intubation).**

• 1.6 Cm - 1 cm (±0.2); indicative of grade 2b & 3a **(Restricted intubation).**

• 1 Cm - 0.7 cm (±0.2); indicative of grade 3a & 3b **(Restricted or Difficult intubation).**

• Submental compliance <0.7 cm indicates laryngoscopic view of grade 4 and genuinely difficult intubation **(Non-Intubating)**.

Hyomental distance and hyomental distance ratio, have been discussed in literature [7].

As mentioned in previous study in 2011, [5] there is a close relation between submental sign and hyomental distance [7]. Hyomental area is the anatomical region involved in this regard. Indeed, Submental Sign (SMS) is indicative of a significant anterior displacement of larynx. Anterior displacement of larynx protrudes the laryngeal elements into the hyomental space or submental area.

The scale is a simple scale and you can even use your pen or your finger as an alternative scale to estimate submental compliance (finger scale) (Figure 1).

While pushing your finger into the submental (hyomental) soft tissue, there is a resistance against your finger in patients with positive Submental Sign.

Submental Sign (SMS) is a warning message of an imminent difficult intubation.

Changing in the normal angle of submental curve from nearly right- angled to obtuse angle proposes an anterior displacement of larynx and consequently a bulky and/or bulged submental space and a positive Submental Sign and difficulty in airway management. Anterior displacement of larynx logically reduces vertical distance of laryngeal elements. Reduced vertical distance of laryngeal elements such as thyroid cartilage (Adam's apple) [8] while is accompanied by non-compressibility, proposes imminent difficult intubation [8].

Results

5000 ASA physical status I and II patients, 2363 men [47.3%] and 2637 women [52.7%]) with a mean age of 40.54 ± 14 years, -without past history of musculoskeletal or neurological disorders and head and neck tumors or radiation history, scheduled for elective surgeries were evaluated for Submental Compliance (SMC) (in cm) and C-L grade of laryngoscopy.

Descriptive and quantitative data of the patients and the airway assessment results are shown in Tables.

We found no significant correlation between SMC and age and weight (Table 1).

No significant difference between the rate of SMC in male and female (p=0.6).

But there was significant negative correlation between SMC and grade of intubation. (r= 0.792, p<0.001) (Table 3).

Figure 2 & 3: Measurement of submental compliance using Submental Scale in a referral patient with the history of a failed intubation. (Horizontal piece and vertical sliding piece).

The Feasibility of intubation based on the novel Javid classification of submental sign has been shown in (Table 4).

Conclusion

Routine examination of submental area as a preventive and lifesaving attempt in all patients who are candidate to tracheal intubation or general anesthesia, would be rational as suggested in 2011.

Quantitative classification of Javid Sign or submental sign makes this sign highly reliable and methodically repeatable. Routine examination of Javid sign is highly recommended as an easy to use and clinical predictor of difficult airway.

Compressibility of other upper airway elements such as Adam's apple (thyroid cartilage) should be in mind as a reliable predictor of difficult intubation as well.

Then a noncompressible prominent thyroid cartilage is accompanied by difficult intubation.

Just looking and touching the submental space, provides a safer anesthesia for patient and anesthesiologist.

Limitations

The most important limitation of the study was the low incidence of difficult intubation especially "grade 3 and 4" which are the target points of the study and long time needed to evaluate the new predictor of difficult airway. Then we enrolled the referral cases of failed difficult intubation in the study. These limitations will be the subject of related future studies as well.

Author Statements

Consent Section

The study was started following obtaining written informed consent. A separate written informed consent was obtained for publishing the photographs.

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