ORIGINAL RESEARCH

Comparison of Palm Print Test, Prayer Sign and Upper Lip Bite Test in Predicting Difficult Laryngoscopy and Intubation in Diabetic Patients

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ABSTRACT

Background: Diabetic patients are prone to the limited joint mobility syndrome (LJM) leading to difficult intubation. This is because of the non-enzymatic glycosylation of collagen and deposition in joints. The atlanto-occipital joint involvement restricts adequate extension to head and neck during laryngoscopy making intubation difficult. The collagen glycosylation starts at the fourth and fifth inter-phalangeal joints. The degree of inter-phalangeal involvement can be assessed by scoring the ink impression with palm of the dominant hand (palm print [PP] sign). Diabetic patients with Limited joint mobility (LJM) syndrome have difficulty in approximating their palms and not able to bend their fingers backwards (the prayer sign). Upper lip bite test was done to assess the range of the mandibular movement and the architecture of the teeth concurrently.

Aim and Objective: To compare Palm print test, Prayer sign and Upper lip bite test in predicting difficult laryngoscopy and intubation in diabetic patients.

Methods: A total of 60 Diabetic patients of age >30 years, who were candidates for tracheal intubation in elective surgery were enrolled in this prospective observational study. Pre-operative tests were carried out with Palm print test, Prayer sign and Upper lip bite test. After induction, direct laryngoscopy was done and laryngeal view was recorded according to the Cormack - Lehane grading system.

Conclusion: This study concludes that Palm print test can be used as a predictive tool for difficult laryngoscopy and intubation in diabetic patients. The higher sensitivity of Palm print test makes it a better tool than Prayer sign and Upper lip bite test for screening. As no single test predicts precisely, Palm print test can be used in conjunction with test like Prayer sign to increase the validity. Palm print test may be investigated as a part of multivariate index to predict difficult laryngoscopy and intubation in diabetic patients.

Keywords: Palm print test, Prayer sign, Upper lip bite test, difficult laryngoscopy, difficult intubation

INTRODUCTION

The management of airway is the primary role of the anaesthesiologist. It includes maintaining airway patency, and ensuring adequate ventilation and oxygenation. Airway management is encountered by the anaesthesiologist during conduct of anaesthesia or resuscitation of the critically ill patients.

Traditionally, the airway can be maintained by mask ventilation and tracheal intubation with endotracheal tubes. In modern day the supraglottic airway devices like laryngeal mask airway (LMA) plays a crucial role in airway management.

Endotracheal intubation remains the gold standard in maintaining definitive airway. The endotracheal intubation is conventionally facilitated by direct laryngoscopy. The alternate methods include tracheal intubation using fiberoptic bronchoscope, video laryngoscope, intubating LMA and various other adjuncts. However the cost and availability of these airway adjuncts force the anaesthesiologist to use conventional laryngoscopes routinely.

Difficult Airway (DA) is defined as "the clinical situation in which a conventionally trained anaesthesiologist experiences difficulty in ventilation of upper airway via mask , difficulty in tracheal intubation or both".

Difficult Laryngoscopy (DL) is defined as a situation where "It is not possible to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy". Difficult laryngoscopy implies "Difficult visualization of larynx" (DVL). Failed intubation occurs in 75% of difficult laryngoscopy (DL) cases and only in 3 % of Easy Laryngoscopy (EL) cases.

Failed or Difficult intubation may lead to a "Cannot intubate - Cannot ventilate" (CICV) situation. CICV is a life threatening situation. Failure to ensure adequate oxygenation either by mask ventilation or intubation may lead to oxygen desaturation.

ASA closed claims study in 1990 revealed that the "adverse respiratory events" is the major contributor (34%) among the total claims related to anaesthesia. Death occurred in 85% of these cases. The major causes were lack of adequate ventilation (38%), intubation into oesophagus (18%) and difficult tracheal intubation (17%). Prior recognition of difficult airway may help to minimize the above adverse effects.

The purpose of preoperative airway assessment is to diagnose the potential for difficult airway which facilitates 'preparedness' such as:

1.   Proper selection of airway equipments and techniques,
2.   Procuring additional airway adjuncts and
3.   Participation of experienced anaesthesiologist in the management when needed.

The detailed history and physical examination will figure out the risk factors that may predict a 'Difficult airway'. Various scores and tests have been used to assess the 'Difficult airway' but none can prove to be precise.

Diabetic patients are prone for the limited joint mobility syndrome leading to difficult intubation. This is due to the non-enzymatic glycosylation of collagen and its deposition in the joints. The atlanto-occipital joint involvement limits adequate extension of head and neck during laryngoscopy making intubation difficult. The collagen glycosylation starts in the fourth and fifth inter-phalangeal joints.

The degree of inter-phalangeal involvement can be assessed by scoring the ink impression made by the palm of the dominant hand (palm print [PP] sign). Diabetic patients with limited joint mobility syndrome have difficulty in approximating their palms and cannot bend their fingers backwards (the prayer sign). Upper lip bite test was done to assess the range of freedom of the mandibular movement and the architecture of the teeth concurrently.

Aim of the Study
To compare and test the validity of palm print test, prayer sign and upper lip bite test in predicting difficult laryngoscopy and intubation in diabetic patients.

MATERIALS AND METHODS
Study Design: Prospective observational study
Participants: Diabetic patients of age more than 30 years who is undergoing elective surgery under GA
Sample Size: 60
The aim, objectives, materials and methods were submitted to the Institutional ethics committee and approval was obtained. 60 patients were selected in accordance with inclusion and exclusion criteria for the study.
Inclusion Criteria
1. Diabetic patients of age more than 30 years who is undergoing GA
2. Duration of diabetes more than 10 years
Exclusion Criteria
1. Patients with airway deformity due to anatomical variation of their face,neck,palate or hands.
2. Patients with coexisting diseases such as Rheumatoid arthritis, oral malignancies and large neck masses.
3. Patient refusal.
Pre Anaesthetic Assessment
As per the departmental protocol the patients posted for elective surgery were investigated for pre-operative biochemical tests (renal function tests and liver function tests), haematological tests (haemoglobin, total count, differential count, platelet count), Chest x-ray (PA view) & 12 lead Electrocardiograph and assessed in the pre-anaesthetic assessment clinic.
All patients were subjected to the preoperative examination by the same anaesthesiologist to avoid inter observer variability.
The tests to be performed on patients preoperatively are given below,
In Palm print test, the palm and fingers of the dominant hand of the patient is firmly pressed against a blue ink pad. The patients hand is then pressed firmly against a white sheet of paper on a hard surface. Grading is done as follows,

- Grade 0 (all phalangeal areas visible)
- Grade 1(deficiency in the inter-phalangeal area of the fifth digit or both fifth and fourth)
- Grade 2 (deficiency in the inter-phalangeal areas of fifth to second digit)
- Grade 3 (only the tips of digits seen).

In Upper lip bite test, Patient is asked to bite their upper lip with lower incisor and categorized into 3 classes as follows,

- Class I: Lower incisor can bite the upper lip above vermion line.
- Class II: Lower incisor can bite the upper lip below vermion line.

- Class III: Lower incisor unable to bite the upper lip.

In Prayer sign, Patient is asked to put his or her hands together in a praying position with the fingers fanned and to press together the palmar surfaces of the interphalangeal joints and the palms. The results are

- Positive – When there is a gap between the palms.
- Negative – When there is no gap between the palms.

Preparation

After airway assessment patients shifted into operating room and minimum mandatory monitors such as pulse oximetry (SpO2), non invasive blood pressure (NIBP), and electrocardiogram (ECG) were attached.

Baseline pulse rate, blood pressure and oxygen saturation were recorded.

An intravenous (IV) line was secured and standard preparations and precautions were taken for general anesthesia with endotracheal tube intubation and controlled mechanical ventilation for all the patients.

Premedication and Induction

All patients received premedication with Glycopyrrolate (0.2 mg), midazolam (1 mg) and fentanyl (2 mcg/kg) intravenously. After pre-oxygenation (100% O2 for 3 minutes) patients induced with Thiopentone (5 mg/kg) and paralysed with succinylcholine (1.5 mg/kg) intravenously.

After ventilation for 1 minute with 100 % O2, with a 10cm pillow under the head and the head in the sniffing position, direct laryngoscopy was done by an experienced anesthesiologist. Direct laryngoscopy was performed with a Mackintosh blade and Cormack-Lehane grade was assessed.

The laryngeal view will be graded based on the criteria of Cormack–Lehane, as follows,
- Grade1 – Visualization of entire glottis aperture.
- Grade2 – Visualization of only arytenoids cartilage or posterior portion of glottis aperture.
- Grade3 – Visualization of epiglottis only
- Grade4 – Visualization of tongue or tongue and soft palate only.

Grades 3 and 4 laryngoscopic views are considered as difficult laryngoscopy as no part of the glottis is visible. After laryngeal view is graded, patient is intubated with the appropriate sized endotracheal tube and placement confirmed clinically and by capnometry. Stylet, gum elastic bougie, laryngeal mask airway (LMA) and i-gel airway are kept ready for emergency.

RESULT

Table1: BMI distribution

Age category	Number (N)	Percentage (%)
<24.9	25	41.7
25-29.9	16	26.7

>30	19	31.7
Total	60	100

60 patients were distributed according to their BMI. 25 patients comes under BMI <24.9 (normal range). 16 patients comes under BMI within 25 to 29.9 (overweight).19 patients comes under BMI >30 (obese).

Table 2: Cross tabulation between Palm print test vs Cormack lehane classification.

		CORMACK- LEHANE				Total	P value
		Grade 1	**Grade 2**	**Grade 3**	**Grade 4**		
Palm Print Test	Grade 0	15	2	9	0	26	
		57.7%	7.7%	34.6%	0.0%	100.0%	
	Grade 1	2	14	2	0	18	
		11.1%	77.8%	11.1%	0.0%	100.0%	
	Grade 2	1	0	11	0	12	<0.0001
		8.3%	0.0%	91.7%	0.0%	100.0%	
	Grade 3	0	0	3	1	4	
		0.0%	0.0%	75.0%	25.0%	100.0%	
Total		18	16	25	1	60	
		30.0%	26.7%	41.7%	1.7%	100.0%	

The cross tabulation and bar chart shows the frequency distribution and interaction between two variables i.e Palm print test and Cormack-lehane. Their interaction is statistically significant as the p-value is <0.0001.

Table 3: Cross tabulation between Prayer sign vs Cormack-lehane classification

		CORMACK- LEHANE				Total	P value
		Grade 1	**Grade 2**	**Grade 3**	**Grade 4**		
Prayer Sign	**Negative**	14	16	6	0	36	
		38.9%	44.4%	16.7%	0.0%	100.0%	
	Positive	4	0	19	1	24	<0.0001
		16.7%	0.0%	79.2%	4.2%	100.0%	
Total		18	16	25	1	60	
		30.0%	26.7%	41.7%	1.7%	100.0%	

The cross tabulation and bar chart shows the frequency distribution and interaction between two variables i.e Prayer sign and Cormack lehane. Their interaction is statistically significant as the p-value is <0.0001.

Table 4: UPPER LIP BITE TEST VS CORMACK-LEHANE

		CORMACK-LEHANE				Total	P value
		Grade 1	**Grade 2**	**Grade 3**	**Grade 4**		
UPPER LIP	**Class 1**	7	8	19	1	35	0.046

BITE		20.0%	22.9%	54.3%	2.9%	100.0%	
	Class 2	5	6	6	0	17	
		29.4%	35.3%	35.3%	0.0%	100.0%	
	Class 3	6	2	0	0	8	
		75.0%	25.0%	0.0%	0.0%	100.0%	
Total		18	16	25	1	60	
		30.0%	26.7%	41.7%	1.7%	100.0%	

Table: Cross tabulation between Upper lip bite test vs Cormack -lehane

The cross tabulation and bar chart shows the frequency distribution and interaction between two variables i.e Upper lip bite test and Cormack lehane. Their interaction is statistically significant as the p-value is 0.046.

Table 5: Binary classification of Palm print test vs Cormack-Lehane classification

		C&L		Total
		Difficult	**Easy**	
PPT	**Difficult**	15	1	16
	Easy	11	33	44
Total		26	34	60

Sensitivity	Specificity	PPV	NPV	Accuracy
76.92%	**88.24%**	**83.33%**	**83.33%**	**83.33%**

Table 6: Binary classification of Prayer sign vs Cormack-Lehane classification

		C&L		Total
		Difficult	**Easy**	
PS	**Difficult**	20	4	24
	Easy	6	30	36
Total		26	34	60

Sensitivity	Specificity	PPV	NPV	Accuracy
57.69%	**97.06%**	**93.75%**	**75.00%**	**80.00%**

Binary results of variables Prayer sign and Cormack lehane shows specificity of 97.06% (true negative) ,sensitivity of 57.69% (true positive) ,positive predictive value 93.75% , negative predictive value 75% and accuracy 80%.

Table 7: UPPER LIP BITE TEST VS CORMACK-LEHANE

		C&L		Total
		Difficult	**Easy**	
ULB	**Difficult**	0	8	8
	Easy	26	26	52
Total		26	34	60

Sensitivity	Specificity	PPV	NPV	Accuracy

0.00%	76.47%	0.00%	50.00%	43.33%

Binary results of variables Upper lip bite test and Cormack lehane shows specificity of 76.47% (true negative) ,sensitivity of 0% (true positive) ,positive predictive value 0% , negative predictive value 50% and accuracy 43.33%.

COMPARISON OF RESULTS OF PALM PRINT TEST VS PRAYER SIGN VS UPPER LIP BITE TEST IN RELATION WITH CORMACK-LEHANE

Table 8: Comparison of results of Binary classification of Palm print test vs Prayer sign vs Upper lip bite test in relation with Cormack Lehane

	PS	PPT	ULB
Sensitivity	57.69%	76.92%	0.00%
Specificity	97.06%	88.24%	76.47%
PPV	93.75%	83.33%	0.00%
NPV	75.00%	83.33%	50.00%
Accuracy	80.00%	83.33%	43.33%

DISCUSSION

The terms 'Difficult airway', 'Difficult intubation', 'Difficult laryngoscopy', and 'Difficult visualization of larynx' are often used interchangeably.

CL grading is the commonest way of estimating 'Difficult Laryngoscopy.' This study has used CL grading to evaluate the laryngoscopy.

Among the various endocrine disorders, diabetes mellitus is the commonest an anaesthetist encounters. Studies by Reissell et al[14] and Nadal et al[7] have reported 31% and 27% incidence of difficult laryngoscopy respectively in diabetic patients. In our study the incidence was 43%.The reasons for the variable incidence of DL or DI are differences in anthropometry among populations, differences in anesthesia protocols, differences in choice of muscle relaxants for intubation, variability in use of ELM (external laryngeal pressure), and choice of laryngoscope blade.

Diabetic patients are prone for the limited joint mobility syndrome leading to difficult intubation. This is due to the non-enzymatic glycosylation of collagen and its deposition in the joints. The atlanto-occipital joint involvement limits adequate extension of head and neck during laryngoscopy making intubation difficult.

Sensitivity

The sensitivity of Palm print test, prayer sign and ULBT in our study is 76.92% ,57.69% and 0% respectively and this result is similar compared to other studies. In study done by vani.v et al sensitivity of palmprint is high (75%) compared to other indices. In study done by Hahim.k et al palm print test has high sensitivity (76.9%) followed by prayer sign (61.5%). In study done by Sajan Philip et al palm print test has high sensitivity (76.7%) followed by prayer sign (54.5%).

Specificity

The specificity of Palm print test, prayer sign and ULBT in our study is 88.24%,97.06% and 76.47% respectively. When compared to other studies, In study done by vani.v et al specificity of palmprint is high (69%) compared to other indices. In study done by Hahim.k et al palm print test has high specificity (89.4%) followed by prayer sign (46.8%). In study done by Sajan Philip et al palm print test has high specificity (89.3%) followed by prayer sign (52.5%).

In our study Prayer sign has high specificity followed by palm print test and Upper lip bite test, whereas in others Palm print test has high specificity compared to prayer sign.

Positive predictive value(PPV)

The PPV of Palm print test, prayer sign and ULBT in our study is 83.33%, 93.75% and 0% respectively. When compared to other studies, In study done by vani.v et al PPV of palmprint is high (31.6%) compared to other indices. In study done by Hahim.k et al palm print test has high PPV (71.4%) followed by prayer sign (24.2%). In study done by Sajan Philip et al palm print test has high PPV (48.2%) followed by prayer sign (22.1%) . In our study Prayer sign has high PPV followed by palm print test and Upper lip bite test, whereas in others Palm print test has high PPV compared to prayer sign.

The variation in terms of specificity and PPV in this study compared to other studies may be attributed to factors relating to patient population studied, protocols followed in the institution, techniques used for direct laryngoscopy, and experience of anesthesiologist

Negative predictive value(NPV)

The NPV of Palm print test, prayer sign and ULBT in our study is 83.33% ,75% and 50% respectively and this result is similar compared to other studies.In study done by Hahim.k et al palm print test has high NPV (91.3%) followed by prayer sign (81.5%). In study done by Sachin ramesh et al palm print test has high NPV (83.33%) followed by prayer sign (75%) . Palm print test has high NPV followed by prayer sign and upper lip bite test.

Accuracy

Accuracy is a statistical measure of how well a binary classification obtained its results. It also refers to the closeness of a measured value to a standard or known value. The Accuracy of Palm print test, prayer sign and ULBT in our study is 83.33% ,80% and 43.33% respectively.

PALM PRINT TEST VS PRAYER SIGN VS UPPER LIP BITE TEST (ULBT)

Palm print test (PPT) has got high sensitivity and high negative predictive value compared to prayer sign and ULBT, and PPT has low specificity and low positive predictive value than prayer sign. ULBT has less sensitivity, specificity, PPV and NPV compared to Palm print and prayer sign.

A good predictor (test/index) should have maximum sensitivity with reasonable specificity.

Palm print test with a higher sensitivity and reasonable specificity can be considered as a better predictor compared to prayer sign and ULBT.

CONCLUSION

This study concludes that Palm print test can be used as a predictive tool for difficult laryngoscopy and intubation in diabetic patients. The higher sensitivity of Palm print test makes it a better tool than Prayer sign and Upper lip bite test for screening. As no single test predicts precisely, Palm print test can be used in conjunction with test like Prayer sign to increase the validity. Palm print test may be investigated as a part of multivariate index to predict Difficult laryngoscopy and intubation in diabetic patients. However the findings of this study have to be confirmed in large multicentric trials in various population, before putting it to regular use.

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