

## ORIGINAL ARTICLE

**Positive Predictive Value of Upper Lip Bite Test in Predicting Difficult Intubation**KIRAN QAMAR<sup>1</sup>, SHEIKH ZIARAT ALI<sup>2</sup>, SABA NAVEED<sup>3</sup>, MEHTAB TIPU CHAUDARY<sup>4</sup>, FARIHA ASLAM<sup>5</sup>, NAZIA RUBAB MAQBOOL<sup>6</sup><sup>1</sup>Anesthesiology, Assistant Professor Department of Anesthesia, Jinnah Hospital, Lahore<sup>2</sup>Anaesthesia Assistant Professor Anaesthesia Fatima Jinnah Medical University, Lahore<sup>3</sup>Anesthesiology, Senior Registrar Anesthesia Department Sir Ganga Ram Hospital, Lahore<sup>4</sup>4th Year/MO Anaesthesia Department Sir Ganga Ram Hospital, Lahore<sup>5</sup>Final Year/WMO Anaesthesia Department Sir Ganga Ram Hospital, Lahore<sup>6</sup>Anesthesia Department Sir Ganga Ram Hospital, LahoreCorrespondence to: Kiran Qamar, Email: [dr\\_kirn@hotmail.com](mailto:dr_kirn@hotmail.com)**ABSTRACT****Objective:** To determine the positive predictive value of upper lip bite test in predicting difficult intubation by taking Cormack and Lehane classification as gold standard.**Design of the Study:** Cross sectional study.**Study Settings:** This cross-sectional study was conducted at Department of Anesthesiology, Sir Ganga Ram Hospital, Lahore from 04/06/2021 to 03/12/2021.**Materials and Methods:** This study involved 313 patients of both genders, aged between 18-70 years undergoing general anesthesia on elective lists having positive upper lip bite test (Grade-III). On the basis of Cormack and Lehane Classification, the diagnosis was verified. Results of the ULBT were compared to the Cormack and Lehane grade-III and grade-IV diagnoses. Every patient's written informed permission was obtained.**Results:** In The mean age of the patients was 43.78±12.32 years. Majority (n=150, 47.9%) of the patients were aged between 36-52 years. There were 198 (63.3%) male and 115 (36.7%) female patients in the study group. Among the procedures, herniorrhaphy (32.9%) and cholecystectomy (26.8%) were the more frequent procedures followed by thyroidectomy (17.6%), tonsillectomy (13.1%) and mastectomy (9.6%). Majority (42.8%) of the patients belonged to ASA Class-I followed by ASA Class-II (29.7%) and ASA Class-III (27.5%). Difficult intubation was confirmed in 232 (74.1%) patients on Cormack and Lehane Classification (as per operational definition). Thus there were 232 true positive patients with 81 false positive patients. With the gold standard Cormack and Lehane Classification, the upper lip bite test yielded a positive predictive value of 74.1 percent in the prediction of difficult intubation.**Conclusion:** According to the gold standard of Cormack and Lehane Classification, an upper lip bite test (Grade-III) has a 74.1 percent positive predictive value for difficult intubation in patients undergoing general anaesthesia with endotracheal intubation on the elective list.**Keywords:** Difficult Intubation, Cormack and Lehane Classification, Upper Lip Bite Test**INTRODUCTION**

Endotracheal intubation under general anaesthesia that is delayed or fails might have catastrophic consequences if it is difficult. A difficult endotracheal intubation is one that requires 3 or more unsuccessful attempts with a standard laryngoscope, according to the American Society of Anesthesiologists (ASA).<sup>1</sup> It has been suggested that a number of preoperative airway assessment tests (inter-incisor gap or mouth opening, Wilson risk score, movement of head and neck, sternomental distance, horizontal length of mandible) can expect challenging intubations, but the positive predictive values (PPVs) of these individual tests are very low.<sup>2</sup>

According to a new study, the upper lip bite test can help predict problematic intubations. If the patient is requested to bite down on their top lip, they are rated on how well they can do so. Biting above the vermilion line is permitted in Grade I. Upper lip can be bit below the vermilion line by lower incisors in grade II. Lower incisors are unable to bite the upper lip in Grade III. Intubation was projected to be simple in grades I and II, but challenging in grades III.

Khan et al. in 2003 first described Upper Lip Bite Test (ULBT) as a pre-operative predictor of difficult intubation with a positive predictive value (PPV) of 28.9% while taking Cormack and Lehane classification as gold standard.<sup>3</sup> However, they themselves reported conflicting results about its positive predictive value later in 2009 (33.3%)<sup>4</sup>, 2011 (100%)<sup>5</sup> and 2013 (37.5%)<sup>6</sup>. A possible explanation for this conflict is different gold standards used in different studies to confirm difficult intubation.

Following Khan et al. (2003), a number of studies determined the positive predictive value of ULBT. The results of these studies can be grouped as very low PPV; 8.2% (2010)<sup>7</sup>, 19.05% (2014)<sup>8</sup>, 33.6% (2005)<sup>9</sup>, 39% (2007)<sup>10</sup>, good; 58.82% (2013)<sup>2</sup>, 66.6% (2006)<sup>11</sup>, 66.7% (2013)<sup>12</sup>, 75% (2014)<sup>13</sup> and very high; 83% (2007)<sup>14</sup>; 100% (2005)<sup>15</sup>.

If the results of this study show good positive predictive value of ULBT in predicting difficult intubation, the study's results will provide a rapid and effective way of pre-operative airway assessment. Also the results of this study will provide baseline local data for future research in this regard.

**MATERIAL AND METHODS**

After taking permission from Institutional Review Board of the hospital this randomized controlled trial was conducted at department of Department of Anesthesia, Sir Ganga Ram Hospital, Lahore from 04/06/2021 to 03/12/2021. Patients were given written permission to participate in the study. Using a 95 percent confidence level, a 5% margin of error, and the estimated percentage of positive predictive value of ULBT to be 71.6 percent in Pakistani population, a sample size of 313 cases was computed.<sup>17</sup>

Male and female patients aged 18-70 years with a positive upper lip bite test undergoing elective surgery under general anaesthesia and endotracheal intubation e.g. cholecystectomy, hernia repair were included in this study. Patients with ASA grade IV, unable to obey verbal commands (on clinical examination), mouthopening less than 2.5 fingers (on clinical examination), cervical spine or maxillofacial fractures (evaluated radiologically), with upper airway pathology such as upper airway tumours (evaluated on history, clinical examination and laryngoscopy), obesity (BMI>30kg/m<sup>2</sup>) were excluded from the study. 313 Patients meeting the inclusion criteria undergoing elective surgical procedure in the General Operation Theatre of Sir Ganga Ram Hospital, Lahore were enrolled into this study. All the patients were asked for upper lip bite test and intubation difficulty was established on ULBT. Later the patients underwent direct laryngoscopy and difficult intubation was confirmed as per operational definition using Cormack and Lehane classification and Cormack and Lehane grade was noted. The results of ULBT were

accessed accordingly and were labeled True Positive or False Positive as per operational definition. SPSS version 18 was used to enter and analyse all of the data. The mean and standard deviation (SD) are used to present numerical data. The frequency and percentage of categorical variables have been reported. The formula  $TP/TP+FP$  has been used to compute the positive predictive value. Data has been sorted by age, gender, ASA classification, and kind of operation. After stratification, a chi-square test was run, with a p-value cutoff of 0.05 considered statistically significant.

## RESULTS

Patients ranged in age from 18 to 70, with a mean age of 43.7812.32 years, according to the study. N=150, or 47.9% of the patients, were in the age range of 36-52. The study included 198 men (63.3 percent) and 115 women (36.7 percent) patients. Among the procedures, herniorrhaphy (32.9%) and cholecystectomy (26.8%) were the more frequent procedures followed by thyroidectomy (17.6%), tonsillectomy (13.1%) and mastectomy (9.6%). Majority (42.8%) of the patients belonged to ASA Class-I followed by ASA Class-II (29.7%) and ASA Class-III (27.5%). These findings have been summarized in Table 1.

Difficult intubation was confirmed in 232 (74.1%) patients on Cormack and Lehane Classification Upper lip bite test positive predictive value was not significantly different when stratified by age ( $p=0.886$ ), gender ( $p=0.949$ ), American Society of Anesthesiologists Class ( $p=0.996$ ), or surgical procedure ( $p=0.753$ ) as shown in table 3.

Table 1: Baseline Characteristics of Study Population

Parameters	Characteristics	Participants
Age (years)	Mean $\pm$ SD	43.78 $\pm$ 12.32
	Range	(18 – 70)
	18-35 years	83 (26.5%)
	36-52 years	150 (47.9%)
Gender	53-70 years	80 (25.6%)
	Male	198 (63.3%)
ASA Class	Female	115 (36.7%)
	Class-I	134 (42.8%)
	Class-II	93 (29.7%)
Surgical Procedure	Class-III	86 (27.5%)
	Thyroidectomy	55 (17.6%)
	Tonsillectomy	41 (13.1%)
	Cholecystectomy	84 (26.8%)
	Mastectomy	30 (9.6%)
	Herniorrhaphy	103 (32.9%)

Table 2: Frequency of Difficult Intubation on Cormack and Lehane Classification

N=313	Difficult Intubation	
	Yes	No
Cormack and Lehane Classification ( Grade-III and Grade-IV)	232 (74.1%)	81 (25.9%)
Calculation of PPV	True Positive = 232 False Positive = 81  PPV = $\frac{232}{232 + 81} = 74.1\%$	

Table 3: Stratification of Positive Predictive Value across Age Groups, gender, ASA Class, Type of surgery

Variables	Diagnosis on Cormack and Lehane Classification		Total	Positive Predictive Value	P value
	True Positive(n=232)	False Positive(n=81)			
<b>Age Group</b>					
18-35 years(n=83)	61 73.5%	22 26.5%	83 100.0%	73.5%	0.886
36-52 years(n=150)	113 75.3%	37 24.7%	150 100.0%	75.3%	
53-70 years(n=80)	58 72.5%	22 27.5%	80 100.0%	72.5%	
<b>Gender</b>					
Male (n=198)	147 74.2%	51 25.8%	198 100.0%	74.2%	0.949
Female(n=115)	85 73.9%	30 26.1%	115 100.0%	73.9%	
<b>ASA-Class</b>					
Class-I (n=134)	99 73.9%	35 26.1%	134 100.0%	73.9%	0.996
Class-II(n=93)	69 74.2%	24 25.8%	93 100.0%	74.2%	
Class-III(n=86)	64 74.4%	22 25.6%	86 100.0%	74.4%	
<b>Type of Surgery</b>					
Thyroidectomy(n=55)	44 80.0%	11 20.0%	55 100.0%	80.0%	0.753
Tonsillectomy(n=41)	31 75.6%	10 24.4%	41 100.0%	75.6%	
Cholecystectomy(n=84)	63 75.0%	21 25.0%	84 100.0%	75.0%	
Mastectomy(n=30)	21 70.0%	9 30.0%	30 100.0%	70.0%	
Herniorrhaphy(n=103)	73 70.9%	30 29.1%	103 100.0%	70.9%	

Chi-square test, observed difference was statistically insignificant

## DISCUSSION

Upper Lip Bite Test (ULBT) has been shown to be a reliable preoperative predictor of difficult intubation. However, the available evidence contained conflicting results (Table 4)<sup>2-15,17</sup> while local published material on this topic was limited where Ali et al. in 2012 reported the positive predictive value of ULBT to be 71.6% in Pakistani Population.<sup>17</sup>

A total of 313 patients, ranging in age from 18 to 70, were included in this study general anesthesia on elective lists having positive upper lip bite test (Grade-III). Diagnosis was confirmed on Cormack and Lehane Classification. According to Cormack and Lehane's (Grade-III and IV) diagnosis, ULBT results were analysed accordingly.

Table 4: Review of Existing Literature

Author	Year	Population	PPV
Khan et al. <sup>5</sup>	2011	Indian	100%
Zahed et al. <sup>15</sup>	2005	Iranian	100%
Hester et al. <sup>14</sup>	2007	American	83.0%
Inal et al. <sup>13</sup>	2014	Portuguese	75.0%
Ali et al. <sup>17</sup>	2004	Pakistani	71.6%
Mohan et al. <sup>12</sup>	2013	Indian	66.7%
Bhat et al. <sup>11</sup>	2006	Indian	66.6%
Shah et al. <sup>2</sup>	2013	Indian	58.82%
Salimi et al. <sup>10</sup>	2007	Iranian	39.0%
Khan et al. <sup>6</sup>	2013	Indian	37.5%
Eberhart et al. <sup>9</sup>	2005	Indian	33.6%
Khan et al. <sup>4</sup>	2009	Indian	33.3%
Khan et al. <sup>3</sup>	2003	Indian	28.9%
Khoirom et al. <sup>8</sup>	2014	Indian	19.05%
Myneni et al. <sup>7</sup>	2010	American	8.2%
Present Study	2017	Pakistani	74.1%

Using the Cormack and Lehane Classification as the gold standard, we found that the upper lip bite test had a positive predictive value of 74.1 percent in the prediction of difficult intubation. Our results are in line with those of Ali et al.<sup>17</sup> (2004) who observed similar positive predictive value of 71.6% for upper lip bite test in patients undergoing surgery at Aga Khan University Hospital, Karachi. Inal et al.<sup>13</sup> (2014) also observed similar positive predictive value of 75.0% for upper lip bite test in Portuguese. Mohan et al.<sup>12</sup> (2013) reported comparable results in Indian population where they observed it to be 66.7%. Khan et al.<sup>5</sup> (2011) reported much higher positive predictive value of 100% in Indian population while Myneni et al.<sup>7</sup> (2010) reported much lower positive predictive value of 8.2% in American patients. A possible explanation for this conflict among various studies can be different gold standards used to evaluate the results of ULBT and the craniofacial differences among various populations<sup>16</sup>.

Using the gold standard of the Cormack and Lehane Classification, researchers discovered that the upper lip bite test had a positive predictive value of 74.1% for predicting difficult intubation in patients having general anaesthesia with endotracheal intubation on the elective list. This observed positive predictive value of ULBT is comparable to those of Mallampati score (59.3%) and short thyromental distance (81.6%)<sup>1</sup>. Thus it is as good as other pre-operative predictors of difficult intubation yet it is a rapid and easy to perform test compared to the others. The results of the present study are in line with the previous report from Ali et al.<sup>17</sup> and this advocates the routine use of upper lip bite test to identify patients who are at higher risk of difficult intubation so that anticipated management can decrease the occurrence of failed intubation and the associated grave consequences.

## CONCLUSION

According to the gold standard of Cormack and Lehane Classification, an upper lip bite test (Grade-III) has a 74.1 percent positive predictive value for difficult intubation in patients undergoing general anaesthesia with endotracheal intubation on the elective list.

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