

# Difficult Intubation (DI) in Patients of Cardiac Surgery of Punjab Institute of Cardiology, Lahore

Difficult Intubation (DI) in Patients of Cardiac Surgery

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## ABSTRACT

**Objective:** The objective of this study was to determine the frequency of difficult intubation among patients of cardiac surgery in the Punjab Institute of cardiology.

**Study Design:** Observational Study

**Place and Duration of Study:** This study was conducted at the Department of Anesthesia, Punjab Institute of Cardiology from October 2020 to February, 2021.

**Materials and Methods:** All the patients of age 20 to 80 years of either gender undergoing elective or emergency cardiac surgery meeting the American Society of Anesthesiologists' (ASA) grades I-IV undergoing general anesthesia with endotracheal intubation were included in the study. Patients were not told anything about this classification and no medication was given beforehand to any of them. While in the Operation Theater, patients ECG was monitored along with all other vitals. Any patient in which Cormack Lehane grade III and IV if seen on laryngoscopic view or if bougie was used in patients with Cormack grade II, was defined as a case of DI.

**Results:** Data of the physical examination was collected and late analyzed to calculate the BMI of these patients. Among all the 110 patients enrolled, the mean value of BMI was  $31.2 + 5.9$ . 50 of 110 patients had a BMI of more than 30, falling into obesity. While categorizing the patients into ASA grading, 71 patients were of grade III or IV and rest 39 patients were of ASA grade I or II. The frequency of difficulty intubation DI among these patients of our study was 23.6% (26 patients among the total 110 patients). Among these patients who had DI, female gender was dominantly affected but the difference of DI among male and female gender was not statistically significant, ( $p = 0.77$ ).

**Conclusion:** Around one fourth of the patients undergoing cardiac surgery can have difficult intubation, depending upon the age, gender, BMI, ASA grading and some other factors. Pre-operative assessment of the patients by the anesthetist should be done thoroughly taking in account the risk factors and Cormack Lehane grade of the patient. If pre-op assessment is not done properly, patients can have DI and end up into cricothyrotomy and lead to significant increase in morbidity and mortality. Studies should be done in all fields of surgery to see the incidence of DI, correlating it with various risk factors.

**Key Words:** Difficult Intubation, Cormack Lehane, Cardiac Surgery, Anesthesia, Preop Assessment

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## INTRODUCTION

The airway management is the cornerstone in the practice of anesthesiology. It is important for the success of surgeon as well as anesthesiologist. One step in the process of general anesthesia is intubation. And difficult intubation (DI) leads to significant morbidity and sometimes can even end up in mortality.

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Published recommendations say the airway assessment should be done beforehand on routine basis and it should a regular practice of all the anesthesiologists so as to identify suspected cases of difficult intubation.<sup>1,2</sup> Studies have shown various factors can predict DI. DI can be in the form of difficulty with the facemask ventilation, or tracheal intubation, requiring emergency surgical access through the trachea to maintain ventilation to prevent mortality. Pre-operative assessment for suspected DI can prevent potential complications before surgery and proper preparation can be done. Most important airway complications that can occur due to DI include failed airway management, oesophageal intubation and pulmonary aspiration.<sup>3,4</sup> Which category of surgeries have the more chances of DI is still a difficult question. Most of the studies have shown DI in obstetric or ENT surgeries. Few studies are available accessing the frequency of patients of cardiac surgery with DI.<sup>5</sup>

A study on DI reported that among all the, incidence of DI in all the surgery patients included in the study was 122/627 (19.46%); this included cardiac as well as non-cardiac surgeries. Incidence of DI in cardiac surgery cases was 24%. Risk factors of DI pointed out in this study were advances age, male gender, higher Mallampati grade, and anticipated DI (P = 0.1). Main finding was the higher incidence of DI cardiac surgery cases versus non-cardiac surgery cases.<sup>6</sup> Another study reported that DI was more among the patients of cardiac surgery patients as compared to non-cardiac surgery (10% vs. 5.2%; P < 0.023).<sup>7</sup>

Cases of DI are seen routinely in the operation theaters by doctors practicing anesthesia. Limited local data is available regarding the frequency of DI cases among cardiac surgeries. The aim of the study was to determine the frequency of difficult intubation among patients of cardiac surgery in the Punjab Institute of cardiology. This study will give an insight of this issue while proving the hypothesis that the cardiac surgical patients have more chances of having DI. Knowing the exact burden of DI will prove the importance of pre-op evaluation for suspected DI cases.

## MATERIALS AND METHODS

In this observational study conducted in the Punjab Institute of cardiology, one of the major tertiary care hospital specified for cardiology, from October 2020 to February, 2021, after the approval from the hospital ethical Review Board. Written informed consent was also taken from all the participants after explaining the rationale of the study and its data collection procedure. During the study period of 6 months, 110 patients were included in the study. Sample size of 110 was calculated using the WHO sample size calculator, taking the expected percentage of patient of DI among all the patients undergoing cardiac surgery of 24%, with confidence level of 95% and an absolute precision of 8%.

All the patients of age 20 to 80 years of either gender undergoing elective or emergency cardiac surgery meeting the American Society of Anesthesiologists' (ASA) grades I-IV undergoing general anesthesia with endotracheal intubation were included in the study. While all the patients with planned regional anaesthesia and general anaesthesia with supraglottic airway devices (SADs) were excluded.

On the day of the visit for evaluation from the anaesthesiologist before the surgery few variables were documented. These included age, gender, body mass index (BMI), abnormal dental status (malaligned or loose teeth or presence of dentures), any facial abnormalities like short neck or presence of beard.

Modified Mallampati class will be assessed.

Class I: Soft palate, fauces, uvula, anterior and posterior tonsil pillars visible

Class II: Uvula is obscured by the base of tongue;

Class III: Soft palate and base of uvula are visible

Class IV: Only hard palate visible

After the evaluation, consultant anaesthesiologist was classified the patients with suspected DI to anticipate the problem beforehand. A patient with a combination of modified Mallampati class III or IV, with facial anomalies or abnormal dental status was considered as a predicted DI.

Patients were not told anything about this classification and no medication was given beforehand to any of them. While in the Operation Theater, patients ECG was monitored along with all other vitals.

All patients were pre-oxygenated for around 3 mins with 100% oxygen later on fentanyl 2 µg/kg IV and propofol 2 mg/kg IV was administered. The process of intubation was done under support of either suxamethonium 2 mg/kg IV or vecuronium 0.1 mg/kg IV, as per the choice of the on duty consultant anaesthesiologist for laryngoscopy.

Laryngoscope of various sizes of blades was made available at the time of intubation and patients' head was placed in sniffing position.

Any patient in which Cormack Lehane grade III and IV if seen on laryngoscopic view or if bougie was used in patients with Cormack grade II, was defined as a case of DI.<sup>9</sup>

The success of intubation was confirmed through the assessment of movements of the chest, and auscultation of the chest. If signs showed the failure of the tracheal intubation, a supra-glottic airway device (SAD) was inserted in order to maintain the oxygen level in the body, if still oxygen level was not maintained facemask ventilation was tried; still not successful last step was to do emergency cricothyroidotomy.

Continuous variables were expressed using mean values along with the standard deviations; while the quantitative or categorical variables were expressed in terms of frequencies and percentages. Frequency of patients with DI was our primary outcome variable. And secondary outcome was the effect modifiers of primary outcome variable i.e. incidence of DI in cardiac surgery patients. Data of the primary outcome variable was stratified for all the effect modifiers and post stratification chi square was applied to the effect of these on the outcome. P – Value of 0.05 was taken as significant.

## RESULTS

In this observational study, 110 patients were included after they met the inclusion as well as the exclusion criteria. Mean age of the patents was  $47.95 \pm 11.8$  years. As the age limit was set between 20 to 80 years, we divided the patients into two age groups, 35 (31.8%) were of age 20 to 50 years old people and 75 (68.2%) were of the age between 51 to 80 years. Male and female ration was around 2:1, 67 were male and 43 were female patients.

Data of the physical examination was collected and later analyzed to calculate the BMI of these patients. Among all the 110 patients enrolled, the mean value of BMI was  $31.2 \pm 5.9$ . 50 of 110 patients had a BMI of more than 30, falling into obesity. While categorizing the patients into ASA grading, 71 patients were of grade III or IV and rest 39 patients were of ASA grade I or II.

The frequency of difficult intubation (DI) among these patients of our study was 23.6% (26 patients among the total 110 patients). Among these patients who had DI, female gender was dominantly affected but the difference of DI among male and female gender was not statistically significant, ( $p = 0.77$ ). Similarly, patients of advanced ASA grade (3 or 4) had DI, but the difference of advanced ASA grade was not statistically significant,  $p$ -value = 0.57.

Table no 2 shows the details of the patients who had DI and their effect modifiers / variables like age, gender, ASA grade and BMI.

Analysis of data collected from our patients clearly showed that the age and BMI were significant risk factors in the development of DI.

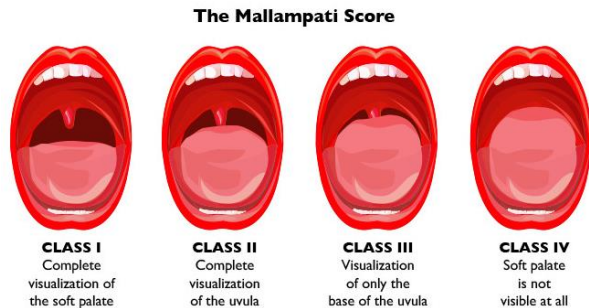
**Table No. 1: showing the details of age, gender, ASA grade and BMI**

Variables		No. (%)
Age (years)	Mean SD	47.95 ± 11.8
	20-50	35(31.82%)
	51-80	75(68.18%)
Gender	Male	67(60.91%)
	Female	43(39.09%)
BMI - Body mass index	Mean SD: 31.25±5.87	
	<30	60 (54.5%)
	>30	50 (45.5%)
ASA grade	I - II	51(46.36%)
	III - IV	59(53.64%)

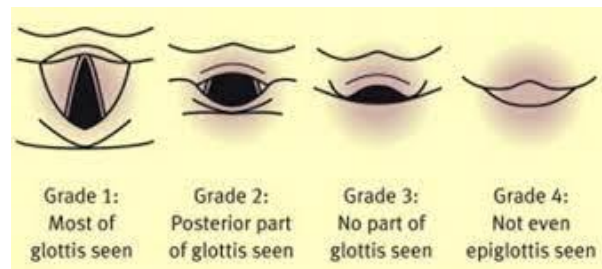
**Table No. 2: Association of age, gender, ASA grade and obesity with the incidence of DI in cardiac surgery patients**

Difficult intubation	Age(in years)		Gender		ASA		BMI	
	20-50	51-80	Male	Female	I - II	III - IV	Upto 30	>30
Yes	6	20	10	16	8	18	9	17
No	44	40	35	49	31	53	51	33
P value	0.008		0.77		0.57		0.01	

P- value ≤ 0.05 is considered as significant



**Figure No.1: The Mallampati Score**



**Figure No.2: Glottis detail**

Among the total 26 patients who had DI, 20 (76.9%) were of advanced age group (age more than 50 years old); and 17 of 26 patients (65.3%) were obese. Not all the patients with obesity developed DI, 17 of 50 (34%) obese patients had DI during their cardiac surgery.

Among the total patients who didn't develop DI, 60% were not obese and 41% were male.

## DISCUSSION

The evaluation of a patient admitted for surgery done by the anesthetist before surgery is important to declare the fitness of the patient, to get the desired anesthesia. The Airway assessment is the most important aspect of anesthetist practice to anticipate difficult intubation (DI). DI is more common in some fields of surgery like cardiac surgery, ENT and obstetrics. Even in the pediatric cardiac surgery patients, incidence of DI is twice than that in other pediatric surgeries.<sup>8</sup>

Difficult tracheal intubation can end up into serious complications both for adult as well as pediatric anesthesiologist. Pediatric cardiac surgery patients have more chances of development of DI due to underlying CHD, disturbed pulmonary blood circulation, making them to de-saturate. Even the process of preoxygenation is difficult among the patients of cardiac surgery.<sup>9,10</sup>

In our study, we included all the cardiac surgeries meeting the inclusion and the exclusion criteria. Every patient was evaluated pre-operatively to categorize into suspected DI case. After the evaluation, consultant anesthesiologist was classified the patients with suspected DI to anticipate the problem beforehand. A patient with a combination of modified Mallampati

class III or IV, with facial anomalies or abnormal dental status, as assessed by an unbiased consultant anesthesiologist was considered as a suspected DI. We included 110 patients, among these cases 23.6% (n = 26 of 110) patients had DI.

Borde DP, et al studied patients of surgery while dividing them into two groups: Cardiac surgery group and non-cardiac surgery group. The incidence of DI among all the surgeries was 19.5%. DI among the patients of cardiac surgery was encountered in 24%, similar to that reported in our study, while in non-cardiac surgeries it was seen in 14.4% patients (P = 0.002). Detailed data analysis showed that patients of advanced age, male gender, with a higher Mallampati grade, and categorization into suspected DI on pre-op assessment were the factors. Advances age, obesity, advanced ASA and obesity was also reported in our study as risk factors. The incidence of unanticipated DI was 48.1% and 53.4% in cardiac and non-cardiac surgery patients, respectively.<sup>11</sup> In an Indian study of around two hundred patients, difficult intubation DI was seen in 13% cases<sup>12</sup>, this was 23.6% in our study, double than that reported.

In a larger study designed after review of literature showing well known risk factors of DI to be male gender, obesity, old age, similar to that reported in my study. This study analyzed around twenty thousand surgeries done under general anesthesia. Poor laryngoscopy was observed more among the patients of cardiac surgery when compared with general surgery patients (7% v 4.2%).<sup>13</sup>

In another study, comparison was done to develop a better approach of anticipation of DI cases along with some other airway parameters. These parameters included inter incisor gap, prognathism, obesity and modified mallampati grading. After the pre-op assessment, patients were also evaluated intra-operatively and were classified according to the Cormack and Lehane views. Frequencies of patients of all types of surgeries with difficult intubation were 3.3%. Major factor behind DI was head and neck movements and h arched palate had the highest specificity (99.38%). Head and neck movements strongly correlated for patients with difficult intubation.<sup>14</sup> Our study focused on only DI cases in cardiac surgery

Workeneh SA, et al defined three different terms; difficult laryngoscopy, difficult intubation, and failed intubation, they reported the frequency of patients of these three terms to be: 12.3%, 9%, and 0.005%, respectively. While analyzing different variables which can predict a case of DI, mouth opening less than 30 mm and a Mallampati classes III or IV were found most sensitive and specific (P value < 0.001).<sup>15</sup>

Studies have shown that any patient with advanced age, overweight or obese, with history of snoring, uncontrolled diabetes, positive upper lip bite test,

Mallampati grade (MPS) class III or IV, and having larger inter-incisor gap are more prone to have DI.<sup>16</sup> Few of these risk factors were also accessed by us in our study, but most of these were not seen, this is a limitation of our study.

Patients with thyroid disease leading enlargement of the gland are also more prone to develop DI. Incidence of DI was reported to be around 5% versus 2.5% when comparing cases of DI between patients of thyroid disease with non-thyroid. Unlike other studies this study reported younger age of thyroid disease with higher ASA category and smaller body habitus to be more significantly associated with DI.<sup>17</sup>

A meta-analysis on the predictors of DI analyzed many studies on Mallampati test, its modifications, Wilson risk score, thyromental distance, sternomental distance, mouth opening test, and upper lip bite test. Most of the studies showed patient selection. Modified Mallampati classification was reported to be most sensitive in the prediction of a case of DI as compared to most of the other tests.<sup>18</sup> Heinrich S, et al reported after analyzing a large data, DI was seen in 4.9 %. Most of the cases were of oromaxillofacial surgery (9%), ENT 7 %, and cardiac surgery (7.0 %).<sup>19</sup>

DI varies with the fields of surgery along with other effect modifiers. More awareness and a structured plan of patient evaluation made by the institutional administration making airway assessment a compulsory step before the declaration of fitness for general anesthesia can prevent significant morbidity and mortalities.

## CONCLUSION

Around one fourth of the patients undergoing cardiac surgery can have difficult intubation, depending upon the age, gender, BMI, ASA grading and some other factors. Pre-operative assessment of the patients by the anesthetist should be done thoroughly taking in account the risk factors and Cormack Lehane grade of the patient. If pre-op assessment is not done properly, patients can have DI and end up into cricothyrotomy and lead to significant increase in morbidity and mortality. Studies should be done in all fields of surgery to see the incidence of DI, correlating it with various risk factors.

### Author's Contribution:

Concept & Design of Study:	Syed Imran-ul-Hassan
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Revisiting Critically:	Syed Imran-ul-Hassan, Shehryar
Final Approval of version:	Syed Imran-ul-Hassan

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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