

INCIDENCE AND PREDICTORS OF DIFFICULT LARYNGOSCOPY IN PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFTING

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ABSTRACT

BACKGROUND

Patients presenting for coronary artery bypass graft surgery can have higher incidence of difficult airway. Awareness about the incidence and predictors of difficult airway in CABG patients will help the anaesthesia provider in being adequately prepared for management of a difficult airway situation thereby reducing the laryngoscopy related adverse events on myocardial oxygenation.

MATERIALS AND METHODS

100 consecutive patients scheduled for CABG under general anaesthesia were enrolled. Age, gender, weight, modified Mallampati class, neck extension, thyromental distance, diabetes mellitus and extent of coronary artery involvement determined by CAG were the study variables. Patients were classified as either having difficult laryngoscopy, or not, as the outcome variable. Associations between these were measured using appropriate statistical tests.

RESULTS

Analysis showed significant association between Mallampati class, number of coronary vessels involved, and diabetes mellitus. Mallampati class 3 or 4, triple vessel disease as evidenced by preoperative coronary angiogram and presence of diabetes mellitus were found to predict more chances of encountering difficult laryngoscopy.

CONCLUSION

13% of patients posted for CABG had difficult laryngoscopy. Advanced age and obesity were not found to be of significance in our population of patients posted for CABG. Mallampati class, presence of diabetes mellitus and more extensive coronary vessel involvement were shown to predict more probability of difficult laryngoscopy in patients presenting for CABG.

KEYWORDS

Difficult Airway, CABG, General Anaesthesia.

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BACKGROUND

Airway management i.e. to secure, preserve and protect the airway during induction, maintenance and recovery from anaesthesia, is the primary responsibility of the anaesthesiologist. Failure to maintain a patent airway can result in catastrophic results. Most anaesthetic mishaps occur at the time of induction and intubation. Orotracheal intubation is the most common method to secure the airway in major surgeries.

Glottic view during laryngoscopy can be classified using different methods like Cormack-Lehane grading¹ and its modifications,² and Percentage of Glottic Opening (POGO) score.³ Coronary artery bypass grafting is a commonly performed open cardiac surgery.⁴ considering the increase in ageing population with associated increase in

cardiovascular disease, the number of patients being posted for CABG is likely to increase in the future. General anaesthesia with controlled ventilation, with endotracheal intubation, is the standard technique of administering anaesthesia to these patients. Endotracheal intubation establishes a definitive airway, provides maximal protection against the aspiration of gastric contents, and allows for positive pressure ventilation with higher airway pressures than via a facemask or supraglottic airway.⁵

General anaesthesia is associated with profound effects on the various organ systems of the body. Loss of airway patency, loss of protective airway reflexes,⁶ hypoventilation and apnoea can occur. Failure to secure a patent airway can result in hypoxic brain injury and death within a few minutes, thereby producing potentially grave implications for difficulty in airway management. Endotracheal intubation as well as laryngoscopy produce an intense noxious stimulus via vagal and glossopharyngeal afferents resulting in tachycardia and hypertension in adult and adolescent patients.⁷ While this is usually a transient phenomenon, it can have detrimental influences on the myocardial oxygenation in patients with coronary artery disease.

Patients presenting for coronary artery bypass graft surgery can have higher incidence of difficult airway because of various factors like old age, obesity, associated metabolic disorders and dental problems.⁸ Various authors have

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stressed the need to minimize the laryngoscopy time in CABG patients because of the detrimental effects of associated stress response on the myocardial oxygen demand- supply balance. Awareness about the incidence and predictors of difficult airway in CABG patients will help the anaesthesia provider in being adequately prepared for management of a difficult airway situation thereby reducing the laryngoscopy related adverse events on myocardial oxygenation.

Objectives

1. To determine what proportion of CABG patients has got Difficult laryngoscopy using Modified Cormack- Lehane laryngoscopy score
2. To determine the association of 8 variables namely Age, Gender, Weight, Modified Mallampati class,^{9,10} Neck extension, Thyromental distance, Diabetes mellitus, and Extent of coronary artery involvement determined by CAG with Difficult laryngoscopy.

MATERIALS AND METHODS

Study Design- Prospective observational study.

Study Population- All patients satisfying the inclusion criteria who give consent to take part in the study.

Study Setting- Dept. Of Anaesthesia, Govt. TD Medical College, Alappuzha.

Inclusion Criteria-

Patients scheduled for elective CABG surgery under general anaesthesia during the study period.

Data Collection Methods-

Interview using a semi structured questionnaire and observation.

Sample Size-

100 consecutive patients scheduled for CABG under general anaesthesia from the beginning of the study.

Sampling Method-

Interview and observation.

Operational Definitions

Difficult Laryngoscopy- Modified Cormack – Lehane class IIB, III and IV view under optimum patient position^{11,12} for laryngoscopy using laryngoscope with appropriate size Macintosh blade. Patients, who are judged to be impossible to intubate using conventional laryngoscopy, and planned for FOB guided intubation during the pre-anaesthetic checkup, will also be classified as difficult laryngoscopy.

Thyromental Distance- Distance in centimeters between the thyroid notch and the lower border of the mentum.

Neck Extension- Measured quantitatively as the distance in centimeters between the suprasternal notch and the tip of the chin with the neck in fully extended and mouth closed.

Modified Mallampati Class- Modification of Mallampati classification used to predict difficult intubation based on relative size of base of tongue with respect to the oral cavity, as proposed by Samsoun and Young.

Extent of Coronary Artery Involvement- Number of coronary vessels involved as mentioned in the preoperative Coronary Angiogram.

Diabetes Mellitus- Patients who are diagnosed to be having diabetes mellitus and was on treatment with insulin or OHA before getting admitted for CABG

Procedure

Pre-anaesthetic evaluation and preoperative preparation was done as per the institutional protocol. Demographic data including age, gender, height and weight were recorded. All the study variables were recorded using appropriate Performa. Patients judged to be having impossible direct laryngoscopy during the pre-anaesthetic evaluation and planned for elective awake fiber optic bronchoscope guided intubation, were proposed to be included in the study by directly classifying as having difficult intubation without assessing the Cormack and Lehane score, but no such patients were encountered during the period of study. All patients were anaesthetized using titrated doses of etomidate and morphine and administered vecuronium 0.1 mg/kg following a priming dose of 0.01 mg/kg administered 2 minutes prior to the intubating dose. Direct laryngoscopy was done using laryngoscope with appropriately sized Macintosh curved blade after 90 seconds by an anaesthesiologist with more than five years of experience, in all cases, after achieving the optimum position for laryngoscopy. Modified Cormack-Lehane score was recorded.

RESULTS

The study was carried out on 100 patients scheduled for CABG under general anaesthesia. Descriptive statistical analysis was carried out for the variables

Study Variables

Age- Mean age of the population studied was 58.4 with a standard deviation of 7.6

Age	Count	Percent
41-50	21	21
51-60	41	41
61-70	34	34
71-80	4	4
Mean±SD	58.4±7.6	

Table 1. Percentage Distribution of the Sample According to Age

Gender- 88% of patients were males and 12% females.

Gender	Count	Percent
Male	88	88
Female	12	12

Table 2. Percentage Distribution of the Sample According to Gender

Weight- Mean weight of study population was 61.8 with standard deviation 8.

Mean	61.8
SD	8.0
Median	61.0
Minimum	44.0
Maximum	85.0

Table 3. Descriptive Statistics for Weight

Thyromental Distance- Mean value was 8.2 cm with standard deviation 1.4. Maximum recorded value was 11 cm and minimum 4 cm.

Mean	8.2
SD	1.4
Median	8.0
Minimum	4.0
Maximum	11.0

Table 4. Descriptive Statistics for Thyromental Distance

Neck Extension- Mean value was 17.5 with standard deviation 2.7. Maximum recorded value was 23cm and minimum value 10cm.

Mean	17.5
SD	2.7
Median	18.0
Minimum	10.0
Maximum	23.0

Table 5. Descriptive Statistics for Neck Extension

Mallampati Class- Mallampati class 3 and 4 were taken as predictor of difficult intubation and class 1 and 2 taken as predictor of easy intubation.

Mallampati Class	Count	Percent
Difficult	22	22
Easy	78	78

Table 6. Percentage Distribution of the Sample According to Mallampati Class

Number of Coronary Vessels Involved- Among the study population only 1 patient had single vessel disease, 14 had double vessel disease and remaining 85 had triple vessel disease.

No. of Coronary Vessels Involved	Count	Percent
Single vessel disease	1	1
Double vessel disease	14	14
Triple vessel disease	85	85

Table 7. Percentage Distribution of the Sample According to No. of Coronary Vessels Involved

Diabetes Mellitus- Diabetes mellitus was present in 55 patients and absent in 45 patients.

Diabetes Mellitus	Count	Percent
Absent	45	45
Present	55	55

Table 8. Percentage Distribution of the Sample According to Diabetes Mellitus

Outcome Variable- The outcome variable studied was difficult laryngoscopy. Difficult laryngoscopy according to the definition was present in 13 patients and remaining 87 had easy laryngoscopy.

Difficult Laryngoscopy	Count	Percent
Absent	87	87
Present	13	13

Table 9. Percentage Distribution of the Sample According to Difficult Airway

Analysis of Association- Association between the study variables and the outcome variable was analysed using appropriate statistical tests.

Statistical Tests Used- Categorical and quantitative variables were expressed as frequency (percentage) and Mean±SD respectively. Chi square test were used to find association of difficult airway with selected categorical variables, independent t test was used for comparison of means of quantitative parameters with difficult airway. Kappa statistics was used to find the agreement in assessment of difficult airway using Mallampati class and Cormack- Lehane laryngoscopy score method. P<0.05 was considered the threshold for statistical significance. Statistical analysis was performed by using a statistical software package SPSS, version 20.0

Age- Independent t test was used to analyse the association between the mean age of the study population and difficult laryngoscopy.

Difficult Laryngoscopy	Mean	SD	N	t	p
Absent	58.1	7.8	87	1.27	0.208
Present	60.9	5.8	13		

Table 10. Comparison of Age based on Difficult Laryngoscopy

Gender- Study population was grouped into two based on the presence or absence of difficult laryngoscopy and on the basis of gender. Chi square test was done to analyse the association.

Gender	Difficult Laryngoscopy				χ^2	p
	Absent		Present			
	Count	Percent	Count	Percent		
Male	78	88.6	10	11.4	1.7	0.18
Female	9	75.0	3	25.0	4	8

Table 11. Comparison of Gender based on Difficult Laryngoscopy

Weight- The study population was grouped into two based on the presence or absence of difficult laryngoscopy and mean weight and standard deviation of the population was calculated. Analysis of association was done using independent t test.

Difficult Laryngoscopy	Mean	SD	N	t	p
Absent	61.4	8.1	87	1.08	0.284
Present	64.0	7.8	13		

Table 12. Comparison of Weight based on Difficult Laryngoscopy

Thyromental Distance- Independent t test was used to analyse the association after grouping the population into two based on presence or absence of difficult airway and calculating mean and standard deviation of the thyromental distance values of the population.

Difficult Laryngoscopy	Mean	SD	N	t	p
Absent	8.2	1.3	87	1.51	0.135
Present	7.6	2.0	13		

Table 13. Comparison of Thyromental Distance based on Difficult Laryngoscopy

Neck Extension- Analysis of association was done in the same way as in the case of thyromental distance using independent t test.

Difficult Laryngoscopy	Mean	SD	N	t	p
Absent	17.7	2.5	87	1.8	0.075
Present	16.3	3.4	13		

Table 14. Comparison of Neck Extension based on Difficult Laryngoscopy

Mallampati Class- Agreement in assessment of difficult airway using Mallampati class and Cormack-Lehane laryngoscopy score method was analysed using Kappa value. Mallampati class 1 and 2 were assumed to predict easy airway management and Mallampati class 3 and 4 difficult airway, for the purpose of analysis.

Mallampati Class	Difficult Airway		
	Present	Absent	Total
Difficult	7	15	22
Easy	6	72	78
Total	13	87	100

Table 15. Agreement between Mallampati Class and Cormack- Lehane Laryngoscopy Score for Difficult Airway

Kappa = 0.28**, p = 0.003, Fair agreement.

Chi square test was done after grouping the population into two groups based on the presence or absence of difficult laryngoscopy and on the basis of Mallampati class 1 or 2 predicting easy airway and 3 or 4 predicting difficult airway.

Mallampati Class	Difficult Airway				χ^2	p
	Absent		Present			
	Count	Percent	Count	Percent		
Difficult	15	68.2	7	31.8	8.83**	0.003
Easy	72	92.3	6	7.7		

Table 16. Comparison of Mallampati Class based on Difficult Airway

**Significant at 0.01 level.

Number of Coronary Vessels Involved- Chi square test was performed after grouping the population into two based on the presence or absence of difficult laryngoscopy and into three based on whether single double or triple vessel disease was present as per the preoperative coronary angiogram (CAG).

No. of Coronary Vessels Involved	Difficult Laryngoscopy				χ^2	p
	Absent		Present			
	Count	Percent	Count	Percent		
Single	0	0.0	1	100.0	7.12*	0.028
Double vessel Disease	13	92.9	1	7.1		
Triple vessel Disease	74	87.1	11	12.9		

Table 17. Comparison of No. of Coronary Vessels Involved based on Difficult Laryngoscopy

*:-Significant at 0.05 level.

Diabetes Mellitus- Chi square test was done after grouping the study population into two based on the presence or absence of difficult laryngoscopy and into two groups based on the presence or absence of diabetes mellitus.

Diabetes Mellitus	Difficult Laryngoscopy				χ^2	p
	Absent		Present			
	Count	Percent	Count	Percent		
Absent	43	95.6	2	4.4	5.3*	0.021
Present	44	80.0	11	20.0		

Table 18. Comparison of Diabetes Mellitus based on Difficult Laryngoscopy

*Significant at 0.05 level.

Statistical analysis of association between the study variables namely age, gender, weight, Thyromental distance, neck extension, Mallampati class, Number of coronary vessels involved, and diabetes mellitus was done as detailed above. The analysis showed significant association between Mallampati class, number of coronary vessels involved, and diabetes mellitus. Mallampati class 3 or 4, Triple vessel disease as evidenced by preoperative coronary angiogram and presence of diabetes mellitus were found to predict more chances of encountering difficult laryngoscopy.

DISCUSSION

Encountering a difficult airway situation while administering general anaesthesia for a patient posted for CABG can be challenging to the anaesthesiologist. Prolonged attempts at laryngoscopy and intubation and ensuing hypoxemia can result in unfavourable alterations in myocardial oxygen demand- supply ratio thereby precipitating myocardial ischemia. Predicting the possibility of difficult airway using the patient details obtained at the time of pre-anaesthetic evaluation will help the anaesthesiologist to be optimally prepared for managing the difficult airway situation effectively. According to existing literature,¹³ patients presenting with cardiovascular disease tend to be of older age group and suffer from co morbidities like diabetes mellitus, obesity and hypertension, but the mean age of patients participated in our study was only 58.4 years. This may be because of genetic influences or that younger aged coronary artery disease patients are more often considered for CABG compared to the older ones. Older age patients can pose difficulty in mask ventilation due to loss of teeth, hollowing of cheeks and higher incidence of obstructive sleep apnoea, but old age per se has not been shown to increase risk for difficult intubation.¹⁴ The present study did not show statistically significant association between advancing age and difficult laryngoscopy.

Previous studies have shown that patients presenting for cardiac surgery carries an increased risk of difficult airway.¹⁵ The degree of coronary artery involvement as evidenced by preoperative coronary angiogram was therefore included as a study variable. Analysis showed a

statistically significant association between the number of coronary vessels involved and difficult laryngoscopy.

Coronary artery disease tend to affect males more often than females and after 60 years of age, almost equal incidence of CAD has been documented in males and females.¹³ Our study showed that males are far more commonly posted for CABG compared to females. No significant association between gender and difficult laryngoscopy was found.

Obesity was not found to be common in our study population. Mean weight of the study population was only 61.8. Obesity per se has not shown to increase the chances of difficulty in intubation according to previous literature.¹⁶ Our study also failed to show statistically significant association between patient weight and difficult laryngoscopy.

Diabetes mellitus has been shown to be a risk factor for difficulty in airway management and various special tests, like the palm print sign, has been advocated for predicting difficult airway in diabetic patients.¹⁷ Our study showed a significant incidence of diabetes mellitus in the study population and also a statistically significant association between the presence of diabetes mellitus and difficult laryngoscopy.

Various anatomical factors pertaining to the airway like thyromental distance, neck circumference Mallampati class etc., had been extensively studied in the general population. Multiple factors taken together have been shown to predict difficult airway rather than standalone measurements.¹⁸ Our study substantiated the same in patients presenting for CABG also, as thyromental distance and neck extension when taken individually failed to show statistically significant association with difficult laryngoscopy. Mallampati class however showed to be statistically significant in predicting difficult laryngoscopy.

CONCLUSION

Difficult airway management is generally encountered in 1-3% of the general population patients presenting for general anaesthesia.¹⁹ Our study showed that 13% of patients presenting for CABG had difficult laryngoscopy which is more than that in general population. Contrary to some existing literature, advanced age and obesity were not found to be of significance in our population of patients posted for CABG. Among various predictors studied, Mallampati class, presence of diabetes mellitus and more extensive coronary vessel involvement were shown to predict higher probability of difficult laryngoscopy in patients presenting for CABG.

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