Correlation between Clinical Methods of Airway Assessment and Modified Cormack -Lehane Grading

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Abstract:
Objective and Aims-To evaluate the efficacy of clinical parameters to predict difficult laryngoscopy and to correlate these parameters to Modified Cormack- Lehane Grading.
Materials and Methods- A total 96 adult patients of age group of 18-70 years of either sex of ASA I, II and III posted for elective surgery under general anaesthesia were included in this study. Pre- clinical evaluation was done by measuring body mass index, Thyromental distance, Hyomental distance, Neck mobility and Mallampati grading. All of the above parameters were correlated with Modified Cormack- Lehane grading. Qualitative variables were correlates using Chi-Square test. Inter-rater kappa agreement was used to find out the strength of agreement between modified CL grade and MPG. A p value of < 0.05 was considered statistically significant.
Results- On comparing Mallampati grading with Modified Cormack- Lehane Grading, P value came to be <0.0001 and kappa value = 0.413 which represents significantly fair relationship.
Conclusion-There is a significantly fair relationship between Mallampati grading (MPG) and Modified Cormack-Lehne grading and poor correlation of other airway parameters with modified Cormack-Lehane Grade (Mod. CL grade) when used alone/individually.
Key words- General Anaesthesia, difficult laryngoscopy, Modified Cormack Lehane Grading, Airway assessment.

I. Introduction

There are several conventional methods for preoperative airway assessment but none of them are 100 percent accurate and they often fail to address many factors associated with difficult intubation. Endotracheal intubation is one of the most important skills for anaesthesiologist in securing airway, however the incidence of unforeseendifficult laryngoscopy and intubation remains high due to poor accuracy of clinical airway assessment techniques.[1]The unanticipated difficult intubation can have several complications like sore throat, airway trauma, aspiration of gastric contents and oesophageal intubation.[2,3]Several patients with normal appearance and normal bed side airway assessment test unexpectedly present with difficult intubation.

There are several radiological assessment techniques to predict difficult laryngoscopy but most of them requires knowledge and they are costly, time consuming and not routinely available. So, we need anatomical predictors to assess difficult laryngoscopy; which is easy, quick and with the use of limited resources.

Previous studies shows that routinely used bed side methods for airway assessment have poor to moderate sensitivity in predicting a difficult laryngoscopy and shows high false positive results.[4,5,6] Therefore, this study was done to evaluate the efficacy of clinical parameters to predict difficult laryngoscopy and intubation and to correlate with these parameters to modified Cormack- lehane grading.[7]

II. Material And Methods

The observational cross-sectionalstudy was conducted in a rural tertiary care institute after approval from ethics committee. Informed consent was obtained.

96 adult patients of 18-70 years of age, any gender, American society of Anaesthesiologist (ASA) grade I to III, posted for elective surgery under general anaesthesia were enrolled for the study.Patients who refused to participate in the study, pregnant woman, associated airway pathology, cervical spine injury, history ofprevious head & neck surgery and history of arthritis were excluded.

After complete evaluation of the airway, patient was made to lie supine with optimum sniffing position. Standard monitors were applied and difficult airway cart was prepared in all the cases. Standard anaesthesia protocol was followed for induction of anaesthesia. Direct laryngoscopy was performed by experienced anaesthesiologist who was aware to modified Cormack-lehane gradingand the assessment of difficult visualization of the larynx and difficult intubation was made by applying the modified Cormack-Lehane

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classification. Intubation is classified as easy (CL Grade 1 and 2a), restricted (2b and 3a) and difficult (CL Grade 3b and 4). [7]

CL 1- Complete visvulization of glottis

CL 2a- Part of the vocal cords are visible

CL 2b- Only posterior elements (areytenoids or of the posterior commissure) of glottis visible

CL 3a- epiglottis is liftable

CL3b- epiglottis is not liftable

CL 4-neighter glottis nor epiglottis is visible.

The number of attempts at intubation, need for alternative difficult intubation approaches and invasive airway access or cancellation of the procedure due to inability to secure the airway was also be noted.

Sample Size:

The study of Khwaja Kamal Nasir et al observed that direct laryngoscopic intubation is difficult in 1%- 4%.[8] Taking this value as reference, the minimum required sample size with 4% margin of error and 5% level of significance is 93 patients. To reduce margin of error, total sample size taken is 96.

Formula used is:-

$$N \geq ((p(1-p))/(ME/z_\alpha)^2$$

Where Z_α is value of Z at two sided alpha error of 5%, ME is margin of error and p is proportion of patient with difficult intubation.

Calculations:-

Difficult lintubation at 1%

$n >= ((.01*(1-.01))/(.04/1.96)^2 = 23.7699 = 24$(approx.)

Difficult lintubation at 4%

$n >= ((.04*(1-.04))/(.04/1.96)^2 = 92.198 = 93$(approx.)

Statistical Analysis:

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. Qualitative variables were correlated using Chi-Square test. Inter-rater kappa agreement was used to find out the strength of agreement between various parameters and final outcome. A p value of <0.05 was considered statistically significant. The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

III. Results

The study was conducted on 96 patients posted for elective surgery and required general anaesthesia. Demographic data regarding age, sex and body mass index of the patients were comparable.

Table 1 illustrates, there are 2 females out of 61 (3.28%) and 2 males out of 35 (5.71%) having difficult laryngoscopy (CL grade 3b and 4).

Table 2 illustrates, the correlation between age and modified Cormack-Lehane grading. We observed that age showed no significant correlation with grades of modified CL grading. (*p* value-0.102)

Table 3 illustrates, in 34 patients with BMI <25 (Kg/m2) had easy laryngoscopy while only 6 patients with BMI >30 (kg/m2) were categorised as easy laryngoscopy with CL grade 1 or 2a.

As per **Table 4**, 50 patients belonging to MPG class l and ll also had easy laryngoscopy with Cl grade 1 and 2a (72.46%), 18 patients with MPG l and ll were in restricted subgroup of CL grading (2b and 3a) and only one patient within easy subgroup of Mallapatti grading encountered with difficult laryngoscopy. (k value- 0.413).

Table 5 shows, that out of 48 patients with thyromental distance(TMD) of 6.0-6.5 cms had difficult laryngoscopic view, while there was no patient of higher CL Grade with TMD < 6.0 cms(p value-0.127).

According to **Table 6**, there were only 4 patients out of 83 had difficult laryngoscopy with hyomental distance (HMD) 4.0-6.0 cms and no patient of difficult laryngoscopy out of 4, who had HMD > 6.0 cms. (p value-0.173)

Table 7 shows restricted neck mobility also had association with restricted laryngoscopic view.

Table 1 – Relationship between Gender and modified CL grading

		MOD.CL GRADE				
		1) Easy	2) Restricted	3) Difficult	Total	P value
SEX	FEMALE	33 (54.10%)	26 (42.62%)	2 (3.28%)	61 (100.00%)	
	MALE	23 (65.71%)	10 (28.57%)	2 (5.71%)	35 (100.00%)	0.368
Total		56 (58.33%)	36 (37.50%)	4 (4.17%)	96 (100.00%)	

Table 2 -Relationship between Distribution of Age and modified CL grade

		MOD.CL GRADE				
		1) Easy	2) Restricted	3) Difficult	Total	P value
AGE DISTRIBUTION	1) <=20	6 (100.00%)	0 (0.00%)	0 (0.00%)	6 (100.00%)	
	2) 21-30	14 (70.00%)	6 (30.00%)	0 (0.00%)	20 (100.00%)	
	3) 31-40	15 (65.22%)	7 (30.43%)	1 (4.35%)	23 (100.00%)	
	4) 41-50	13 (54.17%)	9 (37.50%)	2 (8.33%)	24 (100.00%)	0.102
	5) 51-60	4 (28.57%)	10 (71.43%)	0 (0.00%)	14 (100.00%)	
	6) >60	4 (44.44%)	4 (44.44%)	1 (11.11%)	9 (100.00%)	
Total		56 (58.33%)	36 (37.50%)	4 (4.17%)	96 (100.00%)	

Table 3-Relationship of BMI and Modified CL grade

		MOD.CL GRADE				
		1) Easy	2) Restricted	3) Difficult	Total	P value
BMI(kg/m2)	1) <=25	34 (60.71%)	19 (33.93%)	3 (5.36%)	56 (100.00%)	
	2) 25.1-30	16 (72.73%)	6 (27.27%)	0 (0.00%)	22 (100.00%)	0.115
	3) >30	6 (33.33%)	11 (61.11%)	1 (5.56%)	18 (100.00%)	
Total		56 (58.33%)	36 (37.50%)	4 (4.17%)	96 (100.00%)	

Table 4-relationship between MPG and Modified CL grade

		MOD.CL GRADE					
		1) Easy	2) Restricted	3) Difficult	Total	P value	Kappa
MPG	1) Easy	50 (52.08%)	18 (18.75%)	1 (1.04%)	69 (71.88%)		
	2) Moderately difficult	6 (6.25%)	18 (18.75%)	2 (2.08%)	26 (27.08%)	<.0001	0.413
	3) Severe difficulty	0 (0.00%)	0 (0.00%)	1 (1.04%)	1 (1.04%)		
Total		56 (58.33%)	36 (37.50%)	4 (4.17%)	96 (100.00%)		

Table 5- Relationship between TMD and Modified CL grade

		MOD.CL GRADE				
		1) Easy	2) Restricted	3) Difficult	Total	P value
TMD (cm)	<6.0	2 (28.57%)	5 (71.43%)	0 (0.00%)	7 (100.00%)	
	6.0-6.5	25 (52.08%)	20 (41.67%)	3 (6.25%)	48 (100.00%)	0.127
	>6.5	29 (70.73%)	11 (26.83%)	1 (2.44%)	41 (100.00%)	
Total		56 (58.33%)	36 (37.50%)	4 (4.17%)	96 (100.00%)	

Table 6- Relationship between HMD and Modified CL grade

		MOD.CL GRADE				
		1) Easy	2) Restricted	3) Difficult	Total	P value
HMD(cm)	<4.0	3 (33.33%)	6 (66.67%)	0 (0.00%)	9 (100.00%)	
	4.0-6.0	49 (59.04%)	30 (36.14%)	4 (4.82%)	83 (100.00%)	0.173
	>6.0	4 (100.00%)	0 (0.00%)	0 (0.00%)	4 (100.00%)	
Total		56 (58.33%)	36 (37.50%)	4 (4.17%)	96 (100.00%)	

Table 7- Relationship between Neck mobility with Modified CL grade

		MOD.CL GRADE				
		1) Easy	2) Restricted	3) Difficult	Total	P value
NECK MOBILITY	<90	1 (25.00%)	3 (75.00%)	0 (0.00%)	4 (100.00%)	
	90	7 (31.82%)	13 (59.09%)	2 (9.09%)	22 (100.00%)	0.016
	>90	48 (68.57%)	20 (28.57%)	2 (2.86%)	70 (100.00%)	
Total		56 (58.33%)	36 (37.50%)	4 (4.17%)	96 (100.00%)	

IV. Discussion

Unforeseen difficult laryngoscopy and intubation can be a frightening complication to any anaesthesiologist, which is associated with high mortality, morbidity and other associated serious complications.

There are various factors associated with difficult laryngoscopy such as abnormal facial features, bucked teeth, large tongue and restricted neck movement. Unexpected difficult intubation is difficult to manage and can be life threatening for patient. Pre- operative airway assessment decreases chances of unanticipated difficult intubation, however in some cases they fail to accurately predict difficult intubation.

In our study we used modified Cormack- Lehane Grading and correlated it with other conventional methods of airway assessment like mallampati grading, neck mobility, hyomental distance and thyromental distance. We chose modified CL grading as it is more sensitive than previous CL grading system and has an advantage of increasing the number of grades hence the sensitivity to predict difficult intubation and causes less confusion to anaesthesiologist.[7]

In day to day practice every other anaesthesiologist encounters difficult laryngoscopy, even though patient having normal airway examination. There are various radiological assessment methods to predict difficult intubation, but they are expensive, time consuming and requires great depth of knowledge, it is therefore, necessary to develop clinical methods to evaluate difficult laryngoscopy.

Our study was conducted on 96 adult patients with all range of body mass index who required endotracheal intubation to evaluate efficacy of MPG, TMD, HMD, neck mobility and correlate each of them with modified CL grading.

There was no statistical significance difference between age, sex, body mass index and difficulty in laryngoscopy in our study, which is in similarity with previous studies.[9,10]

Evaluation of difficulty in laryngoscopy was carried out on the basis of modified Cormack-lehane grading [easy/ restricted /difficult] and to find out more accurate co-relation we divided each factor in three groups [easy/ moderate/difficult].

In our study we found that there is a significantly fair relationship between mallampati grading and modified Cormack-lehanegrading, but there is no fair co-relation between other conventional methods of airway assessment and laryngoscopic view when they are used alone / individually.

The reason for not good correlation between anatomical predictors and CL grade may be associated with different operators for each patient or may be confusion/ lack of knowledge of modified CL grading, different lifting force required during laryngoscopy and different methods to measure thyromental and hyomental distanceeg. tape, scale, fingers. Apart from this, our study also had some limitations like we did not include patients with airway pathology, cervical spine injury, rheumatoid arthritis.

In our study larynx was difficult to visualise with CL grade 3b and 4. Use of adjuncts, external pressure and more than one number of attempts were required with restricted subgroup of CL grade (2b and 3a). No failed intubation occurred with difficult MPG and difficult laryngoscopic view.

In today's anaesthetic practice, there is no universally accepted method to evaluate difficult laryngoscopy hence, it is advisable to compare and correlate different pre-operative diagnostic methods and find

out single the most favourable method to rule out unexpected difficult intubation. We all must be well prepared to encounter difficult intubation with every case posted for surgery under general anaesthesia and should have through knowledge to use alternative airway securing techniques in difficult scenarios.

V. Conclusion

There is a significantly fair relationship between Mallampati grading and Modified Cormack-Lehane grading and poor correlation of other airway parameters with Modified CL Grade when used alone/individually.

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