ORIGINAL ARTICLE

Prediction and Prevalence of Difficult Intubation in Major Ethnic Groups of Nepal

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ABSTRACT

Introduction: Preoperative identification of patients at risk for difficult laryngoscopy is important in adopting safer alternative strategies for the induction of anesthesia and intubation. There are many ethnic groups in Nepal but this study is to see the prevalence of difficult intubation in major ethnic groups of Nepal broadly classified as Mongolians, Aryans, Newars and Madhesi. There are various bedside tests to predict the difficult intubation, like Mallampati test, Thyromental distance, Sternomental distance and mouth opening. Difficult laryngoscopy as graded by Cormack and Lehane has been considered a surrogate indicator of difficult intubation. To see the prevalence of difficult intubation in major ethnic groups of Nepal and to compare the different bedside tests for prediction of difficult intubation in that population at Kathmandu Model Hospital from July to September 2023.

Methods: This retrospective study was conducted at the Department of Anesthesiology in Kathmandu Model Hospital, Nepal from July to September on patients who underwent elective surgery under general anesthesia with endotracheal intubation. Data on socio-demographic characteristics, preanesthetic airway assessment and laryngoscopic view were collected. Data were analyzed by SPSS.

Results: Difficult intubation was seen in 5.3% with 0.88% in Chettris, 0.88% in Madhesi and 3.5% in Newars. Malampati grading showed sensitivity of 33.3% and mouth opening showed sensitivity of 33.3%. However, highest specificity of the tests was found to be in Malampati grading with 98.1%.

Conclusion: Prevalence of difficult laryngoscopy in different ethnic groups of Nepalese population was found to be similar to that of other population. The predictors for difficult intubation were sensitive for Mallampati grading and mouth opening (MMP), as well as specific to MMP.

Keywords: Cormack and Lehane grading, Difficult laryngoscopy, Ethnic groups, Malampati grading

INTRODUCTION

Evaluation of difficult intubation before anesthesia is crucial for reducing anesthetic complications. Improper airway management accounts for 30% of deaths.[1] There are various tests preoperatively which have been used for predicting difficult laryngoscopy and intubation like mouth opening, thyromental distance, sternomental distance and Mallampati Grading.[2,8] Difficult laryngoscopy is inability to view the glottis opening using a conventional curve blade laryngoscope, corresponding to a Cormack and Lehane III or IV grade view intraoperatively.[3,9] Failure to keep a patent airway open for more than a few minutes causes brain damage

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or death.[4] Nepal is a well-known multicultural country with different ethnic groups. The major ethnic groups of Nepal include Bhramins, Chettris, Newars, Janajati and Madhesi and they have different craniofacial features. Due to these differences, the predictors for difficult intubation may also differ.[5] Airway difficulties in direct laryngoscopy were identified in 2.8% to 27%.[7] The objective of our study was to determine the diagnostic accuracy and efficacy of various pre-operative tests for better prediction of difficult intubation in different ethnic groups of Nepal identified through Cormack and Lehane grading intraoperatively.

METHODS

This retrospective study was conducted at the Department of Anesthesiology in Kathmandu Model Hospital, Nepal collected July to September 2023.The institutional review board's ethical approval and the patients' informed consent were obtained.

The sample size was calculated using the following Solvin's formula:

$n = N/(1+Ne^2)$,

Where n is the sample size, N is the population size and E is the margin of error to be decided by the researcher.

N= 123
E = 2.5% margin of error= 0.025, then
$n = 123/(1+123 \times 0.025^2)$,
$= 123/(1+123 \times 0.00062)$
$=123/(1+0.076)$
$= 123/1.076$
$=114$

One hundred and fourteen patients who needed endotracheal intubation for a variety of elective procedures were included. They ranged in age from 18 to 65 and had an ASA Physical Status I or II. Patients with apparent pathologies affecting the face, neck, or airway, as well as those who were pregnant or who had diabetes, were excluded. Prior to surgery, each airway assessment test was done and measured for independent variables like Thyromental distance, Sternomental distance, Neck circumference, and Mallampati grading.

Injection propofol and vecuronium were administered on the day of the surgery to induce general anesthesia (GA). Pre-oxygenation with 100% oxygen was performed for three minutes. Then a skilled anesthesiologist performed endotracheal intubation. Endotracheal tubes of the proper size were used to intubate the patients. The Cormack and Lehane grading system were used to classify the glottic views. Difficult laryngoscopy as graded by Cormack and Lehane has been considered a surrogate indicator of difficult intubation.[6] The collected data was entered in Microsoft Excel, then transferred to SPSS and analyzed in SPSS.

RESULTS

A total of 113 patients (36 male and 77 female) were participated in our study. Patients with ASA physical status I to II and age ≥18 years old were included in the study. The mean age of our study population was 42.64±13.97 SD. Patients characteristics such as sex, ethnicity, Mallampati grading, Thyromental distance, sternomental distance and Cormak Lehane grading is given in Figure 1 and 2 and Table 1.

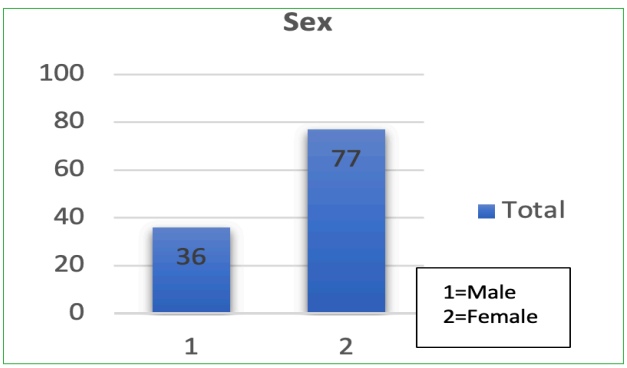

Figure 1: Gender of the patients

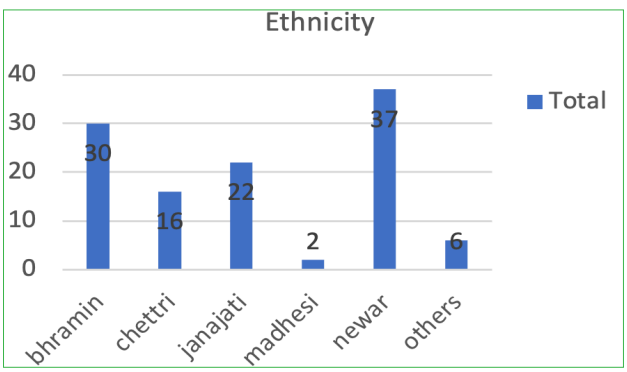

Figure 2. Distribution by ethnicity

Table 1: Preoperative and post-operative evaluation of the characteristics of the patients.

Parameters		Preoperative evaluation									Postoperative evaluation		
Ethnic groups	Total	Mallampati grading			Thyromental distance		Sternomental distance		Neck Circumference		Cormack and Lehane		
		I	II	III	<6	≥6	<12	≥12	<40	≥40	I	II	III
Bhramins	30	22	7	1	0	30	1	29	28	2	20	10	0
Chettris	16	10	5	1	0	16	0	16	14	2	12	3	1
Janajati	22	15	7	0	0	22	0	22	20	2	16	6	0
Madhesi	2	1	0	1	0	2	0	2	2	0	1	0	1
Newars	37	26	8	1	0	37	1	36	28	9	14	19	4
Others	6	2	4	0	0	6	0	6	4	2	2	4	0
Total	113	76	31	4							65	42	6

This table shows different ethnic groups with different preoperative evaluation scorings and post intubation evaluation scorings.

In this study, we found the total number of difficult laryngoscopy and intubation as 6/113 (5.3%) with 0.88% in Chettris, 0.88% in Madhesi and 3.5% in Newars. In this study, difficult intubation was defined Cormack and Lehane grading of III and IV. Preoperative tests such as Mallampati grade II was seen in 31/113 (27.4%) with highest in the Newars (7%) and Bhramins (6.19%). Similarly, Mallampati grading III was seen in 4/113 (3.5%). Neck circumference >40 cm was seen in 17/113 (15%) with highest in the Newars (7.9%).

Individual correlation of Mallampati grading with Cormack and Lehane in different ethnic groups are given in Table 2.

Table 2: Mallampati grading and Cormack Lehane grading in different ethnicity.

	Parameter			
	MP grade I	CL grade I	CL Grade II	CL grade III
Total	76	53	22	1
Bhramin	22	16	6	0
Chettri	10	8	2	0
Janajati	15	13	2	0
Madhesi	1	1	0	0
Newar	26	14	11	1
Others	2	1	1	0
	MP grade II	CL grade I	CL grade II	CL grade III
Total	31	11	19	2
Bhramin	7	4	3	0
Chettri	5	3	1	1
Janajati	7	3	4	0
Madhesi	0	0	0	0
Newar	10	0	8	2
Others	3	1	3	0
	MP Grade III	CL Grade I	CL Grade II	CL Grade III
Total	4	1	1	2
Bhramin	0	0	0	0
Chettri	0	0	0	0
Janajati	0	0	0	0
Madhesi	1	0	0	1
Newar	1	0	0	1
Others	0	0	0	0

The above table no 2 shows that there is significant correlation between Mallampati grading (MP) and Cormack Lehane grading (CL) in Bhramins and

Newars. Preoperative assessment such as MP grade III was mostly seen in Madhesi and Newars that led to CL grading III as well in the same ethnic group.

Table 3. Malampati grading and Cormack and Lehane Grading cross-tabulation

Difficult Not difficult			Cormack and Lehane Grading		
			Total		
Malampati grading	Difficult	Count	2	2	4
		%	33.33	19	3.5
	Not difficult	Count	4	105	109
		%	66.7	98.1	96.5
Total		Count	6	107	113
%			100.0	100.0	100.0

The Mallapati grading fully correlates with Cormack-Lehane grading.

Table 4. Sternomental distance and Cormack and Lehane Grading cross-tabulation

Difficult Not difficult			Cormack and Lehane Grading		
			Total		
Sterno-mental distance	Difficult	Count	0	3	3
		%	0.0	2.8	2.8
	Not difficult	Count	6	104	110
		%	100.0	97.2	97.3
Total		Count	6	107	113
%			100.0	100.0	100.0

The sternomental distance significantly correlates with the Cormack-Lehane grading.

Table 5. Mouth opening and Cormack and Lehane Grading cross-tabulation

Difficult Not difficult			Cormack and Lehane Grading		
			Total		
Mouth Opening	Difficult	Count	2	23	25
		%	33.33	21.5	22.1
	Not difficult	Count	4	84	88
		%	66.7	78.5	77.9
Total		Count	6	107	113
%			100.0	100.0	100.0

The mouth opening significantly correlates with the Cormack-Lehane grading.

DISCUSSION

Difficulty in laryngoscopy has not been determined in the different ethnic groups of Nepal till now. Therefore, this study helps to evaluate the prediction of difficult laryngoscopy in major ethnic groups of Nepal. This study was to see the prevalence of difficult intubation in major ethnic groups of Nepal broadly classified as Mongolians, Aryans, Newars and Madhesi.

The grades of laryngoscopic views were defined by Cormack and Lehane as[3]:

Grade I—visualization of entire laryngeal aperture.

Grade II—visualization of only posterior commissure of the laryngeal aperture.

Grade III—visualization of only epiglottis.

Grade IV—visualization of just the soft palate.

Classification of Mallampati grading is assigned according to the extent the base of the tongue is able to mask the visibility of pharyngeal structures into four class I–IV[3]:

Class I: visualization of the soft palate, fauces, uvula, and anterior and the posterior pillars.

Class II: visualization of the soft palate, fauces, and uvula.

Class III: visualization of soft palate and base of uvula.

Class IV: only hard palate is visible. Soft palate is not visible at all.

There was a correlation between the grade distribution on the Cormack Lehane (CL) and the Mallampati score. 76/113 patients were classified as being in Mallampati class-I; out of which 53 patients were associated with CL grade-I, 22 patients with CL grade-II, and 1 patient with CL grade-III. 31/113 patients had a Mallampati class II; of which 11 of them were associated with a CL grade of I, 19 with a grade of II, and 2 with a grade of III. There were 4 individuals with Mallampati class III, of which 1 of had CL grades I, 1 with grade II and other 2 with CL grade III.

Alemayehu et al[12] reported that difficult intubation was found to be in 9/148 (6.1%) where as in this study difficult intubation was found to be in 6/113 (5.3%) patients.

Another study done by Devkota[13] showed that Mallampati grading had sensitivity 37.93, specificity of 69.92, positive predictive value of 21.35 and negative predictive value of 83.97. The sensitivity and specificity of Mallampati grading in our study was 33.3% and 98.1% respectively as shown in table no 3. Pre-operative assessment such as thyromental distance and sternomental distance showed less sensitivity than mouth opening and Mallampati grading tests. Sensitivity and specificity were highest in Mallampati grading and mouth opening, but specificity of the tests was seen highest in Mallampati grading as 98.1%.

Shah[8] did not categorize the population of Nepal into various ethnic groups, although she had performed a similar study on the general population. However, this study has calculated tests for accessing difficult intubation in different ethnic groups as shown in table 2. Therefore, variations in anatomical structure of different ethnic groups of Nepal have contributed to some of the heterogeneity of results seen. It was seen that preoperative assessment such as Mallampati grade III was mostly seen in Madhesi and Newars that led to Cormack-Lehane grading III as well in the same ethnic group. An ideal preoperative assessment tool for difficult laryngoscopy should have a high sensitivity and specificity and produce few false positives and negatives. The consequence of a false-negative result may be deleterious and even life-threatening. Therefore, decreasing false-negative prediction is far more important than falsely predicting difficult laryngoscopy in unaffected patients.[14] The strength of this study is that we compared different preoperative airway assessments with Cormack-Lehane grading in different ethnic groups of Nepal. Due to the heterogenicity of the studies, we were not able to conduct a meta-analysis on our findings which is the limitation of the present study.

CONCLUSION

This study showed that prevalence of difficult laryngoscopy in different ethnic groups of Nepalese population was found to be similar to that of other population. The predictors for difficult intubation were sensitive for Mallampati grading and mouth opening, as well as specific to Mallampati grading.

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