

Intubation challenges in surgeries of thyroid swellings



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ABSTRACT

Background: Difficult airway is when a trained anesthesiologist experiences difficulty with face mask ventilation of the upper airway or tracheal intubation or both. It has always been a challenging issue for anesthesiologists. **Aims and Objectives:** The objective was pre-operative assessment of airway in patients with goiter and to find the incidence of difficult intubation and its management. **Materials and Methods:** A prospective study was done in 32 patients presenting with goiter of various sizes. Routine airway examination includes mouth opening, Mallampati grading, neck circumference, neck mobility, thyromental distance, tracheal deviation on chest X-ray, AP and lateral views of neck, and Cormack-Lehane grading on laryngoscopy. The technique followed in each case was noted. **Results:** Out of 32 cases, difficult intubation was experienced in five cases. Among the studied parameters, neck mobility (66.7%) followed by neck circumference (44.4%) and Mallampati grading (37.5%) was found to be more predictive in assessing the airway. 62.5% patients were intubated through direct laryngoscopy, followed by bougie in 21.9% patients. Due to difficulty in intubation, 15.6% patients were intubated through videolaryngoscopy. **Conclusion:** We conclude that induction of anesthesia can be challenging for patients with goiter. A thorough history and examination are mandatory pre-operatively in these patients. Neck circumference and neck mobility are the most crucial factors as evident in our study. Videolaryngoscopy plays an important role in patients with difficult airway.

Key words: Difficult airway; Thyroid swelling; Endotracheal intubation

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INTRODUCTION

Difficult airway has been defined as a “clinical situation in which a conventionally trained anesthesiologist experiences difficulty with face mask ventilation of the upper airway or tracheal intubation or both.”¹ It has been a challenging issue for anesthesiologists, more during surgeries related to ear, nose, and throat diseases. An enlarged thyroid is termed as goiter, which is an important risk factor for difficult intubation during its surgery.² Large goiters can compress the trachea, resulting in intubation difficulty. However, moderate-sized swellings can also compress or deviate the trachea when they lie in the same vicinity. Retrosternal extension of goiter and malignant diseases of thyroid can also cause airway obstruction.³ Keeping

these factors in view, a pre-operative assessment of the airway is must.

Aims and objectives

This study was carried out in patients with goiter being operated for thyroidectomy with the aim to:

1. Assess the airway pre-operatively
2. Find the incidence of difficult intubation and its management.

MATERIALS AND METHODS

After approval from the Institutional Ethics Committee and with informed consent of the patients, a hospital-

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based prospective study was done in 32 patients presenting with thyroid swellings of various sizes to the Department of ENT and Head-and-Neck Surgery during a period of 6 months (July 2022–December 2022) in a tertiary care center of Assam.

Inclusion criteria

1. Patients with goiter of age of 18 years or more, who were classified as ASA I and ASA II category
2. Patients consenting for thyroidectomy.

Exclusion criteria

1. Patients with airway deformity not due to goiter
2. Patients with airway tumors.

Statistical analysis

The data collected were tabulated in Microsoft Excel Worksheet. The categorical variables were summarized as proportions and percentages.

Methodology

The study was carried out on patients with thyroid swellings who were admitted in the Department of ENT and Head-and-Neck surgery and scheduled for thyroidectomy over a 6-month period. Pre-operative assessment of the airway was done by a senior anesthesiologist to identify the parameters for difficult intubation.

Thorough history of the thyroid swelling was taken, which includes duration, sudden, or gradual increase in size and other associated pressure symptoms such as dyspnea, dysphagia, hoarseness, or preference for a particular position during sleep.

Clinical examination was done which includes general, local, and airway examination. Routine airway examination includes (1) mouth opening, (2) Mallampati grading, (3) neck circumference, (4) neck mobility, (5) thyromental distance, (6) tracheal deviation on chest X-ray, AP, and lateral views of neck, and (7) Cormack-Lehane grading on laryngoscopy.

The euthyroid status of the patients was verified.

After complete assessment of the airway, cases with difficult intubation have been identified and the mode of intubation and the size of endotracheal tube have been decided for anesthesia.

In the operating theater, patients were positioned with pillows under their shoulder with the head elevated and neck extended in the sniffing position. Each patient was monitored by electrocardiography, pulse oximetry, non-invasive blood pressure, and capnograph. Patients were

pre-oxygenated with 100% oxygen by face mask for a minimum of 3 min. Anesthesia was then induced with propofol 2–3 mg/kg and succinylcholine 1 mg/kg for facilitation of endotracheal intubation. The laryngoscopy was performed by the same anesthesiologist. Without applying external pressure, the Cormack-Lehane score was measured during direct laryngoscopy. The technique followed in each case was noted.

RESULTS

This was a prospective study carried out on 32 (n) patients undergoing thyroidectomy for a period of 6 months. Patients were in the age group of 18–65 years with a sex ratio of 0.68. Majority of the cases had swelling for <1 year.

75% of the patients were within the healthy weight range, while 18.7% of them were overweight and 6.3% were obese. Mouth opening was adequate in majority of patients, i.e., more than 3 fingers. Only 15.6% patients had mouth opening of 2 fingers. Majority (46.9%) of the patients fall under Grade 2 Mallampati, followed by Grade 1 (28.1%), Grade 3 (15.6%), and Grade 4 (9.4%). 81.2% patients had a thyromental distance of more than 6.5 cm. Only 18.8% patients had a distance of <6.5 cm. 71.9% of the patients had normal neck circumference (Table 1). Only 9.4% of patients had decreased neck mobility (Table 2). According to Cormack-Lehane classification, 56.3% patients fall into Grade 2 category, followed by Grade 1 in 25% patients, 12.5% in Grade 3, and 6.2% in Grade 4. Significant deviation of the trachea was seen in 6.2% patients only.

Table 3 shows the number of cases with difficult intubation with respect to high-risk parameters. A total of 5 cases had difficult airway for intubation. 4 of them had wide neck circumference with other associated risk factors. Among the studied parameters, neck mobility (66.7%) followed by neck circumference (44.4%) and Mallampati grading (37.5%) were found to be more predictive in assessing the airway.

Maximum (62.5%) patients were intubated through direct laryngoscopy, followed by bougie in 21.9% patients. Due to difficulty in intubation, 15.6% patients were intubated through videolaryngoscopy (Table 4). The trachea was intubated in all cases. There were no complications.

DISCUSSION

One of the common causes of airway obstruction (compression or tracheal deviation) is goiter, which can lead to difficulty in intubation.³ However, not all goiters cause the same; it depends upon the size, duration, pathological

Table 1: Neck circumference of patients

Neck circumference	Number of patients	Percentage
<39.5 cm	23	71.9
≥39.5 cm	9	28.1
Total	32	100

Table 2: Neck mobility of patients

Neck mobility	Number of patients	Percentage
>90°	27	84.4
80–90°	2	6.2
<80°	3	9.4
Total	32	100

Table 3: Percentage of difficult intubation in high-risk parameters

Parameters	Difficult intubation (%)	No difficult intubation (%)	Total
BMI>30 kg/m ²	0	2 (100)	2
Mouth opening <3 fingers	2 (40)	3 (60)	5
Mallampati Grade 3 and IV	3 (37.5)	5 (62.5)	8
Thyromental distance <6.5 cm	1 (16.7)	5 (83.3)	6
Neck circumference (≥39.5 cm)	4 (44.4)	5 (55.6)	9
Neck mobility <80°	2 (66.7)	1 (33.3)	3
Cormack and Lehane (Grades 3 and 4)	2 (33.3)	4 (66.7)	6
Significant tracheal deviation	0	2 (100)	2

Table 4: Mode of intubation in patients

Mode of intubation	Number of patients	Percentage
Direct laryngoscopy	20	62.5
Bougie	7	21.9
Videolaryngoscopy	5	15.6
Total	32	100

type, or its invasion into the surrounding tissues.³ Hence, a pre-operative assessment of the airway is necessary to avoid failure in intubation.

People are classified as underweight (<18.5 kg/m²), normal (18.5–24.9 kg/m²), overweight (25–29.9 kg/m²), obese (30–34.9 kg/m²), and morbidly obese (>35 kg/m²) according to body mass index.⁴ Uribe et al., in their study found that based on BMI, difficult intubation was noted in underweight, followed by morbidly obese and obese patients. However, they concluded that BMI is a reliable indicator of difficult intubation in males only.⁴ On the other hand, there are studies that show conflicting results regarding correlation of BMI and difficult intubation. Lundström et al., in their study stated that although weak,

high BMI is a statistically significant predictor of difficult and failed intubation.⁵ Ezri et al., found that BMI has no role in deciding the difficulty of laryngoscopy.⁶ The present study had no underweight or morbidly obese patients and no difficulty in intubation was experienced in the two obese patients.

Mouth opening can be measured as an inter-incisor gap, which is the distance between upper and lower incisors at maximum mouth opening. It can also be assessed using fingerbreadths.¹ A gap of >5 cm is considered as normal with no difficulty during laryngoscopy.⁷ This gap implies to 3 fingerbreadths. A distance of <3 cm is considered as a non-reassuring sign.¹ A limited forward movement of mandible adds in more difficulty.⁷ 15.6% patients in our study had <3 fingerbreadths of mouth opening. However, only 2 patients had difficulty in intubation.

Mallampati grading classifies airway according to the structures seen while opening the mouth. Class I: soft palate, fauces, uvula, pillars; Class II: soft palate, fauces, uvula; Class III: soft palate, base of uvula; Class IV: soft palate not visible at all (Figure 1).⁸ Classes III and IV are considered to be at risk for intubation.⁸ In the present study, 5 patients fall under Class III and 3 under Class IV, but difficult intubation was noted in only 3 (37.5%) patients with risk. 14.6% patients with Grade 3 and 44.4% patients with Grade 4 Mallampati had difficulty in intubation in a study by Uribe et al. They concluded that Mallampati score is a strong predictor of difficult airway.⁴ A meta-analysis by Wang et al., also considered a score of more than III to be associated with increased risk for difficult intubation.⁹

Thyromental distance is the straight distance measured between the thyroid notch and the bony point of the mentum and approximated to the nearest 0.5 cm.⁷ It has 83% sensitivity and 99% specificity. A size of <6.5 cm is considered as risk factor for difficult intubation.¹ 16.7% patients had difficult airway in our study with thyromental distance of <6.5 cm. Amathieu et al., in their study found 26.7% patients of <6.5 cm thyromental distance to be associated with increased risk of intubation.² Another study by Savva found that 15.7% of patients with thyromental distance of <6.5 cm had difficult intubation.⁷

Neck examination of the patient is must during airway assessment for intubation. The presence of any mass in the neck, neck circumference, and mobility of the neck is of importance for assessment.¹⁰ History of tracheostomy and presence of hoarseness or stridor should be ruled out.¹⁰ Neck circumference is measured at the level of thyroid cartilage and assessment of the same pre-operatively helps in the prediction of a difficult intubation.¹¹ In a study conducted by Ezri et al., they found that the increase in the soft-tissue

thickness at the level of the suprasternal notch and the vocal cord in obese patients restricted the anterior movement of pharyngeal structures, and hence making it difficult to perform laryngoscopy and intubation.⁶ Gonzalez et al., in their study mentioned that increasing neck circumference results in increased risk of difficult intubation.¹¹ 44.4% of the patients with neck circumference ≥ 39.5 cm in our study had difficult intubation. Mobility of the neck should also be assessed to achieve cervical flexion and atlanto-occipital extension during intubation.¹ In the present study, 66.7% of patients with neck extension $< 80^\circ$ had difficult intubation. 23.6% of patients with short neck and 23.8% with decreased mobility ($< 80^\circ$) had difficulty during intubation in a study by Amathieu et al.² Restricted neck mobility is considered an adverse factor for intubation by Mallampati et al.¹²

Cormack and Lehane graded the laryngoscopic view into Grade 1: Full view of glottis; Grade 2: Only posterior commissure visible; Grade 3: Only tip of epiglottis visible; Grade 4: No glottic structure visible (Figure 2).¹⁰ Grades 3 and 4 are considered as risk factors for intubation.¹¹ 33.3% patients with Grades 3 and 4 in the present study faced difficulty in intubation. A study by Bouaggad et al., found 37.5% of patients belonging to Grades 3 and 4 to be having difficulty in intubation, which was in concordance to our study.¹³

Tracheal compression or deviation can be identified in chest X-rays which helps us in deciding the technique to be used for intubation. It also helps in identifying distal obstruction, airway collapse, or gas trapping.¹ X-ray of the

neck in lateral view helps us to assess the airway in case of any foreign body or obstruction within the airway. It helps in the identification of the nature and level of obstruction. Space of < 5 mm between the C1 spinous process and the occiput is considered as difficult intubation.¹ In our study, significant tracheal deviation did not possess any difficulty during intubation. Amathieu et al., in their study observed tracheal deviation on the chest X-ray in 38 cases, but none of them were associated with difficult intubation.²

In our study, all the study participants were primarily tried to intubate in the conventional manner using Machintosh laryngoscope. In the cases where difficult intubation was encountered, they were intubated using videolaryngoscopy.

Bouaggad et al., found the overall rate of difficult intubation during thyroidectomy to be 5.3%.² Another study by Amathieu et al., found the rate to be 11.1%.¹³ This was almost similar to our study, where the rate was 15.6%.

Limitations of the study

There were few limitations in our study. The size of goiter was not measured and its pathological type was not studied in evaluating the airway; malignant goiter can invade the surrounding structures including the trachea resulting in difficult airway. There was no control group, so it could not be concluded that the studied predictive risk factors for difficult intubation are specific to goiter. Due to the small sample size, the results could not be applied to a large section of the population. Finally, there was no record of previous difficult intubation.

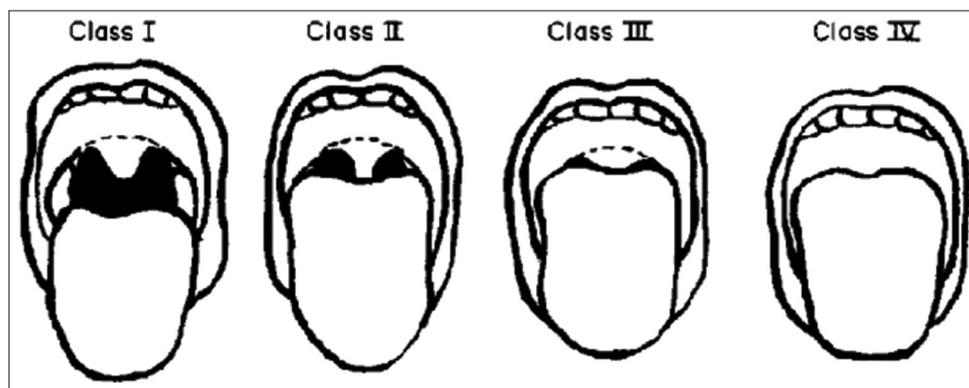


Figure 1: Pictorial representation of structures seen in various Mallampati classes

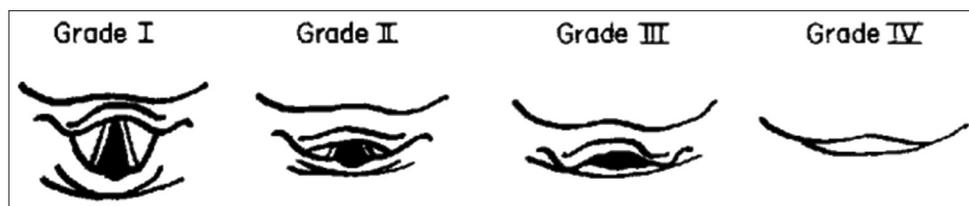


Figure 2: Laryngoscopic views of Cormack-Lehane grades

CONCLUSION

We conclude that induction of anesthesia can be challenging for patients with thyroid swelling. A thorough history and examination are mandatory pre-operatively in patients with goiter. A single predictive factor cannot determine the risk of intubation; however, a combination helps in better assessment. Neck circumference and neck mobility are the most crucial factors as evident in our study. The technique of induction of anesthesia and endotracheal intubation should be adapted according to individual patients' symptoms and anatomical and radiological variations. Videolaryngoscopy is a viable technique in patients with difficult airway. Pre-operative assessment and planning can reduce the incidence of failed intubation to zero.

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Authors Contribution:

JB - Definition of intellectual content, manuscript preparation; **AS** - Clinical protocol, Literature survey, prepared the first draft of manuscript, editing and manuscript revision; **MU** - Implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article; **TKT** - Review manuscript; **RB** - Concept and design, coordination and manuscript revision.

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