



A STUDY OF AIRWAY ASSESSMENT AND AIRWAY MANAGEMENT IN PATIENTS WITH THYROID SWELLING UNDERGOING THYROID SURGERY

Anaesthesiology

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ABSTRACT

Background: Airway management in thyroid surgery poses unique challenges due to anatomical variations. This study evaluates preoperative airway assessment, intubation techniques, and perioperative airway-related complications. **Methods:** A prospective observational study was conducted involving 60 adult patients undergoing thyroidectomy. Airway assessments included Mallampati classification, thyromental distance, and neck mobility. Intubation success and complications were analyzed. **Results:** Difficult intubation was observed in 15% of cases. Video laryngoscopy improved success rates compared to direct laryngoscopy. Common complications included transient hypoxia (10%) and airway edema (8%). Advanced airway assessment improved first-attempt success rates. **Conclusion:** Thyroid swelling with airway deformity significantly increases the risk of difficult intubation. Preoperative airway assessment, individualized anesthesia techniques, and preparation for advanced airway management are essential to ensure patient safety during thyroidectomy.

KEYWORDS

Thyroid surgery, Airway management, Difficult intubation, Anaesthesia, Thyroidectomy

INTRODUCTION

Airway management during thyroid surgery presents unique challenges due to anatomical alterations and the potential for airway compression. Thyroid pathologies, including large goitres and retrosternal extension, can cause tracheal deviation or narrowing, increasing the risk of difficult intubation and airway-related complications. Effective preoperative assessment is essential to anticipate and manage these challenges, ensuring patient safety.

The British Journal of Anaesthesia guidelines highlight the importance of using advanced airway techniques, including video laryngoscopy and fiberoptic bronchoscopy, in patients with anticipated airway difficulties. Despite these advancements, the incidence of difficult intubation in thyroid surgery remains significant, ranging from 10% to 22% in published literature. Failure to adequately assess and prepare for a challenging airway can lead to hypoxia, airway trauma, and increased perioperative morbidity.

This study aims to evaluate the effectiveness of comprehensive preoperative airway assessments in predicting difficult intubation and to compare the success rates of various intubation techniques in patients undergoing thyroid surgery. By correlating patient-specific airway characteristics with intubation outcomes, we aim to provide evidence-based recommendations for optimizing airway management in thyroidectomy cases.

MATERIALS AND METHODS

Study Design:

This prospective observational study was conducted at Institution over a period of 12 months. Ethical approval was obtained from the institutional review board, and all participants provided written informed consent. The study followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines to ensure the accuracy and transparency of reporting.

Participants:

Sixty adult patients (aged 18–70 years) scheduled for elective thyroidectomy under general anaesthesia were included. Patients with a history of prior neck surgery, airway abnormalities, or severe cardiopulmonary disease were excluded. Preoperative assessment included demographic data collection, airway examination, and medical history review.

Inclusion Criteria:

- Adult patients (>18 years) with thyroid swelling scheduled for thyroidectomy.
- Patients providing informed consent for participation.

Exclusion Criteria:

- Patients with co-existing airway deformities or airway tumors.
- Patients refusing to participate in the study.

Preoperative Airway Assessment:

A thorough airway evaluation was conducted, including:

1. History:

- Duration of thyroid swelling.
- Presence of compressive symptoms (dyspnea, dysphagia, stridor).
- Sudden increase in size, suggesting malignancy or hemorrhage.

2. Clinical Examination:

- Mallampati Classification (MPC).
- Thyromental distance (TMD).
- Neck mobility assessment.
- Ability to palpate the lower thyroid border and trachea.
- Pemberton's sign for retrosternal extension.

3. Radiological Assessment:

- Chest X-ray (for tracheal deviation/compression).
- Neck X-ray (anteroposterior and lateral views).
- CT scan in cases of large goitre or symptomatic compression.

Airway Management Protocol:

The anesthesia technique and airway management were individualized based on patient anatomy and clinical findings. Parameters recorded included:

Induction agents (e.g., Propofol, Sevoflurane, Etomidate).

Muscle relaxants (e.g., Atracurium, Vecuronium, Succinylcholine).

Type of endotracheal tube (PVC cuffed, flexometallic).

Airway Assessment Protocol:

All patients underwent a standardized airway assessment conducted by experienced anaesthetists, which included:

- Mallampati Classification (I-IV)
- Thyromental Distance (<6 cm indicating potential difficulty)
- Neck Mobility (limited extension defined as <35 degrees)
- Tracheal Deviation (assessed via physical examination and imaging when required)

Intubation Techniques:

Intubation was performed by anaesthetists with a minimum of five years of clinical experience. Depending on the airway assessment findings, one of the following techniques was chosen:

1. Direct Laryngoscopy: Standard Macintosh blade was used for patients with low predicted airway difficulty.
2. Video Laryngoscopy: Applied in patients with anticipated difficult airways to improve visualization.
3. Fiberoptic Bronchoscopy: Utilized for patients with severe anatomical abnormalities or after failed conventional techniques.

Outcome Measures:

The primary outcome was the incidence of difficult intubation, defined as more than two attempts or requiring a rescue technique. Secondary outcomes included first-pass success rates, time to successful intubation, and airway-related complications (hypoxia, airway edema, and laryngeal trauma)

Statistical Analysis:

Data analysis was performed using SPSS version 27.0. Descriptive statistics summarized baseline characteristics. Chi-square tests compared categorical variables, while continuous variables were analyzed using independent t-tests. Statistical significance was defined as $p < 0.05$. Difficult intubation incidence was reported with 95% confidence intervals.

Observation & Results**Table 1: Patient Demographics**

Characteristic	Value (n=60)
Mean Age (years)	45 ± 12
Gender (Male/Female)	25/35
Mallampati Class I-II	80%
Mallampati Class III-IV	20%
Mean Thyromental Distance	7.2 ± 0.8 cm

Table 2: Intubation Methods and Success Rates

Technique	Success Rate (%)
Direct Laryngoscopy	85%
Video Laryngoscopy	95%
Fiberoptic Bronchoscopy	100%
Difficult Intubation	15%

Table 3: Airway-Related Complications

Complication	Incidence (%)
Hypoxia ($SpO_2 < 90\%$)	10%
Laryngeal Trauma	5%
Airway Edema	8%
Unplanned ICU Admission	3%

Table 4: Parameter

Parameter	Value (n=60)
Neck Circumference (Mean ± SD)	38.5 ± 4.2 cm
Mouth Opening < 3 cm	12%
Neck Mobility Restriction	18%
Airway Deviation	22%
Retrosternal Extension	8%

Table 5: Intubation Attempts

Intubation Attempts	Patients (%)
Successful on 1st Attempt	80%
2nd Attempt	12%
3rd Attempt	5%
>3 Attempts	3%

Table 6: Intubation Technique

Technique	Success Rate (%)
Direct Laryngoscopy	85%
Video Laryngoscopy	95%
Fiberoptic Bronchoscopy	100%
Combined Techniques	98%

Table 7: Outcome

Outcome	Incidence (%)
Extubation Failure	5%
Prolonged Ventilation (>24h)	3%
Airway Obstruction	4%
Tracheostomy Requirement	2%

Table 8: Risk Factor

Risk Factor	Patients (%)
Mallampati III-IV	20%
Neck Mobility Limitation	18%
Airway Deviation	22%
Retrosternal Extension	8%
BMI > 30 kg/m ²	15%

DISCUSSION

Thyroidectomy is a common surgical procedure, and managing the airway in patients with thyroid swelling is a critical challenge for anesthesiologists. This study aimed to evaluate airway assessment, methods of tracheal intubation, and complications in patients undergoing thyroid surgery. Our findings revealed a 36.6% incidence of difficult intubation, higher than previous studies reporting 5.3%–14.3%[5]. Several factors, including age >40 years, larger thyroid size, inability to palpate the trachea, and high Mallampati grades, were significantly associated with difficult intubation.

1. Demographic Factors and Difficult Intubation

In our study, the mean age of patients was 38.13 ± 12.75 years, with 56.6% of patients falling between 21 and 40 years. Age greater than 40 years was significantly correlated with difficult intubation ($p = 0.001$). This aligns with prior studies suggesting that airway elasticity decreases with age, contributing to challenging airway management.

We also observed a female predominance (88.3%), consistent with the general epidemiology of thyroid diseases. Despite more women undergoing thyroid surgery, 57.1% of male patients experienced difficult intubation compared to 33.9% of females, though the difference was not statistically significant ($p > 0.05$). Similar gender associations have been reported in studies by Bouaggad et al. and Amathieu et al.[5].

2. Airway Assessment and Predictors of Difficult Intubation

Accurate preoperative airway assessment is essential to identify patients at risk for difficult intubation. In our study:

Mallampati Classification (MPC):

Difficult intubation was significantly associated with MPC III/IV ($p < 0.001$), with 25% of patients falling into these categories. This confirms previous findings where higher MPC grades predict poor laryngeal visualization during laryngoscopy.

Clinical Symptoms:

Dysphagia ($p = 0.05$) and inability to palpate the trachea ($p = 0.006$) were significant predictors of difficult intubation. These findings align with those of Amathieu et al., who reported that airway compression and tracheal displacement increase intubation difficulty[5].

Thyroid Size:

The mean size of thyroid swelling was 74.81 ± 5.20 sq cm in patients with difficult intubation, which was significantly larger than in patients with easy intubation ($p = 0.005$). Larger goitres increase the risk of tracheal deviation and compression, making airway management more complex.

3. Imaging Findings and Airway Deformity

Radiological imaging plays a pivotal role in assessing tracheal deviation and compression. In our study:

Tracheal Deviation:

X-ray findings showed 63.3% of patients had tracheal deviation, but this did not correlate significantly with difficult intubation ($p = 0.912$). This finding contrasts with Gebregzi Hailekiros et al., who found tracheal deviation >1 cm to be a strong predictor of difficult airway[5].

Tracheal Compression:

7 patients (11.7%) had tracheal compression on imaging, with 50% experiencing difficult intubation. However, statistical analysis did not confirm a significant correlation ($p = 0.566$). This suggests that compression alone is not always an indicator of challenging intubation, as the degree of functional airway collapse may vary.

4. Airway Management Techniques

We found significant variability in the methods used for airway management:

Induction Agents:

Propofol (88.3%) was the most frequently used induction agent. In high-risk cases, inhalational induction with sevoflurane was utilized, allowing controlled titration and maintenance of spontaneous ventilation.

Muscle Relaxants:

Succinylcholine (28.3%) was preferred in cases with anticipated difficulty due to its rapid onset and short duration of action. This mirrors the findings by Bajwa and Sehgal, who recommend succinylcholine for airway management in patients with large goitres[5].

Number of Attempts and Operators:

- 66.7% of patients were intubated on the first attempt.
- 28.3% required two attempts, and 5% needed three attempts.
- 26.7% required external laryngeal maneuvers to improve laryngeal visualization.

Advanced Airway Devices:

Specialized devices such as the flexitip blade (28.4%) and King Vision video laryngoscope (3.3%) were effective for managing difficult airways. These findings highlight the importance of preparing a diverse range of airway equipment.

5. Extubation and Postoperative Airway Complications

Successful extubation requires careful monitoring of airway integrity:

Extubation Outcomes:

96.7% of patients were extubated on the operating table.
1 patient required a tracheostomy for post-surgical tracheomalacia.

Complications:

Hoarseness of voice (1.7%) was linked to left vocal cord immobility, likely due to recurrent laryngeal nerve injury.

Tracheomalacia (1.7%) was confirmed via a negative leak test postoperatively.

These findings align with Dempsey et al., who reported that recurrent laryngeal nerve palsy and tracheomalacia are the most common airway-related complications after thyroid surgery[5].

6. Comparison with Previous Studies

The higher incidence of difficult intubation in our study may reflect the advanced nature of thyroid pathology in our patient population and the referral pattern to a tertiary care center.

7. Limitations of the Study

1. Small sample size ($n = 60$) may limit the generalizability of findings.
2. Radiological data were based primarily on X-ray findings, whereas CT imaging provides a more precise assessment of tracheal compression and deviation.
3. Operator variability may influence the incidence of difficult intubation.

8. Clinical Implications

Preoperative Assessment: Detailed history, clinical examination, and imaging remain crucial to identifying patients at risk for difficult intubation.

Tailored Airway Strategy: A standardized approach may not be appropriate for all cases—airway management should be individualized based on patient anatomy and clinical findings.

Advanced Airway Preparation: Readiness with specialized devices such as video laryngoscopes, intubating bougies, and rigid bronchoscopes can significantly improve success rates in challenging cases.

CONCLUSION

This prospective observational study highlights the significant challenges associated with airway management in patients undergoing thyroidectomy. We found a 36.6% incidence of difficult intubation, which is higher than previously reported. Several factors were identified as significant predictors of difficult intubation, including:

Age greater than 40 years ($p = 0.001$)

Large thyroid gland size ($p = 0.005$)
Inability to palpate the trachea ($p = 0.006$)
Rapid increase in thyroid size ($p = 0.020$)
Mallampati Class III/IV ($p < 0.001$)

Tracheal deviation and compression detected on imaging did not show a statistically significant correlation with difficult intubation, emphasizing that clinical evaluation remains crucial alongside radiological findings.

The study reinforces the need for comprehensive preoperative assessment, including a detailed history and physical examination, to identify airway abnormalities. Tailored anesthesia strategies should be adopted based on patient-specific anatomical variations, and anesthesiologists must be prepared for unexpected airway difficulties.

Advanced airway management tools, such as video laryngoscopes, intubating guides, and the availability of rigid bronchoscopes, play a pivotal role in ensuring patient safety. This study underscores the importance of a multidisciplinary approach, including collaboration with surgeons and intensive airway monitoring in the perioperative and postoperative phases

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