

Postoperative Airway Complications following Thyroid Surgery

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ABSTRACT

Background: Thyroid surgery is often done for thyroid diseases, such as benign and cancerous thyroid conditions. It is usually safe but if not diagnosed and treated promptly, the postoperative airway complications can be life-threatening. Airway compromise can occur following thyroid surgery as a result of a neck hematoma, laryngeal oedema, recurrent laryngeal nerve palsy, bilateral vocal cord palsy, or tracheomalacia. Identification of high risk patients is important as this will help to avoid morbidity and postoperative complications.

Objective: To determine the frequency, types, associated factors, and outcomes of postoperative airway complications among patients undergoing thyroid surgery.

Methods: This descriptive cross-sectional study was conducted at Tertiary Care Hospital in Rawalpindi, from January 2022 to January 2023. The patients were obtained by non-probability consecutive sampling and form a total of 72 patients who are having thyroid surgery. Patients were included who had undergone hemithyroidectomy, subtotal thyroidectomy, total thyroidectomy, or completion thyroidectomy at any age 18 years or older. A proforma was used to record the data related to demographic, clinical diagnosis, pre-operative airway findings, surgery type, intra-operative data, post-operative airway complications, management and outcomes. The data were analyzed by SPSS version 25. Frequencies were computed for categorical variables and the means and standard deviations were computed for continuous variables. A p value < 0.05 was deemed to be significant.

Results: The mean age of patients was 42.6 ± 12.4 years. Females were more commonly affected, accounting for 53 (73.6%) cases. Multinodular goiter was the most frequent diagnosis, observed in 34 (47.2%) patients, and total thyroidectomy was the most commonly performed procedure. Postoperative airway complications were observed in 11 (15.3%) patients. Recurrent laryngeal nerve palsy was the most common complication, seen in 4 (5.6%) patients, followed by neck hematoma in 3 (4.2%), laryngeal edema in 2 (2.8%), tracheomalacia in 1 (1.4%), and bilateral vocal cord palsy in 1 (1.4%) patient. Airway complications were significantly associated with thyroid size greater than 5 cm, retrosternal extension, tracheal compression, difficult intubation, and longer operative duration.

Conclusion: Postoperative airway complications occurred in a considerable proportion of patients undergoing thyroid surgery. Large goiter, retrosternal extension, tracheal compression, difficult intubation, and prolonged surgery were important risk factors. Careful preoperative airway assessment, meticulous surgical technique, secure hemostasis, and close postoperative monitoring are essential to prevent serious airway-related morbidity after thyroid surgery.

Keywords: Thyroidectomy, airway complications, recurrent laryngeal nerve palsy, neck hematoma, tracheomalacia, postoperative complications.

INTRODUCTION

Thyroid surgery is one of the most common endocrine surgeries in the world. It is usually performed on patients who have multinodular goiter, solitary thyroid nodule, Graves' disease, recurrent goiter, or thyroid malignancy. With advances in surgical technique, adequate anesthetics, peri-op monitoring, and post-op care, thyroid surgery is not all that dangerous. But air way complications are a large concern as they can progress quickly and may be life-threatening if immediate action is not taken¹⁻³.

Thyroid surgery may lead to postoperative airway compromise in a variety of ways. These are neck hematoma, laryngeal oedema, injury to the recurrent laryngeal nerves, bilateral vocal cord paralysis, tracheomalacia and compression due to postoperative swelling. Neck hematoma is especially serious as bleeding within the closed cervical space can compress the trachea and cause sudden respiratory deterioration. Likewise, recurrent laryngeal nerve palsy can cause vocal cord immobility and acute upper airway obstruction. Although these complications are not very common, their consequences can be severe⁴⁻⁶.

Patient and surgical factors play a role in the risk for airway complications. Postoperative airways complications are more likely to occur in patients with large thyroid size, long-standing goiter, retrosternal extension, tracheal deviation, tracheal compression, thyroid malignancy, previous surgery, difficult intubation, and prolonged operating time. Intubation and extubation, as well as

postoperative recovery, may be more difficult in patients with large or retrosternal goiters who already may have some pre-existing abnormalities of the airway before surgery. Hence, careful pre-op evaluation is essential to determine those in which special planning of the airway is required⁷⁻⁹.

Other major complications of thyroid surgery are recurrent laryngeal nerve injury and thyroid surgery in the neck. It can manifest through weak voice, hoarseness of voice, aspiration or cough that is not effective or respiratory distress, in bilateral cases. The risk is increased with large surgery, a history of thyroid problems, cancer, distorted anatomy, and challenging dissection. Recurrent laryngeal nerve is a nerve commonly injured during surgery; routine identification and preservation of this nerve during surgery is important to reduce the incidence of injury. Preoperatively, laryngoscopy can be useful in some patients, particularly those with voice changes, history of thyroid surgery, suspected malignancy and large goiter¹⁰⁻¹².

Tracheomalacia is a very uncommon but clinically important airway complication of thyroid surgery. It can happen in a patient with a large goiter present for a long time, which is compressing the wall of the trachea. If the thyroid gland is removed, it could cause the trachea (windpipe) to collapse, causing an obstruction of the air passage. Though rare, it must be ruled out in patients who have a large goiter, which extends behind the sternum, and is found on X-ray to cause significant narrowing of the trachea¹³.

After thyroid surgery, it is important to monitor the patient early after surgery, as many complications of the airways occur within the first few hours after surgery. Neck swelling, stridor, dyspnea, oxygen desaturation, restlessness, voice change and

Received on 12-08-2023

Accepted on 29-12-2023

tension in the wound should be recognized as warning signs. Early recognition and prompt intervention such as oxygen therapy, steroids, nebulisation, opening the wound, evacuation of haematoma, re-intubation, intensive care support or tracheostomy, can avert any significant morbidity or mortality¹⁴.

In local clinical settings, many patients present with large goiters, delayed diagnosis, compressive symptoms, and limited preoperative airway evaluation. These factors may increase the risk of postoperative airway-related complications. Despite the importance of this issue, local data regarding the frequency and associated factors of postoperative airway complications following thyroid surgery remain limited. Therefore, the present study was conducted to determine the frequency, types, associated factors, and outcomes of postoperative airway complications among patients undergoing thyroid surgery.

MATERIALS AND METHODS

This study was conducted in the Department of Surgery at a Tertiary Care Hospital in Rawalpindi. The duration of the study was one year, from January 2022 to January 2023. The study was carried out to determine the frequency, types, risk factors, management, and outcomes of postoperative airway complications among patients undergoing thyroid surgery.

The study used descriptive cross-sectional study design. A total of 72 patients, who were operated on for thyroid disease during the study period, were included. Non-probability consecutive sampling technique was used for selecting patients. Patients who met the inclusion criteria were all enrolled and informed consent was obtained. Prior to data collection, ethical approval of the institutional ethical review committee was obtained.

Patients of both genders, aged 18 years and above, who underwent thyroid surgery for benign or malignant thyroid disease were included in the study. These consisted of hemithyroidectomy patients, subtotal, total and completion thyroidectomy patients. Patients excluded from the study included those with incomplete medical records, those already intubated prior to surgery for reasons other than thyroid surgery, and patients who were undergoing emergency surgery for non-thyroid surgery.

A detailed history and clinical examination was carried out before surgery for each patient. Demographic data (age, gender, BMI, area of residence and smoking status) were collected. The clinical history included: duration of neck swelling, dysphagia, dyspnea, voice changes, stridor, past thyroid surgery, and thyroid dysfunction. Other comorbidities including diabetes mellitus, hypertension, ischemic heart disease, asthma, chronic obstructive pulmonary disease, obesity and obstructive sleep apnea were also recorded.

All patients were routinely assessed preoperatively. Thyroid function tests, complete blood count, renal function tests, serum electrolytes, coagulation profile, viral markers, and other investigations to determine an anesthesiologist's fitness were carried out as indicated. A neck ultrasonography was performed to evaluate thyroid size, nodularity and local extension. Fine-needle aspiration cytology was done as indicated. Computed tomography of the neck and chest was recommended when clinically indicated, especially in patients with large goiter, retrosternal extension or suspected tracheal compression and tracheal deviation. Vocal cord movement was evaluated preoperatively in selected patients, including those with voice change, recurrent goiter, malignant thyroid disease or previous thyroid surgery, using indirect laryngoscopy or flexible laryngoscopy.

Preoperative findings pertaining to the airways were meticulously documented. These comprised tracheal deviation, tracheal compression, retrosternal extension, preoperative hoarseness of voice, preoperative vocal cord palsy, and expected difficult intubation. Airway difficulty was assessed clinically with standard anesthesia parameters and anesthesia assessment was done prior to surgery.

The surgical procedures were carried out by the surgical team under general anesthesia in accordance with standard

surgical procedures. The choice of surgery was determined based on the clinical diagnosis, cytology report, size of the thyroid glands, the lateral involvement of disease, and the suspicion of malignancy. Surgical procedures performed included hemithyroidectomy, subtotal thyroidectomy, total thyroidectomy and completion thyroidectomy. Intraoperative observations included large goiter, retrosternal extension, difficulty dissection, identification of recurrent laryngeal nerves, estimated blood loss, duration of the operation and placement of a drain. Hemostasis was meticulously achieved before closure.

Post surgery patients were transferred to recovery room and then to surgical ward/Intensive Care Unit depending on clinical conditions. During the early postoperative period, all patients were carefully followed for evidence of airway compromise. Significant attention was paid to the presence of neck swelling, difficulty breathing, stridor, oxygen saturation, voice change, feeding difficulties, tension along the wound and drain output. The surgical/Anesthetist team evaluated all patients with suspected airway compromise immediately.

Postoperative airway complications (presence or absence) was the primary outcome variable. Postoperative airway complications were defined as any airway or respiratory problems after the thyroid surgery that required observation, medical treatment, airway support or surgical intervention. Neck hematoma with airway compression, laryngeal edema, tracheomalacia, recurrent laryngeal nerve palsy, bilateral vocal cord palsy, stridor, respiratory distress, re-intubation, need for hematoma evacuation, and admission to the intensive care unit (ICU) were all complications. The complications were neck hematoma with airway compression, laryngeal edema, tracheomalacia, recurrent laryngeal nerve palsy, bilateral vocal cord palsy, stridor, respiratory distress, re-intubation, need for hematoma evacuation, and admission to the intensive care unit (ICU).

The onset of postoperative complications of the airway was also documented and classified as early (within 6 hours), 6 to 24 hours, or >24 hours after the surgery. Airway complications were recorded, such as observation, use of oxygen, nebulisation, steroid treatment, opening of the airway, evacuation of a hematoma, re-intubation, admission to an intensive care unit and tracheostomy. Patient outcomes, including recovery without major intervention, hospital stay, reoperation, hospital readmission, and mortality, were also mentioned.

A structured proforma was used to collect data. Patient's demographic, clinical diagnosis, surgery type, pre-op airway findings, intra-op findings, post-op airway findings, airway management, and final airway outcome were among the collected information. All patient information was kept confidential and patient data were only used for research.

SPSS version 25 was used to enter and analyze data. The statistics used for quantitative variables were mean and standard deviation (age, BMI, operative time and hospital stay). Qualitative variables, e.g. gender, type of thyroid disease, type of surgery, airway finding on preoperative FNA biopsy, and postoperative complications were analyzed as frequencies and percentages. Patients were randomly assigned to two groups: one group had airway complications after the surgery and the other group did not have airway complications after surgery. For categorical variables, the chi-square test or Fisher's exact test was used, as appropriate, and for continuous variables, the independent sample t-test was used. A p value of less than 0.05 was chosen as the criterion for statistical significance.

RESULTS

The study included 72 patients who have been operated on the thyroid gland. Patients' mean age was 42.6 ± 12.4 years with a range from 18 to 70 years. The patients were mostly aged between 31 and 50 years. There were 53 female patients (73.6%) and 19 male patients (26.4%). The mean body mass index was 26.8 ± 4.1 kg/m².

The most frequent indication for surgery was multinodular goiter (34, 47.2%) followed by solitary thyroid nodule (16, 22.2%). Eight (11.1%) patients had Graves' disease, and 10 (13.9%) patients had thyroid malignancy. 4 (5.6%) patients had recurrent goiter. Most patients had their thyroids completely removed.

All patients had the following airway related findings recorded preoperatively. In 15 patients (20.8%), deviation of trachea was found and in 9 patients (12.5%) tracheal compression was seen. In 7 (9.7%) cases, there was resternal extension. 6 (8.3%) patients complained of a change in their voice before surgery and 5 (6.9%) had trouble with intubating.

In 11 (15.3%) patients, postoperative airway complication was noted and 61 (84.7%) patients did not have any airway related complication. Recurrent laryngeal nerve palsy occurred in 4 (5.6%) patients and neck haematoma in 3 (4.2%) patients. Laryngeal edema was discovered in 2 (2.8%) patients. One (1.4%) patient developed tracheomalacia and bilateral vocal cord palsy.

The majority of the airway complications were related to the early postoperative period. Of the 11 patients with an airway complication, 6 (54.5%) experienced symptoms within the first 6 hours after surgery, 3 (27.3%) within 6 to 24 hours and 2 (18.2%) after 24 hours.

The mean hospital stay was longer for patients who developed postoperative airways complications than for those who did not develop complications. The mean hospital duration was 5.1 ± 1.8 days in the patients with airway complications and 2.6 ± 1.1 days in the patients without airway complications. This difference was significant statistically with p-value <0.001.

On statistical analysis, postoperative airway complications were significantly associated with thyroid size greater than 5 cm, retrosternal extension, tracheal compression, difficult intubation, and longer operative duration. Age, gender, type of thyroid surgery, and malignancy showed no statistically significant association with postoperative airway complications.

Overall, the majority of patients recovered without major airway-related morbidity. However, patients with large goiters, retrosternal extension, tracheal compression, and difficult airway management had a higher risk of postoperative airway compromise and required closer postoperative monitoring.

Table 1: Demographic characteristics of patients undergoing thyroid surgery

Variable	Frequency / Mean	Percentage
Total patients	72	100
Mean age	42.6 ± 12.4 years	—
18–30 years	14	19.4
31–50 years	39	54.2
>50 years	19	26.4
Male	19	26.4
Female	53	73.6
Mean BMI	26.8 ± 4.1 kg/m ²	—

Table 2: Clinical diagnosis and type of thyroid surgery

Variable	Frequency	Percentage
Clinical diagnosis		
Multinodular goiter	34	47.2
Solitary thyroid nodule	16	22.2
Graves' disease	8	11.1
Thyroid malignancy	10	13.9
Recurrent goiter	4	5.6
Type of surgery		
Hemithyroidectomy	18	25.0
Subtotal thyroidectomy	9	12.5
Total thyroidectomy	39	54.2
Completion thyroidectomy	6	8.3

Table 3: Preoperative airway-related findings

Finding	Frequency	Percentage
Tracheal deviation	15	20.8
Tracheal compression	9	12.5
Retrosternal extension	7	9.7
Preoperative hoarseness of voice	6	8.3
Preoperative vocal cord palsy	3	4.2
Difficult intubation	5	6.9

Table 4: Frequency of postoperative airway complications

Postoperative airway complication	Frequency	Percentage
No airway complication	61	84.7
Any airway complication	11	15.3
Recurrent laryngeal nerve palsy	4	5.6
Neck hematoma	3	4.2
Laryngeal edema	2	2.8
Tracheomalacia	1	1.4
Bilateral vocal cord palsy	1	1.4
Stridor/respiratory distress	5	6.9

Table 5: Timing and management of postoperative airway complications

Variable	Frequency	Percentage
Timing of complication among 11 cases		
Within 6 hours	6	54.5
6–24 hours	3	27.3
After 24 hours	2	18.2
Management required		
Oxygen support and observation	4	36.4
Steroids/nebulization	3	27.3
Hematoma evacuation	2	18.2
Re-intubation	1	9.1
Tracheostomy	1	9.1
ICU admission	3	27.3

Table 6: Association of selected factors with postoperative airway complications

Variable	Airway complication present n=11	No airway complication n=61	p-value
Mean age	48.3 ± 11.6 years	41.5 ± 12.3 years	0.091
Male gender	4 (36.4%)	15 (24.6%)	0.462
Thyroid size >5 cm	7 (63.6%)	18 (29.5%)	0.028
Retrosternal extension	4 (36.4%)	3 (4.9%)	0.006
Tracheal compression	5 (45.5%)	4 (6.6%)	0.002
Difficult intubation	3 (27.3%)	2 (3.3%)	0.015
Total/completion thyroidectomy	9 (81.8%)	36 (59.0%)	0.194
Thyroid malignancy	3 (27.3%)	7 (11.5%)	0.171
Mean operative time	124.5 ± 28.6 min	96.8 ± 24.2 min	0.001
Mean hospital stay	5.1 ± 1.8 days	2.6 ± 1.1 days	<0.001

Figure 1: Frequency of Postoperative Airway Complications Following Thyroid Surgery

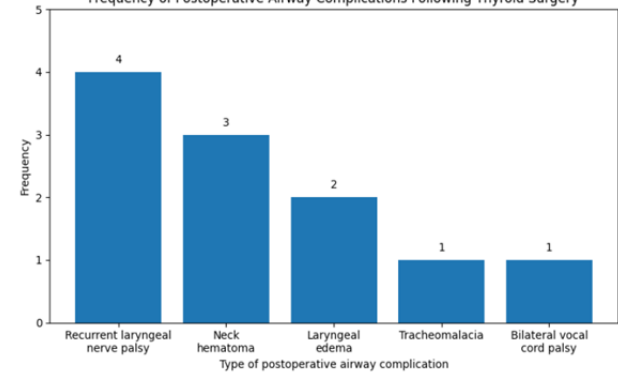


Figure 1: Shows that recurrent laryngeal nerve palsy was the most frequent postoperative airway complication, followed by neck hematoma and laryngeal edema. Tracheomalacia and bilateral vocal cord palsy were less commonly observed.

DISCUSSION

Postoperative airway compromise is one of the most serious complications after thyroid surgery because even a small collection of blood, edema, or vocal cord dysfunction in the confined neck space can rapidly obstruct the airway. In the present study of 72 patients undergoing thyroid surgery, postoperative airway complications were observed in 11 patients, giving an overall

frequency of 15.3%. Although most patients recovered without major morbidity, the findings highlight that airway-related events after thyroidectomy require careful preoperative assessment, meticulous intraoperative technique, and close early postoperative monitoring. The most frequent complication in this study was recurrent laryngeal nerve palsy, followed by neck hematoma and laryngeal edema, while tracheomalacia and bilateral vocal cord palsy were less commonly observed¹⁵.

In the current study, 5.6% of patients were found to have recurrent laryngeal nerve palsy. The clinical significance of this discovery is that injury to the recurrent laryngeal nerve can result in a weak voice, hoarseness, aspiration and acute airway obstruction in bilateral cases. The risk is typically increased in patients who have undergone total thyroidectomy, completion surgery, surgery for malignancy, recurrent goiter, and/or technically challenging dissection. Recurrent laryngeal nerve palsy was more common in the patients who had received large volume surgery on the thyroid and also in the patients with large goiters in the present study. Careful identification of nerves, soft dissection near the tracheoesophageal groove and voice assessment after surgery are important. Preoperative laryngoscopy is also helpful in patients with voice change, history of previous thyroid surgery, malignancy and large goiter as it allows for the detection of pre-existing vocal cord dysfunction prior to surgical intervention^{16,17}.

A total of 4.2% of patients had a neck hematoma. Hematoma occurs less often than some other complications associated with thyroid surgery, but is one of the most serious complications because it can compress the trachea leading to sudden shortness of breath. Most of the airway complications were seen in the first 6 hours after surgery in this study, this is consistent with clinical observation that early postoperative monitoring is very important after thyroidectomy. The risk of hematoma following thyroid surgery could be associated with the failure of hemostasis, hypertension following extubation, large thyroid size, Graves' disease, use of anti-coagulants and bilateral surgeries. Large size of thyroid gland, retrosternal extension, tracheal compression, difficult intubation, and longer operation time were significantly associated with greater incidence of airway complications in the present study. This study indicates that early discharge should not be implemented for patients with difficult anatomy and careful observation should be done during the immediate postoperative period^{18,19}.

Less common, but important, complications in this study were laryngeal edema, tracheomalacia, and bilateral vocal cord palsy. Laryngoedema can happen when the airway is handled badly during intubation, particularly during long procedures, or if a difficult airway is used, or if surgery is performed around the larynx. Tracheomalacia is typically a complication of chronic compression of the voice box (trachea) from long-standing large goiters, which causes weakness of the tracheal wall. It is unusual, but can result in a failure to open the airway post-thyroid surgery. During our study we had one patient who developed tracheomalacia and another who developed bilateral vocal cord palsy and both needed immediate airway assistance. These results highlight the importance of large size, retrosternal extension and radiological signs of narrowing of the trachea as predictors of postoperative airway compromise²⁰.

Airway complications were associated with both thyroid size > 5 cm and retrosternal extension of the thyroid, both tracheal compression and difficult intubation, statistically significantly so, and with longer operative time. This may lead to distortion of normal anatomy, displacement of the trachea, increased vascularity and difficulties with identification of the recurrent laryngeal nerves in larger thyroid glands. Extension of the sternum and compression of the trachea can also make it harder to induce, intubate, extubate, and maintain an airway after surgery. Prolonged surgery may be related to difficult dissection, increased tissue movement and increased postoperative swelling. These findings reinforce the need for a surgeon-anesthetist team to plan the surgery for high-risk thyroid surgeries.

The present study also demonstrated that the hospital stay was significantly longer in patients with the airway complications than in those without airway complications. This is normal as airway compromise is likely to necessitate oxygen therapy, steroids, nebulization, wound exploration, evacuation of a hematoma, re-intubation, admission to the intensive care unit or tracheostomy. The risk of poor outcomes, costs of treatment, and anxiety for patients can also be raised with an increased hospital stay and airway complications. So the prevention approach is the most important one. The selection of candidates, careful preoperative assessment of the airway, correction of poorly controlled hypertension, meticulous surgical hemostasis, protection of the recurrent laryngeal nerve, smooth extubation, and close observation for the first 24 hours are all the critical stages to avoid postoperative airway related morbidity.

The present study has certain limitations. It was performed on a relatively small number of patients (n = 72) and was a single center experience, potentially limiting the generalizability of results. However, long-term follow-up of patients with recurrent laryngeal nerve palsy was not performed; thus, it was not possible to clearly distinguish temporary and permanent nerve damage. Furthermore, sophisticated instruments like regular intraoperative Nerve Monitoring were not evaluated. Because of the small sample size, lack of standardized preoperative laryngoscopy, radiological airway evaluation and short follow-up in the current multicenter study, further studies with larger sample size are recommended to better define the range of predictors of airway complications following thyroid surgery.

CONCLUSION

Postoperative airway complications were observed in a notable proportion of patients undergoing thyroid surgery. Recurrent laryngeal nerve palsy was the most common complication, followed by neck hematoma and laryngeal edema. Large thyroid size, retrosternal extension, tracheal compression, difficult intubation, and longer operative duration were significantly associated with postoperative airway complications. Careful preoperative airway evaluation, meticulous surgical technique, secure hemostasis, recurrent laryngeal nerve protection, and close monitoring during the early postoperative period are essential to reduce airway-related morbidity after thyroid surgery.

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This article may be cited as: Khan M. H., Zaheer A. B., Balouch V., Aslam M., Latif G., Shahwar D. I, Postoperative Airway Complications following Thyroid Surgery. *Pak J Med Health Sci*, 2023; 18(1): 946-950.