

## ORIGINAL RESEARCH

# Postoperative Complications of Thyroid Surgery: A Corroborative Study with an Overview of Evolution of Thyroid Surgery

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## ABSTRACT

**Background:** To study the frequency of postoperative complications after thyroid surgery indicated for various benign and malignant lesions and to corroborate the results in relation to the extent of surgery and a clinical overview of evolution of thyroid surgery.

**Materials and methods:** An analytical study was carried out at a tertiary care center over a period of 3 years from January 2011 to December 2013. Data were collected from 80 patients who underwent thyroidectomies for various thyroid diseases at this center.

**Results:** Hemithyroidectomy, isthmusectomy, subtotal, near-total, and total thyroidectomies were performed in 36 (45%), 6 (7.5%), 8 (10%), 10 (12.5%), and 20 (25%) cases respectively. The overall postoperative complication rate was 20%. Postoperative hypocalcemia and recurrent laryngeal nerve injury were the most common complications. Permanent hypocalcemia and permanent recurrent laryngeal nerve injury were observed in 3.75 and 2.5% of all operated cases respectively. The less common complications were wound hematoma, seroma formation, and superior laryngeal nerve injury. There was no mortality observed in our series.

**Conclusion:** The overall complication rate can be minimized by operating in a bloodless field, doing a meticulous dissection, and correctly identifying and preserving recurrent and superior laryngeal nerves along with parathyroid glands, if feasible.

**Keywords:** Hypocalcemia, Hypoparathyroidism, Hypothyroidism, Recurrent laryngeal nerve injury, Superior laryngeal nerve injury (SLNI), Thyroidectomy.

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## INTRODUCTION

Disorders of the thyroid gland count as the second most common endocrine disorders trailing diabetes mellitus.<sup>1</sup> Thyroid disorders warranting surgical intervention can be either benign tumors or malignant ones. Another reason for thyroid surgery is the swelling or enlargement of thyroid in the form of nodular or colloid goiter, when enlarged, causing difficulties in breathing, voice production, and swallowing. Thyroidectomy is also indicated in cases where an enlarged thyroid gland exhibits toxic symptoms, or where there is a high index of suspicion of malignancy, albeit cosmesis is the most common indication.<sup>2</sup> The type of thyroidectomy is contingent upon the benign or malignant features of lesion, size of the lesion, and degree of impairment.<sup>3</sup> During the eighteenth century, the mortality rate of thyroid surgery was as high as 40% from hemorrhage and sepsis.<sup>4</sup> The advent of modern antiseptic, anesthetic facilities and improved surgical techniques along with better hemostatic and surgical instrumentation during the last century has tremendously contributed to the very low morbidity and mortality rates of modern thyroid surgery. Major postoperative complications of thyroid surgeries include wound infection, hematoma/hemorrhage causing airway compromise, hypocalcemia, recurrent or superior laryngeal nerve injury, and thyroid storm. Precise knowledge of the intricate anatomic details and meticulous surgical technique are prerequisite determinants for successful outcomes and to keep complications within acceptable limits. Ramirez et al<sup>5</sup> asserted that complications accompanying thyroid surgery are directly proportional to the extent of thyroidectomy and inversely proportional to the surgeon's experience.

The aim of this study was to assess the incidence of different complications of various thyroid surgeries done for benign as well as malignant thyroid disorders in a tertiary care center and to compare it with published data with a brief overview of evolution of thyroid surgery.

## MATERIALS AND METHODS

Between January 2011 and December 2013, 80 cases were operated for benign and malignant thyroid disorders. This analytical study was done to assess

complications after various types of thyroid surgeries indicated for benign as well as malignant thyroid lesions. A thorough preoperative work-up was done in all cases and it included complete ear, nose, and throat (ENT) examination, indirect laryngeal examination, blood tests, thyroid profile, neck ultrasound, and needle aspiration cytology. Special investigations like computed tomography, or magnetic resonance imaging, were done in those cases where there was suspicious consistency, retrosternal extension, and extra large thyroid masses causing compressive symptoms. Patients who presented with hoarseness of voice, respiratory difficulty, and swallowing problems were assessed by laryngoscopic examination and documented.

All surgeries were performed by ENT surgeons. The indication for thyroid surgery was benign in 88.75% and malignant in 11.25% cases. Genuine efforts were exercised in each and every surgery to identify and save recurrent and superior laryngeal nerves. Similarly, measures were taken to visualize and preserve parathyroid glands (at least two). In two cases of accidental parathyroid removal, autotransplantation into ipsilateral sternomastoid muscle was done. In two cases, recurrent laryngeal nerve (RLN) was accidentally transected, which was intraoperatively identified and end-to-end anastomosis was done. The types of surgeries done were total thyroidectomy (TT) with or without neck dissection, near-total thyroidectomy (NTT), subtotal thyroidectomy (STT), hemithyroidectomy, and isthmusectomy. The pathologies observed were colloid goiter, nodular goiter, hyperplastic nodule, and papillary and follicular carcinoma.

Laryngeal endoscopy was done and documented in patients who developed hoarseness postoperatively. Vocal cord dysfunction existing after 6 months was labeled as a permanent paralysis. Serum calcium levels were measured on next postoperative day in all operated cases except isthmusectomy cases. Temporary hypoparathyroidism (HPT) was considered when total serum calcium level was less than 8.5 mg/dL associated with muscle spasms, perioral numbness, and tingling sensation and which responded to exogenous calcium supplementation. Likewise, permanent HPT was considered when hypocalcemia persisted for more than 6 months despite regular calcium and vitamin D supplementation. The patients were followed up regularly for at least 6 to 9 months. This study was approved by the Ethics in Research Committee of the institute.

## RESULTS

This case series consisted of 80 patients who underwent different thyroid surgeries. There were 70 females (87.5%) and 12 males (12.5%) with female-to-male ratio

of 5.83:1, and the mean age was 39.29 years. Preoperative diagnosis of benign and malignant pathologies was made in 88.75 and 11.25% cases respectively. Most common pathological diagnosis observed in our series was colloid goiter (multinodular goiter, MNG) occurring in 47.5% of cases, whereas papillary carcinoma accounting for 8.75% was the commonest malignant lesion (Table 1). Majority of cases presented as obvious neck swelling. One case presented with huge neck swelling MNG causing dysphagia but no distress and underwent uneventful thyroid surgery (Fig. 1), whereas in another case, a patient presented with massive goiter with respiratory distress who had to be intubated and later on TT was done on this MNG pathology (Fig. 2).

The types of thyroid operations done were as follows (Table 2). The commonest operation performed was hemithyroidectomy (45%).

The overall postoperative complication rate was 20%. Hypocalcemia and recurrent laryngeal nerve injury (RLNI) were noted in six cases each and were observed as the most common postoperative complication (Table 3).

Recurrent laryngeal nerve injuries occurred in 7.5% (six cases) of all operated cases and accounted for 37.5% of all complications. All the injuries, whether temporary or permanent, were strictly unilateral. Transient and permanent RLNI occurred in 5 and 2.5%

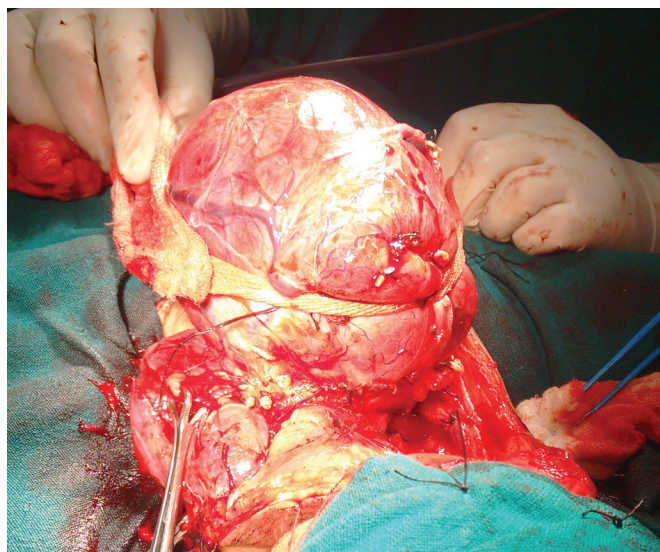
**Table 1:** Thyroid pathology observed in this study

Pathology	Number	Percentage
Colloid goiter	38	47.5
Nodular/MNG	27	33.75
Cyst	2	2.5
Hyperplastic nodule	4	5
Carcinoma	Papillary carcinoma-7 Follicular carcinoma-2	8.75 2.5

MNG: multinodular goiter



**Fig. 1:** Patient with huge MNG presenting with dysphagia with uneventful TT



**Fig. 2:** Patient with large MNG presenting with respiratory distress who was first intubated and, after investigations, underwent uneventful TT

**Table 2:** Type of thyroid operation performed

Type of operation	Number of cases	Percentage
Hemithyroidectomy	36	45
Subtotal thyroidectomy	8	10
Near-total thyroidectomy	10	12.5
Total thyroidectomy (with or without neck dissection)	20	25
Isthmusectomy	6	7.5

**Table 3:** Complications of thyroid surgery

Complications	No	Percentage
Temporary hypocalcemia	3	3.75
Permanent hypocalcemia	3	3.75
Temporary RLNI	4	5
Permanent RLNI	2	2.5
SLN injury	1	1.25
Hematoma formation	1	1.25
Seroma	1	1.25
Tracheal instability	1	1.25

RLNI: recurrent laryngeal nerve injury; SLN: superior laryngeal nerve

cases, respectively. In two cases, transient palsy occurred 2 to 3 weeks after operation and with conservative management and speech therapy it recovered within 2 months after starting treatment. Permanent RLNI occurred in two cases where the first patient underwent NTT for benign pathology, and another patient had TT for benign pathology. In both cases, injury to RLN was identified intraoperatively, and end-to-end anastomosis was done promptly. Laryngoscopic examination of both cases after 6 months showed mild flickering; nevertheless, change in voice quality was inappreciable because of speech therapy given to both cases in postoperative months. None of the permanent RLNI cases was observed in

**Table 4:** Complications seen in surgery done for malignant and benign lesions

	Surgery for malignant lesions	Surgery for benign lesions
Permanent RLNI		2
Temporary RLNI		4
Hematoma		1
SLN injury		1
Permanent HPT	3	
Temporary HPT	3	
Seroma		1
Tracheal instability		1

RLNI: recurrent laryngeal nerve injury; SLN: superior laryngeal nerve

**Table 5:** Complications seen in different thyroid surgeries

	TT	NTT	STT	Hemithyroidectomy	Isthmusectomy
Permanent RLNI	1			1	
Temporary RLNI	2	1		1	
Permanent HPT	3				
Temporary HPT	3				
Hematoma formation				1	
SLN injury	1				
Seroma			1		
Tracheal instability	1				

RLNI: recurrent laryngeal nerve injury; SLN: superior laryngeal nerve; TT: total thyroidectomy; NTT: near-total thyroidectomy; STT: subtotal thyroidectomy

patients operated for malignant lesions. Lesion of external branch of superior laryngeal nerve was suspected in one case as he presented with classic symptoms of vocal fatigue and lowered voice tone and it was endoscopically documented. Transient hypocalcemia was seen in 3.75% of cases, whereas permanent hypocalcemia was observed in 3.75% of all cases. In cases, particularly TT, NTT, and STT, sincere efforts were made to preserve at least two parathyroid glands. One patient developed postoperative hematoma and was reoperated on the 5th postoperative day due to compressive symptoms and ongoing hemorrhage. Other less common postoperative complications observed are tabulated in Table 3. Details of complications according to benign and malignant thyroid pathologies are shown in Table 4. In the benign group, temporary RLNI was the most common complication observed, while permanent HPT was the most common complication observed in cases operated for malignant lesions.

Details of complications for various types of thyroid surgeries are depicted in Table 5. There was no operative mortality observed in this study. A total of nine patients with thyroid malignancy were operated. Papillary carcinoma comprised the majority of cases. Extent of surgery ranged from NTT to TT with central and lateral



neck compartments neck dissection. Tracheal instability was observed in a case operated for huge MNG, although temporary, but the patient required tracheostomy for a week and after that he satisfactorily endured decannulation. Wound infection after thyroid surgery was not observed in our study. None of the cases in our series was operated for hyperthyroidism. There was no postoperative mortality observed in our series.

## DISCUSSION

In 1646, Wilhelm Fabricus recounted the first thyroid surgery done taking advantage of scalpels. Pierre Joseph Desault in 1791, in Paris, did a successful partial thyroidectomy, while Guillaume Dupuytren, in 1808, performed the first TT. In 1821 Johann Hedenus, a German surgeon from Dresden, considered the most successful thyroid surgeon of that time, cited his experiences of six large obstructing goiters removed successfully. The notable advances in surgical practice that occurred in the 1800s assisted in changing the then perspective of thyroid surgery from a bloody and fearsome procedure to a modern and safe surgery. Paramount among those adjuncts were anesthesia, antisepsis, and adequate hemostatic control.<sup>6</sup>

The major breakthrough in surgery came with the crucial introduction of anesthesia, as it was termed by Oliver Wendell Holmes. The introduction of antiseptic techniques by Joseph Lister in 1867 was the second stride in this march of surgical evolution. The decisive step in this surgical evolution was marked by the ability of achieving hemostasis with the help of new surgical instrument introduced by Spencer Wells, who devised a simple, self-retaining arterial forceps in 1872.<sup>6</sup> It was Kocher, widely accepted as “the father of modern thyroid surgery,” whose pioneering work heralded the development of modern thyroid surgery. Kocher performed more than 5,000 thyroid surgeries spanning his vast career and he described initial ligation of inferior thyroid arteries, considerably minimizing the amount of blood loss.<sup>6</sup>

The total rate of complications in our series was 20%, which is in concordance with other studies, that is, 21<sup>7</sup> and 24%.<sup>8</sup> Hematoma formation following thyroidectomy is a rare event occurring in <1 to 2% of all such surgeries.<sup>9</sup> Majority of this feared and life-threatening complications occur within 24 hours after surgery. These cases present with respiratory distress, pain and pressure, dysphagia, and drainage.<sup>10</sup> In our series, only one patient developed hematoma formation on the 5th day, which was immediately explored and evacuated. In the majority of the cases, delayed bleeding is of venous origin; and due to negative pressure on the

large vessels of the neck, it appears on waking or during a bout of cough. To prevent it, it is imperative to check hemostasis circumspectly at the termination of surgery. To be certain whether bloodless bed has been achieved or not, it is advisable to elevate the intrapulmonary pressure to 40 cm H<sub>2</sub>O by performing Valsalva maneuver, which ensures recognition of bleeding vessels.<sup>11</sup>

Injury to SLN, transient or permanent, often goes unnoticed and hence underreported. It was in 1935, after world famous opera singer Amelita Galli-Curci underwent thyroid surgery, with postoperative loss of her upper vocal registry, that the importance of SLN came into existential fact.<sup>6</sup> Injury to SLN will manifest as vocal fatigue, lowered voice tone, and difficulty in singing note intonation.<sup>11</sup> Generally, ligation of superior thyroid vessels near the capsule of the gland avoids injury to the SLN.

Recurrent laryngeal nerve injury (Table 6) remains one of the most debilitating complications in thyroid surgery. Wolfner, while acting as Billroth's first assistant, described the importance of protection of RLN during thyroid surgery. He was the first to bring forth a thorough discussion of RLN anatomy and its potential for operative injury.<sup>6</sup> The incidence of RLNI occurs in 0 to 4% cases, and it depends on the extent of thyroid surgery, presence of Grave's disease, thyroid carcinoma, and need for reoperation.<sup>12,13</sup> The 2.5% incidence of permanent vocal cord palsy observed in our series was in concordance with published data. Extensive surgical excision, preoperative diagnosis of thyroid malignancy, and recurrent goiter are said to be independent risk factors for RLNI as found in a study.<sup>14</sup> In a study, Grave's disease, thyroiditis, recurrent goiter, malignant pathology, and extended thyroid resection were considered independent risk factors on multivariate analysis for temporary RLNI, whereas Grave's disease and recurrent goiter were found to be independent risk factors for permanent RLNI.<sup>15</sup>

Seroma formation, albeit not a serious complication of thyroidectomy, was noted in one patient. Clinically evident seromas respond well to percutaneous aspiration and so did occur in our case, too. The risk of seroma formation increases in direct relation to extent of surgery (bilateral) or thyroidectomy for large goiters.<sup>16</sup>

**Table 6:** Causes of transient recurrent laryngeal paralysis<sup>11</sup>

Excessive nerve skeletalization
Neuritis (due to scarring, myelinic lesion)
Axonal damage due to excessive stretching
“A frigore” or “a calore” paralysis
Injury due to electrocoagulation
Viral neuritis
After difficult intubation

Infections after thyroidectomies are reported as a rarity, and incidences have been noticed to be as low as 0.3<sup>11</sup> or 0.4%<sup>17</sup> in various studies. However, wound infection was not observed in any patient in our series. The use of antibiotics is suggested only when patients have history of severe diabetes, valvular heart diseases, or immunodeficiency. For disinfection and cleaning of the skin, particularly in cases having neoplastic pathology, the use of noniodated disinfectant is advisable so as not to interfere an eventual postsurgical thyroid scan.<sup>11</sup> Patients in whom neck node dissection is planned along with thyroidectomy are prone to developing chylus leak, where there runs a risk of injury to the thoracic duct on the left side and to the lymphatic duct on the right side. Should the leak manifest preoperatively, ligation of the duct must be done. In delayed cases, conservative management in the form of continuous drainage and measures aiming at reducing chyle production must be undertaken.<sup>18</sup>

Postoperative HPT is a serious issue leading to prolonged hospital stay and increased expenditure.<sup>15</sup> The causation of postoperative HPT comprises various factors, with the surgical technique, the devascularization, and unintentional violation of the parathyroid glands being the most significant factors.<sup>19</sup> Wolfner, as Billroth's first assistant, first reported postoperative tetany in 1879. It was Eugene Gley, in 1891, who related it to removal of the parathyroid glands, or to interference with their blood supply.<sup>6</sup> Hypoparathyroidism is considered when the calcium readings are below 7.5 mg/dL or less than 8.5 mg/dL if there are symptoms due to hypocalcemia; if the calcium level remained below 8.5 mg/dL at 1 year, it is considered permanent.<sup>19</sup> The symptoms usually manifest 24 to 48 hours after surgery and occur as paresthesia and numbness over fingertips and perioral area and muscle cramps. In a study, multivariate analysis for temporary HPT, the magnitude of surgical resection, Grave's disease, recurrent goiter, female gender, and specimen weight above 45 gm were observed as independent risk factors, while the extent of surgical resection, Grave's disease, recurrent goiter, and malignant pathology came out as risk factors for permanent HPT.<sup>15</sup> Incidence of permanent HPT was nil in benign disease and 33% in malignant disorders operated in our series. In another study,<sup>20</sup> the high incidence of HPT after thyroidectomy for malignant cases was suggested due to the following reasons:

- Incidences can be overestimated as no effort to discontinue calcium and vitamin D supplementation was made.
- Noncapsular dissection method makes the parathyroid susceptible to devascularization or accidental removal along with thyroid removal leading to high incidence of HPT.
- Central compartment lymphadenectomy in malignant cases exposes risk to blood supply of parathyroids,

particularly if done bilaterally, endangering their vascular supply, which eventually may increase chances of postoperative HPT.

In majority of cases, hypothyroidism is not regarded as a complication of thyroid surgery.<sup>11</sup> More suitably, it should be considered as an expected outcome. In cases of total or completion thyroidectomy, permanent thyroid insufficiency must be expected. The STT may lessen the chances of developing postoperative hypothyroidism; nevertheless, the sound oncologic principles must not be jeopardized by the fear of permanent hypothyroidism.<sup>21</sup> The incidence of postoperative hypothyroidism after NTT in various studies has been reported to be 44<sup>22</sup> to 46.3%.<sup>23</sup> In our series, hypothyroidism was observed only in cases who underwent TT.

Tracheomalacia occurs when the cartilaginous framework of trachea fails to maintain an adequate airway, which can be either due to congenital immaturity of tracheal rings (primary tracheomalacia) or where previously normal cartilage experiences degeneration due to extrinsic compression by enlarged thyroid gland (secondary tracheomalacia).<sup>24</sup> Malpositioning on the operating table may cause rare complications like severe paralysis due to stretching of brachial plexus and also paralysis of ulnar nerve.<sup>11</sup>

Pneumothorax or pneumomediastinum is a very uncommon complication of thyroid surgery and is usually accompanied with extensive surgical procedure that necessitates mediastinal dissection.<sup>25</sup> During difficult thyroidectomies, dissection often extends toward the pleura or mediastinum, so chances of developing pneumothoraces are high where air may escape into cervical fascial planes under low pressure or when pleura is unintentionally breached. However, it bears little clinical significance unless the lung or pleura is perforated. This condition can clinically present in symptomatic cases as having decreased breath sounds or desaturation; therefore if clinical suspicion of airway violation arises, a postoperative chest radiograph is advisable.<sup>21</sup>

Rare complications caused by hyperextension of head during surgery have also been reported which include vertigo, headache, and nausea,<sup>11</sup> and no such complications were observed in our series. Very unusual complications like Claude–Bernard–Horner syndrome and punctiform corneal lesions leading to serious visual damage have also been reported.<sup>11</sup> Hypertrophic scarring or keloid formation is uncommon after thyroid surgery. No such complications were noted in our study.

## CONCLUSION

Conclusively, complications after thyroid surgery depend on patient's condition and presence of comorbidities,

thyroid pathology, surgeon's expertise, and extent of surgery. Hypoparathyroidism and RLNI are the commonest complications observed after thyroidectomies. Attempts must be made to identify and preserve parathyroid glands to avoid HPT. It is of paramount importance for careful postoperative observation and timely intervention should the hypocalcemia develop and manifest. Similarly, recurrent and superior laryngeal nerve injury can be prevented by correctly identifying and following these nerves.

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