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Clinical study of postoperative complications of thyroidectomy

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Abstract
Background: Thyroid surgery is one of the common surgeries performed by general surgeons, Head and neck surgeons, and endocrine surgeons today. The most common complications of thyroid surgery are bleeding, injury to recurrent laryngeal nerves, and parathyroid glands. Other complications include airway obstruction, superior laryngeal nerve injury, infections, and sometimes thyroid crisis. Patients with permanent recurrent laryngeal nerve palsy and hypocalcaemia have life-long problems with a need for continued medication, further surgeries, and rehabilitation. They have a compromised quality of life by an increase in individual's healthcare costs and requiring lifelong alternative therapies.
Objectives: To evaluate the incidence of post thyroidectomy complications. It also intends to evaluate the preoperative and intra-operative factors that contribute to these complications. To assess the modalities to prevent such complications.
Methods: A Prospective study was done from January 2018 to December 2019 on thyroid complications. A total of 78 patients were studied regarding the diagnosis, type of surgery, and the complications in them. The patients were followed up for 1 year.
Results: The majority of patients (59%) were in the 3rd and 4th decade of life age. Female domination more than male. Multinodular goiter is the most common diagnosis. The most common complication was transient Hypocalcaemia (15.38%) and recurrent laryngeal nerve(6.41%). Wound infections in 6.41%and seromas are 2.56%. The incidence of major bleed with respiratory obstruction and thyrotoxicosis is zero. No permanent debilitating complications of RL nerve injury or hypocalcaemia were noted.
Conclusion: A thorough preoperative preparation, with adequate knowledge of Thyroid anatomy and steps of surgery is essential. A clean dissection, meticulous haemostasis and, identification and preservation of Recurrent Laryngeal and Parathyroids can relate to a low rate of complications. Extensive surgeries are associated with a higher rate of complications. Early recognition and prompt treatment of complications enable a better outcome for the patient.

Keywords: thyroidectomy, hypocalcaemia, recurrent laryngeal nerve (RLN), total thyroidectomy (TT), multinodular goiter (MNG)

Introduction
In 925AD the first total thyroidectomy for goiter was reported by Abu al-Qasim [1]. Thyroid surgery in the middle-ages was invariably associated with death due to bleeding and other complications of hypocalcaemia and vocal cord palsy. The reputation of thyroid surgery was so grave that the French Academy of Medical sciences banned it in 1850. In the mid-19th century, thyroid surgery was regarded as a ‘‘proceeding by no means to be thought of’’ in Britain, ‘‘foolhardy’’ in Europe, and ‘‘horrid butchery’’ in America. Emil Theodore Kocher was the first to use precise surgical techniques and meticulous haemostasis to reduce the mortality rate to less than 1% in more than 5000 thyroidectomies [1]. He received a Nobel Prize in 1909 for his work [2]. The modern thyroid surgery as we know it today began sometime in the 1860s in Vienna with the school of Billroth. The recorded history of thyroid surgery is as old as Billroth, Kocher, and Halsted. They were responsible for the development of the technique for thyroidectomy between 1873 and 1910 [3]. In the 1890s, European advances in thyroidectomy were taken to the USA by William Halsted of Baltimore, Charles Mayo of Rochester, and George Crile of Cleveland, Ohio, and further refined by Frank Lahey [4]. Thanks to all these great surgeons, thyroid surgery is one of the common and safe surgeries now.

The primary objectives of thyroidectomy are always the conservation of the parathyroid glands, avoidance of injury to the recurrent and external laryngeal nerve nerves, accurate haemostasis, and excellent cosmesis [3]. Thyroid gland is a highly vascularized organ and surgical resection requires a meticulous surgical technique and hemostasis. Meticulous hemostasis is essential for obtaining good visualization of the surgical field, to avoid intraoperative complications of bleeding and prevent damage to structures such as parathyroid glands and laryngeal nerves. Large case series suggest that rates of these complications are hematoma 1.3%, transient hypoparathyroidism 27.8%, permanent hypoparathyroidism 4.8%, transient RLN injury 1.6% and permanent RLN injury, 0·9% [5]. Complications increase the length of stay in the hospital, the number of consultations, diagnostic tests and treatments needed, and overall cost. Permanent RLN palsy and hypoparathyroidism significantly impair the patient's quality of life [5]. Complications are likely to be more in cases of recurrent tumours, toxic goiters, malignant goiters with invasion, nodal metastasis, and large retrosternal goiters [6]. Rate of complications varies from series to series depending on aetiology and type of surgery. Extensive surgery is associated with more complications. The two most common early complications of thyroid surgery are hypocalcaemia and recurrent laryngeal nerve injury. Hypocalcaemia is the most common postoperative complication of thyroid surgery that may cause severe symptoms and increase hospitalization time. Sometimes they are life threatening. Bilateral recurrent nerve paralysis resulting in adduction of the vocal cords is a life-threatening complication occurring in less than 0.1% of cases that requires emergency management. Recurrent laryngeal nerve paralysis is transient and recovers in most cases. No invasive therapy should be performed for at least six months, except for emergency presentations; laryngeal surgery techniques may offer significant improvement if phonation or respiratory sequelae persist beyond six months, but the results are inconsistent [7]. Prevention of complications depends on careful operative technique and is enhanced by the use of specific techniques such as intraoperative neuromonitoring. Several studies have shown that increased surgeon experience is significantly associated with decreases in complications after thyroid surgery [8]. The incidence of haemorrhage can be avoided with meticulous haemostasis. Thyroid crisis is rare nowadays with the use of antithyroid drugs and beta blockers.

Materials and Methods

A prospective study was conducted from 2019 -2020 in the Department of General Surgery, Dr. Pinnamaneni Siddartha Institute of Medical Sciences, Chinaoutpalli. A total of 78 patients were enrolled who qualified in the inclusion criteria.

Inclusion criteria

1. Patients diagnosed with thyroid swelling that needs surgery.
2. Patients who are in euthyroid status.
3. Patients willing to follow up for 1 year.

Exclusion criteria

1. Patients who are having RLN damage.
2. patients undergoing recurrent Thyroid surgery.
3. patients not able to follow up.

Methods

All cases were evaluated thoroughly with routine haematological parameters and serum calcium levels. An ultrasound examination of the thyroid and neck, thyroid profile (T3, T4, and TSH), and an FNAC were done. A preoperative indirect laryngoscopy (IDL) was done to rule out pre-existing RLN palsy. All the patients were informed in writing of the possible complications and were taken for surgery after a written consent. They were operated on under general anaesthesia. A transverse cervical skin incision is made 2 cm above the sternal notch. Sub platysmal flaps were raised, deep fascia incised in the midline, and strap muscles are retracted. The thyroid gland is mobilised and the middle thyroid vein ligated. Dissection at superior pole done and superior thyroid vessels are isolated and ligated or coagulated with bipolar close to the gland. This protects the superior parathyroid gland. The RLN is searched and identified at the lower pole of the gland and dissection is done close to the gland dissecting from lateral to medial. The gland is isolated and removed from the trachea. In a total thyroidectomy, the other side is dissected in the same way and the gland is removed. Cervical lymph nodes were dissected if indicated. The wound was closed with a drain and post-operative complications were noted. Post operative serum calcium levels were measured on day 1. A routine IDL examination of vocal cords was done post operatively. Any complication was promptly diagnosed with necessary investigations and proper treatment was initiated. On discharge, the patients were followed up at 1 week, 1, 3, 6, and 12months. Those who are unable to come were followed up on the telephone for 1 year. Those lost in follow-up were discarded and the rest patients were analysed.

Results

Table 1: Age distribution-

Age in years	Number	Percentage
11-20	3	3.84
21-30	22	28.20
31-40	24	30.76
41-50	15	19.23
51-60	5	6.41
61-70	5	6.41
71 +	4	5.12
Total	78	100

The majority of patients (58.96%) are in the 3rd and 4th decade of life (22+ 24) followed by the 5th decade with 19.23%. The least number of patients are in extremes of age groups. The youngest patient was a 16-year-old girl and the oldest patient was a 73-year-old man.

Table 2: Sex distribution

Sex	Number	Percentage
Female	67	85.9
Male	11	14.1

Female preponderance is present with 6:1 ratio. (85.9% - 14.1%)

Table 3: Final diagnosis (clinical/ post op hpe)

Diagnosis	Number of cases	Percentage
Mng	34	43.6
1-euthyroid	31	39.74
2 - toxic mng	3	3.84
Solitary nodule	5	6.41
1-euthyroid	3	3.84
2- toxic nodule	2	2.56
Diffuse colloid goiter	14	17.94
Graves disease	9	11.53
Papillary carcinoma	8	10.26
Follicular adenoma	5	6.41
Follicular carcinoma	3	3.84
Total	78	100

The majority of cases are Multinodular goiter (MNG) 34/78 (43.6%) followed by colloid goiter 14/78 (17.94%). Toxic thyroid is seen in 9 cases (11.53%). Papillary carcinoma is next in order with 8 cases (10.26%). 5 cases each of Solitary nodule, and follicular adenoma. 3 cases of Follicular carcinoma were diagnosed on histopathology examination.

Table 4: Operative procedures done.

Procedure	No. of cases	Percentage
Total thyroidectomy (tt)	8	10.26
Tt+ node dissection	5	6.41
Near-total thyroidectomy	8	10.26
Subtotal thyroidectomy	32	41.02
Hemi thyroidectomy	16	20.51
Lobectomy	9	11.54
Total	78	100

The most commonly performed surgery was subtotal thyroidectomy with 32/78cases (41.02%) followed by hemithyroidectomy and lobectomy with 25/78 cases (32%). Total thyroidectomy is 13 cases (includes 5 cases with the central node dissection) and near-total thyroidectomy is in 8 cases.

Table 5: Incidence of post-operative complications

Post op complications	No of cases	Percentage
Bleeding	0	0
Haematoma	1	1.28
Hypocalcaemia	15	19.23
1) Transient	14	17.94
2) Permanent	1	1.28
RLN Palsy.	5	6.41
1) Transient	5	6,41
2) Permanent	0	0
Thyroid crisis	0	0
Airway obstruction	0	0
Seroma	2	2.56
Wound infections	5	6.41
1) Early	3	3.84
2) Late	2	2.56
Hypothyroidism	5	6.41
Recurrent hyperthyroidism	0	0
Hypertrophic scar/ keloid	0	0

Hypocalcaemia is the most common postoperative complication in our study with 15/78 cases (19.23%) followed by unilateral RLN palsy and wound infection in 5 cases each (6.41%). Seroma was seen in 2 cases treated by aspiration. 1 case of hematoma was noticed in the immediate post operative period. The patient was re-operated with hematoma evacuation. Hypothyroidism was observed in 5 cases during follow-up in previously euthyroid patients after subtotal thyroidectomy. There was 1 case of permanent hypocalacemia, but no permanent RLN palsy in our study. Thyroid storm or recurrent hyperthyroidism were not observed in our study. Permanent Hypoparathyroidism is noticed in a case of total thyroidectomy for malignant goiter.

Table 6: Mode of surgery and post op complications

Type of surgery	Hematoma	Hypocalcemia	Rln palsy	Seroma	Wound infection	Hypothyroidism
Tt	1	4	2	0	1	0
Tt+ node dissection	0	4	2	1	1	0
Near tt	0	4	1	0	0	1
Subtotal	0	2	0	1	0	4
Hemi thyroidectomy	0	1	0	0	1	0
Lobectomy	O	0	0	0	0	0

The post-operative complications of hypocalcemia and RLN palsy were noted mostly in patients operated with total thyroidectomy + / - neck node dissection and near-total thyroidectomy. Hypothyroidism was noted in 5 patients during post-operative follow-up in patients who presented with euthyroid MNG and operated with sub-total thyroidectomy.

Table 7: Aetiology and complications.

Diagnosis	Hematoma	Hypocalcemia	Rln palsy	Wound infetions	Hypothyroidism
Malignancy	1	6	2	1	0
Mng+ stn	0	4	1	0	5
Colloid goiter	0	1	0	1	0
Toxic goiter	0	4	2	1	0

The patients with malignant and toxic goiters who needed total thyroidectomy had more complications of hypocalcemia and RLN palsy. Hypothyroidism was noted mostly in cases operated with subtotal or near-total thyroidectomy for cases with MNG.

FOLLOW-UP – Patients with postoperative complications were followed up regularly. All the patients with hypocalcaemia were treated with oral calcium and vitamin D3. 14 out of 15 patients were found to have normal serum calcium levels by 3rd month. 1 patient was having permanent hyocalcaemia. Patients with RLN palsy recovered by 3rd month as confirmed by monthly IDL test. The transient palsy was due to neuropraxia which recovered spontaneously. Wound infections were treated with pus evacuation and antibiotics. Seroma was cleared after needle aspiration under Ultra Sonographic guidance. All patients were checked for thyroid profile and those with hypothyroid were treated with supplementation levothyroxine.

Discussion

Thyroid surgery is one of the common surgeries with known complications. A study of postoperative complications in 78 cases was done in a tertiary care centre for 2 years with a minimum of 1year follow up. In our study, the minimum age of the patient was 16 years and the maximum age was 70 years with the majority of the patients were in the 4th and 5th decade. Female dominance is observed in the 6:1 ratio. MNG is the most common diagnosis (34/78) followed by diffuse colloid goiter (14/78). Of the 78 cases, there were 67 benign cases with 11 malignant cases. 9 cases of Grave's disease, 3 cases of secondary toxic goiter in MNG, and 2 cases of toxic solitary nodules. Total 14 cases of toxic goiter and 64 cases of euthyroid goiter. The most common surgery was subtotal thyroidectomy (32) followed by hemithyroidectomy 16 and lobectomy in 9 cases. Total thyroidectomy and TT with cervical node dissection were done in 8 and 5 cases respectively, and near-total thyroidectomy in 8 cases.

Postoperative complications

The most common postoperative complication is hypocalcaemia observed in 15 cases (19.23%). All the cases of hypocalcaemia were treated with intravenous calcium during hospitalisation and oral calcium after discharge. 14 of the 15 cases have normal calcium levels after 6-8 weeks on follow-up. There was 1 case of permanent hypocalcemia in a case of total thyroidectomy for malignant goitre. Unilateral Recurrent Laryngeal Nerve (RLN) injury was seen in 5 cases which recovered spontaneously. The recovery period for RLN palsy varied from 6-8 weeks. There were no permanent RLN injuries. Seroma was seen in 2 cases and treated by aspiration. Wound infection seen in 5 cases, 3 of them in the immediate post-operative period and 2 of them presenting late in follow up period. All were treated with drainage and antibiotics. 1 case of haematoma for which reoperation was done with the evacuation of the haematoma. Postoperative hypothyroidism was detected in 5 cases and L-thyroxine supplementation was started. No cases of thyroid crisis, airway obstruction, recurrent hyperthyroidism, or post-op wound keloid or hypertrophic scar were observed.

Multiple risk factors have been identified for post-operative complications in thyroid surgery including patient-related factors like previous surgery, procedure-related factors lymph-node dissection, thyroid pathology of thyroiditis or cancer, the extent of thyroid excision, or surgeon experience. Hypocalcaemia is defined as serum calcium less than 8.5mg/dl. Transient hypocalcaemia is defined as low calcium levels occurring during the hospital stay and recovering within 6 months. Permanent hypocalcaemia is when hypocalcaemia persists beyond 6 months. Parathyroid insufficiency is due to either removal of the gland or infarction due to damage to the it's end arteries. Vascular injury is more common than gland removal. Considerable variations in the incidence of postoperative hypoparathyroidism, (from 1.6-50%) especially permanent, are reported in the literature. The identification and preservation of the parathyroids are difficult due to the presence of similar structures such as thyroid nodules, lymph nodes, fat lobules, or fibrosis from previous operations. Therefore, it depends on the knowledge and experience of the surgeon. The best way to prevent hypocalcaemia is by preserving the blood supply of the parathyroid glands There is evidence that systematic and meticulous research can lead to parathyroid gland damage [7]. In fact, it would appear that the number of parathyroids left in situ is more important than the number of those identified. A higher incidence of hypocalcaemia is noticed in total thyroidectomies for carcinoma compared with total thyroidectomies for benign disease.[7] Total thyroidectomy with central neck node dissection places parathyroids and their vascularity at greater risk. The incidence of hypoparathyroidism depends on the type of surgery. It is rarely seen after hemithyroidectomy and subtotal thyroidectomy. The incidence is far greater after near-total and total thyroidectomy.

A retrospective study of data of 2,043 patients of thyroid surgery in Greece was done[5]. Recurrent laryngeal nerve palsy and hypoparathyroidism were set as the primary endpoints, while hematoma and wound infection were set as the secondary endpoints. Transient RLN palsy occurred in 34 (1.6%) and permanent in 19 (0.9%) patients. Multivariate logistic regression analysis showed that extended resection in Graves' disease, thyroiditis, recurrent goiter and thyroid malignancy were all independent risk factors for transient RLN palsy, whereas Graves' disease and recurrent goiter emerged as independent risk factors for permanent RLN palsy. The rates of transient and permanent hypoparathyroidism were 27.8% and 4.8%, respectively. Multivariate analysis for transient hypoparathyroidism revealed that the extent of surgical resection, Graves' disease, recurrent goiter, female gender, and specimen weight were independent predictors. However, the extent of surgical resection, /Graves' disease, recurrent goiter, and malignant disease were independent risk factors for permanent hypoparathyroidism [5]. Postoperative wound infection and hematoma occurred in 6 (0.3%) and 27 (1.3%) patients, respectively [5]. Data of 640 operations performed on benign thyroid gland during 8 years was analysed. Permanent RLN palsy occurred in 2.6% of patients. 27 patients (4.2%) had transit hypocalcaemia and 8 had permanent hypoparathyroidism (1.2%). These complications have been studied in relation to patients' benign thyroid affection and operation.

In the cases of thyroidectomy without search for recurrent laryngeal nerve, nervous paralysis is frequent but the injury to the parathyroid gland is rare. Systematic dissection of recurrent nerve reduces RLN injury but increases the rate of parathyroid injury and subsequent hypoparathyroidism [9]. In our series a systematic search for RLN was done, it could be the cause for the low rate of RLN injury but the increased rate of Parathyroid injury. A study of 608 Thyroid surgery patients by Steurer M *et al*. [10] found 3.4%, 7.2%, and 2.5% of temporary recurrent laryngeal nerve palsies in the benign thyroid disease, thyroid malignancy, and hyperparathyroidism groups, respectively. The permanent recurrent laryngeal nerve palsies in these groups were 0.3%, 1.2%, and 0%, respectively [10]. In our study RLN palsy was more in toxic goiter and malignancy than in benign disease

of the thyroid. Feng-Yu Chiang *et al*. reported 521 patients of thyroid surgery where routine identification of the RLN was done during the operation [11]. The rates of temporary/permanent RLNP were 4.0/0.2%, 2.0/0.7%, 12.0/1.1%, and 10.8/8.1% for groups of benign thyroid disease, thyroid cancer, Graves' disease, and reoperation respectively. Complete recovery of RLN function was documented for 35 of the 37 patients (94.6%) whose RLN integrity had been ensured intraoperatively. Recovery from temporary RLN palsy ranged from 3 days to 4 months (mean, 30.7 days) [11]. Neural monitoring (NM) has been used in thyroid surgery. In a prospective series of 447 patients, NM had a 40% positive predictive value and a 100% negative predictive value for nerve injury with a sensitivity of 63% and a specificity of 97% [7]. In a comparison of RLN identification by standard dissection versus NM in a series of 1000 patients undergoing total thyroidectomy, Barczynski showed that NM diminished the incidence of transient RLN paresis 2.9% for high-risk patients and 0.9% for low-risk patients [7]. A meta-analysis by Higgins, comprising one randomized study and seven comparative studies, showed that systematic visualization of the RLN was still the best technique to avoid RLN injury, with an RLN injury rate of 3.25% using the nerve stimulator versus 3.12% for visualization of the nerve [13]. The use of NM in re-operative cases does not decrease the risk of RLN injury. NM requires a lengthy learning curve, its use modifies the dissection technique, and aids in the identification of the recurrent nerve, even when the nerve is a non-recurrent laryngeal nerve, and it contributes to improving the surgeon's performance [7]. The most common cause of injury resulted from traction to the anterior motor branch of a bifurcated RLN near the ligament of Berry than paratracheal lymph node dissection, incorporating ligature, and adherent cancer [7]. Unilateral RLN injury has minimal symptoms and is detected by routine vocal cord evaluation. Bilateral RLN palsy in adduction can cause acute respiratory distress needing a tracheostomy. The use of energy sources like Ligasure and harmonic scalpel has been tried to reduce the incidence of hypocalcemia and RLN injury. They seem to reduce the operative time and incidence of haematoma, but do not reduce the complication rate of RLN injury and hypocalcaemia [14]. The injury to external branch of superior nerve is more common but are very minor. The incidence of postoperative haemorrhage varies from 0-6.5%. it is due to slipping of ties from a major vessel, bleeding from the cut surface of the thyroid gland. Almost all cases develop haematoma within 24 hrs of surgery. Haematoma causing an airway obstruction is a life-threatening situation requiring emergency surgery. Meticulous haemostasis is the only way to prevent it. Thyroid storm is a rare event nowadays with good preoperative preparation with use of antithyroid drugs and beta blockers.

Conclusion

The commonest complication observed in this present study was temporary hypocalcaemia and temporary recurrent laryngeal nerve injury. The complications are least with simple procedures for benign disease. The rate of complication increases with malignancy and extent of surgery. There were no life-threatening complications in this study. It is the surgeon rather than the equipment that avoid the complications. A sound knowledge of Thyroid anatomy with good surgical technique can help to reduce the complications.

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