Complications of Thyroid Surgery and their risk factors in Malignant Thyroid disease: A Retrospective Study at a Tertiary Care Cancer Center of Nepal.

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Abstract:

Background: For the last few decades, the increase in the incidence of thyroid diseases including malignancies resulted in the increase in the number of thyroid surgeries as well. Thyroidectomy represents one of the commonest surgery performed by otolaryngologists. Thyroidectomy has potential complications like Hematoma, wound infections, hypocalcemia, hoarseness etc. These surgery related complications depends on the type and severity of disease, lack of identification of Recurrent Laryngeal Nerve and parathyroid glands, extent of surgery, neck dissection, previous surgery and size of tumor.

Aims: The aim of this study is to evaluate the complications of thyroid surgery for malignant thyroid disease and to analyze the risk factors of the complications.

Methods: A retrospective study was done from August 2024 to July 2025 in 153 patients with malignant thyroid disease who underwent surgical treatment in ENT-Head and Neck Oncosurgery unit, BP Koirala Memorial Cancer Hospital by reviewing the medical records of all these patients. The postoperative complications and the risk factors associated with these complications were evaluated.

Results: Out of 153 patients with malignant thyroid disease, total thyroidectomy was done in 103 (67.3%) patients, hemithyroidectomy in 33 (21.6%) patients and completion thyroidectomy in 17 (11.1%) patients. 62 (40.5%) patients develop complications after thyroid surgery. Most common complication was hypocalcemia alone in 39 (25.5%) followed by recurrent laryngeal nerve (RLN) palsy alone 5 (3.3%), hematoma 3 (2%), Chyle leak alone 3 (2%), hypocalcemia with chyle leak in 6 (3.9%) & hypocalcemia with hoarseness in 3 (2%). Other less common complications were tracheal injury, oesophageal injury & injury to right pyriform sinus (PFS) & pre-vertebral muscles.

Conclusion: Hypocalcaemia was the most frequent post-thyroidectomy complication, while voice change, hematoma, chyle leak are additional complications. Surgeons have to pay attention to curtail the complications during thyroid surgery.

Keywords: Complications, Hypocalcemia, Recurrent laryngeal nerve, Thyroidectomy

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Introduction

Thyroid disorders are one of the most common endocrine diseases. For the last few decades, the increase in the incidence of thyroid diseases including malignancies resulted in the increase in the number of thyroid surgeries as well.[1] Thyroid carcinoma (TC) accounts for one percent of all carcinomas, with a higher incidence in women. Thyroid surgery remains the preferred option for the treatment of benign as well as treatment of differentiated TC and prolongs the survival of patients. Although there

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is controversy on the selection of the best surgical treatment for differentiated TC, total thyroidectomy (TT) and subtotal thyroidectomy (STT) are still the two main surgical procedures.[2] At the beginning of the twentieth century, the significant complications of thyroidectomy were hematoma and postoperative infection, and most publications reported a low incidence of postoperative mortality.[3–5] Currently, the main postoperative complications are vocal cord palsy due to Recurrent laryngeal nerve (RLN) dysfunction and hypocalcemia.[6,7] The primary goal of safe thyroidectomy is to prevent the occurrence of potential morbidities and injuries to close anatomical structures, such as the RLN and the parathyroid glands.[8] Extent of surgery, experience of the surgeon, lack of identification of RLN / parathyroid glands, malignancy, central and lateral neck dissection, previous surgery and size of goiter are the risk factors for complications.[9]

In Nepal, there is a paucity of institution-based data evaluating the outcomes of thyroid surgery in cancer centers. BP Koirala Memorial Cancer Hospital (BPKMCH), being a national tertiary cancer referral center, manages a significant number of head and neck malignancies, including thyroid cancers. However, there is limited published data on surgical outcomes and complication rates specific to this center. So this clinical study is designed to evaluate the frequency of postoperative complications and to analyze the risk factors of complications in patients undergoing thyroid surgery for malignant thyroid disease at a tertiary cancer care centre, BPKMCH, Bharatpur.

Methods

After obtaining ethical clearance from the Institutional Review Committee (IRC) of BPKMCH, Medical records of all patients who underwent thyroid surgery at the Department of Otolaryngology-Head and Neck Surgery, BPKMCH from the period of August 2024 to July 2025 was retrospectively evaluated. Patients fulfilling the inclusion criteria like; patients who underwent thyroid surgery for histopathologically confirmed thyroid malignancy with complete medical, surgical and follow-up records available were included in the study. Patients with pre-operative hypocalcemia and RLN palsy, patients with missing data, those lost to follow up were excluded from the study. A total of 153 cases of thyroidectomies were identified and reviewed. The collected data included demographic data (Name, age, sex, address), all preoperative investigations and thyroid function test (TFT), S. calcium and S. calcitonin. Findings of Ultrasonography (USG) of the neck, Fine Needle Aspiration Cytology (FNAC) and vocal cord status using Nasopharyngeal Laryngoscopy (NPL) and special investigations like Computed tomography (CT scan), or Magnetic resonance imaging (MRI) done in cases of suspicious consistency, retrosternal extension, and extra-large thyroid masses causing compressive symptoms were recorded. Operative data included details of surgery (operative procedure, status of parathyroid glands and recurrent laryngeal nerve and type of neck dissection if done). Finally, postoperative complications (hypocalcemia, vocal cord palsy, hematoma, seroma, chyle leak, wound infection and others and duration of hospital stay were recorded. Calcium level was measured routinely preoperatively and postoperatively (in both total and completion thyroidectomies) every day till the patient was discharged home. Postoperatively, vocal cord assessment was done if there was change in voice or a clinical concern for vocal cord injury. Biochemical hypocalcemia is defined as any single postoperative corrected serum calcium $\leq$ 8.5 mg/dL associated with symptoms such as perioral or distal paresthesias, muscle spasm or tetany. It is considered temporary, if resolved with calcium supplementation within 6 months. Temporary RLN palsy is defined as postoperative vocal cord immobility or decreased movement associated with hoarseness that resolved within 6 months. If these conditions persisted for more than 6 months, they will be considered permanent. All the patients were followed up postoperatively at 4th and 8th week. And follow up data like USG neck, S. calcium, RLN Status were assessed & recorded. Data were entered in Microsoft Excel and analyzed using SPSS (Statistical Package for the Social Sciences) version 21. The association between the studied variables with the occurrence of complications were evaluated by the Chi-square test or Fisher‘s exact test when applicable. A p-value of <0.05 were considered statistically significant.

RESULTS

This study consisted of 153 patients with malignant thyroid disease who underwent different thyroid surgeries between August 2024 & July 2025. There were 120 females (78.4%) and 33 males (21.6%) with female to male ratio of 3.64:1, and age ranged from 14 - 81 years with the mean age of 42.52 years. The most common age group affected was 31 to 40 years (27.5%). The highest no. of patient visited in this hospital with thyroid malignancy were from Lumbini Province-39 patients (25.5%) followed by Gandaki Province-38 (24.8%), Madhesh Province-21 (13.7%), Bagmati Province-20 (13.1%), Karnali Province-17 (11.1%), Sudurpaschim Province-8 (5.2%), Koshi Province-7 (4.6%) and also from India-3 (2%). (Table. 1)

Table 1: Demographic profile of the studied patients (N=153)

Variable	Category	Frequency	%
Age	<55	119	77.8 %
	>55	34	22.2 %
Sex	M	33	21.6 %
	F	120	78.4 %
Address	Koshi Province	7	4.6 %
	Madhesh Province	21	13.7 %
	Bagmati Province	20	13.1 %
	Gandaki Province	38	24.8 %
	Lumbini Province	39	25.5 %
	Karnali Province	17	11.1 %
	Sudurpaschim Province	8	5.2%
	India	3	2%

Out of 153 patients most common malignant thyroid disease observed in our series was PTC occurring in 138 (90.2%) cases, whereas MTC accounting for 9 (5.9%) cases followed by FTC in 5 (3.3%) cases and ATC in 1(0.7%) case. The disease was most common on right thyroid lobe 88 (57.5%) followed by left lobe 63 (41.2%) and bilateral lobes in 2 (1.3%) cases. Extent of surgery ranged from Hemithyroidectomy to Total Thyroidectomy with central and lateral compartments neck dissection. The types of thyroid surgery done were Total Thyroidectomy 103 (67.3%), Hemithyroidectomy 33 (21.6%) & Completion thyroidectomy 17 (11.1%) respectively. Neck dissection were done on 73 cases (47.7%) which included unilateral in 62 cases (40.5%) and bilateral in 11 (7.2%) cases. The mean duration of hospital stay was 9.39 days (range 3 to 26 days). (Table. 2)

Table 2: Operative profile of the studied patients (N=153)

Variable	Category	Frequency	%
Nodule size	<4cm	92	60.1 %
	>4cm	61	39.9 %
Diagnosis	Papillary thyroid carcinoma (PTC)	138	90.2 %
	Medullary thyroid carcinoma (MTC)	9	5.9 %
	Follicular thyroid carcinoma (FTC)	5	3.3 %
	Anaplastic thyroid carcinoma (ATC)	1	0.7 %
Site	Right	88	57.5 %
	Left	63	41.2 %
	Bilateral	2	1.3 %
Surgery	Right Hemithyroidectomy	26	17 %
	Left Hemithyroidectomy	7	4.6 %
	Total Thyroidectomy	103	67.3 %
	Completion Thyroidectomy	17	11.1 %
Neck Dissection	No	80	52.3 %
	Unilateral	62	40.5 %
	Bilateral	11	7.2 %
Hospital stay	Minimum day	3	
	Maximum day	26	
	Average day	9.39	

The overall postoperative complication was seen in 62 cases (40.5%). Hypocalcemia 48 (31.4%) and recurrent laryngeal nerve (RLN) injury 8 (5.3%) were observed as the most common postoperative complication (Table 3). Postoperative Transient hypocalcemia occurred in 46 cases (30.1%). Transient hypocalcemia alone was found in 37 (24.2%) patients and Permanent hypocalcemia alone occurred in 2 patients (1.3%). Transient hypocalcemia combined with chyle leak was seen in 6 cases (3.9%) & Transient hypocalcemia combined with temporary RLN palsy was seen in 3 cases (2%). Recurrent laryngeal nerve injuries occurred in 8 cases (5.3%). Temporary and permanent RLN injury alone occurred in 3 (2%) and 2 (1.3%) cases, respectively. While temporary RLN palsy combined with transient hypocalcemia occurred in 3 cases (2%). So Temporary palsy occurred in 6 patients with full recovery occurring within 6 months. 1 patient with temporary RLN palsy which was

unilateral associated with stridor need tracheostomy which was removed after 3 weeks. 1 patient had permanent vocal cord palsy which was bilateral and need for tracheotomy. One unilateral permanent RLN palsy was a case of anaplastic carcinoma of thyroid who underwent total thyroidectomy with neck dissection. The right recurrent laryngeal nerve had to be sacrificed as it was involved by the tumor. 3 (2%) patients were reoperated on as a result of a post-operative hematoma. Chyle leaks occurred in 3 (2%) patients undergoing neck dissection. Chyle leak alone was seen in 3 (2%) cases, chyle leak with transient hypocalcemia were observed in 6 (3.9%) cases. Other less complications were seen in 3 (2%) cases which included Tracheal injury in one case which was temporary, oesophageal injury in one case & injury to Rt PFS & prevertebral muscles in one case which were repaired. Wound infection and postoperative mortality were not observed in our study. (Table. 3)

Table 3: Frequency of post-thyroidectomy complications (N=153)

Complication	Category	Frequency	%
No Complications		91	59.5 %
Total Complications		62	40.5 %
Hypocalcemia	No	105	68.6 %
	Transient (alone)	37	24.2 %
	Permanent (alone)	2	1.3 %
	Transient + Chyle leak	6	3.9 %
	Transient + RLN palsy (temporary)	3	2.0 %
Recurrent Nerve Palsy	No	145	94.8 %
	Temporary (alone)	3	2.0 %
	Permanent (alone)	2	1.3 %
	Temporary + Transient hypocalcemia	3	2.0 %
Hematoma	No	150	98 %
	Yes	3	2 %
Chyle Leak	No	144	94 %
	Alone	3	2.0 %
	Chyle leak + Transient hypocalcemia	6	3.9 %
Others	Tracheal injury	1	0.65 %
	Oesophageal injury	1	0.65 %
	Right PFS & Prevertebral muscle	1	0.65 %

The risk factors associated with complications; hypocalcemia and RLN injury are summarized in table 4 and 5 respectively.

Table. 4: Risk Factors for Hypocalcemia after Thyroid Surgery (n=153)

Risk Factor	Category	Hypocalcemia	No Hypocalcemia	p-value
Age	<55	39 (32.8%)	80 (67.2%)	0.46
	≥55	9 (26.5%)	25 (73.5%)	
Sex	Male	8 (24.2%)	25 (75.8%)	0.30
	Female	40 (33.3%)	80 (66.7%)	
Nodule size	<4 cm	22 (23.9%)	70 (76.1%)	0.009
	≥4 cm	26 (42.6%)	35 (57.4%)	
Surgery	Hemithyroidectomy	0 (0%)	33 (100%)	<0.001
	Total thyroidectomy	47 (45.6%)	56 (54.4%)	
	Completion thyroidectomy	1 (5.9%)	16 (94.1%)	
Neck dissection	Yes	40 (54.8%)	33 (45.2%)	<0.001
	No	8 (10%)	72 (90%)	

Table. 5: Risk Factors for RLN Palsy after Thyroid Surgery (n=153)

Risk Factor	Category	RLN Palsy	No RLN Palsy	p-value
Age	<55	2 (1.7%)	117 (98.3%)	0.002
	≥55	6 (17.6%)	28 (82.4%)	
Sex	Male	3 (9.1%)	30 (90.9%)	0.40
	Female	5 (4.2%)	115 (95.8%)	
Nodule size	<4 cm	3 (3.3%)	89 (96.7%)	0.28
	≥4 cm	5 (8.2%)	56 (91.8%)	
Surgery	Hemi	0 (0%)	33 (100%)	0.03
	Total	6 (5.9%)	95 (94.1%)	
	Completion	2 (10.5%)	17 (89.5%)	
Neck dissection	Yes	7 (9.6%)	66 (90.4%)	0.03
	No	1 (1.25%)	79 (98.75%)	

Discussion

Thyroid surgery is the most frequently performed operation in endocrine surgery and most patients recover fully without any adverse events.[10] Complications of thyroid surgery are uncommon but some complications like postoperative bleeding with airway compression and bilateral palsy of recurrent laryngeal nerve (RLN) can be life threatening. There has been a significant reduction in the incidence of complications and mortality in thyroid surgery since the beginning of the 20th century, currently making thyroidectomy a safe surgical procedure.[4]

The incidence of postoperative complications varies in literature from 7.4% to 53% of the operations

performed.[11] The overall postoperative complication rate in the present study was 40.5%. According to Alqahtani SM et al.[12] complication rate were 72.3%, Filho and Kowalski[13] reported complication rate of 38.9 %, Al-hakami et al[14] reported rate of 30.7%, Filho and Kowalski [15] reported 22.2% and 20% complication rate as per Pandey AK et al.[16]

Hypocalcemia

Hypocalcemia is the most common complication in our study. The literature reports the incidence of temporary hypocalcaemia from 1.6-71%, while the incidence of permanent hypocalcaemia varies from 0.4-13.8%.[17] In the present study, postoperative hypocalcemia occurred in 31.4% patients. Transient hypocalcemia developed in 30.1% cases while permanent hypocalcemia developed in 1.3% cases. According to Filho and Kowalski[13] the rate of hypocalcemia was 32.6% (transient-27.5% & permanent- 5.1%), 34.8 % in Al-hakami et al[14], 38.5% in Suwannasarn et al.[18] which were similar to our study. Lodovicio Rosato et al[19] in 2004 reported 8.3% temporary hypocalcemia and 1.7% permanent hypocalcemia rates & 65.3 % in Alqahtani SM et al[12] (Transient-63.7% & Permanent-1.6%).

Table.4 shows the association between different risk factors and post-thyroidectomy hypocalcemia. We found a significant statistical association between nodule size (p= 0.009), Extent of surgery (<0.001) and Neck dissection (<0.001) and the development of hypocalcemia. Alternatively, there was no significant association between age & sex with the occurrence of hypocalcemia. A multicenter study in Italy found that 10% of patients developed symptomatic hypocalcemia, which was predominantly seen after total thyroidectomy.[19] A recent prospective multicenter study reported a 64.2% total incidence of hypocalcemia after total thyroidectomy. In our study, neither gender nor age had a significant effect on the occurrence of hypocalcemia. Nonetheless, in the multivariate analysis reported by Eismontas et al[20], female gender and older age were statistically significant independent predictors of hypocalcemia. Karamanakos SN et al[21] found association of hypocalcemia with female gender. Kamer et al[22] & Erbil Y et al[23] found the risk of hypocalcemia more frequent in older patients. In contrast, Hallgrimsson et al[24] reported more prevalence of transient postoperative hypocalcemia in younger patients. Similar to our study, lateral neck dissection and para-tracheal dissection were the most important risk factors for the occurrence of hypocalcemia in a study by Filho and Kowalski.[15] In the same way, Cheah et al[25] reported a higher incidence of postoperative hypocalcemia when a neck dissection was associated with thyroidectomy than when it was performed without neck dissection (60% vs 17%). Erbil Y et al[23] found significant association between hypocalcemia and extended thyroid surgery which was similar to our study. In contrast, Patau F et al[11] found no significant association between complication and the extent of surgery. Ligation of the main trunk of inferior thyroid artery lateral in the neck during thyroidectomy gives good haemostasis and avoids injury to recurrent laryngeal nerves, but also it may interfere with the blood supply of parathyroids giving rise to hypoparathyroidism with subsequent hypocalcaemia. In agreement to study by Reeve T et al[7], we also preserve the main trunk and ligated and divided individual branches of inferior thyroid artery close to thyroid capsule.

Recurrent Laryngeal Nerve Palsy

Recurrent laryngeal nerve (RLN) injury is one of the most feared complications of thyroid surgery. The incidence of RLN injury after thyroidectomy widely varies, ranging from 4% to 7% for temporary paresis and from 1% to 4% for permanent paralysis.[26] In our study, the overall recurrent laryngeal nerve palsy was observed in 8 (5.2%) cases. Temporary RLN palsy was seen in 6 (4%) and permanent RLN palsy occurred in 2 (1.3%) cases. The incidence of RLN palsy in the study done by Filho and Kowalski[13] (2004) was 1.8% (temporary - 1.2% & permanent - 0.6%), 3.7 % in Al-hakami et al[14] (temporary - 2.8% & permanent - 0.9%) and 2.7 % in Alqahtani SM et al[12] Joliat et al[27] reported a 14% incidence of vocal cord paresis after thyroid surgery. Pezzullo et al[3] found permanent vocal cord palsy in 2.8% of the cases. Chao et al[28] observed a 2.6% incidence of transitory palsy and a 1.7% rate of permanent vocal cord palsy in cases of reoperation.

In our study Recurrent laryngeal nerve palsy were associated with age (p=0.002), extent of surgery (p=0.03) and neck dissection (p=0.03). (Table.5). Recurrent laryngeal nerve palsy was observed

in older age ≥ 55 years and the findings were statistically significant. Sex & Nodule size were not significantly associated with recurrent laryngeal nerve injury. Zakaria HM et al[29] reported that repeat surgery, and total thyroidectomy were associated with a significantly increased risk of postoperative recurrent laryngeal nerve injury. In a study done by Khanzada et al[30], majority of the complications were associated with total thyroidectomy. Erbil Y et al[23] reported predictive factors for nerve palsy as extended thyroid surgery (p= 0.025), absence of neck dissection (p= 0.001), patient age > 50 years (p= 0.025) and repeat thyroid surgery (p= 0.001) which was similar to our study. Ischemia, entrapment, contusion, irritation of the nerve without actual damage, and actual transection are different mechanisms for RLN injury. Variations and distortions of anatomy are contributing factors that increase the risk of nerve injury.[31]

In our group, the dissection and identification of the recurrent laryngeal nerve was performed as a routine manner before the ligation of the inferior pedicle vessels, thus reducing the risk of nerve injury. This early identification of the recurrent laryngeal nerve is also advocated by several other authors.[5]

Other complications:

The present study showed an incidence of chyle leak in 6% of cases which was associated with nodule size (p=0.04), extend of surgery (p < 0.001) and neck dissection (p<0.001) and the findings were statistically significant while hematoma was seen in 2 % of cases & other complications (Tracheal injury, oesophageal injury and right pyriform sinus and prevertebral muscle injury) were seen in 1.95 % cases.

Limitations

Our study was a single-center study and was limited by the small number of available cases, the retrospective nature of the study and the missing additional demographic information and some information was interpreted from the doctor's logs. Hospital's volume of operations and the surgeon's experience have been reported in different studies as risk factors of complication of thyroid surgery. However, these factors couldn't be assessed in our study, as all the patients were operated in the same center and by the surgeons of similar experience.

Conclusion

Conclusively, complications after thyroid surgery depend on patient's condition and presence of comorbidities, thyroid pathology, surgeon's expertise, and extent of surgery. Hypocalcemia and RLN injury are the commonest complications observed after thyroidectomies. Attempts must be made to identify and preserve parathyroid glands to avoid hypocalcemia. 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. Surgical planning and careful intraoperative technique remain paramount to minimize complications in patients with malignant thyroid disease. Studies are recommended to assess the rate of complications during previous or subsequent years in order to evaluate the trends of post-operative complications and improve on techniques and systems to prevent complications. This can be compared to reports from other centers or hospitals to get a larger patient basis and nation-wide analysis.

References

1. Gurrado A, Bellantone R, Cavallaro G, Citton M, Constantinides V, Conzo G, et al. Can total thyroidectomy be safely performed by residents? A comparative retrospective multicenter study. Medicine (Baltimore). 2016;95(14):e3241.
2. Tchabashvili L, Mulita F, Liolis E, Seretis F, Seretis C, Vailas M, et al. Total versus subtotal thyroidectomy for the management of differentiated thyroid carcinoma and their outcome on early postoperative complications. Ann Onc. 2021;32(S1206):1747P.
3. Pezzulo L, Dalrio P, Losito NS, Caraco` C, Mozzillo N. Post-operative complications after completion thyroidectomy for differentiated thyroid cancer. Eur J Surg Oncol. 1997; 23(3):215–8.
4. Moulton-Barrett R, Crumley R, Jalilie S, Segina D, Allison G, Marshak D, et al. Complications of thyroid surgery. Int Surg.1997;82(1):63–6.
5. Shaha A, Jaffe BM. Complications of thyroid surgery performed by residents. Surgery. 1988; 104(6):1109–14.
6. Lin DT, Patel SG, Shaha AR, Singh B, Shah JP. Incidence of inadvertent parathyroid removal during thyroidectomy. Laryngoscope. 2002;112(4):608–11.
7. Reeve T, Thompson NW. Complications of thyroid surgery: how to avoid them, how to manage them, and observations on their possible effect on the whole patient.

World J Surg. 2000;24(8):971–5.

8. Bode R, Celiku E. Postoperative complications of thyroidectomy. Int J Sci Res. 2016;5:27–30.
9. Panthi N, Chettri ST, Shah SP, Poudel D, Manandhar S, Acharya K. Complications of thyroid surgery & their risk factors: A prospective study at a tertiary care center of eastern Nepal. Journal of BP Koirala Institute of Health Sciences. 2019;2(1):25-33.
10. Gourin CG, Tufano RP, Forastiere AA, Koch WM, Pawlik TM, Bristow RE. Volume-based trends in thyroid surgery. Arch Otolaryngol Head Neck Surg. 2010;136(12):1191-8.
11. Pattou F, Combemale F, Fabre S, Carnaille B, Decoulx M, Wemeau JL, et al. Hypocalcaemia following thyroid surgery: incidence and prediction of outcome. World J Surg.1998;22(7):718-24.
12. Alqahtani S M, Almussallam B, Alatawi AS, Alsuhaimi NA, Albalawi A, Albalawi NS, et al. Post-Thyroidectomy Complications and Risk Factors in Tabuk, Saudi Arabia: A Retrospective Cohort Study. Cureus. 2020;12(10): e10852.
13. Filho JG, Kowalski LP. Postoperative Complications of Thyroidectomy for Differentiated Thyroid Carcinoma. Am J Otolaryngol. 2004;25(4):225-30.
14. Al-Hakami HA, Al Garni MA, Malas M, Abughanim S, Alsuraihi A, Al Raddadi T, et al. Surgical complications after thyroid surgery: A 10-Year Experience at Jeddah, Saudi Arabia. Indian J Otolaryngol Head Neck Surg. 2019;71(Suppl 1):1012-7.
15. Filho JG, Kowalski LP. Surgical complications after thyroid surgery performed in a cancer hospital. Otolaryngol head neck surg. 2005;132(3): 490-4.
16. Pandey AK, Maithani T, Agrahari A, Varma A, Bansal C, Bhardwaj A, et al. Postoperative Complications of Thyroid Surgery: A Corroborative Study with an Overview of Evolution of Thyroid Surgery. Int J Head Neck Surg. 2015;6(4):149-54.
17. Mehanna HM, Jain A, Randeva H, Watkinson J, Shaha A. Postoperative hypocalcaemia: the difference a definition makes. Head-Neck. 2010;32(3): 279-83.
18. Suwannasarn M, Jongjaroenprasert W, Chayangsu P, Suvikapakornkul R, Sriphrapradang C. Single measurement of intact parathyroid hormone after thyroidectomy can predict transient and permanent hypoparathyroidism: A prospective study. Asian J Surg. 2017;40(5):350–6.
19. Rosato L, Avenia N, Bernante P, De Palma M, Gulino G, Nasi PG, Pelizzo MR, Pezzullo L. Complications of thyroid surgery: analysis of a multicentric study on 14,934 patients operated on in Italy over 5 years. World J Surg. 2004;28(3):271-6.
20. Eismontas V, Slepavicius A, Janusonis V, Zeromskas P, Beisa V, Strupas K,et al. Predictors of postoperative hypocalcemia occurring after a total thyroidectomy: results of prospective multicenter study. BMC Surg. 2018;18(1):55.
21. Karamanakos SN, Markou KB, Panagopoulos K, Karavias D, Vagianos CE, Scopa CD,et al. Complications and risk factors related to the extent of surgery in thyroidectomy. Results from 2,043 procedures. Hormones (Athens). 2010;9(4):318-25.
22. Kamer E, Unalp HR, Erbil Y, Akguner T, Issever H, Tarcan E: Early prediction of hypocalcemia after thyroidectomy by parathormone measurement in surgical site irrigation fluid. Int J Surg. 2009;7(5):466-71.
23. Erbil Y, Barbaros U, Işsever H, Borucu I, Salmaslioğlu A, Mete O,et al. Predictive factors for recurrent laryngeal nerve palsy and hypoparathyroidism after thyroid surgery. Clin Otolaryngol. 2007;32(1): 32-7.
24. Hallgrimsson P, Nordenstrom E, Almquist M, Bergenfelz AO: Risk factors for medically treated hypocalcemia after surgery for Graves' disease: a Swedish multicenter study of 1,157 patients. World J Surg. 2012;36(8):1933-42.
25. Cheah WK, Arici C, Ituarte PH, Siperstein AE, Duh QY, Clark OH. Complications of neck dissection for thyroid cancer. World J Surg. 2002;26(8):1013-6.
26. Witt RL: Recurrent laryngeal nerve electrophysiologic monitoring in thyroid surgery: the standard of care? J Voice. 2005,19(3):497-500.
27. Joliat GR, Guarnero V, Demartines N, Schweizer V, Matter M. Recurrent laryngeal nerve injury after thyroid and parathyroid surgery: Incidence and postoperative evolution assessment. Medicine (Baltimore). 2017;96(17):e6674.
28. Chao TC, Jeng LB, Lin JD, Chen MF: Reoperative thyroid surgery. World J Surg. 1997;21(6):644-7.
29. Zakaria HM, Al Awad NA, Al Kreedes AS, Al-Mulhim AM, Al-Sharway MA, Hadi MA,et al. Recurrent Laryngeal Nerve Injury in Thyroid Surgery. Oman Med J. 2011;26(1):34-8.
30. Khanzada TW, Samad A, Memon W, Kumar B. Post thyroidectomy complications: the Hyderabad experience. J Ayub Med Coll Abbottabad. 2010;22(1):65-8.
31. Sanapala A, Nagaraju M, Rao LN, Nalluri K. Management of bilateral recurrent laryngeal nerve paresis after thyroidectomy. Anesth Essays Res. 2015,9(2):251-3.