

Complications of Thyroid Surgery & Their Risk Factors: A Prospective Study at a Tertiary Care Center of Eastern Nepal

N Panthi, ST Chettri, SP Shah, D Poudel, S Manandhar, K Acharya
Department of Otolaryngology and Head and Neck Surgery
BP Koirala Institute of Health Sciences, Dharan, Nepal

Abstract

Background: Thyroid surgery is one of the commonest surgeries performed by otolaryngologists. Currently, the main postoperative complications are hypocalcemia and recurrent laryngeal nerve (RLN) palsy. Extent of surgery, lack of identification of RLN/ parathyroid glands, malignancy, central compartment neck dissection, lateral neck dissection, previous surgery and size of goiter are the risk factors for complications. The objectives of this study were to determine the frequency of postoperative complications after thyroid surgery and to analyze the risk factors of complications.

Methods: It was a prospective study of 45 patients undergoing thyroid surgery in eastern Nepal from March 2014 to September 2015. The postoperative complications and the risk factors associated with these complications were evaluated.

Results: There were total of 45 cases of thyroid surgery, with the mean age of 39.04 years. The main postoperative complications were: hypocalcemia (6 or 13.33% cases) and vocal cord palsy due to recurrent laryngeal nerve injury (5 or 11.11% cases). Temporary hypocalcemia was observed in 3 (6.67%) cases while permanent hypocalcemia developed in other 3 (6.67%) cases. Similarly, the temporary and permanent recurrent laryngeal nerve palsy occurred in 3 (6.67%) cases and 2 (4.44%) cases respectively. The risk factors associated with hypocalcemia were: malignancy, repeat operation, central compartment neck dissection and non-identification of parathyroid glands during surgery. Similarly, recurrent laryngeal nerve palsy was observed in cases of malignancy and central compartment neck dissection.

Conclusion: The major postoperative complications of thyroid surgery were hypocalcemia and recurrent laryngeal nerve palsy. Malignancy and central compartment neck dissection had effect on incidence of complications. Sound knowledge of anatomy and meticulous surgical technique are needed to reduce the incidence of complications.

Keywords: Hypocalcemia, recurrent laryngeal nerve palsy, thyroid surgery

Introduction

Thyroid surgery is one of the commonest surgeries performed by otolaryngologists. Currently, the main postoperative complications are vocal cord palsy due to injury to the

recurrent laryngeal nerve and hypocalcemia. Postoperative death is extremely rare.^{1,2}

Recurrent laryngeal nerve palsy is the most feared complication that causes dysphonia and the mechanisms of intraoperative nerve injury include division, laceration, stretching or traction, pressure, crush, electrical, heat, ligature entrapment, ischemia and nerve manipulation. The conditions that put the RLN at a higher risk

Address for correspondence

Dr. Niranjana Panthi
Department of Otolaryngology & Head and Neck Surgery
BP Koirala Institute of Health Sciences, Dharan
Email: niranjana.panthi55@gmail.com

of injury are lack of identification of RLN during surgery, bilateral surgery, surgery for malignant diseases, lymph node dissection, Grave's disease, thyroiditis, previous neck surgery, substernal goitre, longer operative times or greater blood loss, reoperation for bleeding.^{1,2}

The postoperative hypocalcemia is multifactorial in origin. It may be temporary due to ischemia and hypothermia of parathyroid glands or permanent hypocalcemia due to removal or vascular necrosis of glands. Other potential factors causing hypocalcemia are postoperative hemodilution, calcitonin release following thyroid manipulation, central compartment neck dissection, reoperative cases, surgery for substernal goitre, surgery for carcinoma and surgery for Grave's disease.^{3,4} The main purpose of this study was to evaluate the various postoperative complications of thyroidectomy and their risk factors in a tertiary hospital of eastern region of Nepal.

Aims and objectives

- To evaluate the various postoperative complications of thyroid surgery
- To analyze the risk factors of postoperative complications of thyroid surgery

Methods and materials

This prospective descriptive study was conducted in the Department of Otorhinolaryngology and Head & Neck Surgery, BPKIHS. Forty five patients admitted in ENT ward, BPKIHS between March 2014 and August 2015 for thyroid surgery were included. The exclusion criteria included: the patients not willing to participate in the study, those with previously irradiated neck and

thyroid surgery as a part or concomitant of other surgery. Ethical approval was obtained from the Institutional Ethical Review Board. Informed and written consent was taken prior to study.

All the patients were electively admitted after pre-anesthetic check-up. Detailed history was taken and thorough clinical examination was done. Vocal cord assessment was done one day pre-operatively via flexible endoscopy. Pre-operatively; the thyroid function test, ultrasound of neck, fine needle aspiration cytology and serum calcium were done along with routine laboratory investigations. Depending on the need of the clinical condition, the thyroid surgery was planned. Total and near-total were referred as extended thyroidectomy whereas hemithyroidectomy and subtotal thyroidectomy were referred to as conservative thyroidectomy.⁵ The procedures were done under general anesthesia.

All patients had their vocal cords checked at the time of extubation and on second postoperative day and during follow up. Flexible endoscopy was done on second postoperative day and during follow-up. All patients underwent serum calcium analysis 48 hours after surgery and on two subsequent days if they had hypocalcaemia. Postoperative vocal cord palsy was defined as the presence of immobility or decreased movement of the vocal cords. A persisting vocal cord dysfunction and clinical dysphonia after 6 months was considered permanent RLN palsy. Temporary RLN palsy was considered if there was recovery within 6 months.^{5,6}

Hypocalcaemia was considered when serum calcium level was less than 8 mg/dl (normal range 9- 11mg/dl) or when patient experienced clinical symptoms and signs of hypocalcaemia

(perioral or distal extremity paresthesia, muscle cramps, Trousseau and Chvostek's sign), requiring calcium and/or vitamin D supplements and this was considered temporary hypocalcaemia if it was resolved within 6 months. Permanent hypocalcaemia was considered when hypocalcaemia persisted for more than 6 months despite regular calcium and vitamin D supplements.^{5,6}

Other postoperative complications including hematoma, seroma, surgical site infection, were assessed based on clinical findings. All the patients were followed up postoperatively at 4th and 8th week. If any complication was noticed, then the patient was followed up monthly for at least 6 months.

Data entry & analysis

Data were analyzed by SPSS-20 version and summarized using frequency distribution tables and graphical method of presentation. The association between the studied variables with the occurrence of complications was evaluated by the Chi-square test or Fisher's exact test when applicable. Results were considered statistically significant when P-value was <0.05.

Observation and results

There were total of 45 cases of thyroid surgery that met the inclusion criteria. There were 42 patients; 3 patients underwent thyroid surgery twice (completion thyroidectomy done in 3 patients). The mean age was 39.04 years (SD = 12.49) ranging from 22 to 71 years. The most common age group affected was 21 to 30 years (42%). More 38 (≈84%) were females and 7 (16%) were males. Based on final histopathology report, thyroid surgery was performed on 28 (62.2%) benign cases and 17 (37.8%) malignant cases (Tab. 1 & 2).

Complications:

The overall postoperative complication rate was 28.9% (Fig.1). Postoperative hypocalcemia occurred in 6 (13.33%) patients. Temporary hypocalcemia developed in 3 (6.67%) cases while permanent hypocalcemia developed in other 3 (6.67%) cases. The overall recurrent laryngeal nerve palsy was observed in 5 (11.11%) cases. Transient RLN palsy was seen in 3 (6.67%) cases and permanent RLN palsy occurred in 2 (4.44%) cases. Other complications were poor scar in 1 (2.2%) case and chyle leak in 1 (2.2%) case. None of the cases developed hemorrhage, wound infection, seroma, hematoma, airway obstruction etc.

The risk factors associated with hypocalcemia and RLN injury are summarized in table 3 and 4 respectively.

Table 1: Surgery Performed

Thyroid surgery	Frequency	%
Isthmusectomy	2	4.4
Hemithyroidectomy	27	60
Subtotal Thyroidectomy	2	4.4
Near total Thyroidectomy	5	11.1
Total Thyroidectomy	6	13.3
Completion Thyroidectomy	3	6.7
Total	45	100

Table 2: Final Diagnosis

Thyroid swelling	Diagnosis	Frequency	%
Benign (28 cases= 62.2%)	Colloid goiter	17	37.8
	Multinodular goiter	6	13.3
	Lymphocytic thyroiditis	4	8.9
	Graves' Disease	1	2.2
Malignant (17cases= 37.8%)	Papillary carcinoma	16	35.6
	Medullary Carcinoma	1	2.2
Total		45	100

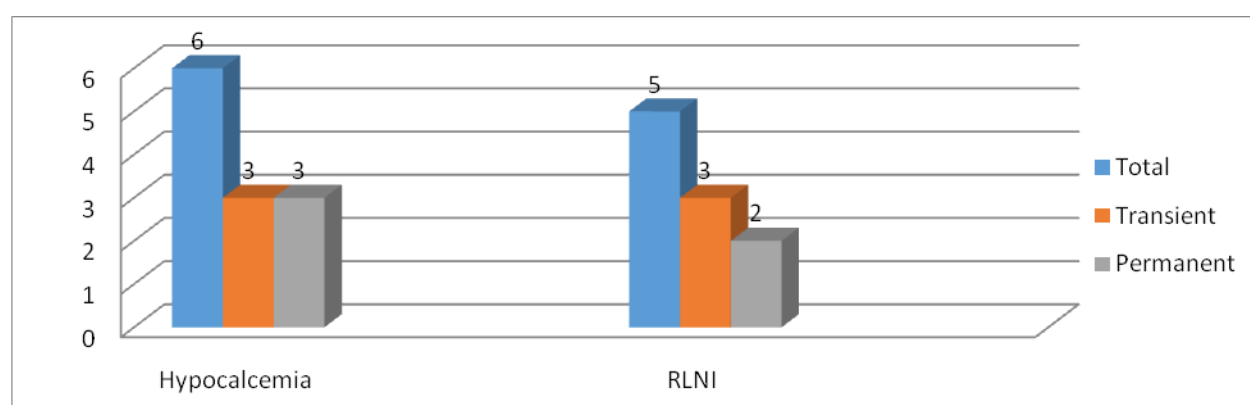


Figure1: Complications

Table 3: Risk factors associated with hypocalcaemia; CCND: central compartment neck dissection; THC: temporary hypocalcaemia; PHC: permanent hypocalcaemia; p value< 0.05 statistically significant.

Risk Factors	Frequency	THC	P value	PHC	P value
Age (years)	≤45	34	1	3	0.422
	≥45	11	2	0	
Gender	Male	7	1	1	0.405
	Female	38	2	2	
Nodule size	≤4cm	21	2	2	0.592
	≥4cm	24	1	1	
Malignancy	Yes	17	2	3	0.048
	No	28	1	0	
Extended thyroid surgery	Yes	11	1	2	0.143
	No	34	2	1	
CCND	Yes	16	3	3	0.039
	No	29	0	0	
Lateral Neck Dissection	Yes	3	0	2	0.09
	No	42	3	1	
Repeat operation	Yes	3	2	1	0.191
	No	42	1	2	
Identification of PTH glands	Yes	38	3	0	0.002
	No	7	0	3	

Table 4: Risk factors associated with recurrent laryngeal nerve injury; CCND: central compartment neck dissection; RLN: Recurrent laryngeal nerve; TRLNI: temporary recurrent laryngeal nerve injury; PRLNI: permanent recurrent laryngeal nerve injury; p value < 0.05 statistically significant

Risk Factors	Frequency	TRLNI	P value	PRLNI	P value	
Age (years)	≤45	34	3	0.565	2	0.567
	≥45	11	0		0	
Gender	Male	7	0	1.00	0	1.00
	Female	38	3		2	
Nodule size	≤4cm	21	2	0.592	0	0.491
	≥4cm	24	1		2	
Malignancy	Yes	17	2	0.547	2	0.137
	No	28	1		0	
Extended thyroid surgery	Yes	11	0	0.565	1	0.433
	No	34	3		1	
CCND	Yes	16	2	0.283	2	0.121
	No	29	1		0	
Lateral Neck Dissection	Yes	3	0	1.00	0	1.00
	No	42	3		2	
Repeat operation	Yes	3	0	1.00	0	1.00
	No	42	3		2	
Identification of RLN	Yes	41	3	1.00	1	0.172
	No	4	0		1	

Discussion

Thyroid surgery is the most frequently performed operation in endocrine surgery and most patients recover fully without any adverse events.⁷ 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.^{1,2,3}

In our study, 31 cases (68.9%) underwent conservative thyroid surgery (isthmusectomy, hemithyroidectomy, subtotal thyroidectomy)

while 11 (24.44%) cases underwent extended thyroidectomy (total or near-total thyroidectomy) and 3 (6.67%) cases underwent repeat (completion thyroidectomy) surgery. Extended thyroidectomy is criticized because of the high complication rates while conservative thyroidectomy is criticized for the development of recurrence in different studies.⁸

The incidence of postoperative complications varies in literature from 7.4% to 53% of the operations performed.⁹ The overall postoperative complication rate in the present study was 28.9%.

Hypocalcemia

Hypocalcemia was the most common complication in the present 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%.¹⁰⁻¹³ In the present study, postoperative hypocalcemia occurred in 6 (13.33%) patients. Transient hypocalcemia developed in 3 (6.67%) cases while permanent hypocalcemia developed in the other 3 (6.67%) cases. British Association of Endocrine and Thyroid Surgeons (BAETS) fourth national audit report in 2012 revealed rates of temporary and permanent hypocalcemia as 15.3% and 12.1% respectively.¹⁴ Lodovicio Rosato et al¹⁵ in 2004 reported 8.3% temporary hypocalcemia and 1.7% permanent hypocalcemia rates.

Risk Factors for hypocalcemia:

Malignancy:

As regards the underlying thyroid pathology, higher incidence of hypocalcemia was observed in malignant cases (5 cases out of total 6 cases of hypocalcemia were malignant) and it was statistically significant. Erbil Y et al⁵, Karamanacos SN et al¹⁶, Hany Aly¹⁷ have reported similar findings. All the 3 cases of permanent hypocalcemia were associated with malignancy (2 cases papillary carcinoma and one case medullary carcinoma).

Temporary hypocalcemia was seen in 1 (2.22%) case of lymphocytic thyroiditis and 2 (4.44%) cases of papillary carcinoma of thyroid.

Other Risk Factors:

Temporary hypocalcemia was also significantly associated with central compartment neck dissection (p= 0.039) and repeat operation (p= 0.009). Similarly, permanent hypocalcemia was significantly associated with central compartment neck dissection (p= 0.039) and non-identification of parathyroid glands during surgery (p= 0.002).

Repeat surgery had a 3 fold increased risk of postoperative hypocalcemia in a study by Erbil Y et al.⁵ Neck dissection and para-tracheal dissection were the most important risk factors for the occurrence of hypocalcemia in a study by Filho and Kowalski.⁶

There was no association between hypocalcemia and extent of surgery in our study.

Similar to our study, Patau F et al⁹ found no significant association between complication and the extent of surgery. Contrary to our study, Erbil Y et al⁵ found significant association between hypocalcemia and extended thyroid surgery.

There was no significant association of hypocalcemia with gender, nodule size and lateral neck dissection in our study. Karamanacos SN et al¹⁶ found association of hypocalcemia with female gender. In contrast to our study, Erbil Y et al⁵ reported increased risk of postoperative hypocalcemia in older patients. Rios-Zambudi A et al¹⁹ found positive association between goiter size and complications. Lateral neck dissection was associated with increased incidence of complication in study by Filho and Kowalski.⁶

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 al²⁰, we also preserve the main trunk and ligate and divide individual branches of inferior thyroid artery close to thyroid capsule.

Recurrent Laryngeal Nerve Palsy

The incidence of RLN injury after thyroidectomy widely varies in the literature, ranging from 0.4% to 13% for temporary paresis and from 0% to 5.2% for permanent paralysis.²¹⁻²³ In our study, the overall recurrent laryngeal nerve palsy was observed in 5 (11.11%) cases. Temporary RLN palsy was seen in 3 (6.67%) and permanent RLN palsy occurred in 2 (4.44%) cases. There was no bilateral vocal cord palsy. One of the cases of permanent RLN palsy was a case of papillary carcinoma of thyroid who underwent total thyroidectomy. The left recurrent laryngeal nerve had to be sacrificed as it was involved by the tumor. In a study by Mirghani H et al²⁴, the recurrent laryngeal nerve involved by tumor was intentionally resected for oncologic reasons. The other case of the permanent RLN palsy was also a case of papillary carcinoma of thyroid. The nerve was not identified because of large size of the tumor with distorted anatomy.

Risk Factors for recurrent laryngeal nerve palsy (RLNP):

Malignancy:

Out of the five cases of RLNP, 4 were the cases of papillary carcinoma of thyroid and 1 was a case of benign colloid goiter. But the association between malignancy and overall nerve palsy was not statistically significant ($p= 0.06$). The two cases that developed permanent RLNP were cases of papillary carcinoma of thyroid. Erbil Y et al⁵ reported similar findings. Osmolski A et al²⁵ found no significant association between malignancy and RLN injury.

Other risk Factors:

Both the cases of permanent recurrent laryngeal nerve palsy were associated with central

compartment neck dissection but the finding was statistically not significant ($p= 0.121$). Recurrent laryngeal nerve palsy (RLNP) was observed only in younger age ≤ 45 years and female sex but the findings were statistically not significant. Nodule size, extent of surgery, lateral neck dissection, repeat surgery and non-identification of recurrent laryngeal nerve during surgery were not significantly associated with recurrent laryngeal nerve injury.

Zakaria HM et al²⁶ reported that repeat surgery, non-identification of RLN and total thyroidectomy were associated with a significantly increased risk of postoperative recurrent laryngeal nerve injury. In a study done by Khanzada et al¹⁸, majority of the complications were associated with total thyroidectomy and male gender. Erbil Y et al⁵ 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 ($p= 0.001$).

Other complications:

Other complications were poor scar in 1 (2.2%) and chyle leak in 1 (2.2%) case.

None of the cases developed hemorrhage, wound infection, seroma, hematoma and airway obstruction.

Limitations

The limitation of our study was small sample size. Hospital's volume of operations and the surgeon's experience have been reported in different studies as risk factors of complication of thyroid surgery.^{7,27} 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

There has been a significant reduction in the incidence of complications and mortality in thyroid surgery as a result of improved surgical technique.

Nevertheless, this study showed that the hypocalcemia was the most common complication followed by recurrent laryngeal nerve palsy. The risk factors that had significant effect on incidence of complications were malignancy and central compartment neck dissection.

References

1. Moulton-Barrett R, Crumley R, Jalilie S, et al. Complications of thyroid surgery. *Int Surg.*1997; 82: 63-6.
2. Al-Suliman NN, Rytto NF, Blichert-Toft M, et al. Experience in a specialist thyroid surgery unit: a demographic study, surgical complications, and outcome. *Eur J Surg.* 1997; 163: 13-20.
3. Watkinson JC, Ramsden J. Thyroid cancer. In: Gleeson M, Browning GG, Burton MJ, Clarke R, Hibbert J, Jones NS, et al, editors. *Otolaryngology –head and neck surgery.* 7th ed. London: Hodder Arnold; 2008: 2663-701.
4. Randolph GW. Surgical anatomy of the recurrent laryngeal nerve. In: Randolph GW, editor. *Surgery of the thyroid and parathyroid glands.* Philadelphia: Saunders; 2003: 300-42.
5. Erbil Y, et al. Predictive factors for recurrent laryngeal nerve palsy and hypoparathyroidism after thyroid surgery. *Clin. Otolaryngol.* 2007; 32: 32-7.
6. Filho J G and Kowalski LP. Surgical complications after thyroid surgery performed in a cancer hospital. *Otolaryngol Head Neck Surg.* 2005; 132: 490-4.
7. Gourin, C.G. Volume-based trends in thyroid surgery. *Arch Otolaryngol Head Neck Surg.* 2010; 136(12): 1191-8.
8. Efremidou EI, Papageorgiou MS, Liratzopoulos N, Manolas KJ. The efficacy and safety of total thyroidectomy in the management of benign thyroid disease, a review of 932 cases. *Can J Surg.* 2009; 52(1): 39-44.
9. Pattou F, Combemale F, Fabre S, et al. Hypocalcaemia following thyroid surgery incidence and prediction of outcome. *World J Surg.*1998; 22: 718-24.
10. McHenry CR, Speroff T, Wentworth D, Murphy T. Risk factors for postthyroidectomy hypocalcaemia. *Surgery.*1994; 116(4): 641-7.
11. Mehanna HM, Jain A. Postoperative hypocalcaemia: the difference a definition makes. *Head-Neck.* 2010; 32(3): 279-83.
12. Jessie WU, Barney H. Hypocalcaemia after thyroidectomy: the need for improved definitions. *World Journal of Endocrine Surgery.* 2010; 2(1): 17-20.
13. Edafe O, Antakia R, Laskar N. Systemic review and meta-analysis of predictors of post-thyroidectomy hypocalcaemia. *Br J Surg.* 2014; 101: 307–20.
14. Lorente-Poch L, Sancho JJ, Muñoz-Nova JL, Sánchez-Velázquez P, Sitges-Serra A. Defining the syndromes of parathyroid failure after total thyroidectomy. *Gland Surgery.* 2015; 4(1): 82-90.
15. 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.
16. Karamanakos SN, Markou KB, Panagopoulos K, Karavias D, Vagianos CE, Scopa CD, Fotopoulou V, Liava A, Vagenas K. Complications and risk factors related to the extent of surgery in thyroidectomy. Results from 2,043 procedures. *Hormones.* 2010; 9(4): 318-25.
 17. Aly H. Post thyroidectomy hypocalcemia. *Egyptian Journal of Surgery.* 2008; 27(1): 41-7.
 18. Khanzada TW, Samad A, Memon W, Kumar B. Post thyroidectomy complications: the Hyderabad experience. *J Ayub Med Coll Abbottabad.* 2010; 22(1): 65-8.
 19. Rios-Zambudi A, Rodriguez J, Riquelme J, Soria T, Canteras M, Parrilla P. Prospective Study of Postoperative Complications After Total Thyroidectomy for Multinodular Goiters by Surgeons With Experience in Endocrine Surgery. *Ann Surg.* 2004; 240: 18-25.
 20. 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: 971-75.
 21. Steurer M, Passler C, Denk DM, et al. Advantages of recurrent laryngeal nerve identification in thyroidectomy and parathyroidectomy and the importance of preoperative and postoperative laryngoscopic examination in more than 1000 nerves at risk. *Laryngoscope.* 2002; 112: 124-33.
 22. Barczyński M, Konturek A, Stopa M, et al. Total thyroidectomy for benign thyroid disease: is it really worth while? *Ann Surg.* 2011; 254: 724-9.
 23. Jeannon JP. Diagnosis of recurrent laryngeal nerve palsy after thyroidectomy: a systematic review. *Int J Clin Pract.* 2009; 63(4): 624-9.
 24. Mirghani H, Francois A, Landry G, Hans S, Menard M, Brasnu D. Repeat of lymphatic dissection for thyroid cancers. *Ann Otolaryngol Chir cervicofac.* 2009; 126(2): 37-42.
 25. Osmólski A, Frenkiel Z, Osmólski R. Complications in surgical treatment of thyroid diseases. *Otolaryngol Pol.* 2006; 60(2): 165-70.
 26. Zakaria HM, Awad NAA, Kreedes ASA, Mulhim AMAA, Sharway MAA, Hadi MA, Sayyah AAA. Recurrent Laryngeal Nerve Injury in Thyroid Surgery. *Oman Medical Journal.* 2011; 26(1): 34-8.
 27. Farrar WB. Complications of thyroidectomy. *Surg Clin North Am.* 1983; 63(6): 1353-61.
-