Research Article

Correlation Between Types of Thyroid Surgery, Goitre Pathology, and Recurrent Laryngeal Nerve Injury-Retrospective Cohort Study

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Abstract

Background: Thyroidectomies are commonly practiced surgical operations involve removal of a part or whole of the gland as suitable to the type and the pathology of goiter. This is to estimate the recurrent laryngeal nerve injury concerning different types and indications of thyroid surgery.

Patients and Methods: A cohort retrospective study of 705 patients with different kinds of goiters admitted to Al-Sadder teaching hospital and Al-Ameer private hospital in Najaf city- Iraq, for thyroid surgery, as a single surgeon experience, from 1 October 2007 to 30 June 2018, with 37 months as a mean follow uptime. Details regarding patient's data, types of thyroid operations and goiter's pathology recorded with consideration to recurrent laryngeal nerve injury.

Results: Seven hundred and five patients with different types of thyroidectomies for different indications. The patient's age ranged from 11 to 80 years. Most of the patients have non-toxic multinodular goiters (67.4%); the second most common indication for surgery was for toxic multinodular goiters that have seen in (19.15%). Malignancy was seen in (14.3%), while Hashimoto's thyroiditis and Grave's disease were the least common indications of surgery in our study constituting (7.6%, 3.4%) respectively. Temporary recurrent laryngeal nerve injuries were seen in (0.69%) of subtotal surgery rising to (10%) (p=0.05), for patients having recurrent goiters. The overall permanent recurrent laryngeal nerve injuries were (0.99%) ranging from (0%) in subtotal up to (5%) (p=0.027) in cases for recurrent goiters.

Conclusion: Although subtotal thyroidectomy is associated with a low rate of recurrent laryngeal nerve injury, total thyroidectomy is preferable because it will reduce the need for redo surgery that accompanied by a significantly high rate of nerve injury.

1. Introduction

Theodor Kocher was the first surgeon who did a total thyroidectomy in 1909 with minimal risk of recurrent laryngeal nerve and parathyroid glands, his achievement led to a reduction in surgical mortality from 50% to less than 4.5% [1]. In the last three decades, more radical total thyroidectomy has replaced bilateral subtotal thyroidectomy as a satisfying option for the management of all patients with Graves' disease, bilateral benign multinodular goiter, and all but very low-risk thyroid cancer patients [2]. Complications rate after thyroid surgery varies widely depending on operating surgeon and from center to center. The Recurrent Laryngeal Nerve Injury (RLNI) represents the most common of all the complications of thyroid surgery [3-5]. The RLNI after thyroidectomy can jeopardize the quality of patient's life [6]. Unilateral RLN Injury leads to hoarseness of voice, while bilateral RLN Injury leads to dyspnea and often life-threatening glottal obstruction [7, 8]. The incidence of RLN injury is higher during re-do surgery, Graves' disease, procedures for thyroid carcinoma and when non-identification of RLN during surgery. However, there was no statistical significant difference in the incidence of RLNI concerning gender [9-11]. Iatrogenic recurrent laryngeal nerve injuries frequently not recognized during surgery. The exact incidence of recurrent laryngeal nerve injury is still controversial [12]. The

incidence of RLNI been reported between 1% to 2% from different thyroid surgery centers when performed by expert neck surgeons. Although many techniques have introduced to prevent nerve injury, still the incidence is high when thyroidectomy performed by less experienced surgeon reaching between 1.5-14% [11, 13, 14] especially when RLN is not identified during operation. The anesthesiologist checked vocal cord mobility at the time of extubation. Indirect laryngoscopy can be done on the 2nd and 15th postoperative day (when laryngeal edema subsides), and repeated as required later on [15]. Up to 2% of patients may have RLN, vocal cord paralysis without any recognized intraoperative event [16]. However up to 50% of patients with paralysis of their vocal cords may run asymptomatic (subclinical) [17, 18]. Echternach et al. reported that laryngeal complications after thyroidectomies primarily caused by injury to the vocal folds during intubation and to a lesser extent by injury to the laryngeal nerve [19].

Mechanisms of injury to the nerve include partial or complete transection, traction or handling of the nerve, crush or contusion, burn, misplaced ligature, and compromised blood supply [20, 21]. Dysphonia starting on the 2nd-5th postoperative days is commonly due to edema, whereas traction injury of the nerve and damage to axons may result in dysphonia lasting up to 6 months. Dysphonia persisting after 6 months is commonly permanent, which may be due to cutting, ligating or cauterization of the nerve [22]. Bilateral RLNI is more serious complication, because both vocal cords may assume a median or paramedian position and cause suffocation from airway obstruction and tracheostomy may be required. The accidental injury commonly occurs at the level of the upper two tracheal rings, where the nerve closely approximates the thyroid lobe [23, 24].

2. Material and Methods

A cohort retrospective study involving 705 patients undergoing different thyroid surgical procedures, an experience of one surgeon, (including radical neck dissection in indicated cases) for different indications from October 2007 to June 2018 in Al-Sadder medical city teaching hospital, Al-Ameer private hospital in Al-Najaf governorate/Iraq. Data includes recording proper history and clinical examination with general and specific investigations (thyroid function test, ultrasound of the neck), and fine-needle aspiration cytology was done to the patients in indicated cases. Preoperatively, patients send for otolaryngologists for vocal cord exams.

Classical operations; Total thyroidectomy (TT) = bilateral total lobectomy and isthmusectomy. Subtotal thyroidectomy (STT) = bilateral subtotal lobectomy leaving 4 gm. of normal thyroid tissue on each side and isthmusectomy. Near-total thyroidectomy (NTT)= total lobectomy, isthmusectomy, and subtotal lobectomy, were done under general anesthesia and suitable positioning, homeostasis done without the use of any non-absorbable suture material in most of the cases, while surgical clips and harmonic cauterization used in few cases and recording operative and post-operative course. Follow up done for 6-120 months with a mean period of 37 months as outpatient visits. Vocal cords examined by the anesthetist at the time of extubation and at 6 weeks, 3 and 6 months later by an otolaryngologist, some cases have been re-examined 12 months postoperatively in indicated cases. Collected data; analyzed and compared with other studies. Applying Chi-square and z-test in order to test the similarities and differences between categorical variables, which are considered significant when the level of $\alpha \leq 0.05$. This work has reported in line with the STROCSS criteria [25].

3. Results

Seven hundred and five patients were enrolled in the present study, underwent different types of thyroid surgery for different kinds of thyroid pathologies, most of our patients 615 (87.2%) were female with male to female ratio (1:6.8). Patient's ages ranged from 11 to 80 years, most of them aged from 20 to 60 years (607 patients 86.1%), with a peak incidence in the 4th and 5th decades of life, there were 475 patients (67.4%) with non-toxic multinodular goiter (non-TMNG). The second commonest pathology was toxic multinodular goiter (TMNG) occurring in 135 patients (19.15%). Malignant thyroid tumor was seen in 101 patients (14.3%), followed by Hashimoto's thyroiditis in 54 patients (7.6%), graves' disease in 24 patients (3.4%), while the least incidence was seen with simple goiter in 17 patients (2.4%), as shown in Table 1.

Female gender was involved more than males in a different type of pathologies, however there was a significant difference with p. value <0.012, regarding the occurrence of Hashimoto's thyroiditis in female patients. There was a significant difference regarding the occurrence of malignancy in male patients 48.9% (44/90) in comparison to female patients 9.3% (57/615), P-value <0.001, also a significant difference in males affected by TMNG, P-value = 0.026, as shown in Table 2. There was no significant difference regarding affection of both genders by non-TMNG, Grave's disease and simple goiter, P-value were 0.693, 0.561 and 0.9 respectively. STT has done for 145 patients (20.5%) in the early phase of the study while NTT and TT done for 560 patients (79.5%) mostly in the last eight years of the study. TT and radical neck dissections were done for 31 patients (4.4%) having a preoperative diagnosis of thyroid carcinoma. Thyroid with unilateral or bilateral lymph node metastasis and for one case (0.32%) having tuberculous lymphadenopathy + MNG.

Forty patients (5.67%) had operations for recurrent goiters of different pathologies.

RLNI was significantly low in STT and NTT in comparison with TT and operations for recurrent goiters, (P value= 0.001). Temporary RLNI was significantly low in goiters treated by STT (0.69%) as compared with (4.97%) and (10%) of goiters managed by TT and in operations for recurrent goiters respectively, (p value=0.05). The same was true regarding Permanent RLNI that seen in our patients treated by STT and NTT with those who were treated by TT as a first-time surgery or for recurrent goiters with the highly significant difference rate (p value= 0.027),

as shown in Table 3. Our study shows a non-significant difference regarding temporary RLN and permanent RLN injuries among patients having operations for different histomorphological types of goiters, as in Table 4. All the RLNI were unilateral and no need for tracheostomy for any patient included in this study. During the follow up of our patients in the present study, we noticed that complete recovery of most of the temporary RLN injuries happened during the first 3 months after surgery (77.4%), and more rapid recovery seen during the first 6 weeks postoperatively in (22.6%). While the remaining patients recovered after 6 months or more, Table 5.

Age group year	Non-TMNG		Hashimoto's thyroiditis		Graves' disease		Total MNG		Malignancy		Simple goitre		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
11-20	2	8	0	8	0	2	0	6	0	4	0	2	2	30
21-30	7	72	1	21	0	3	2	32	10	11	0	7	19	147
31-40	25	130	0	11	4	6	17	30	13	13	1	6	60	196
41-50	16	116	0	8	0	8	2	28	7	13	1	0	26	173
51-60	7	66	0	5	0	1	4	12	14	7	0	0	25	91
61-70	2	19	0	0	0	0	0	2	0	7	0	0	2	28
71-80	0	5	0	0	0	0	0	0	0	2	0	0	0	7
Total	59	416	1	53	4	20	25	110	44	57	2	15	90	615
%	12.4	87.6	1.9	98.1	16.7	83.3	18.5	81.5	43.6	56.4	11.8	88.2	12.8	87.2
Total	475		54		24		135		101		17		705	

Table 1: Distribution of patients with thyroid diseases by age group and gender.

Type of goiter		Hashimoto's disease	Other diseases	OR (95%CI)	P value
Gender	Female	53	562	8.39 (1.14-61.4)	0.012
	Male	1	89		
Type of goiter		**Malignancy**	**Other diseases**	**OR (95%CI)**	**P value**
Gender	Female	57	558	9.36 (5.7-15.3)	<0.001
	Male	44	46		
Type of goiter		**Non-TMNG**	**Other diseases**	**OR (95%CI)**	**P value**

Gender	Female	416	199	0.91 (0.57-1.45)	0.693
	Male	59	31		
Type of goiter		**Grave's disease**	**Other diseases**	**OR (95%CI)**	**P value**
Gender	Female	20	595	1.38 (0.46-4.14)	0.561
	Male	4	86		
Type of goiter		**Toxic MNG**	**Other diseases**	**OR (95%CI)**	**P value**
Gender	Female	110	505	1.76 (1.06-2.92)	0.026
	Male	25	65		
Type of goiter		**Simple goiter**	**Other diseases**	**OR (95%CI)**	**P value**
Gender	Female	15	600	0.909 (0.204-4.04)	0.9
	Male	2	88		

Table 2: Distribution of different types of goiters according to gender.

Complication	STT n=145	NTT n=137	TT n=423	Op for recurrent goiter n=40	TT + radical neck dissection n=31	Total n=705	P value
Temporary RLNI	1	4	21	4	1	31	0.05
Permanent RLNI	0	1	3	2	1	7	0.027
Total	1	5	24	6	2	38	0.001

Table 3: The post-operative RLN injury were recorded and classified according to the type of surgery.

Histopathology	Non TMNG N=475	TMNG N=135	Simple N=17	Grave's disease n=24	Hashimoto's thyroiditis n=54	Malignancy n=101	Total n=705	P value
Temporary RLNI	13	8	0	2	1	7	31	0.139
Permanent RLNI	6	0	0	0	1	0	7	0.565
Total	19	8	0	2	2	7	38	0.586

Table 4: Distribution of the post-operative RLN injury in the various types of histopathology.

Time	STT	NTT	TT	TT+ radical neck dissection	Re-operative surgery	Total
3 months	1	2	18	1	2	24
6 months	-	2	3	-	2	7
Total	1	4	21	1	4	31

Table 5: The relation between time of recovery from temporary RLNI and type of surgery.

4. Discussion

Patients between 21-60 years old were the most common age group affected in the present study, with an overall mean age incidence of 39 ± 14.5 years, this finding will not correspond to Leigh Delbridge et al. [26] study where the mean age was 53 ± 14. Most of our patients were females with (M: F) ratio of (1:6.8), which is less than Antonio Rois et al. [27] study, who found (M: F) ratio of (1:11) and comparable to (1:7) of Leigh Delbridge et al. study [26], 1:6.2 of Iyomasa RM et al. study [28], and higher than 1:3.25 ratio seen from Hazem M. Zakaria et al. study [11]. The current study showed the transient and permanent RLN palsy in (4.4%) and (0.99%) respectively, these findings are compared to many other studies as seen in the following Table 6. This complication is generally unilateral and transient, but sometime it can be bilateral and permanent and it may be either accidental or deliberate [15, 29]. The permanent damaged of RLN often manifests as an irreversible dysphonation and is the most common post thyroidectomy complication [30]. TT and NTT done for 560 patients, including premium and those with first and second-time recurrence goiter of different clinical and histological presentation. Most of them have a smooth post-operative follow up except for 30 patients (5.36%) who had temporary RLN injury while permanent RLN injury developed in 7 cases (1.25%), this finding was comparable with Hazem et al. [11] findings (6.9% and 0.72%), and less than Chaudhar et al. [15] findings (7.69% and 3.84%) for temporary and permanent RLN injury respectively. Our findings were much less than Aytac et al. [29], Kasemsuwan et

al. [10] and Iyomasa RM et al. [28], our results were higher than Jensen PV et al. [31] who had their results for surgery on benign thyroid conditions only Table 6.

The similarity and differences seen in the above-mentioned studies' findings can be explained by multifactorial reasons like the size of the study, the type of surgery (premium or redo, unilateral or bilateral), type of histopathology and the experience of the surgeons. Subtotal thyroidectomy done in 145 patients with (0.69%) TRLN and no permanent injury had been recorded, this finding was less than Chaudhary et al. [15] finding which was (1.53%) and with Hazem et al. [11] findings which were (1.9%) for temporary injury and no permanent injury. We illustrate the comparison in the result between different studies and our study regarding TT and STT as in Table 7. RLN injury in redo operations seen in 15% while in primary operations is 4.81%, which is comparable with Hazem et al. [11] which was 21.7% in redo vs 4.1% in primary (p value = 0.001), and to Pantvaidya G et al. [32] findings (16.2% vs 9%) for redo and primary operation, respectively. Similar findings seen by Landerholm K, et al. [33], Dhillon VK et al. who state an increased risk with redo surgery, malignant disease and total thyroidectomy operations. The incidence of nerve injury in the malignant disease was 6.93% in the present study, which is comparable to Landerholm K et al. [33] studies with (5.9%) and much less than Hazem et al. [11] with 12.8% in malignant conditions, and much lower than Iyomasa RM et al. [27] studies that reports (31.3%).

Study	Year of study	Number of patients	TRLNI%	PRLNI%
Present study	2018	705	4.4	0.99
Chaudhar et al. [15]	2007	310	2.58	0.64
Hazem M. Zakaria et al. [11]	2011	340	4.1	0.3
Pantvaidya G et al. [32]	2018	152	11.2	3.9

Dhillon VK [34]	2018	1547	2.9	0.4
Iyomasa RM et al. [28]	2017	151	22.5	6.6
Jensen PV et al. [31]	2015	114	1.8	0.9
Higgins TS et al. [35]	2011	64699	3.52	1.2

Table 6: Comparison between our study and other studies regarding the incidence of Temporary RLNI and permanent RLNI.

Author	Year	Procedure	No. of patients	TLRNP%	PRLNP%
Present study	2018	STT	145	0.69	0
		TT and NTT	560	5.36	1.25
Higgins TS et al. [34]	2011	TT	64699	2.74	0.75
Chaudhar et al. [19]	2007	STT	310	1.53	0
		TT		7.69	3.84
Aytac et al. [28]	2005	TT	418	13.6	9
Kasemsuwan et al. [10]	1997	TT	105	6.7	7.6
Hazem et al. [11]	2011	STT	340	1.9	0
		TT and NTT		7.2	0.94
Iyomasa RM et al. [27]	2017	TT	151	22.5	6.6
Dhillon VK et al. [33]	2018	TT	1547	2.9	0.4
Jensen PV et al. [30]	2015	TT	114	1.8	0.9

Table 7: Comparison between different studies and our study regarding TT, STT and the incidence of temporary RLNI and permanent RLNI.

Most of our patients (77.4%) recovered from dysphonation symptoms within 6-12 weeks postoperatively while it needs 6-9 months in the study of Pantvaidya G et al. [32]. This finding can be explained by the little insult that the nerve exposed to (by traction or contusion injury) in our patients in whom we avoid diathermy during dissection of the thyroid gland, although there is still controversy regarding the most effective method for protection of RLN from injury. Some surgeons conclude that omitting the identification of RLN may cause less trauma. However, other studies have proved that this is not the case [33, 34]. Opposing the first idea, we agreed that the identification of RLN during operation leading to decreased RLNI incidence, although it requires the surgeon to know of the anatomic course of the nerve and its' variations [35, 36]. Still, good intraoperative homeostasis and the use of loupe magnification are essential for nerve identification and preservation [37, 38].

5. Conclusion

Although subtotal thyroidectomy accompanied by a low rate of recurrent laryngeal nerve injury, still total thyroid removal is preferable because it will prevent the need for redo surgery, which associated with a

significantly higher rate of recurrent laryngeal nerve injuries, and will guarantee removal of carcinomatous tissue.

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