The Factors Related with Postoperative Complications in Benign Nodular Thyroid Surgery

Aysun Simsek Celik · Hasan Erdem · Deniz Guzey ·
Fatih Celebi · Atilla Celik · Selim Birol · Rafet Kaplan

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Abstract Thyroid gland is an important endocrine organ because of its functions. Although the morbidity and mortality of thyroid surgery have decreased markedly, serious complications may still occur. The aim of this retrospective study was to identify the factors influencing the complications in benign nodular thyroid surgery. A total of 332 patients who underwent thyroid surgery between April 2004 and May 2008 were evaluated retrospectively to identify the factors influencing the complications. We found that in surgery lasting more than 90 minutes the risk of permanent recurrent laryngeal nerve (RLN) injury was high, daily drainage more than 50 cc increases the risk of seroma formation, retrosternal goiter surgery have higher risk for bleeding. The flap edema rates were high found in the operations made by resident surgeon and patients with size 3–4 thyroid glands. Low complication rates can be achieved after thyroidectomy with better knowledge of the

surgical anatomy of the neck, thyroid pathology and required surgical treatment.

Keywords Thyroidectomy · Complications · Influencing factors

Introduction

Thyroid nodules are common in the general population and palpable thyroid nodules are present in 4% to 7% of the adult population [1, 2]. Autopsy studies have demonstrated a high prevalence of benign nodular thyroid disease [3]. Benign nodular goiter is the most common endocrine disorder requiring surgical treatment, especially in places with a high prevalence of iodine deficiency such as Turkey [4, 5]. Surgery on the thyroid gland has usually been reserved for patients with goiters accompanied by obstructive manifestations, failed medical management, cosmetic problems and any clinical suspicion of malignant neoplasia [6, 7]. The main concern is the potentially high rate of complications such as hematoma, permanent recurrent laryngeal nerve (RLN) paralysis and hypoparathyroidism [8, 9]. A large or intrathoracic goiter, extensive malignancy, secondary procedure, inexperience of the surgical team and extent of the operation are the criteria that increase the complication rate [10–12]. The aim of this retrospective study is to identify factors influencing complications in benign nodular thyroid surgery.

Methods

This study included 332 patients who underwent thyroid surgery, for pre-operative diagnosis of non toxic benign

A. Simsek Celik · D. Guzey · F. Celebi · S. Birol · R. Kaplan
2nd Department of General Surgery,
Vakif Gureba Training and Research Hospital,
Istanbul, Turkey

H. Erdem
Department of General Surgery,
Umraniye Training and Research Hospital,
Istanbul, Turkey

A. Celik
2nd Department of General Surgery,
Haydarpaşa Numune Training and Research Hospital,
Istanbul, Turkey

A. Simsek Celik (✉)
Libadiye Caddesi, Soyak Goztepe Sitesi, 46. Blok, Daire: 813,
Uskudar 34700, Istanbul, Turkey
e-mail: draysunsimsek@yahoo.com

multinodular and nodular goiter at the Vakif Gureba Hospital, general surgery department between April 2004 and May 2008. The demographic factors of the patients, the operation techniques applied, the experience of the operating team, the amount of postoperative drainage, the size of the thyroid gland, the location of the gland (retrosternal located or not), the operation duration, histopathological results of the excised gland were recorded and searched for their implications on postoperative complications.

Exclusion criteria were: (1) cases with malignant disease diagnosed preoperatively (2) pre-operative malignancy suspicion, and (3) recurrent thyroid surgery.

Permanent injury to the RLN was defined as palsy of the vocal cord, diagnosed by an otolaryngologist using either indirect laryngoscopy or videolaryngostroboscopy, which lasted for more than six months postoperatively. A temporary palsy was defined when a vocal cord recovered within six months after the surgery.

Temporary hypoparathyroidism was defined as a fall in corrected serum calcium concentration below 8 mg/dl and/or the need for calcium supplementation. Permanent hypoparathyroidism was defined as the need for oral vitamin D and/or calcium supplements for six months following surgery to maintain a normal serum calcium concentration.

Data were compared by Chi-square test and Fisher's exact test. Statistical significance was set at $p < 0.05$. All analyses were performed using statistical package for social science (SPSS), version 13.0 (SPSS Inc., Chicago, Illinois).

Results

A total of 332 patients underwent thyroid surgery during the study period. The mean age was 44.87 ± 11.57 (20–79), and 38 patients were male (11.4%), while 294 patients were female (88.6%). The operation technique applied was demonstrated in Table 1, near total thyroidectomy was the most preferred operation technique (62.3%). A total of 80 patients were found to have one of the complications (Table 2). None of the patients had more than one complication.

Table 1 Surgical approach to thyroidectomy

Types of operation	<i>n</i> (%)
Lobectomy + isthmectomy (L)	8 (2.4)
Bilateral subtotal thyroidectomy (BST)	39 (11.7)
Near total thyroidectomy (NTT)	207 (62.3)
Total thyroidectomy (TT)	78 (23.5)
Total	332 (100)

Table 2 Operative morbidity

Complications	<i>n</i>
Temporary recurrent laryngeal nerve	5
Permanent recurrent laryngeal nerve	5
Temporary hypoparathyroidism	39
Permanent hypoparathyroidism	7
Incision site infections	2
Bleeding	2
Hematoma	3
Flap edema	7
Seroma	4
Superior laryngeal nerve injury	3
Systemic complications	3
Organ injury	0
Total	80

Age, gender, the operation type, pathological results, was not statistically significant factors related to complications.

We found that in surgery lasting more than 90 minutes, the risk of occurrence of permanent RLN injury was high ($p < 0.05$).

In our study temporary and permanent RLN injury was found at the rate of 1.5%, temporary and permanent hypoparathyroidism were found 12% and 2.1% respectively.

Temporary hypoparathyroidism rates were similar in lobectomy + isthmectomy (L) 0% (0 patient), in bilateral subtotal thyroidectomy (BST) 5.1% (2 patients), in near total thyroidectomy (NTT) 14.5% (30 patients), and in total thyroidectomy (TT) 9% (7 patients), respectively. Permanent hypoparathyroidism rates were in L 0% (0 patient), in BST 0% (0 patient), in NTT 1% (2 patients), in TT 6.4% (5 patients) respectively and surgery type has no statically significant factor that affects on hypoparathyroidism.

We found that in surgery lasting more than 90 minutes, the risk of permanent RLN injury was significantly high ($p = 0.008$ Fisher's Exact test) ($p < 0.005$).

Additionally, daily drainage more than 50 cc increases the risk for seroma occurrence ($p < 0.05$), it also increases the systemic complications of thyroid surgery. More than 50 cc/day of drainage was associated with a complication rate to 5.3%, while it is 0.3% in the cases with drainage less than 50 cc/day and the difference was statistically significant ($p = 0.036$ Fisher's Exact test) ($p < 0.05$).

Flap edema rates were higher in operation performed by the resident surgeon than that performed by the specialist surgeon ($p = 0.002$ Fisher's Exact test) ($p < 0.05$) and this complication was rare in 0-1 size thyroid gland, it was

higher in 3–4 size thyroid glands ($p=0.021$ Fisher's Exact test) ($p<0.05$).

Bleeding was seen 2 patients in whom the thyroid gland were retrosternal located and this was statistically significant ($p=0.008$ Fisher's Exact test) ($p<0.05$).

Transient or permanent laryngeal superior nerve (LSN) injury was seen in 3 patients (0.9%), which were not statistically significant. LSN injury was diagnosed by an otolaryngologist after indirect laryngoscopy or videolaryngoscopy of the patients with difficulty in producing high pitch voice. Laxicity and the level differences of the vocal cords were observed. It was accepted as permanent injury in those who have the difficulty for more than six months. One patient was diagnosed to have permanent LSN injury.

The parameters that related to the complications were summarized in Table 3.

Discussion

At present day thyroidectomy is an operation with low mortality and morbidity. Better knowledge with the surgical anatomy of the neck, thyroid pathology and required surgical treatment is essential to keep complications within reasonable limits [13]. There is no consensus concerning the appropriate management of benign thyroid nodules [8].

The three main complications following thyroid surgery include RLN palsy, hypoparathyroidism and postoperative hemorrhage [14].

The incidence of permanent RLN injury was reported to range between 0% and 4% and permanent hypoparathyroidism was reported to range between 0% and 12% [15, 16]. Over the last two decades, some surgeons concluded that TT is indicated not only for thyroid cancer but also for benign thyroid disease [17, 18] and that it can be performed as safely as BST [19–21]. The main objection about performing TT has been the higher likelihood of damage to the RLN and induction hypoparathyroidism [6]. However the incidences of permanent RLN injury and permanent hypoparathyroidism associated with thyroid reoperations have been reported to range between 3.1% and 9.5% and between 3.4% and 14% respectively [20, 22]. Pappalardo et al. reported a rate of recurrence up to 14.5% after subtotal resection in their study, even though pharmacological prophylaxis was given [4]. As a result of these reports, the popularity of BST has been decreasing. Some authors compared the complication rates associated with total and subtotal thyroidectomy in benign nodular disease and could not find any significant difference [8]. In our study, the preferred surgical technique did not influence postoperative complication rates.

Table 3 Complication related parameters and it's statistically significance

	TRLN	PRLN	THPT	PHPT	ISI	FE	S	H	B	SLN	OI	SC
Age												
Gender												
Operation type												
Operation duration												
<90 minutes												
>90 minutes		SS										
Operator selection												
Resident						SS						
Specialist												
Gland location												
Retrosternal									SS			
Not retrosternal												
Gland size												
1–2												
3–4						SS						
Daily drainage												
<50 cc												
>50 cc							SS					SS
Histopathologic result												

TRLN: temporary recurrent laryngeal nerve injury, PRLN: permanent recurrent laryngeal nerve injury, THPT: temporary hypoparathyroidism, PHPT: permanent hypoparathyroidism, ISI: incision site infection, FE: flap edema, S: seroma, H: hematoma, B: bleeding, SLN: superior laryngeal nerve injury, OI: organ injury, SC: systemic complications SS: statistically significant

On the other hand in our study, the only factor affecting the permanent RLN injury was the duration of the surgical procedure. No other parameters studied were related to the permanent RLN injury.

The cause of hypoparathyroidism after thyroidectomy is not always readily explicable. There is a risk of iatrogenic injury to the parathyroid glands during any operation in which both lobes of the thyroid gland are explored or removed, although permanent hypoparathyroidism may not be due to direct injury alone [10]. Hypocalcemia following thyroidectomy is usually temporary. There is a wide variation in the reported incidence ranging from 1.6% to 50%. However, most surgical units experienced persistent dysfunction in TT a rate of 2% or less [10].

Delbridge et al. state that transient hypoparathyroidism should be an accepted outcome of bilateral thyroid surgery rather than a complication [23]. It is noted that the degree and duration of hypoparathyroidism increase with the extent of thyroid surgery [24]. Ozbas and colleagues reported that the incidence of temporary hypoparathyroidism had increased with the extent of the surgery however, they also reported that extent of the surgery had no effect on permanent hypoparathyroidism [14]. However we found that surgery type is not a statistically significant factor that affects on hypoparathyroidism.

The amount of postoperative drainage, the operator chosen, the size of the thyroid gland and the duration of the surgery were found to have no statistically significant factors affecting temporary or permanent hypoparathyroidism.

Bleeding is a life threatening early complication of thyroid surgery in various series and it's reported to be in 0.3–1.5% [5] and LSN transient or permanent injuries are relatively frequent and are often underestimated. They manifest as a lowered voice tone, vocal fatigue and difficulty in singing note intonation [25].

Flap edema, seroma and incision site infections were expected complications. These complications are reported in literature 0.3–7% in total and our results were similar [26].

Flap edema rates were higher in patients had a big gland size and operated by the resident surgeon. It could be relate inadequate surgical technique with damage of the lymphatic's and result of poor venous circulation due to haemostatic over ligation.

We have seen that incidentally found thyroid carcinoma has no statistically significant effect on complication occurrence.

There are differences in the factors that influence the complications in thyroid surgery. Some authors have claimed that RLN injury and hypoparathyroidism, which are among the most serious complications, are closely related to the type of surgery and experience of the

operator; however we did not find such results in our study. We have found that the only factor increasing the rate of RLN injury was the duration of the surgery. It can be explained that, the cases with anatomical distortions carry high risk of RLN injury.

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