

Post-thyroidectomy complications in southwestern Saudi Arabia: a retrospective study of a 6-year period

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BACKGROUND: Thyroidectomy is the surgical removal of all or part of the thyroid gland for non-neoplastic and neoplastic thyroid diseases. Major postoperative complications of thyroidectomy, including recurrent laryngeal nerve injury, hypocalcemia, and hypothyroidism, are not infrequent.

OBJECTIVE: Summarize the frequency of surgical complications of thyroidectomy.

DESIGN: Retrospective.

SETTING: Secondary health facility in southwestern Saudi Arabia.

PATIENTS AND METHODS: We collected data from the records of patients who were managed for thyroid diseases between December 2013 and December 2019.

MAIN OUTCOME MEASURE: Complications following thyroidectomy.

SAMPLE SIZE: 339 patients, 280 (82.6%) females and 59 (17.4%) males.

RESULTS: We found 311 (91.7%) benign and 28 (8.3%) malignant thyroid disorders. Definitive management included 129 (38.1%) total thyroidectomies, 70 (20.6%) hemithyroidectomies, 10 (2.9%) subtotal thyroidectomies and 5 (1.5%) near-total thyroidectomies with 125 (36.9%) patients treated non-surgically. The overall complication rate was 11.3%. There were 4 (1.9%) patients with recurrent laryngeal nerve palsy, 16 (7.5%) patients with temporary hypoparathyroidism, 1 (0.5%) patient with paralysis of the external branch of the superior laryngeal nerve and 3 (1.4%) patients with wound hematoma.

CONCLUSION: The rate of complications following thyroidectomy is still high. There is a need for emphasis on comprehensive measures to control the high rate of complications.

LIMITATIONS: Retrospective design and no long-term follow up to monitor late complications.

CONFLICT OF INTEREST: None.

Goiter remains common in the Southwestern region of Saudi Arabia where Bisha is located, in the longest valley of the Arabian Peninsula, standing at an altitude of approximately 610 meters above sea level. In fact, recent studies have shown that the Asir region has the highest prevalence of goiter in Saudi Arabia.¹ Thyroidectomy is a quite common procedure. During the 19th century thyroid surgery was characterized by high morbidity and mortality (up to 40% mortality reported) mainly due to infection and bleeding. Later, with better understanding of anatomy, improved surgical and hemostatic techniques, developments in anesthesia and aseptic techniques, death from thyroidectomy became rare. Even today, potential complications of thyroidectomy include hemorrhage, respiratory obstruction, recurrent laryngeal nerve (RLN) injury, hypocalcemia, hypothyroidism, thyroid storm, and wound infection. Hypocalcemia is the commonest complication in many centers. It is defined as serum calcium of less than 8.8 mg/dL (<2.20 mmol/L) in the presence of a normal serum protein level.²

The extent of surgery influences the frequency of complications. Ideally, the extent of thyroid resection should be determined by the reason for the surgery. Indications for thyroidectomy range from benign conditions like simple multinodular goiter and solitary thyroid nodule to neoplastic conditions such as differentiated thyroid cancer. Indications for thyroidectomy include cosmesis and pressure symptoms in large goiters, but fear of malignancy is the basis for many patients to seek surgical intervention. Other factors influencing the incidence of complications include surgeon's experience, thyroid pathology, size of the goiter and variable anatomy of the recurrent laryngeal nerve.³⁻⁶ Preoperative planning, the use of intraoperative adjuncts and type of anesthesia have been proposed to try and reduce complication rates.⁷⁻⁹ We evaluated the prevalence and types of post-thyroidectomy complications in Bisha and discuss current management considerations and strategies.

PATIENTS AND METHODS

This retrospective study involved data collected from the surgery department of King Abdullah Hospital Bisha between December 2013 and December 2019. Institutional approval was obtained from the ethical committee of King Abdullah Hospital. We included patients of both sexes with clinically confirmed goiter who were operated on by consultants only and had files with complete data. Excluded from the study were subjects with inadequate specimens for diagnosis, incomplete data or data acquisition errors, patients with con-

comitant hyperparathyroidism and surgery with neck dissection. The clinical records of the patients were retrospectively reviewed, and a proforma was used to obtain information from the records that included age, gender, nationality, presenting complaints, comorbidities at admission, preoperative and postoperative vocal cord examination, main diagnosis and methods used in diagnosis (fine needle aspiration cytology, thyroid ultrasound scan, CT scan of the neck, thyroid function test), type of definitive management (surgical or non-surgical), surgical interventions and medical procedures, and results of postoperative histopathological examination of the resected thyroid gland. Vocal cords were examined preoperatively by indirect laryngoscopy and postoperatively while patients were under anesthesia by direct laryngoscopy. Postoperative complications that were recorded included management of complications, blood transfusion, drugs and devices used during hospitalization and discharge status. The records also included information on the procedure performed and the intraoperative details. The routine practice of intraoperative visualization of the parathyroid glands and RLNs was recorded. We did not practice intraoperative neuromonitoring for the RLN. Total serum calcium and albumin were routinely measured pre- and postoperatively. Hypocalcemia was defined as total serum calcium of less than 8.8 mg/dL (<2.20 mmol/L) in the presence of normal serum protein level or as a serum ionized calcium concentration < 4.7 mg/dL (< 1.17 mmol/L).² In Bisha, the reference range for total serum calcium is 2.09 to 2.54 mmol/L. A serum total calcium level of less than 2.09 mmol/L in the presence of normal serum albumin is considered hypocalcemia in Bisha. Patients with symptomatic hypocalcemia were admitted and treated with intravenous calcium gluconate by slow injection with ECG monitoring until symptoms disappeared; patients with mild hypocalcemia were treated on an outpatient basis, with oral calcium carbonate 1 g to 3 g/day in divided doses and vitamin D3. Serum total calcium was monitored every 3 months. Voice change was routinely assessed at the patients' bedside postoperatively. Unilateral RLN paralysis discovered intraoperatively was managed by immediate repair, postoperative steroid injection, speech therapy and medialization by cord injection. IBM SPSS version 26 was used for statistical analysis.

RESULTS

Of 354 patient files, 5 patients had incomplete data and 10 patients had indeterminate pathology results or inconclusive diagnoses, leaving 339 valid observations. Of these, there were 280 (82.6%) females and

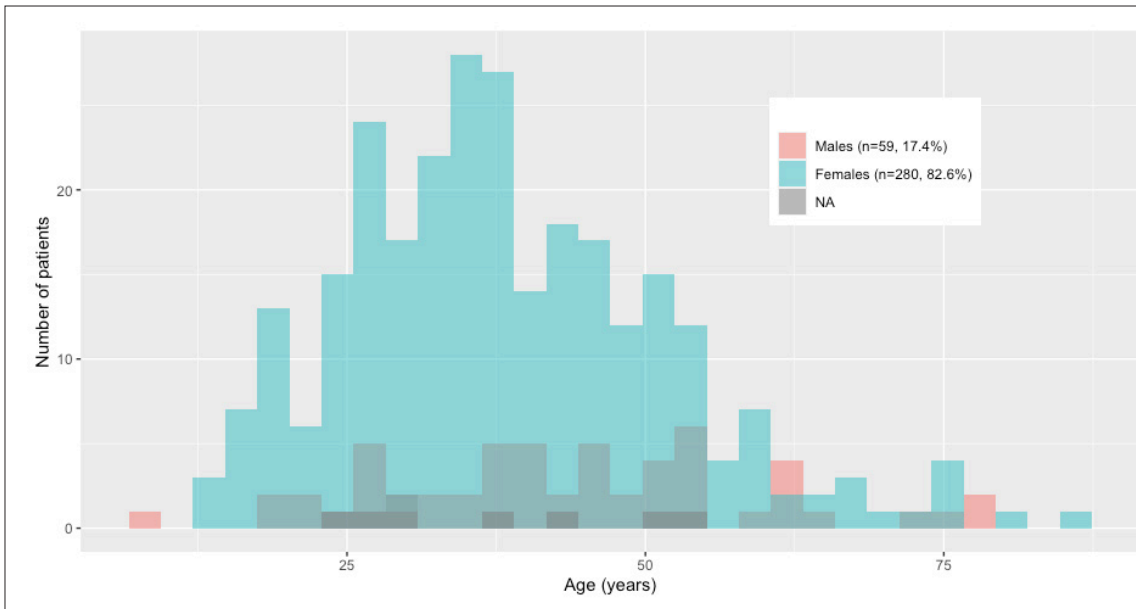


Figure 1. Age and sex distribution of study population (NA: data not available for 25 patients).

59 (17.4%) males resulting in a female /male ratio of 4.75:1 (**Figure 1**). Age ranged from 7 to 94 years with a median (IQR) of 38 (29-48).

Only one (0.3%) patient with thyroid disorder was younger than 12 years of age. The highest incidence of thyroid disorders was 28.1% (96 cases) in the age group 31-40 years and the lowest incidence was 0.3% each in the age groups 81-90 and above 90 years. Most of the males were in the age groups 31-40 (3.5%) and 51-60 (3.5%) while most females were in the age group 31-40 (28.3%). There were 311 (91.7%) benign and 28 (8.3%) malignant thyroid disorders (**Table 1**). The most prevalent benign thyroid disorder was multinodular goiter, which occurred in 138 (40.7%) patients. Of the malignant thyroid disorders, papillary thyroid cancer was the most prevalent, occurring in 18 (5.3%) patients. A total of 287 (84.7%) patients were euthyroid, 15 (4.4%) had toxic goiter and 37 (10.9%) had hypothyroidism. Other clinical features were obstruction in 10 (2.9%) patients, and pain in 7 (2.1%) (**Table 2**). Two hundred fourteen patients (63.1%) underwent surgery (**Table 3**). The remaining 125 (36.9%) of the patients had no surgery. The overall complication rate was 11.2%. Complications after subtotal and hemithyroidectomies for benign thyroid diseases included 4 unilateral recurrent laryngeal nerve palsies (1.9%); complications following total thyroidectomies included 16 transient hypoparathyroidism (7.5%) cases, 3 patients with wound hematoma (1.4%) and 1 case of weakness of voice or dysphonia (0.5%) (**Table 4**).

Table 1. Distribution of thyroid disorders.

Benign thyroid disorders (91.7%)	
Multinodular goiter	138 (40.7)
Colloid goiter	82 (24.2)
Follicular adenoma	25 (7.4)
Thyroid cyst	14 (4.1)
Thyroid nodule (solitary)	10 (2.9)
Hashimoto’s thyroiditis	20 (5.9)
Hurtle cell adenoma	11 (3.2)
Diffuse hyperplasia	8 (2.4)
Mixed follicular/Hürthle	1 (.3)
Granulomatous thyroiditis (De Quervain’s)	2 (.6)
Malignant thyroid disorders (8.3%)	
Papillary thyroid cancer	18 (5.3)
Mixed papillary/follicular carcinoma	7 (2.1)
Follicular thyroid cancer	3 (.9)
Total	339 (100.0)

Values expressed as number of patients (%).

DISCUSSION

Thyroidectomy is one of those surgical procedures in which an intricate knowledge of anatomy is invaluable to avoid a catastrophic outcome for the patient and medical liability for the surgeon. Complications from thyroidectomy can range from transient hypocalcemia or cord paralysis to permanent hypocalcemia, respiratory obstruction, and death. Other serious adverse events can include loss of pitch which may be a career-ending event for a vocalist. Therefore, the surgeon requires special skills, training, and proficiency.

Table 2. Distribution by clinical presentation.

Obstruction	10 (2.9)
Pain	7 (2.1)
Solitary nodule	40 (11.8)
Thyroid cyst	14 (4.1)
Hypothyroidism	37 (10.9)
Thyrotoxicosis	15 (4.4)
Total	123 (36.3)

Values expressed as number of patients (%).

Table 3. Definitive management.

Total thyroidectomy	129 (38.1)
Non-operative	125 (36.9)
Hemithyroidectomy	70 (20.6)
Subtotal thyroidectomy	10 (2.9)
Near-total thyroidectomy	5 (1.5)
Total	339 (100.0)

Values expressed as number of patients (%)

Table 4. Post-thyroidectomy complications.

Complication	
Hypocalcemia	16 (7.5)
Recurrent laryngeal nerve palsy	4 (1.9)
Wound hematoma	3 (1.4)
External branch of superior laryngeal nerve palsy	1 (0.5)
Total	

Values expressed as number of patients (%)

The overall prevalence of post-operative complications varies from center to center but studies have shown that complications are lowest among experienced surgeons and high-volume surgeons.¹⁰ In this study, the overall complication rate was 11.2%. While some centers report high rates, some report low rates of complications. **Table 5** shows the various complications recorded in different centers across Saudi Arabia.¹¹⁻¹⁷ Al-Harbi and Ahmed reported an overall prevalence of 9.6% among 310 patients who underwent thyroidectomy.¹¹ However, this was a retrospective study and only three major complication types were deliberately recorded. On the other hand, Al-Qahtani et al in Tabuk reported an overall prevalence of 72.3%,¹² while Al-Hakami et al from Jeddah reported a complication rate of 43.45%,¹³ and Qobty et al from Aseer region reported a rate as high as 91%.¹⁴ Relatively moderate rates were reported by Al-Eissa et al from Riyadh (14.8%),¹⁵ Al-Amri from Dammam (17.4%)¹⁶ and Al-Shareef et al from Makkah region (16%).¹⁷

In most studies, hypocalcemia is the commonest complication encountered following thyroidectomy. Thyroidectomy is the commonest cause of hypocalcemia worldwide. Post-thyroidectomy hypocalcemia is mostly asymptomatic and transient. It is usually due to devascularization of the parathyroid glands during intra-operative manipulation, some cases are due to inadvertent removal, hemodilution, calcitonin release in hyperthyroid patients, and increased urinary excretion due to surgical stress. The prevalence of hypocalcemia in Saudi Arabia from studies in seven provinces of Saudi Arabia involving 1353 patients, range from 0.07% to 65.3%. The highest recorded prevalence was 65.3%,¹¹ 34.8%,¹³ and 37.3%.¹⁴ This is comparable to a review done by Jessie and Harrison, who reported that the rate of transient hypoparathyroidism ranged from 5% to 71% while the rate of permanent hypoparathyroidism ranged from 0 to 3.5%.¹⁸ All our patients presented on postoperative days 7 to 10. Treatment lasted for 6 to 13 months until patients were asymptomatic and normocalcemic.

Studies suggest that sex, surgical procedure, and perioperative changes in serum calcium are among the factors that influence development of hypocalcemia. The prevalence of hypocalcemia in our study was 7.5% (16/214) and all the cases were females following total thyroidectomy. In most studies, the females have higher rates of hypocalcemia¹⁹⁻²² while other studies show no significant difference with sex.^{19,22-25} The reason for female preponderance is subject to speculation, but the explanations include anatomic differences in terms of the diminutive nature of females, genetic differences in signaling pathways and the influence of estrogen on

parathyroid hormone secretion.²⁶ To avoid parathyroid gland injury, it is helpful to strictly adhere to capsular dissection and to ligate the superior and inferior thyroid arteries distally and close to the thyroid capsule to preserve blood supply to the parathyroid glands.²⁷

One of the most serious complications of thyroidectomy is RLN injury. The prevalence in our study was 1.6%. The prevalence among other centers in Saudi Arabia is from 2.7% to 43% (Table 5). There are reports of high rates of temporary (up to 23.6%) and permanent (up to 15.5%) damage to the nerve following thyroidectomy.²⁸ In a meta-analysis involving 14 934 patients, incidence of RLN injury was 3.4% with the highest frequency among malignant cases. Apart from surgical volume and experience, the literature suggests that the more extensive the thyroidectomy the higher the chance for RLN injury. Hence, total thyroidectomy carries more risk than more conservative excision.

There are differing views on how to avoid RLN injury during surgery. While some recommend routine visualization of the nerve to safeguard it,²⁹⁻³¹ others strongly believe exploring the nerve would increase the incidence of its injury and therefore, advocate its avoidance.^{32,33} Some have advocated for intraoperative nerve monitoring but there is no evidence that this reduces the prevalence of permanent nerve injury.³⁴ Ling et al reported an overall prevalence of 2% in 1696 patients with no significant difference in the incidence of overall, transient, or permanent RLN injury between intraoperative nerve monitoring and visualization alone groups. Zahoor et al emphasized exploration of the nerve only when one encounters difficult thyroid surgery, such as large goiters, recurrences, malignancy and inflammation.³³

In our study, only one patient (0.5% incidence) had injury to the external branch of the superior laryngeal nerve (EBSLN). Among the seven regions, only Al Qahtani et al reported this complication (a prevalence of 1.1%) from their cohort in Tabuk.¹¹ The prevalence of EBSLN injury has been reported from 0% to 20%.³⁵ This nerve is usually injured during dissection in the superior pole and ligation of the superior thyroid vessels. Injury results in voice fatigue and inability to achieve a high frequency note, which is important for professions that require high pitch registrations like vocalists, muezzins, lawyers, teachers, and broadcasters. The diagnosis of injury to EBSLN can be difficult and there is evidence that it is underdiagnosed. Mechanisms of damage include nerve entrapment in the ligature of the superior thyroid vessels, stretching, transection and thermal damage.^{36,37} Nerve ischemia has also been implicated in causing injury to this nerve.³⁸ There is evidence that surgeon experience influences the incidence.³⁹ Several

Table 5. Post-thyroidectomy complication profiles of seven regions of Saudi Arabia (n=1353).

	Location	Overall complication rates	Hypocalcemia (transient/permanent)	Recurrent LN palsy (transient/permanent)	Ext. br. superior laryngeal N. palsy	Hematoma/Seroma	Other adverse postoperative events	Horner's syndrome	Wound infection	Hypothyroidism
Al-Harbi and Ahmed, 2018 ¹¹	Jazan	9.6	5.3	3.12	-	1.25	-	-	-	-
Al-Qahtani et al, 2020 ¹²	Tabuk	72.3	65.3	2.7	1.1	2.7	0.5	-	-	-
Al-Hakami et al, 2019 ¹³	Jeddah	43.45	34.8	3.7	-	1.95	1.7	0.2	1.1	-
Qobty et al, 2020 ^{6,14}	Asir	91.3	37.3	24.7	-	-	43.3	-	6.7	-
Al-Essa et al, 2021 ^{6,15}	Riyadh	14.8	10.6	4.9	-	-	0.8	-	-	-
Al-Amri, 2014 ^{5,16}	Dammam	17.8	0.07	7.35	-	-	8.8	-	-	1.47
Al-shareef et al, 2020 ^{6,17}	Makkah	16	19	43	-	5	-	-	-	33.0

Values are percentage. ^aAll patients underwent total thyroidectomy. ^bScar abnormality. ^cAll are cases of thyroidectomy done for thyroid cancer. ^dRecurrent thyroid cancer

surgical techniques have been proposed to reduce the chances of injuring the EBSLN. Individual ligation of the branches of the superior laryngeal vessels over the gland without necessarily identifying the nerve, deliberate identification of the nerve before ligating the vessels, and use of electrical nerve stimulation with visualization of cricothyroid muscle contraction (using endotracheal surface electrodes) have all been shown to be effective in avoiding EBSLN injury.

In our study, wound hematoma occurred on the first postoperative day in three patients (1.4% prevalence). Immediate surgical evacuation was necessary in two patients and one patient needed blood transfusion. There was no mortality. Risk factors for post-thyroidectomy hematoma include obesity, old age, Grave's disease, malignant goiter, large goiter, total thyroidectomy, bilateral thyroidectomy, inflammatory thyroid conditions,

and thyroidectomy with neck dissection.⁴⁰⁻⁴⁵ There is inconclusive evidence on the role antithrombotic therapy in the causation of post-thyroidectomy wound hematoma, but strong emphasis must be placed on meticulous hemostasis during thyroidectomy.^{41,44,46,47}

The limitations in our study included the retrospective design and there was no long term follow up to monitor late complications. There is a need for a large-scale, high quality, prospective randomized controlled trials to evaluate the various techniques aimed at reducing post-operative complications of thyroidectomy. In summary, serious postoperative complications following thyroidectomy are still frequent. There is a need for comprehensive measures to control the high rate of complications. Thyroidectomy should be limited to experienced surgeons with a special interest in thyroid diseases who are located in high volume centers.

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