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Major post-operative complications of thyroid surgery: Preventable or not?

M. A. Majid and Md. Ibrahim Siddique

Department of Surgery, Faculty of Surgery, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka 1000, Bangladesh.

Abstract

Factors responsible for major complications following thyroid surgery in 598 patients were studied. Patients with non toxic multinodular goiter involving both lobes of thyroid constituted the maximum bulk subjected to thyroidectomy. The most frequent procedure was bilateral subtotal thyroidectomy. Reactionary hemorrhage occurred in 6 patients, all following bilateral procedures and among them 5 patients developed tension hematoma with respiratory obstruction despite the presence of a drain. Temporary vocal cord palsy was observed in 7 patients whereas one patient subjected to total thyroidectomy with neck dissection for papillary carcinoma of thyroid developed permanent right vocal cord palsy. Temporary parathyroid insufficiency was seen in 51 patients and one patient developed permanent hypoparathyroidism. Incidence of parathyroid insufficiency was higher in bilateral procedures as compared to unilateral ones. There was no operation related death in this series, but complications like hemorrhage, vocal cord palsy and parathyroid insufficiency following thyroid surgery are still a deep concern.

Introduction

First thyroid extirpation on record appears to have been performed by a Moorish surgeon, Abul Casem Khalaf Ebn Abbas, usually named Albucasis, in A.D 952. For hundreds of years, no basic progress in thyroidectomy was made and the surgical literature of the late nineteenth century is filled with descriptions of fatalities from thyroid surgery usually resulting from a massive and uncontrollable hemorrhage. In the year 1595, a surgeon was imprisoned for intra-operative death of a 10 year old girl subjected to thyroid surgery[1]. In to this technical and professional arena, Nobel Laureate Theodor Kocher, Professor of Surgery in Berne, Switzerland, perfected the technique of thyroid surgery[1,2]. Thyroidectomy is the most common operation performed by endocrine surgeons for benign and malignant conditions of thyroid[3]. Common indications are neoplastic conditions, toxic adenoma or a toxic nodular goiter, goiter causing pressure symptoms on the esophagus, trachea or recurrent laryngeal nerve, cosmesis and patients' wishes[3,4]. Though, there is a remarkable advancement in thyroid surgery in recent years, complications are still not infrequent. Specific complications leading to significant morbidity following thyroidectomy are bleeding, recurrent laryngeal nerve injury and temporary or permanent hypoparathyroidism. All these three major complications are related to operative technique. A retrospective analysis of 598 thyroidectomies performed over the last 20 years was done to see the actual incidence of these preventable complications in this series. The purpose of this study is to look back to the drawbacks in our technique leading to potentially fatal complications in some of our patients and to highlight the importance of technical perfection for a safe thyroid surgery based on our own experience.

Patients and Methods

Medical records from 598 patients (male 196, female 402) subjected to thyroidectomies for different thyroid disorders, carried out by the authors from January 1988 to July 2007 were reviewed retrospectively. The age range was 15 to 70 years (mean 37.5 years). Patients with two major complications, recurrent laryngeal nerve injury and hypoparathyroidism were followed up for at least one year following surgery. Preoperative work up consisted of measurement of serum TSH, free T4 and T3, USG of thyroid gland, radioisotope scan with 99^{m} Tc, X-ray neck A/P and lateral view with huge multinodular goiter and serum calcium level. FNAC was done in patients

with solitary thyroid nodule and from dominant nodules of a multinodular goiter. Indirect laryngoscopy was a routine. Other investigations for operative fitness were done according to the age of the patients and comorbid illness. Hyperthyroid patients were given antithyroid drugs for 8-12 weeks and surgery was carried out about 3-4 weeks after a euthyroid state was achieved.

Surgical techniques were identical for all procedures. The procedure began with a slightly curved transverse skin crease incison about 2-3 cm above the suprasternal notch. Thyroid gland was exposed by incising the deep cervical fascia in the midline and retracting the strap muscles laterally. Middle thyroid vein was divided between ligatures when present. Superior thyroid pedicle was divided between ligatures close to the gland thus avoiding injury to the external laryngeal nerve. Recurrent laryngeal nerves were identified in close proximity to inferior thyroid artery. Every effort was made to identify the parathyroid glands prior to ligating the branches of inferior thyroid artery close to the gland thus preserving the blood supply of parathyroid glands. In bilateral procedures, when parathyroid glands on one side could not be identified, a thin strip of thyroid tissue posteriorly on the contralateral normal lobe was not removed, practically performing a near total thyroidectomy.

In 6 cases of completion thyroidectomies, the contralateral lobe was removed when a routine paraffin section histopathology reported to be malignant (papillary carcinoma- 4, Follicular carcinoma- 2). Absolute homeostasis was ensured by ligature or bipolar diathermy. Vocal cord movements were examined by the anesthesiologist after extubation and findings were noted down. Postoperative events were monitored carefully with particular attention to reactionary hemorrhage, voice change and clinical features of hypocalcaemia such as circumoral numbness, tingling, muscle cramps and excitability or irritability. Patients with features of hypocalcaemia were treated by intravenous calcium gluconate and later on with oral calcium and sometimes with vitamin D supplements. Serum calcium levels were measured everyday during the hospital stay until it came towards normal or the patients became asymptomatic. Patients with voice changes were examined by ENT surgeons for vocal cord palsy. Patients with features of hypocalcaemia and vocal cord palsy were followed up for at least one year postoperatively.

Results

In this series, right recurrent laryngeal nerve was not identified in three malignant thyroid disorders, (sarcoma-1, follicular carcinoma-2). In relation to hemithyroidectomy, two parathyroid glands were identified and preserved in 68 patients; one parathyroid gland was identified in 39 patients and none in 2 patients. In 6 patients with completion thyroidectomies (initial procedure carried out by others) 2 parathyroids were identified in 4 and one parathyroid in 2 patients. In relation to 483 bilateral procedures (bilateral subtotal thyroidectomy, near total thyroidectomy and total thyroidectomy with or without neck dissection) four parathyroid glands were identified and preserved in 82, three glands in 103, two glands in 179, and one gland in 95 cases. Parathyroid glands could not be identified in 24 cases. These were the cases where near total thyroidectomy was performed. Inferior thyroid veins were dealt with last before removing the part or whole of the gland.

Table I: Major postoperative complications in relation to the extent of surgery (n=598)

Postoperative complications	Operative procedure					
	Hemithyroidectomy (n=109)	Bilateral subtotal thyroidectomy (n=361)	Near total thyroidectomy (n=42)	Total thyroidectomy (n=74)	Total thyroidectomy with neck dissection (n=6)	Completion thyroidectomy (n=6)
Reactionary haemorrhage	-	5	-	-	1	-
Temporary vocal cord palsy*	-	4	-	3	-	-
Permanent vocal cord palsy*	-	-	-	-	1	-
Temporary parathyroid insufficiency	4	11	13	18	4	1
Permanent parathyroid insufficiency	-	-	-	-	-	1
Death	-	-	-	-	-	-

* Vocal cord palsy: All on the right side

Drains were kept deep to strap muscles in selected cases. No drain was given in 33 cases of 115 unilateral procedures. Drains were kept in 416 cases of bilateral procedures. Table 1 depicts major postoperative complications in relation to the extent of thyroid surgery. Reactionary hemorrhage occurred in 6 (1%) patients, all following bilateral procedures. Three patients with malignant thyroid (Sarcoma- 1, Follicular carcinomas- 2) already had right vocal cord palsy preoperatively. Right recurrent laryngeal nerve was transected in one patient (0.16%) out of 595, who was subjected to total thyroidectomy with functional neck dissection for papillary carcinoma of thyroid. 29 (4.87%) patients in this series showed voice changes postoperatively and subsequent indirect laryngoscopy showed limited vocal cord movement or no movement, all on the right side in 8 (1.34%) patients. 7 of them had regained vocal cord function with improvement of voice within an average 2 months postoperatively. The patient with transected nerve had permanent vocal cord palsy. Clinical features of hypoparathyroidism was seen in 52 patients (8.69%). 51 patients (8.52%) recovered clinically as well as biochemically with a normal serum calcium level in between 4 days to 3 months postoperatively. One patient (0.16%) subjected to completion thyroidectomy for follicular carcinoma of thyroid needed oral calcium and vitamin D supplements even after one year following the procedure indicating permanent parathyroid insufficiency. In 483 bilateral procedures, 46 patients (9.52%) and in 115 unilateral procedures, 6 patients (5.21%) developed parathyroid insufficiency for variable degree and duration. There was no operation related death in this series.

Discussion

It was not until the early twentieth century that thyroidectomy became a safe and acceptable operation with the advent of general anesthesia, antiseptics and haemostatic techniques[5]. Before the era of Theodor Kocher, it was such a perilous undertaking that even the world's greatest surgeons were reluctant to undertake and many in fact condemned[1]. More than a century ago, thyroid surgery had a reported mortality rate of 40%[6]. Death from thyroid surgery is extremely rare today. Nevertheless, concern remains about the major postoperative complications like hematoma, vocal cord paralysis due to recurrent laryngeal nerve injury and postoperative hypocalcaemia leading to significant morbidity and longer hospital stay. Hematoma and vocal cord paralysis occur early in the postoperative period[7]. Parathyroid insufficiency, in most cases present 2-5 days after operation, but the onset may be delayed for 2-3 weeks or a patient with marked hypocalcaemia may remain asymptomatic[4].

The immediate life threatening complication following thyroid surgery is hemorrhage under deep cervical fascia[3]. Hemorrhage deep to strap muscles causes tension hematoma leading to laryngeal edema and airway obstruction and results in respiratory death[2,4,5]. It has been reported in 0.3 to 1 percent of consecutive thyroidectomies[2]. In the present series 6 patients (1%) had reactionary hemorrhage, 5 of them presented with respiratory obstruction and hypoxia and one with persistent bleeding through the drainage tube within an average of 3.5 hours postoperatively. All of them were subjected to bilateral procedure. Wound exploration revealed oozing from thyroid remnant in 5 patients and another one from an unrecognized severed inferior thyroid vein. Hemorrhage may also occur following slipping of a ligature on the superior thyroid artery[4]. Drain was found to be an unreliable indicator of hemostasis or persistent bleeding, because in all the six patients drains were kept deep to strap muscles and five of them became blocked. There is no definite evidence that drains prevent hematoma or seroma formation and controversy still remains regarding the use of drains after thyroid surgery. Schoretsanitis and colleagues found no statistically significant difference in the formation of haematoma in 200 patients subjected to thyroidectomy randomly assigned to two groups, one which received suction drainage at the time of surgery, whereas the other did not[8]. It has also been reported that patients with drains had longer postoperative hospital stay and longer duration of postoperative pain. Similar result was experienced by Debry and colleagues[9]. Drain should not be a substitute for intra-operative hemostasis. However, in extensive bilateral procedures or after removal of a large goiter, a properly functioning drain may prevent the formation of a tension hematoma.

Recurrent laryngeal nerve paralysis may be unilateral or bilateral, transient or permanent. Transient paralysis occurs in about 3% of nerves at risk and recovers in 3 weeks to 3 months[4]. Permanent recurrent laryngeal nerve injury occurs in 1 to 3 percent of thyroid operations even in experienced hands especially when undertaken for malignant disease[2]. Loss of function can be caused by transection, ligation, traction, contusion, crush, diathermy burn or even a compromised blood supply. The consequence is vocal cord paresis or paralysis. Unilateral paralysis results in hoarseness and worsening voice. Bilateral vocal cord palsy causes partial airway obstruction leading to stridor,

respiratory distress or both. Transient paralysis may result from pressure on the nerve by clot or by edema in which case recovery is anticipated. In this series of 598 thyroidectomies permanent right vocal cord palsy occurred in one patient (0.16%) out of 595 cases (3 cases already had vocal cord palsy preoperatively) subjected to total thyroidectomy with neck dissection for papillary carcinoma of thyroid. Herranz Gonzales and colleagues reported a 2.3% incidence of unilateral recurrent laryngeal nerve injury in 513 patients who underwent thyroidectomy[10]. They found a significant relationship of recurrent laryngeal nerve injury with secondary procedures, histologic findings and no nerve identification during surgery. There is a popular belief that if you don't disturb the nerve, it will not disturb you. Probably it is a wrong perception as it is indicated that among cases in which surgeons "avoid" rather than expose the recurrent laryngeal nerve there is a 4 percent incidence of vocal cord damage[2]. Moreover, though the nerve is thought by many surgeons to run posterior to the inferior thyroid artery, a significant percentage of cases run anterior to the inferior thyroid artery, a dependable landmark for identification of the nerve. In almost 10% of cases the nerve runs between the branches of the artery. A non recurrent, recurrent laryngeal nerve can also occur more often on the right than on the left and is at much greater risk during operation[2, 11]. The frequency of recurrent laryngeal nerve injury should be below 1%[5]. It is now generally agreed that identification of the nerve per-operatively is the best way to avoid damage. Bilateral Recurrent laryngeal nerve injury is extremely rare. No such fatal complication was found in this study.

Parathyroid damage during thyroid surgery is the second largest category of thyroid related medicolegal claims in western countries and a permanent hypocalaemic state has been reported to occur in 1-3% of cases[5]. The incidence has been reported to be as high as 20 percent when a total thyroidectomy and radical neck dissection were performed and as low as 0.9 percent for subtotal thyroidectomy[2]. Postoperative hypoparathyroidism results in hypocalcaemia and hyperphosphatemia with clinical presentation of circumoral numbness, tingling of fingers and toes and excitability and anxiety during the first few days after operation. Most patients develop symptoms when the serum calcium level is lower than 8 mg/dl. In this series parathyroid insufficiency was observed in 52 (8.69%) patients, and only one patient (0.16%) among them developed permanent parathyroid insufficiency. Several studies reported an incidence of 5% to 30% of postoperative hypocalcaemia in thyroidectomized patients[7,12,13]. Incidence of parathyroid insufficiency was higher in bilateral procedures in comparison to unilateral ones (9.52% vs 5.21%) in this series. Lower incidence of postoperative parathyroid insufficiency in this series possibly did not reflect the actual incidence of parathyroid insufficiency, as serum calcium was not routinely measured in all patients postoperatively. Many patients with significant hypocalcaemia may remain asymptomatic. Following thyroidectomy, whether unilateral or bilateral, transient hypocalcaemia is observed within 12 hours following surgery and in most cases recovers spontaneously within 24 hours[12, 14]. The etiology of transient hypocalcaemia after thyroidectomy is still controversial. Though direct trauma to the parathyroid glands, devascularization of or inadvertent excision of the parathyroid glands can impose significant hypocalcaemia, review of recent literatures suggested it to be mutifactorial. Some have suggested that nonspecific hemodilution associated with the stress of surgery is responsible[12]. Others stated that transient hypocalcaemia following subtotal thyroidectomy is due to a reduction in the renal tubular reabsorption of calcium[14]. Hypocalcaemia following unilateral lobectomy may result from a transient stunning of parathyroid function[15]. In unilateral procedures, parathyroid insufficiency is rare and of minor importance and the condition usually resolves in a few days with or without calcium supplementation. Frequency of parathyroid insufficiency is dependant on the extent of thyroid resection logically increasing the risk of injury to the parathyroid glands[12]. So the situation is different and the degree and duration of postoperative hypocalcaemia is more in bilateral procedures and it was reported that there was a linear relationship between the number of preserved parathyroid glands and early hypocalcaemia[15]. Thyroidectomy for hyperparathyroidism, thyroid carcinoma or after previous neck surgery increases the frequency of permanent hypoparathyroidism as parathyroid preservation is technically difficult in these conditions[16].

In all patients in this series adequate hemostasis was achieved beginning from the skin incision. As thyroid gland is very vascular, avoiding damage to the thyroid itself renders a relatively bloodless field. Recurrent laryngeal nerve(s) was identified successfully in all but 4 cases. At least one parathyroid gland was preserved along with their blood supply in the majority of cases. Main trunk of the inferior thyroid artery was not ligated; rather the branches of the artery were ligated close to the thyroid capsule. Where the parathyroid glands could not be identified per-operatively, near total thyroidectomy was performed. At the end of the

procedure hemostasis was ensured by inspecting the wound following irrigation with normal saline. Anesthesiologist was asked to bring the head of the operating table to the horizontal position and to hyperinflate the lungs which increased the venous pressure in the neck and at the same time blood pressure of the patient was maintained almost to near normal or above the pre-operative recording. At this point, the wound was re-examined and any further bleeding was controlled by fine suture ligature or bipolar diathermy. Drains were kept deep to the strap muscles in majority of bilateral procedures and when a large goiter had been removed, ensuring adequate patency of the drainage tube. Large, bulky dressing on the neck which could mask the early detection of neck swelling or development of a tension hematoma, were avoided. All patients were critically observed for 48 hours postoperatively for clinical features of hypocalcaemia.

A century ago, thyroid surgery was associated with significant morbidity and mortality. Today, death following thyroid surgery is extremely rare. A thorough understanding of the anatomy and pathologic basis of thyroid disorders is essential for a thyroid surgeon. Thyroid gland is very vascular and is intimately related to the anatomical location of recurrent laryngeal nerves and Parathyroid glands, damage to which leads to significant morbidity. Preoperative evaluation, adequate per-operative hemostasis, meticulous dissection and fastidious identification of nerves and parathyroids during surgery are the only way to prevent those major complications.

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