

Thyroidectomy

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Abstract

Thyroidectomy is a common surgical procedure that can be associated with significant complications. These include haemorrhage, infection, permanent recurrent laryngeal nerve palsy, and hypoparathyroidism. Complications should be relatively uncommon in expert hands. This contribution outlines how to carry out a thyroidectomy, highlights the necessary avoidance measures to keep complications to a minimum, and offers guidelines for difficult cases. After surgery, the appropriate outcome measures should be recorded, and patients are entitled to expect recognized standards of care relating to thyroid surgery.

Keywords thyroidectomy; recurrent laryngeal nerve; parathyroid glands; inferior thyroid artery

Emil Theodor Kocher (Berne, Switzerland) is often credited as the 'father of modern thyroid surgery', but the first thyroidectomy was done more than one thousand years ago by Abu al-Qasim, a legendary Islamic surgeon from Andalusia.^{1–3} Thyroidectomy has evolved into an extremely safe and effective procedure thanks to the pioneers of thyroid surgery during the late 19th and early 20th centuries ('the magnificent seven').³

The number of thyroidectomies carried out in the UK is steadily rising, perhaps a reflection of the increase in radiological investigations and the ageing population. The amount of thyroid surgery done by otolaryngologists is also increasing; 31% of thyroid surgery in the UK in 2003–04 was carried out by ENT surgeons, compared to 2.5% in 1989–90.⁴ However, the specialty of the surgical team is unimportant: what matters is the training and the expertise of the surgeon and multidisciplinary team with regards to the diagnosis and management of thyroid disease.²

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Indications

The indications for thyroidectomy include:

- malignancy or suspected malignancy
- thyrotoxicosis
- cosmetic effect
- obstructive symptoms (e.g. compression of the trachea or oesophagus).

Types

The types of thyroid surgery are summarized in Table 1. In general, hemithyroidectomy (thyroid lobectomy including the isthmus) is the minimum surgery that should be done.

Preoperative assessment

The surgical assessment of a thyroid lump involves fine-needle aspiration cytology, together with measurement of thyroid function (thyroid-stimulating hormone and free thyroxine), serum calcium and thyroid antibodies. Movement of the vocal cords should be checked.

Ultrasound may be useful in assessing small nodules, a dominant nodule in a multinodular gland or obtaining a cytological sample if fine-needle aspiration cytology has failed. CT or MRI may be useful (e.g. assessment of retrosternal extension, diagnosis and staging of malignancy).⁵

The consent process for surgery begins in clinic. Ideally, informed consent is taken by the surgeon performing the operation using the complication rates pertaining to their practice (BAES Audit⁶). If hemithyroidectomy is being performed, then the potential need for completion thyroidectomy should be discussed.

Types of thyroidectomy

Type	Description of procedure
Lumpectomy	Excision of a nodule with a small cuff of surrounding thyroid tissue
Partial thyroidectomy	Excision of a nodule with a larger cuff of surrounding thyroid tissue
Hemithyroidectomy	Excision of one lobe of thyroid plus the isthmus
Subtotal thyroidectomy	Excision of more than one-half of the thyroid gland on each side plus the isthmus
*Near-total thyroidectomy	Complete excision of one lobe, the isthmus and >90% of the other side
*Total thyroidectomy	Excision of both lobes and the isthmus
*Completion thyroidectomy	Conversion of a previous thyroidectomy into a total or near-total thyroidectomy

*May be combined with a neck dissection.

Table 1



Figure 1 Marking of the awake patient.

Procedure for thyroid lobectomy

The procedure can be split into ten distinct stages, sometimes referred to as the ‘ten commandments’ by thyroid surgeons!

Preparation

A skincrease collar incision ($\approx 2\text{--}3$ cm or two finger-breadths above the sternal notch when the neck is extended) is marked in the anaesthetic room (Figure 1). General anaesthetic is given with endotracheal intubation. A specialized endotracheal tube is placed with the sensors at the level of the vocal cords if monitoring of the recurrent laryngeal nerve is being done. The patient is placed supine on the operating room table in a slight reverse Trendelenburg. A shoulder roll is used to hyperextend the neck. The neck is infiltrated with 20–30 ml of 1:100,000 epinephrine (Figure 2) and the neck is prepared and draped in the usual way. A right-handed surgeon usually starts on the right side and later moves to the contralateral side of the thyroid lobe that is being removed to facilitate access to vital structures.

Incision

The incision is made with a number 10 blade with one sweep through the skin, subcutaneous tissue, platysma, and down to the avascular deep investing layer of fascia. The size of the



Figure 3 Raising subplatysmal flaps.

incision is not as important as the site and symmetry, although extension beyond the sternocleidomastoids is usually unnecessary. The incision should not cross low between the muscle heads in a thin neck because the resulting scar may become hypertrophic. Care must be taken to avoid damaging the anterior jugular veins.

Exposure: ‘flaps and straps’

Subplatysmal flaps are raised superiorly to the upper border of the thyroid cartilage and inferiorly to the sternal notch, using blunt dissection or monopolar diathermy, with appropriate traction and countertraction on the flaps (Figure 3). Damage to the cutaneous nerves (C2 and C3) and the resulting anaesthesia is avoided by dissecting in this plane.

The flaps are retracted using a self-retaining retractor (Figure 4). The sternohyoid muscle is separated along its median raphe and the plane underneath is developed using blunt dissection. This exposes the sternothyroid muscle which can be retracted or, if the thyroid is large, divided in the upper third (to avoid damage to the ansa cervicalis). One must get down onto the capsule of the gland and into the right plane because there are several layers of areolar tissue between the muscle and the gland.

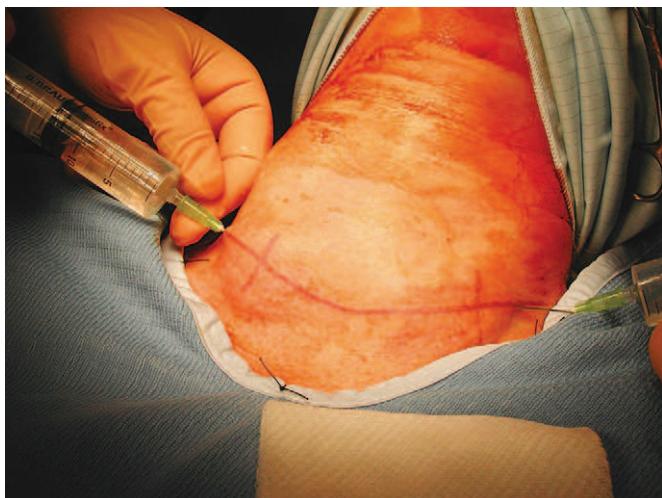


Figure 2 Injection of local anaesthetic.

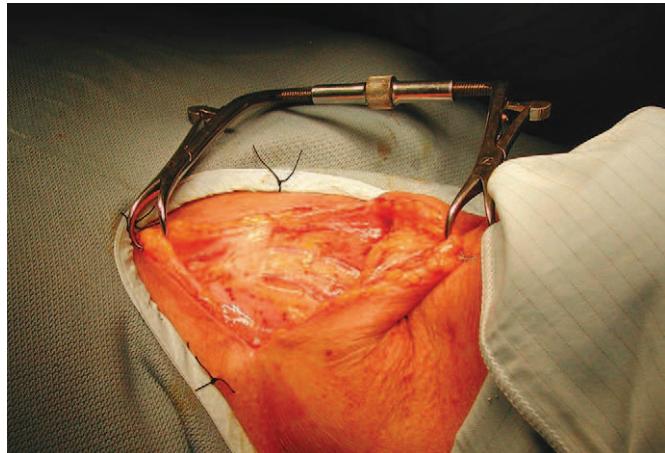


Figure 4 Insertion of Joll's retractor.

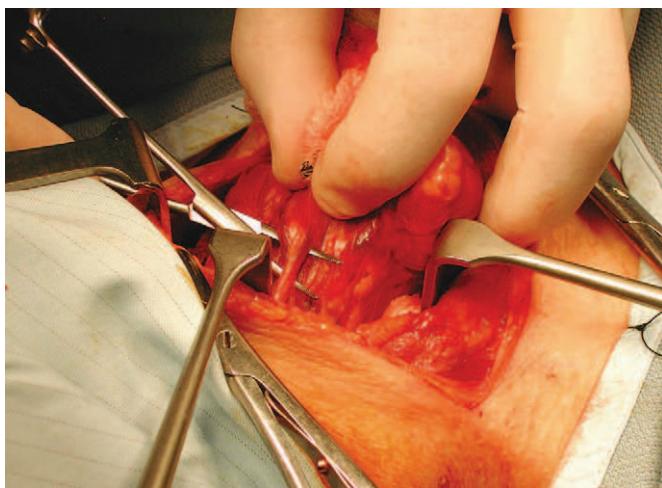


Figure 5 Exposure and ligation of the upper pole.

Mobilization and dissection of the upper pole

The thyroid gland is usually mobilized by initially dissecting the upper pole; the middle thyroid vein may have to be ligated first to facilitate entry into the paracarotid tunnel. Exposure of Joll's triangle (Figure 5) is achieved by superior and lateral retraction of the straps (by the assistant) and inferior traction of the gland (by the surgeon). It is not always identified, but one must know that the external branch of the superior laryngeal nerve, which innervates the cricothyroid muscle, usually runs with the superior pole vessels through Joll's triangle. Ligation of the superior pole close to the gland avoids injuring the external branch of the superior laryngeal nerve (Figure 5). Care is taken to ligate the superior pole vessels individually because the proximal ends can easily disappear deep into the neck once the haemostat is removed. Further dissection on the lateral and inferior parts of gland may enable partial delivery of the thyroid into the wound. A thyroid ima artery may occasionally be encountered (Figure 6).

Identification of the recurrent laryngeal nerve

With the surgeon standing on the same side as the lobe being removed, the assistant rolls the gland medially with a swab to expose the tracheo-oesophageal groove and thyroid bed

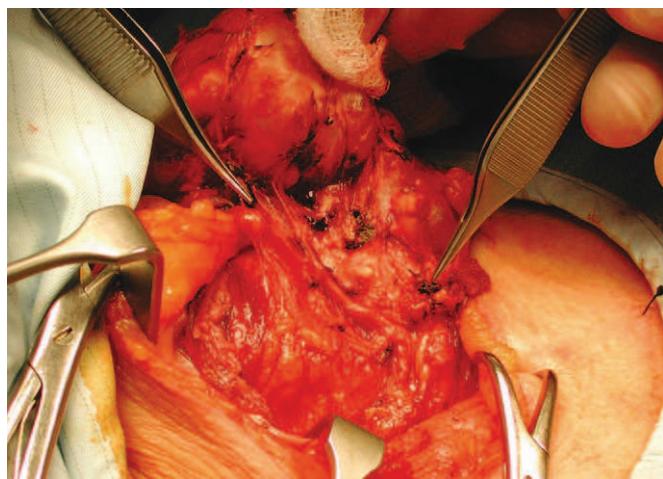


Figure 7 Identification of the recurrent laryngeal nerve and parathyroid glands.

('creeping'; Figure 7). The recurrent laryngeal nerve is carefully exposed by blunt dissection low down in the neck, where it makes up one side of Beahrs' triangle (the other borders are the inferior thyroid artery and the common carotid artery). The recurrent laryngeal nerve is often encountered earlier on the right than the left because it is higher (fourth arch derivative) and is more superficial and lateral. The possibility of a non-recurrent nerve must be considered if the recurrent laryngeal nerve is not identified (Figure 8).⁷ It can also be deviated posteriorly by protuberances of thyroid tissue ('tubercles of Zuckerkandl').⁷

Identification of the parathyroid glands

The parathyroid glands are caramel-coloured and are often variable in size and position (Figure 7). They are often identified before the recurrent laryngeal nerve is found. The superior parathyroid can be found medial to the upper pole in Joll's triangle, but in 80% of cases it is found in the thyroid bed superior to the inferior thyroid artery. The inferior parathyroid is more inconsistent in its position, although most are found on the lower part of thyroid gland below the inferior thyroid artery (44%), or lower still on the thyrothymic ligament (26%).⁸

Dissection of the inferior thyroid artery and removal of the gland

Once the recurrent laryngeal nerve and the parathyroid glands have been identified, the inferior thyroid artery is ligated distal to

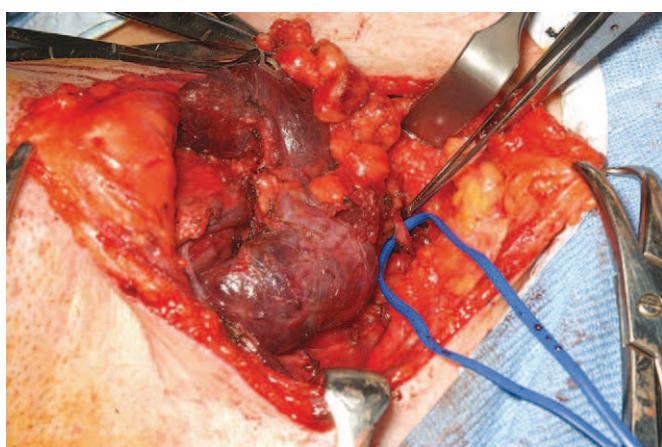


Figure 6 Thyroid ima artery (encircled with blue sloop).

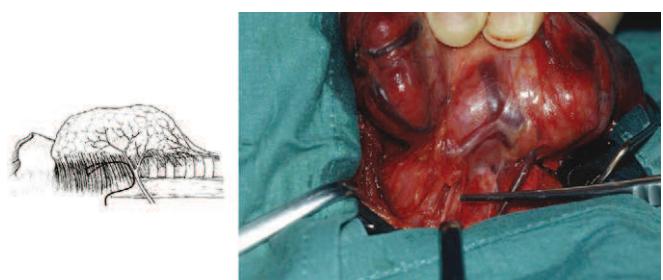


Figure 8 Right non-recurrent laryngeal nerve.

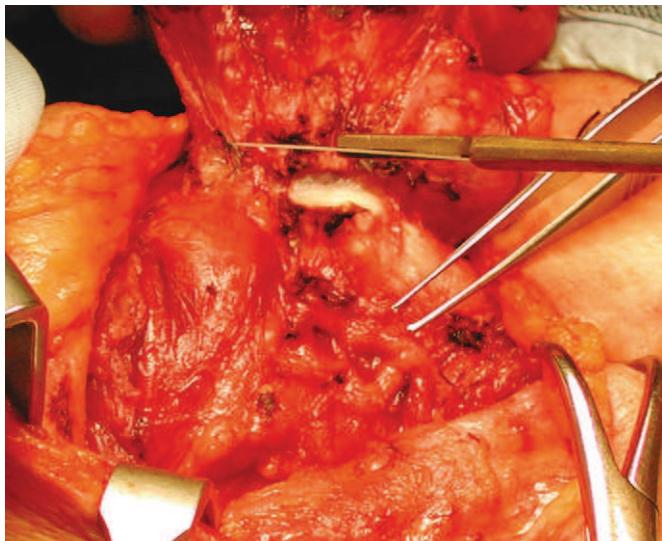


Figure 9 Removal of gland—division of Berry's ligament.

the branches that supply the inferior parathyroid. This is done by staying on the capsule of the gland and peeling the fascia off the thyroid and parathyroids downwards, using bipolar diathermy as necessary. Devascularized parathyroids should be reimplanted (usually in the sternocleidomastoid). The gland is fully mobilized by cutting through Berry's ligament down onto the trachea (a 15 scalpel blade is safer if close to the nerve; Figure 9); the pyramidal lobe is removed if present. The isthmus is dissected off the trachea, divided, then clamped and the contralateral lobe inspected before transfixing with a running suture.

Haemostasis

The commonest site for bleeding is in the 'triangle of concern', comprising the trachea medially and the nerve laterally, with the thyrothymic ligament and loose fat above the sternum at the base and Berry's ligament at the apex (Figure 10). There are many small branches of the inferior thyroid artery within this triangle that require meticulous haemostasis. A Valsalva manoeuvre helps to identify potential bleeding and Surgicel™ can be placed at the apex of the triangle, over the recurrent laryngeal nerve to aid haemostasis and prevent trauma to the nerve by the suction

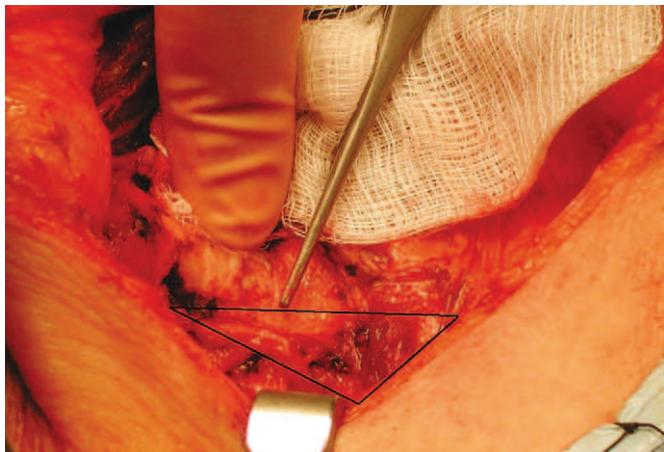


Figure 10 Haemostasis—the 'triangle of concern'.

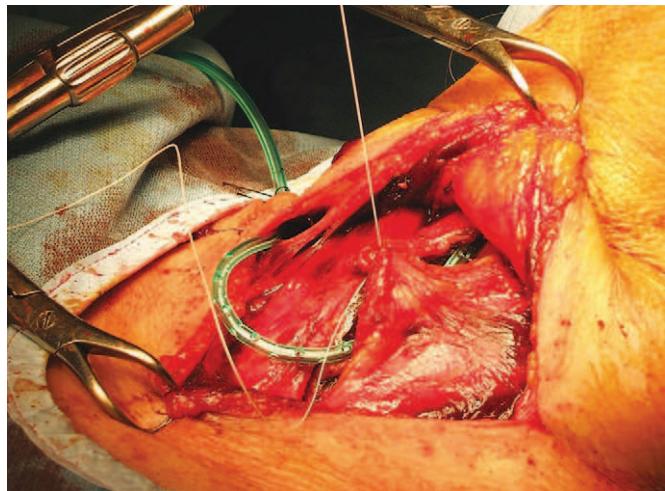


Figure 11 Closure in layers with a drain.

drain. The authors use closed suction drainage in most cases, though some have suggested this may not always be necessary in routine cases.^{9,10}

Closure

The fascia overlying the strap muscles is closed in the midline using a 3-0 interrupted absorbable suture and the platysma and subcutaneous layer reapproximated using the same suture after the shoulder roll is removed (Figure 11). The authors use clips to the skin which are removed in 48 hours (Figure 12); a subcuticular suture can also be used.

Postoperative care

Bleeding and signs of airway compromise are looked for in the immediate postoperative period. Serum calcium is checked at six hours, and then on the morning of the first and second postoperative days after total thyroidectomy. The drain is removed when the output has reduced sufficiently (usually the next day). Vocal cord function is reassessed, together with checking of thyroid function six weeks after surgery. Outcome measures should be recorded prospectively.⁵⁻⁷

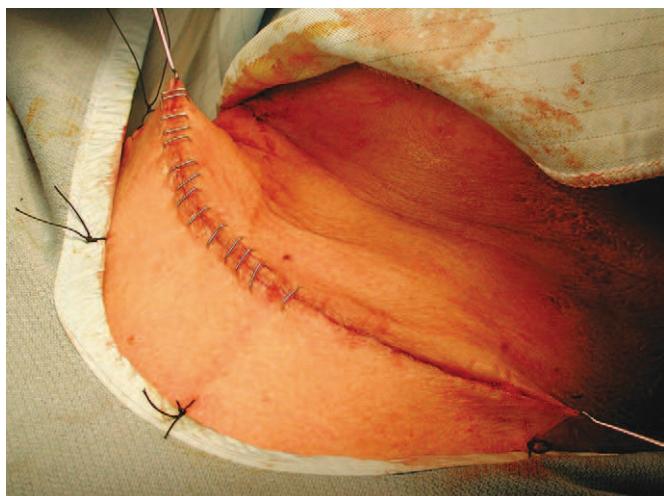


Figure 12 Application of skin clips.

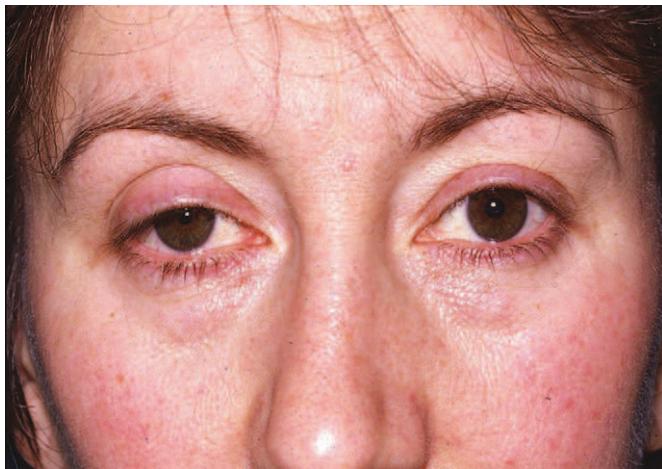


Figure 13 Horner's syndrome after thyroidectomy.

Complications

Complications can be divided into early, intermediate or late, and local or general.

- Early complications include bleeding, voice change and temporary hypoparathyroidism.
- Late complications include a poor scar, permanent hypoparathyroidism, and damage to the recurrent laryngeal nerve and the external branch of the superior laryngeal nerve.

Complications and avoidance measures⁷

Complication	Avoidance measures
Recurrent laryngeal nerve palsy	Identify the nerve early low down, use meticulous surgical technique and consider using a nerve monitor.
Damage to the external branch of the superior laryngeal nerve	Know its course; confirm with a nerve stimulator if seen in Joll's triangle, avoid and ligate superior thyroid vessels individually right on the gland.
Temporary and permanent hypoparathyroidism	Identify all parathyroids, carry out extracapsular dissection with preservation of blood supply and consider using loupes.
Damage to cutaneous nerves C2 and C3	Lift the upper and lower flaps by staying on the deep cervical fascia. Use bipolar diathermy.
Haemorrhage	Meticulous surgical technique; doubly ligate or ligate and transfix the upper pole vessels, ligate the thyroid isthmus and close after a Valsalva manoeuvre. Consider using a drain.
Poor scar	Mark correctly, ensure accurate skin closure. Consider triamcinolone in patients with dark skin.
Infection	Aseptic surgical technique. Consider prophylactic antibiotics in high-risk cases.

Table 2

Guidelines for difficult cases

- Make an adequate incision
- Do the easy side first
- Always consider cancer
- Consider total thyroidectomy for many benign and malignant cases; high-risk patients may need a level VI neck dissection
- Try to identify the recurrent laryngeal nerve and parathyroid glands
- Know the location of the external branch of the superior laryngeal nerve
- Consider using a nerve monitor
- Achieve good access in retrosternal goitre, do the easy side and the upper pole first, and divide the strap muscles at least on one side
- Do not hesitate to split the chest or sacrifice one recurrent laryngeal nerve if malignancy is present

Table 3

Very occasionally, haemorrhage, hypocalcaemia and infection can be fatal after thyroidectomy.¹¹ Complications such as a Horner's Syndrome may also occur rarely (Figure 13). Table 2 outlines how to avoid these complications; Table 3 offers guidelines on how to treat difficult cases. ♦

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