Thyroidectomy

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Abstract

Thyroidectomy requires meticulous dissection and the technique has changed over time. We discuss the gold standard and evolving new methods of performing a thyroidectomy and the common complications and difficulties associated with these. Retrosternal goitres present slightly different challenges. The preoperative assessment and characterization of these retrosternal goitres and the associated increased complication rates are discussed. New techniques to minimize these complications such as nerve monitoring are now more routinely being utilized and are described in this article.

Keywords Complications; retrosternal goitre; technique; thyroidectomy

Introduction

Throughout history, the surgical technique of thyroidectomy has changed for the better. In 1850 thyroidectomy was banned by the French Academy due to its high mortality. However since the work of Theodore Kocher, recognized by the award of the Nobel prize (1909) for demonstrating a mortality of less than 1% for extra-capsular dissection and arterial ligation of the thyroid, conventional thyroidectomy has become a well-accepted, safe procedure.[1] It falls under the remit of the endocrine surgeon, head and neck surgeon and general surgeon with a specialist interest. Techniques are still advancing; with extra-cervical approaches including endoscopic, lateral and face lift incisions and robot-assisted methods, which have developed from the standard cervical Kocher incision thyroidectomy. However the cervical incision continues to provide a safe, and good cosmetic result and is most widely used.

Indications

Benign indications for total thyroidectomy include recurrent thyrotoxicosis and compression symptoms (dysphagia or dyspnoea); a total thyroidectomy is also indicated for papillary carcinoma (>1 cm), follicular carcinoma and medullary thyroid carcinoma. If follicular carcinoma is suspected (by obtaining a Thy3F cytology) a thyroid lobectomy and isthmusectomy is indicated. A total thyroidectomy can also performed prophylactically in those carrying a germline *RET* mutation. Completion thyroidectomy is advised for histologically confirmed follicular cancer greater than 1 cm with vascular invasion by the British Thyroid Association in the *Guidelines for the Management of Thyroid Cancer*.[2] In some low-risk patients with follicular cancer between 2 and 4 cm, a completion thyroidectomy may not be mandatory, but discussion in multidisciplinary team meetings would be advisable. Recurrent thyroid cysts, solitary thyroid nodules increasing in size and asymmetrical thyroid enlargement causing compressive symptoms are also indications for thyroid lobectomy ± isthmusectomy. Thyroid lobectomy is indicated in patients with repeated Thy1 (non-diagnostic) on fine needle aspiration cytology (FNAC) to enable a firm diagnosis to be obtained.

Types

Thyroid surgery usually consists of a thyroid lobectomy (one thyroid lobe and isthmus), an isthmusectomy (the isthmus alone) or a total thyroidectomy. Variations on a total thyroidectomy include: a near total thyroidectomy in benign often thyrotoxic disease (which leaves a tiny residual piece of thyroid usually to preserve the blood supply of a parathyroid or to preserve the recurrent laryngeal nerve (RLN)); subtotal thyroidectomy (historically designed to reduce the risk of hypoparathyroidism, RLN injury and hypothyroidism) — however in thyrotoxic patients, thyrotoxicosis can reoccur. We are also seeing an increase in recurrent benign goitres in the elderly in those where subtotal thyroidectomy was performed for benign disease. Re-operation is associated with a higher risk to the RLN and parathyroids. Subtotal thyroidectomy is therefore no longer recommended. Other variations of thyroid surgery have also been described (e.g. Dunhill's procedure — total lobectomy on one side and subtotal on the other). In those with cancer, clearance of the central (level VI/VII) or lateral neck (II— V) lymph nodes dissection may also be required depending on the type of cancer and the stage of disease.

Preoperative management

Preoperatively patients must be adequately assessed, prepared and consented for the procedure. Due to the changing focus on methods used to reduce cosmetic outcomes, it is recommended that options of surgical approach be discussed with the patient in line with available expertise. Assessment includes a full history and examination focussing on symptoms of thyroid function and compression and changes in gland or nodule size. Preoperative investigation should include thyroid function tests and thyroid antibodies, ultrasound, and FNAC for assessment of nodules.[3] CT is utilized in those patients with compressive symptoms or suspected retrosternal extension. In advanced disease CT/MRI may help with assessment of vascular invasion into internal carotid/internal jugular vein; oesophageal or tracheal invasion or invasion of vertebral fascia: these are all factors which may make a thyroid cancer inoperable or may change the extent of surgery required. These advanced tumours are however only a small percentage of most differentiated thyroid cancers. Technetium scans should be used for assessment of thyrotoxic patients especially in the presence of a nodule, where a lobectomy on the side of the hot nodule may be sufficient. The preparation of the hyperthyroid patient is discussed in an earlier chapter so will not be discussed again here.

The British Association of Endocrine and Thyroid Surgeons (BAETS) recommends routine pre- and postoperative vocal cord

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assessment with laryngoscopy. Preoperative assessment helps to rule out pre-existing RLN injury, which can often be asymptomatic.[4]

Consent

As with all consent processes clinicians should discuss the indication for surgery and other treatment options, explanation of the procedure and the side effects of treatment proposed. Written information leaflets supplement this process. The consent process starts at the first clinic visit and complication rates should be quoted as per the unit or surgeon's own figures. Recognized specific complications are bleeding (around 1% requiring re-operation), change in voice/singing voice (6.1%), RLN injury (1.8%) and a need for calcium and vitamin D postoperatively (temporary (25%) or permanent (12%)).[4] Hormone replacement with levothyroxine should also be discussed. Complication rates are higher in re-do surgery, in patients with retrosternal disease and malignancy. The risk of temporary hypocalcaemia is increased in younger patients, females, Grave's disease and level VI dissection. Length of stay is normally one or two nights for total thyroidectomy; hypocalcaemia accounts for the majority of prolonged stays.

Preparation

The patient can be marked on the ward preoperatively or after positioning on the operating table. The patient is anaesthetized with a general anaesthetic and an endotracheal (ET) tube is used. Nerve monitoring can be undertaken by using a stimulator probe during surgery that responds to electrodes on the end of specialized ET tube. These electrodes may be integrated in the tube or wrapped around a normal ET tube and the tube is positioned so that the electrodes are in contact with the vocal cords. Increasingly, nerve monitors are recommended to identify and avoid injury to the recurrent laryngeal and external branch of the superior laryngeal nerve. Recent audit shows that uptake of use of nerve monitoring is not yet routine across the UK[4]. It does require a skilled anaesthetist and surgeon in using the equipment. In order for nerve stimulation to be used, a short-acting paralysing agent is used for the anaesthetic. Following intubation, the patient is positioned supine on the table with a shoulder support and head ring allowing neck extension. This allows good access but care is required to avoid hyperextension and thereby reduce postoperative pain and paraesthesia. Once positioned, the neck is prepared and draped.

Incision

In conventional thyroidectomy, a skin-crease collar incision (Kocher incision) is used approximately two fingerbreadths above the sternoclavicular joint in neck extension. A higher incision generally gives a better scar than a low incision; the latter also has a higher risk of hypertrophy or keloid scar formation. The site of incision is marked, the midline identified and an incision 4–6 cm is used. The size and position of the incision can be adapted based on the size of the thyroid or indication for surgery. In the conventional approach, the scalpel is used for the skin, followed by scalpel, diathermy, ligasure or ultrasonic scalpel to divide the subcutaneous tissue plane deep to the platysma down to the avascular deep investing layer of fascia.

Alternative approaches: since the achievement of safe and established good outcomes in conventional thyroid surgery, alternative approaches have been developed that continue to be under investigation. There are two principles to the alternative approach: the use of minimally invasive techniques and remote access techniques.

Endoscopic neck surgery was first described in 1996 by Michael Gagner for parathyroidectomy but the technique for thyroidectomy followed shortly after, but as of yet as not been widely accepted in the UK. The aims of minimally invasive procedures are improved cosmetic results while reducing postoperative discomfort, parasthesia and discomfort during swallowing.[5] Many would argue that the conventional approach has minimal postoperative discomfort and the scar generally heals well. Miccoli et al. use a minimally invasive video-assisted procedure that employs a smaller incision and reduced dissection that in Italy is thought to facilitate day case surgery.[6] Patient selection for these procedures is important as they are limited by the nodule size and thyroid volume that can be removed. There is some evidence to support its use in small papillary thyroid cancer nodules in the absence of palpable neck involvement, no evidence of thyroiditis, a relatively normal thyroid gland and no previous history of neck surgery or radiation.[7] Many surgeons are still sceptical of its widespread acceptance, especially in suspected cancers and in large nodules.

Non-cervical approaches to the thyroid include axillary incisions, areolar incisions, postauricular approaches, transoral, infraclavicular and a 'face-lift' approach.[8] These approaches take longer and are more invasive than the conventional thyroidectomy, have a longer recovery time and have also been shown to have a steep learning curve.[9]

Robot-assisted thyroidectomy is perceived as a novel approach to thyroidectomy for reducing scar and neck paraesthesia and is usually performed through a trans-axillary scar. It is limited currently to those patients with a body mass index below 32 kg/m^2, with a small thyroid gland (<5 cm), unilateral nodule, non-malignant disease and in the absence of thyroiditis. A feasibility study in 15 patients in the UK has demonstrated success with robotic-assisted thyroid lobectomy.[10] The average size of the nodule was 2.5 cm with one report (6.6%) of temporary brachial plexus neuropraxia that resolved by day 5. Patient selection appears important with great care taken for correct arm position to reduce brachial plexus damage; average operating time was 200 minutes. Non-cervical approaches have also been associated with postoperative breast tissue anomalies, arm paralysis and unpublished reports of oesophageal perforation, transaction, prolonged shoulder discomfort, chest wall hyperaesthesia, retained thyroid tissue and excessive blood loss.[4] The use of the robot in thyroid surgery is controversial in Britain; as yet it has not shown any significant advantages over the conventional technique, except for cosmesis, but has other significant risks.

Exposure

In conventional thyroidectomy, the incision is followed by raising subplatysmal flaps. This is aided by counter-traction by the assistant using skin hooks or cat's paw retractors. Extension of the flaps superiorly is required to the upper border of the thyroid cartilage and inferiorly to the sternal notch. Care must be taken to avoid the anterior jugular veins. By keeping to the