

Clinically discrete swellings

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Discrete thyroid swellings (thyroid nodules) are common and are palpable in 3–4% of the adult population in the UK and USA. They are three to four times more frequent in women than in men. Diagnosis A discrete swelling in an otherwise impalpable gland is termed isolated or solitary, whereas the preferred term is dominant for a similar swelling in a gland with clinical evidence of generalised abnormality in the form of a palpable contralateral lobe - or generalised mild nodularity. About 70% of discrete thyroid swellings are clinically isolated and about 30% are dominant. The true incidence of isolated swellings is somewhat less than the clinical estimate. Clinical classification is inevitably subjective and overestimates the frequency of truly isolated swellings. When such a gland is exposed at operation or examined by ultrasonography, CT or MRI, clinically impalpable nodules are often detected. The true frequency of thyroid nodularity compared with the clinical detection rate by palpation is shown in Figure 55.12. Demonstrating the presence of impalpable nodules does not change the management of palpable discrete swellings and begs the question of the necessity of investigating incidentally found nodules. The importance of discrete swellings lies in the risk of neoplasia compared with other thyroid swellings. Some 15% of isolated swellings prove to be malignant and an additional 30–40% are follicular adenomas. The remainder are non-neoplastic, largely consisting of areas of colloid degeneration, thyroiditis or cysts. Although the incidence of malignancy or follicular adenoma in clinically dominant swellings is approximately half of that of truly isolated swellings, it is substantial and cannot be ignored (Figure 55.13). Investigation Thyroid function Serum TSH and thyroid hormone levels should be measured. If hyperthyroidism associated with a discrete swelling is confirmed biochemically, it indicates either a 'toxic adenoma' or a manifestation of toxic multinodular goitre. The combination of toxicity and nodularity is important and is an indication for isotope scanning to localise the area(s) of hyperfunction. Autoantibody titres The autoantibody status may determine whether a swelling is a manifestation of chronic lymphocytic thyroiditis. The presence of circulating antibodies increases the risk of thyroid failure after lobectomy. Isotope scan Isotope scanning used to be the mainstay of investigation of discrete thyroid swellings but has been abandoned except when toxicity is associated with nodularity. Ultrasonography This is used to determine the physical characteristics of thyroid swellings. There are a number of ultrasonographic features in a thyroid swelling associated with thyroid neoplasia, including microcalcification and increased vascularity, but only macroscopic capsular breach and nodal involvement are diagnostic of malignancy. Ultrasonography should be used as the primary investigation of any thyroid nodule as a reassuring appearance Ernest L Mazzaferri, 1936–2013, endocrinologist, Ohio State University School of Medicine, Columbus, OH, USA. - - - mitigates the need for FNAC (see Fine-needle aspiration cytology). Fine-needle aspiration cytology FNAC should be used, ideally under ultrasound guidance, on all nodules that do not fulfil a fully benign (U2) classification on ultrasonography. FNAC is reliable in identifying papillary thyroid carcinoma (PTC) but cannot distinguish between a benign follicular adenoma (Figure 55.14) and follicular carcinoma, as this distinction is dependent not on cytology but on histological criteria, which include capsular and vascular invasion. FNAC is

both highly specific and sensitive. Using ultrasonography improves this further, particularly in part cystic, part solid nodules in which ultrasonography allows targeting of the solid element for biopsy. Radiology Plain films have previously been used to assess tracheal compression and deviation, but the modality of choice now is CT scanning. CT scanning is also useful if ultrasonography has identified metastatic disease in the neck as it can assist surgical planning and also assess the superior mediastinum and lungs.

60 50 40 30 Prevalence 20 10 0 10 20 30 40 50 60 Age (years) Figure 55.12 The prevalence of thyroid nodules detected on palpation (dashed line) or by ultrasonography or postmortem examination (solid line) (after Mazzaferri). thyroid swelling Solid Cystic 24% 12% Male Female Female Male 48% 12% 6% 24% Dominant thyroid swelling Cystic Solid 6% 12% Male Male Female Female 12% 24% 3% 6% Generalised thyroid swelling 3% Figure 55.13 The risk of malignancy in thyroid swellings ('rule of 12'). The risk of cancer in a thyroid swelling can be expressed as a factor of 12. The risk is greater in isolated versus dominant swellings, solid versus cystic swellings and in men versus women.

Laryngoscopy Flexible laryngoscopy has rendered indirect laryngoscopy obsolete and is widely used preoperatively to determine the mobility of the vocal cords. The presence of a unilateral cord palsy coexisting with an ipsilateral thyroid nodule of concern is usually diagnostic of malignant disease. Core biopsy Core biopsy is rarely indicated in thyroid masses owing to the vascularity of the thyroid gland and the risk of postprocedure haemorrhage. It can be useful in the rapid diagnosis of widely invasive malignant disease, for example anaplastic carcinoma, or in the diagnosis of lymphadenopathy. Indication for surgery The main indication for operation is the risk of neoplasia, which includes follicular adenoma as well as malignant swellings. The reason for advocating the removal of all follicular neoplasms is that it is seldom possible to distinguish between a follicular adenoma and carcinoma cytologically. Even when the cytology is negative, the age and sex of the patient and the size of the swelling may be relative indications for surgery, especially when a large swelling is responsible for symptoms. There are useful clinical criteria to assist in selection for operation according to the risk of neoplasia and malignancy. Hard texture alone is not reliable as tense cystic swellings may be suspiciously hard but a hard, irregular swelling with any apparent fixity, which is unusual, is highly suspicious. Evidence of RLN paralysis, suggested by hoarseness and a non-occlusive cough and confirmed by laryngoscopy, is almost pathognomonic. Cervical lymphadenopathy along the internal jugular vein in association with a clinically suspicious swelling is almost diagnostic of PTC. In most patients, however, such features are absent. The incidence of thyroid carcinoma in women is about three times that in men, but a discrete swelling in a male is much more likely to be malignant than in a female. The risk of carcinoma is increased at either end of the age range and a discrete swelling in a teenager of either sex must be provisionally diagnosed as carcinoma. Thyroid cysts Routine FNAC (or ultrasonography) shows that over 30% of clinically isolated swellings contain fluid and are cystic or partly cystic. Tense cysts may be hard and mimic carcinoma. Bleeding into a cyst often presents with a history of sudden painful swelling, which resolves to a variable extent over a period of weeks if untreated. Aspiration yields altered blood but reaccumulation is frequent. About 55% of cystic swellings are the result of colloid degeneration or are of uncertain aetiology because of an absence of epithelial cells in the lining. Although most of the remainder are the result of involution in follicular adenomas (Figure 55.15), some 10-15% of cystic follicular swellings are histologically

malignant (30% in men and 10% in women). PTC is often associated with cyst formation (Figure 55.16). Most patients with discrete swellings, however, are women, aged 20–40 years, in whom the risk of malignancy , although significant, is low and the indications for operation are not clear-cut. Ultrasonography is the most useful tool for assessing cysts. If there is no discernible solid element, the cyst is almost certainly benign and does not need to be further investigated. As stated above, simple aspiration is associated with high rates - of reaccumulation. However, ablation using either ethanol or thermal probes (radiofrequency , microwave, laser or high- frequency ultrasound) achieves cyst resolution in up to 90% of cases and should be considered for recurrent, symptomatic cysts. If there is an associated solid element, then consideration should be given to targeting that area with ultrasound-guided FNAC. The indications for operation in isolated or dominant thyroid swellings are listed in Table 55.4 .

Figure 55.14 Thy3 aspiration cytology (Table 55.2). Follicular neoplasm showing increased cellularity with a follicular pattern. Figure 55.15 Apparently simple cystic thyroid swelling, the wall of which comprised follicular neoplastic tissue.

Figure 55.16 Cyst formation in a papillary carcinoma.

Selection of thyroid procedure
The choice of thyroid operation depends on: diagnosis (if known preoperatively); risk of thyroid failure; risk of RLN injury; risk of recurrence; Graves' disease; multinodular goitre; differentiated thyroid cancer; risk of hypoparathyroidism. Total and near-total thyroidectomy do not conserve sufficient thyroid tissue for normal thyroid function and thyroid replacement therapy is necessary . In two-thirds of patients with negative antithyroid antibodies , one thyroid lobe will maintain normal function. Subtotal resections for colloid goitre or Graves' disease run the risk of later growth of the remnant and, if a

second operation is required years later, this greatly increases the risk to the RLN and parathyroid glands. In young patients, total thyroidectomy should be considered. It may be preferable to leave the least affected lobe untouched to permit a straightforward lobectomy in the future if required, rather than carry out subtotal resections. In Graves' disease, preserving large remnants increases the risk of recurrence of the toxicity and, in these cases, it is better to err on the side of removing too much thyroid tissue rather than too little (Table 55.5). Thyroid failure should not be regarded as a failure of treatment, but recurrent toxicity is. thyroidectomy in differentiated thyroid cancer are discussed below . Summary box 55.2 Thyroid operations

Retrosternal goitre Retrosternal goitre tends to arise from the slow growth of a multinodular gland down into the mediastinum. As the gland enlarges within the thoracic inlet, pressure may lead to dysphagia, tracheal compression and eventually airway symptoms. The vast majority of patients have minimal symptoms. Patients should be considered for surgery if there is significant airway compression, if symptoms are present or in young patients - in whom symptoms are likely to develop. In elderly patients with incidentally discovered retrosternal goitres, most surgeons would observe rather than treat prophylactically . Clearly a balance between risk and benefit must be made. If a decision is made to proceed to surgery , assessment of the extent of disease is critical. The vast majority (>95%) of retrosternal goitres can be removed transcervically . Patients most at risk of requiring conversion to an open sternotomy approach include those with malignant disease or who are undergoing revision, those whose goitres that extend into the - posterior mediastinum and those in whom the diameter of the goitre exceeds that of the thoracic inlet. In such cases a joint case with thoracic surgery should be planned. All patients should have cross-sectional imaging. Ideally this is performed in the surgical position and, when interpreting CT chest scans, the surgeon should pay attention to the arm position. If the arms are up (as for standard CT chest)

Neoplasia FNAC positive Thy3-5 Clinical Age suspicion Male sex Hard texture Fixity Recurrent laryngeal nerve palsy Lymphadenopathy Recurrent cyst Toxic adenoma Pressure symptoms Cosmesis Patient's wishes FNAC, /fine-needle aspiration cytology; Thy3-5, see Table 55.2

TABLE 55.5 Comparison of surgical options for Graves' disease.

Option	Control of toxicity	Risk of recurrence	Risk of thyroid failure
Total thyroidectomy	Immediate	None	100%
Control of toxicity	Immediate	5%	Minimal
Return to euthyroid state	Immediate	None	Minimal
Risk of permanent hypoparathyroidism	5%	Minimal	Minimal
Need for follow-up	Minimal	Minimal	Minimal

The risks of recurrence and late failure are a function of the size of the remnant as a proportion of the total gland weight. Large remnants in small glands have a higher risk of recurrence and a low risk of failure, and small remnants in large glands have a higher risk of thyroid failure but a low risk of recurrence. All thyroid operations can be assembled from three basic elements: 1. Total lobectomy 2. Isthmusectomy 3. Subtotal lobectomy

Total thyroidectomy = 2 × total lobectomy + isthmusectomy
 Subtotal thyroidectomy = 2 × subtotal lobectomy + isthmusectomy
 Near-total thyroidectomy = total lobectomy + isthmusectomy + subtotal lobectomy (Dunhill procedure)
 Lobectomy = total lobectomy + isthmusectomy
 Subtotal thyroidectomy Immediate Variable - up to 12 months a Lifelong - up to 5% a Lifelong - up to 100% at 30 years 1% Lifelong

pared with when the arms are down and the neck extended. The approach to surgery is as described in Surgical technique of thyroidectomy . A longer incision is required. The surgeon may mobilise the sternomastoid muscle from the strap muscles to improve access . The ligamentous tissue between the sternal heads of the clavicles may be gently divided to increase the opening for gland delivery . Blunt dissection on the capsule of the gland allows mobilisation. Gentle traction is applied to deliver the gland into the neck. If the goitre has developed from a posteriorly positioned

nodule there is a risk that the RLN may be displaced anteriorly, so great care must be taken in dividing apparent fascial bands that overlie the gland. The blood supply is from the neck, reducing the risk of catastrophic bleeding from the great vessels. Nonetheless, care should be taken in the region of the major blood vessels in the neck and chest. If the gland is fixed and immobile or too large to deliver through a cervical approach, a midline sternotomy is performed and the gland can be dissected from below to achieve a safe total thyroidectomy. Clinically discrete swellings

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The risks of recurrence and late failure are a function of the size of the remnant as a proportion of the total gland weight. Large remnants in small glands have a higher risk of recurrence and a low risk of failure, and small remnants in large glands have a higher risk of thyroid failure but a low risk of recurrence. All thyroid operations can be assembled from three basic elements: 1. Total lobectomy 2. Isthmusectomy 3. Subtotal lobectomy	Total thyroidectomy = 2 × total lobectomy + isthmusectomy	Subtotal thyroidectomy = 2 × subtotal lobectomy + . isthmusectomy	Near-total thyroidectomy = total lobectomy + isthmusectomy + subtotal lobectomy (Dunhill procedure)	Lobectomy = total lobectomy + isthmusectomy	Subtotal thyroidectomy	Immediate	Variable - up to 12 months	a	Lifelong - up to 5%	a	Lifelong - up to 100% at 30 years	1% Lifelong

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