Surgical Management of Thyroid Nodules

Dr. Wai-fan Chan
MBBS(HK), FCShK, FRcSE, FHKAM (Surgery)
General Surgeon, Hong Kong Surgical Centre

Introduction

Referrals to specialists for thyroid nodules have become increasingly common. Controversies still exist over the clinical management, even with the published treatment protocols or recommendations1-3. Surgery is generally indicated if the thyroid nodule is proven or suspected to be malignancy, is causing thyrotoxicosis or is large enough to be accompanied by substantial local symptoms or unacceptable cosmesis, but associated with a unique set of complications. Over the last decade, there have been many advances in the diagnosis and therapy of thyroid nodules. Optimal outcomes in patients with thyroid nodules can only be achieved not until the plaudits and pitfalls of the various diagnostic methods, and the potential complications of surgery is well understood by both the clinicians and the patients. The objective of this article is to give an update in the surgical management of this commonly encountered condition.

Prevalence

The prevalence of palpable thyroid nodules was about 3-4%4,5. A 1955 study, however, showed that the true prevalence of thyroid nodules, based on the autopsy data, was greater than 50% in patients with clinically normal thyroid glands6. As technology improved, high-resolution ultrasonography (USG) has emerged as the commonly used imaging modality for the thyroid gland, the haunting prospect that thyroid nodules could be imaged in over half the population is becoming a clinical reality7,8.

Unless a thyroid nodule is symptomatic, its significance is limited to the possibility that it represents a thyroid malignancy. Thyroid cancer, however, is an uncommon malignancy. In Hong Kong, there were 449 new cases (336 in women and 113 in men) in 2004, representing only 2% of all new cancers. Death from thyroid cancer is even less common, with an incidence of 28 deaths in 2004 representing only 0.24% of all cancer deaths9.

Although clinically apparent thyroid cancer is relatively uncommon, clinically inapparent or occult thyroid cancer is quite common. Most define an occult thyroid cancer as a lesion less than 10 mm that is an unexpected and incidental finding during surgery or autopsy. The prevalence of occult thyroid cancer at autopsy has varied from 0.45% - 22% depending on the methods of detection10,11. Because of the discrepancy between the prevalence of clinically apparent and occult thyroid cancer, it is believed that most occult cancers have little biologic or clinical significance. Nonetheless, various reports have demonstrated nonnegligible prevalence of extrathyroidal invasion, nodal involvement, distant metastasis, and even mortality from occult thyroid cancers12-17. These findings suggested, but did not prove, that at least some of these occult cancers demonstrated aggressive behaviour and should, therefore, be considered biologically important, and it is impossible to fix an effective dimensional cut-off for the risk of thyroid cancers.

Hence, the main aim of management of patients with thyroid nodules is to identify the small proportion of patients with thyroid cancer who require treatment and avoid unnecessary testing and treatment for the majority.

Clinical assessment

With the discovery of thyroid nodules, a complete history and physical examination focusing on the functional status, the thyroid gland and adjacent cervical lymph nodes should be performed. Pertinent historical factors predicting malignancy include a history of head and neck irradiation, family history of thyroid cancer, and rapid growth and hoarseness. Pertinent physical findings suggesting possible malignancy include vocal cord paralysis, ipsilateral cervical lymphadenopathy and fixation of the nodule to surrounding tissues. The incidence of cancer in those with clinical features strongly suggestive of malignancy is high, but most patients do not have these features.

Laboratory test

Serum thyrotropin (TSH) level is the only test routinely performed. If the serum TSH is subnormal, a radionuclide thyroid scan should be obtained to document whether the nodule is functioning, isofunctioning, or hypofunctioning. Because functioning nodules rarely harbour malignancy, if one is found that corresponds to the clinical nodule, no additional cytological evaluation is necessary.

Measurement of serum thyroglobulin is useful in the detection of residual or recurrent disease after total thyroidectomy for differentiated thyroid cancer, but is of no value in the initial detection of the primary malignancy as serum thyroglobulin levels can be
Radiological assessment

Increasing numbers of physician in America would order an ultrasound to evaluate patients with thyroid nodules, both for diagnosis and to perform USG-guided needle aspirates, USG is becoming an extension of the thyroid physical examination. A diagnostic USG should be performed to delineate the nodules unless the serum TSH is suppressed. Clinical criteria (solitary vs. multiple nodules, nodules greater vs. smaller than 10mm, cystic vs. solid nodules) were of no use in determining the risk of malignancy. Patients with multiple nodules on USG have the same risk of malignancy as those with solitary nodule. The diagnosis of thyroid cancer may be missed if only the dominant or largest nodule is aspirated. Sonographic characteristics, including the presence of microcalcification, hypoechoegenity of a solid nodule, irregular or blurred margins and intranodular hypervascularity, have been shown to be closely linked to malignant lesions.

The systematic USG guided fine needle aspiration evaluation of thyroid nodules allows careful selection of the lesion, using sonographic criteria, to submit to fine needle aspiration (FNA), and may account for the higher prevalence of cancer in nonpalpable thyroid lesions (5.4 to 12%) than that reported in palpable lesions (5.0 - 6.4%).

Isotopes scans classify nodule function on their ability to trap iodine. A malignant nodule should appear as a "cold" non-functioning area, a benign nodule as "warm" or "hot". Since, however, most nodules are cold and generally benign, and warm or hot nodules can be malignant, many centres have abandoned isotope scan.

Cytological assessment

Fine needle aspiration cytology (FNAC) is the most accurate and cost effective method for the evaluation of thyroid nodules. Traditionally FNAC results are divided into four categories: nondiagnostic, benign, indeterminate or suspicious for neoplasm, and malignant. Up to 20% of the FNAC of thyroid nodules are initially nondiagnostic, particularly those with cystic component. Because of the 5% risk of malignancy for solitary nodule, such biopsy should be repeated using US guidance. Cystic nodules that repeatedly yield nondiagnostic aspirates need close observation or surgical excision. Surgery should be considered if the cytologically nondiagnostic nodule is solid.

Indeterminate cytology, often reported as 'suspicious', 'follicular lesion/neoplasm' or 'Hurthle cell lesion/neoplasm', can often be found in 15%-30% of FNA specimens and the management is controversial. Some centres suggest a radioiodine thyroid scan, and if a concordant autonomously functioning nodule is not seen, lobectomy should be considered, whilst others would recommend lobectomy to make a definite histological diagnosis as the risk of malignancy is approximately 20%.

Thyroid nodules diagnosed as benign on cytology require follow-up because of low, but not negligible, false negative rate of up to 5% with FNA. Easily palpable nodules should be followed clinically at 6-12 month interval. It is suggested that all other nodules be followed with serial USG 6-12 months after initial FNA. Nodule growth is an indication for repeat biopsy, preferably with US guidance.

Potential complications of thyroid surgery

When surgery is recommended, informed consent should be obtained and patients should be fully informed of the potential benefits and risks of the procedures and of any suitable alternative management. In general, the essential objectives for thyroidectomy are conservation of the parathyroid glands, avoidance of injury to the recurrent laryngeal nerve, an accurate haemostasis and an excellent cosmesis. The complications of recurrent and superior laryngeal nerve injury as well as long-term hypoparathyroidism, although not life-threatening, can result in chronic functional disability that can be more problematic than the underlying disease. Therefore, complete disclosure, entailing explicit explanation using technical and lay terminology about known risks (including serious but low probability risks), relevant implications for the patient's life and occupation, and incidence in the general population and surgeon's practice, is important to most patients, in order to be aware, and psychologically prepared for potential outcomes.

Various risk factors have been identified to influence the likelihood of these complications, including the underlying disease (recurrent goitre, malignancy, hyperthyroidism, substernal goitre), the extent of resection, and the surgical technique (subcapsular dissection and routine identification of the recurrent laryngeal nerve). A clear association between the experience of the surgeon and a decrement in complication rates was also well demonstrated in numerous studies. The incidence of permanent complications following thyroidectomy, performed by surgeons with experience in endocrine surgery, should be less than 1%. Any figure greater than this is generally considered unacceptable.

Laryngeal Nerve Injury
The symptoms of recurrent laryngeal nerve palsy
 depend on the completeness of the nerve injury and the presence of associated injury to the superior laryngeal nerve (SLN) and the contralateral RLN. With isolated unilateral nerve injury, if the position of the paralysed cord is midline and compensated by the contralateral cord is effective, the damage may not be recognised. When the cord remains in the paramedian position, the voice may be hoarse and breathy. The patient’s cough is weak, and aspiration may occur. Damage to the SLN affects voice pitch. Since the cord is unable to lengthen and tense, the voice is low in pitch and breathy in quality.

Bilateral RLN injury is a severe life-threatening complication that results in airway obstruction and requires immediate attention. In this condition, both vocal cords remain in a median or paramedian position. As a result, the patient exhibits inspiratory stridor, dyspnoea, tachypnoea, and nasal flaring, although the voice is near normal.

In addition to the functional disturbance, recurrent laryngeal nerve injury also accounted for majority of the medicolegal claims in thyroid surgery. Surgical adjunct such as intraoperative neuromonitoring has recently been advocated to facilitate the identification of the recurrent laryngeal nerve, to predict postoperative outcome and to reduce the incidence of RLN injury. However, benefit of routine application of this new technique, in specialised centres, was not demonstrated.

**Hypoparathyroidism**

Hypoparathyroidism is another complication that may occur following thyroid surgery. Injury to the parathyroid glands may result from excision of the gland(s) during surgery, devascularisation of the glands, or destruction from capsular haematoma. Postoperative hypoparathyroidism results in hypocalcaemia and is manifested by numbness and tingling of the hands, feet, and lips. If calcium levels are not restored, muscle spasm, seizures and laryngeal stridor are imminent. It often extends the duration of the hospital stay and the need for biochemical tests, and it significantly increases the overall cost of a thyroidectomy. Although hypocalcaemia reverses spontaneously in most cases, it can remain permanent, and lifelong therapy and follow-up are then mandatory to avoid the subtle but severe and potentially lethal complications of chronic hypocalcaemia.

**Postoperative Bleeding**

Postoperative haemorrhage is an uncommon complication, reported in 0.3% to 1% of patients in most large series. However, it is a well recognised and potentially lethal complication. It usually results from a loosened tie around a ligated vessel. If not controlled, bleeding in the neck space may result in tension haematoma leading to tracheal compression and subsequent airway obstruction. Swelling of the neck and bulging of the wound can be followed shortly thereafter by respiration impairment. The urgency of treating this condition when it occurs cannot be overemphasised. Placing a drain is not adequate for decompression if bleeding is from a major vessel. Several studies have documented no benefit of using drains after thyroid surgery.

**Thyroid surgery**

Thyroidectomy is indicated for proven or suspected malignancy, for thyrotoxicosis in selected patients or for sizable lesion accompanied by substantial local symptoms or unacceptable cosmesis. The time-honoured procedure of unilateral subtotal lobectomy is rarely appropriate, the minimum satisfactory procedure being a total lobectomy on the side of the lesion with inclusion of the isthmus. This permits a full histological examination with virtually no risk of tumour seeding and further surgery, often difficult and hazardous, to remove the remnant left in situ after subtotal lobectomy is not needed.

A frozen section taken immediately is helpful if preoperative FNA is not done or nondiagnostic. A skilled pathologist is able to make a correct diagnosis in the majority of cases, permitting a correct operative strategy which may involve total thyroidectomy in many cases of cancer. The follicular lesion with minimal capsular invasion is not readily diagnosed on frozen section, but a simple lobectomy is invariably sufficient. If the definite histology should later reveal an invasive follicular carcinoma after only a lobectomy has been performed, removal of the remaining lobe and completion of the total thyroidectomy can easily be carried out in a few days.

**Conclusion**

Thyroid nodules are common and frequently benign. The author recommended that low risk, asymptomatic nodules should be followed up with clinical palpation or USG in 6-12 months. Fine needle aspiration, either US guided or palpation-directed, is reserved for nodules in the high risk group of patients in whom either the imaging features or the clinical history is worrisome for malignancy, irrespective of the size. Thyroid surgery, either for diagnostic or therapeutic purpose, is associated with minimal long-term morbidity when performed by experienced surgeons. Although the optimal management of thyroid nodules has not been clearly established, strategies such as these, which sensibly limit interventions, obtain reasonable yields, will only work with the collaboration of endocrinologists, radiologists, cytopathologists and surgeons, to establish the “standard of care”.

VOL.11 NO.5 MAY 2006

VOL.12 NO.5 MAY 2007
13. Figure 1. Algorithm for the management of patients with thyroid nodules.

References


