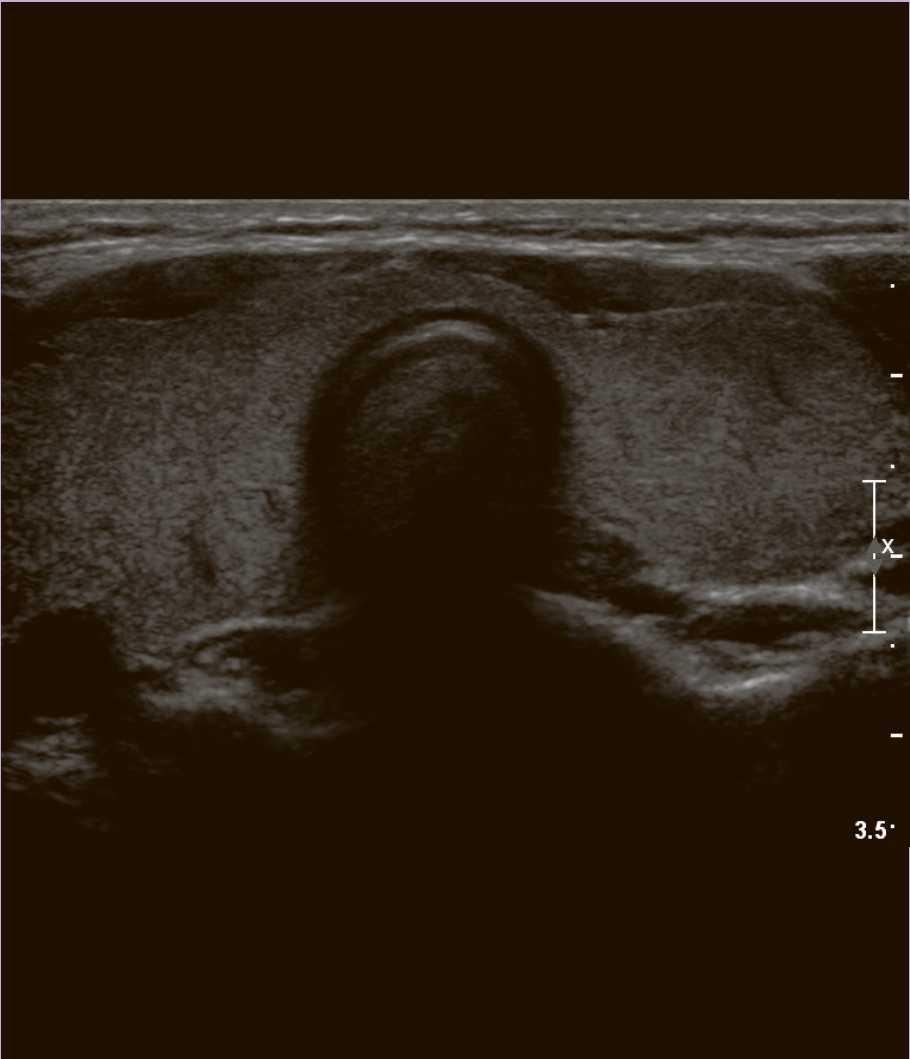
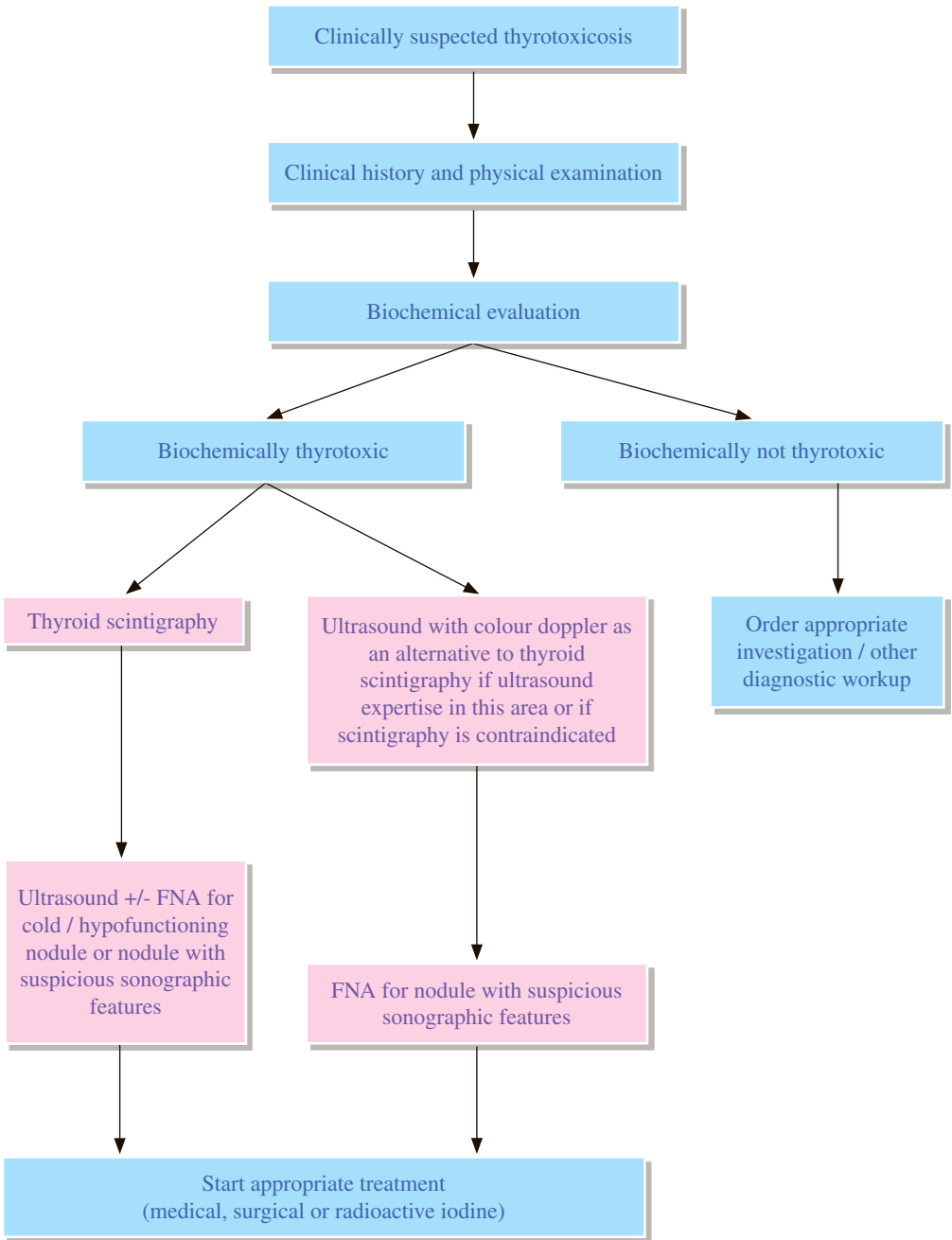


Thyroid Imaging



Hong Kong College of Radiologists



REMARKS

1 Biochemical evaluation

- 1.1 Serum thyroid stimulating hormone (TSH) measurement has the highest sensitivity and specificity in the biochemical evaluation of suspected hyperthyroidism and should be used as an initial screening test. Diagnostic accuracy improves when both a serum TSH and free T4 / total T3 are assessed at the time of the initial evaluation.
- 1.2 Biochemically thyrotoxic:
 - 1.2.1 Suppressed / undetectable serum TSH
 - 1.2.2 Excess serum free T4 / total T3
- 1.3 Subclinical hyperthyroidism:
 - 1.3.1 Low serum TSH
 - 1.3.2 Normal serum free T4 / total T3
- 1.4 Autoantibody tests may be useful to differentiate the causes of hyperthyroidism:
 - 1.4.1 Anti-thyroid peroxidase (anti-TPO) antibody:
 - 1.4.1.1 Elevated in Graves' disease
 - 1.4.1.2 Low/absent in toxic multinodular goiter and toxic adenoma
 - 1.4.2 Thyroid stimulating immunoglobulin (TSI):
 - 1.4.2.1 Elevated in Graves' disease

2 Nuclear medicine (thyroid scintigraphy)

- 2.1 Thyroid scintigraphy facilitates the detection of focal and/or global abnormalities of thyroid gland, correlation of anatomy with function, and detection of aberrant or metastatic functioning thyroid tissue or residual normal tissue after therapy.
- 2.2 Contraindications of thyroid scintigraphy include pregnancy, lactation / breast feeding, recent iodine exposure.
- 2.3 Diagnostic accuracy of thyroid scan using Tc-99m pertechnetate is comparable to that using I-123 in patients with hyperthyroidism and is much cheaper and more widely available.
- 2.4 Thyroid cancer occurs in Graves' disease with an incidence of about 2%. Thyroid nodules larger than 1-1.5 cm should be evaluated before radioactive iodine (RAI) therapy. If a RAI scan is performed, any non-functioning or hypofunctioning nodules should be evaluated with fine needle aspiration (FNA) because they may be malignant.

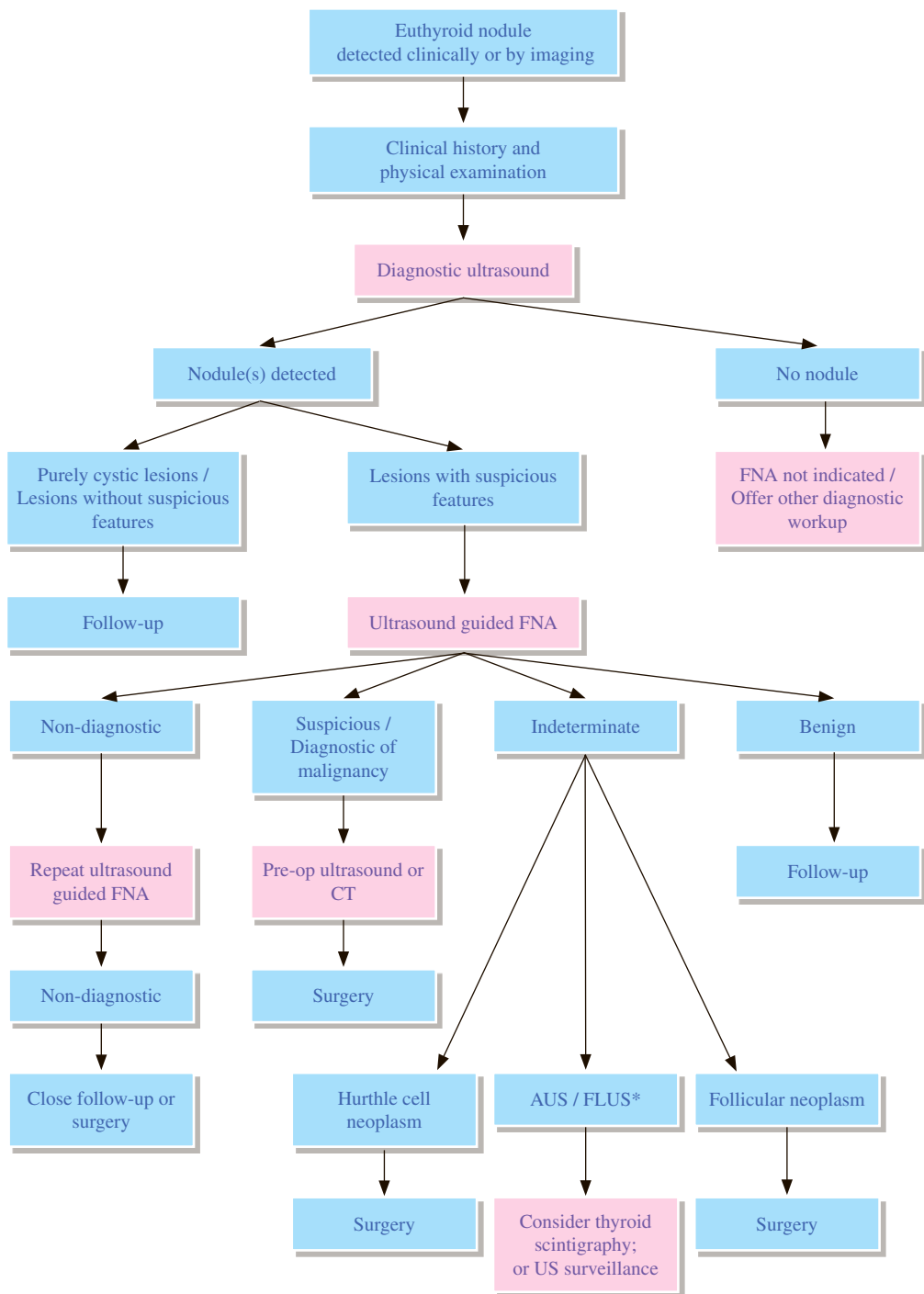
3 US

- 3.1 US can assess the size, texture and vascularity of the thyroid gland and evaluate the sonographic features of non-palpable nodules.
- 3.2 US guided FNA or biopsy can be performed for nodules with suspicious features.

REFERENCES

1. Bahn RS, Burch HB, Cooper DS, Garber JR, Greenlee MC, Klein I, et al. American Thyroid Association, American Association of Clinical Endocrinologists. Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association and American Association of Clinical Endocrinologists. *Thyroid*. 2011; 21: 593-646.
2. Cooper DS, Doherty GM, Haugen BR, Kloos RT, Lee SL, Mandel SJ, et al. Revised American Thyroid Association management guidelines for patients with thyroid nodules and differentiated thyroid cancer. *Thyroid*. 2009; 19: 1167-1214.
3. Gharib H, Papini E, Paschke R, Duick DS, Valcavi R, Hegedüs L, et al; AACE/AME/ETA Task Force on Thyroid Nodules. American Association of Clinical Endocrinologists, Associazione Medici Endocrinologi, and European Thyroid Association Medical Guidelines for clinical practice for the diagnosis and management of thyroid nodules. *Endocr Pract*. 2010; 16: 468-475.
4. The Royal College of Radiologists. *iRefer: Making the best use of clinical radiology*. 7th ed. London: The Royal College of Radiologists, 2012. Section E05.
5. Stocker DJ, Burch HB. Thyroid cancer yield in patients with Graves' disease. *Minerva Endocrinol*. 2003; 28: 205-212.
6. Abraham-Nordling M, Topping O, Hamberger B, Lundell G, Tallstedt L, Calissendorff J, et al. Graves' disease: a long-term quality-of-life follow up of patients randomized to treatment with antithyroid drugs, radiiodine, or surgery. *Thyroid*. 2005; 15: 1279-1286.
7. American College of Radiology. *ACR-SPR Practice Parameter For The Performance Of Scintigraphy And Uptake Measurements For Benign And Malignant Thyroid Disease*. Revised 2014 (Resolution 33). Reston: American College of Radiology; 2014.
8. Ross DS, Burch HB, Cooper DS, Greenlee MC, Laurburg P, Maia AL, et al. 2016 American thyroid association guidelines for diagnosis and management of hyperthyroidism and other causes of thyrotoxicosis. *Thyroid*. 2016; 26: 1343-1421.
9. Verburg FA, Aktolun C, Chiti A, Frangos S, Giovanella L, Hoffmann M, et al. Why the European Association of Nuclear Medicine has declined to endorse the 2015 American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer. *Eur J Nucl Med Mol Imaging*. 2016; 43: 1001-1005.

TI 2 Euthyroid nodule



*AUS: atypia of undetermined significance; FLUS: follicular lesion of undetermined significance

REMARKS

1 Clinical history

- 1.1 Underlying high-risk factors for thyroid cancer should be sought from clinical history:
 - 1.1.1 Family history of thyroid cancer
 - 1.1.2 Personal history of thyroid cancer with surgery done
 - 1.1.3 Previous external beam irradiation to the neck
 - 1.1.4 Exposure to ionizing radiation in childhood
 - 1.1.5 Thyroid nodule is F-18 FDG PET positive

2 US

- 2.1 US can confirm the presence of a thyroid nodule and assess the size, location and sonographic features of the lesion. It can also provide information on the number of nodules, and characterize nodules based on their solid and / or cystic constituents.
- 2.2 US can detect non-palpable nodules, extra-thyroidal lesions and associated cervical lymphadenopathy if present.
- 2.3 Fine needle aspiration (FNA) or biopsy of nodules with suspicious features can be performed using US guidance with good accuracy.
- 2.4 Suspicious sonographic features of thyroid nodules include:
 - 2.4.1 Presence of microcalcifications
 - 2.4.2 Marked hypoechogenicity compared to the normal thyroid parenchyma
 - 2.4.3 Increased intra-nodular vascularity
 - 2.4.4 Irregular infiltrative margins
 - 2.4.5 Taller than wide configuration on transverse scan
 - 2.4.6 Disrupted rim calcifications with extruding soft tissue component
 - 2.4.7 Associated cervical lymphadenopathy

3 Nuclear medicine

- 3.1 Thyroid scintigraphy provides functional information about the thyroid nodules. Non-functioning or hypofunctioning nodules are associated with increased likelihood of malignancy and should be considered for US correlation. FNA is suggested for those with suspicious sonographic features. Tc-99m pertechnetate is the most commonly used tracer.
- 3.2 In follicular lesions at FNA cytologic evaluation, thyroid scintigraphy is able to identify a functioning nodule that may be benign; however, most such nodules are cold on scintigraphy.

4 CT

4.1 CT can provide better as well as additional anatomical information about the thyroid nodules prior to operation, including:

4.1.1 Retrosternal extension

4.1.2 Invasion of adjacent structures

4.1.3 Tracheal compression

4.1.4 Lymph node metastasis

REFERENCES

- 1 Haugen BR, Alexander EK, Bible KC, Doherty GM, Mandel SJ, Nikiforov YE et al. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer. *Thyroid*. 2016; 26: 1-133.
- 2 Gharib H, Papini E, Garber JR, Duick DS, Harrell RM, Hegedus L, et al. American Association of Clinical Endocrinologists, American College of Endocrinology, and Associazione Medici Endocrinologi medical guidelines for clinical practice for the diagnosis and management of thyroid nodules—2016 update: appendix. *Endocr Pract*. 2016; 22(suppl 1): 1-60.
- 3 British Thyroid Association, Royal College of Physicians. Guidelines for the management of thyroid cancer. Report of the Thyroid Cancer Guidelines Update Group. London: Royal College of Physicians; 2007.
- 4 The Royal College of Radiologists. *iRefer: Making the best use of clinical radiology*. 7th ed. London: The Royal College of Radiologists; 2012. Section E04.
- 5 Marqusee E, Benson CB, Frates MC, Doubilet PM, Larsen PR, Cibas ES, Mandel SJ. Usefulness of ultrasonography in the management of nodular thyroid disease. *Ann Intern Med*. 2000; 133: 696-700.
- 6 Alexander EK, Heering JP, Benson CB, Frates MC, Doubilet PM, Cibas ES, Marqusee E. Assessment of nondiagnostic ultrasound-guided fine needle aspiration of thyroid nodules. *J Clin Endocrinol Metab*. 2002; 87: 4924-4927.
- 7 Cappelli C, Castellano M, Pirola I, Cumetti D, Agosti B, Gandossi E, Agabiti Rosei E. The predictive value of ultrasound findings in the management of thyroid nodules. *QJM*. 2007; 100: 29-35.
- 8 Moon WJ, Jung SL, Lee JH, Na DG, Baek JH, Lee YH, Kim J, Kim HS, Byun JS, Lee DH; Thyroid Study Group, Korean Society of Neuro- and Head and Neck Radiology. Benign and malignant thyroid nodules: US differentiation—multicenter retrospective study. *Radiology*. 2008; 247: 762-770.
- 9 Gharib H, Papini E, Paschke R, Duick DS, Valcavi R, Hegedus L, Vitti P; AACE/AME/ETA Task Force on Thyroid Nodules. American Association of Clinical Endocrinologists, Associazione Medici Endocrinologi, and European Thyroid Association Medical Guidelines for clinical practice for the diagnosis and management of thyroid nodules. *Endocr Pract*. 2010; 16: 468-475.

