

# Section I

## *Introduction*

Ultrasound (US) has become a very important tool in the management of thyroid carcinoma, both in primary diagnostics and in the follow-up of patients surgically treated for thyroid carcinoma. According to the Norwegian guidelines [3], “Patients with a palpable thyroid tumor should be referred directly to a center where both US of the whole neck and US-guided cytologic biopsy of the thyroid tumor and of suspicious lymph nodes can be performed. As far as possible, a cytopathologist or a screener should be present to examine the specimen and ensure good quality.” In Norway breast screening centers are established in every county. The intention is to implement this work-up model for thyroid nodules in connection with these centers where the radiologists are familiar with the use of US-guided cytologic biopsies in collaboration with cytopathologists.

The most crucial step when evaluating thyroid lesions and cervical lymph nodes is the US examination, along with deciding whether a lesion should be punctured, how many nodules should be punctured, and from what part of the lesion the sample should be collected. This evaluation and decision is based on the experience of the physician performing the examination, but also on the ability of the US equipment to procure the pathology. Many US physicians have limited experience in this field, and the need for a reference atlas is obvious.

Because of the numerous findings of thyroid nodules at different imaging examinations of the neck, it is very important to have a proper policy on how to handle these findings. It is well accepted that nonsuspicious nodules less than 1 cm should be left alone without doing cytologic biopsy or further follow-up, except for patients who have received external radiation to the head or neck during childhood, or in patients with a family history of medullary or papillary thyroid cancer. Any asymptomatic colloid or hypertrophic nodule, thyroiditis, and goiter may, with some exceptions, be included in this policy.

This atlas demonstrates a broad spectrum of US findings in the thyroid gland in patients with benign and malignant thyroid lesions, and also the different features of metastases in the cervical lymph nodes. The diagnoses given in this atlas were prin-

cipally confirmed by histologic evaluation after surgery. Some cases, however, were confirmed only by cytologic evaluation or histologic evaluation of histologic needle biopsy with clinical follow-up. Lymph node metastases were confirmed by CB and/or thyroglobuline assay in the wash out specimens. In some cases comparable computed tomography or magnetic resonance images are shown, and in most cases the gross pathology and cytologic or histologic findings are presented.

All US images were taken with a Philips HDI 5000 with SonoCT and Xres (Philips Medical Systems, Bothell, WA) using a broadband 12-5-mHz linear transducer. The Doppler images were all taken with a PRF  $\pm$  4 cm/s. The CBs were taken with either a 27- or 25-gauge needle, almost always without aspiration. (We only use aspiration if the first attempts give “dry tap”.) Histologic needle biopsies were taken with the Bard Magnum reusable biopsy gun (Bard Biopsy Systems, Tempe, AZ) using an 18- or 16-gauge needle with a 22- or 15-mm needle advancement. In very small tumors we used the Bard Monopty disposable gun with an 18-gauge needle and 11-mm needle advancement.

The image presentation starts with an overview of the different features of thyroid lesions described in the literature; one new feature is also presented. The images with comments show our definition of the different features with the terminology we use. Thereafter, images of the different pathologic entities are presented, and US features are described. In each case the reader will have information about the patient’s age and sex, a very short clinical history, and the findings on US, cytology, and histology in the cases where either needle biopsy was taken or a resection was performed.

As for US evaluation, the evaluation of the slides with cytologic specimens was based on the experience of the cytopathologist. In almost all cases presented in this atlas there was an immediate on-site evaluation of the smears.

In addition to determining the adequacy of the specimens, on-site evaluation gave the cytopathologist the opportunity to evaluate the specific lesions together with the radiologist. The on-site collaboration between radiologist and cytopathol-

ogist, made the puncture more focused and accurate, and the cytopathologist was able to achieve a better understanding of the characteristics of the whole lesion, as well as the rest of the thyroid gland. This information in some cases turned out to be of crucial importance to the cytopathologist, and ensured an even better interpretation of the smears.

The cytologic biopsy specimens were prepared fresh, air-dried and stained immediately with Diff-Quick. In cases where the clinical information or morphology indicated the possibility of medullary carcinoma, unstained slides were taken for immunocytochemical staining for calcitonin. In cases suspicious for a lymphocytic lesion (thyroiditis or lymphocytic neoplasm), an additional puncture was performed and the material referred for flow cytometric immunophenotyping. The biopsies were diagnosed according to the World Health Organization classification. Histologic nee-

dle biopsy was performed under US guidance in selected cases, mostly in cases with inadequate cytologic biopsy.

The images from the US evaluation were not available for the cytopathologist doing the gross section examination of the resected specimens. For this reason the US images do not precisely show concordance with the images from the gross specimens, the cytology, and histology. The main patterns harmonize, however, to a great extent.

This atlas does not strive to be a complete pathology atlas. The cytologic and histologic images are meant to serve as a cytologic or histologic correspondence to the radiologic images. As such, some of the basic characteristics for each of the entities mentioned are described, some with additional comments due to the experience of the authors.