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ORIGINAL ARTICLE

Extramedullary hematopoiesis involving the thyroid: Fine-needle aspiration features and literature review

Laura C. Been, MD*, Lorna Ogden, MD, S. Thomas Traweek, MD

Thyroid Cytopathology Partners, 12357-A Riata Trace Parkway, Bldg. 5, Suite 100, Austin, Texas 78727

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KEYWORDS
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Introduction The thyroid has rarely been documented as a site of extramedullary hematopoiesis (EMH). We report the largest series to date, with nine cases of EMH, and compare our findings with previous reports of thyroid EMH.

Materials and methods Thyroid nodule fine-needle aspirations (FNAs) were collected over a 4-year period. Thin layer preparations were examined and correlated with clinical features and ultrasound characteristics. A comprehensive review of the English literature was done, and the results were compared with the current series.

Results During the study period, 172,939 thyroid FNAs were examined. Nine samples (0.005%) contained trilineage bone marrow elements. Nodule calcifications were present in 7 patients. None of the patients had a history of a blood disorder, nor was there any evidence of a thyroid malignancy.

Fifteen reports of 18 patients with thyroid EMH were identified in the English literature. Nodule calcifications were reported in 10 patients. Thyroid EMH was associated with primary myelofibrosis in 4 patients, and with chronic anemia in 1; calcifications were absent in 3 patients, and were not specified in the remaining 2. None had evidence of a thyroid malignancy.

Conclusions Thyroidal EMH is an extremely uncommon finding. Clinical and sonographic features are nonspecific. Thyroid EMH is usually an incidental finding, most likely related to mature osseous metaplasia. An occasional association with hematologic disease has been reported, however. To date, there does not appear to be any association with thyroid malignancy and surgery is typically not indicated. Therefore, recognition at the time of FNA is essential.

Introduction

Extramedullary hematopoiesis (EMH) is the presence of immature hematopoietic cells in locations other than the bone marrow. Although EMH is usually found in sites of embryonic marrow development such as liver, spleen, and

*Corresponding author: Laura Been, MD; Thyroid Cytopathology Partners, 12357-A Riata Trace Parkway, Bldg. 5, Suite 100, Austin, Texas 78727; Tel.: 512-814-2537.

E-mail address: Laura@thyroidcytopath.com (L.C. Been).

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lymph nodes, it has been reported in many other locations. The thyroid gland has only occasionally been described as a site for these bone marrow deposits, most often as case reports.[1-15] In this study, we report 9 patients whose thyroid nodule fine-needle aspiration (FNA) showed EMH, and detail the cytologic and clinical features associated with this finding. This cohort was also compared with other cases of thyroid EMH reported in the English literature.

Materials and methods

From thyroid nodule FNAs examined over a 4-year period, 9 samples with bone marrow cells were identified. The FNA biopsies were performed by endocrinologists or radiologists using ultrasound guidance, and were submitted in CytoLyt. Thin layer preparations were examined and classified using The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC).[16] Clinical features and ultrasound characteristics were obtained from the submitting physicians under institutional review board approval and a waiver of informed consent (both from IntegReview, Austin Texas).

The English language literature on thyroid EMH was also reviewed. Searches included the key words *thyroid, extramedullary hematopoiesis, ectopic bone formation, bone metaplasia*, and *osseous metaplasia*. All reports, including cases with histology and/or aspiration cytology, were recorded.

Results

During the study period, 172,939 thyroid FNAs were examined, and 9 samples (0.005% incidence or 1 per 19,215 cases) contained trilineage bone marrow elements. Large megakaryocytes with multilobed nuclei and abundant cytoplasm were the first and most easily recognized hematopoietic cell (Fig. 1). Mononuclear myeloid cells with occasionally reniform nuclei and fine, pale cytoplasmic granules, along with small groups of precursor red cells with small dark uniform nuclei were also present in all cases (Fig. 2). Five samples contained admixed thyroid follicular cells and colloid that were sufficient for a benign diagnosis (Bethesda category II). Four samples were technically inadequate for examination using TBSRTC criteria (Bethesda category I); one of these samples showed rare benign follicular cells and scant colloid; another showed scant colloid, but no follicular cells. The remaining 2 inadequate samples had only bone marrow cells with no thyroid elements. Three (of 9) samples showed multinucleated osteoclast-like giant cells. Hürthle cells and cystic changes were identified in one (1) case each (Fig. 3). Two samples contained adipose tissue with admixed marrow elements (Fig. 4). Two patients had a concurrent biopsy of additional nodules, but the other nodules did not show EMH. No thyroid malignancy was present in any of the samples. The cytologic features of our patients' samples are summarized in Table 1.

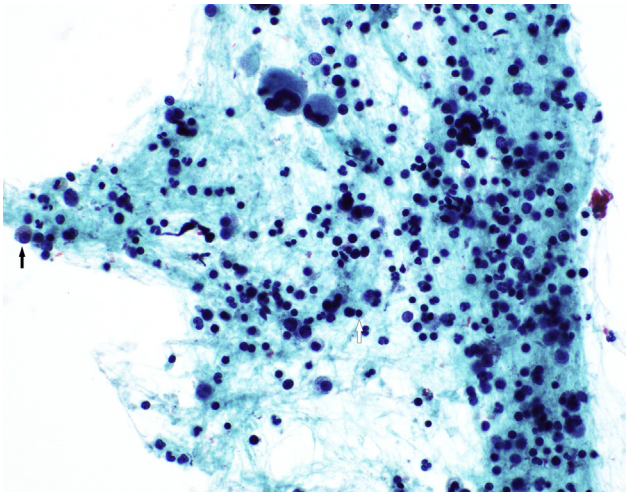

Figure 2 Bone marrow elements including megakaryocytes, mononuclear myeloid cells with pale cytoplasmic granules (black arrow), and precursor red cells with small, dark nuclei (white arrow) (Papanicolaou stain, 400x).

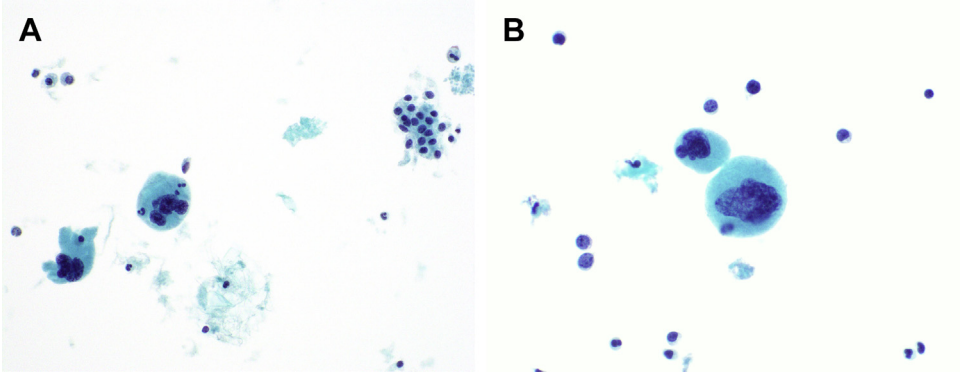

Figure 1 A, ThinPrep showing two megakaryocytes. Flat sheets of follicular cells are present in the background (Papanicolaou stain, 200x). B, Characteristic megakaryocytes with hyperchromatic, multilobed nuclei and abundant cytoplasm (Papanicolaou stain, 400x).