Ectopic Intrathyroidal Thymic Tissue in Omani Children: A Series of Five Case Reports

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Abstract

Ectopic intrathyroidal thymic tissue is a rare congenital anomaly resulting from aberrant migration of thymic tissue during embryonic development, with a reported prevalence of 0.2–2%. It can mimic thyroid nodules in children, creating diagnostic uncertainty and potentially leading to unnecessary invasive procedures. Ultrasound and fine-needle aspiration cytology (FNAC) are valuable tools for accurate diagnosis and differentiation from thyroid neoplasms. To describe the clinical, radiological, and cytological features of pediatric ectopic intrathyroidal thymic tissue diagnosed at the Royal Hospital, Oman, between January 2020 and July 2026. A retrospective descriptive study was conducted on all pediatric patients diagnosed with ectopic intrathyroidal thymic tissue during the study period. Clinical presentation, laboratory findings, thyroid ultrasound characteristics, cytological features, immunocytochemical findings, treatment, and follow-up data were reviewed from electronic medical records. All cases were confirmed by ultrasound-guided FNAC and immunocytochemical studies. Five pediatric patients (three females and two males; age range, 1 year 8 months to 9 years) were identified. Clinical presentation included neck swelling (n=1), incidental thyroid lesions detected during imaging for unrelated conditions (n=2), and abnormal thyroid function (n=2). Ultrasound demonstrated small (4–13 mm), well-defined hypoechoic nodules, predominantly in the posterior thyroid, with characteristic echogenic foci or a "starry-sky" appearance. FNAC showed lymphoid-rich lesions in all cases, and immunocytochemistry confirmed thymic origin without evidence of malignancy. All lesions remained stable during follow-up, with no progression or malignant transformation. Ectopic intrathyroidal thymic tissue should be considered in the differential diagnosis of pediatric thyroid nodules. Recognition of its characteristic ultrasound and cytological features enables accurate diagnosis, avoids unnecessary surgical intervention, and supports conservative management with follow-up imaging.

Keywords: Ectopic; Intrathyroidal; Thymus.

Introduction

The prevalence of having a thyroid nodule in children is 0.2-2%, which is lower than adults. However, the likelihood of the nodule to turn out to be malignant is higher than adults (20-73%).[1]Hence, when thyroid nodules are found in pediatric age group, differential diagnosis of thyroid cancer is crucial.[2] Ectopic intrathyroidal thymic tissue considered to be a rare congenital variant, and the majority of cases are asymptomatic and discovered by accident.[3] To avoid needless biopsy or surgery, it is essential to get an accurate diagnosis of these lesions.[3] Only a few cases of ectopic intrathyroidal thymus tissue have been documented so far.[3,4,5]

We report five cases of intrathyroidal thymic tissue: one presented with neck swelling, two with abnormal thyroid function (one with hyperthyroidism and one with subclinical hypothyroidism), and two were incidental findings during imaging performed for other indications.

Case Reports

Case one

A 7-year-old girl presented with clinical features suggestive of hyperthyroidism. On physical examination, she was afebrile with mild exophthalmos and a small, diffusely enlarged thyroid gland. No palpable thyroid nodules were identified.

Laboratory investigations revealed abnormal thyroid function tests (TFTs) consistent with hyperthyroidism: elevated free T4 (36.9 pmol/L; reference range: 11–18), borderline elevated free T3, normal thyroid-stimulating hormone (TSH), and negative TSH receptor antibodies.

Thyroid ultrasound demonstrated a suspicious hypoechoic nodule in the lower pole of the left thyroid lobe, classified as TI-RADS 5, measuring 4 × 4 × 10 mm. Additionally, a midline infra-thyroid hypoechoic lesion with diffusely scattered hyperechoic foci was identified, raising the possibility of ectopic thymic tissue versus a reactive lymph node.

A thyroid scintigraphy using Tc-99m pertechnetate (34 MBq) showed a heterogeneous thyroid gland with normal overall radiotracer uptake. However, the small size of the thyroid nodule (<10 mm) limited its assessment due to the spatial resolution of the gamma camera.

Ultrasound-guided FNAC of the left thyroid nodule was performed under local anesthesia, with rapid on-site evaluation. Cytological smears were moderately cellular, showing a mixed lymphoid population predominated by small lymphocytes with dense, uniform nuclei and scant cytoplasm. Tingible body macrophages were absent. Scattered anucleate and nucleated squamous cells, keratin debris, and small fragments of adipose tissue were noted, with a background of lymphoglandular bodies. No colloid, psammomatous calcifications, follicular cells, Hurthle cells, or cells with nuclear features of papillary thyroid carcinoma were identified (Figure 1).

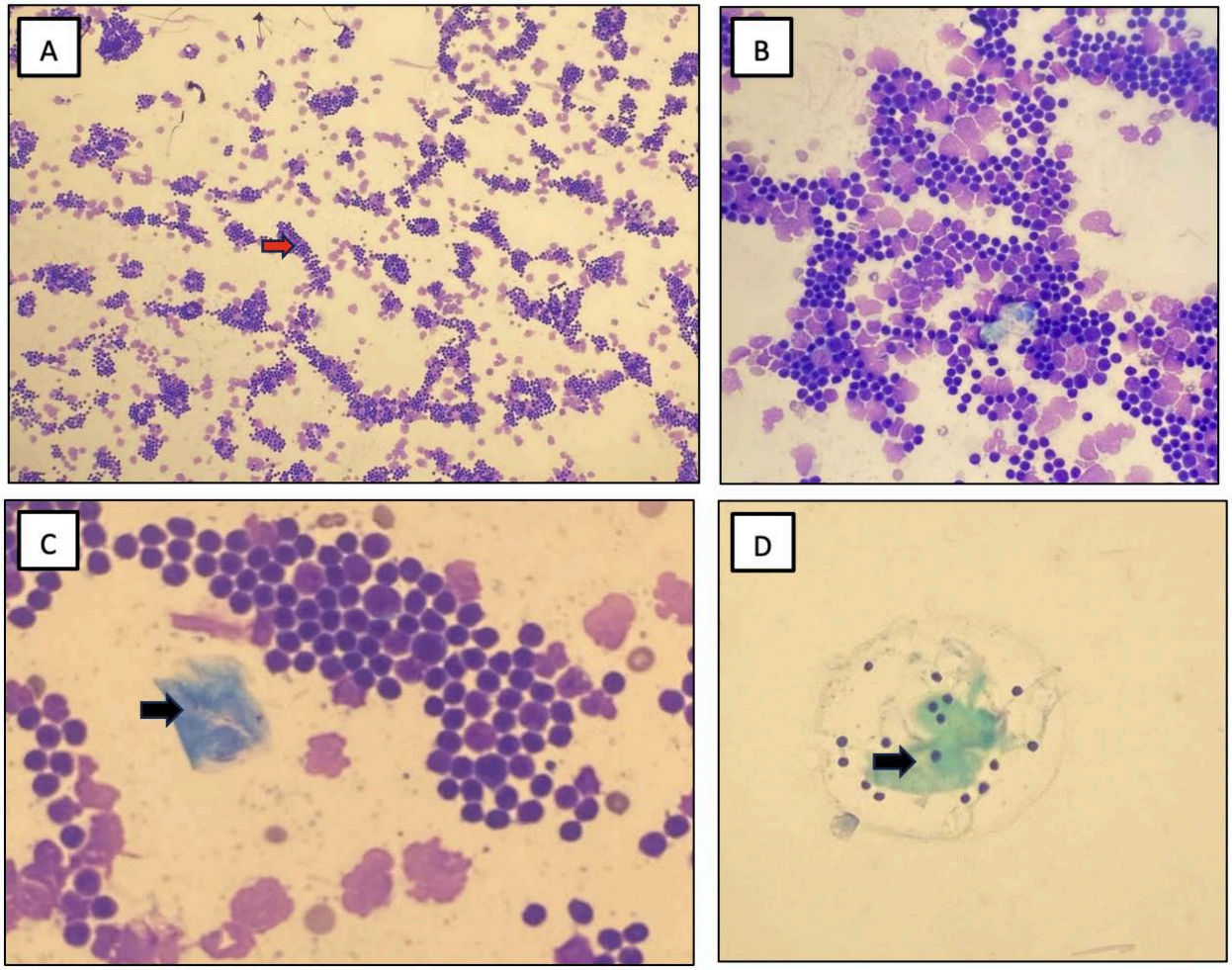

Figure 1: (Patient 1): (A) mixed lymphoid population, predominated by small mature lymphocytes (red arrow). (B and C) anucleated squamous cells (black arrow). (D) keratin flakes (black arrow).

Immunocytochemical staining performed on unstained fixed slides revealed that most lymphoid cells expressed T-cell markers (CD3 and TdT), with rare scattered B-cells highlighted by CD20. The cytomorphological features and immunophenotype were consistent with ectopic thymic tissue. (Figure 2)

Over a 4-year follow-up period, with thyroid ultrasonography performed at annual intervals, the thyroid ultrasonography demonstrated a stable, small heterogeneous hypoechoic nodule in the left thyroid lobe, measuring approximately 5 × 4 × 9 mm, with persistent imaging features favoring ectopic intrathyroidal thymic tissue. The thyroid gland remained normal in size and vascularity, with no evidence of retrosternal extension or significant cervical lymphadenopathy (TI-RADS 2).

The patient was commenced on carbimazole for the management of hyperthyroidism and has remained under regular clinical and biochemical follow-up.

Informed consent was obtained from the guardians.

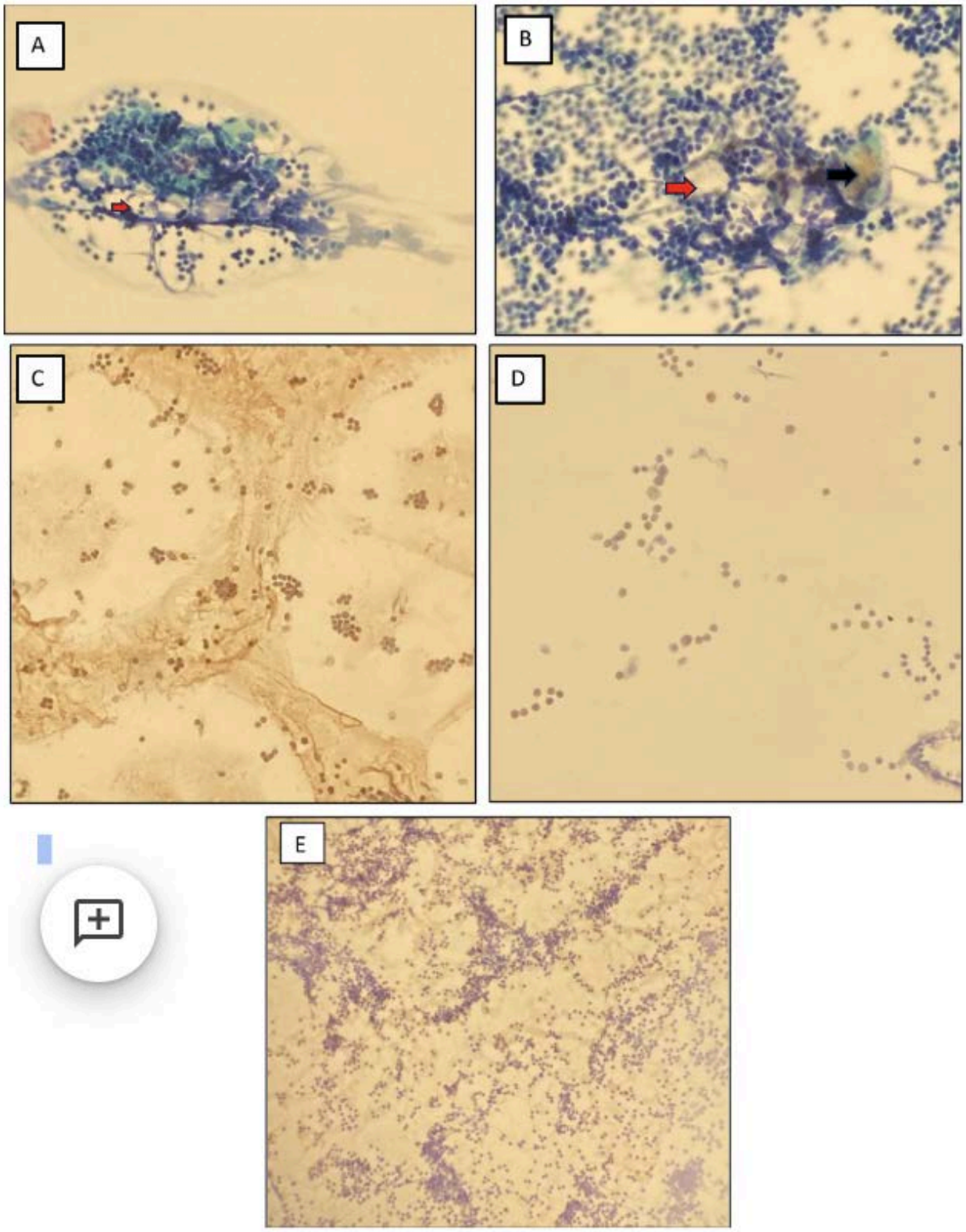

Figure 2: (Patient 1): (A and B) adipocytes (Red arrow) and anucleated squamous cells (black arrow). (C) TDT immunohistochemical stain. (D) CD3 immunohistochemical stain. (E) CD20 immunohistochemical stain.

Case two

A 7-year-old boy was initially evaluated at the age of 2 years for adenoid hypertrophy. A computed tomography (CT) scan performed at that time and revealed a non-enhancing, hypodense nodule in the left thyroid lobe. Subsequent TFTs were within normal limits.

Thyroid ultrasound showed a solitary, well-defined hypoechoic nodule measuring 6 × 4 mm located at the posterior aspect of the left lobe, with central mixed echogenicity (TI-RADS 3) (Figure 3). Due to its size and location, the nodule was not amenable to FNAC. The patient was therefore managed conservatively with serial ultrasound and laboratory monitoring every six months.

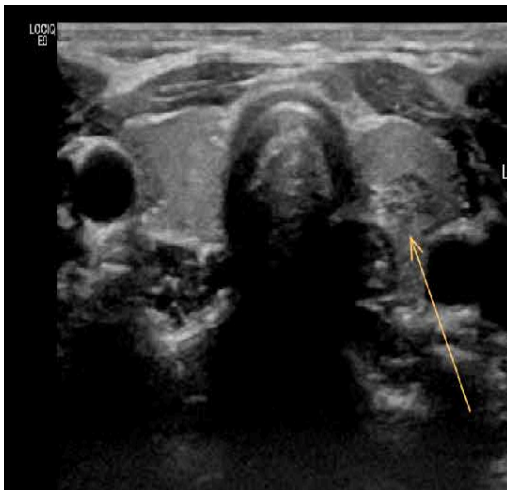

Figure 3: (Patient2): Thyroid ultrasound showed a solitary, well-defined hypoechoic nodule measuring 6 x 4 mm located at the posterior aspect of the left lobe, with central mixed echogenicity.

Clinically, the patient remained asymptomatic and continued to thrive. Follow-up TFTs remained within normal limits. The next ultrasound demonstrated a stable nodule measuring 7 × 6 × 3 mm, with persistent heterogenous echotexture (TI-RADS 3). However, a new finding of concern was a suspicious internal echogenic focus within a left level III cervical lymph node, raising the possibility of microcalcifications.

Urgent FNAC was performed under local anesthesia with rapid on-site evaluation. Cytological examination of the thyroid nodule revealed a lymphoid-rich lesion. Cytomorphological features and immunohistochemical staining performed on the cell block were consistent with ectopic thymic tissue, similar to the findings in the previous case (Figures 4 and 5). FNAC of the left cervical lymph node revealed a mixed lymphoid population without evidence of psammoma body calcification or metastatic carcinoma.

The patient continued under surveillance over 5 years, and the last repeated ultrasound showed a normal-sized thyroid gland with preserved echotexture. The previously noted left thyroid nodule remained unchanged in size and appearance, with stable imaging features. A few echogenic foci persisted within the nodule, without abnormal vascularity or newly identified lesions (TI-RADS 3). Bilateral subcentimetric cervical lymph nodes with benign features were noted. In view of the lesion's long-term stability and benign imaging characteristics, no further intervention was considered necessary.

Informed consent was obtained from the guardians.

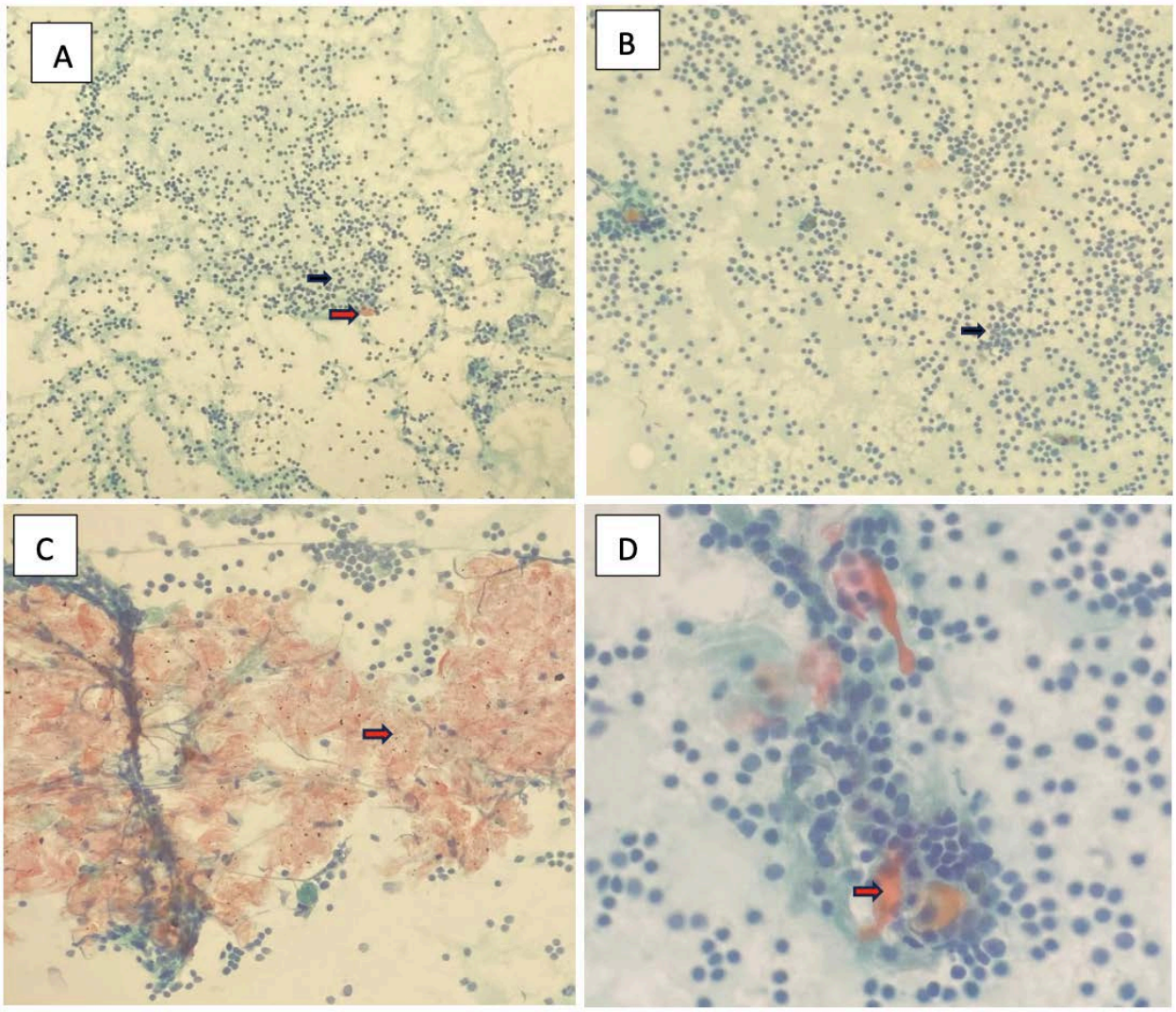

Figure 4: (Patient2): (A and B) mixed lymphoid population, predominated by small mature lymphocytes (black arrow) with occasional squamous cells (red arrow). (C) Keratin flakes (red arrow). (D) anucleated squamous cells (red arrow).

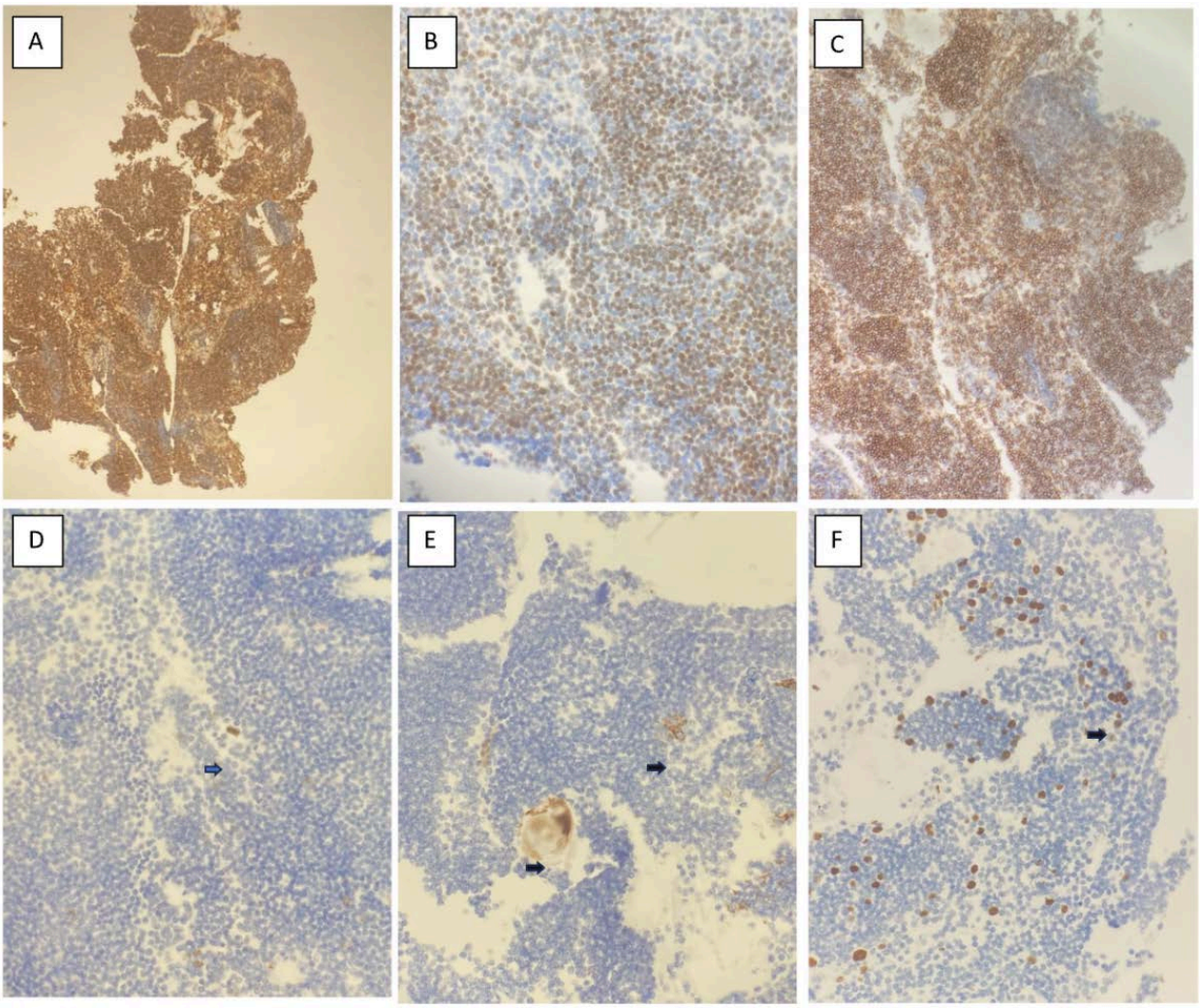

Figure 5: (Patient2): All IHC stains was done on cell block. Majority of the cells show positivity to TdT IHC stain (A), CD3 (B), CD1a (C) and only scattered CD20 positive lymphocytes) (blue arrow)(D). Squamous cells are highlighted by CK5/6 (black arrow) (E) and P63 (black arrow) (F).

Case three

A 9-year-girl was referred for evaluation of subclinical hypothyroidism. Laboratory investigations revealed mildly elevated free T4 at 22.26 pmol/L (reference range: 12.5–21.5) and elevated TSH at 7.82 m[IU]/L (reference range: 0.6–4.84). Thyroid peroxidase (TPO) antibodies were negative.

Thyroid ultrasound demonstrated a well-defined hypoechoic solid structure in the left lobe, measuring 13 × 5 × 4 mm, with a characteristic "starry sky" appearance, suggestive of ectopic intrathyroidal thymic tissue) (TI-RADS 4).

FNAC of the left thyroid lesion was performed. Cytological evaluation revealed the absence of thyroid parenchymal elements and no evidence of malignant epithelial cells. Immunocytochemical analysis supported a diagnosis of ectopic intrathyroidal thymic tissue over thyroidal lymphocytic thyroiditis (Figure 6).

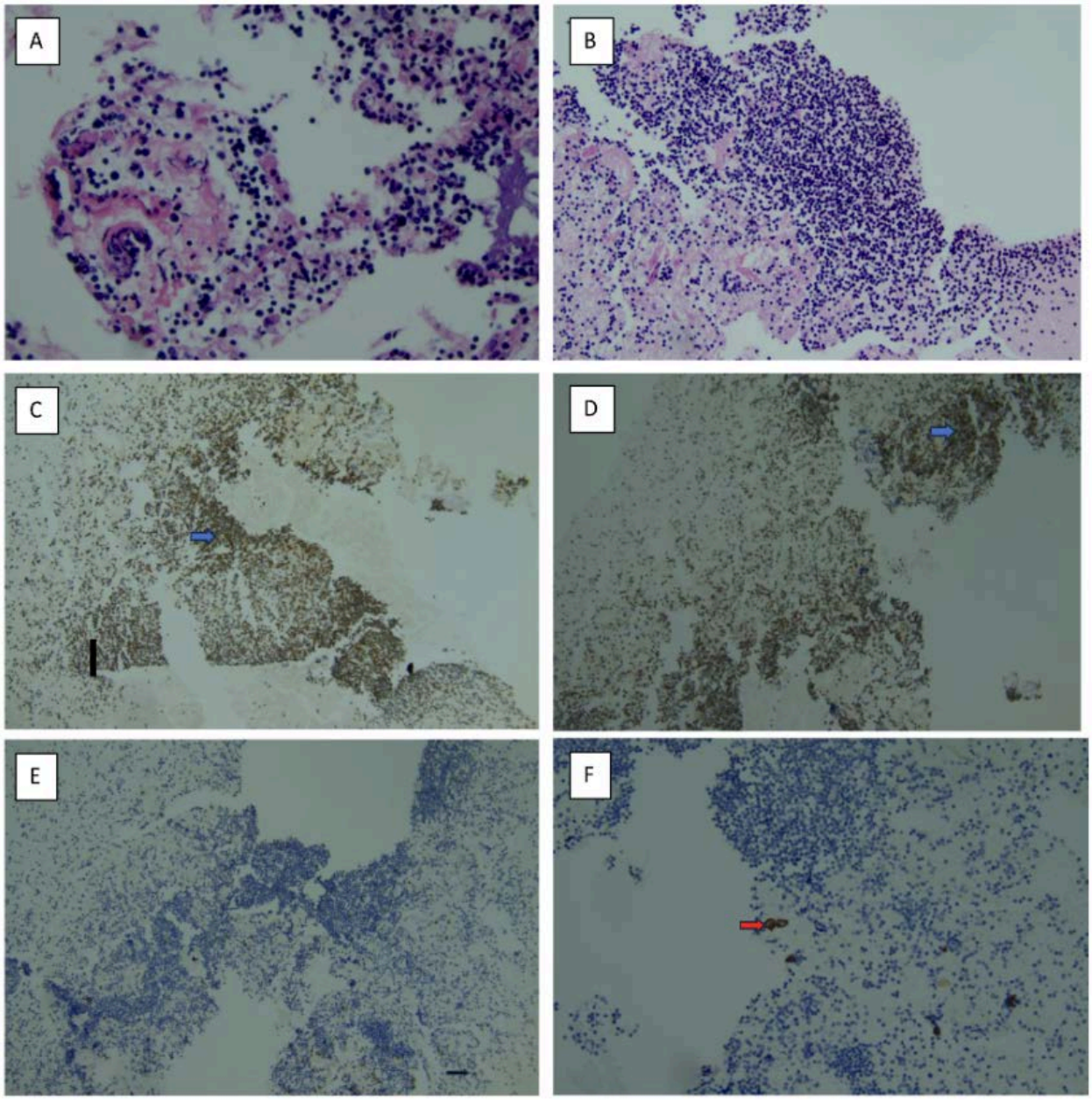

Figure 6: (Patient 3): All IHC stains was done on cell block (A and B). Majority of the cells show positivity to CD1a IHC stain (blue arrow) (C), CD3 (blue arrow) (D) and only scattered CD20 positive lymphocytes (black arrow) (E). Squamous cells are highlighted by CK5/6 (red arrow) (F).

After 2 months of observation without treatment, repeat laboratory investigations demonstrated normalization of thyroid function tests, with no biochemical evidence of hypothyroidism. Concurrent thyroid ultrasonography revealed an ill-defined hypoechoic solid lesion measuring approximately 4 × 3 × 4 mm, located posterior to the mid-portion of the left thyroid lobe and lateral to the esophagus. The lesion demonstrated an intrathyroidal projection and central vascularity, with no suspicious sonographic features or interval increase in size (TI-RADS 4).

Given the normalization of thyroid function and the benign, stable imaging appearance of the lesion, no specific intervention was required, and the patient continued to undergo regular clinical follow-up.
Informed consent was obtained from the guardians.

Case four

A 1 year and 8-month-old boy presented with a palpable neck swelling. Laboratory evaluation revealed normal serum free T4 and TSH levels. TPO antibodies were negative.
Thyroid ultrasound demonstrated a normal-sized gland with preserved echotexture. A small, hypoechoic solid nodule measuring 4 × 5 mm was identified in the posterior aspect of the right lobe, situated close to the right carotid artery. No calcifications were noted (TI-RADS 4).

Ultrasound-guided FNAC of the right thyroid nodule was performed. Cytological examination revealed findings consistent with those seen in the previously described cases and favored a diagnosis of ectopic thymic tissue (Figure 7).

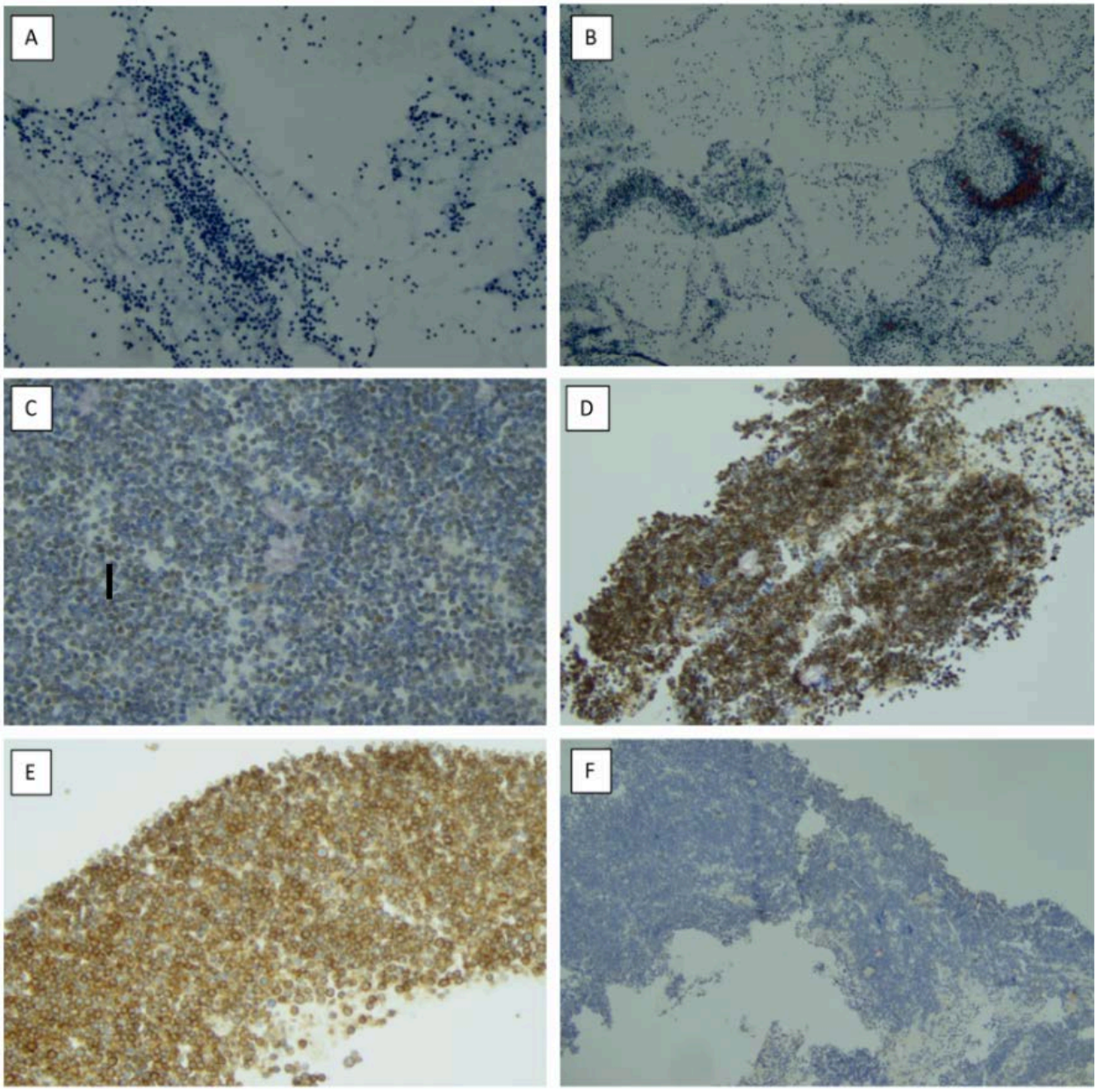

Figure 7: (Patient 4): (A) Mixed lymphoid population, predominated by small mature lymphocytes. (B) lymphoid rich smear with anucleated squamous cells. Majority of the cells show positivity to Tdt IHC stain (C), CD1a (D), CD3 (E) and only scattered CD20 positive lymphocytes (F).

Over a 3-year follow-up period, with thyroid ultrasonography performed at annual intervals. The most recent ultrasound examination showed no definite focal thyroid nodule. Therefore; no further intervention was required, and the patient remained under routine clinical surveillance.
Informed consent was obtained from the guardians.

Case five

A 3-year-old girl was diagnosed with stage II left-sided Wilms tumor when she was 2 years. As part of her diagnostic workup, a chest CT scan was performed, which incidentally revealed a thyroid nodule.
Laboratory investigations showed normal free T4 and TSH levels. TPO antibodies were not assessed.

Thyroid ultrasound demonstrated a solitary nodule in the left lobe measuring 7 × 6 mm. The lesion was hypoechoic with slight heterogeneity and a mildly lobulated contour. No significant internal vascularity, surrounding halo sign, or calcifications were identified (TI-RADS 4).
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NAC of the nodule revealed cytological features consistent with ectopic intrathyroidal thymic tissue, similar to previously reported cases (Figure 8).

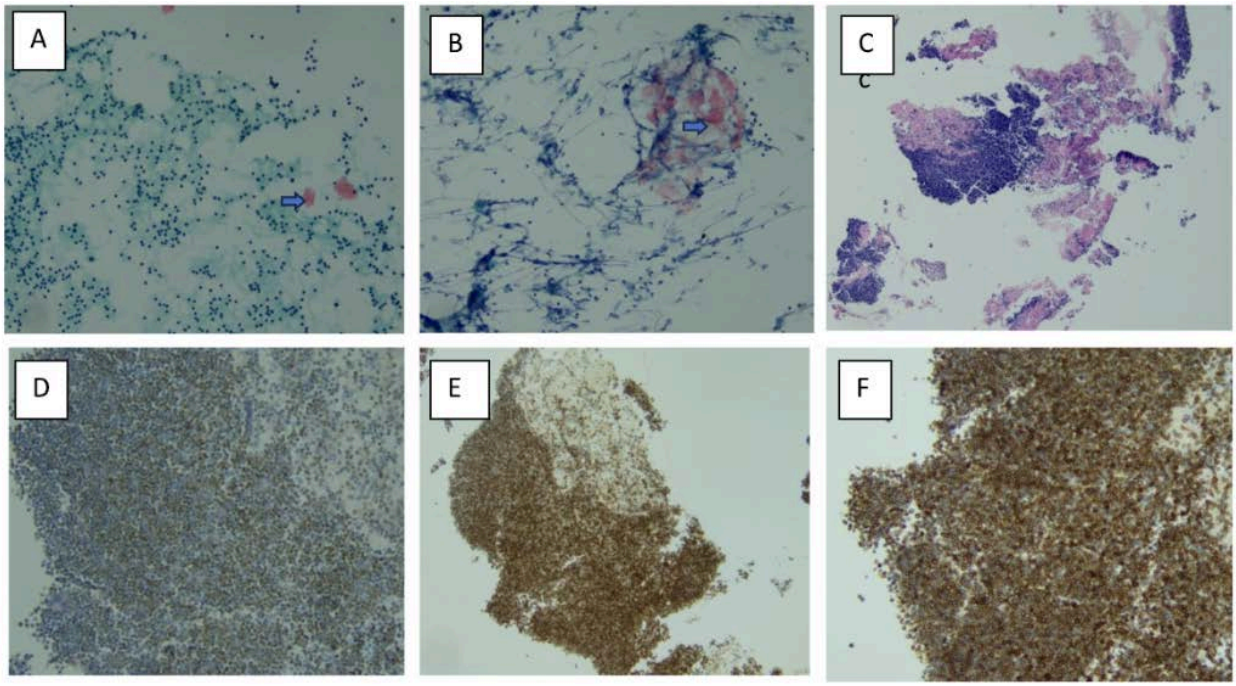

Figure 8: (Patient 5): (A) Mixed lymphoid population, admixed with anucleated squamous cells (blue arrow) (A and B). Cell block (C). Majority of the cells show positivity to Tdt IHC stain (D), CD1a (E), CD3 (F).

The patient completed seven cycles of chemotherapy. Follow-up thyroid ultrasonography performed 1 year later demonstrated a stable, well-defined cystic nodule in the left thyroid lobe measuring 6 × 3 mm. The lesion contained a few thin internal septations and mildly turbid contents, with no associated calcifications, corresponding to TI-RADS 2. Given the benign sonographic features and interval stability, continued clinical and ultrasonographic follow-up was recommended.

Informed consent was obtained from the guardians.

Table 1: Summary of cases.

Case	Age (years)	Presentation	Thyroid Function	Imaging Findings	FNAC Findings	Management	Follow-up/Outcome
1	7	Hyperthyroidism symptoms	Elevated free T4, borderline high free T3, normal TSH	Left thyroid lobe nodule (4×4×10 mm), TI-RADS 5, suspicious nodule	Lymphoid-rich lesion, T-cell predominance, consistent with thymic tissue	Carbimazole for hyperthyroidism	4 years follow up, Stable nodule on ultrasound
2	7	Incidental during adenoid hypertrophy evaluation	Normal TFT	Left lobe nodule (6×4 mm) with mixed echogenicity (TI-RADS 3); suspicious cervical lymph node	Thymic tissue in thyroid nodule; benign lymphoid in lymph node	Conservative	5 years follow up, Stable nodule and lymph nodes.
3	9	Subclinical hypothyroidism	Elevated TSH, mild high free T4, negative TPO antibodies	Left lobe lesion (13×5×4 mm) with "starry sky" appearance (TI-RADS 4)	Thymic tissue; no thyroid parenchyma or malignancy	Conservative	2 months follow up, Stable lesion with central vascularity.
4	1.7 (1 year 8 months)	Neck swelling	Normal TFT	Right lobe nodule (initially 4×5 mm, later 10×4×4 mm), hypoechoic, near carotid artery (TI-RADS 4).	Thymic tissue	Conservative	3 years follow up, no definite focal thyroid nodule was identified in the last scan.
5	3	Incidental on chest CT for Wilms tumor	Normal TFT; TPO antibodies not tested	Left lobe nodule (7×6 mm), hypoechoic with mild heterogeneity and lobulated margins (TI-RADS 4)	Thymic tissue	Chemotherapy for Wilms tumor; no thyroid treatment.	1 year follow up, Stable lesion.

Discussion

The thymus considered as a specialized primary lymphoid organ of the immune system. At the sixth week of gestation, the thymus starts to develops from the ventral wings of the fourth and third branchial pouches. Endodermal cells within the out-pouching proliferate and fuse at the midline late in the seventh week of gestation to form paired solid masses which are covered by a mesenchymal capsule near the pericardium. Throughout the eighth week, the thymic primordium elongates caudally and medially to form the thymopharyngeal duct. When the primordial thymus descents to the final position in the anterior superior mediastinum, the upper end of the thymus is drawn out and then disappears. The residual endodermal epithelium degenerates into the concentric thymic corpuscules of Hassall. By the third month of gestation, a cortex and medulla develop in the thymus. Ectopic thymic tissue can be discovered any- where along the thymopharyngeal duct.[6,7,8] Multiple theories were proposed to suggest an explanation for the formation of an ectopic cervical thymic mass. It could be due to persistence of thymopharyngeal duct or hyperplasia of undescended thymus or sequestrated thymic remenants.[9] The thymus plays a functional role in the regulation of cell mediated immunity of T cells by positive selection and prevention of autoimmune diseases by negative selection.[10]

The prevalence of having a thyroid nodule in children is 0.2-2%, which is lower than adults. However, the likelihood of the nodule to turn out to be malignant is higher than adults (20-73%).[1] Colloid cysts, Nodular goiter, follicular adenomas, lymphocytic thyroiditis, degenerating nodules, and malignant thyroid nodules are frequently included in the differential diagnosis for thyroid nodules in children.[11]

Ectopic intrathyroidal thymic tissue is rare cause of pediatric neck mass and usually found incidentally. The first investigation of choice to assess a neck mass is ultrasonography. It reveals an ectopic intrathyroidal thymic tissue as a hypoechoic mass with multiple linear or punctate internal echoes, similar to the normotopic thymus. This characteristic echo-structure of a thyroidal nodule is a clue to diagnose ectopic intrathyroidal thymic tissue.[12] The multiple echogenic internal dots within a thyroid nodule could be mistaken as microcalcification of a malignant thyroid nodule.13 Ectopic intrathyroidal thymic tissue can be diagnosed radiologically when ultrasonographic features are characteristic and classical of thymic tissue, while histopathological confirmation is warranted if imaging findings are inconclusive.

In recent literature, there is a shift of diagnostic algorithm from biopsy to radiology diagnosis alone.[14]Han et al. and Zielke et al. both concluded that ectopic cervical thymus can be diagnosed with ultrasound alone and therefore there is no need for biopsy or surgical excision.[12,15,16] In 2014, Ozel et al. reported that there is no solid evidence in the literature support the increase incidence of malignant transformation of ectopic cervical thymic mass compared to normal thymic tissue. Moreover, ectopic thymus seen to involute like the normal thymus. Therefore, biopsy or surgical excision of ectopic thymic tissue were not acceptable.[6] However, FNAC of the intrathyroidal nodule is essential to confirm the radiological diagnosis.[15]

In our cases, the patients were managed conservatively after confirming the diagnosis by FNAC. The patients were followed up with ultrasound and no new changes found.

The main limitations of this study are its retrospective design, small sample size, and single-center setting. In addition, all cases were confirmed by FNAC, limiting assessment of an ultrasound-only diagnostic approach. Larger multicenter studies with longer follow-up are needed to validate these findings.

Conclusion

Ectopic intrathyroidal thymic tissue considered a rare cause of thyroid nodule in pediatric age group. Awareness of the radiologist, imaging findings, and correct cytopathological interpretation allow the correct diagnosis to be made. A conservative management is advised for intrathyroidal ectopic thymus, except in symptomatic cases with tracheal compression, inconclusive FNAC or histologically confirmed neoplasia.

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