

Fine-needle aspiration-induced infarction of a thyroid nodule: A rare diagnostic pitfall – A case report

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ABSTRACT

Fine-needle aspiration (FNA) is the most widely used diagnostic tool for evaluating thyroid nodules and plays a crucial role in guiding surgical management. Although considered safe and minimally invasive, it may rarely induce secondary histologic alterations, including nodule infarction, which can obscure histopathological interpretation and create diagnostic uncertainty. A 72-year-old woman presented with a gradually enlarging anterior neck swelling of 1 year's duration. An earlier FNA had been reported as a colloid cyst. Repeat ultrasonography demonstrated a cystic lesion in the left thyroid lobe, and repeat FNA revealed atypia of undetermined significance, oncocytic type (Bethesda category III). Total thyroidectomy was performed 4 weeks after the repeat FNA because of indeterminate cytology and increasing lesion size. Histopathology demonstrated a completely infarcted thyroid nodule with no viable tumor cells. After multidisciplinary discussion, no further oncologic treatment was recommended, and the patient was started on thyroxine replacement therapy. Correlation of cytologic, clinical, and histopathological findings is essential for appropriate management.

Key words: Atypia of undetermined significance, Fine-needle aspiration, Infarction, Thyroid nodule, Vanishing tumor

Fine-needle aspiration (FNA) is the most widely used diagnostic method for evaluating thyroid nodules and guiding surgical management decisions. It has a reported sensitivity of 65–99% and specificity of 72–100%, making it a highly reliable diagnostic tool compared with other non-invasive modalities such as ultrasonography and radionuclide imaging. Despite being an invasive procedure, FNA is generally safe, rapid, and associated with very low complication rates. Most complications are minor and include local pain or small hematomas. However, FNA-induced trauma may occasionally produce secondary histopathological changes within a thyroid nodule. These alterations can obscure the underlying pathology and complicate

interpretation of the resected specimen. Thyroid nodule infarction is a rare post-FNA change, more commonly observed in oncocytic (Hürthle cell) lesions, and may lead to diagnostic uncertainty [1].

We report a case of a thyroid nodule with Bethesda category III cytology that demonstrated complete infarction on final histopathology following total thyroidectomy, highlighting the diagnostic challenges posed by FNA-related changes.

CASE REPORT

A 72-year-old woman presented with an anterior neck swelling that she had first noticed 1 year earlier. The swelling had gradually increased in size but was not

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associated with pain, compressive symptoms, dysphagia, voice changes, or systemic symptoms such as weight loss or fever. She was clinically euthyroid, with no relevant family history of thyroid disease or thyroid malignancy and no history of prior radiation exposure to the head or neck. One year before presentation, she had undergone FNA of the lesion, which had been reported as a colloid cyst, and she was advised regular follow-up. Because of progressive enlargement of the swelling, she sought re-evaluation.

Clinical examination revealed an enlarged left thyroid lobe with a palpable, firm, non-tender nodule measuring approximately 4 × 3 cm.

Ultrasonography of the neck demonstrated a 3 × 2.8 × 3 cm cystic lesion with a thick wall in the left thyroid lobe, along with two smaller cystic lesions in the right lobe.

After informed consent was obtained, the patient was positioned supine with the neck slightly extended. Under ultrasound guidance and aseptic precautions, a 25–27-gauge needle was inserted into the lesion of interest. Sampling was performed using the capillary technique without suction, with 2–4 passes. The aspirated material was expelled onto glass slides, and smears were prepared, either air-dried or alcohol-fixed, and subsequently stained for cytological evaluation. Cytology was reported as atypia of undetermined significance (AUS), oncocytic type (Bethesda category III) (Fig. 1). In view of the indeterminate cytology and progressive increase in lesion size, the patient underwent open total thyroidectomy 4 weeks after the repeat FNA.

The post-operative course was uneventful, and the patient recovered without complications.

Histopathological examination of the resected thyroid specimen revealed a completely infarcted nodule in the left lobe. The lesion showed a thickened capsule and abundant eosinophilic granular material, with no viable tumor cells. No evidence of capsular or vascular invasion was identified, and the background thyroid parenchyma was unremarkable (Fig. 2).

The case was discussed at a multidisciplinary tumor board meeting. In the absence of definitive evidence of malignancy on cytology and because histopathology was non-contributory due to complete infarction, no further oncologic treatment was recommended. The patient was started on thyroxine supplementation and is currently under regular follow-up.

DISCUSSION

FNA cytology remains a cornerstone in the diagnostic workup of thyroid nodules, offering high sensitivity and specificity for distinguishing benign from malignant lesions. However, despite its minimally invasive nature, FNA is not without complications. Among the rare but clinically significant complications is thyroid nodule infarction, a phenomenon that can obscure histological interpretation and complicate clinical decision-making [1].

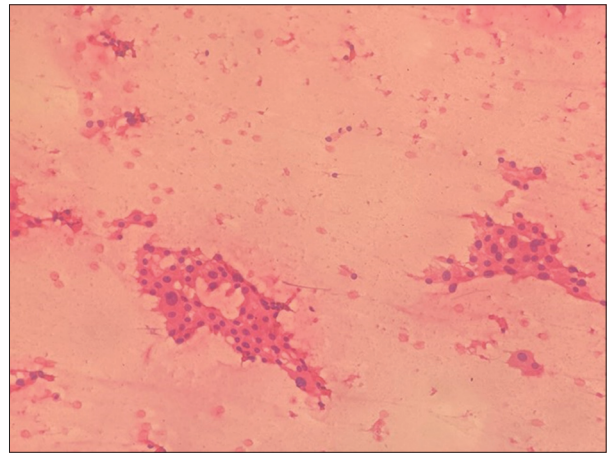


Figure 1: Fine-needle aspiration cytology of the thyroid nodule showing a Bethesda category III lesion (atypia of undetermined significance), oncocytic type. Smears are paucicellular, with clusters of Hürthle cells. The cells are enlarged, with abundant eosinophilic granular cytoplasm and round-to-oval nuclei. The background shows thick and thin colloid

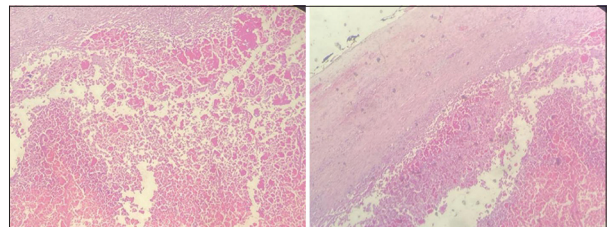


Figure 2: Histopathological examination of the resected thyroid specimen demonstrating a completely infarcted nodule in the left lobe, with no viable tumor cells

In our case, a 72-year-old woman presented with a progressively enlarging thyroid nodule that had initially been reported as a colloid cyst on FNA. A repeat FNA was performed because of interval enlargement revealed AUS, oncocytic type (Bethesda category III). Surgical excision through total thyroidectomy was undertaken in view of the indeterminate cytology and increasing nodule size. Histopathological examination revealed complete infarction of the thyroid nodule with no viable tumor tissue identified, creating a diagnostic dilemma because infarction limited evaluation for malignancy.

The literature has reported a variable incidence of thyroid nodule infarction following FNA, ranging from 0% to 10%. Infarction may occur because of vascular disruption, thrombosis, or ischemic injury resulting from needle trauma during the aspiration procedure [1]. FNA-induced infarction has been documented as an uncommon but recognized complication. Das *et al.* described two cases of infarcted papillary thyroid carcinoma (PTC) in which only small peripheral areas of viable tumor allowed a definitive diagnosis [2]. Similarly, Liu *et al.* reported a series of 12 infarcted PTCs (1.9% of all PTC cases), demonstrating that infarction may be focal or near-total and may occur between 13 and 133 days after FNA. Histologic findings commonly include necrosis, hemorrhage, granulation tissue, fibrosis, and dystrophic calcification [1].

The phenomenon has also been described as “vanishing tumors,” referring to thyroid lesions

previously diagnosed on cytology that demonstrates only regressive changes such as infarction or fibrosis on final histology. Bhatia *et al.* reported that approximately 2.5% of thyroidectomy specimens showed nodules partially or completely replaced by post-FNA changes, making pathological confirmation difficult. These changes may include hemorrhage, fibrosis, squamous metaplasia, cystic degeneration, and complete necrosis, with occasional small residual tumor foci at the periphery providing clues to the underlying diagnosis [3]. Similarly, Eze *et al.* described 14 cases of “vanishing thyroid tumors” following ultrasonography-guided FNA, in which nodules were completely or largely replaced by secondary changes such as organizing hemorrhage, fibrosis, granulation tissue, and calcifications. In several cases, only minimal residual malignant or benign cells were identified at the periphery, while some nodules showed complete obliteration with no residual tumor, resulting in difficulty establishing a definitive histopathological diagnosis [4]. Jose *et al.* described a similar case of a vanishing PTC in which malignancy was diagnosed preoperatively on cytology. However, the thyroidectomy specimen demonstrated complete infarction with no viable tumor cells. In contrast, in our case, the preoperative FNA showed AUS without definitive evidence of malignancy, and histopathology was non-contributory because of complete infarction. Consequently, after multidisciplinary tumor board discussion, the patient was managed conservatively with follow-up rather than additional oncologic treatment [5].

Hürthle cells are commonly encountered in reactive or hyperplastic thyroid conditions, such as lymphocytic thyroiditis and multinodular goiter, where they are considered metaplastic. However, they may also be

present in neoplastic lesions such as Hürthle cell adenoma or carcinoma. A considerable proportion of cases reported as follicular neoplasm, Hürthle cell type (Bethesda IV), approximately 16–25%, is ultimately proven to represent hyperplastic oncocytic proliferations rather than true neoplasms [6]. Oncocytic lesions, such as the one in our case, may be particularly susceptible to infarction following FNA. Varma and Chelmeda reported similar observations in infarcted Hürthle cell tumors, emphasizing the diagnostic challenges posed by infarcted tissue and the importance of careful examination of the peripheral areas of the lesion [7].

Several mechanisms have been proposed to explain infarction following FNA, including needle-induced vascular injury, thrombosis of intratumoral vessels, and increased susceptibility of highly vascular tumors to ischemic damage. Infarction is also thought to occur more frequently when surgery is performed within a relatively short interval after FNA, typically within 2–6 weeks [1]. Table 1 summarizes selected studies reporting this phenomenon.

In our practice, this represents the first case in which we encountered complete infarction of a thyroid nodule following FNA. This case highlights the diagnostic challenges associated with FNA-induced changes and underscores the importance of correlating cytological findings with histopathology. FNAC may yield false-negative results because of sampling error, particularly in complex or predominantly cystic lesions. Therefore, correlation of cytological findings with ultrasonographic characteristics, clinical findings, and subsequent histopathological examination is essential, particularly in patients with indeterminate cytology

Table 1: Selected reported cases of thyroid nodule infarction or “vanishing tumors” following fine-needle aspiration

Author/ Year	No. of cases	Pre-operative FNA cytology	Histologic diagnosis	Interval to surgery	Key histologic findings	Management/ Outcome
Liu <i>et al.</i> , 2014 [1]	12	67% PTC; others AUS or benign	Infarcted PTC (often follicular variant)	Mean 52 days (13–133)	Focal or near-total infarction; granulation tissue; calcification	Total thyroidectomy; most received radioactive iodine
Das <i>et al.</i> , 2009 [2]	2	PTC	Infarcted papillary thyroid carcinoma	Few weeks	Coagulative necrosis with viable tumor at periphery	Surgery; diagnosis confirmed from residual tumor
Bhatia <i>et al.</i> , 2016 [3]	17	AUS/ indeterminate (41%); benign (59%)	Vanishing or regressed nodules	Variable	Hemorrhage; fibrosis; squamous metaplasia; necrosis	Conservative if no malignancy; treatment if carcinoma present
Eze <i>et al.</i> , 2013 [4]	14	PTC (5); AUS/ indeterminate (5); benign (2); follicular neoplasm (1); non-diagnostic (1)	Vanishing tumors; residual PTC or benign nodules in some cases	Mostly 1–2 months	Cystic degeneration; hemorrhage; fibrosis; granulation tissue; calcification; squamous metaplasia	Lobectomy or total thyroidectomy based on clinical suspicion
Jose <i>et al.</i> , 2019 [5]	1	PTC	Completely infarcted PTC	~2 weeks	Necrotic nodule without viable tumor cells	Follow-up only; no additional therapy
Varma and Chelmeda, 2017 [7]	1	Suspicious for Hürthle cell neoplasm	Infarcted Hürthle cell tumor	4 weeks	Central infarction with rim of viable oncocytic cells	Surgery; no additional therapy
Kouba <i>et al.</i> , 2018 [8]	9	Mostly suspicious or positive for PTC; some AUS	Infarcted PTC	Mean 35 days (2–69)	Partial or complete infarction; hemorrhage; fibrosis; calcification	Surgical excision; molecular testing for BRAF mutation

FNA: Fine needle aspiration, PTC: Papillary thyroid carcinoma, AUS: Atypia of undetermined significance

(Bethesda categories III–IV), to ensure appropriate diagnosis and management. It also emphasizes the value of multidisciplinary discussion when histopathological evaluation is limited by infarcted tissue.

CONCLUSION

This case illustrates extensive infarction of a thyroid nodule following FNA in a 72-year-old patient, resulting in marked necrosis with no viable tumor cells on histopathological examination. Such postprocedural infarction may create diagnostic uncertainty and can simulate a regressed or “vanishing” thyroid tumor. Awareness of this rare phenomenon is important for pathologists and clinicians, as correlation with prior cytological findings and clinical history is essential for accurate interpretation. Recognition of FNA-induced infarction helps avoid potential diagnostic pitfalls and ensures appropriate patient management and follow-up.

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