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**Case Report**

# A rare case of non-functioning parathyroid carcinoma masquerading as euthyroid neck mass

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## ABSTRACT

Parathyroid carcinoma is an exceptionally rare endocrine malignancy, often functional, manifesting with hypercalcemia and elevated parathyroid hormone (PTH) levels. Non-functional parathyroid carcinoma lacks classical biochemical features, making its diagnosis particularly challenging. Here, we present a case of 60-year-old male with swelling in the anterior aspect of right side of neck. Ultrasound of the neck showed complex cystic nodule suggesting fine needle aspiration cytology (FNAC) to rule out papillary neoplasm. FNAC results were suggestive of hyperplastic colloid nodule. Then the routine blood tests, including serum calcium and thyroid function, were within normal limits and the patient was taken up for total thyroidectomy. Histopathology of the specimen revealed features suggestive of medullary thyroid carcinoma, necessitating IHC. Tumor cells stained strongly positive for GATA3 and PTH, while being negative for calcitonin, MCEA, TTF1, and S100. Focal capsular and lymphovascular invasion was noted and the final diagnosis of parathyroid carcinoma was made. Parathyroid carcinoma is a rare and aggressive tumor that may clinically and radiologically mimic a thyroid nodule, especially in its non-functional form. Diagnosis is extremely difficult and is best confirmed with immunohistochemistry.

**Keywords:** Parathyroid carcinoma, Thyroid nodule, Immunohistochemistry

## INTRODUCTION

Parathyroid carcinoma is an exceedingly rare malignancy, accounting for less than 0.005% of all cancers.[1] Typically, it presents as with clinical features of hypercalcemia such as hyperparathyroidism, including severe hypercalcemia, an elevated serum parathyroid hormone (PTH) level, nephrolithiasis or nephrocalcinosis, osteopenia, gastrointestinal disturbances, depression, fatigue, or memory.[2] The features of hypercalcemia is due to excessive secretion of parathyroid hormone by the functioning tumor. So the parathyroid carcinoma which has normal level of calcium and parathyroid hormone is given the entity as non-functional parathyroid carcinoma. Very few cases of non-functional parathyroid carcinoma have been reported all over the world due to the difficulties in diagnosis because of the absence of symptoms of hyperparathyroidism. Only way to diagnose parathyroid carcinoma is with a positive histological finding and confirmation with immunohistochemistry.

## CASE REPORT

A 60-year-old male presented with a 4-month history of a painless, gradually enlarging swelling on the right side of the neck. The swelling initially appeared as a groundnut-sized mass and progressed to the size of a lemon. It moved with deglutition and had no associated symptoms of

hyperthyroidism, hypothyroidism, or hyperparathyroidism. The patient had no history of diabetes, hypertension, coronary artery disease, tuberculosis, asthma, epilepsy, or thyroid disorders. He had no prior surgical history but had a history of chronic smoking and alcohol use for 10 years. On examination, a 6×4 cm firm swelling was palpated in the right thyroid lobe. Ultrasound of the neck revealed a well-defined complex cystic nodule measuring 5.3×3 cm with multiple thick septations and microcalcification in the right lobe. Internal echoes and peripheral vascularity seen with mass effect over the trachea, carotid and jugular vessels. The left lobe of thyroid was normal. No lymphadenopathy was noted. Result was complex cystic nodule suggesting FNAC to rule out papillary neoplasm.

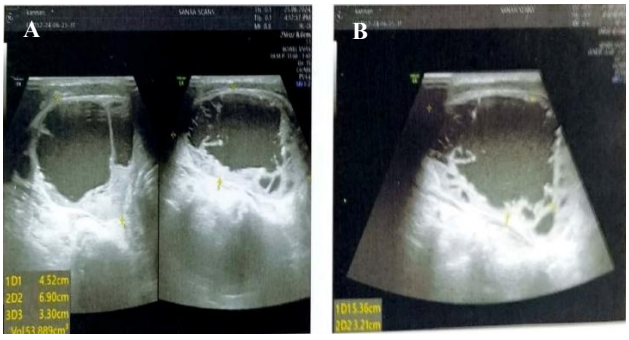


**Figure 1 (A and B): Cystic nodule with thick septations and microcalcification in right lobe of thyroid.**

FNAC which was first done revealed scattered acinar cells with colloid and macrophages, interpreted as a hyperplastic colloid nodule. To confirm a subsequent ultrasound-guided FNAC showed only colloid material and RBCs, with no follicular cells. Then we proceeded to do Routine blood tests, including serum calcium and thyroid function which were within normal limits. Videolaryngoscopy showed mobile and normal bilateral vocal cords. As there are no other symptoms and signs of local invasion, since USG result came as to rule out papillary neoplasm, after the discussion with surgical oncologist patient was planned for total thyroidectomy. Under general anaesthesia, in sterile aseptic precautions patient put in supine position with neck extension. Collar incision made and subplatysmal flaps were raised. Strap muscles dissected and retracted. A 4×3 cm cystic swelling was identified in the right lobe of the thyroid, superior lobe of thyroid dissected on right. Double ligated right superior thyroid vessels which was cut. Right upper lobe released from bed. Inferior thyroid artery identified. Recurrent laryngeal nerve identified by lateral approach and preserved. Right parathyroid glands could not be identified. Same procedure repeated on left with preservation of left parathyroids. Berrys ligament dissected and thyroid gland removed intoto. Drain kept and wound closed in layers. The postoperative period was uneventful, and the patient was discharged on postoperative day 4 with oral calcium supplementation.

Histopathology of right lobe revealed shows cyst wall composed of cells arranged in insular pattern, nests are separated by prominent vascular septae. Individual tumor cells exhibit salt and pepper like chromatin with focal areas of calcification features suggestive of medullary thyroid carcinoma, necessitating IHC to rule out possibility of poorly differentiated thyroid carcinoma. Left lobe of thyroid and isthmus showed normal thyroid follicles. IHC results showed tumor cells stained strongly positive for GATA3 and PTH, while being negative for calcitonin, MCEA, TTF1, and S100. Focal capsular and lymphovascular invasion was noted. So the final diagnosis was made as parathyroid carcinoma. GATA3 and PTH positivity on immunohistochemistry confirmed the diagnosis. Postoperative serum calcitonin was <2 pg/ml (normal <8.4 pg/ml) and serum calcium was 8.95 mg/dl.

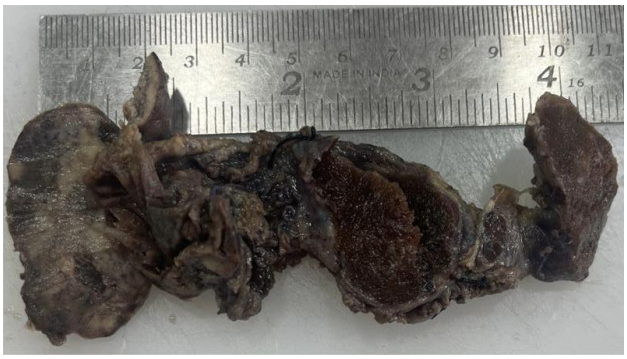

**Figure 2: Gross total thyroidectomy specimen, whole measuring 11×3×1.5 cm.**

Right lobe measuring 4×3×0.5 cm. External surface: smooth capsule intact. Cut surface: ill defined, grey white to tan lesion measuring 3.5×2.5×1 cm is seen involving predominantly upper and middle portion of right lobe of thyroid; on serial section: cystic changes are seen; no areas of necrosis or papillae seen grossly; left lobe measuring 3×2.5×0.5 cm. External surface: smooth. Cut surface: colloid present.

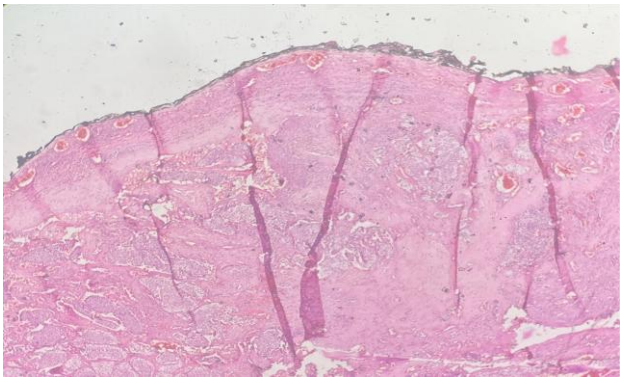

**Figure 3: HPE specimen showing tumor surrounded by fibrous capsule and cells arranged in insular pattern.**

Tc-99m sestamibi scintigraphy showed no evidence of residual or metastatic disease in neck or elsewhere in the body. The patient was started on thyroid hormone

replacement. At 6-month follow-up, there were no signs of recurrence or hypocalcemia.

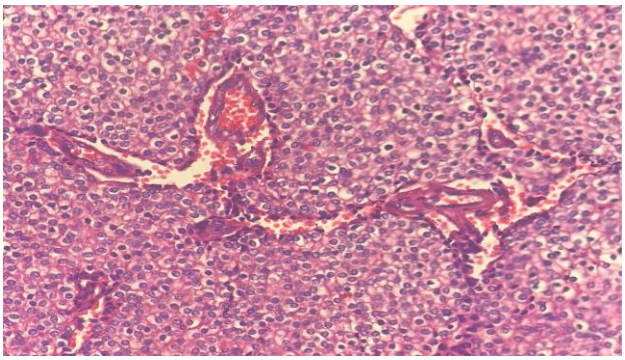

**Figure 4: Cells arranged in organoid pattern with salt and pepper chromatin, clear to eosinophilic cytoplasm, inconspicuous nucleoli.**

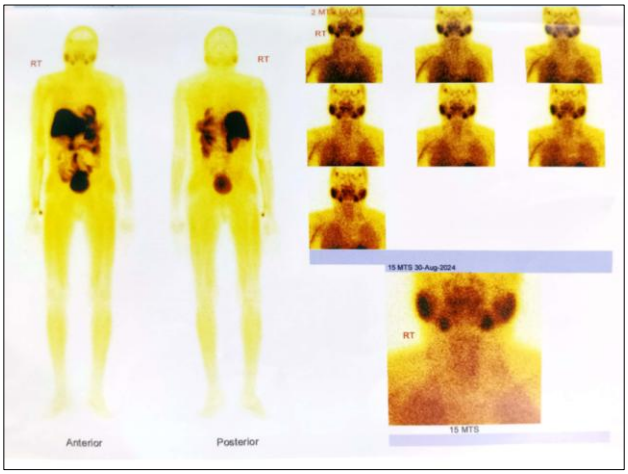


**Figure 5: Tc-99m sestamibi whole body scintigraphy showing no evidence of mibi avid lesions in the neck or anywhere else in the body.**

## DISCUSSION

Parathyroid carcinoma (PC) is a rare endocrine malignancy, accounting for less than 1% of all primary hyperparathyroidism cases and an even smaller fraction of head and neck tumors.[3,4] While the majority of PCs are functional and present with symptoms related to hypercalcemia, non-functional variants are extremely rare and diagnostically challenging. These tumors may mimic thyroid nodules in clinical presentation and radiologic imaging, particularly in the absence of biochemical abnormalities. Nonfunctional PC is diagnosed in most patients in the sixth or seventh decade (age range 27–71 years). The tumor size is variable but ranges between 5 and 11 cm, and in almost half of the cases, loco regional spread into thyroid, cervical soft tissues and superior mediastinum is usually present at diagnosis.[5] Here we described about a patient with thyroid nodule who underwent routine investigations, whose ultrasound and cytology showed features of colloid nodule to rule out neoplasm. But the histology revealed medullary carcinoma or undifferentiated carcinoma of thyroid, and we resorted for immunohistochemistry which confirmed the diagnosis of parathyroid carcinoma. Since the patient did not have any features of hypercalcemia, we came to the diagnosis of non-functioning parathyroid carcinoma. As the patients usually come with complaints of swelling of the neck mostly associated with pressure symptoms it is possible to miss the diagnosis of parathyroid carcinoma as well as non-functioning parathyroid carcinoma. As evidenced in our patient, nonfunctioning PTCs may be asymptomatic or symptomatic with a neck mass being an isolated sign during physical examination.[6] This case underscores the limitations of FNAC in distinguishing parathyroid from thyroid pathology. Morphologic overlap, especially in cystic or colloid-rich lesions, can lead to misclassification. As in other reported cases, FNAC in our patient failed to detect parathyroid origin, demonstrating the need for high clinical suspicion in cystic nodules without functional thyroid or parathyroid abnormalities. Histologically, the tumor cells resembled parathyroid chief cells, and showed an island-like or sheet-like arrangement, the former showing cystic degeneration and containing hemorrhagic fluid in the extracellular space like classic features of neuroendocrine differentiation, initially raising suspicion of medullary thyroid carcinoma.[7] However, immunohistochemistry was crucial in arriving at the correct diagnosis. Strong positivity for GATA3 and PTH, and absence of calcitonin, TTF1, and MCEA, conclusively indicated a parathyroid origin.[8] GATA3 is a transcription factor expressed in parathyroid tissue, and its combination with PTH staining improves diagnostic specificity, especially in non-functional tumors. It is also important to highlight that the right parathyroid glands could not be identified intraoperatively, possibly due to tumor infiltration. A parathyroid scan reveals the presence of ectopic and abnormal parathyroid tissue in the anterior neck and elsewhere. The presence of a sestamibi-avid lesion outside of the anterior neck raises the suspicion for a metastatic process. So postoperatively we did Tc-99m sestamibi scintigraphy which showed no evidence of residual or metastatic disease in neck or elsewhere in the body.[9] The absence of hypercalcemia despite histological aggressiveness (evidenced by capsular and vascular invasion) aligns with previously published literature on non-functional PC.[10,11] This subtype may represent a distinct biological entity with retained intracellular hormone synthesis but absent secretion, or production of an inactive PTH molecule. Currently, there are no established TNM staging guidelines for non-functional parathyroid carcinoma due to its rarity.[12] Nonetheless, en bloc surgical excision with clear margins remains the cornerstone of treatment. Adjuvant therapy is generally not indicated unless there is evidence of recurrence or metastasis. Benefits of adjuvant therapy (chemotherapy and radiotherapy) are unclear.[13]

In this case, the patient underwent total thyroidectomy and remains disease-free at six months postoperatively, emphasizing the importance of complete resection and

regular follow-up. However, given the aggressive potential and propensity for local recurrence, long-term surveillance is essential.

## CONCLUSION

Non-functional parathyroid carcinoma is an exceedingly rare and diagnostically elusive entity, particularly when it clinically and radiologically mimics a thyroid nodule. This case emphasizes the importance of maintaining a differential diagnosis of parathyroid carcinoma in cystic or suspicious thyroid lesions with inconclusive FNAC, even in the absence of hyperparathyroid symptoms or hypercalcemia. Immunohistochemistry plays a pivotal role in confirming the diagnosis, especially with markers such as GATA3 and PTH.

Early surgical intervention with complete excision offers the best prognosis. Given the risk of recurrence and lack of standardized staging, long-term follow-up with serial imaging and biochemical monitoring remains essential. Increased awareness among clinicians and pathologists can aid in early recognition and improve outcomes in such rare presentations.

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