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*Case Report*

# Metastatic brain lesion as the initial presentation of follicular thyroid carcinoma

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## ABSTRACT

**Background:** Metastatic brain lesions, of thyroid origin, are rare manifestations of differentiated thyroid cancer, with papillary thyroid carcinoma being the most common subtype. Considering the rarity of metastatic follicular thyroid carcinoma to the brain, the present article outlines its clinical presentation, neuroradiological findings, pathological features, and outcome.

**Case Description:** A 52-year-old female presented with a 6-month history of progressive and holocephalic headache. Examination revealed a tracheal deviation to the left side due to an enlarged goiter. Brain CT scan showed a right occipital, slightly hyperdense lesion associated with a 0.4 cm midline shift to the left side. Brain MRI demonstrated a right occipital, avidly-enhancing, extra-axial lesion with disproportionate and extensive vasogenic edema**.** As the lesion was solitary, the patient underwent craniotomy and tumor resection. Histopathological examination revealed a tumor consistent of small follicles, composed of uniform round nuclei without papillary thyroid carcinoma nuclear features, suggestive of metastatic follicular thyroid carcinoma to the brain. Postoperatively, the patient was neurologically intact. She was discharged in a stable condition with laboratory/radiological investigations and follow-up at neurosurgery, endocrine, radiotherapy, and thyroid surgery clinics.

**Conclusion:** Follicular thyroid carcinoma may rarely metastasize to the central nervous system. A high index of suspicion is required to identify patients with thyroid cancer who initially present with neurological manifestations. Complete surgical resection of the metastatic brain lesion is safe, feasible and is associated with a prolonged overall survival.

**Keywords:** Central nervous system, Metastasis, Thyroid cancer

## INTRODUCTION

The incidence of thyroid cancer has increased significantly in the past few decades.[12] Thyroid cancer can be broadly divided into differentiated and undifferentiated (Anaplastic) types.[1] Each type is further sub-classified into several subtypes.[1] Differentiated thyroid cancer includes: papillary thyroid cancer, follicular thyroid cancer, and Hurthle-cell thyroid cancer.[1]

Metastatic brain lesions, of thyroid origin, are rare manifestations of differentiated thyroid cancer, with papillary thyroid cancer being the most common subtype.[6] Follicular thyroid cancer metastasis to the brain is rare.[6] The low prevalence of thyroid cancer has been reported in few studies in the literature.[5,6]

A multi-center study, comprised ten hospitals, in Maryland and Washington, DC, revealed a prevalence of 0.3% of brain metastasis from differentiated thyroid cancer.[6] Another study was conducted in a tertiary center, reported a 1.4% prevalence of brain metastasis from differentiated thyroid cancer.[5]

Considering the rarity of metastatic follicular thyroid carcinoma to the brain, the present article outlines its clinical presentation, neuroradiological findings, pathological features, and outcome. A review of the pertinent literature is additionally discussed.

## CASE DESCRIPTION

### Clinical presentation

A 52-year-old female, known to have hypertension, diabetes mellitus, and dyslipidemia, presented to the emergency department complaining of a 6-month history of progressive headache. The headache was continuous, band-like, holocephalic, and more intense in the morning. It was associated with dizziness and vomiting for 3 days before presentation. The patient reported no history of heat/cold intolerance, palpitations, dysphagia, dysphonia, or symptoms suggestive of hyper/hypometabolism.

### Physical examination

On initial assessment, the patient was hypertensive, alert, and oriented to person, place, and time with a Glasgow Coma Scale of 15/15. The muscle power and sensation were intact. The cranial nerves and cerebellar examination were unremarkable. The visual fields were intact to confrontation with full extraocular muscles movement. The patient had a left-sided tracheal deviation due to an enlarged goiter.

### Radiological imaging

Brain computed tomography (CT) scan showed a right occipital homogenously hyperdense lesion causing 0.4 cm midline shift to the left side [Figures 1a and b]. Brain magnetic resonance image (MRI) demonstrated a right occipital avidly-enhancing, extra-axial, hyperintense lesion with disproportionate and extensive vasogenic edema [Figures 1c-e]. The abdomen and pelvis CT scan revealed no intra-abdominal malignancy or metastasis.

### Surgical intervention

As the lesion was solitary and exerting midline shift, the patient underwent craniotomy and tumor resection. Intraoperatively, the incision was made in the parieto-occipital area. The boarders of the tumor were precisely localized using the neuronavigation system. The tumor was dural-based. Considering the well-encapsulated nature of the tumor, it was excised in one piece [Figure 2]. Intraoperative frozen section of the lesion was suggestive of metastasis, mostly of thyroid-origin. The patient tolerated the surgery well with no complications.

### Histopathological features

The histopathological sections of the lesion were composed of thyroid follicles with round, uniform nuclei and occasional grooves [Figure 3]. Immunohistochemically, the tumor was positive for PAX8, thyroglobulin, and CK19. These findings were in favor of metastatic follicular thyroid carcinoma.

The subsequent thyroid fine-needle aspiration (FNA) from the left lobe showed microfollicles and groups of crowded thyroid follicular epithelial cells with nuclear overlapping. No intranuclear grooves or inclusions were seen. Colloid was scant.

As such, these findings were diagnostic for a follicular neoplasm (Bethesda system, Category IV). Subsequently, the patient underwent total thyroidectomy. Examination of the thyroid gland revealed a 6 cm widely-invasive follicular carcinoma in the left lobe (pT3a, pN0).

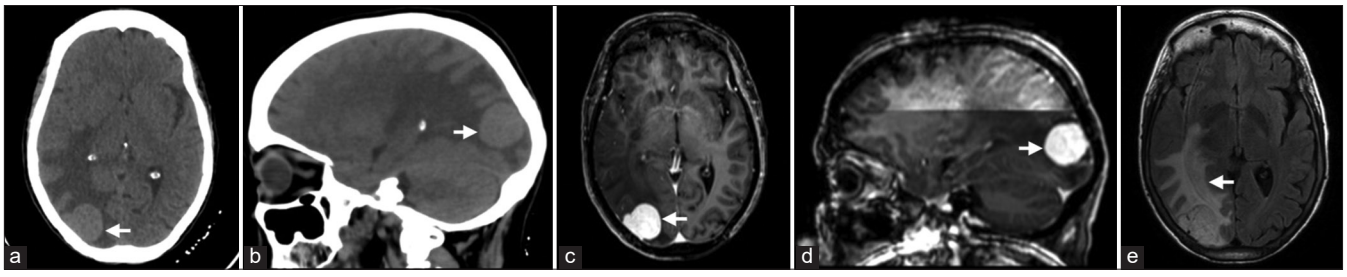


**Figure 1:** (a and b) Axial and sagittal brain CT without contrast. (c and d) Axial and sagittal T1-weighted brain MRI post gadolinium administration. (e) T2/Fluid-attenuated inversion recovery brain MRI. (a and b) The images demonstrate a right occipital, extra-axial, well-defined, round hyperdense lesion, measuring 3 × 2.4 × 2.6 cm in transverse, anteroposterior, and craniocaudal dimensions (Arrow). (c and d) The lesion is dural-based and demonstrates homogeneous enhancement (Arrow) post gadolinium administration. There is no intratumoral hemorrhage. (e) There is extensive and disproportionate vasogenic edema (Arrow) involving the right occipital, temporal, and parietal lobes, causing a midline shift of 4 mm.

### Outcome and follow-up

Postoperative brain CT scan demonstrated a complete resection of the lesion [Figure 4]. During hospital stay, the patient did not develop any neurological deficits. One month following surgical resection of the metastatic brain lesion, stereotactic radiosurgery was performed on the surgical cavity to eliminate possible residual cells.

A complete oncological work-up was performed to investigate the thyroid and lung masses.

The chest CT showed multiple bilateral metastatic pulmonary nodules. The findings of the positron emission tomography (PET) scan confirmed the pre-existing suspicious thyroid cancer, with metaplastic cervical lymph nodes, and bilateral pulmonary nodules. No evidence of hypermetabolic brain lesions was noted postoperatively. The iodine whole-body scan showed an iodine-refractory residual thyroid tissue on the right thyroid bed.

The patient was discharged in a stable condition with laboratory/radiological investigations and follow-up at neurosurgery, endocrine, radiotherapy, and thyroid surgery clinics.

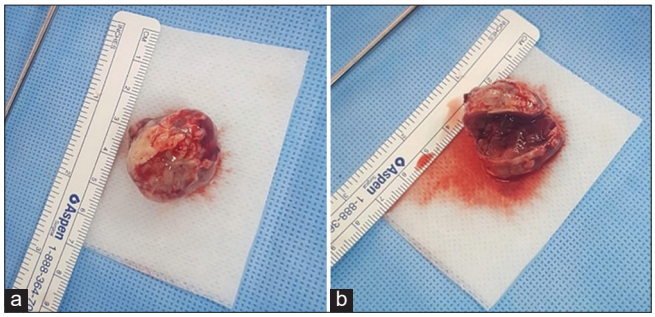

**Figure 2:** (a and b) Gross pathological image of the tumor following *en bloc* resection. (a) The tumor measures approximately 2.5 × 2 × 1 cm. (b) The pathological tissue is soft, reddish, and rich in vascular blood supply.

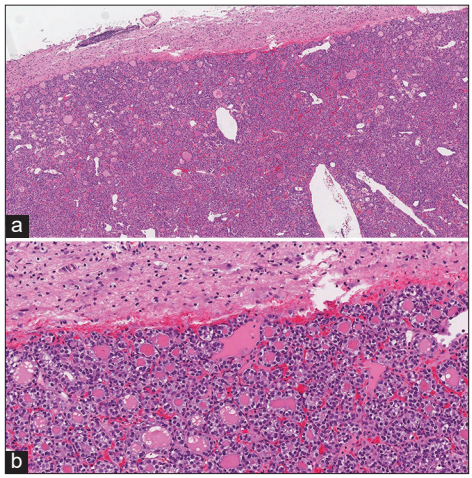

**Figure 3:** (a and b) Hematoxylin and eosin-stained section of the metastatic brain lesion. (a) The tumor is well-demarcated from the adjacent gliotic brain parenchyma. (b) The tumor is consistent of small follicles which are composed of uniform, round nuclei without papillary thyroid carcinoma nuclear features.

## DISCUSSION

In the present case, the diagnosis of follicular thyroid carcinoma was rendered following histopathological investigations of the occipital brain lesion and FNA of the thyroid gland. The neuroradiological imaging, including brain CT, magnetic resonance imaging, and PET, identified a solitary central nervous system lesion. The present article discusses one of the unusual sites of distant metastasis of follicular thyroid carcinoma to the brain.[5,6]

In such cases, the clinical presentation ranges from headache to focal neurological deficits, and in some cases, the diagnosis was made incidentally.[5,6] The patient in the present case developed metastatic follicular thyroid carcinoma in the occipital lobe, after presenting with headache. The clinical manifestations were related to the patient's space-occupying lesion. The frozen section and permanent histopathology confirmed the diagnosis.

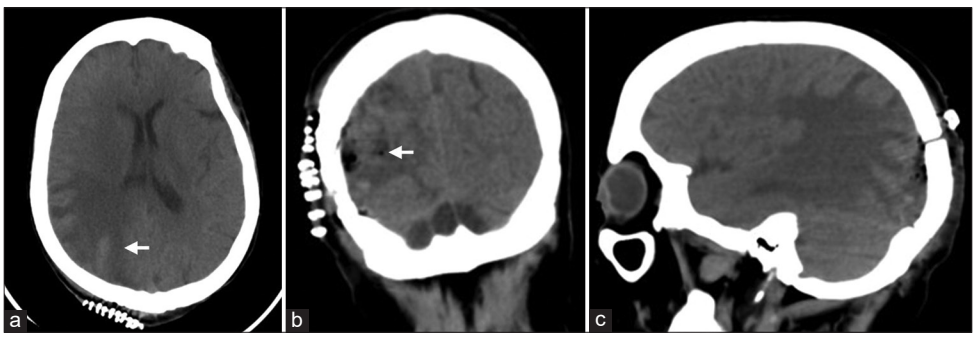

**Figure 4:** (a-c) Postoperative axial, coronal, and sagittal brain CT without contrast. The images demonstrate multiple, tiny air foci within the surgical cavity, along with minimal fluid and hemorrhagic hyperdensities, representing expected postoperative changes (Arrow). There is improvement of the left-sided midline shift from 4 mm to 2 mm and partial resolution of the right parieto-occipital vasogenic edema.

Metastatic follicular thyroid carcinoma may exhibit various radiological features, including but not limited to; highly-enhancing masses with cystic formation, ring enhancement, varying degrees of edema, and hemorrhage.[5,8] In the present case, brain MRI showed an avidly-enhancing, extra-axial lesion with disproportionate, extensive vasogenic edema.

Considering the rarity of metastatic follicular thyroid carcinoma to the brain, the optimal management can be challenging.[5,6] Surgical resection, stereotactic radiosurgery, whole brain radiation, and radioiodine therapy are the available treatment options for such lesions.[4,7,11] Surgical resection is associated with a longer survival in comparison to non-surgical treatment modalities.[7,11] Surgical resection is the superior option, attaining the longest survival period; which can vary depending on different prognostic factors including age, The Eastern Cooperative Oncology Group Scale of Performance Status, number of brain metastasis, and the presence of other distant metastasis.[4,5,7] Radioiodine therapy is considered the most inferior treatment option due to the limited radioiodine uptake by the metastatic lesions, that is, radioactive iodine-refractory lesions.[7]

Untreated, such metastatic thyroid carcinomas tend to be associated with a short-survival rate.[5] The reported survival rate ranges from 1 to 2 years following pathological-confirmed diagnosis.[5] The survival period differs depending on: the type of intervention (Surgery vs. Radiotherapy vs. Radioactive Iodine Therapy), number of brain metastasis, location of the brain metastasis, distant metastasis to other organs, and patient's comorbidities.[1,5,7]

Cacho-Diaz *et al.* investigated approximately 400 patients with thyroid cancer.[2] Of which, a total of seven patients were diagnosed with brain metastasis of thyroid origin.[2] Of the seven patients, follicular thyroid carcinoma was identified in one patient.[2] The authors concluded that brain metastasis due to thyroid carcinoma is a rare phenomenon that carries a dismal prognosis.[2] Of note, the authors confirmed that surgical resection, followed by whole-brain radiation, significantly improves the overall survival (Mean survival: 46 months vs. 5.6 months).[2,3,9,10]

## CONCLUSION

Follicular thyroid carcinoma may rarely metastasize to the central nervous system. A high index of suspicion is required to identify patients with thyroid cancer who initially present with neurological manifestations. Complete surgical resection of the metastatic brain lesion is safe, feasible and is associated with a prolonged overall survival.

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**Authors' Contributions**

Abdulaziz Alanazi: Conceptualization, Writing – Original Draft, Writing – Review and Editing. Ali Alkhaibary: Conceptualization, Project administration, Investigation – Radiological and Pathological Images, Writing – Original Draft, Writing – Review and Editing. Sami Khairy: Conceptualization, Supervision, Writing – Review and Editing. Fahd AlSufiani: Investigations – Pathological Images, Writing – Review and Edi ting. Ali H. Alassiri: Investigations – Pathological Images, Writing – Review and Editing. Ahmed Aloraidi: Supervision, Writing – Review and Editing. Ahmed Alkhani: Conceptualization, Supervision, Surgical Intervention, Writing – Review and Editing. All authors have critically reviewed and approved the final version of the manuscript.

**Declaration of patient consent**

Institutional Review Board (IRB) permission obtained for the study.

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**Conflicts of interest**

There are no conflicts of interest.

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