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Rare Case of Cavernous Sinus Infiltration and Sphenoiditis from Breast Metastasis to the Brain

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Abstract

Background: *Triple-negative breast cancer is an aggressive subtype of breast cancer characterized by the absence of estrogen, progesterone and HER2/neu expression. It is especially known for its poor prognosis, particularly when diagnosed late in its course. Despite advances in treatment over the years, Triple negative breast cancer frequently presents with rapid progression and a high propensity for metastasis. While brain metastasis from breast cancer are relatively common, metastasis to the carvenous and sphenoid sinus is exceedingly rare. This case also highlights the unique feature of isolated abducent nerve palsy and the rapid progressive nature of the disease despite neo-adjuvant and adjuvant chemotherapy as well as radical mastectomy. The report emphasizes the importance of a multidisciplinary approach in managing complex and evolving clinical scenarios in advanced breast cancer.*

Case Presentation: *We present a unique case of a 45-year-old Nigerian woman with advanced triple-negative invasive Ductal Carcinoma (T4c, N2, Mx), initially presenting as a large, globular mass in the right breast. Despite neo- adjuvant chemotherapy, the disease showed progressive features, leading to a decision for modified mastectomy. Subsequent to the mastectomy, the patient experienced an unexpected metastatic spread to the brain, specifically the cavernous sinus, resulting in isolated abducens palsy.*

Conclusion: *This case outlines the rarity of the metastasis, the progression, the diagnostic challenges and the multidisciplinary approach taken to address the evolving clinical complexities. This case report contributes valuable insights into the rare metastatic patterns of triple negative breast cancer and underscores the critical role of a collaborative treatment strategy.*

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Introduction

Breast cancer, entrenched as a multifaceted challenge in the field of oncology, exhibits a range of clinical presentations and trajectories that defy easy prediction. Among the myriad complications that hinder treatment progress, prognosis, and contribute to mortality, metastases stand out as a pervasive and formidable factor. Notably, brain metastases are particularly prevalent in cases where breast cancer presents late and proves resistant to conventional treatments, as exemplified in the case under discussion.

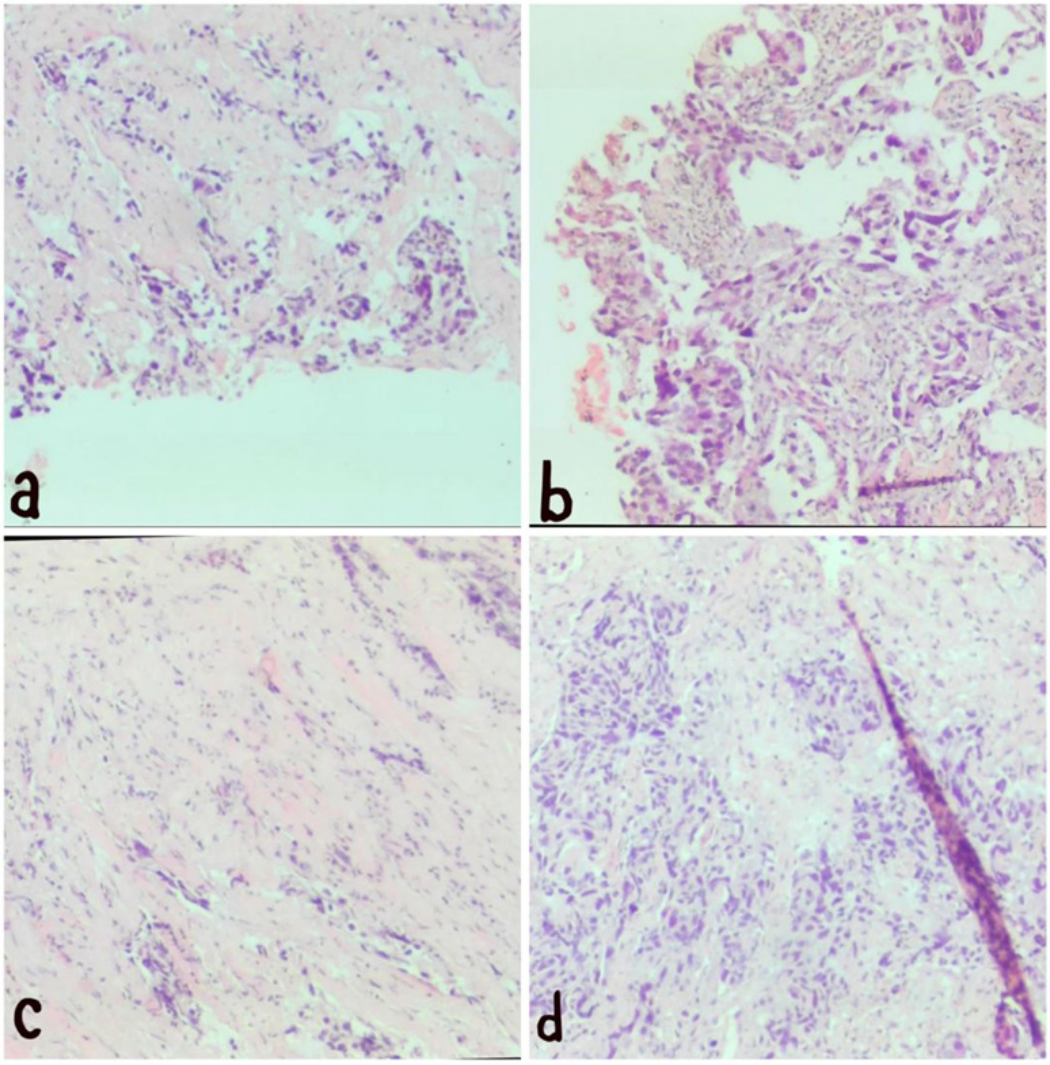
In the realm of metastatic breast cancer, a unique and seldom-encountered manifestation involves the infiltration of the cavernous sinus-a rare presentation occurring in less than 1% of the global population [1,2]. This atypical involvement of the cavernous sinus often becomes suspect due to distinctive clinical features, such as abducens nerve palsy and diplopia [1]. The suspicion triggers the necessity for a diagnostic tool of great significance: Brain MRI. The confirmation of cavernous sinus involvement through imaging not only adds to the diagnostic intricacies but also underscores the rarity and clinical impact of this manifestation.

Understanding the intricacies of metastatic breast cancer involving the cavernous sinus is paramount, given its scarcity and the unique challenges it poses. This report navigates through the complexities of such cases, shedding light on the diagnostic journey, the clinical nuances, and the broader implications for managing metastatic breast cancer, especially when it extends to rare and neuroanatomically sensitive sites.

Case Presentation

45-year-old Nigerian woman initially presented with a 7-month history of a large, globular right breast mass, (T4c, N2, Mx) stage III. Histology done following a core needle biopsy made an impression of a right- sided, triple-negative, Invasive Ductal Carcinoma [Figure 1].

Figure 1: a) and b) Breast Histology at 10x magnification showing atypical ductal epithelial cells, diffusely invading the desmoplastic fibro collagenous stroma in sheets, cords and trabeculae. There is a poor attempt at gland formation and mitoses are not brisk. c) and d) Breast Histology: Slide at 40x magnification shows large ductal epithelial cells into the desmoplastic tissue and fat. All slides show breast tissue with Invasive Ductal Carcinoma



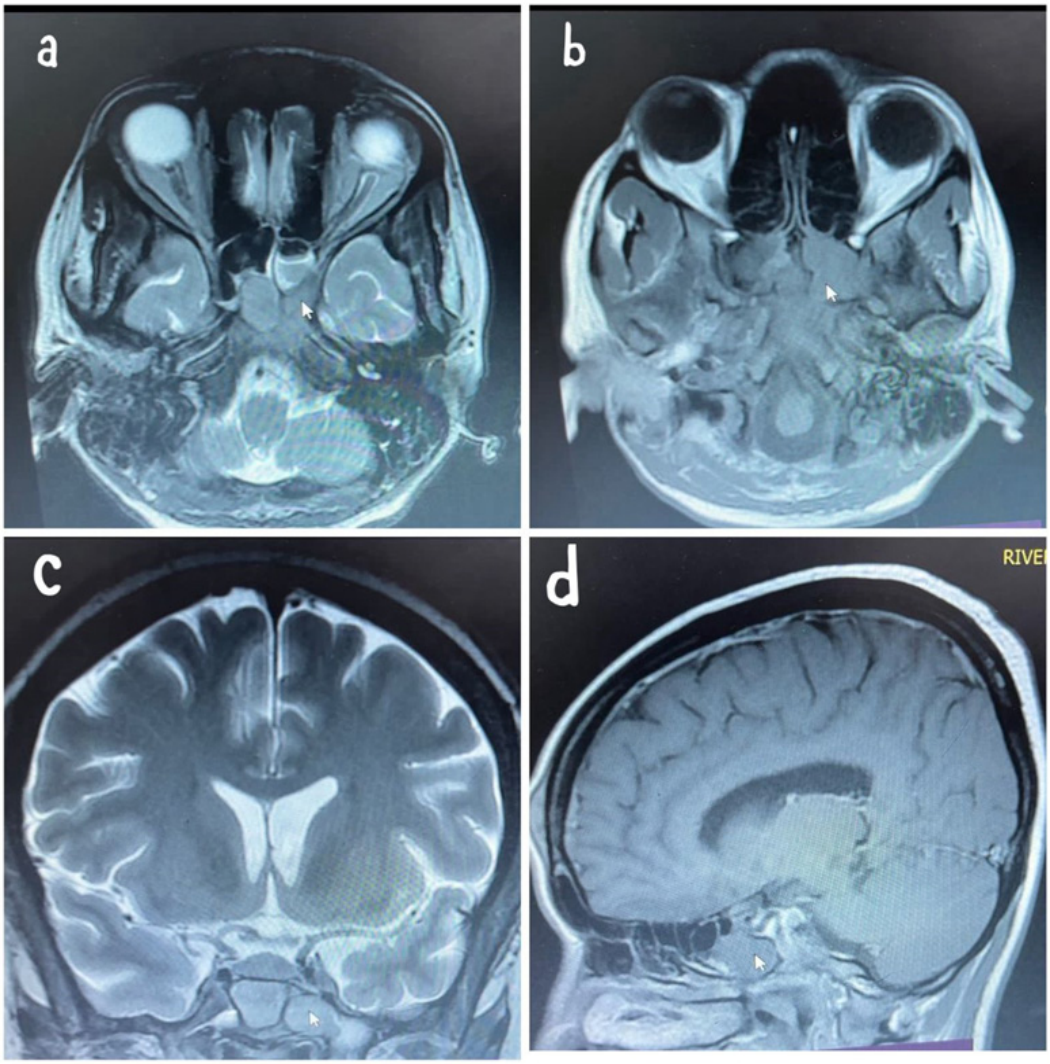
She was placed on neo-adjuvant chemotherapy with 5-fluorouracil, cyclophosphamide, and doxorubicin which was later changed to Docetaxel and Carboplatin in sequence, but with no significant improvement/ regression, rather was seen to have progressive disease, hence, the decision for an operative intervention [modified radical mastectomy] was made to debulk the tumour.

Post Mastectomy, adjuvant chemotherapy was commenced. The patient was placed on Capecitebine while awaiting Radiotherapy and this was given in a scheduled dose pattern.

Unexpectedly, two hard masses were observed at the frontal bone by the fourth-week post-operation with increasing bone pain, gait distortion and Right-hand lymphedema by the eighth week, a slight deviation of the left eye was observed with an associated complaint of diplopia. On further ophthalmic examination, Strabismus of the left eye was noted. An MRI of the brain and an X-ray of the skull were requested which indicated sphenoiditis and cavernous and sphenoid sinus sinus infiltration by a tumor due to brain metastases [Figure 2] causing isolated abducent nerve palsy, however, the X-ray showed no significant findings aside from the two frontal bony masses. An Ophthalmology review confirmed Abducent nerve palsy due to secondary infiltration/ brain metastasis. She also developed intermittent headaches though a fundoscopy done showed no features suggestive of raised intracranial pressure. A neurosurgical consult was also sought.

Figure 2: Brain MRI: a) Shows Axial T2 view of the brain with irregular contrast enhanced lesion invading the left carvenous sinus and sphenoid sinus with lesion surrounding the left internal carotid artery as indicated

by the arrow. b) Image shows Axial T1 view of the brain with lesion in the Carvenous sinus. c) Image shows a coronal T2 view with lesion at the carvenous sinus indicated by the arrow. d) Image in Saggital T1 view with tumor in the cavernous and sphenoid sinus extending to the clivus of the sphenoid bone and also a single Frontal cranial bone mass.



MRI: Magnetic Resonance Imaging

Due to her continued deterioration, she was commenced on Vinorelbine (one cycle given) and also placed on oral methotrexate and Cyclophosphamide [taken for two weeks but later discontinued However there was no obvious clinical improvement

Despite interventions, including Vinorelbine, oral methotrexate, Cyclophosphamide, IV etoposide, and Oral Temozolamide, clinical improvement was elusive. Notably, upon initiation of IV Etoposide and oral Temozolamide due to the brain metastasis, the cranial bone masses showed positive response, with a subsequent decrease, improvement in diplopia, and enhanced overall condition. However, persistent right leg pain, strabismus and righthand lymphedema remains.

Discussion

Breast cancer remains a major pathology fraught with uncertainties in the management outcomes. Most complications from Breast cancers arise due to metastasis to other organs [liver, lung, bone, and brain]. The incidence of Brain metastasis from breast cancer is relatively frequent. About 10-15% of patients with stage IV breast cancer have brain metastasis and about 5% of patients with breast cancer will have brain metastasis over five years, However, metastasis to the brain is distinct from intracranial metastasis whichmay or may

not involve the brain parenchyma [1]. Metastasis to other intracranial structures accounts for a less than significant percentage of intracranial metastasis. Metastasis to the cavernous sinus from the breast is a relatively rare and unusual finding, occurring in less than 1% of patients with cancerwith associated sphenoiditis [2]. This may be due to direct bony infiltration, by metastatic cells, of the sphenoid bone or may be an indication of brain metastasis. Involvement of the abducent nerve is commonly the initial presentation due to its anatomic path through the cavernous sinus [3,4]. Hence, the most common initial presentation is diplopia as also observed by our patient. Systemic symptoms such as Fever may be indicative of an infective cause [which was absent in this patient] and the absence of proptosis, photophobia nor any other signs of cranial nerve III, IV, and V involvement ruled out Cavernous Sinus Thrombosis of which there was an associated, though small, risk.

The management of suspected intracranial metastasis is multidisciplinary and should typically be of the Oncological MDT. It requires a high index of suspicion especially with the sudden onset of eye signs particularly of the abducent nerve. Confirmation is via imaging modalities - Brain CT, MRI, and plain X-rays. The presence of headache, vomiting, anisocoria, seizures, decreased consciousness, and papilledema determines the presence of raised intracranial pressure which was absent in this patient.

Brain metastases have a poor prognostic outcome despite multimodal treatment courses, therefore most treatment courses are considered palliative [3]. The treatment plan for brain metastases requires a multidisciplinary and aggressive approach which includes ophthalmological intervention, Surgical resection, whole-brain Radiotherapy and Systemic therapy involving chemotherapy, immunotherapy, and targeted therapy. Although Radiotherapy and Surgical intervention produces better outcome and survival rates, we tend to settle for a more systemic approach involving mostly chemotherapy as seen in this patient, due to environmental factors such as financial constraints because of the rising poverty and unemployment rate in this region which was the same situation with this patient.

Although, there have been several Chemotherapy drugs that have shown promising results such as Temozolomide, Etoposide, and Carboplatin studies have shown no significant improvement in the survival rates of patients with brain metastases [5-8].

Conclusions

The cavernous sinus is a large venous channel located between the sphenoid bone and the temporal bone allowing major veins to drain blood from your brain and face, it also contains cranial nerves III, IV, V1, and VI. Metastases to this region, though rare, are commonly from the breast and lung.

Metastases in this region usually signal a poor treatment outcome. Radiotherapy and Surgical approaches tend to be the better treatment of choice to improve patient quality of life, however, in certain scenarios, chemotherapy tends to be used as the primary modality of choice due to the benefit-cost ratio, risk-benefit ratio and unavailability of the necessary radio-therapeutic equipment. Systemic management, although limited in the complete eradication of the malignancy, is necessary for palliation as it provides some extent of relief of symptoms.

Declarations

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Not applicable.

Consent for Publication

Not applicable

Availability of Supporting Data

Not applicable.

Competing Interests

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Authors Contribution

Bukola Adu Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

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Adu G. Bukola and Kue S. David equally contributed to the work and should be considered co-first authors.

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