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Transosseous Teratoma of The Frontal and Parietal Bones: A Rare Case Report and Surgical Management

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Abstract

BACKGROUND Teratomas are rare congenital tumors arising from pluripotent germ cells and contain tissues derived from all three germ layers: ectoderm, mesoderm, and endoderm. Intracranial teratomas are uncommon, accounting for less than 0.5% of all central nervous system tumors, and typically occur in midline structures such as the pineal or suprasellar regions. Primary involvement of cranial bones with transosseous extension is exceptionally rare. These lesions may lead to progressive cranial deformity and local bone destruction. While isolated cases involving the petrosal bone have been reported, localization at the cranial vault is exceedingly uncommon. To our knowledge, this report describes the first case of a transosseous teratoma involving the frontal and parietal bones.

CASE PRESENTATION A 39-year-old male presented with persistent headache and vertigo, associated with a subcutaneous swelling at the bregma that progressively enlarged following a hair transplant procedure. Imaging revealed an osteolytic transosseous lesion involving both the external and internal cortical tables, with intraspongious extension and multiple hair follicles embedded within the mass. The patient underwent complete surgical excision, including resection of the outer cortical bone to delineate tumor margins and achieve total removal clearly. Histopathological examination confirmed the diagnosis of a mature teratoma. The postoperative course was uneventful, and the patient was discharged on the third postoperative day without neurological deficits.

DISCUSSION Transosseous teratomas of the cranial vault are extremely rare. Their pathogenesis is thought to involve aberrant migration of germ cells during embryogenesis, resulting in ectopic growth within bone. Differential diagnosis includes dermoid and epidermoid cysts, osteolytic skull tumors, and other germ cell neoplasms. Complete surgical excision remains the treatment of choice to prevent recurrence. Given the potential for malignant transformation, long-term clinical and radiological follow-up is recommended.

CONCLUSION: This case underscores the importance of early diagnosis and complete surgical resection in the management of transosseous cranial teratomas. Further reports are needed to better define optimal management strategies for these rare lesions.

KEY WORDS: transosseous teratoma, skull teratoma, osteolytic skull lesion, cranial teratoma, germ cell tumor

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INTRODUCTION

Teratomas are rare congenital tumors derived from pluripotent germ cells and contain tissues originating from all three germ layers: ectoderm, mesoderm, and endoderm. While intracranial teratomas are uncommon, comprising less than 0.5% of all central nervous system (CNS) tumors, their occurrence in the skull bones, particularly the frontal and parietal bones, is extremely rare[1]. These lesions can be classified as mature (benign), immature (potentially malignant), or malignant teratomas, depending on their histopathological composition[2].

Transosseous teratomas involve direct infiltration or primary growth within the cranial bones, leading to progressive cranial deformities, local bone destruction, and potential compression of adjacent brain structures[3]. Their clinical presentation varies depending on size and location, with symptoms including headache, focal neurological deficits, seizures, or increased intracranial pressure[4]. Imaging studies, particularly magnetic resonance imaging (MRI) and computed tomography (CT), play a crucial role in diagnosing these tumors, often revealing mixed cystic and solid components with calcifications[5].

Surgical resection remains the primary treatment, aiming for total excision while preserving neurological function. Due to the risk of recurrence and potential malignant transformation, long-term follow-up is essential[6]. This paper discusses the clinical presentation, diagnostic approach, and management strategies for transosseous teratomas of the frontal and parietal bones, based on current literature and reported cases.

CASE PRESENTATION

A 39-year-old patient was admitted for evaluation and specialized treatment due to persistent headache and vertigo that began approximately two months ago and did not respond to conservative management. Previous to the onset of the symptoms, the patient presented a subcutaneous swelling on the bregma point. The patient affirmed that he had it from birth, but it started to swell two months ago, after a hair transplant.

Brain MRI & CT scan were performed at another facility, which described an osteolytic craniodural process in the anterior third of the superior sagittal sinus region (Figure 1, Figure 2). Correlating the clinical examination with the paraclinical investigations, a neurosurgical indication was established. The patient and their family were thoroughly informed about the medical condition. The patient opted for surgical treatment.

Surgery was performed under general anesthesia with orotracheal intubation. An arcuate incision was made, circumscribing the lesion. The subcutaneous tissue was dissected, revealing a parafluid, yellowish, caseous collection, which was expressed, collected, and sent for bacteriological examination. (Figure 3, Figure 4). Extensive lavage was performed using normal saline, betadine, and hydrogen peroxide until the purulent collection was completely removed. An osteolytic lesion was identified at the level of the calvaria, causing osteolysis of the outer table, involving the bregma, the spongy bone, and, partially posteriorly, the inner table of the bone. Multiple hair follicles were observed within the lesion. A significantly greater transosseous intraspongious extension was noted compared to the osteolysis of the outer cortical bone. Consequently, a resection of the external cortical bone was performed to fully expose the intraspongious tumor margins, allowing for complete excision of the lesion. (Figure 5). A total

excision of the tumoral formation was performed (Figure 6, Figure 7), and the specimen was sent for histopathological examination. In the posterior part of the lesion, inner cortical bone was perforated by the tumor. After the removal of the tumor, the dura mater of the superior sagittal sinus was exposed (Figure 8). Meticulous hemostasis was achieved. The surgical wound was closed in anatomical layers, and a dressing was applied. On the second day a postoperative brain CT scan was performed, showing complete resection of the tumoral mass (Figure 9). The patient was discharged on the third day, in good general condition, without neurological deficit.

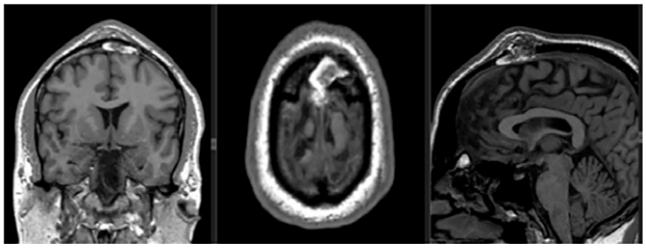

Figure 1. Preoperative MRI Scan (T1+ CS)

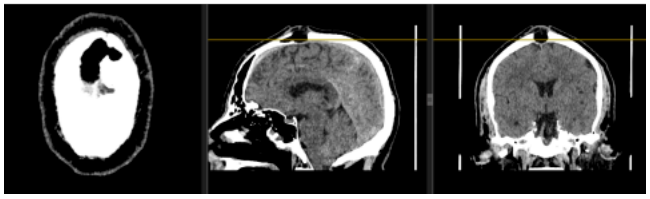

Figure 2. Osteolytic transosseous lesion

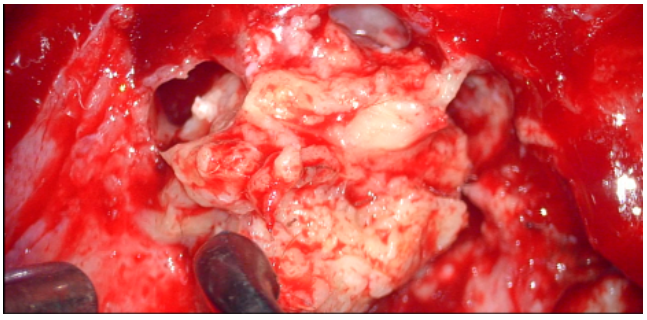

Figure 3. The aspect of the osteolytic mass, which contains hair follicles and the parafluid, yellowish, caseous collection.

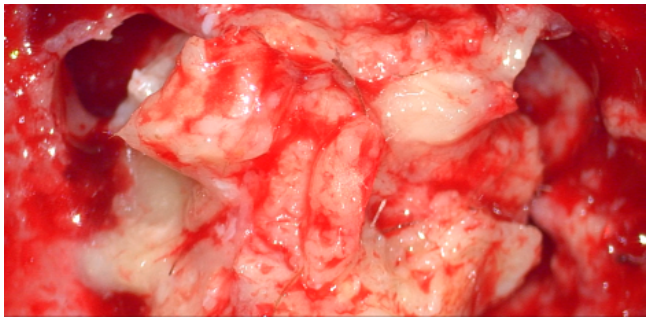

Figure 4. Detailed aspect of the teratoma. In the left superior corner is highlighted the transosseous intraspongious extension

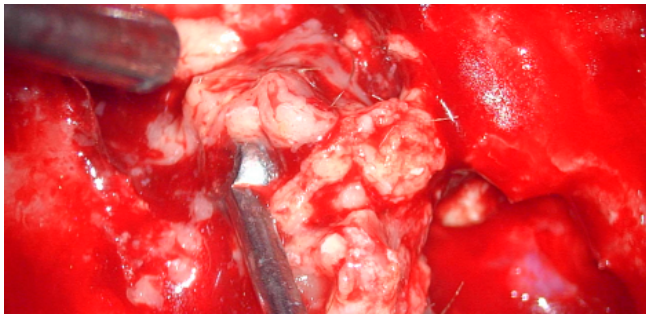

Figure 5. Removal of the tumor

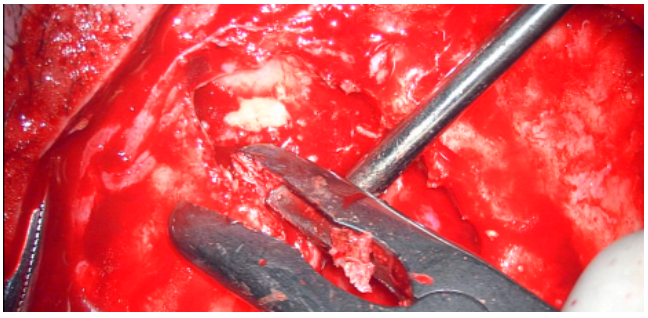

Figure 6. Resection of the external cortical bone to identify the margins of the spongy destruction

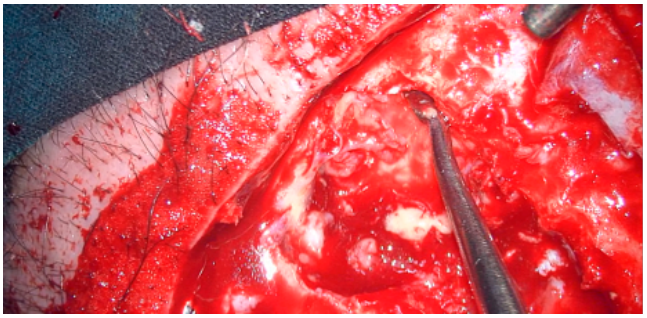

Figure. Identification of the intraspongious bony margins and curettage of the bone to ensure complete excision

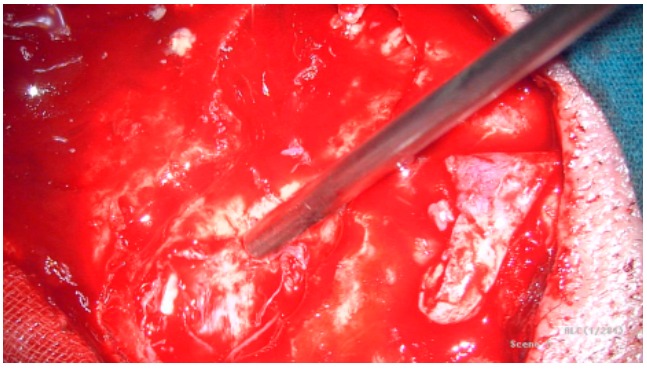

Figure 7. Posterior part of the lesion with the osteolytic effect of the inner cortical bone. Dura mater of the superior sagittal sinus highlighted with the aspirator

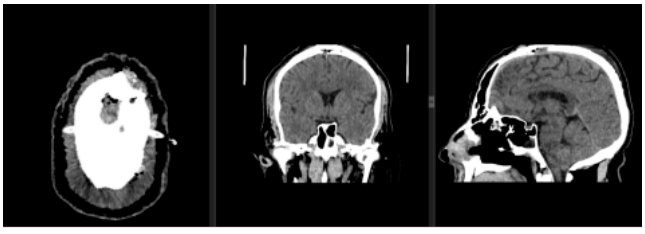

Figure 8. Postoperative CT scan.

DISCUSSION

Transosseous teratomas of the cranial bones are exceedingly rare, with few cases documented in the literature[7]. The most common location was reported in the petrosal bone[8,9].

Their origin is hypothesized to stem from aberrant migration of germ cells during embryogenesis, leading to ectopic growth within the cranial vault[10]. Unlike intracranial teratomas, which commonly occur in midline structures such as the pineal or suprasellar regions, transosseous teratomas may present with progressive cranial deformities and focal neurological symptoms due to local mass effect[11].

Radiological findings are essential for preoperative planning. CT scans often demonstrate a heterogeneous mass with calcifications. At the same time, MRI provides superior visualization of cystic and solid tumor components[12]. Differential diagnoses include dermoid and epidermoid cysts, osteolytic skull lesions, and other germ cell tumors[13]. Histopathological analysis confirms the diagnosis, with mature teratomas containing well-differentiated tissue elements and immature teratomas exhibiting primitive neuroectodermal structures, which correlate with a higher risk of recurrence and malignancy[14].

Surgical excision is the cornerstone of treatment. A similar therapeutic principle has also been emphasized in the management of other rare cranial lesions, including a recent case report of a retroauricular extracranial AVM, in which complete surgical resection was regarded as the definitive treatment [15]. Complete resection minimizes the risk of recurrence, though challenges arise due to the tumor's infiltration into the skull and adjacent dura [16]. In cases of incomplete resection or immature teratomas, adjuvant therapies such as chemotherapy or radiotherapy may be considered. Long-term follow-up with serial imaging is recommended to monitor for potential recurrence or malignant transformation.

Advances in neurosurgical techniques, including intraoperative navigation and endoscopic-assisted approaches, have improved surgical outcomes, reducing morbidity and improving tumor resection rates. However, due to the rarity of transosseous teratomas, further research and case studies are needed to establish standardized treatment protocols.

CONCLUSION

This is the first case of transosseous teratoma reported in the literature. Transosseous teratomas of the frontal and parietal bones are rare entities that pose significant diagnostic and surgical challenges. Their clinical presentation varies, often leading to delayed diagnosis. Imaging studies, particularly MRI and CT, are crucial in identifying characteristic features and differentiating them from other skull lesions. Surgical resection remains the primary treatment modality, with total excision being the goal to prevent recurrence. Given the potential for malignant transformation in immature teratomas, long-term follow-up is essential. Future research is necessary to understand their pathogenesis better and optimize management strategies.

Ethics Statement and Conflict of Interest Disclosures

Financial support and sponsorship: All authors have declared that no financial support was received from any organization for the submitted work.

Ethics Consideration: The authors declare that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national laws. Written informed consent was provided by the patient participant in this study.

Conflict of interest: No known conflict of interest correlated with this publication.

Availability of data and materials: The data used and/or analyzed throughout this study are available from the corresponding authors upon reasonable request.

Competing interests: The authors declared that they have no competing interests.

The use of generative AI and AI-assisted technologies: The authors did not use in this article generative AI and AI-assisted technologies.

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