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CASE REPORT

Epithelioid Sarcoma of the Skull: A Differential Diagnostic Approach

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Abstract

Epithelioid sarcoma of the scalp as a primary site of origin is a rare occurrence a and has a broad differential diagnosis. The radiological features for each of the differential diagnoses are similar but sometimes can be very unique. The present case study provides relevance and significance in considering the possibility of primary epithelioid sarcoma while examining benign lumps with no skin ulceration or pain. The case report focuses on imaging features of epithelioid sarcoma while employing to describe the lesion using multimodality imaging in addition to Computer Tomography, early intervention in the form of complete excision of these tumours through surgery and primary repair when required. Adequate adjuvant treatment is needed following the excision, with the goal of preventing recurrences.

Keywords: Epithelioid Sarcoma, Skull imaging, Osteomyelitis.

Introduction

Epithelioid sarcoma (ES) of the scalp as a primary site of origin is a rare occurrence and hence possess a challenge in early diagnosis and timely intervention. Only 12 cases of primary epithelioid sarcoma (PES) originating from the scalp have been reported to date, including the present study.[1-10] In addition, there is no recommended treatment modality specific for PES of the scalp, the reason being that there have been very few cases and limited study is available on the role of chemotherapy.[11] Thus, even in the recent time, wide surgical resection and adjuvant radiotherapy remain the mainstay of treatment.[12-16]

Case Presentation

The present study depicts a case of a 17-years old female clinically presented with a history of scalp lump, mainly in the right frontal region, which interfered with her during praying. Over a period of six months, the subject noticed incidentally a small, slowly growing, painless bulge under the scalp. A neurological examination did not reveal any deficits apart from mild neurological symptoms. Still, a physical examination found a right frontal large firm, painless palpable lump, which had no mobility over the underlying bone and the skin covering the lesion could not be retracted.

Computed Tomography (CT) scan before surgery showed an expansile lytic and destructive bony lesion of the right frontal bone (involving both tables of the skull vault) associated with the large hypo dense intradiploic soft tissue mass lesion with slightly extra-axial extension and minimal indenting the right frontal lobe. It showed a wide transition zone, periosteal reaction and soft tissue component (Figures *1A*, *1B*).

Bone windows in the CT scan show irregular destruction and erosion of the calvarium's inner and outer table (Figures *2A-2C*). A 3D reconstruction of the skull bone revealed the irregular destruction (Figure *3*).The differential diagnosis of the epithelioid sarcomas are very broad (Table *1*) and the radiological features for each of the differential are similar but sometimes can be very unique (Figures *4A-4K*).

The tumour was resected within the normal bone followed by the excision of the markedly thickened dura. A duroplasty with galeal flap and a reconstruction of the skull bone with a titanium mesh was performed.

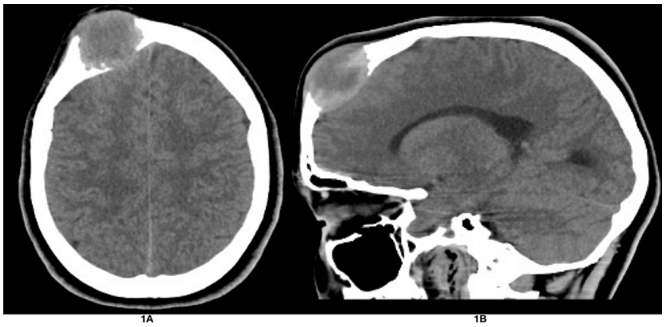

Figure 1: Head CT scan soft tissue window Axial (1A) and Sagittal (1B) demonstrating a well-circumscribed intradiploic exophytic hypodense soft tissue mass lesion with surrounding bone destruction of the right frontal bone (involving both tables of the skull vault) minimally indenting the right frontal lobe. No underlying brain edema.

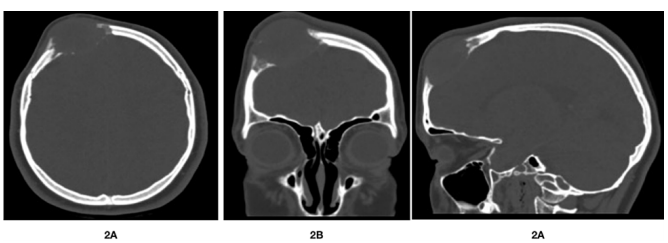

Figure 2: Head CT scan bone window images reveals an irregular destruction and erosion of both tables of the vault.

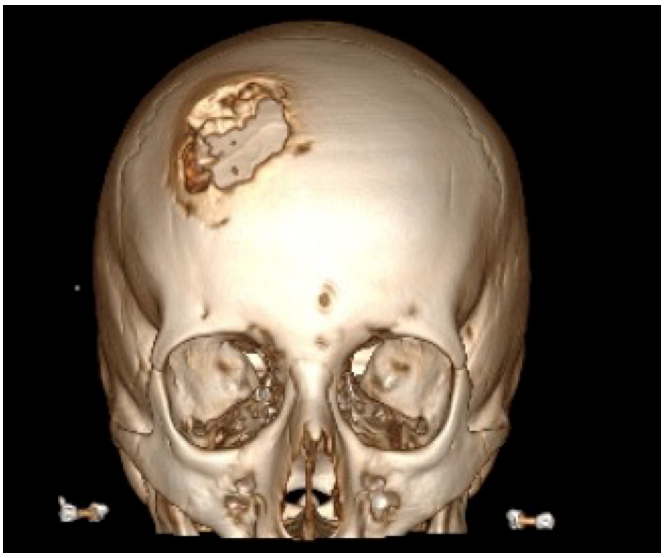

Figure 3: Volume rendering (VR) head CT reconstruction reveals an irregular frontal skull defect or bone resorption at the site of the soft tissue mass lesion.

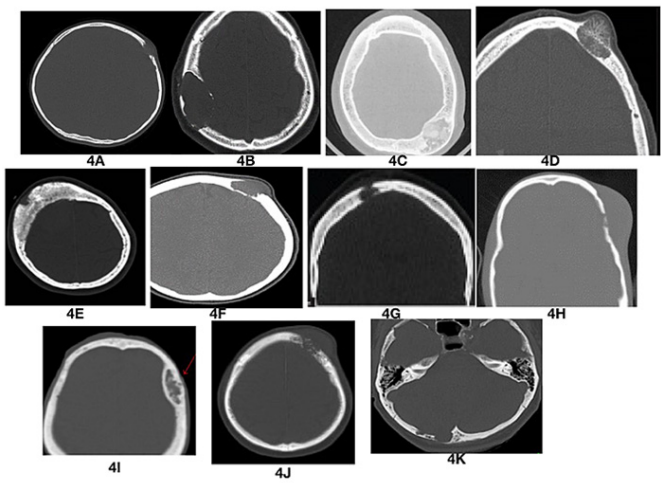

Figure 4: The Radiological features of various differential diagnosis for Epitheloid Sarcoma of the Skull including : Eosinophilic granuloma (4A), Epidermoid/Dermoid (4B), Fibrous Dysplasia (4C), Hemangioma (4D), Hemangiopericytoma (4E), Giant Cell Tumour (4F), Osteomyelitis (4G), Calverial Tuberculosis (4H), Brown Tumour (4I), Metastasis (4J) & Normal Variant (4K)

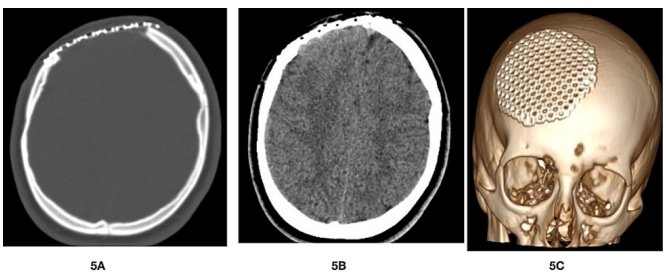

Figure 5: CT scan Bone window (5A), Brain Window (5B) and Volume Rendering (5C) post-surgical excision of the right frontal skull tumour with titanium mesh placement.

Table 1: Differential Diagnosis for the Epitheloid Sarcomas with various characteristics

Name	Definition	Incidence	Site	Radiological features
Eosinophilic granuloma / Langerhans cell histiocytosis (LCH)	Rare multisystem disease with a wide and heterogeneous clinical spectrum and variable extent of involvement.	More common in the pediatric population, with peak incidence 1-3 years of age.	Multiorgan involvement depends on its subtypes 70% of cases affect bone	Osteolytic bony defect involving the outer and inner table of the skull vault with bevelled bony edges and mixed density extradural lesion (Figure 4A).
Epidermoid / Dermoid	Developmental anomaly accumulation of normally dividing cells (epidermal cells).	0.5% of all primary intracranial tumours and are slightly more common in females	Intra cranial Rare extra cranial	A well-circumscribed extra-axial hypodense area surrounded by a hyperdense rim. Erosion of both tables of the vault (Figure 4B).
Fibrous dysplasia	Non-neoplastic tumour like congenital process, defect in osteoblastic differentiation and maturation, with the replacement of normal bone with large fibrous stroma and islands of immature woven bone.	Children and young adults, (between 3 and 15 years). In polyostotic form, patients usually present by 10 years old. No recognized gender predilection	Can affect any bone and can be divided into four subtypes 8 (although there is some overlap): monostotic polyostotic craniofacial cherubism	Smooth well-defined border homogeneous ground glass matrix with endosteal scalloping and cortical thinning due to the expansive nature of the lesion (Figure 4C).
Hemangioma	Benign slow-growing vascular lesions (osseous venous low flow vascular malformations).	Female-male ratio 3:1 4th-5th decades of life.	The calvaria is the second most prevalent site for intraosseous hemangiomas (frontal & parietal bones)	A lytic expansile lesion with a sclerotic rim (usually with a honeycomb or sunburst like appearance). Erosions of both internal & external plates. Simulate an aggressive pseudo hair on end periosteal reaction (Figure 4D).
Hemangio-pericytoma	Angioblastic sub-type meningioma, arise from smooth muscle perivascular pericytes of dural capillaries (pericytes of Zimmerman) Most recent studies suggest arising from fibroblast (solitary fibrous tumours of the dura).	Less than 1% of all intracranial tumours. Younger adults (30-50 years). Slight male predilection (M: F 1.4:1).	Rare tumours of the meninges (aggressive versions of solitary fibrous tumours of the dura) frequently extend through the skull vault. Another common location is the posterior occipital region..	Usually supratentorial masses, often lobulated in contour. Highly vascular and have a tendency to erode adjacent bone. No hyperostosis. No calcifications (Figure 4E).

Giant cell tumour	The benign bone tumour typically arises from the metaphysis of long bones, extending into the epiphysis adjacent to the joint surface. Resultant hyperproliferation of osteoclasts (known as osteoclastomas).	Typically seen in early adulthood between the ages of 20 and 50, with a peak incidence between 20 and 30. Mild female predilection, especially when located in the spine. However, malignant transformation is far more common in men (Male: Female of 3:1).	It can affect any bone, the most common sites around the knee: distal femur and proximal tibia distal radius sacrum vertebral body: Multiple locations: ≈1% (association with Paget disease).	A narrow zone of transition, a broader zone of transition is seen in more aggressive giant cell tumours. The overlying cortex is thinned, expanded, or deficient periosteal reaction. No sclerosis No soft tissue component. No matrix calcification/mineralization (Figure 4F).
Osteomyelitis	hematogenous spread, although direct extension from trauma and/or ulcers. Inflammation of bone, typically bacterial, may be acute or chronic.	At any age, without specific risk factors, it is particularly common between the ages of 2-12 years and is more common in males (Male: Female of 3:1).	The location of osteomyelitis within a bone varies with age, on account of changes in vascularization of different parts of the bone.	The earliest changes are seen in adjacent soft tissues +/- muscle outlines with swelling and loss or Focal bony lysis or cortical loss endosteal scalloping. There is regional osteopenia with periosteal reaction/ thickening (periostitis). There is a blurring of normal fat planes. In chronic/ untreated cases sequestrum, and/or cloaca may be seen (Figure 4G).
Calvarial Tuberculosis	Hematogenous spread or direct inoculation to the diploe has been proposed to be a cause, especially in patients from low socioeconomic status	No gender predilections but 80% of the cases are younger than 20 years.	Parietal and frontal bones are usually involved due to the high cancellous portion.	Osteolytic destruction lesion of both the inner and outer table crossing the suture. Skin involvement was evident in the form of a discharging sinus (Figure 4H).
Brown tumour	Known as osteitis fibrosa cystica . It is focal giant cell lesions of the bone caused by primary hyperparathyroidism. It represents a reparative cellular process, rather than a neoplastic process. Most common in chronic renal disease.		Common in skull and the pelvic girdle.	Well-defined, a purely expansible lytic lacelike lesion that provokes little reactive bone. The cortex may be thinned and expanded with sclerotic border and amorphous calcifications or unformed deposit of calcium and without periosteal reaction (Figure 4I).

Metastasis	Most common malignant bone tumours in adults (after the 5th decade of life). Metastases are usually secondary to breast, lung, prostate, kidney and thyroid cancer in adults and to neuroblastoma or sarcomas in children.	Depends on primary tumour.	Any bone can be affected.	Expansile osteolytic, sclerotic or mixed pattern depending on the primary tumour. If multiple osteolytic lesions with a soft tissue component extending into adjacent tissues If solitary thyroid or renal neoplasm should be suspected (Figure 4J).
Normal Variant	Skull "pseudolesions" include arachnoid granulations, prominent venous lakes and surgical burr holes.		Depends at surgical or anatomical site.	Sharply marginated, hypoattenuating structures in close association with a dural venous sinus or surgical site (Figure 4K).

Results indicated that it closely resembled an epidermoid cyst, however, histopathological diagnosis of epithelioid sarcoma was established. The tumour cells were diffusely and strongly positive for cytokeratin (CK) AE1/AE3 and negative for epithelial membrane antigen (EMA), P63, S100, CD34, Transducin-like enhancer protein-1 (TLE-1), smooth muscle actin (SMA) and myogenin. BAF47 (INI-1) immunostain was retained in tumour cell nuclei.

External beam radiation therapy (EBRT) and chemotherapy were advised as adjuvant treatment, but the patient and the family refused any further treatment. The patient eventually received adjuvant external beam radiation two weeks later. The patient did not have any adverse event during or immediately following the treatment.

After the intervention, the patient's neurological status remained stable with intact motor strength and sensation. Long term follow-up was advised to further assess the post-treatment status. A post excision CT of the right frontal skull tumour showed no measurable residual disease and no extra/subdural collections or pneumocephalus with the intact titanium mesh (Figure *5A-5C*).A bone scan done after the excision showed a sizable photopenic area within the right side of the frontal bone, which correlated with tumour resection (postsurgical changes). There was no evidence of osteoblastic metastases.

Discussion

The skull is one of the common sites of metastasis (22%) after lungs (51%) and the regional lymph nodes (34%). ES has a predilection for the male gender and the male to female ratio is 1.2:1. However, among the cases reported for PES of the scalp, including the present study, the ratio was found to be 1.4:1.[1-10] The age range at the time of diagnosis is also wide and varies from 1 to 80 years.[1] Most of the reported cases of PES are focused on histopathological morphology of epithelioid tumour cells and in this report, the focus is towards the radiological features to reiterate the importance of considering PES as a probable diagnosis from a list of differentials that present with an unknown calvarial lesion.

The most recent case report of PES is similar to this report in that it has focused on imaging

features while it employed to describe the lesions using multimodality imaging in addition to CT modality. Compared to the case presented by Zhang et al.[1],, in which the calvarium had no erosion and the dura was intact, this report illustrates a case where both the tables of the vault showed erosion, with a wide zone of transition, periosteal reaction and thickening of the dura and the soft tissue component. While the case reported by Zhang et al.[1]was a fast-growing tumour that grew within a month and became fungating and painful while this case reports a slowly growing tumour over a period of six months with no pain involved.[1]

Despite the rarity of the tumour, PES is considered as a possibility because on CT scan, it appeared as a well-circumscribed extracerebral hypodense area surrounded by a hyperdense rim with erosion of both tables of the vault. As an unknown calvarial lesion, it is differentiated against 11 types of lesions, namely, eosinophilic granuloma/ histiocytosis, epidermoid/ dermoid cyst, fibrous dysplasia, hemangioma, hemangiopericytoma, giant cell tumour, osteomyelitis, calvarial tuberculosis, brown tumour, metastases, and normal variant.[17-20]

Eight of the reported cases, including the case reported in this study, were local at the time of diagnosis while two had metastasised to the lymph nodes and one was a recurrence.[2-10] Unlike two other cases which had hemorrhage and three cases that had ulcers, the case reported in this study had neither and it was painless at the time of diagnosis.[2,5,7,8]

The aggressive nature of ES warrants radical tumour resection and lymphadenectomy (in case of lymph node involvemen)t and is often used in combination with radiation therapy (perioperative or postoperative) despite limited data available to support its usage and further research in the field is required.[11]

After the successful diagnosis of PES of the scalp (within six months of its appearance), the next challenge was surgical intervention and repair of the deformed skull. Upon diagnosis, ES must undergo maximal safe total excision followed by adjuvant radiotherapy to reduce the risk of local recurrence.[14-16] Adjuvant radiation therapy is effective in local control but has no effect on overall survival.

The present case report demonstrates the possibility of reconstruction following complete excision of the scalp tumour. A duroplasty with a galeal flap was performed and the skull bone reconstruction was successfully done with a titanium mesh. The patient's neurologic functioning remained stable and the motor strength and sensation were intact after the surgery. The surgery was followed by EBRT and another dose was planned for two weeks later. There is a mixed pattern of treatment employed in the other eleven cases of PES, wherein, some had sufficed to radical tumour resection, while others combined it with radiation therapy.[1-10]

The study evidently provides relevance and significance of considering the possibility of primary ES while examining benign lumps with no skin ulceration or pain. The CT scan of all such cases must be examined and differentiated while keeping in mind the chance of ES of the skull to ensure early detection and correct diagnosis. In addition, the early and aggressive intervention of complete tumour resection, radiotherapy, and repair of the damaged bone may contribute to maintain the stability of the patient's neurological function.

Conclusion

As PES of the scalp is quite rare, additional information about cell morphology could add valuable information to assist in distinguishing ES from other tumours. The study does not include histological features. Moreover, MRI was not employed as an additional modality besides CT scan to strengthen the diagnosis in the context of radiological imaging. The above mentioned aspects can be some of the limitations of this case report. The study recommends early intervention in the form of complete excision of these tumours through surgery and primary repair when required. Adequate adjuvant treatment is needed following the excision, with the goal of preventing recurrences.

References

1. Zhang Y, Mirpuri TM, Ho CL: Primary Epithelioid Sarcoma Manifesting as a Fungating Scalp Mass-Imaging Features and Treatment

Options. A Case Report and Literature Review. J Rad Case Rep. 2021; 15:1-9.

2. Zhang XW, Deng YJ, Zhou L, Deng H. Epithelioid sarcoma of the scalp: a case report and literature review. Int J Clin Exp Pathol. 2019 Oct 1;12(10):3908-3914.
3. Kim YS, Kwak HS, Chung GH, Kim YN, Hwang S: Epithelioid sarcoma arising from the temporal space: A case report. Medicine. 2018; 97(38).
4. Gurwale S, Gore C, Kaur S, Deshpande A. Primary epithelioid sarcoma of scalp. Asian J Onco. 2017;03(01):071.
5. Tocco I, Bassetto F, Vindigni V. Primary epithelioid sarcoma of the scalp complicated by humoral hypercalcemia of malignancy. Eplasty. 2012;12:ic18. Epub 2012 Dec 10.
6. Hanna S, Kaste S, Jenkins J, et al.: Epithelioid sarcoma: clinical, MR imaging and pathologic findings. Skeletal radiology. 2002; 31(7):400-412.
7. Suwantemee C: Primary epithelioid sarcoma of the scalp. Plast Reconstr Surg. 1999; 104(3) :785-788.
8. Skoog L, Pereira ST, Tani E: Fine-needle aspiration cytology and immunocytochemistry of soft-tissue tumours and osteo/ chondrosarcomas of the head and neck. Diagn Cytopathol. 1999; 20:131-136.
9. Pappo A et.al: Epithelioid sarcoma in children. J Pediatr Surg Case Rep. 1996; 31(12):1663-1665.
10. Kodet R, Smelhaus V, Newton WA, Hamoudi AB, et al: Epithelioid sarcoma in childhood: an immunohistochemical, electron microscopic, and clinicopathologic study of 11 cases under 15 years of age and review of the literature. Pediatr path. 1994; 14:433-451.
11. Wolf PS, Flum DR, Tanas MR, et al: Epithelioid sarcoma: the University of Washington experience. Am. J. Surg. 2008; 196:407- 412.
12. Steinberg BD, Gelberman RH, Mankin HJ, et al: Epithelioid sarcoma in the upper extremity. J Bone Jt. Surg. 1992; 74(1):28-35.
13. Evans HL, Baer SC: Epithelioid sarcoma: a clinicopathologic and prognostic study of 26 cases.. Semin Diagn Pathol. 1993 Nov; 10(4):286-291.
14. de Visscher SA, van Ginkel RJ, Wobbes T, et al: Epithelioid sarcoma: still an only surgically curable disease. Cancer. 2006; 107(3):606-612.
15. Shimm DS, Suit HD: Radiation therapy of epithelioid sarcoma. Cancer. 1983; 52:1022-1025.
16. Livi L, Shah N, Paiar F,et al: Treatment of epithelioid sarcoma at the Royal Marsden Hospital. Sarcoma. 2003; 7(3-4):149-152.
17. Gaillard F. Eosinophilic Granuloma - Skull | Radiology Case | Radiopaedia.org [Internet]. Accessed: 2022 Feb 19: https://radiopaedia.org/cases/eosinophilic-granuloma-skull.
18. Gaivas S, Rotariu D, Dumitrescu GF, et aI: Intradiploic epidermoid cyst of the skull Intradiploic epidermoid cyst of the skull. Case report. Romanian Neurosurgery. 2011; 18:2.
19. Pattison J. Fibrous dysplasia of the skull [Internet]. Eurorad. 2001 [cited 2022Nov16].
20. Armah HB, Parwani AV. Epithelioid sarcoma. Arch Pathol Lab Med. 2009;133(5):814-9.