Case Report

A case of cavernous skull hemangioma of the frontal bone: Imaging features and diagnostic importance

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ABSTRACT

Skull hemangiomas are rare, benign vascular tumors that account for <1% of all osseous neoplasms. They are typically slow-growing lesions arising from the diploic space of the calvarial bones, most frequently involving the frontal and parietal regions. We present the case of a 40-year-old woman with a painless, gradually enlarging swelling over the right frontal region for 7 years. Computed tomography of the skull revealed a well-circumscribed, expansile, lytic lesion in the diploic space of the right frontal bone, showing thickened trabeculae radiating from a central point, producing a characteristic "sunburst" appearance. The lesion demonstrated homogeneous post-contrast enhancement without evidence of cortical destruction or intracranial extension. Surgical excision was performed for cosmetic reasons, and histopathological examination confirmed the diagnosis of cavernous skull hemangioma. The post-operative course was uneventful, and follow-up imaging revealed no recurrence. Recognition of the distinctive imaging features of skull hemangiomas is essential for differentiating them from aggressive skull lesions and guiding appropriate management.

Key words: Calvarial cavernous hemangioma, Case report, Skull hemangioma, Vascular tumors

Calvarial cavernous hemangiomas are extremely uncommon, benign, slow-growing vascular tumors that arise from the diploic space of the skull vault and account for only approximately 0.2% of all bone tumors [1]. They are more common in women and usually present in the 4th and 5th decades of life. The diploic space is the spongy (cancellous) component of the skull located between the inner and outer cortical tables and contains marrow, trabecular bone, and venous channels [1,2]. Although usually asymptomatic, they can present as a painless, slow-growing bony swelling over the forehead, causing symptoms such as headache and other neurological manifestations, depending on the size and extent of involvement [2,3]. Hence, it is extremely important to differentiate it from other lesions involving the cranium to avoid unnecessary intervention, as these lesions may be managed conservatively unless symptomatic or associated with cosmetic deformity [2,3].

We describe the case of a 40-year-old woman who presented with gradually increasing forehead swelling, emphasizing the diagnostic importance of recognizing the characteristic imaging features of this condition.

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CASE PRESENTATION

A 40-year-old woman presented with a gradually enlarging swelling over the right frontal region for 7 years (Fig. 1). The swelling was painless and slow-growing, with no associated headaches, visual disturbances, or neurological symptoms. The patient had no history of trauma, prior surgery, or systemic illness.

General physical examination was unremarkable, and vital signs were within normal limits. On clinical examination, a firm, non-tender, immobile bony swelling measuring approximately 4 × 3 cm was palpated over the right frontal bone. The overlying skin was normal without erythema or warmth, and no bruit was detected on auscultation. Neurological examination was unremarkable, and there were no focal neurological deficits. The routine hematological and biochemical parameters were within normal limits.

Non-contrast computed tomography (CT) of the skull demonstrated a well-circumscribed, expansile, lytic

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lesion involving the diploic space of the right frontal bone (Figs. 2 and 3). The lesion exhibited coarse trabeculae radiating from a central point, producing a characteristic "sunburst" appearance. Both the inner and outer tables were thinned but preserved, with mild indentation of the underlying right frontal lobe. No periosteal reaction or associated soft-tissue component was observed. On contrast-enhanced CT, the lesion showed intense, homogeneous enhancement consistent with its vascular nature, and no evidence of intracranial or extracranial extension was observed.

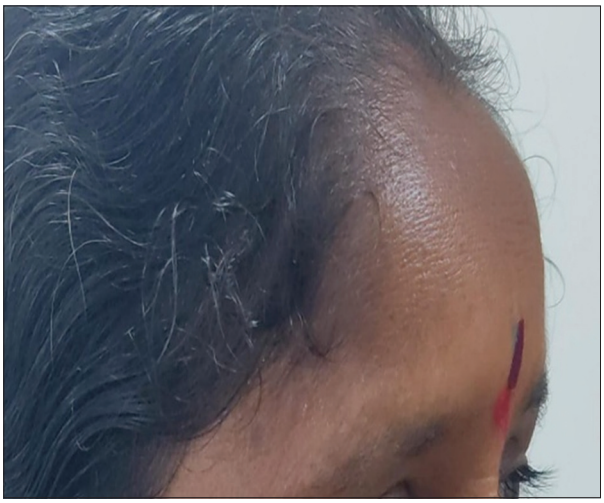

Figure 1: Smooth, well-defined, non-tender bony swelling over the frontal region

Given the progressive increase in size and cosmetic concerns, surgical excision was performed. Under general anaesthesia, a frontal scalp incision was made over the lesion, and the underlying calvarial bone was exposed. A well-defined intradiploic lesion was identified, and en bloc excision was carried out with removal of the involved segment of the frontal bone. The lesion appeared well-encapsulated, reddish-brown, and highly vascular, and was confined to the diploic space. Care was taken to preserve the underlying intact dura, which showed no evidence of invasion. The resulting bony defect was reconstructed with cranioplasty.

Histopathological examination revealed multiple dilated, thin-walled vascular channels lined by flattened endothelial cells within a bony stroma, confirming the diagnosis of cavernous hemangioma. The post-operative course was uneventful. At the 6-month follow-up, the patient remained asymptomatic, with no evidence of recurrence on follow-up CT imaging.

DISCUSSION

Calvarial cavernous hemangiomas emphasize the importance of anatomical location and recognition of characteristic imaging patterns, alongside clinical presentation, in the diagnosis of a disease [1]. Despite their benign nature, these lesions frequently enter the differential diagnosis of more aggressive skull

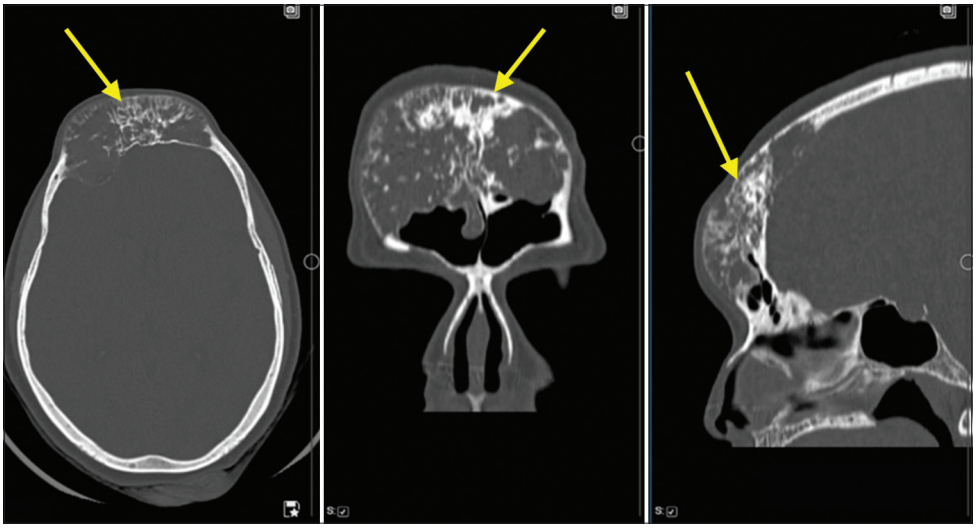

Figure 2: Non-contrast computed tomography (bone-window) images showing a well-circumscribed expansile lytic lesion in the right frontal bone diploic space with coarse trabeculae radiating from a central focus, creating a "sunburst" pattern

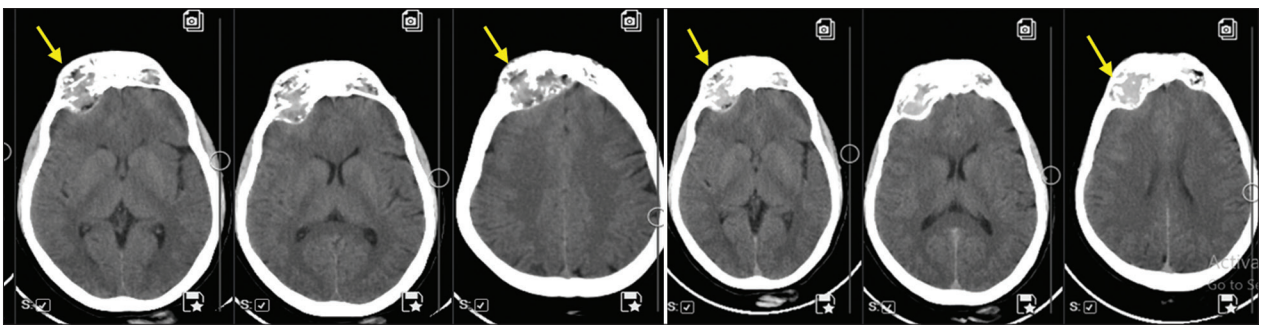

Figure 3: Axial non-contrast computed tomography (soft-tissue window) images show a well-defined expansile diploic lesion in the right frontal bone causing mild indentation of the frontal lobe without cortical breach or soft-tissue extension

pathologies and tumors, making radiological pattern recognition extremely important for their appropriate management [2,3]. Intraosseous cavernous hemangiomas most frequently involve the vertebral column, with calvarial involvement being uncommon, accounting for approximately 0.2% of all bone tumors and up to 10% of benign skull tumors [4]. They arise from the venous channels of the diploic space (cancellous component between the outer and inner tables of the skull bone, containing marrow, trabeculae, and venous channels) and are characterized as benign, slow-growing, and cause bone remodeling rather than infiltration. They are more common in women and arise in the fourth and fifth decades of life [4]. Skull hemangiomas are reportedly more common in the calvarium than in the skull base and more frequently involve the frontal and parietal bones [3,4].

Although their pathogenesis is unclear, it has been proposed that they can arise from the abnormal differentiation of blood vessels, causing gradual expansion of vascular spaces, which eventually pushes the surrounding trabeculae and grows in size, causing thinning of the outer and inner tables of the skull, and the characteristic sunburst pattern on imaging [5]. There are also theories to suggest that a previous history of trauma causes the subsequent release of angiogenic factors, causing abnormal angiogenesis, although not proven, as a possible trigger for the development of this condition [5].

Calvarial cavernous hemangiomas are usually asymptomatic and slow-growing [6]. However, when symptomatic, they can become palpable and cause headache, pain/tenderness, visual deficits, eyelid edema, and neurological manifestations, such as cranial nerve involvement (diplopia, facial nerve palsy, vertigo), ptosis, seizures, and ataxia, depending on the size and extent of involvement [6,7]. As discussed earlier, imaging is the key to the diagnosis of this condition. CT typically reveals a well-defined expansile lytic lesion within the diploic space and thinning of the outer and/or inner cortical table [5]. The characteristic sunburst/spoke wheel appearance (on the tangential view) and the classic honeycomb pattern on imaging (more marked on the axial view) result from radially oriented trabeculae originating from a common center (as they are gradually pushed outwards) around the lesion and have been reported many times in the literature, and play an important role in diagnosis [5,7-9]. Although magnetic resonance imaging (MRI) may further characterize the soft tissue components and exclude dural or intracranial extension, it was not performed in this case.

The differential diagnosis of calvarial skull lesions is broad and includes fibrous dysplasia, Langerhans cell histiocytosis, intraosseous meningioma, metastasis, dermoid and epidermoid cysts, aneurysmal bone cysts, Paget's disease, and osteoma [9-11]. Unlike aggressive lesions, calvarial cavernous hemangiomas demonstrate slow growth, well-circumscribed margins, trabecular preservation, and the absence of cortical destruction or periosteal reaction. Accurate differentiation from these entities is essential, as there have been reports of it demonstrating a dural tail sign, similar to primary calvarial meningioma, dural penetration (though rare), and meningeal infiltration [8-10]. The management of this condition largely depends on the symptoms and presence of indications such as pain, cosmetic deformity, neurological manifestations, and mass effect on the brain, and most commonly includes en bloc resection followed by cranioplasty, which allows complete removal and restoration of skull contour [1,10,11]. Other management options mentioned in the literature include preoperative angioembolization (to reduce bleeding), radiotherapy, and gamma-knife radiosurgery [1,4].

While calvarial cavernous hemangiomas are well described, this case is notable for its clear clinico-radiological correlation, prolonged indolent clinical course, and characteristic intradiploic imaging features visualized on axial, coronal, and sagittal images. The clinical, imaging, and histopathological findings were consistent with each other, supporting the diagnosis. This highlights the importance of recognizing the anatomical location and characteristic imaging patterns to accurately distinguish this lesion from other calvarial pathologies and to guide appropriate management.

However, this case is limited by the absence of advanced imaging modalities, such as MRI or angiographic evaluation, which may have provided additional characterization of lesion extent and adjacent soft tissue, although they were not essential for diagnosis or management in this case.

CONCLUSION

Skull hemangiomas are rare, benign vascular tumors that may present as slow-growing, painless bony swellings. Recognition of their characteristic radiological features is crucial to differentiate them from aggressive calvarial lesions, such as metastases or meningiomas. Accurate imaging diagnosis prevents unnecessary extensive intervention, as most cases have an excellent prognosis following complete excision or conservative management when asymptomatic.

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