Case Report

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Intracranial osteochondroma arising from the posterior clinoid process: a rare case report with diagnostic challenges and comprehensive literature review

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Introduction and importance: Intracranial osteochondroma is rare, presenting diagnostic challenges due to overlapping imaging findings with other pathologies. This case report highlights the significance of considering osteochondroma in calcified tumour differentials near bone.

Case presentation: A 34-year-old man with vision deterioration and headaches had an MRI revealing a suprasellar lesion. Intraoperatively, a bony hard tumour was partially resected. Subsequent computed tomography (CT) confirmed a calcified mass contiguous with the posterior clinoid.

Clinical discussion: Reviewing 28 cases, skull base osteochondromas were common, with differential diagnoses including craniopharyngioma and meningioma. Surgical decision-making involved balancing complete resection for convexity and falx cases versus partial resection for skull base tumours due to proximity to critical structures.

Conclusion: Intracranial osteochondroma poses diagnostic challenges, especially near bone. Tailored surgical approaches are vital, with complete resection yielding good outcomes for convexity and falx cases. Close follow-up is crucial for monitoring recurrences and complications.

Keywords: Computed tomography, magnetic resonance imaging, osteochondroma, posterior clinoid, skull base

Introduction

Osteochondroma is the most common benign bone tumour that can develop from any bone with enchondral ossification[1]. Some consider it to be a developmental lesion rather than a true neoplasm that results from a herniated fragment of the growth plate[2]. Osteochondroma commonly originates within the long bones, comprising ~35% of benign and 8% of all bone tumours. Conversely, its manifestation within the intracranial region is comparatively rare, accounting for only 0.1–0.2% of all intracranial tumours[3]. Altogether 27 cases of intracranial osteochondroma have been reported in the literature[4–31]. Here, we report a case of osteochondroma arising from the posterior clinoid process. The case is discussed and the literature is reviewed. This case report has been reported in line with the SCARE Criteria[32].

HIGHLIGHTS

- This case report presents a rare occurrence of intracranial osteochondroma arising from the posterior clinoid process, highlighting the diagnostic challenges faced due to overlapping imaging findings with other pathologies.
- The 34-year-old patient with visual disturbance symptoms underwent partial tumour resection, revealing a bony hard lesion, and subsequent computed tomography imaging showed a calcified suprasellar mass with a unique cauliflower-like appearance.
- The comprehensive literature review highlights the rarity of intracranial osteochondroma, emphasizing the importance of considering this diagnosis in calcified tumours near bone and tailoring surgical approaches based on tumour location for optimal outcomes.

Case report

A 34-year-old male presented with a progressive decline in vision on both sides and intermittent headaches over 2 years. His medical and familial background revealed no noteworthy history. Ophthalmological assessment yielded normal results. Neurological examinations were unremarkable. MRI unveiled a heterogeneous suprasellar mass, predominantly exhibiting low signal intensity across all sequences. Notably, T1-weighted images [Fig. 1A] depicted high signal intensities within the lesion. T2-weighted images

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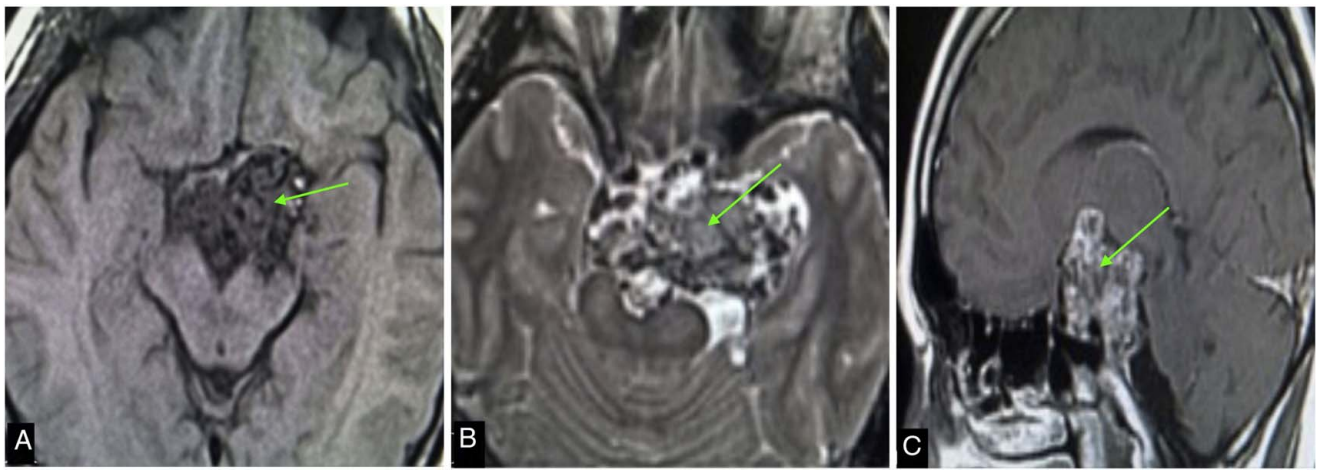

Figure 1. (A) Axial T1-weighted MR image demonstrating predominantly low signal suprasellar mass (green arrow) with areas of high signal intensity likely marrow fat. (B) Axial T2-weighted MR image showing heterogeneous intensity suprasellar mass (green arrow) with adjacent mass effect. (C) Sagittal T1-weighted MR image with gadolinium depicting heterogeneous enhancement of the mass (green arrow).

displayed heterogeneous high signals in the periphery [Fig. 1B], and gadolinium-enhanced contrast images exhibited varied enhancement patterns [Fig. 1C]. Posteriorly, the mass exerted pressure on the brainstem without associated perilesional oedema. During the preoperative assessment, the potential diagnoses considered included craniopharyngioma, meningioma, dermoid tumour, and osteochondromatous lesion. The absence of significant post-contrast enhancement and the location of mass aided in excluding craniopharyngioma. Furthermore, the heterogeneous signal and absence of a dural tail were indicative factors in ruling out meningioma. The lack of surrounding oedema also leaned towards the likelihood of an osteochondroma. Dermoid tumour was also considered as it presents with heterogeneous signal characteristics due to the presence of fat, calcification, and hair follicles. However, the absence of enhancement in imaging helped to differentiate it from the other differential diagnoses. A biopsy, conducted through a right orbito-zygomatic craniotomy, revealed an exceptionally firm tumour, allowing only partial resection. Numerous small calcified fragments were excised and subjected to histopathological examination.

Post-biopsy, the patient developed a headache, prompting a computed tomography (CT) scan. The CT scan unveiled a calcified suprasellar mass measuring $50 \times 45 \times 36$ mm, exhibiting a cauliflower-like appearance [Fig. 2A and B]. The sella turcica appeared distorted from the posterior aspect, accompanied by a reduced volume. Additionally, there was a defect in the cortical outline of the left-sided posterior clinoid process, with the cortical outline seamlessly merging with the calcified mass.

Pathological analysis of the excised pieces revealed a macroscopic composition predominantly consisting of bone. Microscopic examination disclosed trabecular bone with marrow spaces containing hematopoietic elements, including megakaryocytes and adipocytes. A cartilaginous cap was identified in a portion of the tissue [Fig. 3], with no presence of epithelial elements. These findings were indicative of an osteochondromatous lesion. Over a 64-month follow-up post-surgery, there was a gradual amelioration of symptoms, with no reported recurrences.

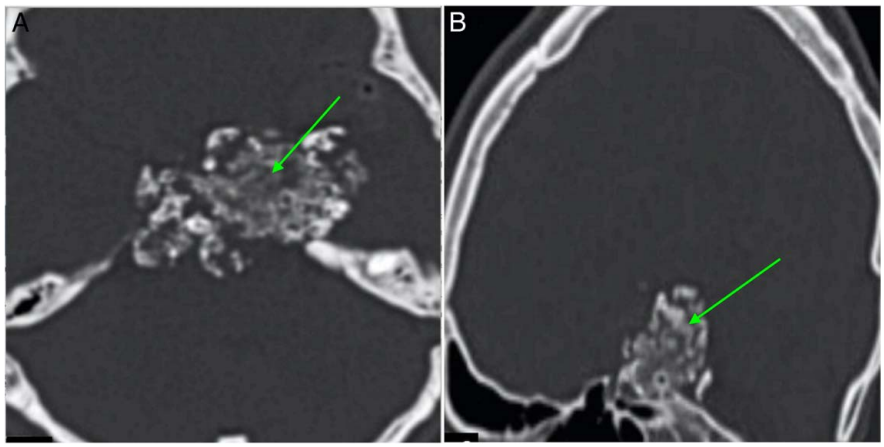

Figure 2. (A) Postoperative axial computed tomography (CT) bone window image showing exophytic extra-axial cauliflower-like bony mass (green arrow) around the Dorsal Sella and clinoid process. (B) Postoperative sagittal CT bone window image showing exophytic extra-axial cauliflower-like bony mass (green arrow) around Dorsal Sella and clinoid process.

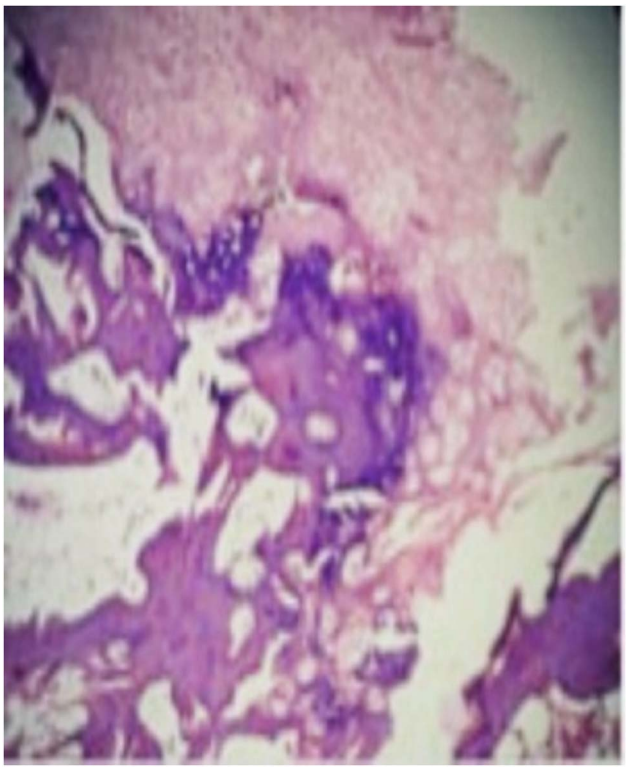

Figure 3. Photomicrograph showing the tumour consisting of bony trabeculae containing marrow elements and adipocytes along with foci of hyaline cartilage. Original magnification: 100 ×.

Clinical discussion

Osteochondroma, also known as exostosis, represents a benign bony outgrowth covered by hyaline cartilage. In both CT and MRI, a distinctive characteristic of osteochondroma is the seamless connection of the lesion with the cortex and medullary canal of the originating bone[3]. Our investigation encompassed a comprehensive review of the literature, utilizing databases such as Embase, Medline (via PubMed), Scopus, Cochrane Library, and Google Scholar. The searches were conducted using MeSH terms, combined key terms, text words, and search strings. To access the records, the following combination of key terms were used: intracranial osteochondroma AND case report, intracranial osteochondroma AND recurrence, and intracranial osteochondroma AND follow-up. After identifying the key relevant articles their references were looked into (ancestor search strategy). Similarly, other studies which cited were looked at the line (descendent search strategy).

As of the present, a total of 29 cases of intracranial osteochondroma have been documented, including the case under consideration (Table 1). Notably, of the 29 cases, 23 (79.31%) involved male individuals. The predominant locations for intracranial osteochondroma were the skull base (46.4%), followed by the convexity (39.3%) and the falx (14.3%). Within the skull base, the posterior clinoid process (5 cases), parasellar-middle cranial fossa region (4 cases), sella turcica (2 cases), petrous bone (1 case), and foramen magnum (2 cases) were identified as the most common sites. In our scenario, the affected area encompasses the posterior clinoid process of the skull base.

Skull base osteochondroma often originates in the parasellar region, in proximity to the confluence of sphenopetrosal, sphenooccipital, and petro-occipital synchondroses[21–23]. The prevalent clinical manifestation among patients with skull base osteochondroma was focal cranial nerve deficits. In contrast, patients with convexity and falcine osteochondroma typically presented with symptoms such as headache and epilepsy. In these instances, the cranial nerves most commonly affected were the optic nerve and abducens nerve, mirroring our case where visual disturbances and headaches were evident.

Intracranial osteochondroma can exhibit similarities to meningioma and oligodendroglioma in CT and MRI due to the presence of calcifications[23–26]. In rare instances, acute intratumoral haemorrhage may imitate pituitary apoplexy[23]. CT proves to be a more effective modality than MRI in illustrating the exophytic nature of the bony lesion and its connection with the bone of origin. MRI may reveal areas of high signal in T1-weighted images, indicative of fatty bone marrow, as observed in our case[23]. Contrast-enhanced MRI may display heterogeneous enhancement, posing a challenge in differentiation from meningioma, as both exhibit enhancement[17,18,20,23]. Angiography reveals osteochondromas as avascular[12,16,24], and Thallium-201 SPECT demonstrates extremely low uptake[28]. These modalities aid in distinguishing osteochondromas from highly vascular tumours like meningiomas.

The primary treatment for osteochondroma is complete surgical excision, as incomplete excision may lead to recurrences[1,24]. Gross total resection was successful in convexity and falcine osteochondroma cases, resulting in a symptom improvement rate of 66.7%. However, one falcine osteochondroma case succumbed to postoperative complications[21], and a case of convexity osteochondroma experienced recurrences and malignant transformation to chondrosarcoma[4]. Skull base osteochondroma cases achieved partial to subtotal resection, yielding symptom improvement in 41.7% without recurrences. Two skull base osteochondroma cases died due to postoperative complications, one from intratumoral haemorrhage on the second postoperative day[8] and the other from pulmonary infection on the 12th postoperative day[22]. In a paramedian skull base osteochondroma, multiple operations were performed due to recurrences, resulting in no significant improvement of symptoms, and the patient eventually succumbed to intracranial haemorrhage during a follow-up after 3 years[12]. Consequently, it can be inferred that complete resection of convexity and falcine osteochondroma yields substantial symptom improvement without recurrences. However, the decision to resect skull base osteochondroma should be carefully considered due to its proximity to carotid arteries and branches, cavernous sinuses, and cranial nerves. Small and asymptomatic skull base osteochondromas may be observed, while in symptomatic cases, subtotal or partial resection with close follow-up represents a viable management strategy. In the Follow-up study conducted by Forsythe *et al.*[5]. and Herskowitz *et al.*[7], spanning 6 months, there was no discernible evidence of recurrence observed. Alpers *et al.*[4]., conducted the longest period of follow-up extended to 68 months, during which recurrence manifested in the form of chondrosarcoma, resulting in the patient's demise after the 11th postoperative day. Conversely, in our instance, a partial removal was carried out, leading to an improvement in clinical symptoms with no subsequent recurrences in follow-up for 64 months.

Table 1

Summary of cases of intracranial Osteochondroma

Location	Age (years)	Sex	Clinical history	Treatment	Clinical improvement	Authors, (year)
1.[a]Posterior clinoid	24	M	Symptoms due to left abducens paralysis	PSR	Died 2nd postoperative day due to haemorrhage in the residual tumour	Ito[8], (1974)
2. Posterior clinoid	38	M	Epilespy	PSR	Not available	Sato[17], (1996)
3. Posterior clinoid	43	M	Visual disturbance, diplopia	PSR	Yes	Hongo[28], (2015)
4. Posterior clinoid	16	F	Visual disturbances	TR	Yes	Zanotti[30], (2018)
5. Posterior clinoid	34	M	Visual disturbances, headache	PSR	Yes	Present case
6. Parasellar	52	F	Visual disturbance	PSR	No	Himuro[9], (1977)
7. Parasellar	15	M	Left abducens palsy, trigeminal neuralgia	PSR	Yes	Hatayama[14], (1989)
8. Middle fossa	41	M	Visual disturbance, diplopia	PSR	No	Ikeda[10], (1980)
9. Middle fossa	24	M	Left hemiparesis	Multiple operation due to recurrence	Died due to intracranial haemorrhage during follow-up period after 3 years 9 months	Yamaguchi[12] (1983)
10. Sella turcica	49	M	Visual disturbance	PSR	Yes	Richards[6], (1960)
11. Sella turcica	29	M	Headache, visual disturbance	PSR	Yes	Inoue[23], (2009)
12. Basi-occiput	20	M	Hemiplegia & horseness of voice	PSR	Died 12th postoperative day due to pulmonary infection	Bonde[22], (2007)
13. Foramen magnum	73	M	Quadriparesis, headache	TR	Yes	Lotfinia[26], (2012)
14. Foramen magnum	51	M	Quadriparesis, radiculopathy	En bloc laminectomy and surgical decompression.	yes	Sinha[31], (2020)
15[a] Convexity	49	M	Epilespy	Multiple operations due to recurrences	Recurrence with chondrosarcoma transformation. Died 11th postoperative day	Alpers[4], (1935)
16. Convexity	51	M	Headache	Removed in paecemeal	Yes	Forsythe[5], (1947)
17. Convexity	57	F	Gait distrubances, memory disturbance	TR	Yes	Herskowitz[7], (1973)
18. Convexity	20	M	Headche, vomiting, visual disturbances	TR	No	Matz[11], (1981)
19. Convexity	28	F	Epilespy	TR	Yes	Mashiyama[16], (1994)
20. Convexity	45	F	Headache	TR	Yes	Nagai[18], (1998)
21. Convexity	25	M	Epilespy	TR	Yes	Haddad[19], (1998)
22. Convexity	33	F	Headache, hemiplegia	TR	Not available	Somerset[24], (2010)
23. Convexity	24	M	Headache, epilespy	TR	Yes	Venkata[25], (2011)
24. Convexity	17	M	Epilepsy; facial deviation, headache	TR	Yes	Amita[27], (2014)
25. Convexity	25	M	Headache, dizziness, speech disorders	TR	Not available	Kaptan[29], (2018)
26. Falx	48	M	Headache, gait disturbances	TR	Yes	Crawford[13], (1987)
27. Falx	48	M	Gait disturbances, headache	TR	Yes	Beck[15], (1989)
28. Falx	15	M	Headache, epilespy, sleep apnoea	TR	Yes	Lin[20], (2002)
29.[a] Falx	53	M	Epilespy	TR	Died	Omalu[21], (2003)

F, female; M, male; PSR, partial-subtotal resection; TR, total resection.
[a]Died.

Conclusion

Intracranial osteochondroma is rare and presents diagnostic challenges, warranting consideration in calcified tumour differentials near the bone. Tailored surgical approaches are crucial, balancing complete resection for convexity cases and partial resection for skull base tumours. Future research should explore refined diagnostic modalities and long-term outcomes.

Ethical approval

Not applicable.

Consent

Written informed consent was obtained from the patient for publication of this case report and the accompanying images. A copy of the written consent is available for review by the Editor-in-chief of this journal on request.

Author contribution

B.R.T.: conceptualization, as mentor and reviewer for this case report and for data interpretation. S.K.: contributed in literature review and writing the case report. All authors have read and approved the manuscript.

Conflicts of interest disclosure

All the authors declare that they have no competing interest.

Research registration unique identifying number (UIN)

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