ISSN 1220-8841 (Print)
ISSN 2344-4959 (Online)

ROMANIAN
NEUROSURGERY

Vol. XXXX | No. 1 March 2026

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DOI: 10.33962/roneuro-2026-004

Romanian Neurosurgery (2026) XXXX (1): pp. 29-32
DOI: 10.33962/roneuro-2026-004
www.journals.lapub.co.uk/index.php/roneurosurgery

Dural metastasis of chordoma: A rare pattern of tumour dissemination

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ABSTRACT

Background: Chordoma is a rare malignant bone tumour derived from notochordal remnants, characterised by slow growth and aggressive local behaviour. Although distant metastases are increasingly recognised, dural metastasis remains exceptionally rare.

Case description: We describe the case of a 72-year-old female patient with a history of a suprasellar chordoma, initially resected 8 years ago. The patient presented with tumour recurrence at the original site and a newly identified frontal dural metastasis. Imaging revealed growth of the residual clival tumour along with a well-circumscribed dural-based lesion in the frontal convexity. Surgical management consisted of resection of the recurrent clival lesion and complete excision of the frontal dural metastasis. The procedures were well tolerated, and postoperative recovery was uneventful, with resolution of preoperative neurological symptoms. Histopathological analysis confirmed the diagnosis of recurrent chordoma and dural metastasis.

Conclusion: Dural metastasis of chordoma is an uncommon but important diagnostic entity that should be considered in patients with a history of chordoma presenting with new dural-based lesions. Early recognition is crucial to avoid misdiagnosis and guide appropriate management.

Keywords
cordoma,
dural metastases,
microsurgery,
skull base neoplasms

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ISSN 2344-4959 (online)
ISSN 1220-8841 (print)

First published
March 2026 by
London Academic Publishing
www.london-ap.uk

INTRODUCTION

Chordomas are rare malignant tumors accounting for approximately 1–4% of primary bone neoplasms. They originate from embryonic remnants of the notochord and are most commonly located in the sacrococcygeal region, followed by the skull base (clivus) and the mobile spine. Despite their low-grade histological appearance, chordomas demonstrate aggressive local invasion and a high rate of local recurrence (9,10).

Traditionally, chordomas have been considered tumors with limited metastatic potential. However, recent series report distant metastases in 3–48% of patients, particularly in advanced or recurrent disease (2–5). The lungs, bones, liver, and lymph nodes represent the most frequent metastatic sites (4,5). In contrast, dural metastasis—either

intracranial or spinal—is exceptionally rare, with only isolated cases described in the literature (1,3,6–8).

The aim of this manuscript is to review dural metastasis of chordoma, highlighting its clinical relevance, radiological characteristics, possible mechanisms of dissemination, and therapeutic considerations.

Case report

We report the case of a 72-year-old female patient with a history of a suprasellar chordoma initially treated in 2017. She underwent subtotal resection of a 3.5 cm suprasellar lesion with calcifications, confirmed as a chordoma on histopathology, followed by adjuvant radiosurgery (CyberKnife) (Figure 1)

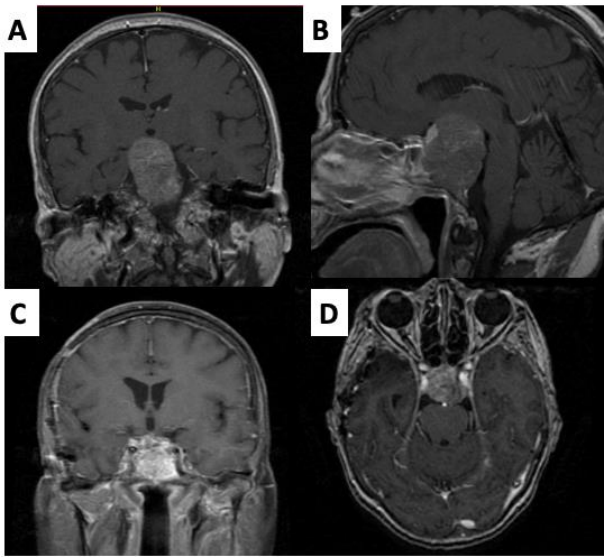

Figure 1. Initial MRI (A–B): Contrast-enhanced coronal and sagittal T1-weighted images reveal a solid sellar and suprasellar mass located at the skull base, extending posteriorly into the prepontine and interpeduncular cisterns, with approximate dimensions of 30 × 30 × 35 mm. **Early postoperative MRI (C–D)**: Contrast-enhanced coronal and axial T1-weighted images demonstrate postoperative changes with residual tumor measuring approximately 30 × 20 × 22 mm.

Over the following years, the patient developed cognitive decline, trigeminal symptoms, and decreased visual acuity. During follow-up, imaging demonstrated progressive growth of the residual tumor with suspected dural metastasis in the left frontal region.

In 2024, the patient underwent a left-sided craniotomy with resection of tumor growth in the region of the cavernous sinus and compression of the clinoid process. Complete excision of the frontal dural metastasis was achieved (Figure 2). Postoperatively, she received adjuvant proton therapy. The patient subsequently demonstrated good clinical evolution, with stabilization of the residual tumor and no new neurological deficits.

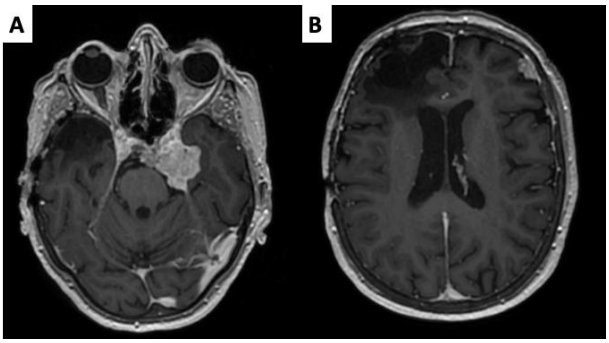

Figure 2 (A–B). Axial T1-weighted contrast-enhanced images show tumor recurrence in the suprasellar region with cavernous sinus invasion (A) and the development of a left frontal dural metastasis (B)

Histopathological examination revealed a hypercellular neoplastic proliferation composed of round cells with central nuclei, some with eosinophilic cytoplasm and others with clear cytoplasm, arranged in small nests and cord-like structures on a chondromyxoid stroma. Occasional mitotic figures were identified. Immunohistochemistry showed strong and diffuse positivity for AE1/AE3 and S100, and focal positivity for EMA. The Ki-67 proliferation index was 15%. These findings were consistent with recurrent chordoma and dural metastasis.

Discussion

Dural metastasis from chordomas remains an exceptionally rare phenomenon, with only a few cases documented in the literature. Understanding the mechanisms underlying this dissemination is crucial for both diagnosis and management. Several potential pathways have been proposed: hematogenous spread, direct extension from adjacent osseous structures, and cerebrospinal fluid (CSF) dissemination ("drop metastasis"), particularly following surgical manipulation of clival chordomas (1–5).

Hematogenous spread is primarily observed in advanced or recurrent disease. Direct extension into the dura is plausible in skull base chordomas due to

the proximity to venous sinuses, facilitating local invasion (3). CSF dissemination may explain distant dural metastases occurring months to years after initial surgery (4,5).

Clinically, dural metastases present according to their location and mass effect. Reported symptoms include progressive headache, seizures, focal neurological deficits, and, in spinal cases, signs of cord or root compression. Importantly, cranial dural metastases often develop years after initial chordoma treatment, reflecting the slow-growing but persistent nature of these tumors (1–5).

Radiologically, MRI is the modality of choice. Lesions are typically extra-axial, dural-based, iso- to hypointense on T1, variably hyperintense on T2, and enhance intensely and homogeneously with contrast. Occasionally, a dural tail may be observed, mimicking meningioma. Adjacent bone changes from the primary tumor may assist in diagnosis (3–7).

Differential diagnoses include meningioma, dural lymphoma, metastases from other primaries, and solitary fibrous tumor/hemangiopericytoma. In patients with prior chordoma, dural metastasis should be considered, especially if lesions develop years after treatment (3,5,8).

Management is individualized, considering systemic disease, neurological status, and lesion location. Surgery is indicated for decompression, symptom relief, or histopathological confirmation. Adjuvant radiotherapy, including proton or carbon ion therapy, can be considered, particularly for residual or surgically challenging lesions. Prognosis depends mainly on systemic tumor burden rather than dural involvement alone, though local control improves neurological outcomes (2,4,6,9).

A literature review identified five previously published cases of cranial dural metastases from chordoma (Table 1). All cases originated from skull base chordomas, predominantly clival, reflecting the tumor's predilection for local dural spread and, in some instances, CSF-mediated dissemination. Unlike spinal "drop metastases," these lesions presented as isolated dural masses within the cranial cavity.

Intervals from primary surgery to metastasis varied from 6 to 18 months, indicating that dissemination may be early (surgical manipulation or dural invasion) or delayed, reflecting the slow growth of chordomas. Clinically, patients presented with headache, motor deficits, and occasionally multiple neurological deficits, depending on metastasis location (posterior fossa, convexity, skull base). Surgical resection was the mainstay, sometimes complemented by radiotherapy. Complete resection improved neurological symptoms in most patients, though outcomes ranged from partial improvement to disease stabilization.

These five cases reinforce that cranial dural metastases from chordoma are extremely rare. Vigilant postoperative follow-up and multidisciplinary management are crucial. Surgery remains the primary treatment for symptomatic lesions, while adjuvant radiotherapy may be individualized to reduce recurrence risk.

Conclusion

Cranial dural metastasis of chordoma represents a rare but clinically significant pattern of tumor dissemination. Its radiological similarity to meningioma necessitates awareness, particularly in patients with prior chordoma. Accurate diagnosis relies on clinical history, imaging, and histopathology. Recognition of dural metastasis can influence therapeutic decision-making and prognostic assessment.

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