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Case Report

Case Report

Rare dorsal ossified meningioma in an elderly female: a case report and comprehensive review of literature

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Abstract

Meningiomas, typically benign neoplasms originating in the central nervous system, display a predilection for female patients. Although they predominantly manifest within the cranial vault, ~25% of primary spinal neoplasms are attributed to these tumors. The occurrence of ossification in spinal meningiomas is an uncommon phenomenon, with scant documentation in medical literature. In this report, we detail the clinical journey of an octogenarian female patient afflicted with an ossified spinal meningioma, which was associated with left lower extremity weakness and reduced sensation. Diagnostic imaging, specifically magnetic resonance imaging, identified a mass exerting pressure on the spinal cord, necessitating its surgical removal. Subsequent histopathological examinations corroborated the initial diagnosis. Postoperative magnetic resonance imaging scans confirmed the absence of residual tumor tissue and ruled out recurrence. A comprehensive review of existing literature yielded 47 analogous cases, with a majority involving elderly female patients and the thoracic region of the spine being the most common site. The standard therapeutic approach is surgical intervention, which is often complicated by the tumor's tenacious adherence to surrounding structures and the potential for ensuing operative complications. This case highlights the exceptional nature of ossified spinal meningiomas and emphasizes the critical need for meticulous surgical management.

Keywords: meningioma; ossified tumor; outcome; spine

Introduction

Meningiomas stand as the most prevalent primary benign tumors within the central nervous system. They typically manifest as benign growths and exhibit a prevalence twice as high in females compared to males. Factors contributing to their occurrence encompass ethnicity, familial predisposition, and prior exposure to radiation [1, 2]. Although meningiomas predominantly arise intracranially, they can also manifest within the spinal cord. Spinal meningiomas constitute ~25% of primary spinal tumors [2]. Ossification within spinal meningiomas is an infrequent occurrence, with only 46 reported cases preceding the one detailed in this case report. Herein, we present a case of ossified spinal meningioma in an 80-year-old female.

Case presentation

An otherwise healthy 80-year-old female patient presented with left lower extremity weakness following frequent falls ~1 month ago. Upon examination, motor power in the left lower limb was

Figure 1. Preoperative MRI, sagittal view, T2WI, shows tumor mass at levels D10–D11.

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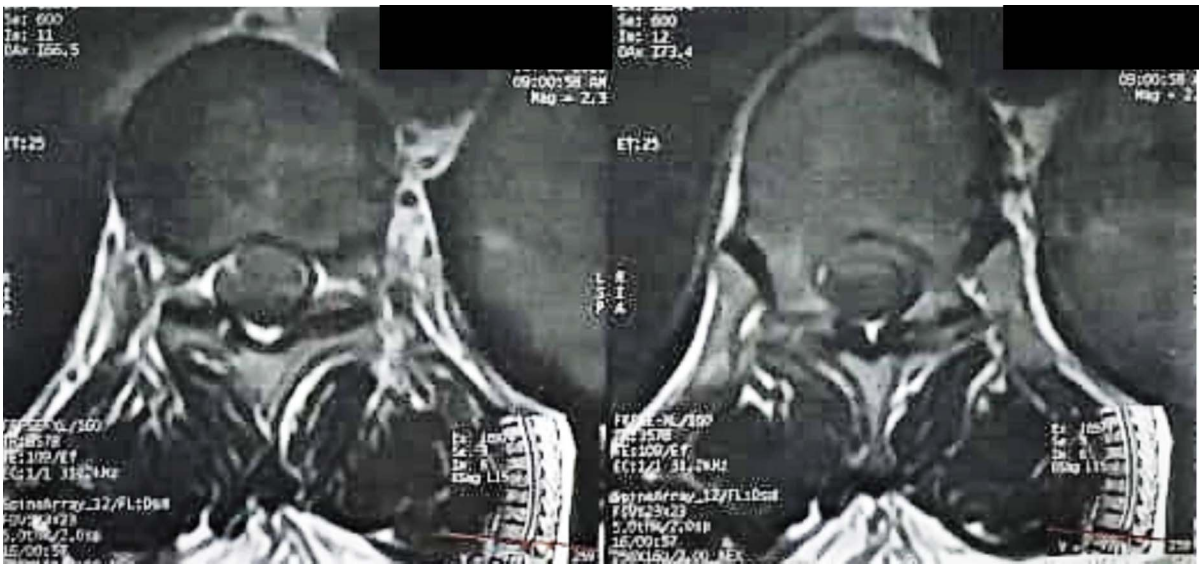

Figure 2. Preoperative MRI, axial view, T2WI, shows of hypointensely calcified regions within the tumor.

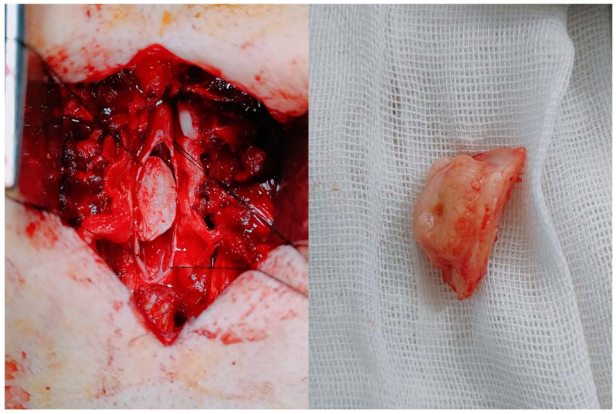

Figure 3. Intraoperative images showing the tumor after dissection and after complete excision.

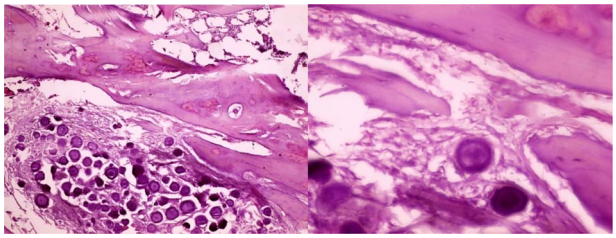

Figure 4. Histopathology shows the classical psammoma bodies, which are composed of calcium deposits or punctate calcifications within the tumor mass.

graded as III, accompanied by hypoesthesia. Without any other accompanying symptoms, magnetic resonance imaging (MRI) of the spine revealed a lesion within the vertebral canal causing compression of the spinal cord at the D10–D11 level (Fig. 1). T1-weighted images (T1WI) displayed hypointense calcified regions within the lesion, while T2-weighted images (T2WI) exhibited variable signal intensity, predominantly hypointense, in addition to surrounding tissue changes indicative of compression and edema (Fig. 2). Subsequently, the patient underwent surgical excision of the lesion, including laminectomy of D10–D11. A sharp

Figure 5. Postoperative MRI, sagittal view, T2WI, showing complete resection of the tumor.

dissection of the mass from the dura was performed during the surgery (Fig. 3). Two months after surgery, the patient underwent a short course of physiotherapy for several weeks, and now they

Table 1. Summary of all documented cases

Study (Year)	Age/ Gender	Tumor number	Ossified	Level	Location	Symptoms	Treatment	Clinical outcomes	Recurrence	Histological characteristics
Roger *et al.*, 1928 [5]	16/F	1	Ossified	T9	Lateral	Myelopathy	GTR	Improved (3 months)	No	Psammoma bodies, bone cells
Freidberg *et al.*, 1972 [6]	69/F	1	Ossified	T1–2	Ventral	Myelopathy	GTR + dura	Improved (6 weeks)	NA	Psammoma bodies, mature cancellous bone
Kandel *et al.*, 1989 [7]	17/F	1	Ossified	T8	Dorsal	Myelopathy	GTR	NA	No	Meningotheliomatous, psammoma bodies, bone spicule
Niijima *et al.*, 1993 [8]	75/F	1	Ossified	T8–9	Dorsolateral	Myelopathy	GTR + dura	Improved (14 months)	NA	Psammoma bodies, bone spicule
Kitagawa *et al.*, 1994 [9]	75/F	1	Ossified	T9–10	NA	Myelopathy	NA	NA	NA	Psammoma bodies, bone tissue
	60/F	1	Ossified	T6–8	NA	Myelopathy	NA	NA	NA	Psammoma bodies, bone tissue
Nakayama *et al.*, 1996 [10]	74/F	1	Ossified	T9	Dorsal	Myelopathy	GTR	NA	NA	Matured lamellar bone tissue
	45/M	1	Ossified	C1–3	Ventral	Myelopathy	GTR	NA	NA	Matured bone tissue
Huang *et al.*, 1999 [11]	73/F	1	Ossified	T5	Lateral	Myelopathy	GTR	Improved	NA	Psammoma bodies, bone marrow
Saito *et al.*, 2001 [12]	54/F	1	Ossified	T11	Dorsal	NA	GTR + dura	Improved	No	Metaplastic (osseous)
Naderi *et al.*, 2001 [13]	15/M	1	Ossified	T4	Dorsal	Myelopathy	GTR + dura	Improved (3 months)	NA	Psammoma bodies, mature bone tissue
Liu *et al.*, 2006 [14]	70/F	1	Ossified	T11	Dorsolateral	Myelopathy	GTR	Improved (2 years)	No	Psammoma bodies, woven bone
Hirabayashi *et al.*, 2009 [15]	82/F	1	Partially ossified	L3	Dorsolateral	Cauda equina syndrome	GTR	Improved	No (5 years)	Osseous
Tahir *et al.*, 2009 [16]	40/F	1	Partially ossified	T6	Dorsolateral	Myelopathy	GTR	Improved (8 months)	No	Mineralized bone
Uchida *et al.*, 2009 [17]	40/F	2	Ossified	T8 and T12	Dorsal, dorsolateral	Myelopathy	GTR + dura	Improved	No (2 years)	Psammoma bodies, mature bone
Licci *et al.*, 2010 [18]	58/F	1	Ossified	T6	Dorsal	Myelopathy	GTR	Improved (1 year)	NA	Psammoma bodies, lamellar bone tissue, hematopoiesis
Chotai *et al.*, 2013 [19]	61/F	1	Ossified	T4–5	Dorsal	Myelopathy	GTR + dura	Improved (1 month)	NA	Psammoma bodies, mature lamellar bone, hematopoiesis
Study (Year)	Age/Gender	Tumor number	Ossified	Level	Location	Symptoms	Treatment	Clinical outcomes	Recurrence	Histological characteristics
Ju *et al.*, 2013 [20]	61/F	1	Ossified	T9–10	Lateral	Myelopathy	GTR + dura	Improved (1 month)	NA	Heterotopic ossification
Taneoka *et al.*, 2013 [21]	78/F	1	Ossified	T9	Dorsal	Myelopathy	GTR + dura	Improved	NA	Psammoma bodies, mature bone, hematopoiesis
Yamane *et al.*, 2014 [22]	61/F	1	Ossified	T12	Ventrolateral	Myelopathy	GTR	Improved	No (2 years)	Psammoma bodies, cancellous bone with bone marrow
Chan *et al.*, 2014 [23]	64/F	1	Ossified	T9–10	Dorsal	Myelopathy	GTR	Improved (6 month)	NA	Psammoma bodies, bone marrow, hematopoiesis
Alafaci *et al.*, 2015 [24]	45/M	1	Ossified	T2–3	Ventral 4, lateral 1, dorsal 4	Myelopathy	GTR	Improved	No	Seven cases of osseous component in association with psammoma bodies, two cases of immature bone trabeculae
	75/F	1	Ossified	T3–4		Myelopathy	GTR	Improved	No	
	86/F	1	Ossified	T3–4		Myelopathy	GTR	Improved	No	
	65/F	1	Ossified	T7		Myelopathy	GTR	Improved	No	
	72/F	1	Ossified	C7		Myelopathy	STR	Improved	No	
	40/F	1	Ossified	T1–2		Myelopathy	STR	Improved	No	
	65/F	1	Ossified	T7–8		Myelopathy	GTR	Improved	No	
	40/F	1	Ossified	C7		Myelopathy	GTR	Improved	No	
	41/F	1	Ossified	T2–3		Myelopathy	GTR	Improved	No	

(Continued)

Table 1. Continued.

Study (Year)	Age/ Gender	Tumor number	Ossified	Level	Location	Symptoms	Treatment	Clinical outcomes	Recurrence	Histological characteristics
Kim *et al.*, 2016 [28]	51/F	1	Ossified	T4	Dorsal	Myelopathy	GTR	Improved	No	Psammoma bodies
	77/F	1	Ossified	T9	Dorsal	Myelopathy	GTR	Improved	No	Psammoma bodies
Demir *et al.*, 2016 [25]	26/F	1	Ossified-calcified	T9–11	Dorsal	Myelopathy	GTR	NA	NA	Psammoma bodies
Cochran *et al.*, 2016 [26]	47/F	1	Ossified	T8	Ventral	Radiculopathy	GTR	Improved	No (22 months)	Psammoma bodies, bone marrow, hematopoiesis
Xia and Tian, 2016 [27]	90/M	1	Ossified	T10–11	Dorsal	Spinal cord injury after fall	GTR	NA	NA	Psammoma bodies, bone trabeculae
Prakash *et al.*, 2018 [29]	60/F	1	Ossified	T7–8	Dorsolateral	Myelopathy	GTR	Improved (6 month)	NA	Psammoma bodies, immature bony trabeculae
Sakamoto *et al.*, 2018 [38]	57/F	1	Ossified	C7	Ventro-laterodorsal	Myelopathy	STR	Improved	NA	Osseous core, fibrous
Murakami *et al.*, 2019 [4]	29/F	1	Ossified	T12	Lateral	Back pain, leg numbness	GTR + dura	Unchanged (12 months)	NA	Psammoma bodies, mature bone tissue
Taha *et al.*, 2019 [30]	22/F	1	Ossified	T4–5	Dorsal	Myelopathy	GTR	Improved (6 month)	NA	Psammoma bodies, bone trabeculae
Wang *et al.*, 2019 [31]	52/F	1	Ossified	T4	Dorsal	Back pain	GTR	Improved	No (2.5 years)	Psammoma bodies, immature trabecular bone, hematopoiesis
Xu *et al.*, 2020 [32]	85/F	1	Ossified	T11	Lateral	Back pain, leg pain	GTR + dura	Improved	No (1 year)	Psammoma bodies
Buchanan *et al.*, 2021 [33]	64/M	1	Ossified	T4	Dorsal	Myelopathy	GTR + dura	Improved (6 month)	NA	Psammoma bodies, bone formation, osseous metaplasia
Wong *et al.*, 2021 [34]	75/F	1	Ossified	T10- T11	NA	Myelopathy	GTR + dura	Not improved (6 months)	NA	Psammoma bodies, immature trabeculae bone
Thakur *et al.*, 2021 [35]	74/F	1	Ossified	T8	Ventrolateral	Tingling paresthesia	GTR + dura	Improved	NA	Psammoma bodies, bony hard-tissue fragments
Dong *et al.*, 2022 [36]	76/F	5	Ossified	T7–12	Dorsal	Myelopathy	GTR + dura	Improved	No	Psammoma bodies, trabecular bone, hematopoiesis
Xu *et al.*, 2023 [39]	68/F	1	Ossified	T10	Dorsal	Paresthesia, gait disturbance	GTR	Improved	No	meningioma with diffused psammomatous bodies
Taha *et al.*, 2024 (present)	80/F	1	Ossified,calcified	T10–11	Dorsal	Lower limb weakness	GTR	Improved	No	classical psammoma bodies, characterized by calcium deposits

GTR, gross total resection; STR, subtotal resection.

can ambulate without support. The postoperative period was uneventful. Histopathological analysis revealed the presence of classical psammoma bodies, characterized by calcium deposits or punctate calcifications within the tumor mass, consistent with a diagnosis of classic meningioma ossified (Fig. 4). A follow-up MRI performed after 3 months demonstrated complete excision with no evidence of tumor recurrence (Fig. 5).

Discussion

Spinal meningioma exhibits various classifications, comprising up to 15 histologic subtypes, with the psammomatous, meningothelial, and transitional types being the most prevalent. Ossification of spinal meningioma is a relatively uncommon occurrence, reported in 5%–10% of cases [3].

Based on our comprehensive review of the existing literature, our investigation identified 47 cases of ossified spinal meningioma, which includes the case detailed in this report (Table 1). Our analysis revealed a predominance of occurrences in females (42 cases) compared to males (5 cases). The average age of patients afflicted with ossified spinal meningioma was 64.6 years, with ages ranging from 15 to 90 years. The thoracic spine was the most common site of manifestation, accounting for 89.3% (42 cases) of cases, followed by the cervical spine (4 cases, 9%) and lumbar spine (1 case, 1.7%). Treatment modalities primarily involved gross total resection in 42 cases, subtotal resection in 3 cases, and insufficiently described resection extents in 2 cases. Postoperatively, the majority of patients demonstrated gradual improvement, with 25 cases showing no recurrence, although recurrence status was not reported for the remainder of the cases (Table 1).

Our analysis indicates that while ossified spinal meningioma exhibits a higher prevalence among females, no substantiated correlation between this condition and sex hormones has been identified [40].

While CT scans offer superior diagnostic capabilities for spinal tumors compared to MRI, differentiation between calcification and ossification necessitates histopathologic examination [33]. The mechanism underlying the ossification of spinal meningiomas remains unclear, though several theories have been proposed. Kubota *et al.* [37] suggested that ossification occurs as an advanced stage of psammomatous calcification of meningioma as part of the neoplastic process. However, this theory does not account for all cases of ossified spinal meningioma documented in the literature, as ossification can occur without preceding psammomatous calcification [3]. Another theory proposed by Uchida *et al.* [17] implicates genetic predispositions, such as osteoblast transcription factors SOX9 and Runx-2, although this may not be applicable to all patients. Genetic analysis is not routinely indicated for such tumor cases.

Surgical intervention remains the cornerstone of treatment for spinal meningiomas, whether calcified or completely ossified. Computed tomography (CT) plays a crucial role in preoperative planning and identifying the ossified component of the tumor. Dense calcifications serve as a guide for intraoperative tumor localization using fluoroscopy or O-arm imaging. Surgical resection of ossified spinal meningioma can be challenging due to tumor adherence to adjacent neural elements and dural invasion. This adherence may result in an unclear dissection plane, potentially impacting postoperative outcomes and hindering gross total tumor resection, with subsequent risks of spinal cord trauma or injury [13, 24]. Nonetheless, reported literature indicates minimal postoperative complications thus far.

Conclusion

Ossified meningiomas represent benign yet exceedingly rare spinal tumors. Across the documented literature, clinical presentations vary widely but exhibit common patterns. There is a notable predominance of female patients, with lesions commonly observed in the thoracic spine. Surgical excision remains the cornerstone of treatment, necessitating careful consideration to mitigate potential complications.

Conflict of interest statement

None declared.

Funding

None declared.

Ethical approval

Ethics clearance was not necessary since the University waives ethics approval for publication of case reports involving no patients' images, and the case report is not containing any personal information. The ethical approval is obligatory for research that involve human or animal experiments.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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