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REVIEW ARTICLE

Chondroblastoma of Thoracic Vertebrae: a Case Report and Review of the Literature

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Abstract

Chondroblastoma is a rare benign cartilaginous bone tumor typically seen at the epiphysis of long axial bones. In this regard, there are rare findings about spinal chondroblastomas. We report a 29-year-old man with T1 vertebral chondroblastoma misdiagnosed with a traumatic fracture following an accident. The patient was admitted to our clinic with a chief complaint of axial back pain and kyphosis following posterior spinal fixation. We report his clinical and imaging data before his past operation and at this admission. Our patient underwent a two-stage operation. In the first stage, posterior spinal reconstruction and kyphosis correction was performed. In the second stage, mass resection was performed anteriorly in the T1 vertebral body as much as possible. The results confirmed the chondroblastoma diagnosis histologically. Our patient remained symptom-free with no growth in tumor remnant during 6 months follow-up. Although vertebral chondroblastoma is a sporadic tumor, it should be considered in the differential diagnosis when facing a vertebral infiltrative osteolytic mass, even when mimicking a traumatic fracture after the accident. In addition, histological confirmation is necessary under such conditions. We also reviewed the literature's clinical presentations, imaging findings, and treatments of 34 case reports with vertebral chondroblastoma.

Keywords Spinal chondroblastoma · Vertebral fracture · Case report

Introduction

Chondroblastoma is a rare benign cartilaginous tumor that mainly occurs in long bone epiphysis at the ossification center [1]. The distal end of the femur is the most common site for chondroblastoma. The other preferred sites for this tumor are the proximal end of the humerus, the proximal end of the femur, and the proximal end of the tibia, talus, and innominate bones, in the order of their appearance [2–6]. Chondroblastoma is a rare skeletal tumor that accounts for less than 1% of all primary skeletal tumors. The peak of this lesion is the second and third decades of life, with twice prevalency in men over women [7, 8]. The most common clinical manifestation of chondroblastoma is insidious local pain. Radiological imaging of chondroblastoma typically reveals a well-defined radiolucent lesion with a thin sclerotic rim developed eccentrically at the epiphysis of long bones occasionally extended to the metaphysis. CT scanning may also show internal calcifications giving the lesion a mottled appearance [9–12]. This tumor appears macroscopically as a cartilaginous lesion with hemorrhagic and cystic patches, the consistency of which varies depending on the calcification degree. Chondroblastoma is characterized by polygonal chondrocyte-like cells and a chondroid matrix with large cells on histological examination [13–16]. Treatment options for this lesion include local curettage or resection with a margin of normal tissue [11, 17]. The local recurrence rate varies from 24 to 100% [3], depending on the treatment option and the presence of giant cells [11, 12]. Although this pathology is very rare and its most clinical symptom is axial pain, we report a case with thoracic vertebral chondroblastoma discovered incidentally following assessment for proximal junction kyphosis.

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Case Presentation

Our case is a 29-year-old man referred to our clinic with a primary complaint of gradually worsening upper back pain and paresthesia in his lower extremities after slipping down the stairs 2 months ago. He mentioned that he had a T1 fracture 6 months ago due to a vehicle accident, which necessitated posterior spinal (C6–C7 and T2–T3) fixation and fusion, as well as laminectomy at another medical institution (Fig. 1).

General examination revealed no gross evidence of deformity or atrophy in posterior spinal muscles. The muscle strength examinations were full in all extremities. Deep tendon reflexes were normal and symmetric. Also, he had no specific family history and was taking no medication. In laboratory assessment, no abnormality was found. The neurological examination showed normal findings. An ill-defined radiolucent lesion affecting the body of the T1 vertebra was discovered on lumbar radiography. In addition, a massive lobulated heterogeneous osteolytic tumor affecting the T1 vertebral body with spinal canal invasion was discovered on CT scanning. Magnetic resonance imaging confirmed the T1 fracture appeared hypointense on spin-echo T1-weighted MR

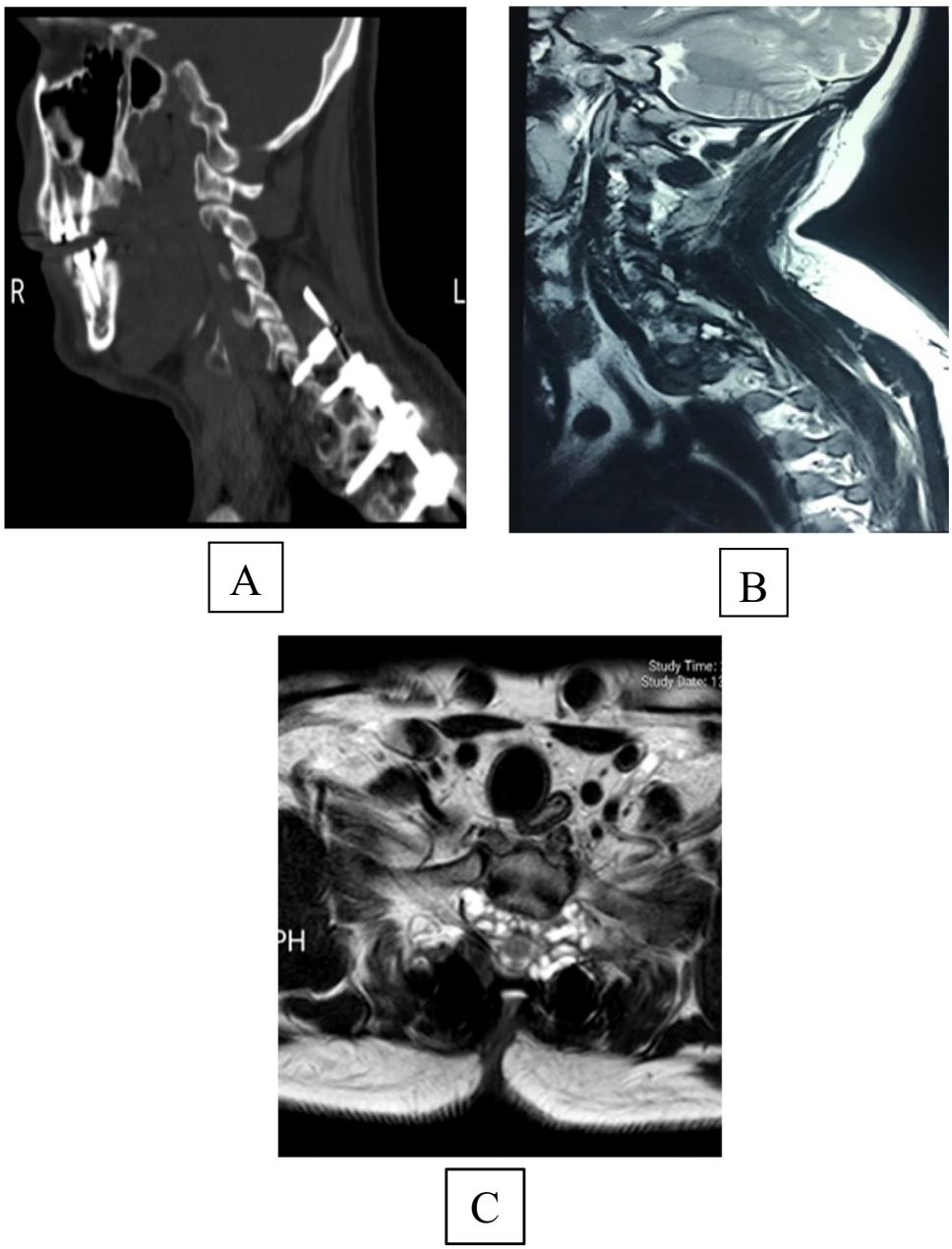

Fig. 1 Sagittal reconstructed non-enhanced cervico-thoracic CT scan (**A**), sagittal cervico-thoracic T2-weighted MR image (**B**), axial cervico-thoracic T2-weighted MR image (**C**) showing T1 vertebral body pathological fracture and failed posterior fixation 2 months before referring

image, heterogenous with the prominent thin hyperintensity lobulated rim on FSE T2-weighted MR image, and hypointense on FSE-STIR-weighted image. Furthermore, heterogenous enhancement was observed in contrast with enhanced T1-weighted MR images with fat saturated. This infiltration extended to the spinal canal and narrowed the epidural space without intra-medullary invasion, suggesting bone origin pathologies.

Thus, the patient was prepared for surgical intervention. In the initial operation, previously inserted screws were corrected, and new lateral masses and pedicular screws were applied instead. These operations were performed under fluoroscopy and neuromonitoring guide via the posterior approach. In the second surgical procedure through the anterior approach, the level of the T1 vertebra is determined by C-arm. During the inspection, the whole T1 vertebral body was filled up with the tumor, leading to its relative invasion to surrounding tissue. Corpectomy of the T1 vertebra, including the disc above and below, was performed, followed by placing an expandible cage with a size proportional to the defect. All these procedures were done under neuromonitoring control (Fig. 2). Samples taken during surgery were sent for pathological evaluation. Macrospically, the tissue extracted displayed a rubbery cream pattern. According to histological findings, the sample was a benign tumor with the widespread proliferation of oval cells with well-defined cell boundaries. It also contained monomorphic nuclei with irregular nuclear contours and occasional nuclear grooves. The neoplastic cells were mixed with occasional osteoclast-type multinucleated giant cells. Small areas of immature cartilage formation were also seen, and the findings indicated the correct diagnosis of chondroblastoma (Fig. 3). Retrieved tissue was also sent to a pathologist who specialized in bone tumors to reconfirm the definitive diagnosis of chondroblastoma double. According to pathology confirmation and resection of the lesion, the prognosis is good, and no adjuvant therapy was required. The post-operation imaging showed sagittal balance correction, and the patient affirmed pain relief without any complication. In 6 months, the patient came to our clinic for follow-up, and he expressed neither axial pain nor other complaints with a regular appearance in CT and MRI images (Fig. 4).

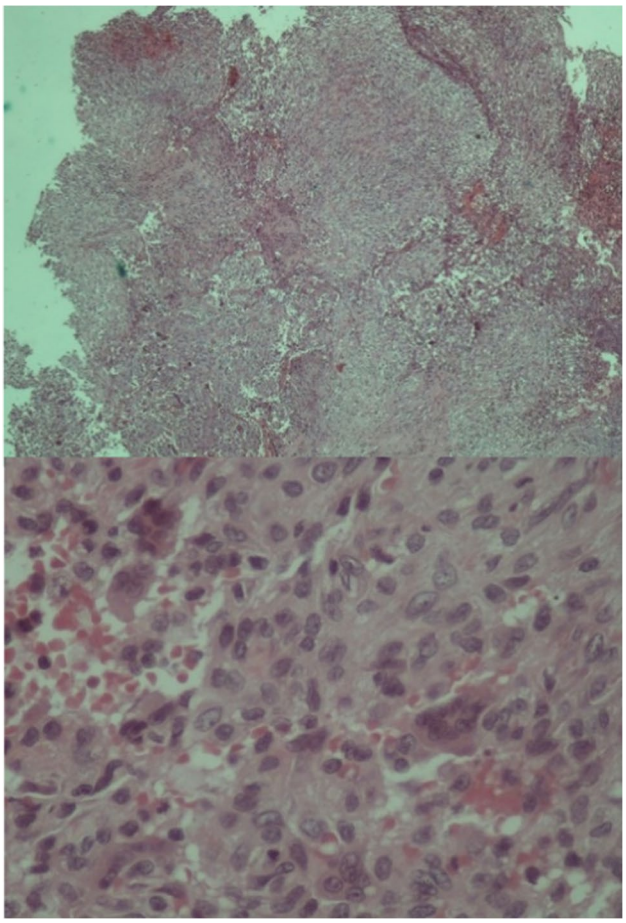

Fig. 3 Diffuse proliferation of oval cells with well-defined cell borders. Osteoclast-type multinucleated giant cells and small areas of immature cartilage formations can be seen occasionally. (**A**, H&E×100) (**B**, H&E×200)

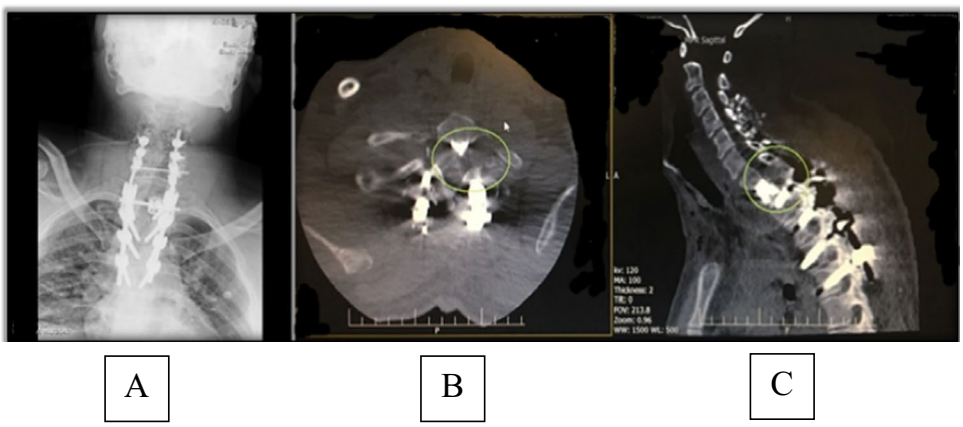

Fig. 2 Anteroposterior radiography (**A**); Axial reconstructed CT scan (**B**); sagittal reconstructed CT scan (**C**); showing posterior spinal (C_4,C_5,C_6,C_7 lateral masses T_2,T_3,T_4,T_5 pedicular screws) fixation and anteriorly T1 vertebral corpectomy and expandible cage insertion

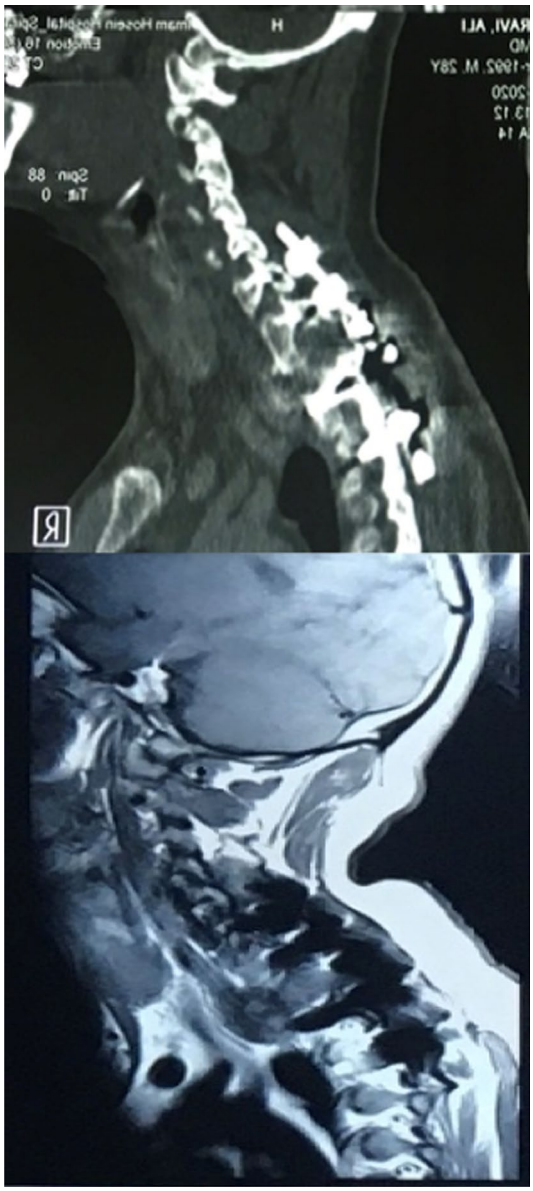

Fig. 4 Sagittal reconstructed CT scan (**A**); T2-weighted MRI image (**B**); 6 months after operation demonstrating no growth in tumor remnant

Discussion

Although vertebral chondroblastoma is benign in nature, it has a higher tendency to local recurrence than the extravertebral ones [3, 7–10, 18, 19]. In addition, on imaging, vertebral chondroblastoma presents as osteolytic lesions invading the spinal canal with a sclerotic border. On T1-weighted MRI images and T2-weighted MRI images, we observed a hypo-signal mass with varying signal intensities depending on histological parameters (e.g., cellularity and calcification) [20]. These radiological features were compatible with our patient imaging. However, the radiological features of vertebral chondroblastoma may reveal important clues to come into account. When we encountered aggressive tumor is in vertebral body other differential diagnoses (e.g., aneurysmal bone cyst, tuberculosis spondylitis, eosinophilic granuloma, giant cell tumors, chondromyxoid fibroma) should be differentiate from each other by histological assessment [3, 9, 10]. Tathe et al. indicated that intraoperative crash smear cytology is a rapid intraoperative diagnostic tool to confirm chondroblastoma diagnosis. Immunohistochemistry and gene mutation analysis were concerned as a new avenue to differentiate chondroblastoma from other overlap clinicoradiological pathologies [21, 22]. The primary treatment for chondroblastoma is surgery as en bloc resection or curettage, followed by radiosurgery as adjuvant therapy. However, chemotherapy is not performed for the treatment of this tumor [12]. Regarding the controversial role of adjuvant therapy in preventing tumor recurrence, more studies with longer follow-up duration are required to clarify this issue [11, 23, 24].

To this end, we reviewed 34 case reports of vertebral chondroblastoma in the literature (Table 1). In our review, we did not include the patients with a lack of imaging or clinical findings. Overall, 24 men and 10 women with vertebral chondroblastoma aged 11 to 62 years were described. The body and posterior elements of vertebrae were involved in approximately all patients. The affected areas were the thoracic zone in 14 patients, the lumbar zone in 14 patients, the cervical zone in 4 patients, and sacral vertebrae in 2 patients [2–4, 6, 7, 10, 13–15, 17, 19, 20, 23, 25–30]. In our patient, the tumor was discovered by chance during evaluation for proximal junctional kyphosis after undergoing posterior spinal fixation. In another center, his invaded vertebra by tumor was misdiagnosed as a traumatic fracture. Therefore, posterior spinal fixation was performed for him. In literature, symptoms last from 1 month to 2.5 years (with a mean of 9.7 months). In specimens related to 3 patients, ABC was seen [2, 11]. Chondroblastoma accompanied by ABC can be misleading to correct diagnosis. In this regard, two pathologists examined the tissue sample of our patient to confirm the diagnosis.

Furthermore, one of our review studies reported chondroblastoma with pulmonary metastasis [20]. Kunze et al. described 7 patients with metastatic chondroblastoma, but none had vertebral chondroblastoma. They announced that the meantime to diagnose lung metastasis was 8.4 years, and the mean survival time was 12.3 years. They mentioned no difference in pathologic features of metastatic chondroblastoma with the conventional ones [31–33]. In our review, we just described one patient with lung metastasis diagnosed by FDG uptake in both lower lobes of the lungs when performing a PET-CT scan to assess its metastatic status [20]. The pointed patient underwent laminectomy of the invaded

Table 1 Literature review of the vertebral chondroblastoma

Authors & Year	Location	Age(years)/ Gender	Symptoms	Duration of symptoms	Approach	f/u recurrency
Kurth AA et al. 2000 [2]	T8	62/M	NM	NM	A+P	18m
Venkatasamy A et al. 2017 [3]	T2-T3	27/F	Left-sided chest pain and transient episodes of sweating of left hemithorax, aching medial aspect of arm radiating pain and numbness	12m	P+A	2y/No
Vialle R et al. 2005 [4]	L3	23/F	Low back pain	6m	A+p	3y/no
	L4	55/F	Low back pain	12m	A+P	6y/no
Tathe et al. 2018 [6]	T6	17/M	Progressive weakness and numbness of lower limbs	1m	P	NM
Attar A et al. 2001 [7]	T2	48/M	Inter scapular pain	12m	A+P	NM
Jia Q et al. 2018 [11]	T5-T6	37/M	Palpable mass of posterior segment pf 6^{th} rib	16m	p	NM
	T6	35/M	Thoracic pain	10m	P	NM
	T7	36/F	Thoracic back pain Lower extremities weakness	10m	p	NM
	T7-T9	16/M	Thoracic back pain and palpable mass	5m	p	NM
	L1	19/M	Axial back pain, sphincter disturbance & paraplegia	3m	p	48m/yes
	L1	53/F	Low back pain	8m	p	18m/yes
	L3	26/M	Low back pain	12m	P	NM
	L4	60/M	Progressive low back pain	10m	p	NM
	L5	18/M	Low back pain	12m	p	NM
	L5	53/F	Low back pain and right limb weakness	1m	p	NM
Hernández Martínez SJ et al. 2011 [13]	L4	30/F	Low back pain	1m	NM	NM
Leung LY et al. 2001 [14]	L5	54/M	Occasional pain over left the paraspinal area and left sciatic	4m	A+P	10m/yes
Howe JW et al. 1988 [15]	C5-C6	16/M	Tightness of neck muscles and limitation and painful neck movement	NM	A+P	NM
Lee YH et al. 2005 [18]	T7	40/M	Upper back pain+ lower extremities weakness, sensory change below T9	NM	A+P	NM
Osman W et al. 2014 [19]	T12	18/M	Back pain and lower limbs weakness and numbness	6m	P	11y
Sohn SH et al. 2009 [20]	L4	21/M	Lumbago metastasis to lung	6m	P	3y
Zheng BW et al. 2021 [23]	Sacrum	17/M	Sacrococcygeal tenderness and bilateral kyphotic sign	NM	Biopsy	18m/yes
Hoeffel JC et al. 1987 [25]	C7	9/M	Cervical pain, the anterior position of head, cough and dyspnea	3m	NM	1y/yes Dead after 6 years
Buraczewski J et al. 1957 [26]	T3-T4	28/M	Weakness of limbs, gait disturbance, unusual	30m	P+4500	2y
Sagoo NS et al. 2020 [27]	T12	11/F	Scoliosis+ back pain and paraparasia	14m	A+P	7y/no
Shin BJ et al. 2001 [28]	L1	36/M	Low back pain	NM	P+A	14m/No
Akai M et al. 1986 [29]	sacrum	48/M	Low back pain	18m	Biopsy	3m/dead
Giri P et al. 2017 [30]	T6-T7	17/M	Back pain and lower limbs weakness and numbness	5m	P	NM

C cervical vertebrae, *T* thoracic vertebra, *L* lumbar vertebra, *M* male, *F* female, *m* month, *P* posterior approach, *A* anterior approach, *y* year, *NM* not mentioned

vertebra and wedge resection of the involved lung, with no tumor growth after 3 years of follow-up. In 13 case reports, both anterior and posterior approaches were used to resect involved vertebral mass lesions and spine stabilization [7, 11, 13, 14, 17, 18, 27, 28]. In the other 16 case reports, the only posterior approach was employed [11, 20, 26]. Aspiration with subtotal resection and surrounding curettage was considered in 3 patients (2 with sacral chondroblastoma and one with lumbar vertebral chondroblastoma), However, one of two patients with sacral chondroblastoma died after 3 months of intervention [18]. In our case described, posterior spinal reconstruction was performed in the first stage. In the 2nd stage, resection of chondroblastoma in the T1 vertebral body was performed as much as possible. If the patient had been referred to our center primarily, an aspiration biopsy to determine the nature of this fracture could have been the better choice. The mean follow-up duration in studies was about 3 years. The recurrence duration ranged from 1.5 to 10 months according to four reports [11, 14, 17]. In these studies, vertebral chondroblastoma originated from the first lumbar vertebrae in 2 patients and the fourth lumbar vertebrae in the other 2 patients. During a 6-month follow-up, our patient was neurologically intact, and no growth in the remnant tumor was observed in MRI images. In this regard, there is no consensus on the duration of these patients' follow-up, considering their tumor remnant.

Conclusion

Although vertebral chondroblastoma is a rare phenomenon, it should be considered when facing an osteolytic vertebral lesion. This case warned us when facing a young patient with a vertebral fracture following an accident not just relate it to the trauma. It is mandatory to assess its images in more detail to not miss pathologic reasons. Despite benign nature of vertebral chondroblastoma, more studies with longer follow-ups are required to determine its behavior.

Declarations

Conflict of Interest The authors declare no competing interests.

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