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Diagnostic features of lumbar canal osteochondroma and review of literature

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Abstract: *Osteochondroma is a common benign primary bone tumor that can be multiple or solitary and is usually caused by a developmental defect in the growth plate. Osteochondroma usually arises from an osteochondroma near the ends of long bones and is less likely to occur in the spine. Data show that the incidence of single spinal osteochondroma is only 1.3%-4%, and the most common sites are cervical vertebra, thoracic vertebra, thoracolumbar and lumbar vertebra. Osteochondroma of the lumbar spine is rare because its ossification center generally ossified around 30 years of age, later than cervical and thoracic vertebrae. Only about 30% of patients with osteochondroma of the lumbar spine had intact cartilage caps. If the thickness of the cartilage cap is assessed, it is difficult to see on conventional radiographs. Conventional radiographic assessment is usually used to diagnose osteochondroma in the extremities, whereas radiographic diagnosis of osteochondroma in the spine is more difficult. This case was reported as a female patient with a single osteochondroma, which occurred in the lumbar spine and had a complete cartilage cap during the operation. This case is rare, which can provide some help for clinical practice to avoid misdiagnosis and missed treatment of this kind of disease.*

Keywords: *Osteochondroma; The lumbar spine.Diagnosis; Treatment*

1. Introduction

Osteochondroma is the most common benign bone tumor.It is often located in the metaphysis of long bones and is the ectopic development of cartilage growth plates.This tumor accounts for 10-15% of all bone tumors and 20-50% of benign bone tumors [1].It usually occurs in adolescent patients because it is a cartilage growth plate disease that usually stops growing after bone matures [2].Most patients have no subjective symptoms and the malignant conversion rate is low, so patients often do not follow up regularly, resulting in delayed treatment.

Osteochondroma of the spine, though rare, only accounts for 1.3-4.1% of all osteochondromas [3].However, 0.5-1% of osteochondromas of the spine may develop into insidious but progressive myelopathy, radiculopathy, or both, which can lead to severe neurological sequelae if not diagnosed and treated early.It is also not clear which cases are likely to develop myelopathy.In addition, indications for resection of asymptomatic lesions are also controversial [4].This case describes a patient with osteochondroma in the lumbar spinal canal, whose cartilaginous cap was found near the dural sac by computed tomography (CT) following the onset of neurological dysfunction.In this case, if the cartilage cap was observed, even after bone maturation, the lesion could continue to progress and lead to neurological dysfunction, so the lesion was removed and reported below.

2. Manuscript Preparation

2.1. Case report

The patient, female, was admitted to the hospital due to "intermittent low back pain with claudication for 25 days" (Department of Orthopedics, Heping Hospital, Changzhi Medical College,

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On July 27, 2021), the patient developed waist discomfort without obvious inducement 25 days ago, accompanied by intermittent claudication, which was aggravated after fatigue, and could be relieved after bed rest. The patient was not accompanied by night pain, poor appetite, fatigue, afternoon low fever, night sweat and other tuberculosis symptoms. He has been treated in Beijing Chaoyang Hospital affiliated to Capital Medical University and Changzhi Huaihai Hospital .Lumbar MRI examination (subject on July 20, 2021, using Siemens 3.0T superconducting MAGNETIC resonance imaging machine, supine position with scanning layers 11 and layer thickness 4.0mm) showed (Figure 1): lumbar spinal stenosis, abnormal high signal of the articular process at the level of the lumbar 3/4 disc with compression of the right nerve root. Home in bed after conservative treatment of traction, acupuncture, physical therapy, claudication symptoms aggravate gradually, now the patient to walk 50 meters of the right lower limb serious discomfort, today for further diagnosis and treatment in our hospital treatment, lumbar CT taken (on July 26, 2021 subjects use Germany's Siemens Sensationl6 multislice CT machine supine) check show (Figure 2) :Abnormally high signal in the facet of the lumbar 3/4 intervertebral disc with compression of the right nerve root, secondary to lumbar spinal stenosis. The patient was admitted to the hospital with osteochondroma of lumbar vertebra.

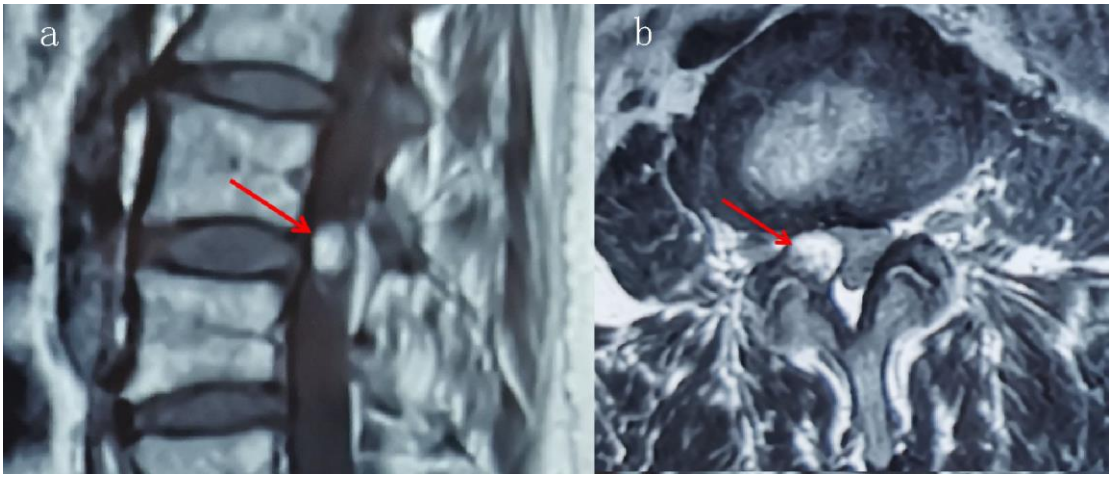

Figure 1: Plain MRI scan of the lumbar spine (a) showing abnormally high signal at the level of the lumbar 3-4 disc (b) showing compression of the right nerve root and dural sac, and stenosis of the intervertebral canal, occupying more than 40%

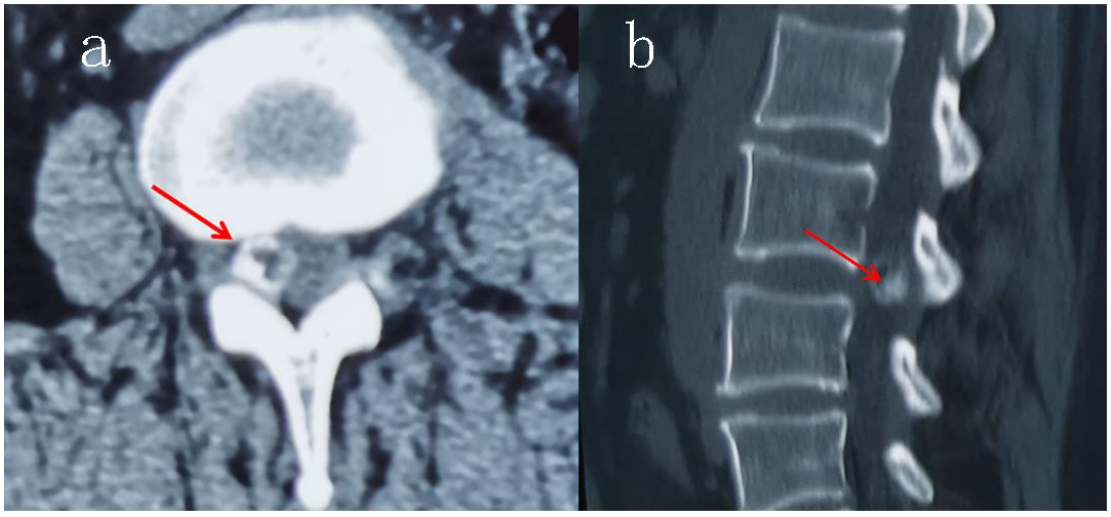

Figure 2 Plain CT scan of lumbar vertebrae (a) shows the lesion at the level of the right articular process, with clear boundaries and calcification, invading the right crypt (b) shows the growth of the apical cartilage cap into the spinal canal

The patient had a history of hyperthyroidism for more than 1 year and was treated with methimazole 10mg three times a day for a long time, with manageable symptoms. Physical examination (July 27, 2021) :Lumbar spine physiological curvature straighten, waist 3-4 spinous process, vertebral side pressure taps pain (+), the right leg medial, foot back inside hypoesthesia, bilateral iliopsoas muscle strength and quadriceps muscle power level 4, pretibial muscle group on the

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right side, tibialis posterior muscle group, first toe extensor muscle strength level 4, the left leg muscles before, tibialis posterior muscle group, first toe extensor muscle strength level 4 +, on the right side of the knee tendon reflex is abate, the left knee tendon reflection is normal, Bilateral Achilles tendon reflex did not elicit, bilateral straight leg elevation test (-), reinforcement test (-), bilateral femoral nerve traction test (-), bilateral Babinski sign negative, bilateral patellar clonus and ankle clonus negative. All specimens were obtained with the consent of the specimen donor and the approval of the Ethics Committee of The Heping Hospital Affiliated to Changzhi Medical College.

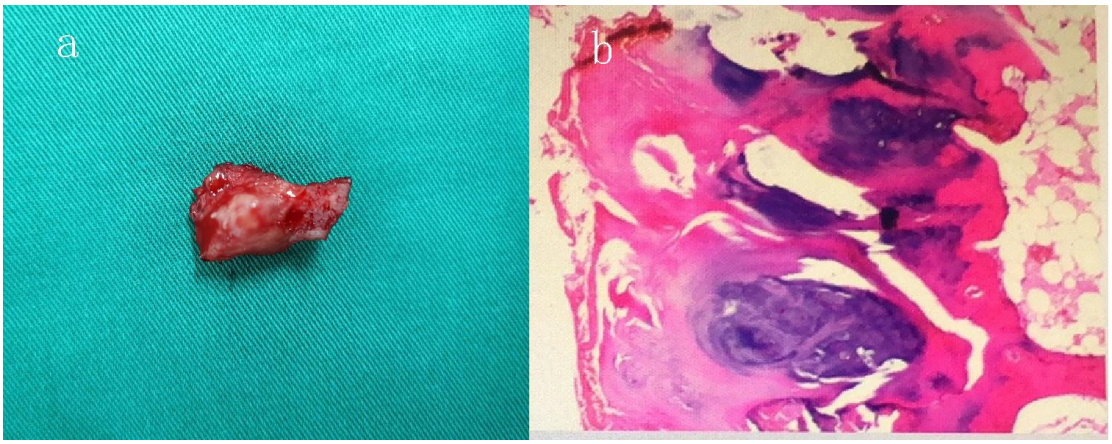

*Figure 3 Pathological tissue and its pathological report (a) shows a lump of gray bone tissue with a size of 2.8cm*1.1cm*1.5cm(b) shows the immunohistochemical results of the pathological tissue with a magnification of 400 times, which is consistent with osteochondroma*

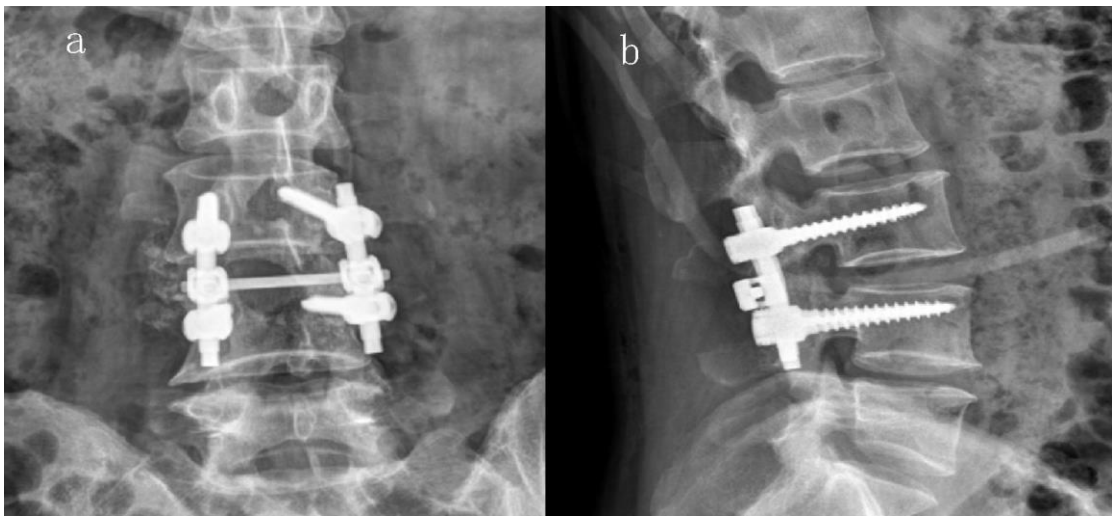

Figure 4 Anteroposterior and lateral lumbar vertebrae (a) shows the lumbar 3-4 intervertebral space is restored and there is curvature (b) shows the anteroposterior lumbar internal fixation is in good position

After admission, the preoperative preparation was actively improved, and the preliminary diagnosis was "lumbar osteochondroma". A posterior midlumbar incision was taken under general anesthesia, skin, subcutaneous tissue, deep fascia, paraspinal muscle was stripped, and both sides of lumbar 3-4 lamina, facet joint and transverse process root were exposed, and screws were inserted into the vertebral arch at both sides of L3 and L4.Get rid of the lumbar 3 spinous process and the right lower articular process joint and upper articular process joint of lumbar 4,remove the yellow ligament, show epidural group, intraoperative see oppression of the dural sac were placeholder organization and some adhesion, the right side of the L4 nerve root slant gray color, nerve root tension and independent pulsation is poor, carefully separate and exfoliate the adhesions between the dura mater and placeholder organization with a scraping spoon and nucleus pulposus forceps and remove it. See the dural sac slowly float. The right L4 nerve root was decompressed appropriately, and the right L4 nerve root recovered autonomously with moderate tension and good activity. The bone knife was used to remove part of the cortical bone of the left lumbar 3-4 lamina to expose the cancellous bone, and the gnawed bone was implanted back into the right transverse process and left articular process. The

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appropriate titanium rod and connecting rod were selected to fix the lumbar 3-4 vertebrae, and the surgical field was rinsed. A drainage tube was indwelled at the incision and the incision was sutured layer by layer. Postoperative specimens were observed by naked eye. Size: 2.5cm*2.0cm*1.5cm, hard, smooth surface, cartilaginous cap tissue can be seen. Pathology Report (August 3, 2021): Generally mushroom-shaped, with a thin fibrous sheath covering the pearly white cartilaginous cap, the thickness of the cartilage cap on the surface is different, some cells around the cap are less, and some chondrocytes are surrounded by rich hyaline cartilage matrix, the outermost layer of tissue is the perichondrium, which is composed of dense fibrous tissue. The overall structure appears as a disorderly growth plate, showing varying degrees of mineralization and irregular punctured or annular calcification. Consistent with osteochondroma (Figure 3).The patient's lumbar discomfort and pain in the right lower limb were completely relieved, and the X-ray internal fixation was in good position after review (Figure 4).

2.2. Discussion

Osteochondroma is a common benign primary bone tumor, usually caused by a developmental defect in the growth plate. It generally arises from osteochondroma near the ends of long bones. Osteochondroma can occur in any part of the bone, but most osteochondromas tend to occur in the knee area [5].Osteochondroma can develop during the growth period of the skeletal system [6].It is generally believed that osteochondroma stops increasing in volume at the end of bone growth [7].However, symptoms in adults are often associated with bone development.Osteochondroma is less likely to occur in the spine and is more likely to occur in men than women (M/F ratio :2.5/1).Data show that only 1.3%-4% of single osteochondromas occur in the spine, and 50% of the cases have lesions in the cervical spine, among which the axial vertebra is most often involved [6],the next most common site is the thoracic vertebra.Some studies have suggested that the microtrauma and displacement of growth cartilage in part of epiphyseal caused by greater stress caused by activity is an important reason for the high incidence of cervical and thoracic osteochondroma.Although the mobility of lumbar vertebrae is much higher than that of thoracic vertebrae, the incidence of lumbar vertebrae is low because the ossification center of lumbar vertebrae generally ossifies around 30 years old, later than that of cervical vertebrae and thoracic vertebrae [8].With age, the cartilage on the surface of osteochondroma will become thin, calcify or ossify, or even disappear [9].Intact cartilage caps are seen in only about 30% of patients.In this case, if the lesion occurred in the lumbar spine,Intraoperative cases with intact cartilage caps are rare.

Osteochondromas can occur in multiple or single cases.About 10% of osteochondromas are hereditary. Hereditary Multiple Osteochondromas (HMO) is inherited by autosomal dominance [10].The penetrance rate was about 96% in females and 100% in males.It is now widely suspected that HMO cases have somatic exotin-glycosyltransferase 1 (EXT1) or exotin-glycosyltransferase 2 (EXT2) pathogenic variants [11].A large number of studies have shown that the disease burden of patients with EXT1 pathogenic variant is higher than that of patients with EXT2 pathogenic variant, including more exogenous osteophytes, skeletal deformities and short stature.Individuals with EXT1 pathogenic variants may also have a higher risk of chondrosarcoma [12].However, this case was reported as a single osteochondroma.

X-ray assessment is usually used to diagnose osteochondroma in the extremities, whereas X-ray diagnosis of osteochondroma in the spine is more difficult.Some scholars believe that only 21% of osteochondromas of the spine can be diagnosed by X-ray film [6].X-rays do not provide much information about the relationship between the tumor and other structures.The lesion can only be shown on X-ray film with or without pedicled, the width of the base, whether the medullary cavity of the lesion is connected with the medullary cavity of bone, etc.Therefore, it is necessary to use CT and MRI to evaluate osteochondroma of the spine.CT or MRI can show the neural structure, spinal cord or nerve root compression and the relationship between the mass and surrounding tissues [13].In particular, MRI can assess the thickness of the cartilage cap, which is difficult to see on conventional radiographs. Therefore, CT and MRI are considered the most appropriate methods for the detection and evaluation of spinal osteochondroma disease [6,13,14].Osteochondroma should be highly suspected if imaging shows pedicled or unpedicled bony prominences, cortical and cancellous tissue attached to normal bone, and transparent cartilaginous shadows of irregular calcification and/or ossification at the apex. In addition, if there are cortical irregularities, popcorn calcification and increased cartilage cap thickness in the imaging examination, it should be highly suspected as malignant.

Osteochondropathy can be completely asymptomatic [15].A lot of people are found by accident on imaging tests.In general, asymptomatic lesions can be followed conservatively, and surgery can be

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considered when the diagnosis is unclear, if the patient is in pain or has progressive neurological dysfunction [16].The surgery requires the removal of the entire tumor bone, including the cartilage cap. The nerve function can be restored, and the possibility of tumor recurrence is minimal. In this case, posterior pedicle screw fixation was performed to avoid spinal instability after surgery.

Malignant transformation is rare in cases of osteochondroma. It is even rarer for a single osteochondroma to develop into a malignant tumor.It has been estimated that the malignant conversion rate of isolated osteochondromas at all tumor sites is about 1%, and that of multiple exogenous osteochondromas is 10-15%[7].If the cartilage cap thickness exceeds 3cm, malignant lesions should be suspected [11].If the lesion recurs after total resection, occurs after the skeletal system matures, or suddenly becomes painful as the lesion increases in size,we should be highly suspicious of malevolence. Thus, although osteochondromas are the most common benign bone tumors, they are rarely located in the spine. Asymptomatic osteochondroma of the spine can be followed radiographically. If neurological symptoms and pain occur, surgery may be necessary.It is important to note that osteochondroma of the spine needs to be differentiated from secondary chondrosarcoma.

Acknowledgements

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