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Case Report

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Adult Intradural Extramedullary Ewing's Sarcoma of the Lumbar Spine and Involving the Intervertebral Foramen: A Case Report

Xintong Chen[1,2,3]; Tao Xu[1,3]; Weixian Tian[1,3]; Hansong Sheng[1,3]*

[1]Department of Neurosurgery, The Second Affiliated Hospital and Yuying Children's Hospital of Wenzhou Medical University, Wenzhou, Zhejiang 325000, China.

[2]The Second School of Medicine, Wenzhou Medical University, Wenzhou, Zhejiang 325000, China.

[3]Wenzhou Municipal Key Laboratory of Neurodevelopmental Pathology and Physiology, Wenzhou Medical University, Wenzhou, 325035, PR China.

Abstract

Spinal intradural extramedullary Ewing's sarcoma (IEES) is very rare. Here, we report an adult IEES located in the lumbar spine and involving the intervertebral foramen. A 45-year-old gentleman presented with a one-month history of low back pain. The magnetic resonance imaging (MRI) and computed tomography (CT) showed occupation of the spinal canal and right intervertebral foramen at L4-5 levels. He underwent total laminectomy and pedicle screw internal fixation. Intraoperatively the tumor was localized in the intradural space of the spinal cord and invaded the right intervertebral foramen. Pathological and immunohistochemical examination suggested extraosseous Ewing's sarcoma (EES). Further molecular detection of the tumor showed the EWSR1 rearrangement, confirming the tumor as EES. Postoperatively, the patient received chemotherapy. No recurrence, metastasis, or failure of internal fixation were noted at a 7-month post-surgery examination. We presented this rare case of adult spinal IEES invading the foramen intervertebral spine and reviewed relevant literature in the hope of providing some insight into the diagnosis and treatment of this disease.

Keywords: Ewing's sarcoma; Spinal cord neoplasms; Intradural extramedullary; Intervertebral foramen.

Introduction

EES belongs to the Ewing's sarcoma family of tumors (ESFT). ESFT shares a common aberrant fusion and is distinguished into several subtypes based on cellular differentiation and anatomic location, namely Ewing's sarcoma of bone (ESB), EES, primitive neuroectodermal tumor (PNET), and Askin tumor [1,2]. Compared to the second most common bone tumor, ESB, EES has a lower incidence rate, a higher average age of onset, and is more likely to arise in axial locations [3-5]. The paravertebral region is a relatively rare location for EES, and tumors almost arise from extradural paraspinal soft tissue in this region [6]. Therefore, IEES is extremely rare and constitutes only 2.9% of all perispinal Ewing's sarcoma in adults [6,7]. What's more, IEES with involvement of the intervertebral foramen makes the case even rarer. In this article, we report an adult IEES in the lumbar spine and involving the intervertebral foramen.

Case report

A 45-year-old gentleman presented with lower back pain in early June 2022. The symptoms worsened after about half a mon-

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Correspondance: *Hansong Sheng, Department of Neurosurgery, The Second Affiliated Hospital and Yuying Children's Hospital of Wenzhou Medical University, Wenzhou, Zhejiang 325000, China.*

Email: shenghansong@126.com

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th, when he experienced discomfort in the right lower extremity (no lower extremity pain), and was seen at a local hospital. MRI showed irregular clump-like shadow in the L4/5 right intervertebral foramen, about 26 mm × 37 mm × 44 mm, and it protruded into the spinal canal. T1-weighted imaging (T1WI) showed equal signal, T2-weighted imaging (T2WI) and T2-weighted imaging with fat suppression (T2WI-FS) showed mixed hypersignal shadow (Figure 1a-b). In early July of the same year, the patient was admitted to our hospital with pain in his lower back and right lower limb. Local bone resorption of the L4 vertebral body and sclerotic edges can be seen on CT scan (Figure 2). No significant abnormalities were seen on chest CT scan. Contrast-enhanced MRI (CE-MRI) revealed a mass of about 45×42×23 mm in the spinal canal and right intervertebral foramen at the L4/5 level with intense contrast enhancement (Figure 1c).

The patient underwent neuraxial tumor resection and internal spinal fixation under general anesthesia. Under the positioning of the C-arm machine, L3-4 laminas were disconnected and the L4-5 upper articular processes were excised. After longitudinal incision of the dura, the tumor was found located subdural and grew into the L4-5 intervertebral foramen, about 4×4 cm with clear margin and incomplete capsule (Figure 3a). The tumor was removed in blocks under neuroelectrophysiological supervision, and the incision of the dural sac was sutured continuously. Connecting plates were used to fix the repositioned L3-4 laminas. L3-5 were fixed with pedicle screws, and the transverse processes were implanted with bone mud and bone chips. An X-ray fluoroscopic machine showed appropriate positions of the lumbar pedicle screws (Figure 3b), then the screw connecting rod was connected and locked. The drainage tube was inserted, the skin and subcutaneous tissue were sutured layer by layer.

Immunohistochemistry revealed: CD99(+), FLI-1(+), Vim(+), INI-1(+), S-100(partly+) Ki-67(+20%), CD56(partly+), Syn(-), CgA(-) , CK(-), SOX-10(-), SMA(-), GFAP(-), CD45(-), Desmin(-), CD34(-), WT-1(-), SSTR2(-), and H3K27M(-). Postoperative pathology of the tumor tissue revealed small round cell malignancy, and the pathological diagnosis was EES (Figure 4). Molecular detection showed positive for t(22q12) (EWSR1), confirming the diagnosis of Ewing's sarcoma.

The patient received 3 sessions of chemotherapy one and a half months after surgery. The chemotherapy regimen is alternating VDC (vindesine, doxorubicin, and cyclophosphamide) and IE (etoposide and ifosfamide), once a month. Seven months after surgery, CE-MRI showed that the L3-5 vertebral body and adnexal internal fixation were in place, and there was no abnormal strengthening in the spinal canal. The patient then continued to receive chemotherapy 3 times with the same regimen as before.

Discussion

Reviewing the literature, nearly 50 cases of IEES has been reported from 1997 to 2022 [5-21]. IEES usually affects the lumbar/sacral region as in our case [12]. The symptomatology is similar with other space-occupying lesion of the spinal cord, influenced by mass effect or invasion of adjacent structures, and the chief complaint is pain as in our case [1,5,12,14,22]. Such clinical manifestations are difficult to distinguish from other intraspinal tumors and may even be ignored by patient at early stage [6,10]. Thus, diagnosis of these neoplasms is delayed. In our case, the symp-

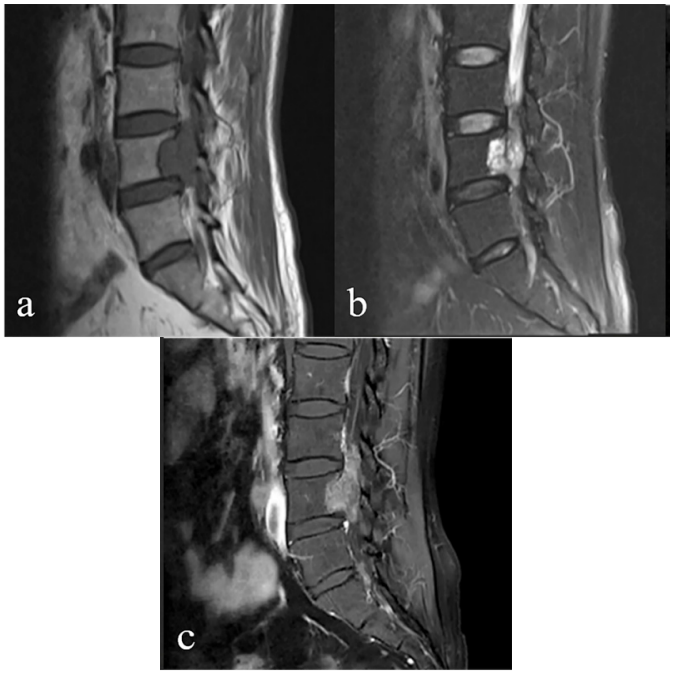

Figure 1: MRI showed irregular clump-like shadow in the L4/5 right intervertebral foramen and the spinal canal.
(a) T1WI showed equal signal. **(b)** T2WI-FS showed mixed hypersignal shadow. **(c)** CE-MRI showed an intensely enhanced lesion.

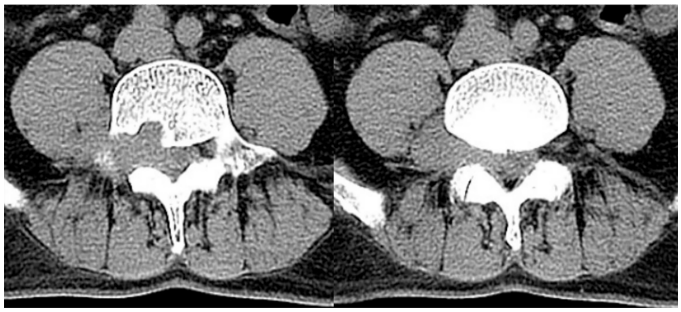

Figure 2: CT showed a slightly dense shadow of the L4/5 planar spinal canal and right intervertebral foramen. Local bone resorption of the L4 vertebral body and sclerotic edges were seen on CT.

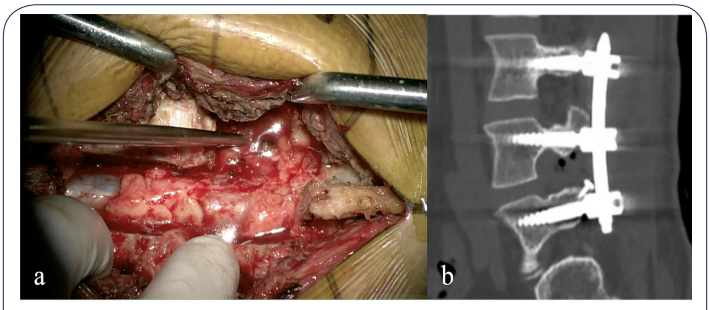

Figure 3: (a) Intraoperative picture showing lesion intradural and grew into the intervertebral foramen.
(b) X-ray fluoroscopic machine showed appropriate positions of the lumbar pedicle screws.

tom duration was at least one month, while the average duration of the chief symptoms was 3 months [12].

Even if the imaging findings lack specificity, MRI is the preferred choice for tumor assessment in ESFT, including EES [1,10]. MRI reveals iso-signal intensity on T1WI, hypersignal intensity corresponding to necrosis or cystic change on T2WI, and irregular enhanced signaling after gadolinium administration [1,10,14]. Additionally, cortical erosion and periosteal reaction are seen in 40% of cases of EES as in our case [1]. Chest CT are sensitive for detecting lung and other distant or nodal metastases [1]. However, in previous literatures, masses were mostly seen only in the spinal canal [5,6,10,12,22]. In our case, the mass was not only found in the spinal canal, but also in one side of the intervertebral foramen.

The diagnosis of EES usually relies on postoperative pathological examination. On gross examination, the fish-like round mass was seen at operation in our case, and it extended to the intervertebral foramen, invading the spinal cord and nerve roots. Prior to our case, this rare manifestation of large-scale and intervertebral foramen invasions had only been reported in very few IEES cases [8]. Microscopically, the tumor shows large irregular sheets of small round blue cells with scant clear or eosinophilic cytoplasm and minimal extracellular matrix as in our case [2,10]. However, small round blue cells also occur in other tumors like lymphoma and rhabdomyosarcoma [1,10]. Therefore, further differentiation is needed through immunohistochemistry.

A spectrum of immunohistochemical markers is used to study EES [3]. Diffuse membranous expression of CD99 is characteristic for Ewing sarcoma (~95%) [2,5,23,24]. CD99 lacks specificity, however, as it also expressed in other primitive neuroectodermal tumors [23]. Friend leukemia integration 1 (FLI1) is highly expressed in cases of Ewing sarcoma with EWSR1-FLI1 gene fusion and has relatively higher specificity than CD99 [2,3,23]. Besides, vimentin (Vim) also diffusely expressed in these tumors [23]. The patient in our case showed positive for CD99, FLI1, Vim, indicating a favored diagnosis of EES.

At genetic level, reciprocal translocation t (11;22) (q24;q12) of the EWSR1 gene on chromosome 22 with the FLI1 gene on chromosome 11 occurred in more than 85% of all ESFT cases [1,10,12]. Such translocation results in the EWSR1-FLI1 fusion gene acting as an oncogenic transcription factor in ESFT [25]. The remaining few cases contain fusions of the EWSR1 gene or FUS gene with other ETS gene family members [26]. The patient in our case took molecular detection and revealed positive for t(22q12) (EWSR1), consistent with literature reports.

Treatment for spinal EES is difficult and currently not unified due to the sparsity of literature and cases [10]. Surgical resection is usually the initial intervention for EES in adults, especially for the relief of spinal cord compression symptoms and cytoreductive purposes [25]. Due to the large extent of the lesion and the involvement of intervertebral foramen, our patient underwent posterior total laminectomy, took the screw-rod system fixation and partly bone grafting. The internal fixation not only ensured complete tumor removal, but also stabilized the spine and promoted bone graft fusion [27,28]. Chemotherapy regimens are identical for EES and ESB, including vincristine, doxorubicin, and cyclophosphamide alternating with ifosfamide and etoposide [1].

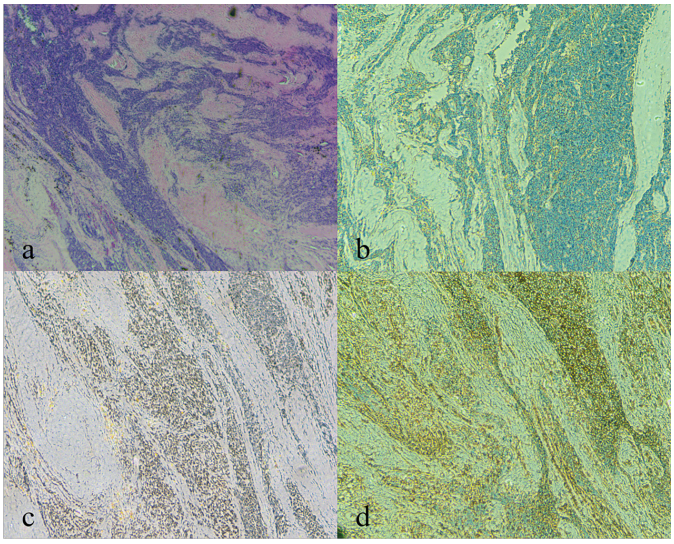

Figure 4: (a) H&E stain within the tumor showed the small round blue cell appearance (magnification ×40). Immunostaining was positive for **(b)** CD99, **(c)** FLI-1, and **(d)** Vim (magnification ×100).

In our case, the patient received chemotherapy once a month after surgical resection. Besides, radiotherapy is used in patients with unresectable primary lesions, inadequate surgical margins, or poor response to chemotherapy [1].

IEES has a high propensity for local recurrence and distant metastasis [14]. Relative studies showed a median progression free survival (PFS) of 12 months and median overall survival (OS) of 14 months for spinal IEES [12]. In our case, the patient was re-examined 7 months after surgery and showed no obvious signs of recurrent metastasis.

Conclusion

we provided an extremely rare case of adult IEES in the lumbar spine and involving the intervertebral foramen. We also reviewed relevant literature regarding its epidemiology, diagnosis, treatment and prognosis. Given the nonspecific clinical symptoms, imaging manifestations, and highly progressive nature of spinal EES, physicians should take the diagnosis of this type of tumor into serious consideration, despite of their low incidence. Surgical resection is still the initial intervention of the disease. We presented a surgical option that combined total laminectomy with pedicle screw internal fixation due to the large extent of the lesion.

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