Intradural Extramedullary Ewing's Sarcoma Recurrence with Acute Clinical Presentation and Literature Review

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SUMMARY – *The intradural extramedullary space is an extremely unusual site for the onset of Ewing's sarcoma. We describe a case of recurrence of intradural extramedullary Ewing's sarcoma and review the literature available on this topic.*

Introduction

The intradural extramedullary space is an extremely uncommon site for Ewing's sarcoma (ES), and very few case reports have documented such involvement. The aim of the present paper was to describe imaging and clinical findings as well as the history of a patient with recurrent intradural extramedullary ES, and review the literature available on this topic.

Case Report

A 44-year-old woman with acute paraplegic syndrome and no history of trauma was admitted to a local emergency unit. Computed tomography (CT) of the lumbar spine disclosed a hypodense mass in the spinal canal at L1-L2 level. The CT scan showed no osteolytic or osteosclerotic changes in the vertebrae.

The patient was referred to our hospital for neurological examinations and care, and underwent neurological evaluation and MRI of the whole spine at 3 T. MRI displayed a large mass developing inside the vertebral canal and com-

pressing the spinal cord at mid-thoracic level (T6-T7) (Figure 1). In addition, several smaller lesions were detected involving the lower spine, at both thoracic and lumbar levels (Figures 1-3). All lesions were intradural extramedullary, and showed medium to low signal intensity on T2-w images; a hypointense capsule surrounding the major thoracic lesion was also identified. After gadolinium injection, the lesions were highlighted with diffuse and homogenous contrast enhancement on T1-w images. Due to compression of the spinal cord, the clinical situation required urgent neurosurgery. The pathologic examination established a diagnosis of intradural extramedullary ES (Figure 4).

The patient's history included breast cancer seven years earlier (treated with mastectomy followed by six-cycle adjuvant chemotherapy), and a primitive intradural extramedullary ES discovered exactly thirty-one months before the acute presentation of its recurrence, as described above. The woman was referred for imaging for lower limb pain, and the primitive tumor was found as an intradural extramedullary neof ormation at lumbar level (L4-L5). At that time, whole-body staging did not detect any other site of disease and the patient un-

Figure 1 3 T MRI of the spine. Sagittal fast spin echo (FSE) T2-w plain images (A – thoracic, C – lumbar) and FSE T1-w images obtained after gadolinium injection (B – thoracic, D – lumbar) show a large mass compressing the spinal cord at T6-T7 and some smaller lesions at L1-L2 level (white arrows). All lesions involve the intradural extramedullary space; they present medium to low signal intensity on T2-w images and diffuse and homogenous contrast enhancement. A,B) A hypointense capsule characterizes the major thoracic lesion.

Figure 2 A) Sagittal FSE T2-w plain images identify further small intradural extramedullary lesions within the canal. B) These are better enhanced after gadolinium contrast agent on FSE T1-w (white broken arrows).

derwent surgery. After laminectomy, the mass appeared with a capsule and a complete resection was performed. Three months later, no sign of persistence or recurrence of the disease was observed; positron emission tomography (PET) revealed a slight and diffuse uptake of ^{18}F -fluorodeoxyglucose over the lumbar area, and this was attributed to post-surgery inflammation. However, adjuvant therapy was started with combined chemotherapy (vincristine, cyclophosphamide, adriamycin, ifosfamide and etoposide) and radiation therapy on the lumbar region (multiple fields with a total dose of 5400 cGy). Clinically, the patient had mild

lower back pain (irradiating to left lower limb) after surgical intervention; symptoms slightly increased after radiation therapy. The subsequent clinical and imaging follow-up (MRI and PET as well as other oncologic markers) did not reveal any recurrence of the disease (Figure 5) until the patient entered the emergency unit.

Discussion

Ewing's sarcoma (ES) is a very uncommon malignancy that characteristically presents as an undifferentiated pediatric bone tumor with

soft-tissue extension. Between 1973 and 2004, the incidence of ES in the US population was 2.93 per 1 million. This tumor usually affects white populations, and has a slight male predominance (especially in older patients). Adult ES is a very rare condition with fewer than five per cent of cases presenting in patients over the age of 40 years. About a quarter of patients with ES have detectable metastases at diagnosis; the most common sites for metastasis from ES are lungs (50%), bone (25%), and bone marrow (20%)^{1,2}. The spinal column is the affected site in only 3.5-7% of cases³.

Although James Ewing described the disease for the first time in 1921 as an osteolytic lesion, a malignant, small, round-cell tumor of the bone, in 1969 Tefft et al. recognized the first series of patients with soft-tissue tumors that histologically resembled ES, but with no clear osseous involvement. The neoplasm originated from uncharacterized mesenchymal cell with histological features similar to primary osseous ES^{4,5}. Extrasosseous ES represent only 16 per cent of all cases; moreover, they account for less than 1% of ES arising in adults². The disease has only rarely been noted to primarily involve the central nervous system. The five-year survival rate of extrasosseous ES has been reported between 38% and 67%, while the rate dropped to 0%-37.5% when the spine is involved³. Concerning the spine, extrasosseous ES is mainly found in the paravertebral regions and epidural space^{3,6}.

On the other hand, spinal cord tumors are also rare and affect only a minority of the population. They are classified based on their anatomic location in relation to the dura mater and spinal cord as epidural, intradural extramedullary or intradural intramedullary. ES primarily involving these sites is extremely rare and available literature is limited to less than seven cases reported in the whole scientific literature^{3,6-9}. A partial resection of the ES mass seriously affects the prognosis of the patient and local recurrence. The surgeon's expertise and a careful recognition of the tumor plane are essential to

remove the tumor while retaining neurological functions and to obtain the optimal prognosis (Figure 5)³. Primary intradural central nervous system ES shares imaging and histopathological features with central primitive neuroectodermal tumors. However, establishment of the right diagnosis is crucial⁹.

This report represents one of the very few papers describing primary intradural extramedullary ES. Further cases have been described in which spinal intradural extraosseous lesions were metastases from ES originating elsewhere in the body^{3,6-9}. This is the only case focused on skip lesions and the potential acute presentation of recurrent disease. Imaging appearance and findings have been fully provided and enhanced at 3 T MRI (Figures 1-3), since they are almost completely missing in previous reports.

In the history of our 44-year-old patient, none of the follow-up examinations performed, including tumor markers, PET imaging, and MRI at 1.5 T showed any relapse of the disease. Nevertheless it is important to consider that MRI of the whole spine should be mandatory in the follow-up of this disease because skip lesions may occur and represent the only site of relapse. High field MRI with the utmost anatomic detail and contrast-enhanced sequences should also be considered of paramount importance, since some small lesions may not be detectable at lower field MRI or PET (Figure 3).

Conclusions

Primary intradural extramedullary ES is an extremely rare malignancy confined to case reports. This tumor may present or relapse with skip metastases. Skip intradural extramedullary lesions may have acute paraplegic clinical presentation. Conventional MRI, PET and other oncologic markers may be not sufficient in the early detection of recurrence. MRI follow-up should include high anatomic detail, contrast enhancement sequences and evaluation of the whole spine.

Figure 3 A) Sagittal FSE T2-w plain images of the lumbar spine at 3 T provide excellent anatomic details and spatial resolution and detect up to very small lesions (white broken arrows). B) Contrast enhancement of lesions on the coronal plane (FSE T1-w).

Figure 4 Resected mass – Ewing's sarcoma skip intradural extramedullary metastasis. The tumor is composed of uniform round cells with a solid, lobular pattern (hematoxylin-eosin, low-power view). Inset: strong membranous CD99 immunoreactivity (high-power view).

Figure 5 A) CT scan (multiplanar sagittal reconstruction). B) 1.5 T MRI (FSE T2-w images. C) Contrast-enhanced FSE T1-w images with fat saturation after surgical resection of primitive lumbar intradural extramedullary Ewing's sarcoma.

References

- 1 Balamuth NJ, Womer RB. Ewing's sarcoma. *Lancet Oncol.* 2010; 11 (2): 184-192.
- 2 Hurie J, Sariego J. Extraosseous Ewing's sarcoma. *Am Surg.* 2009; 75 (12): 1255-1257.
- 3 Kim SW, Shin H. Primary intradural extraosseous Ewing's sarcoma. *J Korean Neurosurg Soc.* 2009; 45 (3): 179-181.
- 4 Ewing J. Diffuse endothelioma of bone. *Proc NY Pathol Soc.* 1921; 7: 17-24.
- 5 Tefft M, Vawter GF, Mitus A. Paravertebral "round cell" tumors in children. *Radiology.* 1969; 92: 1501-1509.
- 6 Vincentelli F, Caruso G, Figarella-Branger D. Primary intradural Ewing's sarcoma of the cauda equina presenting with acute bleeding. *Acta Neurochir.* 2010; 152 (3): 563-564.
- 7 Hareesh KP, Chinikkatti SK, Prabhakar R, et al. A rare case of intradural extramedullary Ewing's sarcoma with skip metastases in the spine. *Spinal Cord.* 2008; 46 (8): 582-584.
- 8 Uesaka T, Amano T, Inamura T, et al. Intradural extramedullary spinal Ewing's sarcoma in childhood. *J Clin Neurosci.* 2003; 10 (1): 122-125.
- 9 Karikari IO, Mehta AI, Nimjee S, et al. Primary intradural extraosseous Ewing sarcoma of the spine: case report and literature review. *Neurosurgery.* 2011; 69 (4): E995-999.

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