

Case Report

Primary Ewing's sarcoma of the renal pelvis in an adult: a rare case report and literature review

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Abstract: Ewing's sarcoma/primitive neuroectodermal tumor (ES/PNET) is a malignancy that is likely to occur in the bone during childhood and adolescence. Extraskeletal Ewing's sarcomas (EES) have been reported in soft tissue of the sides of the vertebra, isthmus faucium, paranasal sinus, abdominal aorta area, and other areas, but it is very rare for it to arise from the renal pelvis in clinical cases. We herein report a case of a 39-year-old female undergoing pregnancy with symptoms of gross hematuria and slight soreness in the right flank. Radiology showed a mass in the right renal pelvis with moderate hydronephrosis. Radical nephroureterectomy was performed, and the condition was diagnosed as primary ES/PNET based on examination of pathology and cytogenetics, and postoperative chemoradiotherapy was not performed immediately owing to a frail body and the newborn. Currently, the patient is recovering well without recurrence or metastasis within the four-month postoperative follow-up period. According to existing literature, this is the second reported case of ES/PNET in the renal pelvis but the first reported case in a pregnant patient.

Keywords: Ewing's sarcoma, renal pelvis, radiological characteristics, pathological features

Introduction

ES/PNET is a dangerous malignancy derived from primitive neuroectoderm with biological aggression and poor prognosis, and abnormal upregulation of insulin-like growth factor 1 (IGF1) is a chief factor in cell proliferation [1, 2]. EES are a place in the soft tissue of the high-grade, malignant small round cell sarcoma, accounting for only 1.1% of malignancy in soft tissue, which have been discovered in the soft tissue of the vertebral side, isthmus faucium, paranasal sinus, pelvic, abdominal aorta area, and other areas [3], but those arising from the renal pelvis are particularly rare. The diagnosis of EWS/PNET is predominantly based on a classical histology of primitive small round cells, strong CD99 immunoreactivity as measured using immunohistochemistry, accompanied by specific changes to the EWSR1 gene [4]. Unfortunately, there are currently no known specific radiographic manifestations of ES/PNET of the renal pelvis. The purpose of our report is to facilitate better imaging diag-

nosis and clinical treatment for ES/PNET in renal pelvis.

Case presentation

A 39-year-old woman was found to have a mass in her right renal pelvis during regular prenatal examination at a local hospital ultrasound and radiology department. This patient subsequently presented with gross hematuria and slight soreness of the right flank area in the following months. The patient was then brought into the Nephrology Department of our hospital for further investigation. Physical examination, blood chemistry, and routine blood tests were within normal ranges. The lesion was revealed to be ill-defined hypoechoic mass accompanied by moderate blood flow signal in ultrasonography. Early abdominal magnetic resonance image (MRI) indicated an irregular 2.6 × 2.5 cm lesion. It was isointense on fat-suppression T2 weighted image (FST2WI), hypointense on T1WI (**Figure 1A, 1B**) but visibly hyperintense on DWI, occupying the dilated right renal pelvis. Sub-

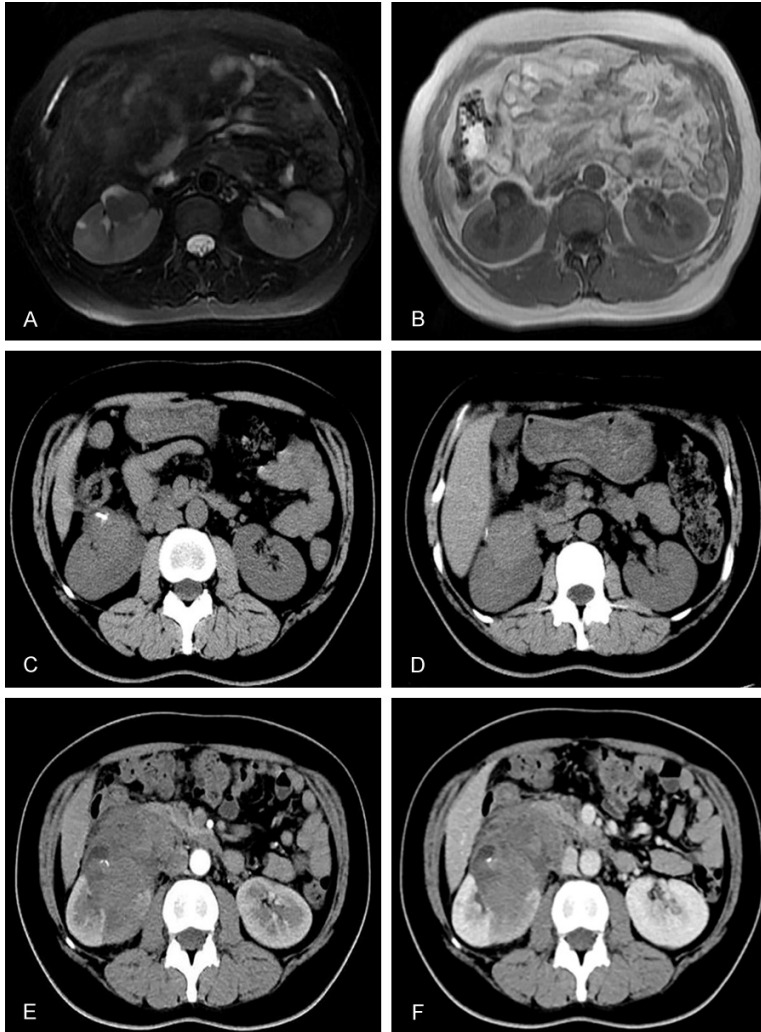


Figure 1. Early MRI indicated (A) the mass of right renal pelvis to be homogeneous irregular isointense on FST2WI and (B) heterogeneous intense on T1WI with focal hemorrhage areas. (C, D) An unenhanced CT scan indicated an ill-defined hypodense mass of 38 HU with strip-like calcification one month after cesarean. (E, F) Cortical and parenchymal phase CT images demonstrated an obviously enlarged, slightly enhancing soft-tissue attenuation mass with obscure margin infiltrating surrounding tissues, organ in the next month's CT review.

sequently, the patient underwent cesarean delivery. An unenhanced computed tomography (CT) scan was performed demonstrating a 5.0 cm in diameter irregular homogeneous hypodense mass with 38 HU and palpable concomitant of calcification one month after cesarean (Figure 1C, 1D). The lesion was subsequently exophytic to invade surrounding tissues, organ, and encase right renal artery branch complemented by moderate hydronephrosis in the next month's CT review. The firm ingredients showed moderate heterogeneous enhance-

ment confirmed by about 30 HU to 54 HU in pre- and post-enhanced CT images, respectively (Figure 1E, 1F), and there were no significantly enlarged lymph nodes in the retroperitoneal area. In general, the mass increased by an average of 5 cm in diameter, presenting with rapid growth after cesarean section. PETCT examination showed no evidence of distant metastasis. The open, right radical nephroureterectomy with ligation of the ureteral stump and lymphadenectomy were conducted 2 months after the end of parturition.

Gross examination showed an irregular, solid 7 × 6 × 5 cm mass gray-white in color with partial gray-red accompanied by cystic cut surface and local necrosis. There was no apparent involvement of renal parenchyma on visual inspection of incisional kidney specimen. Microscopy displayed small round cells tumor with the deeply stained nuclei (Figure 2A) that arose from the right renal pelvis on hematoxylin-eosin (HE) staining, infiltrating into the whole layer of the renal pelvis with focal involvement of renal parenchyma but without implicating the lymph nodes. Immunohistochemistry showed positive results for CD99

(Figure 2B), Fli-1 (Figure 2C); focal Syn, Ki-67 of 30%; negative for CD34, CK-pan, LCA, Desmin, EMA, D2-40, GATA3, and S-100. The gene locus-specific probe-Ewing's sarcoma breakpoint region 1 (GLP-EWSR1) also indicated breakage and recombination in the EWSR1 gene (Figure 2D). According to classical pathological and cytogenetical profile, a diagnosis of ES/PNET in the renal pelvis was rendered. Post-operative chemoradiotherapy was not immediately implemented because the patient's poor general condition. The patient was found to be

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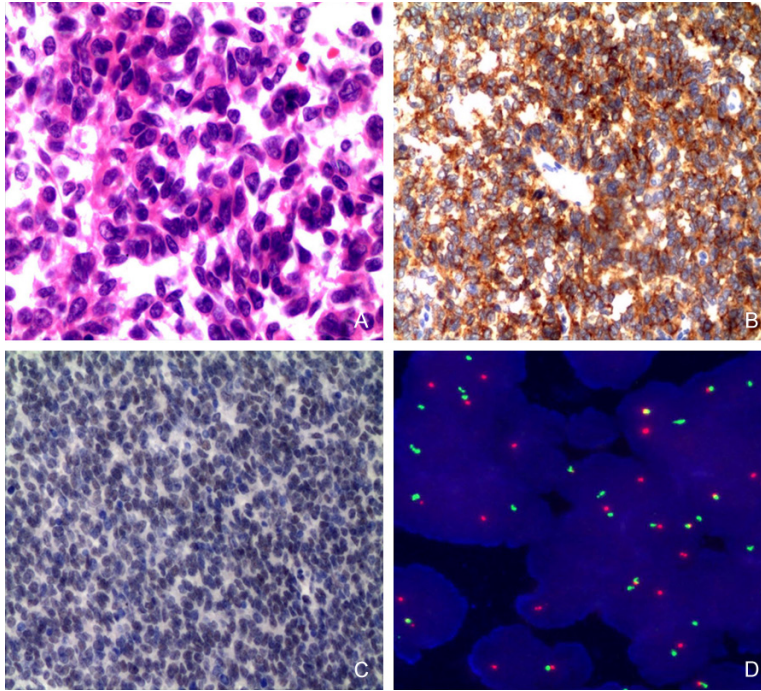


Figure 2. Microscopic image displaying the uniform small round cells tumor with deeply stained nucleus (hematoxylin-eosin staining, $\times 200$, A). Immunohistochemical staining reveals positive for CD99 ($\times 200$, B) and Fli-1 ($\times 200$, C). Fluorescence *in situ* analysis using GLP-EWSR1 shows more than 10% of the cells with a red-green-yellow signal prompting rearrangement of EWSR1 gene ($\times 100$, D).

tant metastasis and local recurrence [1]. Histologically, a characteristic small round cell tumor may show a representative Homer-Wright daisy-shape in some cases. Our case was partially suspected of pseudo rosettes. Immunohistochemistry showed high expression of CD99, no expression of WT-1, different degrees of expression of synaptophysin, LEU-7, vimentin, Syn, NSE, S-100, and visible CK in ES/PNET cells. Furthermore, positive expression of Fli-1 had a high degree of sensitivity and specificity for ES/PNET. T (11;22)(q24;q12) translocation generating a EWSR1-FLI1 fusion gene was viewed in 85%-90% of ES/PNET by genetic testing [1, 3, 10]. The results in present case showed positive for CD99, Fli-1 and rearrangement of EWSR1 gene, which was typical for ES/PNET relatively.

doing well, without recurrence or metastasis, after 4 months of postoperative follow-up.

Discussion

The incidence of primary sarcoma in the renal pelvis is extremely low, including the described rare leiomyosarcoma, rhabdomyosarcoma, and cystic embryonal sarcoma [5-7]. Zhihong Liu [8] reported that the world's first renal pelvis ES/PNET in 2014, which is by far no more than 5 cases according to literature. Precise, early diagnosis is essential because different treatments are implemented for different tumors. Most patients with ES/PNET of the urinary tract have nonspecific symptoms such as hematuria, flank pain, dysuria, fever, dizziness, weight loss, a palpable mass and others [9]. The current case share similarities with ES/PNET of the kidney and the first reported case in renal pelvis clinically, excepting the patient's different age and gender. Applebaum [3] found that EES had a bimodal distribution of older than 35 years or younger than 5 years and the mean age of renal PNET was usually 30.4 years old, with 61% of male predominance and 50% incidence of dis-

Although there are no known specific radiographic manifestations of ES/PNET of renal pelvis mimicking urothelial carcinoma (UC), or hamartoma, teratoma, or renal cell carcinoma (RCC) when involving the renal pelvis. We emphasize here that imaging examination is a necessary method of staging and differential diagnosis, and it is beneficial to confirm the nature of the tumor, whether there has been a metastasis or invasion of adjacent tissues, and for making the final therapeutic strategies. Somarouthu [11] reviewed 26 cases of EES patients from 1999 to 2011 and discovered that the mean diameter was 9 cm in images and the most common primary sites were the torso and extremities. Tumors were almost isodense on CT, isointense on T1WI and hyperintense on T2WI. Necrosis, hemorrhage and invasion of adjacent organs appeared but without calcification that accounted for only 10% in EES [12]. Our case presented iso-hypodense on CT, iso-intense on FST2WI and heterogeneous intense on T1WI with focal hemorrhage areas, which is basically consistent with above reports. Furthermore, it showed a tendency to rapidly infiltrate margins and invade the adja-

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cent structures within two months after cesarean delivery, which may be due to the poor postpartum constitution. Therefore, the ultimate survival time of current case requires continuous follow-up and further study of large sample data are needed to trace about survival rate, recurrence rates of renal pelvis ES/PNET.

The differential diagnosis for renal pelvis ES/PNET includes UC, amyloidosis, endometriosis, fibroepithelial polyp, other soft-tissue sarcomas, lymphoma, inflammation, and other signs. UC is characterized by a mass lesion or thickening of the wall. CT typically shows enhancement of soft tissue attenuation, and a sessile filling defect on the excretory phase. Ureteral endometriosis is usually seen in reproductive women, and it often occurs in the distal third of the ureter. Most cases are accompanied by other pelvic foci of endometriosis. MRI reportedly shows some typical features corresponding to hemorrhagic or cystic foci [13]. Amyloidosis is characterized by abnormal deposition of protein and protein derivatives, and the lower ureter is the most continually involved site. It often shows a thickened wall, calcifications, intra-ureteral filling defects, and stricture, with slight enhancement on CT [14]. MRI findings show a hypointensity on T2WI ureteral amyloidosis. Preoperative diagnosis is difficult because ES/PNET presents with symptoms and radiological features similar to urothelial carcinoma (UC) or renal cell carcinoma (RCC) if the kidney is involved, with only rare morbidity. Hence, the diagnosis is ultimately based on pathological features. CT-guided fine needle aspiration biopsy and ureteroscopic biopsy are still important for determining the exact preoperative diagnosis [15, 16]. Given the rarity of this pathogenic site, there are no consistent views of treatment modalities about ES/PNET of renal pelvis. although surgical resection with chemotherapy or radiotherapy may be the preferential treatment for ES/PNET in kidney to improve survival rate [1, 17]. Scientific research system and long-term follow-up data are indispensable to the implementation of accurate treatment strategies for ES/PNET in the renal pelvis.

Finally, ES/PNET should be considered as a differential diagnosis of renal pelvis mass with malignant traits. Very few case reports in literature make this situation still crucial.

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Disclosure of conflict of interest

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