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Case report

A rare, highly aggressive primitive neuroectodermal tumor of the kidney: Case report and literature review

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ABSTRACT

We report a case of a 14-year-old boy who initially suffered from a sudden onset of abdominal pain for 2 weeks with a protrusive soft mass over the left upper abdomen. No obvious symptomatic symptoms or body weight loss were observed. However, early lung metastasis was detected after an initial computed tomographic examination. Even after we performed salvage *en bloc* resection of the huge retroperitoneal tumor after primary neoadjuvant chemotherapy, the final outcome was still poor. A diagnosis according to radiologic findings was uncharacteristic. Finally, a pathologic diagnosis based on histologic and immunohistochemical results revealed a rare renal peripheral primitive neuroectodermal tumor.

1. Introduction

A primitive neuroectodermal tumor is one of a remarkable group of tumors that originate in cells from the primitive neural crest, share the same reciprocal translocation between chromosomes 11 and 22, and show the same patterns of biochemical and oncogenic expressions. Some primitive neuroectodermal tumors occur in the brain while others [peripheral primitive neuroectodermal tumors (PNETs)] occur at sites outside the brain such as in the extremities, pelvis, chest wall, and retroperitonium. Here, we present a case of a 14-year-old boy with a renal PNET and lung metastases.

2. Case report

A 14-year-old boy suffered from a sudden onset of abdominal pain for 2 weeks. A physical examination showed a protrusive soft mass over the left upper abdomen with tenderness. Besides a poor appetite recently, he denied fever, vomiting, diarrhea, or body weight loss. The abdominal echo revealed a huge mass of about 16.7 × 17.1 cm in the left retroperitonium. Abdomen computed tomography (CT) showed a huge renal tumor with suspicion of direct invasion of the spleen, pancreas body, and tail (Fig. 1) in combination with lung metastases (Fig. 2). Under the impression of a left huge renal tumor with multiple lung metastases, an incisional biopsy of the left renal tumor was done, and the pathology revealed a PNET. Initially, the patient received neoadjuvant treatment according to the protocol consisting of vincristine, actinomycin D, ifosfamide, and adriamycin beginning on January 2, 2007. Thereafter, treatment was shifted to a VAI (vincristine, actinomycin D, and ifosfamide) regimen until March 2007. However, an abdominal CT on May 4, 2007 after four cycles of VAI revealed an increasing size of the renal tumor. Because the VAI protocol had a poor effect, chemotherapy was then shifted to VIP (vincristine, ifosfamide, and cisplatin). After two cycles of VIP chemotherapy, the bilateral lung lesions regressed (Fig. 3), and partial regression of the left renal PNET (Fig. 4) was noted on a follow-up CT scan in June 2007. Finally, we performed salvage *en bloc* resection of the huge retroperitoneal tumor after primary neoadjuvant chemotherapy. The operative findings showed a huge retroperitoneal tumor with severe adhesion to the retroperitoneal space. Grossly, the tumor of 12 × 19 × 20 cm was located over the upper pole of the left kidney (Fig. 5), and heterogeneous and cystic components with blood clots were also noted. The pathology showed a highly specific cluster of differentiated CD 99 (Fig. 6), and the special stain finally confirmed the diagnosis of PNET. Postoperatively, the patient received

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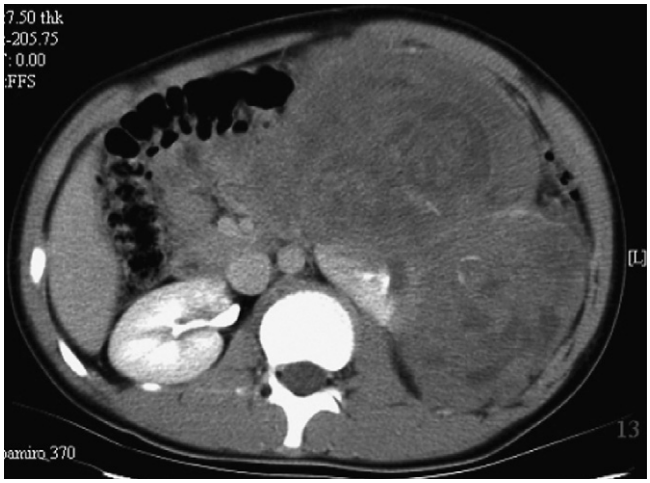

Fig. 1. Abdominal computed tomographic scan showing a huge mass (19.5 × 18.8 × 11.8 cm) arising from the left kidney, with central necrosis.

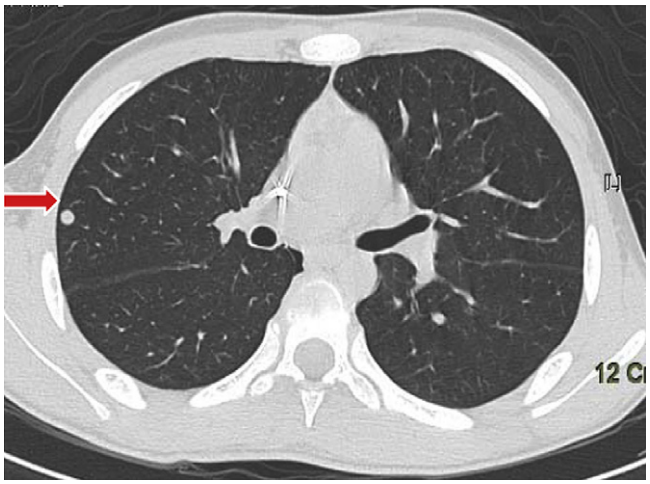

Fig. 2. Small nodules over the bilateral lung field suspected of being lung metastasis (arrow).

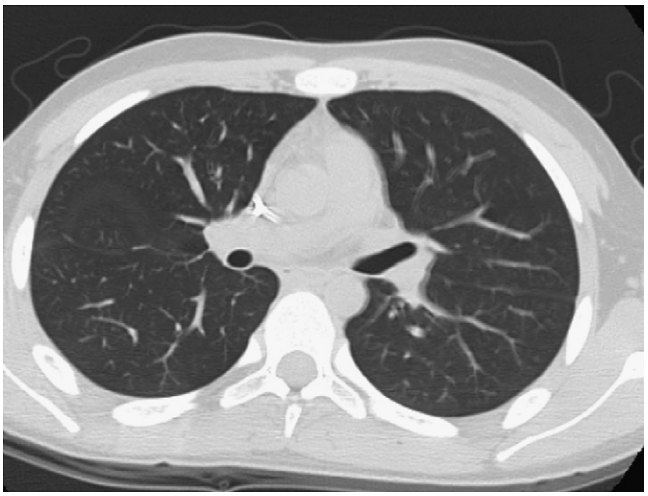

Fig. 3. Normal bilateral lung parenchyma. No evidence of lymphoadenopathy of >1 cm.

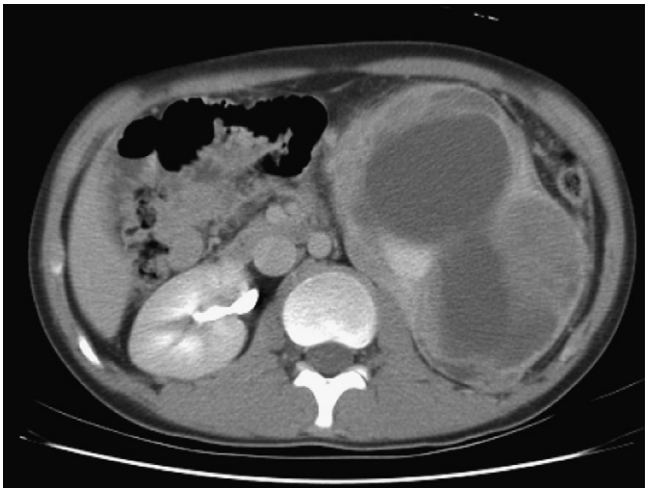

Fig. 4. Partial regression of the left renal primitive neuroectodermal tumor and tumor size shrinkage to 16.5 × 15 × 9.7 cm.

adjuvant chemotherapy consisting of vincristine, ifosfamide, and carboplatin, and irinotecan/temozolomide protocol for palliative treatment. Unfortunately, the disease progressed and was combined with complications of chemotherapeutic toxicity, septic shock, and *Klebsiella pneumoniae*. Thereafter, multiple liver and lung metastases and even brain metastases with intracranial bleeding developed. Finally, the patient's condition went downhill, and he died due to chemotherapeutic toxicity and his poor physical condition in January 2008.

3. Discussion

PNETs, first recognized by Stout[1] in 1918, are members of the family of small round-cell tumors. The differential diagnosis of PNETs includes lymphomas, neuroblastomas, Ewing's sarcoma,

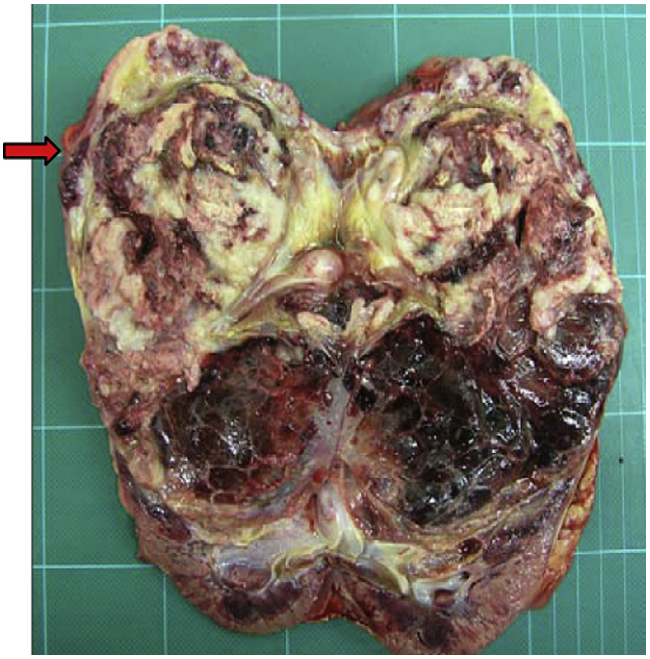

Fig. 5. A huge renal tumor (12 × 19 × 20 cm) growth in the upper pole of the kidney with heterogeneous components and cystic components with blood clots (arrow).

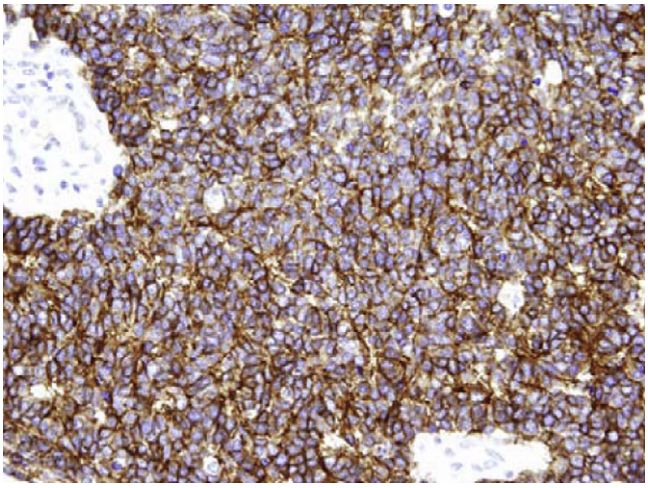

Fig. 6. Tumor cells diffusely and strongly positive for CD99 in a membranous pattern (×200).

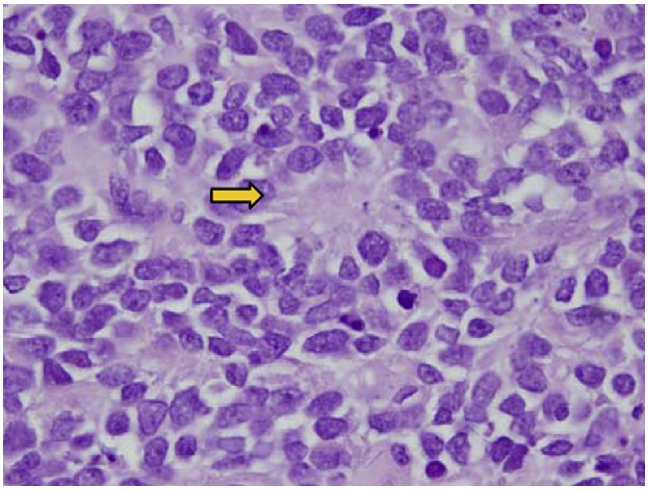

Fig. 7. Homer–Wright-type rosettes (arrow), a typical histological feature of primitive neuroectodermal tumors and CD117 staining in a combined cytoplasmic and membranous pattern (×400).

rhabdomyosarcomas, small-cell osteogenic sarcomas, mesenchymal chondrosarcomas, and undifferentiated carcinomas.[2] They tend to be grayish and encapsulated, and contain focal areas of hemorrhage and or necrosis. PNETs of the kidney are extremely rare disease entities and are morphologically and immunophenotypically indistinct from extrarenal PNETs.[3] They show the same gene fusion[4] and have similar poor outcomes.

They frequently arise during childhood or adolescence. Homer–Wright-type rosettes (Fig. 7), less defined in extraskeletal Ewing's sarcoma, are a typical histological feature of PNETs and can direct the diagnosis although they are also found in neuroblastomas.[5]

To date, there is no absolute protocol or treatment for PNETs owing to their rarity. Most reported cases underwent a radical nephrectomy, adjuvant chemotherapy (vincristine, ifosfamide, doxorubicin, cyclophosphamide, and etoposide), radiotherapy, or a bone marrow transplant. The literature suggests a chemotherapeutic protocol for PNETs consisting of four CEVAIE cycles, each including three 3-week courses: CEV (500 mg/m^2 carboplatin, 150 mg/m^2 epirubicin, and 1.5 mg/m^2 vincristine); IVA (9 g/m^2 ifosfamide, 1.5 mg/m^2 actinomycin, and 1.5 mg/m^2 vincristine); and IVE (9 g/m^2 ifosfamide, 600 mg/m^2 etoposide, and 1.5 mg/m^2 vincristine).[6] However, the outcome of PNET remains poor despite these therapies. Thyavihally et al[7] reported 60% and 42% survival rates at 3 and 5 years, respectively. PNETs are considered very aggressive tumors, but the advent of effective multimodality therapy has improved the prognosis over time, and 5-year survival is reported to be around 60%. Unfortunately, survival in patients with metastatic disease at diagnosis has not improved despite aggressive treatment.[8]

In this case, preoperative neoadjuvant chemotherapy in the first stage of treatment was mandatory to avoid a mutilating surgical procedure and to diminish the risk of disseminating tumor cells intraoperatively. Lung metastases showed dramatic total regression, and the tumor size shrank after two cycles of chemotherapy with VIP. Unfortunately, the postoperative death was caused by chemotherapeutic toxicity and some complications induced by his poor general condition.

4. Conclusions

Renal PNETs are rare. Differentiation of small round-cell tumors of the kidney may be challenging, and asymptomatic lesions in this location are often detected only by chance. Multimodal treatment protocols combining tumor debulking, chemotherapy, and radiotherapy may be useful for initial treatment, but the ultimate disease-free survival is still poor.

Conflicts of interest statement

The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in the manuscript.

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