

PNET/EWING'S SARCOMA OF THE KIDNEY: IMAGING FINDINGS IN TWO CASES

P. De Visschere¹, A. De Potter², F. Claus³, T. Mulkens⁴, R. Oyen³, A. Verbaeys⁵, C. Maes⁶, G. Villeirs¹

The CT-imaging findings of primary renal PNET/Ewing's sarcoma in two patients were retrospectively assessed. A large renal mass with heterogeneous contrast enhancement and necrotic and hemorrhagic areas were the predominant characteristics. In adolescents or young adults presenting with a large renal mass, PNET/Ewing's sarcoma may be included in the differential diagnosis.

Primitive Neuroectodermal Tumor (PNET) or Ewing's sarcoma of primary renal origin is a very rare entity with aggressive behavior. Affected patients are adolescents or young adults, with variable and aspecific clinical presentation. In most cases the presence of a renal tumoral mass is assessed with ultrasound or computed tomography, but the diagnosis of PNET/Ewing's sarcoma is usually made only on histopathology after nephrectomy, based on immunohistochemical and cytogenetic tests. We report on the CT-imaging findings in two cases of renal PNET/Ewing's sarcoma.

Case presentations

In 2011 two new cases of PNET/Ewing's sarcoma of primary renal origin were diagnosed at our institutions and treated with radical nephrectomy including regional lymph node dissection and adjuvant chemotherapy. The patients were a 24-year-old female (Fig. 1) and a 26-year-old male (Fig. 2) presenting with vague abdominal pain and without remarkable clinical records. The histopathology reports revealed small round blue cells with Homer-Wright type rosette formation on hematoxylin and eosin staining, largely positive immunohistochemical staining for CD99 and EWS rearrangement (EWS-FLI1 translocation) on fluorescent in situ hybridization (FISH). The abdominal CT findings were retrospectively reviewed. In both cases unenhanced CT scans were performed followed by at least

2 postcontrast scans including axial, coronal and sagittal multiplanar reconstructions in the venous phase. In both cases, the tumor was located at the upper pole of the kidney and had a maximum size of about 10 cm diameter. One tumor was ill-defined and showed tumor extension into the renal vein and inferior vena cava. The second tumor was sharply demarcated from the normal parenchyma and showed no vascular tumor thrombus. Both tumors consisted of solid components with hemorrhagic, cystic and necrotic areas, resulting in heterogeneous attenuation numbers on unenhanced and contrast-enhanced CT scans. The solid components showed moderate enhancement. The tumors were at least partially surrounded by a small rim of healthy renal cortex. In one case, the tumor showed sparse and diffuse microcalcifications, histologically confirmed as dystrophic calcifications in necrosis. Enlarged retroperitoneal lymph nodes were noted in one patient, proven non-metastatic following regional lymphadenectomy.

Discussion

PNET/Ewing's sarcoma of the kidney is an exceedingly rare entity, only about 50 cases were reported in literature (1, 2). The true incidence however, may have been underestimated as the number of case reports is increasing in recent years, probably due to advanced immunohistochemistry, enabling better characterization of renal tumors (1).

PNET/Ewing's sarcoma of the kidney typically occurs in adolescents and young adults with a reported median age of 24-27 years (1, 3). The clinical presentation is variable and aspecific with patients complaining of flank pain (85%), palpable abdominal mass (60%), hematuria (37%) or weight loss (8%) (1, 4).

Histopathology is essential to the diagnosis of renal PNET/Ewing's sarcoma (2-4). Microscopically PNET/Ewing's sarcoma is characterized by small round tumor cells with typical Homer-Wright rosette-like growth pattern (2, 3, 5). Overexpression of the surface membrane CD99 is a suggestive diagnostic clue on immunohistochemistry but the final diagnosis of PNET/Ewing's sarcoma is based on cytogenetic analysis (FISH and PCR) revealing EWS gene rearrangement, including the t(11;22)(q24;q12) translocation (1-3, 5). It remains unclear whether or not Ewing's sarcoma and PNET are distinct entities since they have similar biologic, pathological and molecular findings (2, 5). In the WHO classification they are considered as one entity, presumed to originate from one common precursor (the neural cells in the kidney or the embryonic neural crest cells that migrate into the kidney) probably blocked in a different stage of differentiation (3-5). PNET shows more mature neural cells than Ewing's sarcoma as demonstrated by the expression of neural immunohistochemical markers such as NSE, vimentin, synaptophysin and S-100 (1).

Imaging findings in PNET/Ewing's sarcoma are variable and nonspecific. The CT-appearance of PNET/Ewing's sarcoma is characterized by a large renal mass with heterogeneous contrast enhancement, necrotic or hemorrhagic areas and sometimes calcifications (1). However, the radiological features are indistinguishable from other primary, malignant renal parenchymal tumors or urothelial cancer (1, 2, 4). Other tumors that may be considered in the differential

From: 1. Department of Radiology, Ghent University Hospital, Ghent, Belgium, 2. Department of Pathology, Ghent University Hospital, Ghent, Belgium, 3. Department of Radiology, University Hospitals Leuven, Leuven, Belgium, 4. Department of Radiology, Heilig-Hartziekenhuis, Lier, Belgium, 5. Department of Urology, Ghent University Hospital, Ghent, Belgium, 6. Department of Urology, Heilig-Hartziekenhuis, Lier, Belgium.

Address of correspondence: Dr P. De Visschere, M.D., Department of Radiology, Division of Genitourinary Radiology and Mammography, Ghent University Hospital, -1 DWG Li, De Pintelaan 185, B-9000 Ghent, Belgium. E-mail: Pieter.DeVisschere@uzgent.be

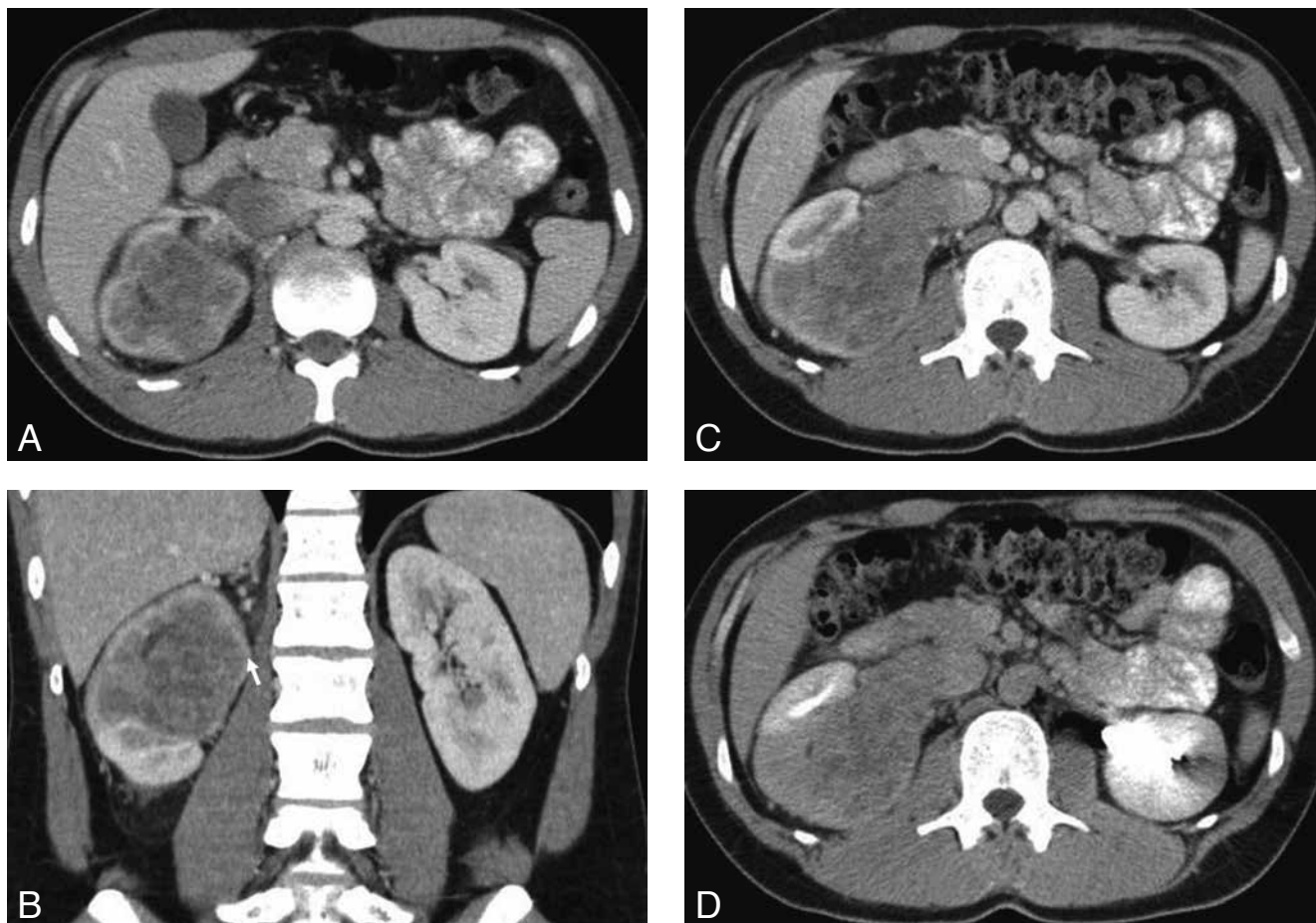


Fig. 1. — Case 1: PNET/Ewing's sarcoma of the right kidney in a 26-year-old male. In this late corticomedullary phase after contrast administration (A,B) the upper pole mass in the right kidney shows enhancing solid components and extensive non-enhancing necrotic and cystic areas. The tumor is ill-defined and partially surrounded by a small rim of normal renal cortex (arrow). There is tumor thrombus in the right renal vein and inferior vena cava (C). In delayed phase (D) the renal calices and pelvis are compressed by the mass.

diagnosis include rhabdomyosarcoma, Wilms' tumor, carcinoid tumor, neuroblastoma, lymphoma, desmoplastic small round cell tumor and nephroblastoma (1, 3, 5). Since no pathognomonic features of PNET/Ewing's sarcoma have been described, it is difficult to preoperatively diagnose this entity (1, 4). Nevertheless, in adolescents or young adults presenting with a renal mass, PNET/Ewing's sarcoma may be included in the differential diagnosis and a preoperative fine needle aspiration or core needle biopsy can be taken into consideration (3).

Most PNET/Ewing's sarcomas have an aggressive behavior and the majority of patients present at advanced stage disease (57,6%), including lymph node invasion

(25%), pulmonary metastases (20%) and liver metastases (14%) (1-5). One third of patients present with tumor thrombi in the renal vein or inferior vena cava at the time of diagnosis (1).

The management principles of renal PNET/Ewing's sarcoma have been extrapolated from osseous Ewing's sarcoma, although the sequence of neoadjuvant chemotherapy followed by surgery, which is the standard of care in osseous Ewing's sarcoma, is usually not relevant in renal PNET/Ewing's sarcoma since surgery is for the majority of cases the initial and necessary step to the diagnosis (2). The treatment options should be further investigated, but regarding the small number of patients with renal PNET/Ewing's

sarcoma this is hard to achieve. Therefore radical nephrectomy still remains the most important modality of treatment (1, 3). Since most patients with apparently localized disease do have occult metastasis, additional polychemotherapy is usually warranted. The standard chemotherapeutic agents currently used are vincristine, ifosfamide, doxorubicine, etoposide, adriamycine and ifosfamide (1, 2). The role of radiotherapy is not clear, but it may be indicated in case of positive surgical margins or involvement of Gerota's fascia (3).

The prognosis of patients with renal PNET/Ewing's sarcoma is poor, with high local recurrence rates and only a minority of patients experiencing long disease-free survival (1-4).

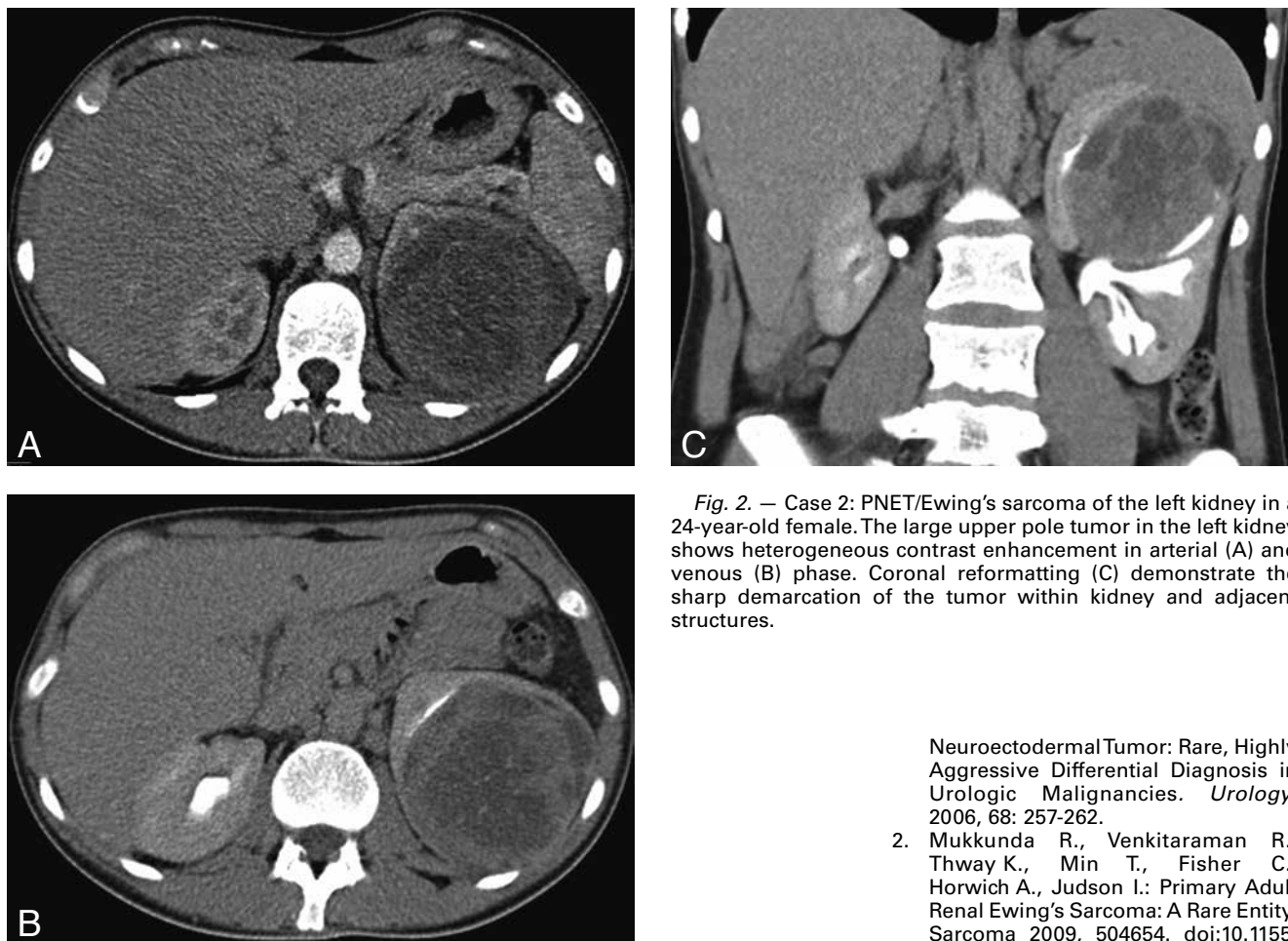


Fig. 2. — Case 2: PNET/Ewing's sarcoma of the left kidney in a 24-year-old female. The large upper pole tumor in the left kidney shows heterogeneous contrast enhancement in arterial (A) and venous (B) phase. Coronal reformatting (C) demonstrate the sharp demarcation of the tumor within kidney and adjacent structures.

Conclusions

The CT-appearance of PNET/Ewing's sarcoma of primary renal origin is that of a large renal mass with heterogeneous contrast enhancement, necrotic or hemorrhagic areas and occasional calcifications. It is virtually indistinguishable from other renal tumors such as renal cell carcinoma. Nevertheless, in adolescents or young adults presenting with a large renal mass the diagnosis of PNET/Ewing's sarcoma

may be suggested and a preoperative fine needle aspiration or core needle biopsy can be taken into consideration. Radical nephrectomy remains the most important modality of treatment, although neoadjuvant chemotherapy preceding nephrectomy might be a possible treatment alternative.

References

1. Ellinger J., Bastian P.J., Hauser S., Biermann K., Müller S.C.: Primitive

Neuroectodermal Tumor: Rare, Highly Aggressive Differential Diagnosis in Urologic Malignancies. *Urology*, 2006, 68: 257-262.

2. Mukkunda R., Venkitaraman R., Thway K., Min T., Fisher C., Horwich A., Judson I.: Primary Adult Renal Ewing's Sarcoma: A Rare Entity. *Sarcoma* 2009, 504654. doi:10.1155/2009/504654.
3. Thyaviahally Y.Y., Tongaonkar H.B., Gupta S., Kurkure P.A., Amare P., Muckaden M.A., Desai S.B.: Primitive Neuroectodermal Tumor of the Kidney: A Single Institute Series of 16 Patients. *Urology*, 2008, 71: 292-296. doi:10.1016/j.urology.2007.09.051.
4. Rappaport A., Oyen R.H.: Renal Lymphoma and Renal Sarcoma. In: Quaia E. (ed). *Radiological Imaging of the Kidney*, 1st edn. Springer-Verlag, Berlin Heidelberg, 2011, pp 631-642.
5. Pomara G., Cappello F., Cuttano M.G., Rappa F., Morelli G., Mancini P., Selli C.: Primitive Neuroectodermal Tumor (PNET) of the kidney: a case report. *BMC Cancer*, 2004, 4: 3.