Metanephric adenoma of the kidney: an unusual diagnostic challenge

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Abstract

Although metanephric adenoma (MA) is a rare, benign neoplasm of epithelial cells, it is often difficult to distinguish this entity from other malignant neoplasms preoperatively. We report a case of a large renal mass for which preoperative diagnosis was indeterminate, with the differential diagnosis including Wilms’ tumor, MA, and papillary renal cell carcinoma (PRCC). Accurate postoperative differentiation of MA from PRCC is critical because adjuvant therapy is considered after surgical resection of PRCC tumors.

Introduction

Metanephric neoplasms comprise a spectrum of kidney tumors containing renal epithelial or stromal cells or both.1 Metanephric adenoma (MA) is a rare neoplasm, accounting for 0.2% of adult renal epithelial neoplasms.2 The majority of cases occurs in patients 50-60 years of age3 and is seen predominantly in females by a 2:1 ratio.4 Although MA is usually benign, a few cases of metastatic disease have been reported.5 Several diseases can resemble MA including Wilms’ tumor, metastatic lung carcinoma, and metastatic papillary thyroid carcinoma; however, it is most difficult to distinguish MA from papillary renal cell carcinoma (PRCC). We describe here a case of a large renal mass and the challenge of establishing a preoperative diagnosis.

Case Report

A 28-year-old woman presented with a history of three urinary tract infections in the course of six months, and associated right flank pain with no hematuria or weight loss. She reported frequent urination of 6-8 times a day and urethral tingling at the end of urination. During one of these infections, she was treated with ciprofloxacin because the urine culture was positive for enterococcus. However, when she experienced similar symptoms a month later, both urinalysis and urine cultures were negative at that time. Because nephrolithiasis was suspected as a possible cause of recurrent urinary tract infections, a non-contrast computer tomography (CT) scan of the abdomen was performed. A large heterogeneous soft tissue mass (7.6×10.6×7.3 cm) was found arising from the superior pole of the right kidney and displacing the liver anteriorly. Hyperdense areas within the mass were consistent with recent hemorrhages. A small amount of fluid was found adjacent to the mass and in the dependent pelvis. A left-sided para-aortic lymph node measuring 1.1 cm was seen, as well as several small lymph nodes in the mesentry. The liver, spleen, and pancreas were unremarkable, and the left kidney showed no evidence of mass or hydronephrosis. Magnetic resonance angiography (MRA) revealed intra-renal arteries draped around the mass, although no definite tumor vascularization was seen and the tumor did not extend into the renal veins or inferior vena cava. MRA also revealed a normal renal artery, two renal veins, and a ureter on the right side. Magnetic resonance imaging (MRI) detected no fat within the mass (Figure 1). Sagittal T1-weighted and axial T2-weighted MRI showed no evidence of metastatic disease in the brain.

The possibility of hydatid cyst or parasitic infection was considered in the differential diagnosis owing to the unusual multicystic appearance of the mass with peripheral vascular supply and recent exposure to parasites endemic to Paraguay. No detectable levels of echinococcus antibody or Entamoeba histolytica antibody were observed in ELISA analysis. In addition, the sedimentation rate and C-reactive protein level were within the normal range, indicating that the mass was not an abscess or parasitic infection. The peripheral blood count and hemoglobin level were normal.

Preoperative diagnosis was indeterminate, with the differential diagnosis still including Wilms’ tumor, MA, and metastatic PRCC. Given the size of the mass and possibility of malignant disease, a radical nephrectomy was performed. Although the resected tumor was well circumscribed with a pseudocapsule, it was not well encapsulated. The mass was tan in color, measuring 10×6.5×7.5 cm and involving the upper pole and the middle portion of the kidney. On the cut surface, the tumor was well circumscribed, tan and lobulated, with multiple foci of hemorrhage and one focus of cystic degeneration. The tumor extended to, but not through, the renal capsule and occluded the upper pole collecting system at the renal pelvis.

Microscopically, the tumor was demarcated from the surrounding renal parenchyma by a pseudocapsule of variable thickness. Architecturally, the tumor was retiform, micropapil-
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Lesions, MA has the highest incidence (12%). The differential diagnosis of renal MA is normal. PRC is also characterized by the presence of enlarged cytoplasm, large nuclei, and strongly positive CK7 andEMA immunoreactions, although two cases have been reported with only focal and weak EMA immunoreactions. In our case, the only considerations that supported a diagnosis of PRC were CK7 positivity and very focal and weak EMA positivity. The predominance of epithelial cells also excluded a diagnosis of Wilms’malignant mesenchymal tumor, which is characterized by epithelial, stromal, and blastemal components. Diagnosis of oncocytoma was excluded by the lack of oncocytic cells (granular eosinophilic cells), absence of CK8 and CK18 expression, and absence of chromosomal abnormalities (such as loss of chromosomes Y, 1, and 14; absence of translocation of chromosome 11; and gain of chromosome 12). Based on these histologic and cytogenetic features, a diagnosis of MA was suggested. The patient remains disease free 28 months following right nephrectomy.

Discussion

MA is a rare neoplasm that often presents as asymptomatic, although symptoms can include abdominal pain, abdominal mass, hematuria, dysuria, fever, or hypertension. Among renal lesions, MA has the highest incidence (12%) of polyehymatoma. MA tumors appear tan in color with multiple foci of hemorrhage. Calcifications are uncommon, and only occur in approximately 20% of cases. MA is composed of tightly packed uniform small epithelial cells with small regular nuclei, a high nuclei-to-cytoplasm ratio, and no mitotic figures. The differential diagnosis of renal MA includes PRC and epithelial Wilms’s tumor.

In our case, diffuse positive immunostaining of the tumor for CD57 and WT-1, weak or negative staining for cytokeratin 7 and EMA, and positive immunostaining for racemase and WT-1 (Figure 2F), and was only very focally, weakly positive for cytokeratin 7 and epithelial membrane antigen (EMA). Immunostain for racemase (P504s) was negative in the tumor. Interphase cytogenetic studies by fluorescent in situ hybridization showed no evidence of trisomy for chromosomes 7 or 17.

PRCC is associated with a gain of chromosomes 7 and 17 and loss of sex chromosome Y, whereas the number of these chromosomes in MA is normal. PRCC is also characterized by the presence of enlarged cytoplasm, large nuclei, and strongly positive CK7 and EMA immunoreactions, although two cases have been reported with only focal and weak EMA immunoreactions. In our case, the only considerations that supported a diagnosis of PRCC were CK7 positivity and very focal and weak EMA positivity. The predominance of epithelial cells also excluded a diagnosis of Wilms’ tumor, which is characterized by epithelial, stromal, and blastemal components. A diagnosis of oncocytoma was excluded by the lack of oncocytic cells (granular eosinophilic cells), absence of CK8 and CK18 expression, and absence of chromosomal abnormalities (such as loss of chromosomes Y, 1, and 14; absence of translocation of chromosome 11; and gain of chromosome 12). Based on these histologic and cytogenetic features, a diagnosis of MA was suggested. The patient remains disease free 28 months following right nephrectomy.

References

1. Pins MR, Jones EC, Martul EV, et al. Metanephric adenoma-like tumors of the kidney: report of three malignancies with emphasis on discriminating features. Arch Pathol Lab Med 1999;123:415-20.
2. Amin MB, Amin MB, Tamboli P, et al. Prognostic impact of histologic subtyping of adult renal epithelial neoplasms: an experience of 405 cases. Am J Surg Pathol 2002;26:281-91.
3. Burger M, Junker K, Denzinger S, et al. Metanephric adenoma of the kidney: a clinicopathologic and molecular study of two cases. J Clin Pathol 2007;60:832-3.
4. Schmelz HU, Stoschek M, Schwerer M, et
al. Metanephric adenoma of the kidney: case report and review of the literature. Int Urol Nephrol 2005;37:213-7.
5. Renshaw AA, Freyer RD, Hammers AY. Metastatic metanephric adenoma in a child. Am J Surg Pathol 2000;24:570-4.
6. Nakagawa T, Kanai Y, Fujimoto H, et al. Malignant mixed epithelial and stromal tumours of the kidney: a report of the first two cases with a fatal clinical outcome. Histopathology 2004;44:302-4.
7. Brunelli M, Eble JN, Zhang S, et al. Metanephric adenoma lacks the gains of chromosomes 7 and 17 and loss of Y that are typical of papillary renal cell carcinoma and papillary adenoma. Mod Pathol 2003;16:1060-3.
8. Rakheja D, Lian F, Tomlinson GE, et al. Renal metanephric adenoma with previously unreported cytogenetic abnormalities: case report and review of the literature. Pediatr Dev Path 2005;8:218-23.
9. Davis CJ Jr, Barton JH, Sesterhenn IA, et al. Metanephric adenoma. Clinopathological study of fifty patients. Am J Surg Pathol 1995;19:1101-14.
10. Argani P. Metanephric neoplasms: the hyperdifferentiated, benign end of the Wilms’s tumor spectrum? Clin Lab Med 2005;25:379-92.
11. Olqac S, Hutchinson B, Tickoo SK, et al. Alpha-methylacyl-CoA racemase as a marker in the differential diagnosis of metanephric adenoma. Mod Pathol 2006;19:218-24.
12. Skinnider BF, Folpe AL, Hennigar RA, et al. Distribution of cytokeratins and vimentin in adult renal neoplasms and normal renal tissue: potential utility of a cytokeratin antibody panel in the differential diagnosis of renal tumors. Am J Surg Pathol 2005;29:747-54.
13. Bastide C, Rambeaud JJ, Bach AM, et al. Metanephric adenoma of the kidney: clinical and radiological study of nine cases. BJU Int 2009;103:1544-8.
14. Algaba F. Renal adenomas: pathological differential diagnosis with malignant tumors. Adv Urol 2008:974848.
15. Granter SR, Fletcher JA, Renshaw AA. Cytologic and cytogenetic analysis of metanephric adenoma of the kidney: a report of two cases. Am J Clin Pathol 1997;108:544-9.