Clinical Case Report

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Metanephric adenoma with low apparent diffusion coefficient value mimicking renal cell carcinoma

A case report

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Abstract

Rationale: Metanephric adenoma (MA) is a rare and often benign tumor. Most MAs were misdiagnosed as renal cell carcinomas (RCCs) preoperatively. Diffusion weighted imaging (DWI) and apparent diffusion coefficient (ADC) mapping can help to differentiate benign and malignant tumors. However, there are still pitfalls in using DWI and ADC to discriminate benign and malignant lesions.

Patient concerns: A 56-year-old woman had a right renal metanephric adenoma. The tumor showed very low ADC value preoperatively and was misdiagnosed as a renal cell carcinoma.

Diagnosis: Intraoperative ultrasound-guided percutaneous biopsy of tumor was performed. Based on the histopathological findings and immunohistochemical stains, a diagnosis of metanephric adenoma was suggested.

Interventions: The patient received percutaneous cryoablation of this tumor. Five years later, she underwent right partial nephrectomy because local recurrence was revealed on a follow-up computed tomography (CT).

Outcomes: MA was confirmed again by histological examination. The patient was uneventful after surgery.

Lessons: ADC mapping can be used for differentiating RCCs from other benign tumors by their lower ADC values. However, some benign and malignant lesions have overlapped low ADC values. This case illustrated that a benign lesion such as MA could mimic RCC on ADC, by its highly cellular component. Cryoablation is an optional treatment, which has an increased risk of local recurrence. Follow-up CT or MRI is useful and necessary for detection of local recurrence by depicting enhancing solid parts in a tumor over time.

Abbreviations: ADC = apparent diffusion coefficient, AUA = American Urological Association, CT = computed tomography, DWI = diffusion weighted imaging, MA = metanephric adenoma, MRE = magnetic resonance elastography, MRI = magnetic resonance imaging, RBC = red blood cell, RCC = renal cell carcinoma, SRT = small renal tumor.

Keywords: apparent diffusion coefficient map, cryoablation, diffusion weighted image, metanephric adenoma, renal cell carcinoma

1. Introduction

Metanephric adenoma (MA) is a rare tumor, accounting for 0.2% of adult renal epithelial neoplasm.[1] It occurs most commonly in middle-aged women, with a 2:1 female preponderance.[2] MA is considered benign with no local or distant recurrence reported in literature to date.

No specific or pathognomonic imaging findings of MA have been documented in literature. Most MAs were misdiagnosed as renal cell carcinomas (RCCs) preoperatively. Nowadays, diffusion weighted imaging (DWI) and apparent diffusion coefficient (ADC) mapping can help to differentiate benign and malignant tumors.[3] However, there are still pitfalls in using DWI and ADC to determine between benign and malignant lesions.

We present a 56-year-old woman who had a right renal metanephric adenoma and underwent percutaneous cryoablation for the same. The tumor showed very low ADC value preoperatively and was suspicious of local recurrence after 5 years since cryoablation.

2. Case report

A 56-year-old woman was a patient with stage Ia endometrial cancer status post-abdominal total hysterectomy, bilateral salpingo-oophorectomy, and dissection of pelvic lymph nodes. A right renal tumor was found on first-year follow-up computed tomography (CT) examination. She presented to us without any discomforts or complaints. Significant lab findings included traces of red blood cell (RBC) and negative protein on urinalysis, and the hematology values and the biochemical tests were all within normal range. Tumor markers were not checked.

CT revealed a mild heterogeneous solid tumor (Fig. 1A) in the mid-pole of the right kidney, measuring 2.6 × 2.4 cm. It was

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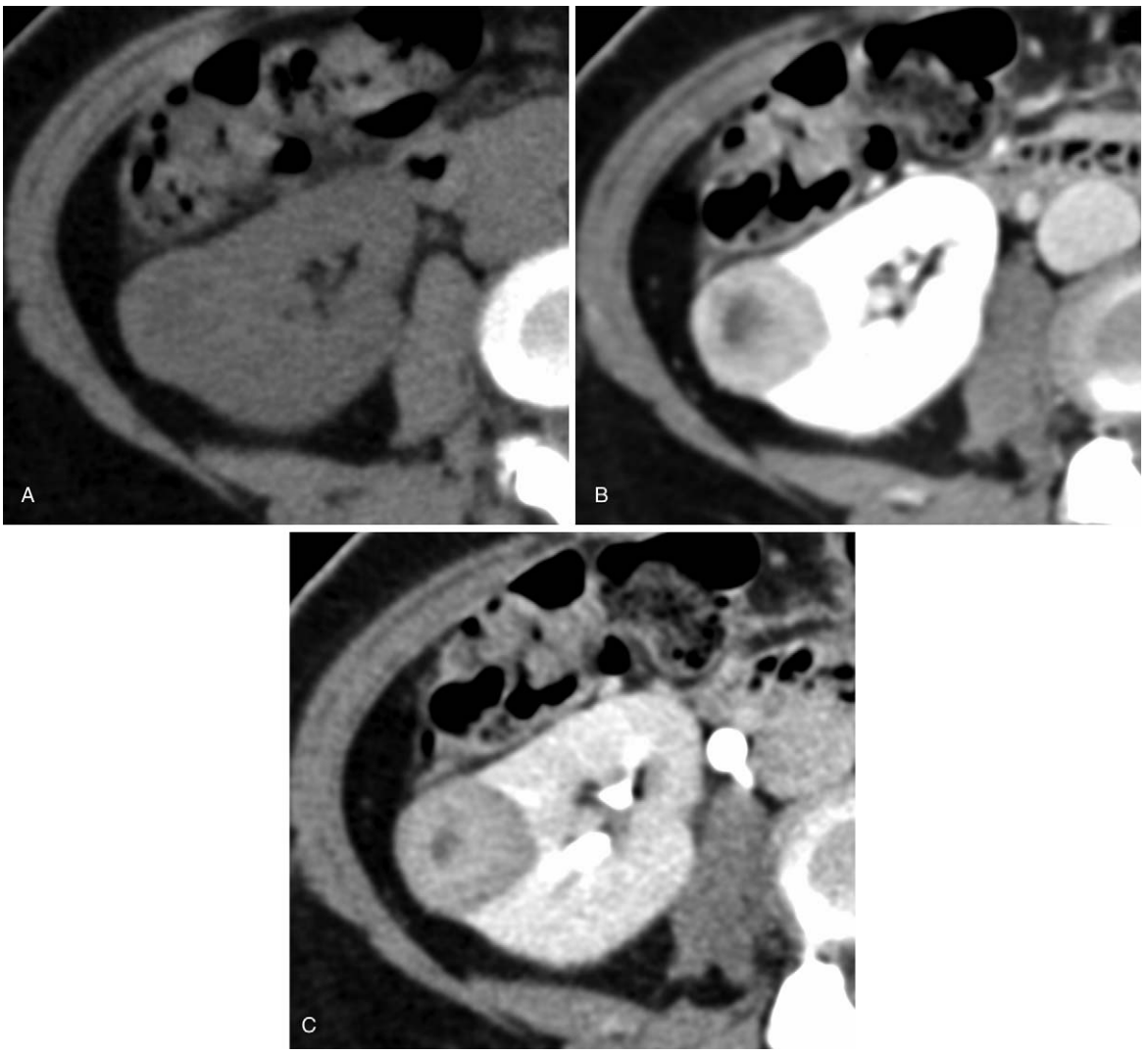

Figure 1. Computed tomography (CT) of the right kidney. (A) Non-enhanced CT shows an exophytic nodule at the mid-pole of the right kidney. The tumor was measured 40 Hounsfield unit (HU), slightly dense than adjacent renal parenchyma. (B) Medullary and 1C) delayed phase contrast CT shows a well-circumscribed, hypovascular tumor with cystic component. Enhancement of the tumor was less than that of right renal cortex and medulla in all phases.

well-demarcated, not encapsulated, and mildly enhanced after contrast administration. Enhancement of the tumor was less than that of right renal cortex and medulla in all phases (Fig. 1B and C). There was also a central cystic area in the tumor. Neither recurrent endometrial cancer, lymphadenopathy nor bone metastases could be found. On prior magnetic resonance imaging (MRI) scan for endometrial cancer staging, the renal tumor was already noted. It was hypointense and partially cystic on T2-weighted images. Fluid restriction was perceptible on DWI and ADC mapping (Fig. 2).

Considering the possibility of malignancy, intraoperative ultrasound-guided percutaneous biopsy of tumor and right nephron sparing surgery (percutaneous cryoablation) were performed. Histopathological findings and immunohistochemical stains showing positively for CD57 and Wilms tumor 1 and negatively for cytokeratin 7 confirmed the diagnosis of metanephric adenoma (MA) rather than papillary RCC. After 5 years of follow up, a right partial nephrectomy for tumor excision was performed due to suspected tumor recurrence (Fig. 3). On histopathological examination, the excised tumor (Fig. 4) was composed of tightly packed small, uniform, round acini, and tubules with an embryonal appearance, in scanty hyalinized stroma. Tumor cells were monotonous with bland small uniform nuclei. Neither necrosis or hemorrhage, nor nucleoli or mitosis were seen, implying the benignity of the tumor. The histopathological features were consistent with MA. The patient progressed well after the surgery. Follow-up CT scan performed after 12 months showed no residual or recurrent tumor.

The Institutional Review Board of Chang Gung Medical Foundation approved reporting of this case (IRB permit no. 201801089B0) and waiver of obtaining informed consent from the patient.

3. Discussion

Metanephric adenoma (MA) of the kidney is uncommon and composes a little proportion of adult renal epithelial neoplasm.

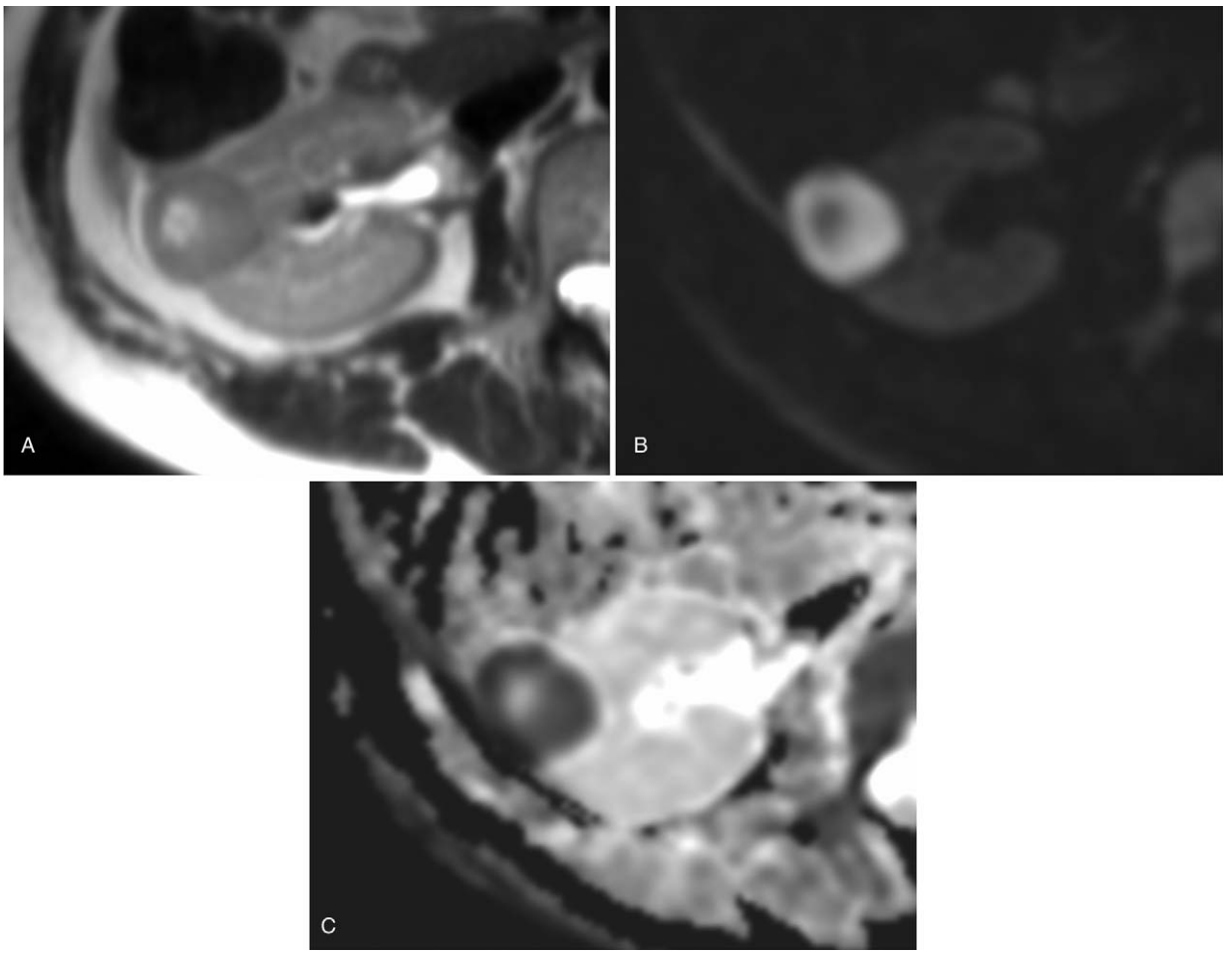

Figure 2. Magnetic resonance imaging (MRI) of the right kidney. (A) T2 weighted imaging shows a well-demarcated, hypointense nodule with cystic area at mid-pole of the right kidney. (B) Diffusion weighted image with *b*-values of 1000 s/mm^2 and (C) apparent diffusion coefficient mapping confirmed fluid restriction in the nodule, implying highly cellular nature of the nodule.

It occurs in children and adults, with peak incidence at 40 to 60 years of age. Around two thirds of patients with MA are women and approximately 50% of MA are incidental findings.[4] The mean size of MA is 5.5 cm, ranging from 0.3 to 20 cm in size.[2,5] It is typically unilateral in location, well-defined, unencapsulated, solitary, and solid.[2,4,5] Other common findings include foci of hemorrhage and necrosis, calcification, and small cysts.[4,6] MA usually had higher attenuation on non-contrast CT and less enhancement than adjacent renal parenchyma on enhanced CT during all enhanced phases.[7,8] Most MAs were commonly hypo or iso-intense lesion on T1- and slightly hyperintense on T2-weighted MR images.[6] However no reliable imaging findings can distinguish MAs from other renal tumors. It must always be considered in the differential diagnosis of renal tumors at any ages. The primary differential diagnosis in adults with MA is renal cell carcinoma (RCC), especially papillary RCC.[7] In pediatric group, MA must be differentiated from Wilms tumor.[9]

Diffusion weighted imaging (DWI) and apparent diffusion coefficient (ADC) mapping are sensitive diagnostic tools and noninvasive indicators for cellular status, cytotoxic edema, cellular density, and cellular organization of tissues.[10] They can be used to determine between benign and malignant lesions. In a recent meta-analysis study, renal carcinomas had a mean ADC value of $1.61 \pm 0.08 \times 10^{-3}$ mm^2/s versus $2.1 \pm 0.09 \times 10^{-3}$ mm^2/s for benign tumors ($P < .0001$).[3] However, some benign and malignant lesions may have overlapped low ADC values. The MA of our patient had a low mean ADC value of 0.79×10^{-3} mm^2/s with b value of 1000 s/mm^2 probably because it is a highly cellular epithelial tumor composed of small, uniform, embryonic-appearing cells.[4] Further evaluation on the ADC and b value for better distinguishing benign and malignant lesions need to be established. In addition to anatomical and functional MRI, magnetic resonance elastography (MRE) have potential for characterization of small renal tumors (SRTs).[11] The diagnostic validity of MRE on metanephric adenoma may need more investigation.

Most reported cases of metanephric adenoma had received partial or total nephrectomy and the prognosis is excellent.[12] Partial nephrectomy is the preferred treatment option for managing T1a renal tumors (<4 cm) according to American Urological Association (AUA) guidelines, thermal treatments (radiofrequency and cryoablation) are accepted as optional techniques to treat small renal masses in healthy patients and as recommended management in selected patients whose condition do not allow surgery.[13] However, thermal ablation may have

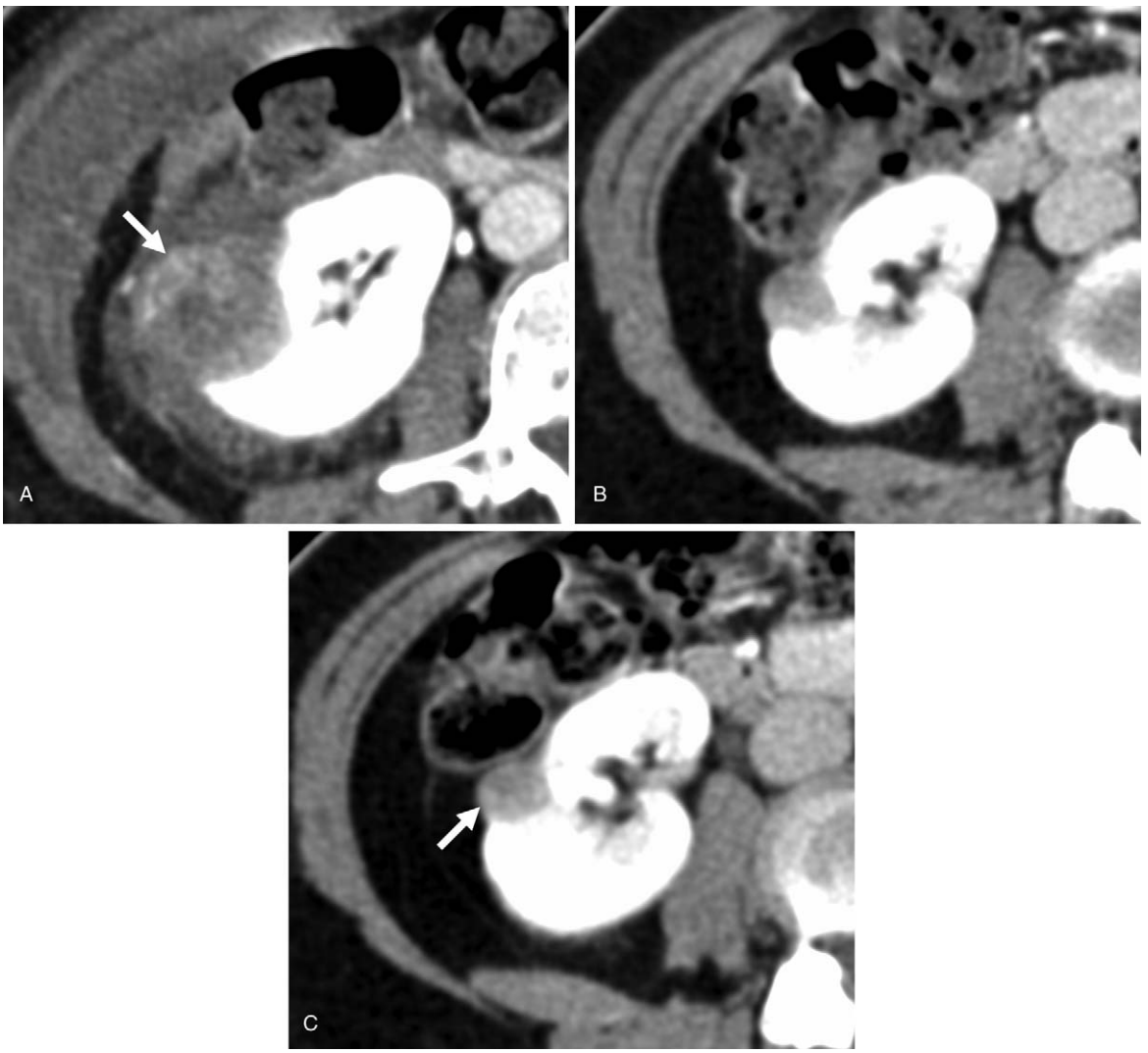

Figure 3. Sequential follow up computed tomographic (CT) images of a middle-aged woman with recurrent metanephric adenoma after cryoablation. (A) Post-contrast CT on the first day after cryoablation. It shows faint enhancement (arrow) in the ablated lesion, indicating hyperemic change or viable tumor. Perirenal hematoma is also noted. (B) and (C) CT scan at 4th and 5th year after thermal ablation. Gradually increased solid component of the lesion as well as mild irregular, nodular enhancement at periphery of the tumor (arrow) can be observed after comparison of sequential follow up images. Recurrence of metanephric adenoma is highly suspected.

increased risk of local recurrence.[13] Regular imaging follow-up with CT or MRI scans is necessary for cryoablated tumors. In our case, post-cryoablation local recurrence of MA was highly suspected after sequentially annual follow-up CT scan. Several studies[14,15] suggested monitoring with CT or MRI imaging of the cryolesion on postoperative day 1, to rule out immediate postoperative complications, and at 1, 3, 6, 12 months and then annually. The required duration of follow-up remains unknown.[14]

In conclusion, metanephric adenoma can occur at any age, most commonly in women at age in 5th to 6th decades of life. Regardless of imaging modalities, most MAs are solitary, well-circumscribed, and well-defined tumors with hypovascularity. The primary differential diagnoses of MA are renal cell carcinoma (especially papillary renal cell carcinoma) and Wilm tumor. Generally, focal renal malignancies had higher restricted diffusion and lower ADC values than benign tumors. Optimal ADC and *b* values for distinguishing benign and malignant lesions are still not clearly found. Most patients with MA were treated with partial or total nephrectomy but cryoablation can be

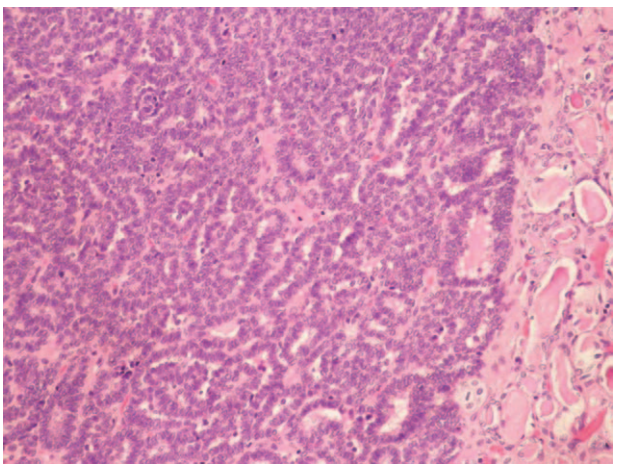

Figure 4. Histological features of metanephric adenoma (H&E, ×100). The tumor is tightly packed, composed of small uniform epithelial cells forming small acini and glomeruloid structures.

an optional treatment. Although MA is relatively benign, post treatment follow-up is still necessary.

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