Metanephric adenoma: MR imaging features with histopathological correlation

M. Delzongle\textsuperscript{a}, S. Boukamel\textsuperscript{b}, F. Kemeny\textsuperscript{c}, I. Chaaban\textsuperscript{a}, D. Abadzhieva\textsuperscript{a}, M. Sahnoun\textsuperscript{a}, P. Soyer\textsuperscript{d,∗}, P. Béroud\textsuperscript{a}

\textsuperscript{a} Department of Medical Imaging, centre hospitalier de Meaux, 6-8, rue Saint-Fiacre, 77100 Meaux, France
\textsuperscript{b} Department of Urology, centre hospitalier de Meaux, 6-8, rue Saint-Fiacre, 77100 Meaux, France
\textsuperscript{c} Department of Pathology, hôpital de Marne-la-Vallée, 2-4, cours de la Gondoire, 77600 Jossigny, France
\textsuperscript{d} Department of Radiology, hôpital Lariboisière, AP–HP, 2, rue Ambroise-Paré, 75010 Paris, France

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Metanephric adenoma (AM) is a benign renal tumour representing 0.2% of all renal tumours [1]. It is both clinically and radiologically difficult to differentiate from renal carcinoma, often resulting in unnecessary surgery. We report herein the magnetic resonance (MR) imaging features of a MA incidentally discovered in a 50-year-old man and subsequently histopathologically confirmed.

Case report

A 50-year-old man with prior history of surgically-repaired right inguinal hernia, arterial hypertension and chronic obstructive bronchitis underwent chest computed tomography (CT) examination because of a clinical worsening of his pulmonary status. CT examination incidentally revealed the presence of a soft tissue lesion at the inferior aspect of the left kidney. Before intravenous administration of iodinated contrast material, the renal lesion was isodense relative to the adjacent renal parenchyma (35 HU), deforming the outline of the kidney. No calcifications or pyelocalyceal cavity involvement were observed. After intravenous administration of iodinated contrast material, the lesion appeared as a rounded and well-demarcated mass, measuring 32 \times 27 mm on its two largest axial perpendicular diameters. Contrast enhancement was moderate and gradual, with an attenuation value of 51 HU during the early phase and 79 HU during the late phase following injection.

∗ Corresponding author.
E-mail address: philippe.soyer@lrb.aphp.fr (P. Soyer).

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The lesion remained hypoattenuating relative to the adjacent renal parenchyma. MR imaging examination was performed before renal biopsy and showed a homogeneous lesion at the inferior aspect of the left kidney, which was slightly hypointense on T1-weighted MR images by comparison to the adjacent renal parenchyma. A small hyperintense area was observed on fat-saturated T1-weighted MR images suggestive of bleeding (Fig. 1). On T2-weighted MR images, the lesion was mildly hyperintense with a peripheral hypointense rim (Fig. 2). The renal lesion was markedly hyperintense on the diffusion-weighted MR sequence (Fig. 3) and had an apparent diffusion coefficient (ADC) of \(1.62 \times 10^{-3}\) mm\(^2\)/s (b = 50 and 800 s/mm\(^2\)). After intravenous administration of 10 ml of a gadolinium chelate (gadoterate meglumine, Dotarem\(^{\text{R}}\), Guerbet, Roissy-Charles-de-Gaulle, France), the lesion showed a slow and gradual contrast enhancement and remained hypointense by comparison with the adjacent renal parenchyma (Fig. 4). Histopathological analysis of the renal tissues obtained with percutaneous biopsy revealed a tubulo-papillary proliferation made up of regular cubo-cylindrical cells with a monotonous appearance and large nuclei occupying almost the entire cytoplasm. No mitoses were visible (Fig. 5). The immunohistochemical study revealed that the cell expression profile was CK7\(^{-}\), P504\(^{+}\) (weak and focal), EMA\(^{-}\) and Wt1\(^{++}\). The histological appearance definitely confirmed the diagnosis of MA.

**Discussion**

MA is a rare tumour that is more common in women (2:1 sex ratio) and arises at a mean age of 46.8 years [1,2]. However, cases of MA have been reported in children [3].

These tumours generally have a benign course but lymph node metastases have been described [4]. As was the case with our patient, 50% of these tumours are discovered incidentally [1]. The most commonly accompanying symptoms are hematuria, low back pain or a palpable renal mass. In 12% of patients, MA is associated with polycythaemia [1]. A single lesion is most common although exceptional cases of multifocal or bilateral MA have been published in the literature [5]. On average, these tumours measure 3.6 cm (range: 1.5–8 cm) [2].

MA appears as a well-defined lesion on imaging [2,6,7]. On ultrasonography, MA is most often hyperechoic but can also be iso- and even hypoechoic [2]. Duplex Doppler ultrasonography demonstrates hypovascularisation of the lesion [2]. Contrast-enhanced ultrasonography has not established capabilities to clearly differentiate MA from a malignant renal tumour [6].

On CT images, MA appears as a hyper- or isointensating mass with only mild contrast enhancement [2]. Calcifications may also be present [2,6].

MR imaging is currently considered as the gold-standard examination for the characterisation of renal masses [8]. On MR imaging, MA typically appears as an iso- or hypointense mass on T1-weighted sequences and slightly hyperintense on T2-weighted sequences, as was the case here [6].
MRI features of metanephric adenoma

Figure 4. T1-weighted (TR/TE = 3.41/1.5 ms) gradient-echo (3D VIBE) MR image in the axial plane obtained after injection of gadolinium chelate. a: during the arterial phase (30 seconds), the renal lesion shows slight contrast enhancement (arrow) and is hypointense by comparison with the adjacent renal parenchyma; b: during the delayed phase (2 minutes), the lesion is heterogeneous with almost total but less intense enhancement than the adjacent renal parenchyma (arrow).

Figure 5. Histopathological examination of the renal lesion shows a tubulo-papillary tumour proliferation made up of regular cubo-cylindrical cells (HES staining, ×100 magnification).

Nonetheless, several cases of hypointense MA on both T1- and T2-weighted MR images have been reported [2]. Hypointensity are due to the presence of calcifications in 2/3 of cases [2]. Several studies have demonstrated the utility of diffusion-weighted MR imaging for the characterisation of focal renal lesions. Calculation of the apparent diffusion coefficient (ADC) helps better characterize renal lesions. In this regard, renal tumours have a significantly lower mean ADC value than normal renal parenchyma [9,10], and malignant tumours have a significantly lower mean ADC value than benign renal tumours [10]. These data were confirmed in a recent meta-analysis of 17 studies and 764 patients, since renal carcinomas were found to have a mean ADC of $1.61 \pm 0.08 \times 10^{-3}$ mm$^2$/s vs. $2.1 \pm 0.09 \times 10^{-3}$ mm$^2$/s for benign tumours ($P<0.0001$) [10]. In our patient, the tumour had an ADC of $1.62 \times 10^{-3}$ mm$^2$/s. However, the discriminatory potential of ADC and the b values to be used to optimise differentiation have yet to be clearly established. After injection of a gadolinium chelate, the lesion remains hypointense by comparison to the adjacent renal parenchyma, confirming the hypervascular nature of the tumour [2].

Treatment of MA has not been widely discussed, although some authors recommend simple surveillance after the diagnosis has been confirmed. For example, Wang et al. reported 7 cases of MA followed-up but not otherwise treated after diagnosis: neither recurrence nor local metastasis was observed after a follow-up period ranging from 7 to 57 months [11]. However, most authors recommend an initial partial nephrectomy followed by surveillance [2,7], especially since a minimally invasive surgical technique can be used [12], because of the risk of lymph node or bone metastases [4]. The contribution of a biopsy and immunohistochemical analysis has been studied in certain cases [13]. The immunohistochemical profile of MA is typically EMA−, WT1+, CD57++ and CK7±. Immunohistochemical analysis confirms the diagnosis in the majority of cases and, most importantly, rules out renal carcinoma [13]. This stresses the importance of biopsy in the overall management of small renal masses. Once diagnosed, benign renal tumours can be removed using a tumour resection sparing the surrounding renal parenchyma [7,13]. In addition, few complications have been reported with renal tumour biopsies and no cases of tumoral seeding along the needle tract have been published [13].

In conclusion, the imaging features of MA are not specific and do not allow the presence of malignant disease to be entirely ruled out. The possible uses of diffusion-weighted MR imaging to differentiate between MA and other renal tumours and especially from malignant disease have yet to be fully explored. MA has a well-established immunohistochemical profile, which confirms the diagnosis. The use of percutaneous biopsy is therefore recommended in order to determine the best therapeutic option.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References