Case report

The definitive role of CEUS in an ambiguous case of renal cell carcinoma

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Abstract

Angiomyolipoma is a benign tumor consisting of abnormal vessels, smooth muscles, and fatty
tissue. Renal cell carcinoma is an insidious neoplasm accounting for approximately 2% of global
cancer diagnoses. Due to similar diagnostic features, the differentiation between the two types
is sometimes difficult. We hereby present the case of a 60-year-old patient with no clinical symp-
toms and a focal lesion in the parenchymal layer of the left kidney incidentally detected on ultra-
sound examination. The putative diagnosis was angiomyolipoma, which was then confirmed
by another ultrasound and computed tomography examinations. However, a further radiologic
consultation revealed another probable diagnosis – renal cell carcinoma. Contrast-enhanced
ultrasound was conducted, and the enhancement pattern was suggestive of cancer. To sum up, a
thorough imaging examination plays an important role in the diagnostic work-up of neoplastic
lesions in the kidney. Even then, however, the radiological image of the lesion may be misleading,
so differential diagnosis is important for making a proper diagnosis.

Introduction

Angiomyolipoma (AML) is a benign tumor consisting of
abnormal vessels, smooth muscles, and fatty tissue. It
accounts for 0.3–3% of all renal masses and is the most
common type of benign kidney tumors[1]. About 80% of
AMLs present as isolated entities[2], but they are also fre-
quently associated with tuberous sclerosis complex (TSC)
[3]. AML is radiologically classified into three subtypes
according to the amount of fat which is quantified by CT
or MRI: fat-rich AML, fat-poor AML, and fat-invisible
AML[4]. Abundant fat tissue is a characteristic feature on
imaging. However, sometimes there is too little of it to be
detected. This poses a difficulty in differentiating AML from
renal cell carcinoma (RCC). RCC is an insidious neoplasm
accounting for approximately 2% of global cancer diagno-
ses[5]. It is classified into three major histological subtypes:
clear cell, papillary, and chromophobe[6].

Imaging plays a central role in the diagnosis and manage-
ment of renal AMLs and RCC. Ultrasound is the examination
through which kidney lesions are most commonly diagnosed.
Contrast-enhanced ultrasound (CEUS) allows for the identifi-
cation of active bleeding and is a valuable real-time diagnostic
test in abdominal emergencies due to AML. It can also be used
for distinguishing between malignant and benign renal lesions.

Case description

We present the case of a 60-year-old patient with no clinical
symptoms and a focal lesion in the parenchymal layer of the
left kidney which was incidentally detected on ultrasound
examination. The lesion was well-demarcated, hyperechoic,
measuring 22×18 mm, with no blood flow signals in the
Doppler option, and located on the dorsolateral side, extend-
ing slightly beyond the contour of the kidney. Based on the

Fig. 1. *Well-demarcated lesion in the dorsal aspect of the left kidney; strong, rather peripheral contrast enhancement in the early arterial phase*
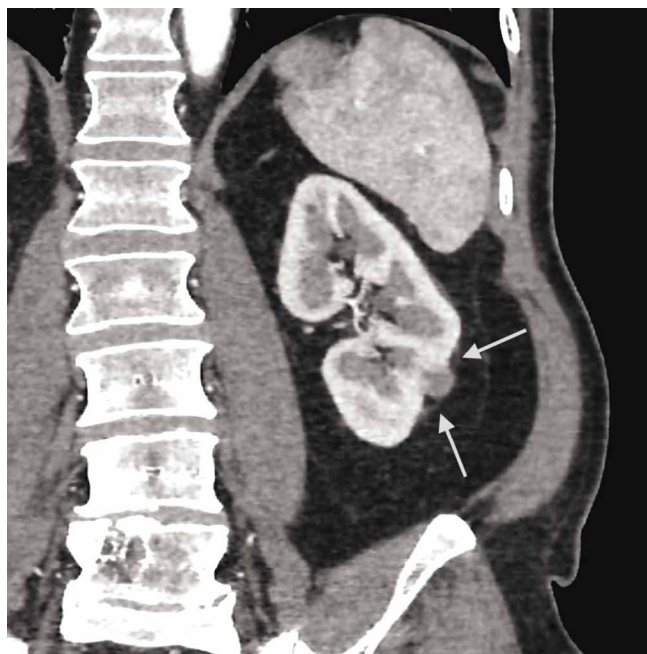

Fig. 2. *Renal capsule distorted by the focal mass; coronal CT reconstruction clearly indicated extra-tumor, subcapsular location of the fatty tissue described initially as a component of AML*
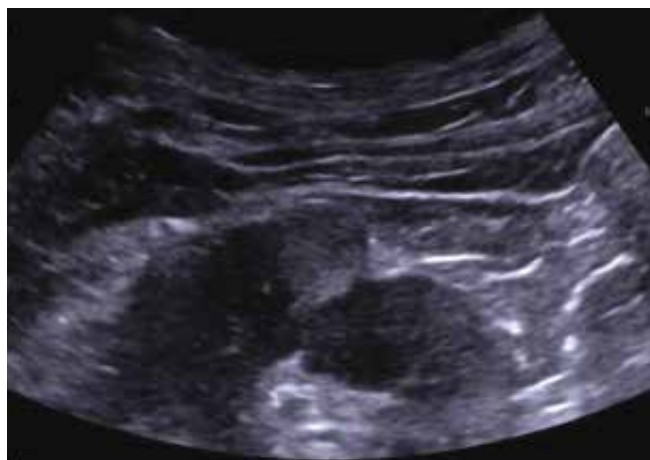

Fig. 3. *B-mode image of the well-demarcated, heterogeneously hyperechoic focal lesion within the renal cortex*
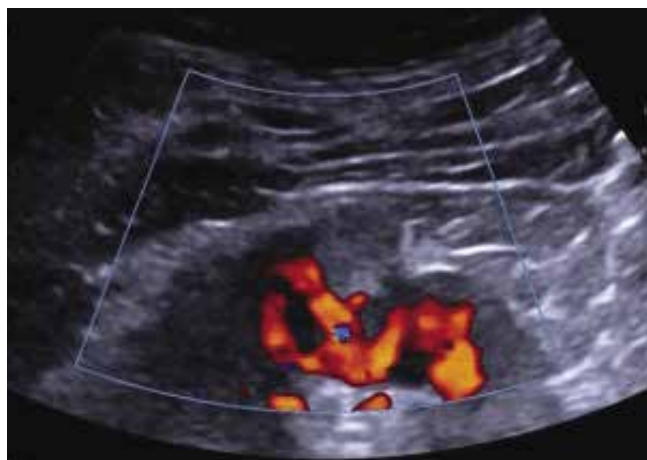

Fig. 4. *No apparent flow signals consistent with vascularization of the lesion; prominent modeling of the renal vessels at the tumor margin visible in color Doppler images*

US findings, the diagnosis of AML was made. In four follow-up ultrasound examinations performed by independent ultrasonographers over a period of 18 months, the morphological image and dimensions of the lesion were invariable, so the diagnosis of AML was maintained.

In order to verify the nature of the lesion (despite the absence of clinical symptoms) CT was performed, revealing an isodense well-demarked lesion in the native phase, with strong enhancement after contrast administration (Visipaque 120 ml). In the axial projection, there was an area of fatty tissue at the periphery of the lesion, recognized as its component, supporting the diagnosis of AML. Afterwards, however, the patient reported to a highly specialized medical

center, where his CT images were re-assessed by an independent radiologist who raised the suspicion of the malignant character of the lesion, possibly RCC. Coronal reconstruction of the CT showed that the renal capsule surrounding the tumor was distorted, enabling the subcapsular fatty tissue to protrude around the mass, thus mimicking the fatty component of angiomyolipoma (Fig. 1 and Fig. 2). CEUS examination was then performed three times with 1.2 ml of SonoVue contrast agent (total of 3.6 ml) at 10 min intervals, each time after complete washout of contrast. Rapid, robust contrast enhancement of the lesion was observed in the early arterial phase, followed by an earlier wash-out as compared to the surrounding renal parenchyma. Although the morphological US image did not allow for unambiguous discrimination
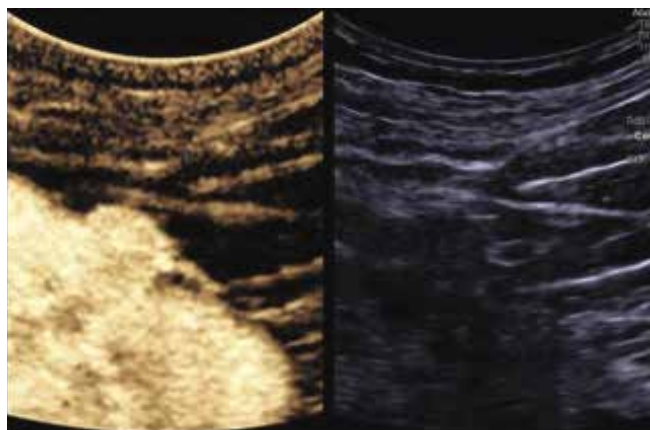
Fig. 5. *Intense contrast enhancement of the lesion in the early arterial phase is visible on CEUS images (10 seconds from contrast administration)*
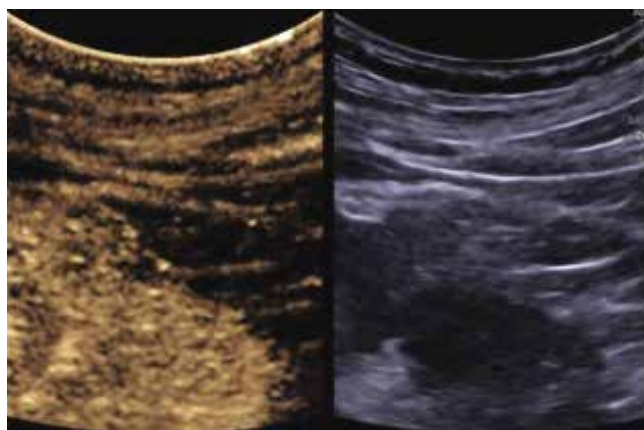

Fig. 6. *Relatively earlier contrast washout compared to the surrounding normal renal parenchyma is visible on CEUS images (after 2:50 minutes from contrast administration)*

Fig. 7. *Intra-operative image depicting the resected tumor; histopathological examination confirmed renal cell carcinoma*

between AML and RCC, the enhancement pattern was highly suggestive of malignancy (Fig. 3, Fig. 4, Fig. 5, Fig. 6). The patient underwent laparoscopic organ-sparing resection of the renal tumor. The lesion was removed in its entirety, and the histopathological examination confirmed the diagnosis of RCC (Fig. 7).

Discussion and conclusion

80% of angiomyolipomas are usually detected incidentally during abdominal ultrasound, computed tomography (CT) or magnetic resonance imaging (MRI)[7].

Biopsy is needed for proper diagnosis of AML, however it is very rarely used because of the tumor rupture and bleeding risks.

Ultrasound examination may point towards the diagnosis of AML, however due to its similarity to RCC the following differences should be considered:

• evaluation of external outlines – in AML the borders are smooth and the lesion is well circumscribed;

• acoustic shadow – may be seen in some AMLs (21–33%), but has not been described in renal cell carcinomas;
• AMLs are more often homogeneous lesions. Renal cell carcinoma is more often heterogeneous (65–76%). Fluid areas are far more common in renal cell carcinoma;
• The presence of an anechoic "halo" around the lesion is more frequently observed in carcinomas than in AMLs;
• Intra-tumoral cysts are found in 73% of RCCs but are rarely seen in classic AMLs[8].

CEUS is a fast, low-risk and cost-effective method for the local diagnosis and staging of renal cell carcinoma[9]. It can be used to observe the continuous micro- and macrocirculation of a renal mass[10]. Benign and malignant kidney lesions can be distinguished since they exhibit a different vascularization pattern to the surrounding healthy renal parenchyma. Furthermore, CEUS is relatively harmless, with no effects on the thyroid and kidney function. It also shows only a low incidence of side effects such as nephrotoxicity[9]. CEUS is a valuable real-time diagnostic work-up for abdominal emergencies caused by AML or RCC. Besides that, using color-flow Doppler sonography, the blood flow of tumor can be measured, and solid tumor, aneurysm, and pseudoaneurysm can be distinguished. Therefore, despite the lack of accuracy, US has certain clinical value in the diagnosis of AML or RCC[11].

Other diagnostic procedures such as CT or MRI may help to diagnose AML. The detection of adipose tissue is the fundamental diagnostic criterion in classic AMLs. However, a minority of AMLs lack visually detectable fat on imaging, making them harder to distinguish from renal cell carcinomas[12]. In addition, the occurrence of AML and RCC simultaneously may be possible. The presented case shows the differences between various imaging examinations. US revealed the typical picture of AML, which was checked by many by independent ultrasonographers. However, other imaging modalities – CEUS and CT – suggested carcinoma, which was then confirmed histopathologically.

To sum up, AML is mostly detected incidentally during abdominal imaging examinations. Symptoms may not

occur, therefore a thorough imaging examination plays an important role in the diagnostic work-up of neoplastic lesions in the kidney. Even then, though, the radiological image of the lesion may be misleading, so differential diagnosis is very important for making a proper diagnosis.

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Conflict of interest

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