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Case Report

Radiologic features of mixed epithelial and stromal tumors of the kidney: Hyperattenuating on unenhanced computed tomography and T2-hypointensity on magnetic resonance imaging [☆]

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ABSTRACT

In the 2016 World Health Organization renal tumor classification, the mixed epithelial and stromal tumor family was introduced as a new entity. This family encompasses a spectrum of tumors, ranging from predominantly cystic tumors (adult cystic nephromas) to tumors that are variably solid (mixed epithelial and stromal tumors). The majority of previous studies incorporating “mixed epithelial and stromal tumor” in the titles were actually reports of imaging findings of adult cystic nephroma. Thus, the solid component of mixed epithelial and stromal tumors has not been well evaluated. In this study, we present 2 cases of mixed epithelial and stromal tumors, as defined by the 2016 World Health Organization classification, showing a predominantly solid component. The characteristic findings of the solid component of these tumors were T2-hypointensity on magnetic resonance imaging and hyperattenuation on unenhanced computed tomography. Angiomyolipoma with epithelial cysts and epithelioid angiomyolipoma should be considered in the differential diagnosis of mixed epithelial and stromal tumors.

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Introduction

Mixed epithelial and stromal tumor (MEST) of the kidney is a rare tumor that was first presented by Michal and Syrucek in 1998 [1]. Prior to 1998, renal tumors with the same histology were reported using several different names, such

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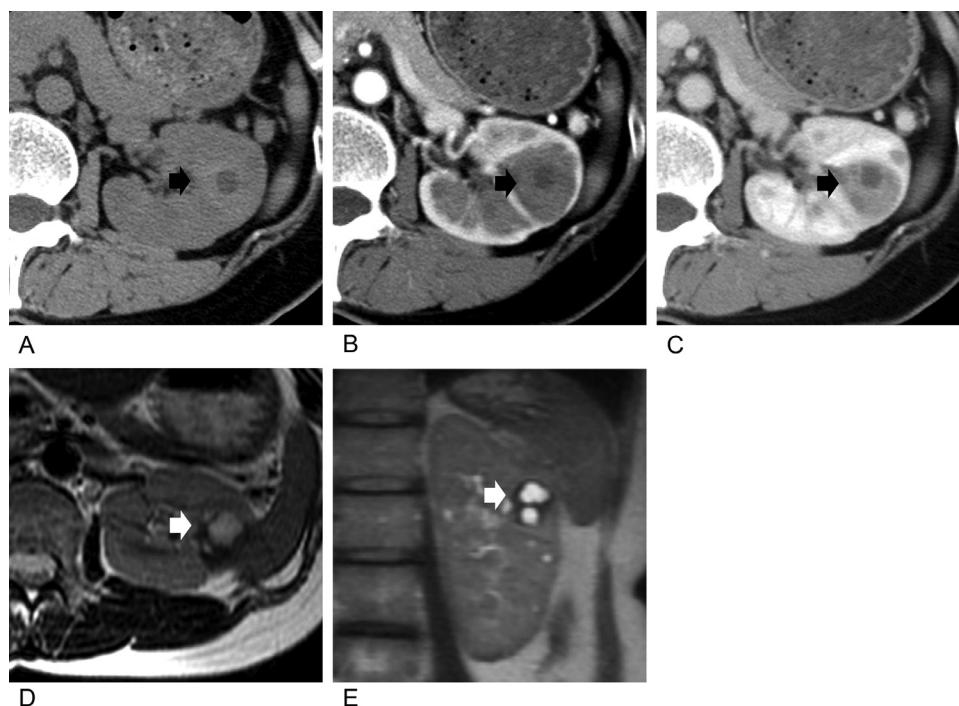


Fig. 1 – Imaging findings in a 47-year-old female with mixed epithelial and stromal tumor of the kidney. (A–C) Axial-unenhanced (A), arterial phase contrast-enhanced (B), and nephrographic phase contrast-enhanced (C) computed tomography (CT) scans demonstrate a well-margined mass in the left kidney containing cystic lesions and a solid component (arrow). The solid component shows high attenuation on nonenhanced CT and is slightly enhanced on dynamic CT. (D, E) Axial (D) and coronal (E) T2-weighted magnetic resonance images showing T2-hypointensity of the solid component.

as leiomyomatous renal hamartoma, multilocular cyst with ovarian stroma, and cystic hamartoma of the renal pelvis [2–6]. These tumors were classified as mixed epithelial and stromal tumors in the 2004 World Health Organization (WHO) renal tumor classification. In the majority of cases, they are benign in nature; however, 13 cases with malignant transformation have been reported [7]. Due to their predominance in middle-aged women, a strong association with estrogen exposure has been hypothesized [8].

According to several past studies, the imaging findings of MESTs have been radiologically classified into 2 different patterns: (A) multiseptate cystic renal mass with septa and nodular components [9,10] and (B) solid mass with cystic lesions [11–13]. In the 2016 WHO renal tumor classification, the MEST family was introduced as a new entity, characterized in composition by an epithelial component that lines a variable cystic architecture and a spindle-cell stromal component [14]. The MEST family encompasses a spectrum of tumors, ranging from predominantly cystic tumors (adult cystic nephromas) to tumors that are variably solid (MESTs) [14]. When comparing the 2016 classification with the prior version, adult cystic nephroma corresponds to what was referred to as type A tumor (multiseptate cystic renal mass with septa and nodular components) in the prior version, and MEST corresponds to type B tumor (solid mass with cystic lesions).

The majority of previous studies incorporating “MEST” in the titles were actually reports of imaging findings of adult cystic nephromas, as per the 2016 WHO classification crite-

ria. Thus, the solid component of MESTs has not been well evaluated. Herein, we present 2 cases of MESTs as defined in the 2016 WHO classification, showing a predominantly solid component.

Case report

Case 1

Patient 1 was a 47-year-old female with an incidental finding of a left renal mass on abdominal ultrasonography (US). She denied having hematuria, flank pain, or irritable urinary symptoms. Laboratory examination findings, including urine analysis, were normal.

Abdominal computed tomography (CT) showed a well-margined mass laterally in the interpolar region of the left kidney (maximal diameter: 3 cm), composed of cystic lesions and solid components. The solid components showed high attenuation and slight enhancement on dynamic CT (Fig. 1). There was no exophytic component, calcification, or capsule. On magnetic resonance imaging (MRI), axial- and coronal single-shot fast spin-echo (T2-weighted) images showed a T2-hypointense solid part with cystic lesions. The T2-hypointense solid part appeared compatible with the hyperattenuating lesion on CT.

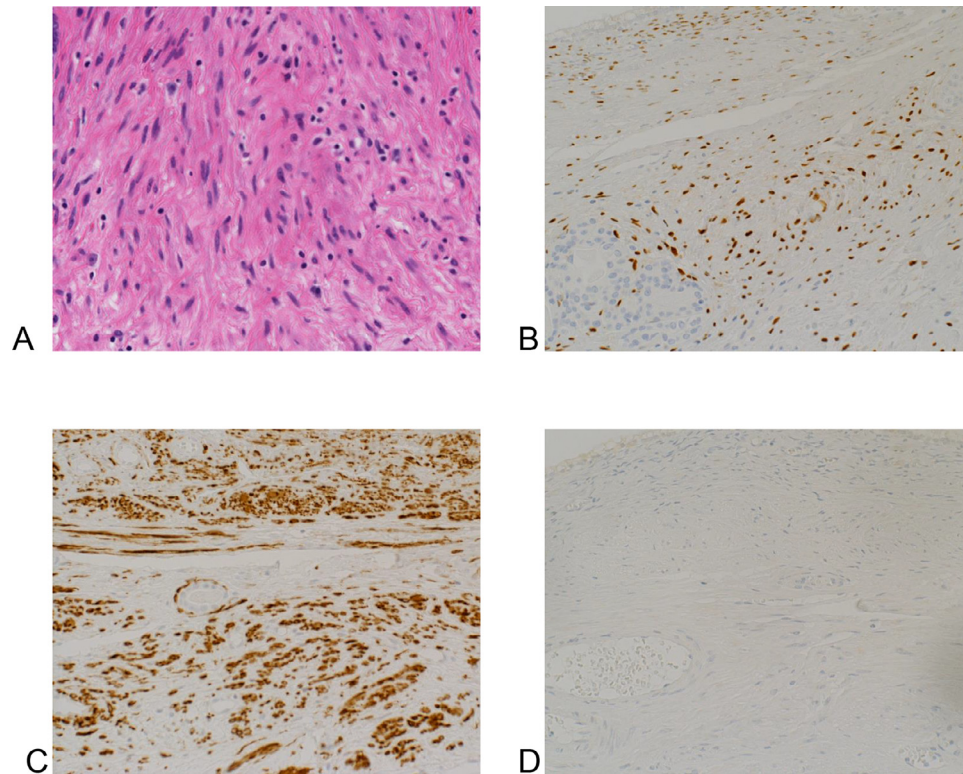


Fig. 2 – Histological findings of MEST case 1. (A) Hematoxylin-Eosin stain. The solid component of the tumor consisted of stromal spindle cells. (B–D) Immunohistochemical study. Stromal spindle cells were positive for progesterone, estrogen receptors (B), smooth muscle actin, and desmin (C). Stromal components were negative for HMB-45 (D).

On macroscopic examination, the tumor was located in the interpolar region of the left kidney, had a maximal diameter of 3 cm, and contained solid and cystic components. Histopathologically, the cystic components were covered with epithelial cells and the solid ones were composed of stromal spindle cells (Fig. 2). Mitotic figures were rarely found. The immunohistochemical study showed that the stromal spindle cells were positive for progesterone, estrogen receptors, smooth muscle actin, and desmin. There were <1% of Ki-67-positive cells. The epithelial cells were positive for cytokeratin and CD10. Both the epithelial and stromal components were negative for HMB-45. Based on all findings, the diagnosis of MEST was confirmed.

Case 2

Patient 2 was a 28-year-old female with an incidental finding of a right renal mass on abdominal US during a medical checkup. She denied having hematuria, flank pain, or irritable urinary symptoms. Laboratory examination findings, including urine analysis, were normal. She had no relevant past medical history and no history of smoking or consuming alcohol.

CT showed a well-demarcated, heterogeneous, exophytic mass (maximal diameter: 8 cm) with cysts (Fig. 3). The solid parts consisted of 2 different components; one was hyperattenuating and gradually enhanced, and the other was isoattenuating and only slightly enhanced on dynamic CT.

MRI showed an exophytic mass containing minimal solid fatty components (referring to the in-out phase) and some cystic lesions. The solid components without fat were composed of 2 different parts; T2-hypointense and T2-hyperintense. The T2-hypointense solid part appeared compatible with the hyperattenuating lesion on unenhanced CT.

On macroscopic examination, the tumor was yellowish-white, well-demarcated, located in the lower pole of the right kidney, had a maximal diameter of 8 cm, and contained solid and cystic components. Histopathologically, the cystic components were covered with epithelial cells and the solid parts were composed of fibrous/hyalinized tissue, stromal spindle cells, and edematous change. Mitotic figures were rarely found. The immunohistochemical study showed that the stromal spindle cells were positive for progesterone, estrogen receptors, and smooth muscle actin but negative for HMB-45. The epithelial cells were positive for cytokeratin and CD10. Based on all findings, the diagnosis of MEST was confirmed.

Discussion

In both presented cases, the tumors were well-circumscribed, heterogeneous solid masses containing cystic components. In the first case, the solid parts comprising stromal spindle cells were delineated as T2-hypointense on MRI and hyperattenuating on CT. In the second case, the T2-hypointense

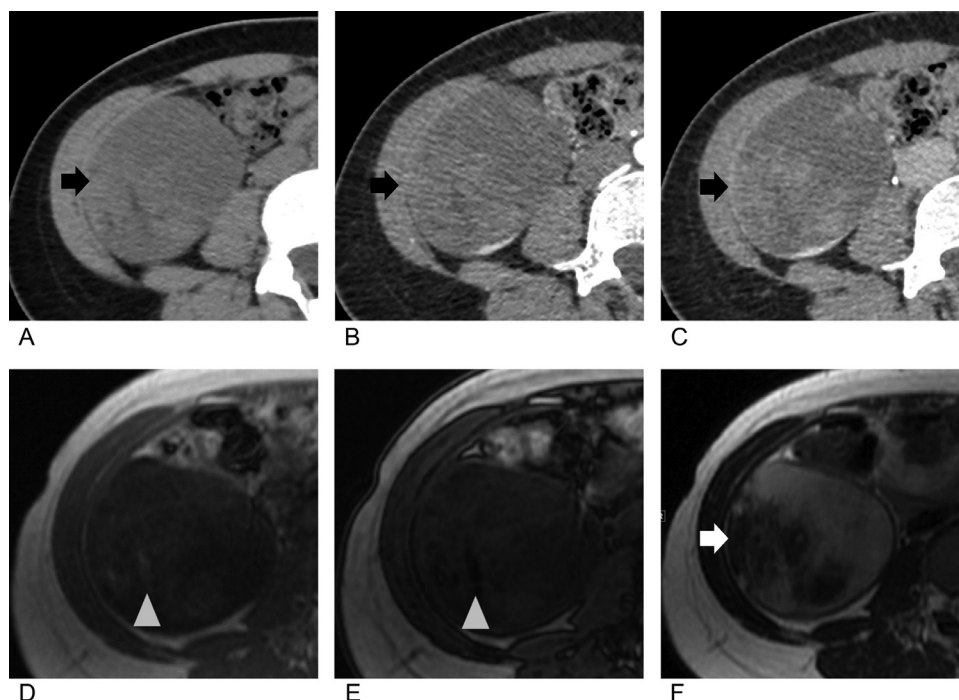


Fig. 3 – Imaging findings in a 28-year-old female with mixed epithelial and stromal tumor of the kidney. (A–C) Axial-unenhanced (A), arterial phase contrast-enhanced (B), and nephrographic phase contrast-enhanced (C) computed tomography (CT) scans show a well-demarcated, heterogeneous, exophytic mass with cysts in the right kidney. The solid part consists of 2 different components; one is hyperattenuating and gradually enhances (arrow), and the other is isoattenuating with only slight enhancement on dynamic CT. (D, E) In-phase (D) and out-of-phase (E) magnetic resonance (MR) images show minimal solid fat in the solid component (arrowhead). (F) Axial T2-weighted MR image. The solid component without fat has 2 different parts; one is T2-hypointense and the other is T2-hyperintense. The T2-hypointense solid part appears to be compatible with the hyperattenuating lesion on unenhanced CT.

and hyperattenuating areas corresponded to the solid parts made of stromal spindle cells and the T2-hyperintense area corresponded to edematous change. Previous studies have indicated that the solid parts of MEST of the kidney (MESTK) were visualized as T2-hypointense [15,16]; however, the reason was not mentioned. Homogeneous T2-hypointensity and hyperattenuation are findings typical for the smooth muscle component of angiomyolipomas (AMLs) and a diagnostic clue for fat-poor type AML [17,18]. Those findings are similar to the solid stromal component of MEST and in our cases; the T2-hypointense and hyperattenuating areas of MEST corresponded to the stromal spindle cells. Thus, T2-hypointensity and hyperattenuation could be findings indicating a tumor's stromal component. Note that as the stromal component of MEST is often degenerated (hyalinization, fibrosis, or edematous change), it will not necessarily show T2-hypointensity and hyperattenuation at all area of the solid part (like case 2).

The imaging findings of MEST are similar to those of renal cell carcinoma. However, MEST may be more similar to AML with epithelial cysts (AMLEC) than to renal cell carcinoma. AMLEC is a cystic variant of AML, first recognized and termed by Fine et al. in 2006 [19,20]. It is composed of a T2-hypointense and hyperattenuating solid component and a cystic component. The solid component is often accompanied by a small

fat component. According to Chu et al., 34% of MESTKs also contain microscopic adipose tissue [21]. In one of our cases, the tumor also had a fatty component that was detectable on CT and MRI. The tumor location could be the point for differentiation between AMLEC and MEST, namely, tendency for herniation into the renal pelvis is a characteristic of MESTs [15,22,23]. Sex could be another point for differentiation. AMLEC occur in both sexes, while cases of MEST are predominantly females, or males with long-term history of hormone therapy.

Epithelioid AML (eAML) should also be considered in the differential diagnosis of MEST, because it also shows heterogeneous T2-hypointensity and hyperattenuation. It was first described as a rare variant of AML by Martignoni et al. and Mai et al. in 1995 and 1996, respectively [24]. Renal eAML was classified as a new category of renal neoplasms in the 2016 WHO classification and is considered a potentially malignant mesenchymal neoplasm with possible lymph node metastasis, local recurrence, and distant metastasis [14]. The radiological appearance of most renal eAMLs tends to be a heterogeneously solid, homogeneously solid, or multilocular cystic lesion with massive hemorrhage, with hyperattenuation on unenhanced CT images and hypointensity on T2-weighted images [25]. These findings overlap with MEST. However, in eAML, hemorrhage is very frequently seen in

solid and/or cystic component, while there are very few reports of hemorrhage in MEST. The finding of hemorrhage may be useful for differentiation.

This study had several limitations. First, the number of cases was very small because of the rarity of this disease. Second, selection bias may have existed because the study was performed at a single institution.

In conclusion, T2-hypointensity on MRI and hyperattenuation on unenhanced CT would be the characteristic findings of the solid component of MEST. AMLEC and eAML should be considered in the differential diagnosis of MEST.

Patient consent statement

This is a report that reexamined past imaging findings because of changing the classification, and it was not possible to obtain written informed consent.

However, patient anonymity has been maintained in all cases.

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