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Solid papillary renal cell carcinoma: clinicopathologic, morphologic, and immunohistochemical analysis of 10 cases and review of the literature

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ABSTRACT

Solid papillary renal cell carcinoma is rarely reported in the literature, and its tumor characteristics are not entirely compatible with the concept of 2 histological subtypes of papillary renal cell carcinoma (PRCC). Tumor is composed mostly of small compressed tubules and short abortive papillae giving solid appearance of monomorphic epithelial cells with scanty cytoplasm and small nuclei, sometimes mimicking spindle cells, without or with sparse true papillae. It shows immunohistochemical (+CK7, +EMA, +AMACR) and genetic hallmarks (polysomy/trisomy 7/17, loss of Y) of conventional PRCC. About 53 cases have been described in the literature, with male predominance and age ranging from 17 to 82 years. By available follow-up data, solid PRCC has a favorable clinical course. We describe 10 cases compatible with the diagnosis of solid PRCC. All patients were males age range was from 34 to 70 years, and all but one were pT1 according to TNM 2009. On follow-up, 9 patients were without evidence of disease, and 1 had recurrent tumor. Size of the tumor ranged from 1.4 to 5.5 cm (mean, 3.32 cm). Tumors were well-circumscribed whitish to yellow masses with granular surface. Although solid architecture was a prominent morphologic feature, detailed analysis revealed that the tumors were composed of compressed short abortive papillae and compressed tubules admixed with true solid areas. Well-formed papillae were exceptionally present. All 10 cases were strongly and diffusely positive for CK7 and negative for WT-1. In conclusion, solid PRCC is a rare tumor with an incidence of less than 1% of all renal tumors. In majority of the cases, tumors were composed of tightly compressed tubular structures and short abortive papillae that render a solid morphologic appearance. Immunohistochemical and molecular features do not differ from conventional PRCC. Metanephric adenoma; epithelioid nephroblastoma; and, rarely, mucinous tubular and spindle cell carcinoma and oncocytic variant of PRCC should be considered in the differential diagnosis.

1. Introduction

Papillary renal cell carcinoma (PRCC) was first formally recognized as a specific entity in the Heidelberg classification, and then it was accepted in the 2004 World Health Organization (WHO) classification [1–2]. It was described as a malignant renal tumor with characteristic papillary or tubulopapillary architecture and with specific immunohistochemical and cytogenetic profile. PRCC is the second most common renal cell carcinoma (RCC) subtype occurring in up to 18.5% of all RCCs [3–5]. The description of PRCC dates back to 1974 in the study of Mancilla-Jimenez et al [6]. The authors reported in detail the ultrasonographic, macroscopic, and microscopic features of PRCC and recognized 2 consistent histologic patterns, namely, the papillae lined either by a single row of cells with scant cytoplasm or cells with pseudostratifed nuclei and abundant eosinophilic cytoplasm. Besides these 2 patterns,

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Table 1
Clinicopathological features and follow-up of solid PRCC

Case	Age (y)	Sex	Size (cm)	Follow-up
1	49	M	5.5	NED-8 y
2	70	M	1.5	DOC-3 y[a]
3	37	M	3.5	NED
4	66	M	2.5	NA
5	60	M	4.5	NED
6	54	M	2.8	NED-5 y
7	63	M	4	NED
8	34	M	2.5	NED-13 y
9	52	M	1.4	NED-9.5 y
10	48	M	5	AWD-8 y[b]

NED, no evidence of desease; DOC, dead for other reasons; NA, not available; AWD, alive with desease.
[a] Bilateral nephrectomy for PRCCs; dead for metastatic prostate cancer 3 years later; MSCT during follow-up diagnostics showed nephrectomy area without tumor.
[b] Only T3N0Mx tumor, recidivant tumor after 8 years, placed in the prior nephrectomy area.

they also reported papillary tumors with clear cells and other morphological features. PRCCs were later characterized in more details in several studies [7–9]. In 2004, the WHO classification adopted 2 types of PRCC: type 1, with papillae lined by a single cell layer of cuboidal cells with scant cytoplasm, and type 2, in which papillae are lined by large eosinophilic cells with pseudostratified nuclei [2]. Although less frequently encountered, several additional patterns were subsequently reported in the literature, including oncocytic [10–11], PRCC with clear cells [12], and solid PRCC. Solid variant of PRCC is composed of monomorphic epithelial cells with scant cytoplasm and small nuclei, arranged in tightly packed, ill-defined tubules or papillae and solid sheets [3,13–18]. It closely resembles metanephric adenoma (MA) and may share similar morphologic features with epitheloid nephroblastoma or mucinous tubular and spindle cell carcinoma (MTSC).

In this study, we describe a series of 10 cases collected from multiple institutions, and we discuss the diagnostic pitfalls and the differential diagnosis of the solid form of PRCC.

2. Material and methods

Ten cases compatible with the diagnosis of solid PRCC were retrieved out of 1311 papillary RCCs (including institutional, consultation, and archive cases) in the Pilsen Tumor Registry. Pathologic examination of all available hematoxylin and eosin–stained sections from each case (range, 1-18 slides) was performed by at least 3 pathologists (MU, FS, and OH). Cases were reevaluated, and solid, tubular, and papillary components were accessed as percentage of the tumor. Tissue for light microscopy was fixed in 4% formaldehyde and embedded in paraffin using routine procedures. Three-micrometer thin sections were cut and stained with hematoxylin and eosin to evaluate the architecture of the tumors. Basal membranes were highlighted by periodic acid Schiff (PAS) stain.

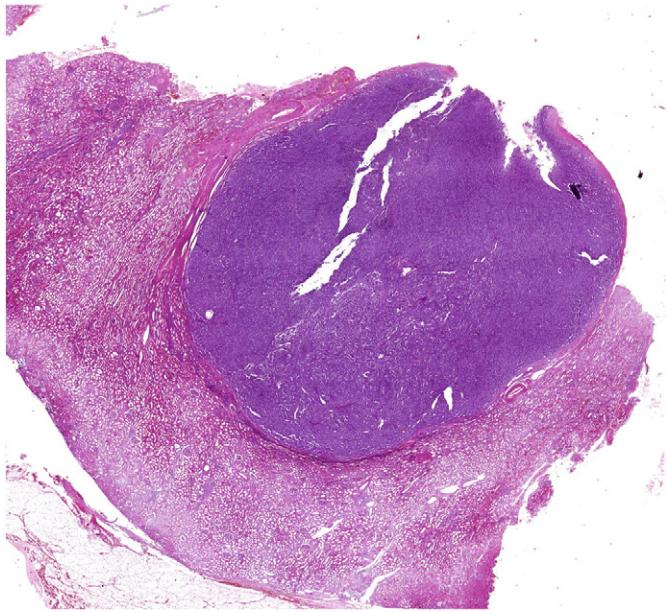

Fig. 1. Using scanning magnification, most of the tumors appeared completely solid.

The immunohistochemical study was performed using a Ventana Benchmark XT automated stainer (Ventana Medical System, Inc, Tucson, AZ).

The following primary antibodies were used in the immunohistochemical study: racemase/AMACR (13H4, monoclonal, DAKO, Glostrup, Denmark, 1:200), cytokeratin 7 (OV-TL12/30, monoclonal, DakoCytomation, Carpenteria CA, 1:200), epithelial membrane antigen (EMA) (E29, monoclonal, DakoCytomation, 1:1000), CD10 (monoclonal, Sp67, Ventana, RTU), CD34 (QBEnd-10, monoclonal, Dako, 1:100), CD57(NK 1, Leica Biosystems, Newcastle upon Tyne, UK, 1:200), WT1 (GF-H2, monoclonal, DakoCytomation, 1:150), Ki-67 (MIB1, monoclonal, Dako, 1:1000). Appropriate positive and negative controls were used. Immunostains were scored as 1+ (focal in small clusters of individual cells), 2+ (up to 50% positive cells), and 3+ (diffuse strong positivity in more than 50% of cells).

3. Results

The clinicopathologic data are summarized in Table 1. The age of the patients ranged from 34 to 70 years (mean age, 53.30); all patients were male. Size of the tumor in the largest diameter ranged from 1.4 to 5.5 cm (mean, 3.32 cm). Most of the cases were pT1 stage (TNM 09); 1 tumor was pT3. Most of the patients (8/10) were alive and well without signs of metastatic disease or relapse within follow-up period of 3-13 years. One patient was faced with recurrent tumor 8 years after resection. One patient had bilateral nephrectomy due to multiple small PRCCs and died of metastatic prostate cancer 3 years later.

Table 2
Gross and microscopic features of solid PRCC

Patient	Gross description	True solid (%)	Compressed tubuli (%)	Compressed abortive papillae; occasional glomeruloid formations (%)	True papillae (%)	Capsule	ISUP grade
1	Yellow well-circumscribed nodule	10	40	50	0	+	1
2	Yellow well-circumscribed nodule, bilateral papillary RCCs	20	70	10	0	+	1
3	Gray well-circumscribed nodule	5	80	10	5	+	2
4	Yellow well-circumscribed nodule	80	10	5	5	+	1
5	Gray well-circumscribed nodule	20	30	50	0	−	1
6	Yellow well-circumscribed nodule	5	10	80	5	+	1
7	Yellow well-circumscribed nodule	20	70	10	0	+	1
8	Yellow well-circumscribed nodule	10	50	40	0	−/+	1
9	Yellow well-circumscribed nodule	30	10	60	0	+	1
10	Yellow well-circumscribed nodule, necrotic −50%	60	20	20	0	+	2