

**Case studies**

Glomus tumor of renal pelvis: a case report and review of the literature

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Summary Glomus tumors are uncommon benign perivascular neoplasms that have rarely been described outside of their usual peripheral soft tissue sites. We report a unique case of glomus tumor of the renal pelvis in a 53-year-old woman who presented with microscopic hematuria associated with obstruction of the ureteropelvic junction and marked hydronephrosis. At initial gross examination, the tumor mimicked a urothelial carcinoma.

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Glomus tumors represent less than 2% of soft tissue tumors [1,2]. They most often occur in the extremities, typically in the subungual region of the fingers. They only rarely involve the internal organs such as mediastinum, lung, trachea, and stomach [2,3]. Reports of glomus tumors in the genitourinary regions are extremely rare and involve mostly clitoris, vagina, cervix, and the periurethral soft tissue [4–6]. In the kidney, only one case with a location in the renal capsule has been published to date [7]. Histologically, glomus tumors are composed of round cells surrounding vascular spaces of varying sizes. The normal glomus cell is thought to be a modified smooth muscle cell based on ultrastructural and immunohistochemical characteristics. The great majority of these tumors are benign; however, rare cases with atypical/malignant behavior have been reported [8–11].

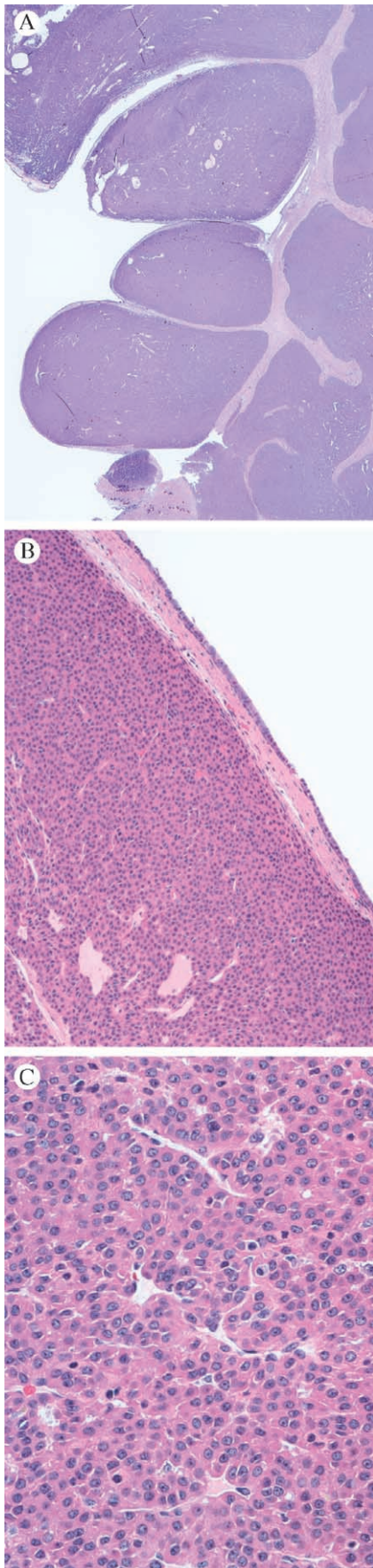
1. Case report

A 53-year-old woman presented with a vague discomfort in her right flank and with microscopic hematuria. Imaging studies including an abdominal computed tomography scan and a retrograde pyelogram demonstrated a solid mass located in the right ureteropelvic junction with associated hydronephrosis and a nonfunctioning kidney and atrophy of the surrounding parenchyma. A radical nephrectomy was performed. Gross examination by the urologist in the operating room showed a polypoid mass involving the distal renal pelvis and proximal ureter mimicking a urothelial carcinoma; a completion right ureterectomy was performed.

2. Pathological findings

Gross examination showed a polypoid mass predominantly located in the distal renal pelvis and extending to the proximal ureter. The tumor measured 2.5 cm and appeared

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well circumscribed. On light-microscopic examination, the tumor consisted of multiple circumscribed lobules of round to oval cells with a uniform appearance. The neoplastic cells had well-defined cell borders. The nuclei were uniformly round and had no to minimal atypia with a vesicular chromatin pattern and occasional single nucleoli. The cytoplasm was moderate and densely eosinophilic. Numerous vessels of varying size, some with hemangiopericytoma-like configuration, were dispersed throughout the tumor (Fig. 1). Spindle cells, tumor necrosis, and intravascular invasion were absent. The mitotic rate varied from 1 to 3 per 50 high-powered fields (HPFs). Immunohistochemically, the tumor cells were immunoreactive for smooth muscle actin and calponin with stains for type IV collagen demonstrating collagen investing individual cells (Fig. 2). The tumor cells were negative for desmin, cytokeratin 7 and 20, AE1/AE3, synaptophysin, chromogranin, CD56, S-100 protein, and EMA. In addition, an immunostain with the nuclear proliferation marker Ki-67 revealed approximately 10% positivity. These results established the diagnosis of a renal pelvic glomus tumor. Although this tumor appears to be primary at this site, one cannot entirely exclude the possibility of a metastasis from an occult soft tissue primary. In support of this being a primary pelvic glomus tumor, the patient had an uneventful postoperative course and remains free of disease without any other primary site at 6-month follow-up.

3. Discussion

Glomus tumor, first described in 1924 by Masson [12], is a distinct perivascular neoplasm that is believed to originate from modified smooth muscle cells that are present in the walls of specialized arteriovenous shunts (*Sucquet-Hoyer canals*) engaged in thermoregulation.

Glomus tumors are well circumscribed and composed of varying proportions of glomocytes, blood vessels and smooth muscle. On the basis of proportions of the components, glomus tumors are divided in three subgroups: glomus tumor proper, glomangioma, and glomangiomyoma. Histologic subgroups do not appear to correlate with clinical presentation. Most glomus tumors are solitary and benign. However, rare cases of atypical and malignant glomus tumors with recurrences, metastases, and death have been reported [8-11]. In one study, 52 cases of atypical glomus tumors of the peripheral soft tissues were retrospectively analyzed in an attempt to establish criteria of malignancy [8]. Those authors proposed that deep location, size larger than 2 cm, atypical mitotic figures, moderate-to high-grade

Fig. 1 (A) Low-power view of multilobular growth pattern with lobules protruding into the renal pelvis. The lobules are separated by thick fibrous bands. (B) Glomus tumor covered by a thinned layer of urothelium. (C) Monomorphic polygonal tumor cells with numerous branched thin-walled vessels. The tumor cells have well-defined cell borders, centrally located round nuclei with pinpoint nucleoli, and eosinophilic cytoplasm.

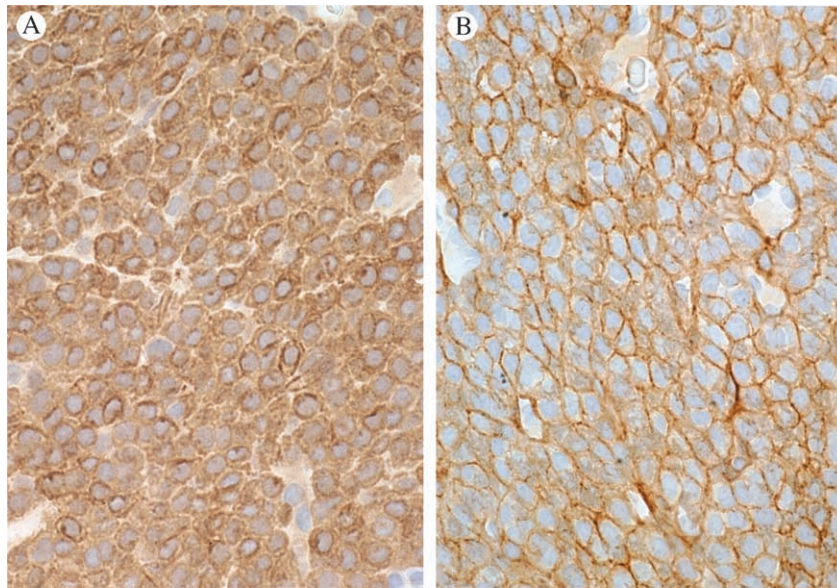


Fig. 2 (A) Strong cytoplasmic staining for calponin. (B) Type IV collagen immunostain with membranous staining outlining each tumor cell.

nuclear atypia, and 5 or more mitoses per 50 HPF should be considered as criteria for malignancy. However, none of their cases was located in an internal anatomic site. The behavior of glomus tumors arising in the internal organs are not well known due to rarity of such cases and limited follow-up. Multiple glomus tumors have been reported to occur during childhood and in neurofibromatosis type 1. In some cases, an autosomal-dominant mode of inheritance has been suggested, and a gene for inherited glomus tumors is identified on chromosome 1p21-22 [1].

The main differential diagnostic consideration for renal glomus tumor includes other perivascular tumors (hemangiopericytoma, juxtaglomerular tumor), smooth muscle neoplasms (epithelioid leiomyoma), carcinoid tumor, and paraganglioma. Glomus tumors can have a hemangiopericytomatous (staghorn) vascular pattern. However, hemangiopericytomas are negative for actin and positive for CD34 and lack the uniform round cells that are seen in glomus tumors. Juxtaglomerular cell tumor is a rare renal tumor of the young adult, usually presenting with severe hypertension caused by excessive renin secretion [13]. Their histology may resemble that of hemangiopericytoma and glomus tumors. The stroma contains chronic inflammatory cells with a main component of mast cells. The tumor cells are usually immunoreactive for CD34 and actin. At the ultrastructural level, the presence of rhomboid-shaped renin protogranules is diagnostic. However, this tumor occurs in the cortex and not in the pelvis of the kidney. The presence of uniform cells with central nuclei, clear to eosinophilic cytoplasm, and occasional organoid growth pattern also suggests the diagnosis of carcinoid tumor or paraganglioma. The immunohistochemical staining pattern usually assists in differentiating these entities: glomus tumors show positivity for actin, whereas tumors with neuroendocrine features

show positivity for neuron-specific enolase and chromogranin. In addition, glomus tumors show prominent intercellular basal lamina outlining individual or small group of cells. Glomus tumors are usually negative for all neuroendocrine markers. In the case reported herein, the tumor cells were positive for smooth muscle actin and calponin. A stain with type IV collagen demonstrated collagen investing individual cells. The tumor was negative for desmin, excluding an epithelioid smooth muscle tumor. Immunohistochemical stains were also negative for cytokeratin 7 and 20 and for AE1/AE3, excluding a urothelial carcinoma. The tumor did not express synaptophysin, chromogranin, or CD56, excluding a carcinoid tumor. Both S100 and the aforementioned neuroendocrine stains were negative ruling out a paraganglioma.

To our knowledge, the current study is the first to document a glomus tumor within the kidney in peer-reviewed literature. In the present case, the benign cytohistologic features, including uniform appearance with minimal atypia and low mitotic rate, as well as a complete surgical removal would be expected to be associated with an excellent clinical outcome.

References

- [1] Enzinger FM, Weiss SW. Perivascular tumors. In: Enzinger FM, Weiss SW, editors. *Enzinger and Weiss' soft tissue tumors*. 4th ed. St Louis (MO): Mosby; 2001. p. 985-1035.
- [2] Gaertner EM, Steinberg DM, Huber M, et al. Pulmonary and mediastinal glomus tumors—report of five cases including a pulmonary glomangiosarcoma: a clinicopathologic study with literature review. *Am J Surg Pathol* 2000;24:1105-14.
- [3] Miettinen M, Paal E, Lasota J, et al. Gastrointestinal glomus tumors: a clinicopathologic, immunohistochemical, and molecular genetic study of 32 cases. *Am J Surg Pathol* 2002;26:301-11.

- [4] Sonobe H, Ro JY, Ramos M, et al. Glomus tumor of the female external genitalia: a report of two cases. *Int J Gynecol Pathol* 1994; 13:359-64.
- [5] Blandamura S, Florea G, Brotto M, et al. Periarethral glomangiomyoma in women: case report and review of the literature. *Histopathology* 2000;36:571-2.
- [6] Albores-Saavedra J, Gilcrease M. Glomus tumor of the uterine cervix. *Int J Gynecol Pathol* 1999;18:69-72.
- [7] Billard F, Dumollard JM, Cucherousset J, et al. Two benign vascular tumors of the kidney capsule. *Ann Pathol* 1991;11:266-70.
- [8] Folpe AL, Fanburg-Smith JC, Miettinen M, et al. Atypical and malignant glomus tumors: analysis of 52 cases, with a proposal for the reclassification of glomus tumors. *Am J Surg Pathol* 2001;25:1-12.
- [9] Leu HJ. Glomus tumours: morbid-anatomical analysis of 58 cases, especially infiltrated forms [in German]. *Dtsch Med Wochenschr* 1981;106:171-4.
- [10] Gould EW, Manivel JC, Albores-Saavedra J, et al. Locally infiltrative glomus tumors and glomangiosarcomas. A clinical, ultrastructural, and immunohistochemical study. *Cancer* 1990;65: 310-8.
- [11] Watanabe K, Hoshi N, Tsu-Ura Y, et al. A case of glomangiosarcoma. *Fukushima J Med Sci* 1995;41:71-7.
- [12] Masson P. Le glomus neuromyoarterial des regions tactiles et ses tumeurs. *Lyon Chir* 1924;2:257-80.
- [13] Rosai J. Urinary tract. In: Rosai J, editor. *Rosai and Ackerman's Surgical Pathology*. 9th ed. 2004. p. 1163-317.