# Can Renal Hemangiomas be Diagnosed Preoperatively?

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**ABSTRACT:** **Background:** Renal hemangiomas are rare benign tumors seldom distinguished from malignant tumors preoperatively.
**Objectives:** To describe the Memorial Sloan-Kettering Cancer Center (MSKCC) experience with diagnosing and treating renal hemangiomas, and to explore possible clinical and radiologic features that can aid in diagnosing renal hemangiomas preoperatively.
**Methods:** Patients with renal hemangiomas treated at MSKCC were identified in our prospectively collected renal tumor database. Descriptive statistics were used to describe the patient characteristics and the tumor characteristics. All available preoperative imaging studies were reviewed to assess common findings and explore possible characteristics distinguishing benign hemangiomas from malignant renal tumors preoperatively.
**Results:** Of 6341 patients in our database 15 were identified. Eleven (73%) were males, median age at diagnosis was 53.3 years, and the affected side was evenly distributed. All but two patients were treated surgically. The mean decrease in estimated glomerular filtration rate (eGFR) after surgery was 36.3%; one patient had an abnormal presurgical eGFR and only two patients had a normal eGFR after surgery. We could not identify radiographic features that would make preoperative diagnosis certain, but we did identify features characteristic of hepatic hemangiomas that were also present in some of the renal hemangiomas.
**Conclusions:** Most renal hemangiomas cannot be distinguished from other common renal cortical tumors preoperatively. In select cases a renal biopsy can identify this benign lesion and the deleterious effects of extirpative surgery can be avoided.

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**KEY WORDS:** surgically induced chronic kidney disease, hemangioma, nephrectomy, presurgical diagnosis, renal cortical tumor

Renal hemangiomas are rare benign tumors. Although hemangiomas may occur anywhere in the urinary tract, there is propensity towards the kidney. Since Virchow first described hemangiomas in 1867, approximately 200 cases of renal hemangioma have been reported in the literature [1,2].

Hemangiomas are usually benign, unilateral, isolated and likely originate from embryonic rests of angioblastic cells [3]. Renal hemangiomas as large as 10 cm have been reported, but smaller tumors of 1–2 cm are more frequently documented. Two distinct pathologic forms, capillary and cavernous, are differentiated based on their size and the depth of the vascular or lymphatic channels [4]. The most common sites of formation are the tips of renal papillae, and the common clinical presentation is gross hematuria [5]. Peterson and Thompson [6] reported that 92% of the hemangiomas are submucosal-papillary-medullary, with parenchymal-subcapsular constituting the remainder.

There is a paucity of literature on genito-urinary hemangiomas. Hemangiomas involving the bladder, ureter, urethra, and kidney have been reported. There appears to be no predilection towards gender and no documented reports of primary or secondary malignancy. These tumors grow by mass effect with compression of surrounding tissues. Classically these lesions appear in the third or fourth decade of life with renal colic or painless hematuria [2].

The aim of this report is to summarize our clinical experience with renal hemangiomas, focusing specifically on radiographic features which may raise the possibility of this diagnosis preoperatively.

## PATIENTS AND METHODS

After institutional review board approval we identified all patients treated at Memorial Sloan-Kettering Cancer Center (MSKCC) between 1992 and 2013 for renal hemangiomas using our prospectively collected renal tumor database. Patients were also identified by searching pathology and radiology reports for the diagnosis of renal hemangiomas. Demographic data, signs and symptoms leading to the diagnosis, imaging studies performed, pathology reports of resected specimens, and follow up data were collected.

All available imaging studies were reviewed by a single radiologist (C.K.) and assessed for common findings and possible characteristics distinguishing renal hemangiomas from other renal cortical tumors. All imaging studies were reviewed using our institution's PACS system (Picture Archiving and Communications System). Estimated glomerular filtration rate (eGFR) was calculated using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation [7].

Descriptive statistics were used to present the patient characteristics, tumor characteristics and follow-up data.

## RESULTS

Of the 6341 patients in our database, we identified 15 (0.2%) with a diagnosis of a renal hemangioma. Patients' characteristics are presented in Table 1. Of the 15 patients, 7 were treated at MSKCC. A pathologic review was performed at MSKCC for the remaining eight patients who had been diagnosed and treated elsewhere. Data available for these eight patients were limited.

Eleven of 15 patients (73%) were males and the median age at diagnosis was 53.3 years (range 32.2–74.8 years). Of the seven patients treated at MSKCC, four were lifetime non-smokers, one was a former smoker, one patient was an active smoker, and for the remaining patient smoking status was not available.

In five of the seven patients a renal hemangioma was incidentally found on imaging done for other causes. Two patients were diagnosed after developing signs or symptoms: microscopic hematuria in one patient and a combination of gross hematuria and renal colic in the other. During the evaluation of the diagnosed renal mass, urine cytology was evaluated in four patients and was negative for malignant cells in all four. One patient underwent a diagnostic ureteroscopy that was unremarkable, and a biopsy taken during the procedure was benign. In two of seven patients hemangiomas were found at other sites at the time of the diagnosis of a renal hemangioma. One patient had splenic hemangiomas and the other had liver and vertebral hemangiomas.

Of the seven patients treated at MSKCC, a partial nephrectomy was performed in one, radical nephrectomy in two, nephro-ureterectomy in two, and two patients did not have surgery during their recorded follow-up. One of these patients had a percutaneous biopsy that diagnosed the renal mass as a hemangioma which has been followed since. The second patient was lost to follow-up shortly after being diagnosed with a renal hemangioma by imaging. With a median follow-up time of 1.4 years all patients were alive at the time of last follow-up and none had suffered a local recurrence.

All patients but one had a normal preoperative eGFR (> 60 ml/min/1.73 m$^2$). One patient had borderline preoperative eGFR (59.6 ml/min/1.73 m$^2$). The mean change in eGFR in patients treated surgically was a decrease of 36.3%. The postoperative eGFR was normal in two patients and less than 60 ml/min/1.73 m$^2$ in three patients. The serum creatinine used to calculate the postoperative eGFR was the first available after discharge from the hospital. This was obtained at a median of 47 days after surgery and no sooner than 3 weeks after surgery.

**Table 1.** Patient and tumor characteristics

| | All patients (n=15) | Patients treated at MSKCC (n=7) |
|---|---|---|
| Median age at diagnosis | 53.3 years | 53.3 years |
| **Gender** | | |
| Male | 11 (73%) | 5 (71%) |
| Female | 4 (27%) | 2 (29%) |
| **Smoking status** | N/A | |
| Non-smoker | | 4 (57%) |
| Past smoker | | 1 (14%) |
| Current smoker | | 1 (14%) |
| N/A | | 1 (14%) |
| **Presenting sign/symptom** | N/A | |
| Hematuria only | | 1 (14%) |
| Hematuria + flank pain | | 1 (14%) |
| Incidental | | 5 (71%) |
| **Side of hemangioma** | | |
| Left | 7 (47%) | 2 (29%) |
| Right | 8 (53%) | 5 (71%) |
| Median tumor size | N/A | 3.0 cm |
| **Extrarenal sites of hemangiomas** | N/A | |
| Liver | | 1 (14%) |
| Spleen | | 1 (14%) |
| Vertebrae | | 1 (14%) |
| **Treatment** | | |
| Partial nephrectomy | 2 (13%) | 1 (14%) |
| Radical nephrectomy | 8 (53%) | 2 (29%) |
| Nephroureterectomy | 3 (20%) | 2 (29%) |
| Surveillance | 2 (13%) | 2 (29%) |
| **Normal preoperative eGFR** | N/A | |
| Yes | | 5 (83%) |
| No | | 1 (17%) |
| **Normal postoperative eGFR** (6 patients treated surgically) | N/A | |
| Yes | | 2 (40%) |
| No | | 3 (60%) |
| Mean postoperative change eGFR | N/A | -36.3% |

MSKCC = Memorial Sloan-Kettering Cancer Center, N/A = not available, eGFR = estimated glomerular filtration rate

### RADIOLOGY REVIEW OF PREOPERATIVE IMAGING

Of the 15 patients included in this case collection of renal hemangiomas, pre-treatment cross-sectional imaging data were available for five patients through our institution's PACS system. Of these five patients, two underwent contrast-enhanced computed tomography and three underwent both CT and magnetic resonance imaging (MRI) prior to treatment.

In general, the imaging appearance of renal hemangiomas in these cases was similar to clear-cell renal cell carcinoma in four and urothelial carcinoma in one. The hemangiomas mimicking clear-cell renal carcinomas appeared as well-defined, solid masses and demonstrated cystic components as well as avid contrast enhancement [Figure 1]. The hemangioma mimicking a centrally located urothelial carcinoma appeared ill-defined and demonstrated early peripheral, nodular contrast enhancement as well as delayed enhancement – a feature typical of hemangiomas, especially as seen in the liver [Figure 2]. However, the ill-defined margins, the presence of marked involvement of the renal hilar, as well as perinephric adipose tissue were highly suggestive of a malignant lesion. In addition, there was wall thickening of the collecting system and proximal ureter, a feature often seen in urothelial carcinoma.

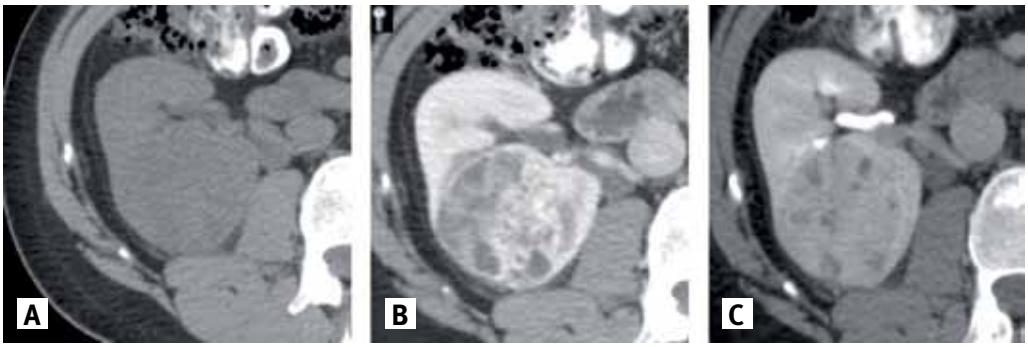


**Figure 1.** Right kidney hemangioma mimicking a renal cell carcinoma. **[A]** Pre-contrast image, **[B]** Post-contrast image, **[C]** Delayed image

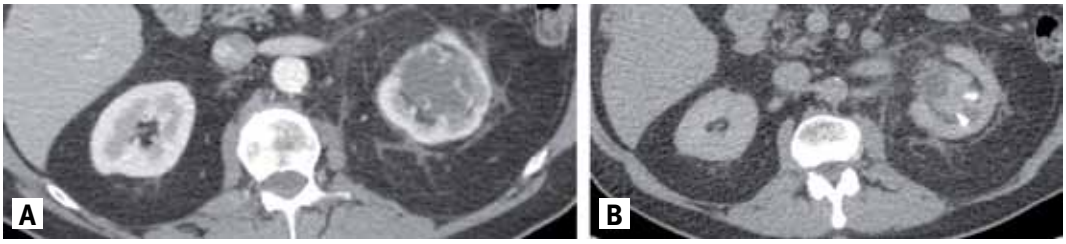


**Figure 2.** Left kidney hemangioma mimicking a centrally located urothelial carcinoma. **[A]** Post-contrast image, **[B]** Delayed image

## DISCUSSION

Renal hemangiomas are extremely rare renal tumors, as can be appreciated by the small proportion of these tumors in our large database of patients with renal tumors. Two case series of renal hemangiomas have been published thus far. Both reports included different primary vascular tumors of the kidney (including arteriovenous malformation, lymphangiomas and angiosarcomas) and did not focus solely on hemangiomas. Brown and co-authors [8] reported on 25 patients with primary vascular tumors and tumor-like lesions of the kidney, including 8 malignant lesions (angiosarcomas) and 3 arteriovenous malformations. Nine of 14 patients (64%) with renal hemangiomas in this series were males and the mean size of the hemangiomas was 2.0 cm (range 0.2–3.5 cm).

Mehta et al. [9] reported on 15 patients with primary benign vascular tumors and tumor-like lesions of the kidney, of which 6 were renal hemangiomas, 6 were arteriovenous malformations, 2 were lymphangiomas and 1 patient had intravascular papillary endothelial hyperplasia. All six patients were males and the average size of the hemangiomas was 3.4 cm (range 0.5–9.0 cm) in this series.

When combining our results with these two reports, it is clear that renal hemangiomas are more common in men (26/35, 74%). These reports, together with our data, also indicate the generally small size of renal hemangiomas as all renal hemangiomas were reported to be 4.5 cm or less in size, with the exception of a single patient with a 9.0 cm hemangioma.

Reviewing the preoperative imaging studies we could not identify features that can be used to differentiate between renal hemangiomas and other renal cortical tumors preoperatively. We did see delayed enhancement on some of the preoperative imaging studies, a feature typical of hepatic hemangiomas.

Most hemangiomas cannot be distinguished preoperatively from malignant renal tumors, but lack of risk factors, negative cytology, negative upper tract endoscopy in cases suspicious for urothelial carcinoma, and delayed enhancement on imaging studies can raise the suspicion of a hemangioma and prompt a percutaneous biopsy. Since most patients with hemangiomas are young and the decline in renal function after surgical treatment can be dramatic, clinical identification of a benign renal tumor can obviate the need for surgical resection and prevent renal insufficiency and the health risks associated with it [10-15]. Our series includes only a single patient who underwent a percutaneous biopsy. This patient did not suffer biopsy-related complications and was last seen at follow-up 2.9 years after diagnosis without a change in size of the hemangioma, no related symptoms and no need for treatment. Prior series reported a low complication rate after percutaneous biopsies of small renal masses [16], but since renal hemangiomas are a rare entity, data on percutaneous biopsies of renal hemangiomas and biopsy-related complications do not exist. Series of percutaneous biopsies of hepatic hemangiomas report a low risk for complication, including a low risk for hemorrhage, which is a main concern in biopsies of vascular lesions [17,18].

Daneshmand and Huffman [19] described 15 patients with presumed renal hemangiomas managed endoscopically. The

patients in this series had negative preoperative imaging and were diagnosed during ureteroscopy for unilateral upper tract hematuria. The diagnosis was based solely on appearance of the lesion, without biopsy and pathological confirmation. The size of the lesions in this series was 2 mm to 1 cm, the authors reported there was no predilection to size or location, the mean age was 37.5 years, and there was no mention of the gender of the patients. While this report is interesting for the fact that these patients were managed with a kidney-preserving approach, the tumors in this series were small enough to be missed on cross-sectional imaging and, therefore, did not pose a dilemma as to whether they are benign or malignant renal tumors.

We acknowledge the shortcomings of our report – its retrospective nature and small cohort size. Nonetheless, this is one of the largest series of renal hemangiomas reported to date, characterizing them both clinically and radiographically.

## CONCLUSIONS

Most renal hemangiomas cannot be distinguished from malignant renal tumors preoperatively. Clinical and radiological features can raise the suspicion of a hemangioma in select cases and prompt a biopsy of the renal mass. Identification of such benign lesions and prevention of surgical resection could avoid an unnecessary operation and the associated adverse potential impact on renal function and overall health.

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