

# Cystic Renal Cell Carcinoma: Our Series

## Abstract

**Introduction:** Complex renal cystic lesions have long posed a clinical dilemma to clinicians as they represent a heterogeneous group of both benign and malignant conditions sharing similar clinical and radiological features. The Bosniak classification system based on computed tomography (CT) imaging remains the gold standard to predict the risk of malignancy in cystic renal masses. We retrospectively reviewed our series of patients who underwent surgery for renal cysts, their histopathological diagnosis, the outcome of surgery, and follow-up. **Materials and Methods:** We retrospectively reviewed the inpatient charts of the hospital for patients with renal cysts undergoing surgery for the same during the period January 2000-December 2017. CT images of these patients were re-reviewed. Clinical, surgical, radiological, pathological, and postoperative outcomes were analyzed. Based on the final pathology findings, the patients were stratified into a renal cell carcinoma (RCC) or a benign tumor subgroup. **Results:** During the 18-year study period, 31 patients with Bosniak I simple renal cysts, 23 with Bosniak 2 cysts, 1 patient with Bosniak IIF cyst, 8 with III cyst, and 11 with IV cyst underwent surgery. None of the patients with Bosniak I, II, and IIF had malignancy on histopathological examination (HPR) of the resected cyst wall. Five of the eight patients with Bosniak III and all 11 patients with Bosniak IV cysts had malignant lesions. Histopathological variety of RCC was clear cell type with Fuhrman Grade 1–2 in all the 16 patients. None of the patients have had either local or systematic recurrence of the malignancy. Five patients died during the follow-up period due to causes other than malignancy. **Conclusions:** Patients with unifocal cystic RCC evaluated and managed using standard imaging carry an excellent prognosis. Bosniak classification system is very effective in predicting malignancy in categories II, IIF, and IV, but low in category III, and that 37.5% of Bosniak III cysts were benign on HPR.

**Keywords:** Kidney, carcinoma, renal cell, cysts, nephrectomy

## Introduction

One of the most difficult problems in renal imaging remains the differentiation between benign renal cysts and cystic renal cell carcinoma (RCC).<sup>[1]</sup> The wall of the cyst; its thickness and contour; the number, contour, and thickness of any septa; the amount, character, and location of any calcifications; the density of fluid in the lesion; the margination of the lesion; and the presence of solid components are the factors used to determine a complex renal cyst's benign or malignant nature.<sup>[2]</sup> Bosniak developed a classification scheme primarily based on computed tomography (CT) imaging criteria that divided renal cystic lesions into categories that were distinct from one another in terms of the likelihood of malignancy.<sup>[3]</sup>

Simple renal cysts (SRCs) or Bosniak Class I renal cysts are the most common

benign renal lesions, found in over 50% of patients older than 50 years,<sup>[4]</sup> need no specific treatment unless patients present symptomatically<sup>[3]</sup> and transformation of SRCs into RCC is considered extremely rare. Qin *et al.*<sup>[5]</sup> treated 31 cases of RCC derived from SRCs. Fourteen of these had a CT or magnetic resonance imaging (MRI) detected SRC and RCC detected on the histopathological examination (HPR) of the decorticated cyst. The other 17 who had SRC were monitored by ultrasound every 6 months and surgery performed only when a complication arose during surveillance as detected on ultrasonography and confirmed by CT or MRI. The authors concluded that RCC could be detected incidentally in cases of SRC and that regular follow-up was necessary to diagnose complications including malignancy arising in them.

Han *et al.*<sup>[6]</sup> reviewed the records of 97 patients who underwent surgery for complex cystic renal masses. Malignancy

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was significantly associated with cyst size ( $>2$  cm), male gender, and younger patient age ( $<50$  years). According to the Bosniak classification, there was no category I cyst, and all 8 category II cysts were benign. However, 3 of 18 (17%) category IIF cysts, 21 of 39 (54%) category III cysts, and 29 of 32 (90%) category IV cysts were malignant. CRCC has a better prognosis due to low nuclear grade and tumor-node-metastasis stage, regardless of tumor size.<sup>[7]</sup> The 10-year survival rates and nonrecurrence rate after operation were 97.3% and 90.3%, respectively.<sup>[8,9]</sup> We retrospectively reviewed our series of patients who underwent surgery for renal cysts, their histopathological diagnosis, outcome of surgery, and follow-up.

## Materials and Methods

With approval obtained from the Institutional/University ethical committee, we retrospectively reviewed the inpatient charts of the hospital, for patients with renal cysts undergoing surgery for the same during the period January 2000 to December 2017. CT images of these patients were re-reviewed [Figures 1 and 2]. The solid component of the entire tumor was measured and visually graded into four groups, including none,  $<25\%$ ,  $25\%$  to  $50\%$ , or  $>50\%$ . Additional imaging characteristics were also recorded, such as the Bosniak classification, maximal diameter in cm, tumor location ( $50\%$  or greater exophytic,  $<50\%$  exophytic and endophytic), and the presence of calcifications, septations, and other cysts.

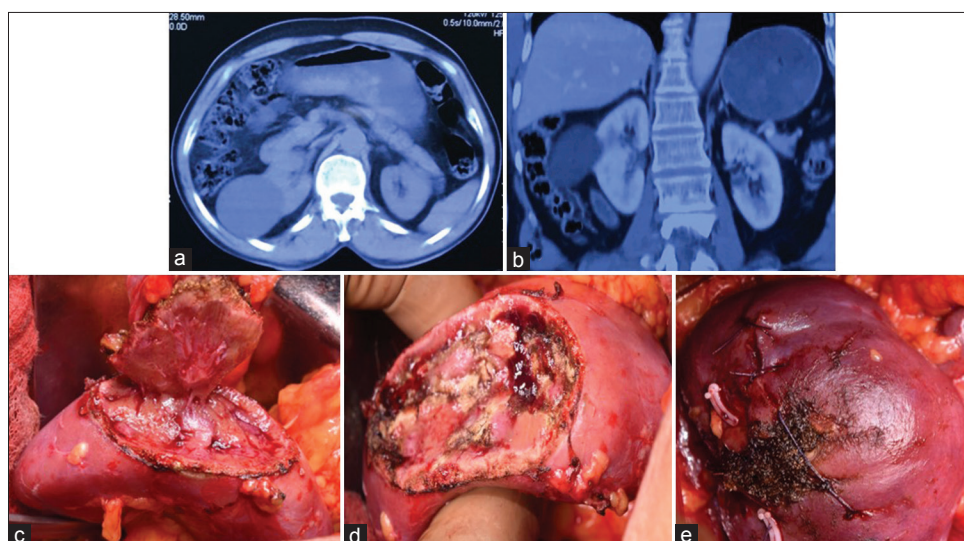
Clinical, surgical, radiological, pathological, and postoperative outcomes were analyzed. Based on final pathology findings, the patients were stratified into an RCC or a benign tumor subgroup. Univariate analyses of clinical, radiological, and pathological parameters were done using the Fisher's exact test and the Student *t*-test.

## Results

During the 18-year study period, 138 patients were diagnosed to have Bosniak I SRCs and 23 with Bosniak II cysts. Of these, 31 patients with Bosniak I and all 23 patients with Bosniak II cysts underwent surgery for various indications as shown in Table 1. None of these patients had malignancy on HPR of the resected cyst wall.

During the same period, 1 patient with Bosniak IIF cyst, 8 with III cyst, and 11 with IV cyst underwent surgery [Table 2]. The median age, size of the cysts, indications for surgery, outcome, and histological diagnosis are shown in Table 2. Five (62.5%) of the patients with Bosniak III and all 11 (100%) patients with Bosniak IV cysts had malignancy as confirmed on HPR of the cyst wall. The excision of cysts involved partial nephrectomy in 10 patients with Bosniak III/IV cysts and nine patients with Bosniak III/IV cysts had nephrectomy (radical) as it was not feasible to perform partial without compromising the vasculature. Of the 10 patients undergoing partial nephrectomy, three patients with Bosniak III had no malignancy on HPR, whereas none of the nine patients undergoing nephrectomy had a benign lesion on HPR. A total of 16 patients with Bosniak III/IV cysts had RCC on HPR, 9 of these were clear cell, and 3 had a follicular type of RCC. Nearly all the patients with RCC had cysts located in the mid and lower portion of the kidneys and all these cysts were either exophytic or partially exophytic/endophytic. The solid component of the cyst in patients with Bosniak III/IV was  $<25\%$  in 12,  $25\text{--}50\%$  in 4, and  $>50\%$  in the remaining three.

In our study, all patients with Bosniak I, II, and IIF had benign lesions. All 16 patients with RCC were followed up after surgery. The histopathological variety of RCC



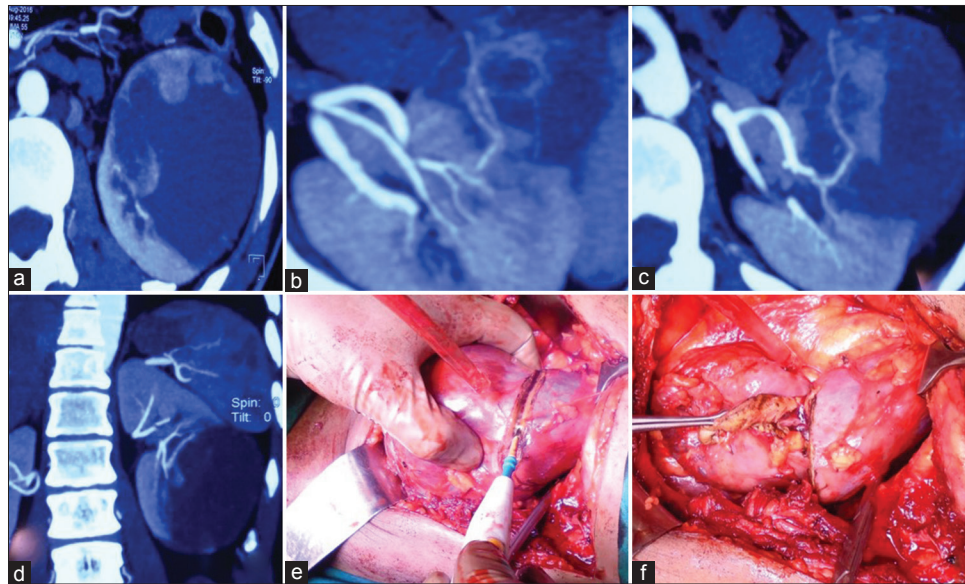
**Figure 1:** (a and b) Computed tomography images of a Bosniak III cyst with thickened wall towards the kidney. (c-e) Steps of partial nephrectomy performed

**Table 1: Demographics of patients with Bosniak I and II cysts undergoing surgery**

<i>n</i>	Bosniak classification	I	II
1	Number of patients undergoing surgery	31	23
2	Median age (range) years	53.07±9.86 (42-76)	56.21±9.44 (33-78)
3	Median size of cysts (range) cm	13.27±3.22 (9-18)	11.36±3.19 (5-19)
4	Indications for surgery		
	Pain	21	12
	Turbidity of cystic contents	10	11
5	Surgery	31	23
	Laparoscopic excision/marsupialization	31	18
	Open excision of cyst/partial nephrectomy	-	5
6	Histopathological examination of the cyst wall/contents	31 - benign	23 - benign

**Table 2: Distribution of patients according to Bosniak classification**

<i>n</i>	Bosniak classification	IIIF	III	IV
1	Number of patients undergoing surgery	1	8	11
2	Median age (range) years		59.75±11.03 (39-77)	66.08±5.29 (54-71)
3	Size of the cyst (range) cm	8	10.09±2.42 (6-14)	9.40±1.85 (7-12)
4	Indications for surgery			
	Pain	1	-	-
	Septations/wall calcification	1	4	2
	Solid component in wall	-	4	11
5	Surgery done			
	Laparoscopic excision	1	-	-
	Partial nephrectomy	-	6	4
	Nephrectomy	-	2	7
6	Histopathological diagnosis	Benign 1	Benign 3, malignant 5	Benign 0, malignant 11



**Figure 2: (a-d) Computed tomography angiography of the kidney. A well-defined cyst seen in the left kidney with the cyst wall showing solid elements. Vascular branches to the solid elements are noted. (e and f) Partial nephrectomy being performed**

was clear cell type with Fuhrman Grade 1–2 in all the 16 patients. None of the patients have had either local or systematic recurrence of the malignancy. Five patients died during the follow-up period due to causes other than malignancy.

## Discussion

The diagnosis and management of complex renal cysts were contentious before the introduction of Bosniak classification, and a combination of CT, ultrasound, and



urography was used to distinguish between benign and malignant cystic renal lesions. The Bosniak classification was the first to correlate radiological findings to treatment advice. Complex renal cysts categorized as Bosniak III and IV are expected to be malignant lesions, and surgical excision is recommended. The Bosniak classification has been fully embraced by international urology and radiological societies and implemented into guidelines.<sup>[10]</sup>

An important modification to the Bosniak classification was done in 1993, wherein Bosniak category IIF was introduced to bridge category II and III with the option of radiological follow-up.<sup>[11]</sup> The original Bosniak classification in 1986 was based on CT findings. The technique of CT has evolved over the years, which implies that current CT shows details that were not visible in 1986. New imaging modalities such as MRI and contrast-enhanced ultrasonography have become available and may contribute to the current Bosniak classification system.<sup>[10]</sup> Schoots *et al.*<sup>[10]</sup> systematically reviewed the published literature on the Bosniak classification for renal cysts (1) to assess malignancy risk in the different Bosniak categories and (2) to assess the long-term oncologic outcome of patients treated in concordance with this system, based on radiological recurrence and metastatic disease. A total of 3,036 complex renal cysts were categorized into Bosniak II, IIF, III, and IV. In surgical and radiological cohorts, pooled estimates showed a malignancy prevalence of 0.51 in Bosniak III and 0.89 in Bosniak IV cysts, respectively. Stable Bosniak IIF cysts showed a malignancy rate of <1% during radiological follow-up (surveillance). The authors believe that the Bosniak classification system for complex renal cysts was highly effective in categories II, IIF, and IV.

Schoots *et al.*<sup>[10]</sup> in their series observed that the Bosniak classification system was very effective in categories II, IIF, and IV, but low in category III, and that 49% of Bosniak III cysts were overtreated because of a benign outcome. Our series too showed similar findings, 3 of the 8 patients with Bosniak III cysts underwent partial nephrectomy and were benign on HPR. Schoots *et al.*<sup>[10]</sup> believe that surveillance would have been a rational alternative to surgery in these patients and have suggested further studies to assess whether surveillance of Bosniak III cysts would prove to be safe.

Historically cystic form of RCC (cRCC) was thought to be an indolent or slow-growing version of RCC composed predominantly of cysts.<sup>[12]</sup> Traditionally, >75% cystic on pathological review was the threshold used to define cRCC.<sup>[13]</sup> However, this classification does not help in making a preoperative decision. Cross-sectional imaging offers the benefit of assessing tumor morphology without surgical manipulation, allowing for accurate assessment of the solid and cystic components, and classification of cRCC. Kashan *et al.*<sup>[14]</sup> evaluated the outcomes of surgical intervention and active surveillance (AS) in patients

diagnosed with cystic RCC with a radiological cutoff of >50% cystic. Of the 138 identified cases of cystic RCC, 102 (73.9%) were RCC and 36 (26.1%) were benign masses. Of the tumors, 77.5% were Fuhrman Grade 1–2, 83.4% were stage pT2 or less, and 65.9% showed clear cell histology. On univariate analysis, male gender, a solid component, and increasing Bosniak classification were significant for malignancy.

Several previous reports have shown that this condition presents with less aggressive pathological features and carries a minimal risk of recurrence or metastasis following surgery and patients with cRCC have an excellent prognosis when compared to clear cell RCC.<sup>[15,16]</sup> These lesions are predominantly cystic with the solid portions of these tumors often being significantly smaller than the entire lesion.<sup>[15]</sup> The solid portion is thought to contain the malignant components of these lesions, so that the tumor burden is often significantly less than that of other tumors of similar size.<sup>[15]</sup> Today, most of the patients with Bosniak 3 and 4 complex cystic renal masses undergo surgery. However, because of the excellent prognosis and minimal risk of recurrence or metastases, AS can also be an acceptable initial approach to these lesions.<sup>[17,18]</sup>

Recent guidelines on the management of localized renal cancer state that AS can be initially implemented in patients with Bosniak 3 and 4 complex cystic lesions who have limited life expectancy, are at higher risk for surgical complications, or have favorable tumor characteristics on imaging.<sup>[17]</sup> Kashan *et al.*<sup>[14]</sup> showed that initial management by AS followed by surgery was associated with no difference in the proportion of malignancy or overall survival compared to that in patients initially treated with surgery. Since cRCC lesions are smaller overall, have a smaller solid component, and carry a lower oncologic risk than similar RCC masses, initial AS strategies can be considered in a select group of patients.

## Conclusion

Renal cysts remain one of the most difficult problems in renal imaging as differentiation between benign renal cysts and cystic Renal cell carcinoma (RCC) is a major concern for a Urologist. Use of Bosniak classification helps in dividing renal cystic lesions into distinct categories. Bosniak cysts of type I, II and IIF are likely to be benign. Bosniak type III and IV can be considered suspicious of renal cell carcinoma. Presence of solid components within the cysts, suggest a malignant component. Our study has similarly confirmed that type IV cysts are highly suspicious of RCC.

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## Conflicts of interest

There are no conflicts of interest

## References

1. Bosniak MA. The Bosniak renal cyst classification: 25 years later. *Radiology* 2012;262:781-5.
2. Campbell SC, Lane BR. Malignant renal tumors. In: Wein AJ, Kavoussi LR, Partin AW, Peters CA, editors. *Campbell-Walsh Urology*. 11<sup>th</sup> ed. Philadelphia: Elsevier; 2016. p. 1314.
3. Israel GM, Bosniak MA. An update of the Bosniak renal cyst classification system. *Urology* 2005;66:484-8.
4. Kissane JM. The morphology of renal cystic disease. *Perspect Nephrol Hypertens* 1976;4:31-63.
5. Qin X, Ye L, Zhang H, Dai B, Zhu Y, Shi G, *et al.* Complicated variation of simple renal cyst usually means malignancy: Results from a cohort study. *World J Surg Oncol* 2014;12:316.
6. Han HH, Choi KH, Oh YT, Yang SC, Han WK. Differential diagnosis of complex renal cysts based on lesion size along with the Bosniak renal cyst classification. *Yonsei Med J* 2012;53:729-33.
7. Papadimitriou VG, Takos D, Adamopoulos V, Vegertaki U, Heretis JM, Stamatiou KN, *et al.* Unusual case of multilocular cystic renal cell carcinoma treated with nephron-sparing technique. *G Chir* 2009;30:345-8.
8. Tosaka A, Yoshida K, Kobayashi N, Takeuchi S, Uchijima Y, Saitoh H. A report of two cases of multilocular cystic renal cell carcinoma: Review of 51 cases reported and the results of a prognostic survey. *Hinyokika Kyo* 1992;38:1045-50.
9. Zhang J, Liu B, Song N, Hua L, Wang Z, Gu M, *et al.* Diagnosis and treatment of cystic renal cell carcinoma. *World J Surg Oncol* 2013;11:158.
10. Schoots IG, Zaccari K, Hunink MG, Verhagen PCMS. Bosniak classification for complex renal cysts reevaluated: A systematic review. *J Urol* 2017;198:12-21.
11. Israel GM, Bosniak MA. Calcification in cystic renal masses: Is it important in diagnosis? *Radiology* 2003;226:47-52.
12. Hartman DS, Davis CJ Jr., Johns T, Goldman SM. Cystic renal cell carcinoma. *Urology* 1986;28:145-53.
13. Corica FA, Iczkowski KA, Cheng L, Zincke H, Blute ML, Wendel A, *et al.* Cystic renal cell carcinoma is cured by resection: A study of 24 cases with long-term followup. *J Urol* 1999;161:408-11.
14. Kashan M, Ghanaat M, Hötter AM, Duzgol C, Sanchez A, DiNatale RG, *et al.* Cystic renal cell carcinoma: A report on outcomes of surgery and active surveillance in patients retrospectively identified on pretreatment imaging. *J Urol* 2018;200:275-82.
15. Park JJ, Jeong BC, Kim CK, Seo SI, Carriere KC, Kim M, *et al.* Postoperative outcome of cystic renal cell carcinoma defined on preoperative imaging: A retrospective study. *J Urol* 2017;197:991-7.
16. Winters BR, Gore JL, Holt SK, Harper JD, Lin DW, Wright JL. Cystic renal cell carcinoma carries an excellent prognosis regardless of tumor size. *Urol Oncol* 2015;33:505.e9-13.
17. Richard PO, Violette PD, Jewett MA, Pouliot F, Leveridge M, So A, *et al.* CUA guideline on the management of cystic renal lesions. *Can Urol Assoc J* 2017;11:E66-73.
18. Nerli RB, Patil R, Magdum P, Sharma V, Ghagane S. Partial nephrectomy for renal cell carcinoma: Operative steps. *J Sci Soc* 2017;44:110.