

# Pathological report and prognostic meaning of Bosniak IV cysts: results from a contemporary cohort

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**Introduction** Surgery is the recommended treatment for Bosniak IV renal cysts. We performed a retrospective analysis of Bosniak IV lesions surgically removed to increase evidence on their prognostic meaning.

**Material and methods** Patients with a Bosniak IV cyst were considered. A contrast-enhanced computed tomography (CT) scan or magnetic resonance imaging (MRI) detected a solid component with contrast enhancement. In no case a percutaneous biopsy was performed. A radical (9, 21.4%) or partial (33, 78.6%) nephrectomy was performed with laparoscopic (14, 33.3%) or robot-assisted (28, 66.7%) approach. Analysis of the final pathology was performed, and recurrence rate was assessed.

**Results** 42 patients were included. Median lesion size was 54.7 mm (IQR 20.0–81.2). A solid tumour was detected in 40 patients (95.2%), whereas in 2 cases (4.8%) a benign cyst without neoplastic component was diagnosed. Final pathology revealed a low-grade clear cell renal cell carcinoma (ccRCC) in 16 cases (38.0%), a multilocular cystic renal neoplasm of low malignant potential in 6 cases (14.3%), a low-grade papillary RCC (pRCC) type I in 4 cases (9.5%), a clear cell papillary RCC (ccpRCC) in 10 cases (23.8%) and an oncocytoma in 2 cases (4.8%). A high-grade ccRCC was detected in 2 cases (4.8%), whereas no patients had a pRCC type II. In all cases surgical margins were negative. Median follow-up was 24 months and no recurrence occurred.

**Conclusions** Our results increase evidence on the favourable pathology and good prognosis of Bosniak IV renal cysts, supporting the role of surgery as a definitive treatment and suggesting the need for a low-intensity follow-up.

**Key Words:** renal cell carcinoma ◊ Bosniak ◊ follow-up ◊ renal cyst

## INTRODUCTION

Cystic renal masses are a common incidental finding at abdominal imaging with an overall prevalence of 10–41% in adult population [1]. The historical Bosniak classification divides renal cysts into 5 classes according to structural features such as internal septa, thickening of septa or wall, presence and shape of calcifications within the wall or septa, contrast enhancement and presence of a solid component inside the cyst [2]. Recently, an updated version of the Bosniak classification has been described and vali-

dated, aiming at improving the predictive ability for malignancy [3].

According to European Association of Urology (EAU) guidelines, Bosniak I and II cysts do not require treatment or follow-up because of their benign nature [4]. Instead, Bosniak IIF, III, and IV cysts are potentially malignant, with renal cell carcinoma (RCC) being found in approximately 10–20% of Bosniak IIF [5], 50% of Bosniak III [6] and 80–90% of Bosniak IV lesions [7]. While active treatment is the recommended approach for Bosniak IV, Bosniak IIF and III cysts are liable to active

surveillance (AS). Indeed, surgery results in overtreatment in nearly 50% of surgically removed Bosniak III cysts which are found to be tumours with a low malignant potential [8].

At final pathology, the majority of surgically removed cysts are clear cell RCC (ccRCC) with low malignant potential, multilocular cystic renal neoplasms of low malignant potential, papillary RCCs (pRCC) type I or benign multilocular cysts [9]. Nouhaud et al. found that 175 out of 216 renal cysts (81.0%) were malignant or had a low malignant potential (specifically 90.9% of Bosniak IV and 69.8% of Bosniak III cysts), of which 60% ccRCC, 24% pRCC and 6.9% multilocular cystic renal tumour of low malignant potential [10]. pRCC type 1 with favourable prognosis is a frequent finding among Bosniak III and IV cysts, so that some authors suggest that tumour pattern (solid vs. cystic) should be included in preoperative scoring systems to better stratify patient's prognosis [11]. Clear cell papillary RCC (ccpRCC) represents a histological subtype with indolent behaviour recently added to the World Health Organization classification of renal tumours. Authors have shown that this entity exhibits two patterns, cystic and solid, the former being classified in some series as Bosniak IV, III and IIF in 57%, 33% and 10% of cases, respectively [12].

At present, EAU guidelines recommend to manage Bosniak III lesions as localised RCC, with the possibility to offer AS as an alternative. Despite evidence regarding low malignant potential and good prognosis, surgery is still the recommended treatment for Bosniak IV cysts [13]. The aim of our study is therefore to increase evidence on the association between Bosniak IV class and favourable pathology, supporting the role of surgery as a definitive treatment and potentially suggesting the need for a low-intensity follow-up.

## MATERIAL AND METHODS

Between 2018 and 2022, patients with a Bosniak IV renal cyst suspected for malignancy were considered. A preoperative contrast-enhanced computed tomography (CT) scan or magnetic resonance imaging (MRI) was performed to assess size, location and features of the cyst. In all cases a solid component with contrast enhancement was detected inside the cyst. Patients with a predominantly solid renal mass with a small cystic component were excluded. In no case a preoperative percutaneous biopsy was performed. A transperitoneal radical or partial nephrectomy was performed in all cases either with laparoscopic or robot-assisted approach. The choice between radical vs partial nephrectomy

was assessed in the preoperative planning according to the feasibility of enucleation and the risk of cystic rupture. All procedures were performed by well-trained urologists with a high expertise in laparoscopy. Two Urology departments were involved: Sant'Anna Hospital (San Fermo della Battaglia, Como, Italy) and Busto Arsizio Hospital (Busto Arsizio, Varese, Italy). Preoperative data were collected and the final pathology of the removed cysts and oncological outcome were retrospectively analysed. Patients were followed-up according to their prognostic factors mainly defined by histology, tumour stage and grade and surgical margins. Neither a specific predictive nomogram nor a standardized protocol were used to schedule controls.

Median and interquartile range (IQR) vs. numbers and proportions were used to describe continuous and categorical variables, respectively. Data were analyzed with R software version 3.4.1 (R Foundation for Statistical Computing, Vienna, Austria). The study was approved by the local ethical committee in compliance with the Helsinki Declaration and all patients signed the informed consent.

## RESULTS

Overall, 42 patients with a median age of 65.7 years (IQR 55.0–74.5) were included in the analysis. Median tumour size was 54.7 mm (IQR 20.0–81.2). In 26 cases (61.9%) a CT scan was performed preoperatively and the exam was considered enough to clarify the diagnosis. In 9 cases (21.4%) a MRI was performed following the detection of a cystic lesion with a doubtful solid component inside at abdominal ultrasound. The remaining 7 patients (16.7%) underwent a MRI after performing a CT scan. The R.E.N.A.L. nephrometry score was calculated for each patient and data is shown in Table 1. Radical nephrectomy was performed in 33 cases (78.6%), whereas a nephron-sparing surgery was carried out in 9 cases (21.4%). Intraoperative cyst rupture did not occur in any case. Laparoscopic vs robot-assisted approach was used in 14 (33.3%) vs 28 (66.7%) cases (Table 1).

Table 2 shows the pathology report of the surgically removed renal lesions. A solid tumour was detected in 40 patients overall (95.2%), whereas in 2 cases (4.8%) a benign cyst without the presence of a neoplastic component was diagnosed. Among patients with evidence of a solid tumour inside the cyst, 38 malignant lesions (90.5%) and 2 benign oncocytomas (4.8%) were detected. The majority of malignant tumours were low-grade (Fuhrman 1–2) ccRCCs (16, 38.0%), followed by 10 (23.8%) ccpRCCs and 6 (14.3%) multilocular cystic renal neoplasms

of low malignant potential. In 4 cases (9.5%) a low-grade (Fuhrman 1–2) pRCC type I was observed. The remaining 2 cysts (4.8%) harboured a high-grade (Fuhrman 3–4) ccRCC. No pRCCs type II were detected. In all cases surgical margins were negative (Table 2).

Nine patients (21.4%) experienced a postoperative complication, the majority of which were low-grade (Table 3). Specifically, 3 patients (7.1%) had fever and required a prolonged antibiotic therapy, 2 patients reported postoperative pain which was controlled through non-steroidal anti-inflammatory drugs (NSAIDs) and 1 case (2.4%) of paralytic ileum re-

solved spontaneously. Blood transfusion was needed in 2 cases (4.8%), but neither embolization nor surgical revision were necessary. A urinary leakage was detected in 1 patient (2.4%) and managed through the insertion of a ureteral stent. After 1 month, a CT scan was repeated, the leakage was solved and the ureteral stent removed. In a median follow-up of 24.0 months (IQR 12.0–38.2) no local or systemic tumour recurrence was observed (Table 3).

## DISCUSSION

Bosniak IV renal cysts are commonly managed by surgery, according to the EAU guidelines [13]. Studies showed that a considerable percentage of these lesions have a favourable histology with good prognosis [9, 10]. The concept of AS of Bosniak IV cysts has been risen by some authors. Shaish et al described the results of 138 small (<4 cm) Bosniak category IIF, III and IV renal lesions which had been actively surveilled for a median time of 2.7 years. 88% of category 2F lesions were downgraded or remained stable, 45% of category 3 or 4 lesions were downgraded to 2F or lower. No association was observed between initial size, change in size or duration of follow-up and change in Bosniak category [14]. However, the main limitation of this study was the absence of histology. In a retrospective study by Loumala et al, 85 vs. 21 patients with a Bosniak IV renal cyst underwent surgery vs. AS, respectively. In a median follow-up of 66 months, AS did not increase the risk of metastatic spread or cancer-specific mortality [15]. To date, surgery is still considered the gold standard for the treatment of Bosniak IV renal cysts. In order to increase evidence in literature, we retrospectively analysed the results of our contemporary experience of Bosniak IV renal lesions surgically removed.

**Table 1.** Perioperative characteristics of 42 patients treated with radical or partial nephrectomy for a Bosniak IV cyst

Variable		Overall (42 patients)
Age, years	Median (IQR)	65.7 (55.0–74.5)
Gender, M/F	n (%)	22 (52.4) / 20 (47.6)
Tumour size, mm	Median (IQR)	54.7 (20.0–81.2)
Preoperative imaging	n (%)	
CT scan		26 (61.9)
MRI		9 (21.4)
CT scan + MRI		7 (16.7)
R.E.N.A.L. nephrometry score	n (%)	
7		8 (19.1)
8		4 (9.5)
9		14 (33.3)
10		16 (38.1)
Treatment, RN / PN	n (%)	33 (78.6) / 9 (21.4)
Approach, Laparoscopic / Robotic	n (%)	14 (33.3) / 28 (66.7)

IQR – interquartile range; M – males; F – females; CT – computed tomography; MRI – magnetic resonance imaging; RN – radical nephrectomy; PN – partial nephrectomy; n – number of patients

**Table 2.** Pathology report of 42 patients treated with radical or partial nephrectomy for a Bosniak IV cyst

Variable		Overall (42 patients)
Low-grade (Fuhrman 1–2) ccRCC	n (%)	16 (38.0)
High-grade (Fuhrman 3–4) ccRCC	n (%)	2 (4.8)
Low-grade (Fuhrman 1–2) pRCC type I	n (%)	4 (9.5)
Multilocular cystic renal neoplasm of low malignant potential	n (%)	6 (14.3)
ccpRCC	n (%)	10 (23.8)
Oncocytoma	n (%)	2 (4.8)
Benign cyst with no tumour inside	n (%)	2 (4.8)
Positive surgical margins	n (%)	0 (0)

IQR – interquartile range; ccRCC – clear-cell renal cell carcinoma; pRCC – papillary renal cell carcinoma; ccpRCC – clear cell papillary renal cell carcinoma; n – number of patients

**Table 3.** Postoperative complications and outcomes of 42 patients treated with radical or partial nephrectomy for a Bosniak IV cyst

Variable		Overall (42 patients)
Fever	n (%)	3 (7.1)
Pain	n (%)	2 (4.8)
Urinary leakage	n (%)	1 (2.4)
Blood transfusion	n (%)	2 (4.8)
Paralytic ileum	n (%)	1 (2.4)
Total complications	n (%)	9 (21.4)
Follow-up, months	Median (IQR)	24.0 (12.0–38.2)
Tumour recurrence	n (%)	0 (0)

IQR – interquartile range; n – number of patients

Our study shows that the majority of Bosniak IV renal cysts harbour a solid tumour with low grade or low malignant potential, therefore confirming the favourable histology and good prognosis reported by other studies in literature [9, 10]. Despite the potential role of AS has been advocated in this setting, surgery still seems the proper treatment. Indeed, the possibility of a high-grade tumour must be taken into account. Biopsy of cystic lesions is usually not performed for the fear of cyst rupture and tumour cell spillage, therefore surgical removal is the preferred way to obtain an accurate pathological report. Results suggest that surgical treatment, avoiding cyst rupture and obtaining negative margins, provides good oncological outcomes with no evidence of tumour recurrence at mid-term follow-up. AS of renal masses still lacks of standardized follow-up protocols [13]. Patients often end up doing very frequent controls with a high number of radiological exams. Some concerns have been raised on the effective number of controls to schedule to detect a recurrence during the follow-up, with less frequent chest and abdominal imaging needed. Considering the favourable oncological outcomes, data again seem to support surgery for the treatment of Bosniak IV cysts, with the possibility to subsequently apply a low-intensity follow-up protocol.

Despite its strengths, limitations of our study need to be taken into account. Firstly, the relatively low number of patients and the short-term follow-up are a main concern. Secondly, the retrospective nature of the study. Thirdly, the lack of a standardized follow-up protocol. Lastly, the absence of an 'active surveillance' arm to make a comparison on oncological outcomes with the 'surgical' arm. Further prospective studies with a higher number of patients and a longer follow-up are needed to confirm these results.

## CONCLUSIONS

Surgery is still the recommended treatment for Bosniak IV renal cysts according to international guidelines. However, studies in literature show that the majority of lesions have low malignant potential and good prognosis. The results of our contemporary experience increase evidence on the favourable histology of Bosniak IV lesions, supporting the role of surgery as a definitive treatment and potentially suggesting a low-intensity follow-up protocol for these patients. Further data with longer follow-up is needed to support this evidence.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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