

Received: 2013.04.30  
Accepted: 2013.05.20  
Published: 2013.07.01

# Ten-year treatment outcomes including blood cell count disturbances in patients with simple renal cysts

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**Source of support:** Departmental sources

**Background:** The simple renal cyst is the most common benign kidney disease. It may cause pain and hypertension, especially if significantly enlarged. As in polycystic kidney disease, blood cell count disturbances are frequently observed in simple renal cysts. The aim of our study was to assess such disturbances, changes in blood pressure, and complication rate in our patients undergoing surgery due to simple renal cyst in the last 10 years.





**Material/Methods:** 210 patients with simple renal cysts were underwent surgery between 2002 and 2012. Two different kinds of operation were conducted: aspiration of cyst fluid with injection of sclerosing agent, and laparoscopic/retroperitoneoscopic decortications of the cyst wall. A control group comprised 134 patients with benign prostate hyperplasia. The following data were obtained: cyst burden, hematocrit, hemoglobin, red blood cells, thrombocytes, occurrence of pain, and blood pressure before and after the operation. Complications were collected and presented in Clavien score.

**Results:** Hematocrit, hemoglobin, and red blood cells were significantly increased in the experimental group. A positive correlation was observed between cyst burden and the parameters mentioned above. Of 91 patients with hypertension, 56 (61.7%) had blood pressure reduction after the operation. Treatment relieved the loin pain in 132 (88%) patients. Complications occurred in 15 (7.4%) patients.

**Conclusions:** Patients with simple renal cysts have high values of red blood cells, hematocrit, and hemoglobin. Treatment decreases blood pressure in patients with hypertension. Complications after treatment are rare and mild.

**Key words:** **simple renal cyst • red blood cells • blood pressure • complications**

**Full-text PDF:** <http://www.medscimonit.com/download/index/idArt/889337>

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## Background

The simple renal cyst (SRC) is the most common benign kidney disease. Its overall prevalence ranges from 5–41% depending on population and type of measure, but most likely it is between 7% and 10% [1,2]. Males are affected twice as often as females (a 2: 1 ratio). SRCs are defined as Type I in the Bosniak classification and are characterized by round or oval shape with a hairline-thin wall [3]. SRC is without septa or calcifications and does not enhance after contrast injection on computer tomography (CT) examination. The well established indications for cyst treatment are concomitant symptoms caused by the lesion, including pain, hypertension, hemorrhage within the cyst, or cyst rupture [4,5]. However, there might be other indications. It was shown that polycythemia may occur in patients with unilateral cystic disease [6], probably due to production of erythropoietin (EPO) by the cyst wall. This phenomenon was first described in acquired dominant polycystic kidney disease (ADPKD) [7,8]. The aim of this study was to assess SRC treatment outcomes in our 10 years of experience. In addition, we analyzed the number of red blood cells in patients with and without SRCs as indirect equivalents of erythropoietin concentration.

## Material and Methods

From 2002 through 2012 we operated on 210 patients with SRCs. The descriptive statistics of experimental and control group are given in Table 1. Patients were treated either by laparoscopic (n=135) or retroperitoneoscopic (n=45) SRC decortication or by simple fluid aspiration under ultrasound guidance with subsequent sclerosing agent injection (n=30). Laparoscopic or retroperitoneoscopic approach is chosen depending on cyst

location in preoperative CT scans. All the SRC treatment techniques are described elsewhere.

Briefly, laparoscopic renal cyst decortication is conducted in a 45 degree modified flank position with the assistance of 3 trocars (10 mm, 10 mm, and 5 mm). Pneumoperitoneum is achieved with a Veress needle. A 1-mm trocar for the camera is placed just lateral to the rectus at the level of the umbilicus, while the other two cameras are positioned under direct visualization. For a right-sided lesion, the 10 mm trocar for right hand is placed just above the midclavicular line beneath the costal margin. The 5-mm trocar for left hand is placed at the same line 3 finger widths caudate to the umbilicus. After mobilization of the colon, Gerota's fascia is swept out of the cyst wall. The wall is then incised and fluid is aspirated. Resection of the cyst wall is conducted with a harmonic knife. Subsequently, resection margins are coagulated with an argon beam.

Retroperitoneoscopic approach is also conducted with 3 trocars (10 mm, 10 mm, and 5 mm). A 2-cm skin incision is made just beneath the 12<sup>th</sup> rib at the superior lumbar triangle. With blunt finger dissection, a space is created between the psoas muscle and Gerota's fascia. Subsequent balloon dilatation allows for wider trocar movements. A second 10-mm trocar is placed under laparoscopic vision along the anterior axillary line in line with the first trocar. A third 5-mm trocar is placed a few finger widths posterior to the second trocar. Further steps are similar to those in laparoscopic approach.

In patient with comorbidities, fluid aspiration under ultrasound visualization is occasionally conducted. Various sclerosing agents are in use, including alcohol, tetracycline, minocycline, and Povidine-iodine [9–14]. In our patients we used tetracycline.

**Table 1.** Descriptive statistics of the experimental and control group.

		SRC group		BPH group	
Number of patients (n)		210		134	
Age (yr) (SD)		65	(12.5)	66	(18.6)
Gender (%)	Male	90	(42.9)	134	(100%)
	Female	120	(57.1)	0	
Side (%)	Right	105	(50%)		
	Left	80	(38%)		
	Bilateral	25	(12%)		
Lesion (%)	Unilateral	185	(88%)		
	Bilateral	25	(12%)		
Cyst (%)	Solitary	173	(82%)		
	Multifocal	47	(18%)		
Mean cyst size (cm) (SD)		7.45	(1.7)		

SD – standard deviation; SRC – simple renal cyst; BPH – benign prostate hyperplasia.

**Table 2.** Mean values of blood cell count, BMI and creatinine concentration in experimental and control group.

	SRC group	BPH group	p value
HGB	14.1	13.4	0.02
HCT	41.7	38.8	0.01
RBC	4.79	4.46	0.03
PLT	227.9	253.5	0.02
Creatinine concentration (mg/dl)	0.91	0.88	0.23
eGFR (ml/min*1.72 <sup>2</sup> )	97.5	93.3	0.09
BMI (kg/m <sup>2</sup> )	27.5	26.8	0.15

SRC – simple renal cyst; BPH – benign prostate hiperplasia; HGB – hemoglobin; HCT – hematocrite; RBC – red blood cells; PLT – thrombocytes; eGFR – estimated glomerular filtration rate; BMI – body mass index.

**Table 3.** Preoperative and 1-year postoperative values of blood cell count, creatinine concentration, eGFR and BMI.

	Preoperative values (SD)	Postoperative values (SD)	p values
HGB	14.1 (1.2)	13.1 (1.5)	0.02
HCT	41.7 (4.11)	38.6 (6.2)	0.006
RBC	4.7 (0.48)	4.3 (0.5)	0.03
PLT	227.9 (48.3)	227.4 (82.4)	0.9
Creatinine concentration (mg/dl) (SD)	0.91 (0.41)	0.87 (0.43)	0.78
eGFR (ml/min*1.72 <sup>2</sup> )	97.5 (44.2)	96.9 (47.6)	0.89
BMI (kg/m <sup>2</sup> ) (SD)	627.5 (3.4)	27.2 (2.7)	0.83

SD – standard deviation; HGB – hemoglobin; HCT – hematocrite; RBC – red blood cells; PLT – thrombocytes; eGFR – estimated glomerular filtration rate; BMI – body mass index.

On the assumption that the cyst wall produces erythropoietin, we searched for correlations between cyst burden and number of red blood cells (RBC), hemoglobin (HGB), hematocrit (HCT), and thrombocytes (PLT). We considered the cyst burden as a spherical surface according to the following function ( $4\pi R^2$ ; R-cyst radius). In case of multiple cysts, the burden was estimated in terms of surface sum of the 3 major cysts. Additionally, we compared our cohort with a control group of patients treated due to benign prostate hyperplasia (BPH) (n=134). Secondly, we assessed mean blood pressure (MAP) in patients with SRC before and 1 year after surgery. As a positive response, we adopted either reduction of MAP in patients with hypertension (considered systolic pressure >140 mmHg and/or diastolic pressure >90 mmHg) or dose reduction of antihypertensive drugs. Finally, we assessed complications after SRC operation according to Clavien score [15]. Follow-up was ultrasound of the kidneys every year. A reduction of cyst size of at least 50% in diameter was considered successful treatment.

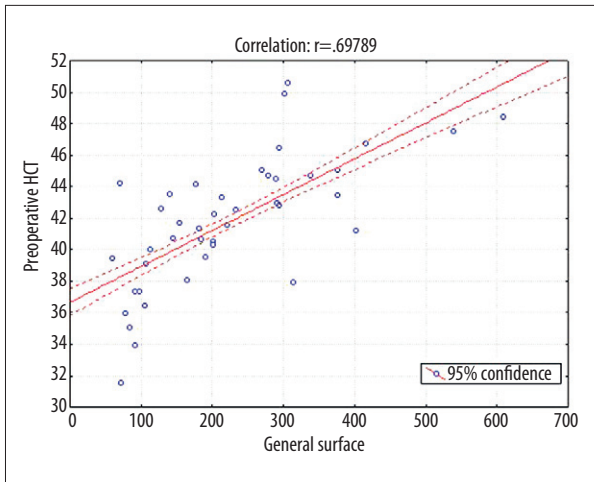
To exclude any influence of nutritional status or impaired glomerular filtration (GFR) rate on blood cell count, additional data covering

weight, height, and creatinine concentration were obtained. Based on these parameters, body mass index (BMI) and estimated GFR (eGFR – formula according to Cockcroft-Gault) were calculated and presented before and after treatment (Tables 2 and 3).

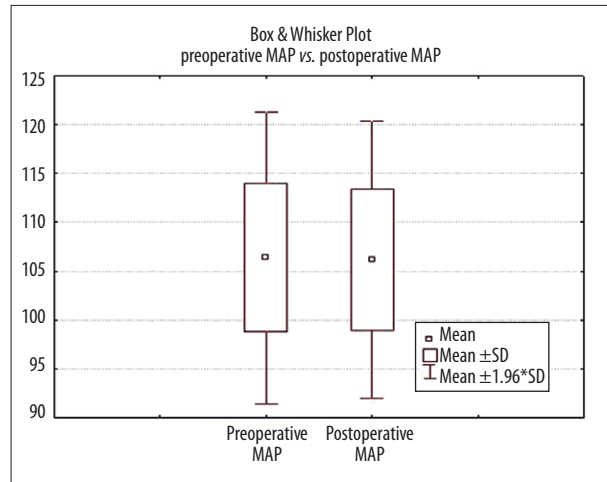
All continuous variables were examined for normality with the Kolmogorov-Smirnov test. Pearson r correlation was used for estimation of continuous variables with normal distribution. Logarithmic transformation of variables without normal distribution was conducted. Dependent and independent variables were examined with t-tests. Independent variables without normal distribution were examined with the Mann-Whitney U test. We adopted p-level of 5% as significant.

## Results

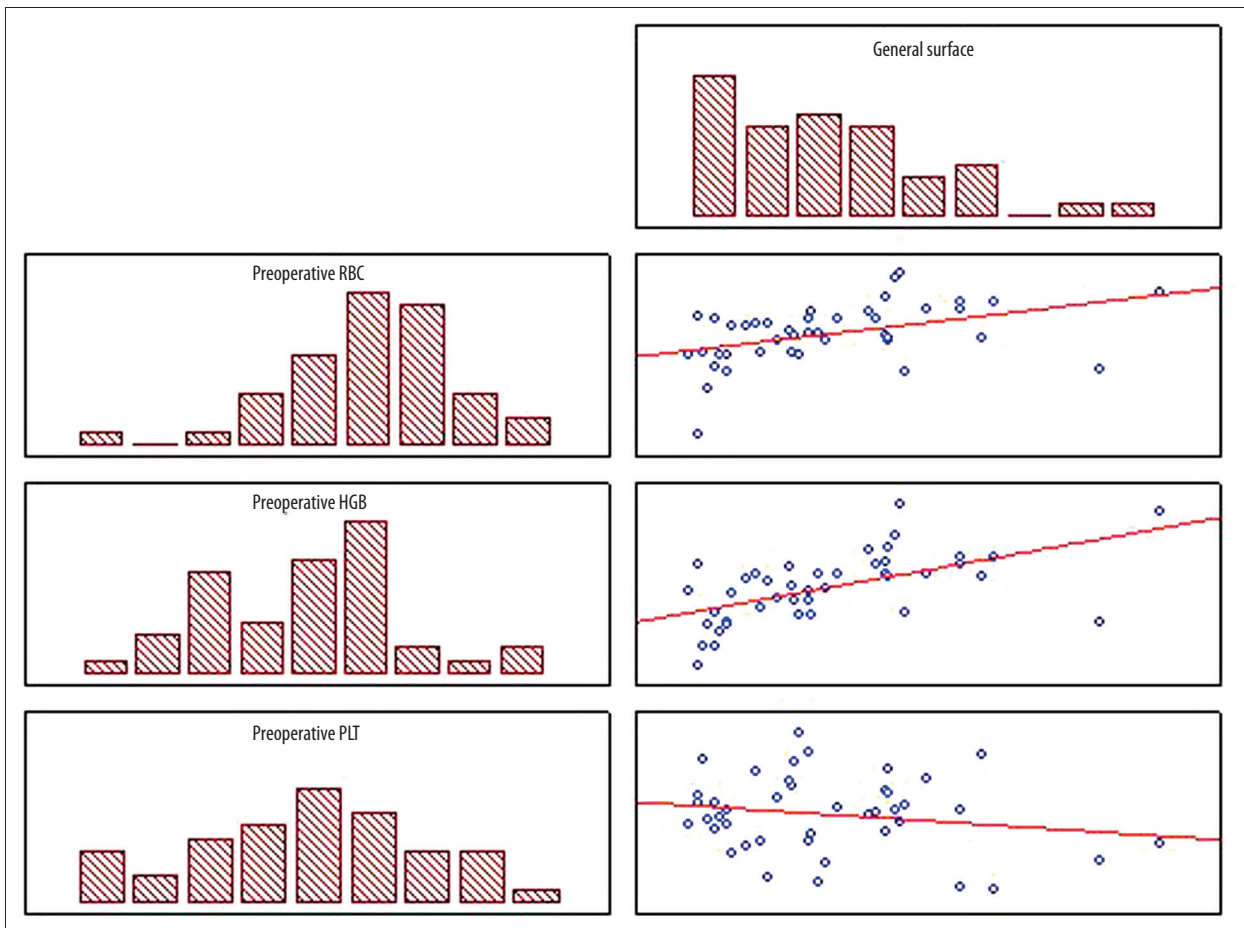
One hundred fifty (71.4%) patients desired treatment due to discomfort or pain in the loin. Others were treated due to significantly enlarged (>10 cm) SRC without any symptoms. Ninety-one (43.3%) patients had hypertension before surgery.



**Figure 1.** The correlation plot between HCT and cyst burden.



**Figure 3.** Comparison of preoperative and postoperative MAP (mean arterial pressure [mmHg]); SD-standard deviation.



**Figure 2.** The correlation plots between cyst burden and RBC, HGB and PLT.

Preoperatively, there were no differences between experimental and control group in terms of creatinine concentration, estimated glomerular filtration rate, and body mass index (Table 2).

BMI, creatinine concentration and eGFR did not change significantly after SRC treatment (Table 3).

HGB, HCT, and RBC were significantly higher in the SRC group than in the BPH group (Table 2). The cyst burden was positively correlated with preoperative HCT ( $r=0.69$ ;  $p<0.01$ ), RBC ( $r=0.42$ ;  $p<0.01$ ) and HGB ( $r=0.57$ ;  $p<0.01$ ), and inversely correlated with PLT ( $r=-0.18$ ;  $p<0.01$ ) (Figures 1 and 2). One year after SRC treatment, we observed significant reduction in HCT, RBC, and HGB and no change in PLT (Table 3).

After the operation we did not observe significant MAP reduction ( $p=0.17$ ). The mean MAP preoperatively and postoperatively was equal to 106.3 mmHg and 106.1 mmHg respectively (Figure 3). However, positive response in patients with hypertension was observed. Of 91 patients with hypertension, 56 (61.7%) had blood pressure reduction and antihypertensive drugs dose adjusted. Fifteen patients (16.4%) had only antihypertensive drugs dose reduction and 20 (21.9%) patients had stable hypertension.

Treatment relieved the pain in the loin in 132 (88%) patients. Recurrence occurred more frequently in patients who underwent cyst aspiration and sclerotherapy; the rate was 43.3% (13 patients). The recurrence rate in the laparoscopic group in 10-year follow-up was 2.9% (4 patients) and 4.4% (2 pts) in the retroperitoneoscopic group.

Complications occurred in 15 (7.4%) patients, of whom 10 (4.7%) were Grade I, 4 (1.9%) were Grade II, and 1 (0.4%) was Grade III in Clavien classification.

## Discussion

It is well known that patients with long-term chronic kidney disease (CKD) require erythropoietin (EPO) supplementation. However, patients with CKD due to ADPKD usually have normal red blood cell values due to high EPO concentration in plasma and in the cyst fluid [16]. It is not known whether SRC also may produce EPO. Attar et al. [6] showed that patients with unilateral cystic disease as well as patients with ADPKD may have polycythemia. HCT, RBC, and HGB may serve as indirect equivalents of plasma EPO concentration. As shown, these parameters are significantly increased in patients with SRC in comparison with a cohort of patients without SRC. In addition we found a positive correlation between cyst burden and the parameters mentioned above. One year after the operation, HCT, HGB, and RBC decreased significantly. All those findings support the thesis of EPO production by the cyst wall. PLT also corresponds to EPO concentration, but to a significantly lesser degree [17]. Our results show that PLT count was lower in the experimental group. In our opinion this discrepancy is due to the character of our control group. It was shown that recurrent urinary tract obstruction and infection may lead to reactive thrombocytosis [18].

The prevalence of hypertension in patients with SRC is about 40% [19], as confirmed by our results. One concept of such etiopathology is that the enlarged cyst compresses renal parenchyma, which results in decreased blood flow through the kidney and increased rennin production. Although we did not observe reduction of MAP in our experimental group after the operation, we believe the positive effect is notable. The positive effect was observed in 71 (78%) patients, especially in patients with diagnosed hypertension. Other authors have also confirmed the positive effect of cyst treatment on blood pressure reduction [20].

Laparoscopic and retroperitoneoscopic decortication of the SRCs showed excellent results in terms of pain release and low recurrence rate. The high recurrence rate in patients treated with aspiration and sclerotherapy indicates that such treatment should be avoided whenever possible in favor of a laparoscopic/retroperitoneoscopic approach. However, comorbidities usually preclude such an approach and make aspiration the only possible treatment. Our outcomes are similar to data obtained previously [21]. In case of recurrence after aspiration and sclerotherapy, we repeat the operation.

Complications after SRC treatment are rare and mild. We did not observe complications after cyst aspiration. Most of the complications were Grade I, most commonly increased body temperature requiring antipyretics. Grade II complications occurred in patients with prolonged pyrexia, who required additional doses of antibiotics. The only patient with a Grade III complication had inadvertent diaphragm incision into the pleura and required suction drainage.

## Conclusions

1. Patients with SRC have high values of HCT, HGB, and RBC, probably due to increased erythropoietin concentration.
2. Higher measured parameters are positively correlated with cyst burden.
3. SRC treatment positively affects blood pressure in patients with hypertension.
4. Laparoscopic and retroperitoneoscopic surgery is characterized by low recurrence rate, in contrast to aspiration and sclerotherapy approach.
5. Pain release after symptomatic cyst treatment is observed in nearly 90% of cases.
6. Complications after SRC treatment are rare and mild.

## Statement

The authors declare that they have no conflict of interest.

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