

Does the Simple Renal Cyst Treatment Improve Renal Function: A Pilot Study

Abstract

Background: The current study aims to assess the effects of the large simple renal cyst (SRC) surgery on renal function for the first time. **Materials and Methods:** This case-series study included 22 patients with larger than 50 mm single SRC who underwent laparoscopic cyst unroofing surgery. Twenty-four-hour urinary protein, creatinine, and volume along with plasma creatinine and estimated glomerular filtration rate (GFR) were measured in patients before and 1 month after surgery. Patients underwent abdominopelvic computed tomography-scan without contrast and parenchymal thickness diameter adjacent to the cyst was measured before and after surgery. **Results:** Mean age and weight of patients were 52.2 ± 8.9 years and 77 ± 10.9 kg, respectively. There was no significant difference between plasma creatinine and GFR before and after surgery ($P = 0.25$ and 0.37 , respectively). Twenty-four-hour urinary volume, creatinine, and protein before and after surgery revealed no significant changes ($P = 0.37$, 0.08 , and 0.31 , respectively). The mean improvement of parenchymal thickness diameter after surgery was 10.4 ± 0.7 mm which was statistically significant ($P = 0.001$). However, it was not correlated with the mean estimated GFR change ($r = 0.349$, $P = 0.13$). **Conclusions:** Although laparoscopic unroofing of renal cyst recovered renal parenchymal thickness noticeably, it did not improve renal function significantly; therefore, the latter factor lonely should not be considered a reason for surgery decision. Observation can be chosen as a safe treatment strategy in large SRCs without concern about renal function.

Keywords: Cystic Kidney Disease, glomerular filtration rate, Kidney Function Tests, Laparoscopy

Introduction

Simple renal cyst (SRC) is the most prevalent renal cystic disease that accounts for about 70% of benign renal masses.^[1] The prevalence of these renal cysts increases gradually by aging which accounts for about 50% in patients with 50 years.^[2] Simple cysts are usually asymptomatic and found incidentally during imaging such as ultrasonography, computed tomography (CT), or magnetic resonance imaging.^[2,3] Most SRCs do not need treatment although pain, infection, upper urinary tract obstruction, hematuria, and renal failure mandate intervention.^[4] The treatment of renal cysts includes percutaneous aspiration, sclerotherapy, and cyst unroofing which can be done through laparoscopic or open surgery.^[5]

The main concern about renal cyst is its effect on renal function. Simple cysts may create compression on the adjacent

kidney parenchyma which results in kidney parenchyma destruction and consequently causes renal dysfunction. Moreover, this developed cyst may compress the ureter, followed by hydronephrosis and then obstruction.^[6]

Some of the researchers believe that SRCs are associated with decreased renal function as an independent factor while others have concluded no impression.^[7,8]

Renal cysts which compress kidney parenchyma can lead to decreased parenchyma diameter. It is supposed that this diameter can be compensated dramatically by cyst surgery. It is still unclear whether this parenchymal recovery has an association with renal function improvement. The aim of the current study is to assess the effects of large SRCs surgery on kidney functions. In addition, we want to respond to the following question; is there a significant association between parenchyma diameter changes following surgery and renal function improvement?

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Materials and Methods

Patients with a large single SRC (size of 50 mm and above in ultrasonography) who had referred to university hospitals from September 2016 to September 2018 were enrolled in this nonrandomized case-series study in Isfahan, Iran. All patients had a history of flank pain as an indication of renal cyst treatment.^[9] Patients with small renal cyst (<50 mm), multiple cysts, chronic kidney diseases, hydronephrosis with any other reason, history of kidney operation, pregnancy, open surgical procedure requirement, suspicious evidence of malignancy in imaging, and no consent for participation in the current study were excluded from this study. Consent forms for participation were obtained from patients. This study was approved by the Ethics Committee of Isfahan University of Medical Sciences. All patients underwent laparoscopic renal cyst unroofing by a single endourologist (MM).^[10]

Renal function assessment

Twenty-four-hour urinary creatinine, volume, protein, and plasma creatinine were measured in patients.

Estimated glomerular filtration rate (GFR) was measured using creatinine clearance (CrCl) formula;^[11]

UV/P U: concentration of creatinine in urine in mg/dL, V: volume of urine produced per minute, and P: plasma creatinine in mg/dL.

Radiological assessment

Then patients underwent abdominopelvic CT-scan without contrast (Medical Health Care GE VCT light speed, GE, USA). Technical features of CT were as following: 0.645 collimation, minimum slice thickness of 0.645, kV of 120, and mAs of 200 by Philips scanner. The least distance between cyst margin and the pyelocaliceal system was measured as cyst adjacent renal parenchymal diameter by a single expert radiologist [Figure 1].

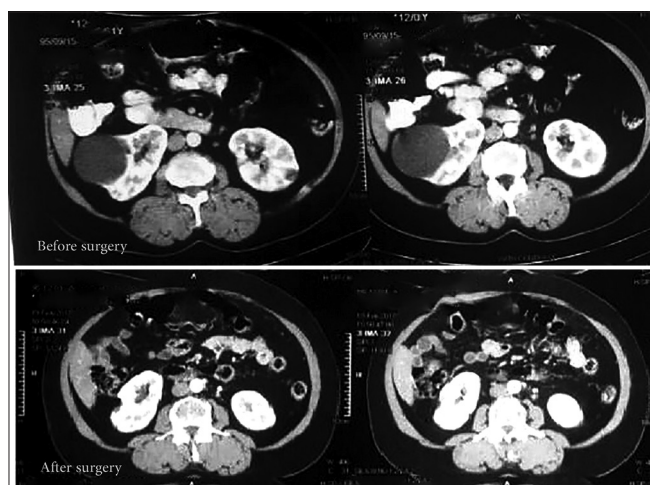


Figure 1: The abdominopelvic computed tomography scan before and after surgery

All these variables were evaluated and compared before and 1 month after surgery.

Statistical analysis

The data were analyzed with IBM SPSS 20-United States software (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). Descriptive data were reported in mean \pm standard deviation. Paired *t*-test, Chi-square, and regression test were used for data analysis. *P* < 0.05 was considered statistically significant.

Results

This study was conducted on 22 patients with a single large SRC, consisted of 7 (31.8%) females and 15 (68.2%) males. The mean age of patients was 52.2 ± 8.9 years with a range of 30–65 years. The mean weight of patients was 77 ± 10.9 kilograms with the range of 58–98 kg. The statistical power of the study was 80%.

As shown in Table 1, there was no significant difference between plasma creatinine and estimated GFR before and after surgery (*P* = 0.25 and 0.37, respectively). Twenty-four-hour urinary volume, creatinine, and protein changed before and after surgery also showed no significant changes (*P* = 0.37, 0.08, and 0.31, respectively).

The mean GFR difference was 2 ± 1.5 and the mean parenchyma diameter change was 10.4 ± 0.7 mm. Pearson correlation coefficient showed no significant association between GFR changes and parenchymal diameter changes (*r* = 0.349, *P* = 0.13). No major complication was reported after laparoscopic surgery.

Discussion

One of the main challenges about the treatment of renal cyst that to the best of our knowledge has not been evaluated widely is whether renal function improves after renal cyst treatment. This is the question that we have decided to answer in the current study for the first time. We used plasma creatinine, GFR, 24-h urinary volume, urinary creatinine, and urinary protein to assess renal function. These parameters were measured before laparoscopic cyst unroofing and after the

Table 1: Plasma creatinine, glomerular filtration rate, 24 h urinary volume, creatinine, protein, and mean parenchymal diameters prior to and after surgery

Variables	Mean \pm SD		<i>P</i>
	Before surgery	After surgery	
Plasma creatinine	1.1 \pm 0.3	1.08 \pm 0.2	0.25
Estimated GFR	78.5 \pm 18.8	76.5 \pm 20.3	0.37
24 h urinary volume	1583.3 \pm 160.1	1800 \pm 332.7	0.37
24 h urinary creatinine	1207.3 \pm 153.3	1021.8 \pm 148.2	0.08
24 h urinary protein	169.7 \pm 85.9	293.9 \pm 188.7	0.31
Mean parenchymal diameters (cm)	0.9 \pm 0.8	1.94 \pm 0.9	0.001

SD: Standard deviation, GFR: Glomerular filtration rate

operation. We found that none of the mentioned parameters have significantly changed after surgery. These results indicated that the treatment of large SRCs did not affect renal function in comparison to its function before surgery. Hence, the size of the renal cyst cannot be considered lonely as an indication for intervention to preserve renal function. The next assessment was the association of renal parenchyma diameter changes with GFR changes. We found that renal parenchyma thickness as one of the principles of renal function had not been varied significantly after laparoscopic SRC unroofing. In an overall view, our study revealed no improvement of renal function after surgical cyst treatment so this should be considered in future treatment strategy decisions. Some previous studies have been used different methods to assess the effect of renal cyst on renal function. Chin *et al.* revealed the presence of a SRC was not related to the renal dysfunction using GFR.^[12] On the other hand, the study done by Al-Said study showed kidney cyst^[13] was associated with reduced renal function by measuring GFR and renal parenchymal volume; this is meanwhile the renal parenchymal volume was strongly correlated with GFR in another study,^[14] so we used GFR in our study and presented renal parenchymal thickness next to the cyst as a new measured criterion.

Tatar *et al.*, assessed renal function in patients with a single kidney to evaluate the impacts of SRC on kidney survival in this critical group. They have defined renal malfunction as GFR decrease and need for renal replacement therapy. In their study, patients with a single SRC presented a significantly higher rate of renal failure and renal replacement therapy need and therefore, a simple cyst cannot be considered innocent.^[15]

In the other study, Kwon *et al.*, compared patients with renal cyst larger than 4 centimeters with a normal group using a dimercapto succinic acid (DMSA) renal scan. They presented that patients with cystic kidney had a significantly higher rate of hypertension prevalence in comparison to the normal study population. Another point about patients with SRC was a significantly lower rate of DMSA uptake in the kidney with a cyst in comparison to a normal one. Besides, patients with SRC had 5.8% less uptake in comparison to the normal one in their DMSA scan.^[16]

Simple cysts in the donor's kidney also had short and long-term effects on the allograft function. Moreover, the donor kidney with cyst had more glomerular sclerosis compared to control in the pathology report.^[17]

Our study included some limitations such as small sample size, short follow-up, and GFR calculation analysis because 24 h creatinine clearance is not a reliable method for estimated GFR.

Conclusions

In overall, we have to declare that renal function and renal parenchyma diameter have not changed significantly after surgery. Hence, SRC size merely should not be considered

a criterion for intervention to rescue renal function. As this study is a pilot one and has assessed patients' renal function before and after laparoscopic unroofing for the first time, further studies with a larger study population and with longer follow-up duration are recommended.

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Conflicts of interest

There are no conflicts of interest.

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