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The efficacy of retroperitoneal laparoscopic deroofing of simple renal cyst with perirenal fat tissue wadding technique

A retrospective study

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Abstract

Treatment options for simple renal cyst (SRC) include open surgery, laparoscopy with decortication, or percutaneous aspiration with or without sclerotherapy. Though laparoscopic unroofing achieves better results than percutaneous sclerotherapy, the reported recurrence rate is still up to 19%. Thus, it is necessary to find methods to reduce the recurrence rate.

To investigate whether the perirenal pedicled fat tissue wadding technique during retroperitoneal laproscopic deroofing (RLD) of SRC affects the incidence of recurrence.

A retrospective analysis was carried out on clinical data of 254 patients with SRC treated by RLD in our hospital from 2008 to 2016. Among these patients,119 had a simple retroperitoneal deroofing (SRD) and 135 received a retroperitoneoscopic deroofing with wadding of the cyst using perirenal fat tissue (RDCW). The recurrence rate and variables, as well as perioperative complications, were compared. To further explore the potential variables influencing cyst recurrence rate, univariate and multivariate regression analyses were applied.

A total of 251 patients were included in the analysis. The operation was successfully completed laparoscopically in all cases with no conversion to open surgery. No mortality or significant complication occurred in both groups. After a median follow-up of 38.67 months, we noted 41 recurrences. According to the univariate and multivariate regression analyses, patients managed with the wadding technique had superior recurrence-free survival (RFS), compared with patients in SRD group (log-rank $P = .03$ and $P = .04$, respectively). Moreover, patients with single renal cyst had a lower recurrence rate, compared with patients with multiple renal cysts (log-rank $P < .01$). Regarding the operation time, blood loss, and hospital stay, no statistically significant difference was found between 2 groups (P values .13, .30, and .75, respectively). However, less postoperative drainage and shorter postoperative interval until tube removal ($P = .04$) were observed in RDCW group.

The perirenal pedicled fat tissue wadding technique can decrease the cyst recurrence rate and RCDW represents an effective and safe treatment option in the management of renal cysts.

Abbreviations: BMI = body mass index, CT = computed tomography, RDCW = retroperitoneoscopic deroofing with wadding of the cyst using perirenal fat tissue, RFS = recurrence-free survival, RLD = retroperitoneal laproscopic deroofing, SRC = simple renal cyst, SRD = simple retroperitoneal deroofing.

Keywords: pedicled fat tissue, recurrence, retroperitoneal laproscopic deroofing, simple renal cyst, wadding technique

1. Introduction

Simple renal cyst (SRC) is a common non-neoplastic disease of the renal parenchyma. It is estimated that the prevalence of renal cysts increases with age [1] from 0.22% to 0.55% in children to 20% in the fourth decade, and up to 33% in the sixth decade of life.[2–4] Most patients with SRC (90%–95%) are asymptomatic. Their renal cysts were detected incidentally by ultrasonography and computed tomography (CT) scans obtained for other reasons.[5] However, a small subset of patients suffers from dull flank pain, infection, hypertension, hydronephrosis, or impaired renal function.[5,6] When these symptoms occur, treatment is usually required.

The management options include percutaneous aspiration with or without sclerotherapy, open surgery, and laparoscopic cyst deroofing.[7] Theoretically, the ideal primary therapy is simple aspiration or sclerotherapy due to their minimally invasive. However, the recurrence rate after simple aspiration alone is up to 90% and 43% after a single session of sclerotherapy.[6,8–10] Thus the laparoscopic technique, which not only has a high success rate, but is also characterized by minimal invasiveness, low morbidity, and early recuperation, became the preferred treatment.[7,10,11] Nevertheless, the reported recurrence rate is up to 19%.[12] To obtain a high success rate, urologists have made many attempts such as wadding the cysts with omental or perirenal fat tissue.[13–15] Though their results were very encouraging, they were criticized by the small sample population and sparse data on long-term follow-up following the surgery.

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Thus, the aim of this long-term follow-up study was to investigate the efficacy of retroperitoneoscopic deroofing technique applied together with wadding using perirenal pedicled fat tissue.

2. Methods

2.1. Patients

A retrospective study of 254 patients with SRC who underwent retroperitoneal laparoscopic deroofing (RLD) was performed in China-Japan Friendship Hospital from 2008 to 2016. For the present study, a formal approval from the ethical committee was obtained, and the principles of the Declaration of Helsinki followed. Written informed consent was obtained from all the patients for their data to be used for research purposes.

Among these patients, 119 had a simple retroperitoneal deroofing (SRD) and 135 received a retroperitoneoscopic deroofing with wadding of the cyst using perirenal fat tissue (RDCW). All the procedures were performed by 4 urologists (GZ, FZL, TYW, and WX) with experience of more than 500 cases on laparoscopic surgery. The surgery indication including patients with symptomatic SRC and those in whom the size of renal cyst enlarged in a short time. Patients who had a history of previous renal surgery, bilateral cysts, parapelvic cysts, endogenous cysts, complicated cysts (Bosniak III and IV)[16] and asymptomatic cyst size less than 5 cm in their greatest dimension were excluded from this study.

In order to compare the feasibility and outcomes of the 2 methods, we retrospectively reviewed the medical records. Detailed demographic characteristics and clinical data are described in Table 1. The follow-up was conducted by telephone and regular outpatient ultrasonography or CT examination. Disease recurrence was defined as the presence of a perirenal anechoic area or visible evidence of a cyst detected by imaging tools such as ultrasonography or CT at the operative site. The follow-up period was defined as the time from the date of surgery to the latest follow-up day or the date of recurrence. The latest follow-up date was March 6, 2017.

2.2. Technique and procedure

All the patients were successfully managed by RLD using a 3-port technique (Fig. 1A). After the induction of general anesthesia, the patient was catheterized and positioned in the standard left/right lateral decubitus position. The first port was inserted 2 inch below and posterior to the tip of the 12th rib. A 2 cm deep stab incision was made down to the thoracolumbar fascia and manual digital dilatation was performed with the purpose of creating adequate space for the placement of the retroperitoneal balloon. Subsequently, a homemade balloon created by tying a double fingerstall surgeon glove, one inside and the other over a catheter, was made. The indigenous balloon was then introduced through the first port site outside the Gerota fascia and inflated with 400 to 500 mL air kept for about 5 min to create adequate working space in the retroperitoneum. After deflating the retroperitoneal balloon it was removed, and then a 1.2 cm blunt-tip trocar was placed and a 30-degree laparoscope was inserted through the sheath. Carbon dioxide was insufflated to 12 mm Hg and the initial retroperitoneoscopy was performed for orientation and confirmation of the anatomic landmarks. Typically, 2 working ports (0.5 and 1.0 cm respectively) were placed under laparoendovision. One at lumbar angle, allowing a grasping forcep to be inserted, and another more anteriorly, along or more medial to anterior axillary line, at least 3 cm above the iliac crest to allow maneuverability, allowing a dissecting forcep or clip applier to be inserted via this trocar. The direction of dissection depended on the location of the renal cyst (anterior, posterior, or central aspect; upper, middle, or lower pole). Gerota fascia was incised over the area corresponding to the position of the cyst. The overlying perinephric fat was dissected from the cyst and the surrounding parenchyma (Fig. 1B). Then the cyst was unroofed 1 to 1.5 cm adjacent to the renal parenchyma, leaving behind the floor of the cyst. The cyst fluid was aspirated and the cystic wall was sent for pathologic analysis (Fig. 1C and D). Subsequently, the perirenal fat was placed and fixed over the base of the cyst and the remained cyst wall with polyglactin 2-0 sutures so as to avoid injury to the underlying parenchyma. The 18 French tube used for drainage was placed in the retroperitoneum (Fig. 1E and F), and the port sites were cleansed and closed.

Table 1

Clinical data and perioperative data comparison between RDCW and SRD groups.

Variable/(mean ± SD) or n	RDCW	SRD	*P* values
Total (n)	133	118	
Age, y	57.86 ± 11.63	59.83 ± 11.83	*.19*
≥60	60	62	*.24*
<60	73	56	
Sex			
Male	86	69	*.31*
Female	47	49	
BMI	24.63 ± 3.30	25.16 ± .3.25	*.20*
≥25	58	61	*.20*
<25	75	57	
Number of cysts			
Single	44	38	*.88*
Multiple	89	80	
Side of cyst			
Left	75	65	*.84*
Right	58	53	
Location of cyst			
Upper pole	50	54	*.08*
Middle pole	44	24	
Lower pole	39	40	
Cyst diameter, cm	6.94 ± 1.91	6.69 ± 1.62	*.28*
≥6	94	72	*.11*
<6	39	46	
Clinical presentation			
Pain	38	43	
Haematuria	3	0	
Hypertension	50	69	
Urinary tract obstruction	9	9	
Cyst enlargement	86	70	
Perioperative results and follow-up			
Operation duration, min	62.54 ± 22.43	66.89 ± 22.68	*.13*
Blood loss, mL	16.0 ± 15.1	18.1 ± 16.4	*.30*
Tube removal time (day 0)	2.64 ± 1.18	3.01 ± 1.75	*.04*
Hospitalization time (day 0)	4.75 ± 1.35	4.81 ± 1.25	*.75*
Postoperative drainage, mL	60.96 ± 52.74	79.91 ± 81.32	*.03*
Complication			
Urine leakage	0	1	
Hematoma	0	0	
Transient fever	2	1	
Radiological recurrence	12	29	

BMI = body mass index, RDCW = retroperitoneoscopic deroofing with wadding of the cyst using perirenal fat tissue, SD = standard deviation, SRD = simple retroperitoneal deroofing.

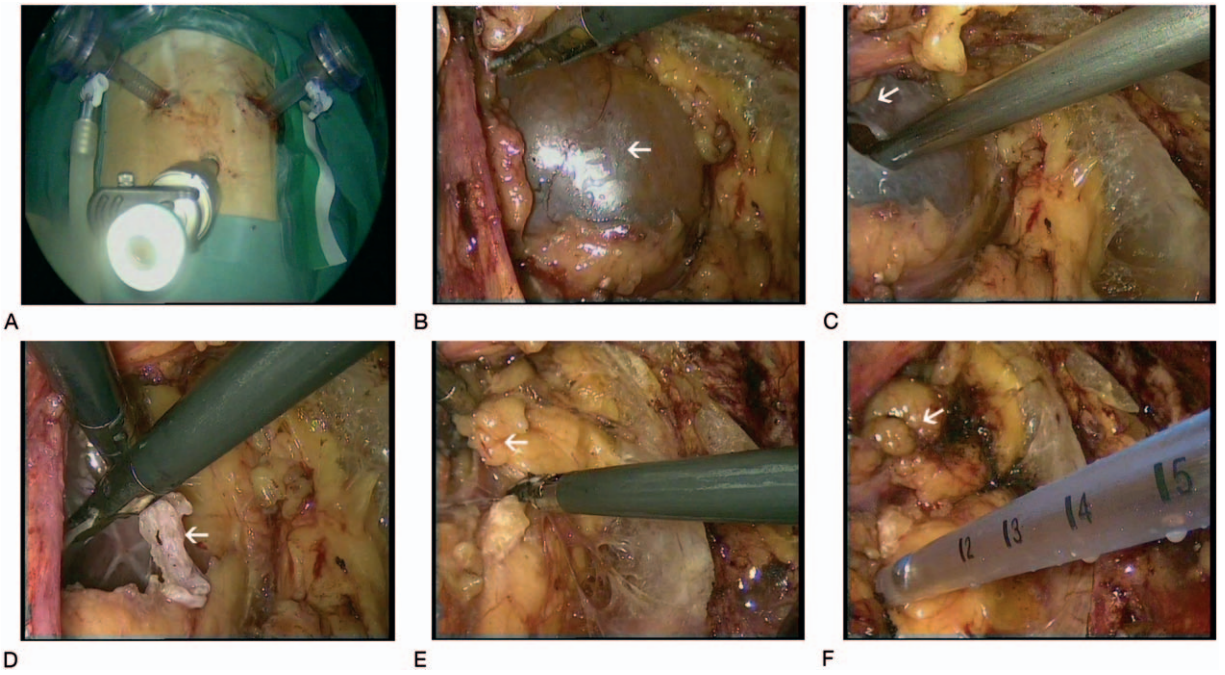

Figure 1. The operation procedure of RDCW: Trocar placement (A). Built artificial aeroperitoneum in the retroperitoneum and exposure of cyst (see arrow, B). Cyst unroofed and cyst fluid aspirated (see arrow, C). Cystic wall was excised (white arrow) for pathologic analysis (D). Pedicled fat flap (see arrow, E). Plugged fat tissue and placed drainage tube (F). RDCW = retroperitoneoscopic deroofing with wadding of the cyst using perirenal fat tissue.

2.3. Statistical analysis

The coprimary endpoints of the present study were recurrence-free survival (RFS) which we defied as the time from surgery to the first occurrence of renal cysts. Patients without events were censored at the time of their last follow-up. The data were computerized using SPSS 19.0 for Windows (IBM, Chicago, IL). Categorical data were examined using the χ^2 test and the continuous variable was assessed using the independent sample t test. The Kaplan–Meier method was used to determine the RFS rate. Survival curves between 2 categories in univariate analysis were compared using a Log-rank test. Multivariate survival analysis was performed using a Cox regression model (forward likelihood ratio model) to evaluate the risk of independent factors. In univariate and multivariate regression analysis, continuous variables, such as age, body mass index (BMI), and cyst diameter, were categorized into 2 levels according to the mean or median of the included data. Finally, age (≥60 years vs < 60 years), sex (male vs female), cyst diameter (≥6 cm vs < 6 cm), BMI (≥25 vs < 25), location of cyst (upper, middle, or lower third), number of cysts (single vs multiple), surgery technique (RDCW vs SRD) were included as independent variables. $P < .05$ was considered to indicate a statistically significant difference.

3. Results

Of the 254 patients, 3 cases were excluded because they were found by pathologic analysis to have a malignancy and then underwent radical nephroureterectomy. Finally, 251 patients met the criterion were included in this study. No significant difference had been found regarding age, sex, BMI, side of renal cyst (left or right), location of cyst (upper, middle, or lower pole) and cyst diameter between RCDW and SRD groups (Table 1). Laparoscopic deroofing was the primary treatment in 11 cases and the secondary treatment in 9 cases (3 in the RCDW group and 6 in the SRD group) after an unsuccessful cyst aspiration. The operation was successfully completed laparoscopically in all the cases with no conversion to open surgery. Assessing the safety, efficacy, and feasibility of the technique, there was no mortality or significant complication in both groups except 3 patients who suffered from transient fever and 1 patient who developed leakage of urine postoperatively. That was due to a large cyst that had excessive adhesions that required more dissection. We treated the leakage successfully by double-J ureteric stenting. With regard to the operation time, blood loss, hospital stay, no statistically significant difference were found between the 2 groups. However, less postoperative drainage and shorter postoperative interval until tube removal ($P = .04$) were observed in RDCW group.

No patient was lost at follow-up. The patients were followed for a median time of 38.67 months (range 4.01–98.33 months). At last follow up, 41 recurrences (12 in the RCDW group and 29 in the SRD group) occurred and all the cases resolved by observation and do not need reoperation.

To analyze the factors associated with RFS rate, univariate and multivariate regression analyses were conducted. The Kaplan–Meier analyses showed that there was no significant difference in recurrence with cyst size, side, location, and age (all P nonsignificant; Fig. 2C–F). However, patients managed with the wadding technique had superior RFS, compared with patients in SRD group (log-rank $P = .03$, Fig. 2A). Moreover, patients with single renal cyst had a lower recurrence rate, compared with patients with multiple renal cysts (log-rank $P < .01$, Fig. 2B).

Figure 3 shows the results of Kaplan–Meier estimates RFS for different surgical management (RDCW vs SRD) stratified by the cyst number (Fig. 3A and B) and cyst diameter (Fig. 3C and D) in the 251 patients. The results indicated that the wadding technique represents an effective method decreasing the recurrence rate only in the single renal cyst or the cyst diameter < 6 cm (log-rank

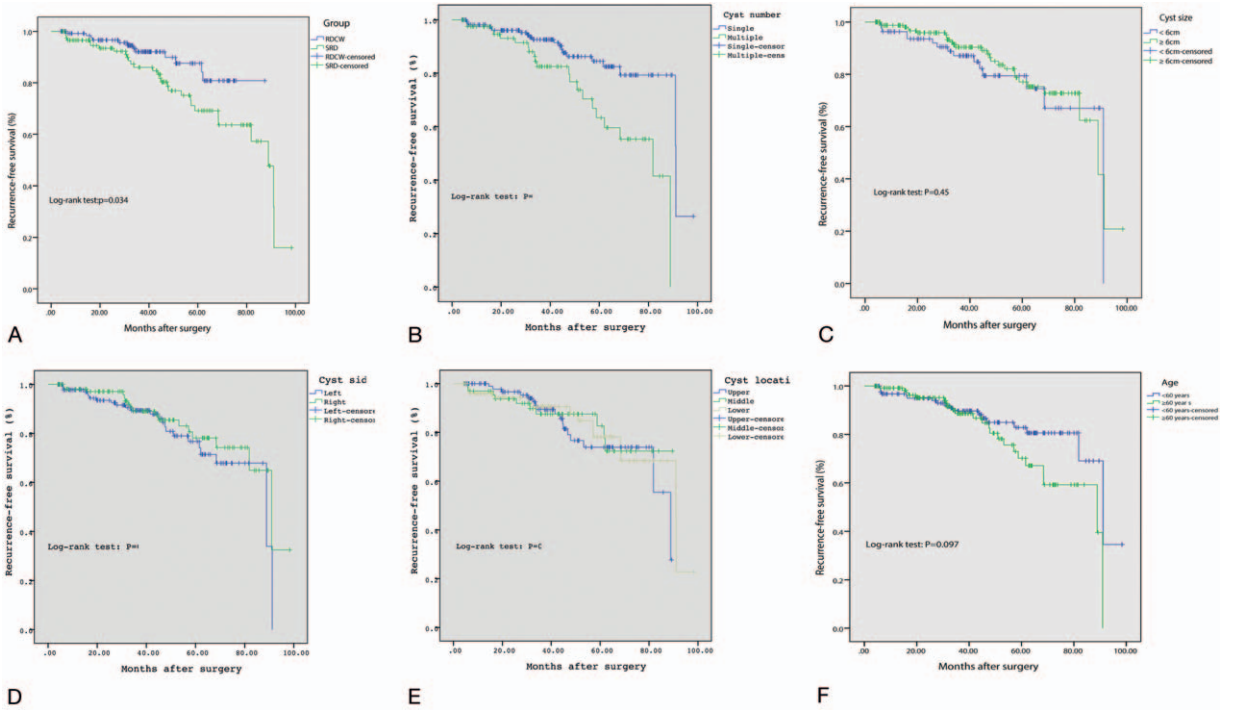

Figure 2. Kaplan–Meier plots of RFS for the 251 patients with simple renal cyst in relation to surgical management, cyst number, cyst size, cyst side, cyst location, and age. A–F, RDCW = retroperitoneoscopic deroofing with wadding of the cyst using perirenal fat tissue, RFS = recurrence-free survival, SRD = simple retroperitoneal deroofing.

$P = .02$ and $P < .01$ respectively, Fig. 3A and D). In addition, we stratified analyses by surgical management (Fig. 4A and B) and cyst diameter (Fig. 4C and D) to explore the association of RFS with different cyst numbers (single vs multiple). Compared with multiple renal cysts, the single renal cyst had a lower recurrence rate when the diameter measured ≥6 cm or cysts were managed with wadding technique (log-rank $P < .01$ and $P = .01$ respectively, Fig. 4C and A).

Though $P < .05$ in a single test of significance was considered statistically significant, correction for multiple testing may remove that nominal significance. While in our study, a further multivariate analysis also confirmed that wadding technique (Exp(B), 2.073; 95% CI, 1.038–4.141; $P = .04$) and the single renal cyst (Exp(B), 2.543; 95% CI, 1.352–4.783; $P < .01$) were independent predicting factors for a lower recurrence rate (Table 2).

4. Discussion

SRCs are quite common in adults with an incidence that increases with age.[1] With the advent of modern imaging methods, more and more incidental renal cysts are being detected. Although most cysts are asymptomatic (85%–90%) and remain untreated, a small proportion of SRCs may become symptomatic due to enlargement or occurrence of complications like lumber pain, haemorrhage, infection, urinary tract infection and collecting system obstruction, cyst rupture or compression requiring intervention.[4,17] The therapeutic goal is usually focused on reducing its volume and thereby abate the symptoms, and to avoid complications such as haematuria or pain secondary to spontaneous or traumatic rupture of a large renal cyst.[6]

Several techniques have been proposed for the treatment of symptomatic simple renal cyst, while the ideal management remained controversial. Open surgery offers a high success rate; however, it presents an invasive procedure with the comorbidity of flank incision.

With the development of many new advanced techniques in endourology and interventional radiology, percutaneous aspiration, with or without sclerosant injection, was recommended as the first-line treatment since it offers less invasive alternatives to open surgery. Nevertheless, the recurrence rate varies between 41% and 78% with simple aspiration alone and 32% and 100% with sclerosing agent.[6,18] In addition, although several studies have reported on the safety and less invasiveness of single-session aspiration and sclerotherapy,[8,19,20] the complications after ethanol sclerotherapy including pain, fever, urine leak, bleeding, and systemic reactions, like intoxication, tachycardia, and shock should not be ignored.[10,21] Since the advent of laparoscopy in the past decade, laparoscopic therapeutic techniques for renal cysts have largely replaced open surgical treatment of renal cysts. It has been confirmed as safe and effective since it combines the advantages of a less invasive procedure with lower recurrence, minimal complications, reduced operative time, minimal blood loss, and early recuperation.[7,22,23] However, the reported recurrence rate is still up to 19%, regardless the technique used.[12] Jacobsson et al[24] have shown that secretory activity of the remaining cyst wall after unroofing may play a causal role in cystic recurrence. If the resection of such a wall is incomplete, the residual secreting cyst wall can become adherent to surrounding tissues with the development of a new cyst.[11,25] To improve the efficacy and prevent recurrences, some urologists advocated fulguration of the base of the renal cysts after unroofing to destroy the secretory activity of the residual cyst wall and thereby avoid recurrence.[13,26,27] However, other authors have shown that fulguration has a risk of fistulization with the major renal vessels or collecting system.[28] Such injury may be caused by

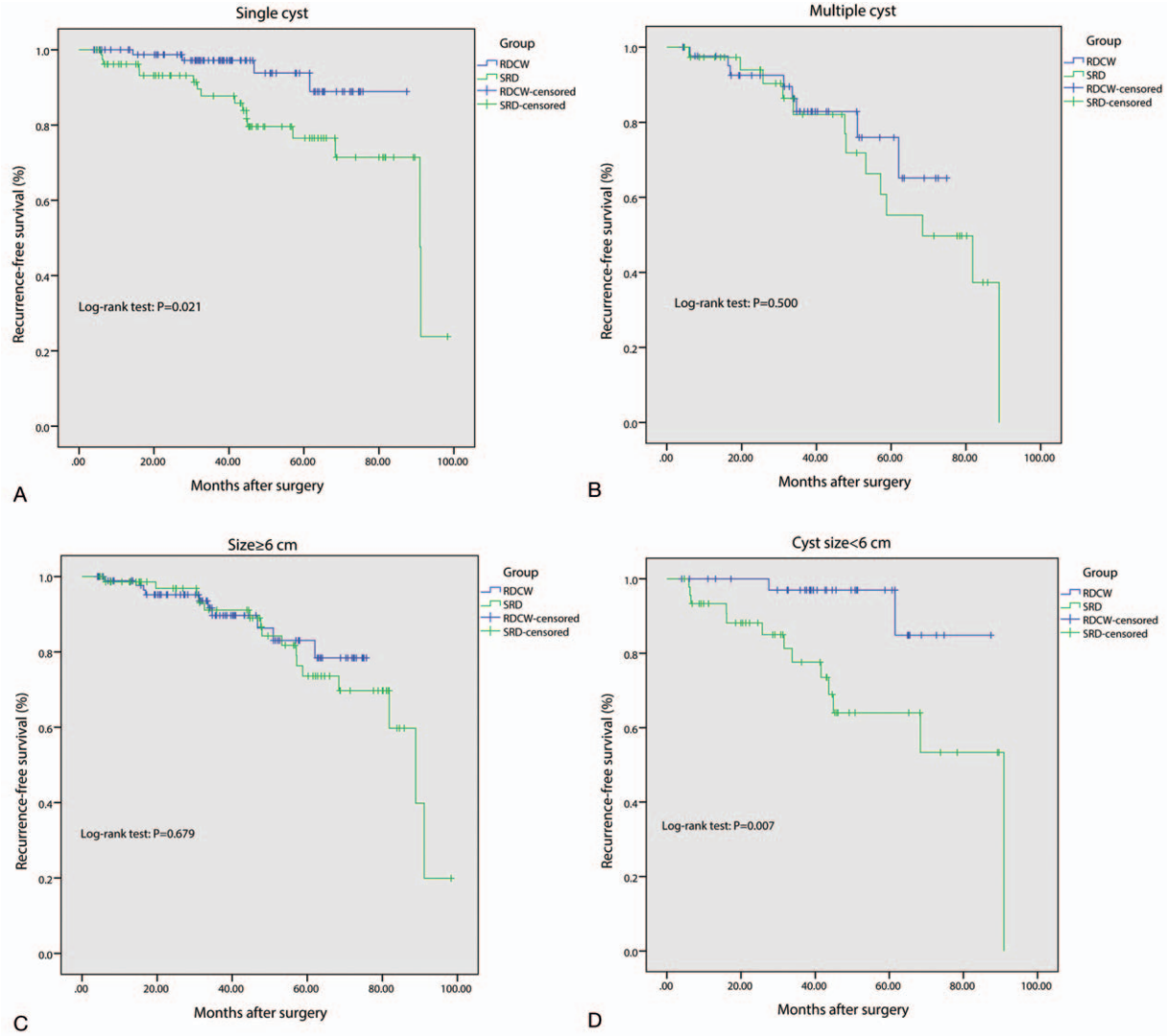

Figure 3. Kaplan–Meier plots estimate RFS for different types of surgical management (RDCW vs SRD) stratified by cyst number (A, B) and cyst size (C, D) in 251 patients with simple renal cyst. RDCW = retroperitoneoscopic deroofing with wadding of the cyst using perirenal fat tissue, RFS = recurrence-free survival, SRD = simple retroperitoneal deroofing.

direct trauma or thermal damage arisen from the dispersion of energy into the surrounding parenchyma. Thus, it is necessary to find new methods to reduce the recurrence rate.

Francesco et al [14] and Mohamed et al[15] once described a wadding technique, which can be achieved through a retroperitoneal approach using perirenal fat or through a transperitoneal approach using omentum fat, to decrease the cyst recurrence rate. Insertion of a wad of fat tissue into the base of the cyst and fixation to the cyst wall will prevent adhesion of the cavity wall to the surrounding tissue or the coaptation of the residual cyst wall, acting as a wick, and facilitating drainage and absorption of the liquid secreted by the remaining cyst wall and the cyst base, thus diminishing the risk of cyst recurrence.[13]

Though all their results were very encouraging, they were criticized due to the small sample population and sparse data on long-term follow-up following the surgery. Thus, we conducted this retrospectively cohort study to investigate the efficacy of RDCW in a long follow-up analysis.

In our study, 133 patients underwent the wading method after excising the cyst wall 1 to 1.5 cm adjacent to the renal parenchyma. Additional to both the size and number of renal cysts they also observed positive correlations with age.[5,13] Univariate analysis and multivariate survival analysis were performed to analyze the factors associated with cyst recurrence. As mentioned above, the wadding technique was an effective method decreasing the cyst recurrence rate.

Regarding the surgical safety, the equivalent operative times, intraoperative blood loss, and days of hospital stay between the 2 groups in our series are consistent with a previously published comparison.[14,15] Moreover, our complication rate was acceptable. Only 3 patients developed transient fever and 1 patient had a urine leakage occurred during dissection of adhesions surrounding a 11.5-cm middle pole cyst. He improved with conservative management, and his drain and stent were removed 4 weeks postoperatively.

To our knowledge, this is the largest cohort study investigating the efficacy of wading technique in patients with SRC, there were several limitations. First, the study was retrospective in nature. Potential selection bias cannot be ignored. In addition, it is difficult to represent the characteristics of patients in general since

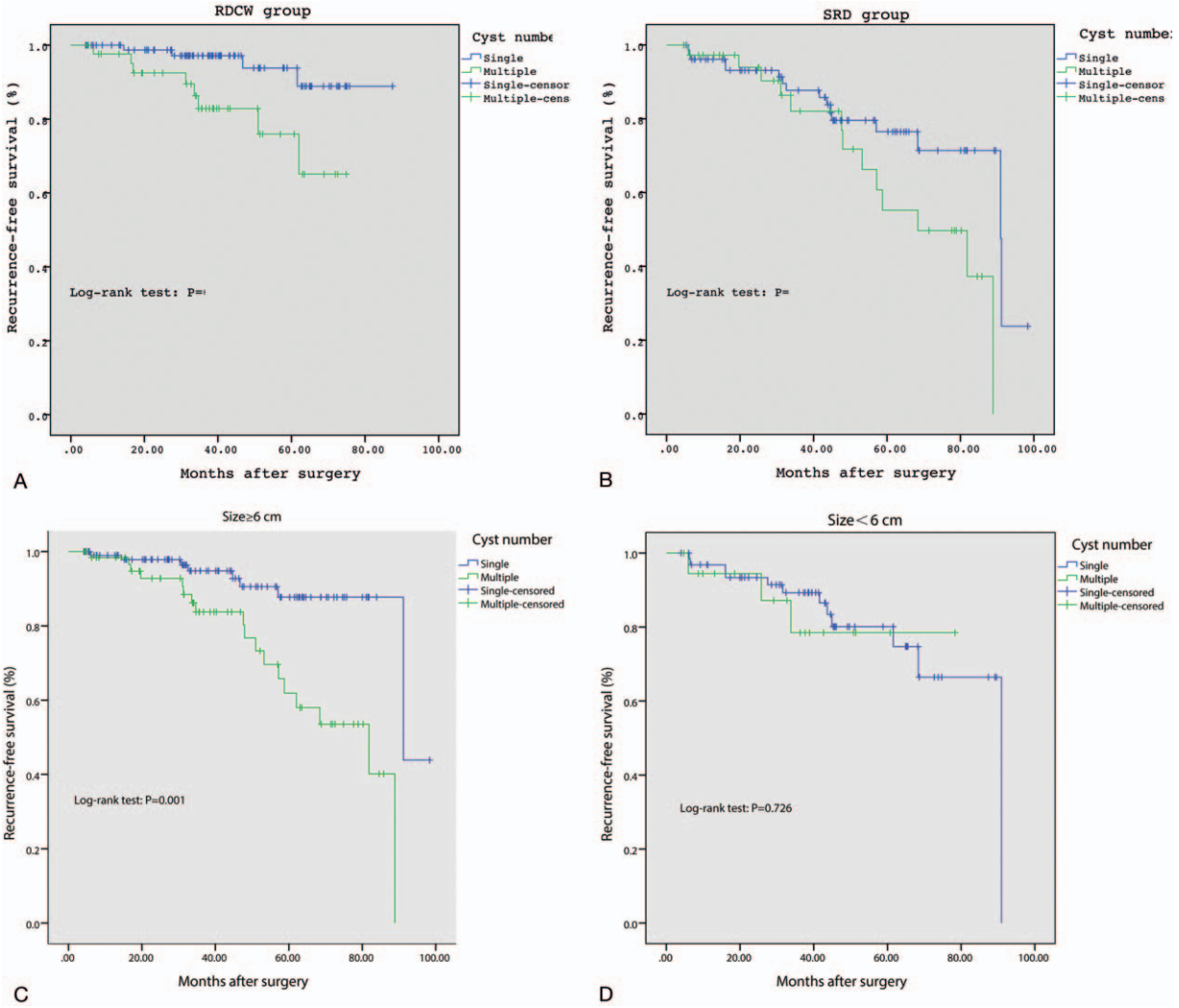

Figure 4. Kaplan–Meier plots estimate RFS for different cyst numbers (single vs multiple) stratified by surgical management (A, B) and cyst size (C, D) in 251 patients with simple renal cyst. RDCW = retroperitoneoscopic deroofing with wadding of the cyst using perirenal fat tissue, RFS = recurrence-free survival, SRD = simple retroperitoneal deroofing.

Table 2

Multivariable Cox regression analysis of recurrence-free survival for the 251 patients who were followed up.

Covariate	Coefficient	Standard error	*P*	Exp (B)	Relative risk confidence interval
Group (SRD vs RDCW)	0.729	0.353	*.04*	2.073	1.038–4.141
Cyst number (single vs multiple)	0.933	0.322	*<.01*	2.543	1.352–4.783

P values < .05 are shown as italic.

SRD = simple retroperitoneal deroofing, RDCW = retroperitoneoscopic deroofing with wadding of the cyst using perirenal fat tissue.

it was a single-center analysis. Finally, overall sample size and follow-up are limited. Thus, further multicenter, randomized controlled trial and long-term follow-up in the future would be needed to verify this outcome.

In conclusion, the perirenal pedicled fat tissue wadding technique can decrease the cyst recurrence rate and RCDW represents an effective and safe treatment option in the management of renal cyst.

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