



# Comparison of single-session aspiration and ethanol sclerotherapy with laparoscopic de-roofing in the management of symptomatic simple renal cysts

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## ABSTRACT

**Objective:** The aim of the study was to compare the efficacy and cost-effectiveness of single-session aspiration and ethanol sclerotherapy with laparoscopic de-roofing in the management of symptomatic simple renal cysts.

**Material and methods:** Between March 2010 and December 2012, patients with simple renal cysts presenting with pressure and pain symptoms were divided into two groups. In Group 1 following local anesthetic administration, single session percutaneous aspiration with 95% ethanol sclerotherapy (n=38) and in Group 2 transperitoneal laparoscopic de-roofing under general anesthesia (n=42) were performed. The data were evaluated retrospectively and demographic characteristics, duration of operation and hospitalization, complication rates, cost effectiveness, radiological and symptomatic success rates at six month- follow-up were compared between the two groups.

**Results:** The mean age and gender of the patients, cyst diameter, side and localization of the cyst and indications for intervention were similar in two groups. The median course of treatment and hospitalization were significantly decreased in Group 1 (respectively 33 min versus 59 min and 6 hours versus 24 hours, p<0.001). As complications in Group 1 fever in two patients (5.3%) and in Group 2 bleeding requiring transfusion in one patient (2.4%) were observed (p=0.495). Total cost was calculated as \$ 131.7 in Group 1 and \$ 729.8 in Group 2. After the sixth month follow-up control radiological success rates were found to be significantly higher in Group 2, while symptomatic success rate is similar in both groups (63.2% versus 95.2%, p<0.001; 94.7% versus 97.6%, p=0.498, respectively).

**Conclusion:** Single-session percutaneous aspiration with alcohol sclerotherapy and laparoscopic de-roofing are safe and effective methods in the treatment of symptomatic simple renal cysts. While radiological recurrence rate was higher in single session percutaneous aspiration with alcohol sclerotherapy, however similar symptomatic recurrence rates were seen with laparoscopy. Therefore single session percutaneous aspiration combined with alcohol sclerotherapy seems to be an important option in the treatment of simple renal cysts when considering the duration of the operation, hospitalization and total costs of the process.

**Keywords:** Cystic renal diseases; efficiency; healthcare costs; laparoscopic surgery; sclerotherapy.

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## Introduction

Simple renal cyst is the most frequently seen benign pathology of the kidney. Though simple renal cyst can be seen at every age, its incidence tends to increase in number, and size with aging. Simple renal cysts are encountered each of every 5 individuals after age of 40, and each of every 3 individuals after age of 60.<sup>[1]</sup> Inner layer of simple renal cysts is covered with single-layered squamous or cubic epithelium, and contains plasma-like clear or straw-coloured fluid within a trans-

parent capsule. Usually they have elliptical or ring-like formations. They can be frequently solitary, unilateral, multiple and/or bilateral. Their pathogenetic mechanism, and origin are not fully elucidated, but accumulation of fluid secondary to obstruction and abnormal cellular proliferation of renal tubuli developing at any level are thought to cause the development of a simple renal cyst.<sup>[1,2]</sup>

Simple renal cysts frequently do not give symptoms, and they are incidentally detected during radiological examinations performed

for other reasons. The mostly observed symptom is flank pain. Pelvicalyceal system obstruction due to mass effect of the cyst, palpable abdominal mass, hematuria when the cyst opens into a collecting system, hypertension related to increased level of renin secondary to segmental ischemia, and compression of renal/segmental arteries can be also observed.<sup>[2,3]</sup> Asymptomatic simple cysts do not require treatment. However in the presence of pain refractory to analgesics, and other symptoms, cysts should be intervened. Methods used in the treatment of simple cysts include percutaneous aspiration, percutaneous aspiration combined with intracystic injection of sclerosing agents, laparoscopic, and open surgical interventions.<sup>[4]</sup>

The objective of our study is to compare one-session percutaneous aspiration, alcohol sclerotherapy with laparoscopic de-roofing with respect to their effectiveness, and cost.

## Material and methods

The patients whose renal cysts detected as etiological factor for flank pain and/or compression on the pelvicalyceal system using urinary ultrasound (US), non-contrast, and contrast-enhanced computed tomography (CT), and underwent percutaneous aspiration/ethanol sclerotherapy or laparoscopic de-roofing operations between March 2010, and December 2012 because of failure of pain control with first-line nonsteroidal antiinflammatory drugs were retrospectively evaluated based on the criteria presented in Table 1. Only patients with simple renal cysts (Bosniak Class 1 category) were included in the study. Patients with Bosniak Class  $\geq 2$  renal cysts were excluded from the study.

**Single-session percutaneous aspiration, and sclerotherapy with 95% ethanol (Group 1):** The patients were laid in the lateral decubitus position with their affected side looking upwards. With the aid of US, the angle of access tract into the cyst from the subcostal region was determined, and local anesthesia with 10 mL 2% prilocaine hydrochloride was applied on the entry site. Following necessary operation site disinfection, and sterile draping, under the guidance of US with a 2.5-5.0 MHz convex probe, the cyst was punctured, and aspirated with 18 G Chiba needle. The first 30 mL portion of the aspirated fluid was separated for cytological, microbiological, and biochemical analyses. After complete evacuation of the cyst, 95% ethanol solution volumetrically equal to 1/4 of the aspirated fluid (max. 100 mL) was injected into the cyst. To achieve contact of ethanol with all inner surfaces of the cyst, the patient was laid in prone, supine, right, and left lateral decubitus positions at 5 minute-intervals. Excluding 2 patients who developed complications, after an observation period of 6 hours, the patients were discharged with prescription of oral antimicrobial, and analgesic drugs.

**Laparoscopic transperitoneal de-roofing (Group 2):** Under general anesthesia, following insertion of nasogastric tube, and urethral catheter, the patients were laid in 45° semilateral decubitus position, and with an Veress needle peritoneal cavity was entered from an infraumbilical site. Then CO<sub>2</sub> was delivered under insufflation pressure of 20 mmHg into the abdominal cavity to achieve pneumoperitoneum. The first trocar (10 mm-calibre camera trocar) was advanced through the access tract created with a Veress needle. Then, a trocar with a calibre of 5 mm was inserted under direct vision from the midpoint between xyphoid, and the umbilicus, and another one with the same calibre was inserted at the intersection point between midclavicular line, and an imaginary horizontal line passing through the umbilicus. Following placement of trocars, intraperitoneal insufflation pressure was dropped to 12 mmHg. Omentum was dissected away from its adhesion to the abdominal wall, Toldt white line was exposed, and the colon was deviated to the medial side. Gerota fascia was passed through, and the cyst was exposed. The cyst was opened, and excised, and extracted using laparoscopic scissors connected to a cautery from 1-2 mm away from the normal renal parenchyma. After irrigation, and hemostatic control, a Nelaton catheter was placed through the trocar access tract into the loge for drainage, and evacuation of intraabdominal gas. Then trocar entry sites were closed. Aspirated fluid was separated for cytological, microbiological, and specimen of the cyst wall for histopathological assessments. In all patients except one who developed complications, drains were removed the next day, and the patients were discharged with prescriptions of oral antibiotics, and analgesics.

Records of demographic, and operative data of the patients were retrospectively evaluated. During 6 months of the follow-up period, pain relief was considered as symptomatic success, and regression of pelvicalyceal system obstruction, and decrease of more than 50% in cyst size relative to the baseline were considered as radiological success.<sup>[4-6]</sup> Procedural costs were calculated according to the Statement of Amendmend in Actual Processing of Healthcare Applications 2013 released on 07.25. 2014. Both groups were compared as for demographic characteristics, procedures applied, hospital stay, complications, cost, symptomatic, and radiological success rates.

## Statistical analysis

For the comparisons of demographic, and surgical data Paired-Samples t Test, and for those of success rates Pearson's *chi*-Square), Likelihood Ratio or Fisher's Exact test were used according to the distribution of frequencies. In statistical analysis, Statistical Package for the Social Sciences version 11.5.2.1 (SPSS, Inc, Chicago, IL, USA) package program was used, and p values less than 0.05 were considered as statistically significant. Descriptive statistics for continuous variables were

**Table 1. Inclusion, and exclusion criteria of the study**

Inclusion criteria	Exclusion criteria
Bosniak Class 1 category cyst	Bosniak Class $\geq 2$ category cyst
Cortical cyst	Parapelvic cyst
At least 6 months of clinical, and radiological follow-up	Previous intervention to the cyst

expressed as means  $\pm$  standard deviation (SD) or medians, while descriptive statistics for categorical variables were indicated as frequencies, and percentages (%) (Table 3).

## Results

Mean age of all patients was  $52.4 \pm 12.5$  (21-74) years. A total of 38 patients with a mean age of  $53.2 \pm 13.7$  (range, 21-74 yrs) years including 22 (57.9%) male, and 16 female (42.1%) patients, underwent percutaneous aspiration, and ethanol sclerotherapy. Cysts with a mean size of  $8.5 \pm 2.7$  cm were localized in the right (n=31; 73.8%), and left (n=11; 26.2%) kidneys, upper (n=9; 21.5%), middle (n=14; 33.3%), and lower (n=19; 45.2%) poles of the left kidney. The patients were surgically intervened because of flank pain unresponsive to analgesics (n=36; 94.7%), and compression of the cyst on the pelvicalyceal system (n=2; 5.3%). Median procedural time, and hospital stay were calculated as 33 (range: 28-43) minutes, and 6 (range 6-24) hours, respectively. As complications, high fever was observed in 2 (5.3%) patients which was brought under control with intravenous hydration, and paracetamol.

Laparoscopic transperitoneal de-roofing was applied for a total of 42 patients (male, n=23; 54.8%, and female, n=19; 45.2%) with a mean age of  $51.1 \pm 11.6$  (range: 25-71) years. Cysts with a mean size of  $8.5 \pm 2.7$  cm were localized in the right (n=31; 73.8%), and left (n=11; 26.2%) kidneys, upper (n=9; 21.5%), middle (n=14; 33.3%), and lower (n=19; 45.2%) poles of the left kidney. The patients were surgically intervened because of flank pain unresponsive to analgesics (n=38; 90.5%), and compression of the cyst on the pelvicalyceal system (n=4; 9.5%). Median procedural time, time elapsed till drain withdrawal time and hospital stay were calculated as 59 (range: 50-102) minutes, 6 (range, 6-48) hours, and 24 (range 24-72) hours, respectively. As a complication, decrease in hemoglobin/hematocrit values, and profuse bleeding coming through the drain in one patient (2.4%) necessitated blood transfusion, and bleeding control was made using open surgery.

Characteristics of the cases, and operative outcomes are summarized in Tables 2, and 3. During control visits performed at 6, months, symptomatic, and radiological success rates in Groups 1, and 2 were detected as 94.7, and 97.6% (p=0.498) vs. 63.2, and 95.2%, respectively (p<0.001).

## Discussion

Ultrasonography or CT-guided needle aspiration combined with decompression of a simple renal cyst is a simple, and minimally invasive method.. However recurrence rates up to 90% have been reported in cases where only contents of the cysts were aspirated.<sup>[7]</sup> Therefore, in addition to aspiration, sclerosing substances were injected into cysts to damage secretory epithelial lining of the cavity with the intention to increase procedural success rates. Firstly, in the year 1981 Bean described the method of aspiration of the simple cyst combined with intracystic injection of sclerosing agent (95% ethanol) with success rates increasing up to 97 percent.<sup>[8]</sup> In advanced years, with the same objective many sclerosing agents as glucose, sodium marfuate, lipidol, phenol, tetracycline, minocycline-HCl, bismuth phosphate, urea colo-hydro-lactate, polydocanol, pantopac, acetic acid, povidone-iodine, ethanolamine oleate, OK-432, and n-buthyl cyanoacrilate have been used.<sup>[2,4,7]</sup> As demonstrated in the literature none of the sclerosing agents used is more advantageous than others. Besides, recurrence rates ranging between 3-100% have been reported when aspiration/sclerotherapy was used in the management of simple renal cysts.<sup>[2,6,8,9]</sup> However overall success rate is 70-95 percent.<sup>[10]</sup> Besides, some authors reported that multiple-session percutaneous sclerotherapy has lower incidence rates when compared with single-session aspiration/sclerotherapy However longer hospital stay, and discomfort because of indwelling catheter, are important disadvantages of this method.<sup>[11]</sup> Complication rates are very low with aspiration/sclerotherapy (1.3-20%). Pain, high fever, hematuria which can be controlled with conservative therapy, and perirenal hematoma are the most frequently observed complications.<sup>[10]</sup> However among rarely seen serious complications as adjacent organ injury, pneumothorax, surgical intervention requiring hematoma, and ureteropelvic stenosis developed in the long-term because of oozing of sclerosing agent into the collecting system have been reported.<sup>[6,7]</sup> In our series in compliance with the literature data symptomatic and radiological recurrence rates in the aspiration/sclerotherapy group were 5.3, and 36.8%, respectively, while complication (fever) rate was 5.3 percent.

As a minimally invasive, and effective method, in the treatment of simple cysts laparoscopic decortication was firstly described by

Hulbert in the year 1992.<sup>[12]</sup> Generally, symptomatic, and radiological success rates of 90% have been reported in the literature.<sup>[7,13]</sup> Laparoscopic surgery whose effectiveness is comparable to open surgery is a minimally invasive technique with lesser labour loss, shorter hospitalization, and higher patient satisfaction. Important disadvantages of laparoscopic surgery have been reported as longer operative time, and higher procedural cost, however with increased experience, and sophisticated equipments, its operative time becomes comparable to that of the open surgery, and when all of these parameters are taken into consideration it appears to be more superior technique than open surgery.<sup>[7,10,12]</sup> Generally laparoscopic renal cyst decortication series cited in the literature have been investigated in small patient populations with complication rates ranging

between 0, and 13 percent (median 23.4%).<sup>[14]</sup> Bleeding is the most frequently observed complication. Tissue/organ injuries, infection / peritonitis, trocar insertion site hernia, conversion to open surgery, urine leakage, and urethral stricture are other complications.<sup>[10,14]</sup> In our series in compliance with the literature, in patients who underwent laparoscopic transperitoneal de-roofing, symptomatic, and radiological recurrence, and complication (bleeding) rates were detected as 2.4, 4.8, and 2.4%, respectively.

**Table 2. Characteristics of the cases**

	Group 1 (n:38)	Group 2 (n:42)
Age (mean±SD)*	53.2±13.7	51.1±11.6
Male/Female*	22/16	23/19
Diameter of the cyst (mean±SD) cm*	9.5±2.9	8.5±2.7
Laterality (n) right/left*	28/10	31/11
Location (n), upper/middle/lower pole*	7/15/16	9/14/19
Indication for intervention (n) (pain/compression)*	36/2	38/4

p>0.05. SD: standard deviation

**Table 3. Surgical outcomes**

	Group 1	Group 2
Median procedural time min*	33	59
Median hospital stay (hr)*	6	24
Complication rate (%)**	5.3	2.4
Total cost (\$)*	131.7	729.8
Procedural cost (\$)	121.4	
Daily hospital bed cost (\$)	2.9	
Material cost (\$)	7.3	
Operation, and hospital care/bed cost (\$)		348.2
Laparoscopic consumable cost (\$)		381.6
Median amount of invoice (incl. cost incurred by complications, \$*)	131.9	737.1

p<0.05 \*\*p=0.495

**Table 4. Comparative studies between aspiration/ sclerotherapy, and laparoscopic surgery performed by various authors**

Author	Study design, and techniques compared	Follow-up period	Outcomes, and recommendations
Huang et al. <sup>[5]</sup>	Non-randomized controlled study Percutaneous aspiration + povidone iodine sclerotherapy (n: 10) plus laparoscopic unroofing (n: 10)	3 months	Treatment success (≥50% decrease in the largest diameter of the cyst, and elimination of symptoms) 20 vs. 100% First-line treatment of simple renal cysts is laparoscopic intervention
Okeke et al. <sup>[9]</sup>	Percutaneous aspiration + 95% ethanol sclerotherapy (n: 6) plus laparoscopic de-roofing (n: 7)	17 months	All patients in the aspiration/sclerotherapy group had experienced recurrent painful episodes. In the laparoscopic de-roofing group none of the patients experienced recurrent painful episodes
Agarwal et al. <sup>[15]</sup>	Randomized controlled study Percutaneous aspiration 1% polidacanol sclerotherapy (n: 20) plus laparoscopic de-roofing (n: 20)	3 months	Complete regression (≥50% decrease in the largest diameter of the cyst, and elimination of symptoms) rates (90% vs. 95%). In the aspiration/sclerotherapy group an additional 5% partially regression (only pain relief) Efficacies of both methods are similar: aspiration/sclerotherapy group has lower morbidity rates, and shorter hospital stay.
Shao et al. <sup>[16]</sup>	Retrospective study Percutaneous aspiration + 95% ethanol sclerotherapy (n: 986) + laparoscopic decortication (n: 208)	12 months	Complete regression rates of both groups are similar; the aspiration/sclerotherapy group had shorter procedural time, but higher recurrence rates. However in large-sized cysts laparoscopic is more advantageous

Before developments achieved in laparoscopic surgery, the first-line treatment in simple renal cysts was percutaneous aspiration and injection of sclerosing agent. However in recent years, some studies indicating laparoscopic surgery as the first-line treatment in the management of simple renal cysts have been published.<sup>[5,9]</sup> However limited number of comparative studies between aspiration/sclerotherapy, and laparoscopic surgery have been published in the literature which have not standard definition of the concept of “success” in the evaluation of their treatment outcomes. This fact complicates interpretation of available studies (Table 4).<sup>[5,9,15,16]</sup> As is seen in our study, and in almost all of series, whatever the definition would be, laparoscopic procedures yield higher success rates. The most important disadvantage of this technique appears to be its cost. Some studies published related to patients who had undergone aspiration/sclerotherapy suggested otherwise, but similar to our study, in many articles authors reported higher partial/symptomatic success (pain control) rates. However lower complete/radiological success which can be defined as decrease in the size of the cyst and/or its removal together with pain control, and higher recurrence rates are the most important disadvantages of this technique.

As a gold standard diagnostic method, during fluoroscopy, and laparoscopy performed before aspiration/sclerotherapy contrast agent is injected into the cyst, then after opening of the cyst wall methylene blue is injected through ureteral catheter, and communication between the cyst and collecting system (if any) is evaluated under direct vision. However in our study the communication between the cyst, and the collecting system was evaluated during routinely performed non-contrast/contrast-enhanced CT which is a limitation of our study despite lack of postprocedural urine leakage.

In conclusion, when our study, and available data are evaluated in combination, the objective in the treatment of simple renal cysts is pain relief, especially in elder patients, in consideration of lower morbidity, and shorter hospitalization, and cost aspiration/sclerotherapy appears to be the first line therapy. However in especially young patients and/or those with larger cysts laparoscopic surgery seems to be the rational first-line therapy when treatment failure, and long-term recurrences of aspiration/sclerotherapy are taken into account. However, the appropriate selection of the first-line therapy in the treatment of simple cysts requires conduction of prospective, randomized, controlled studies with larger patient population.

**Ethics Committee Approval:** At the time of this study, ethics committee approval was not needed for retrospective studies in our university.

**Informed Consent:** Written informed consent was obtained from patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

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