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Conservative and radiological management of simple renal cysts: a comprehensive review

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To review the conservative and radiological management of simple renal cysts a systematic literature review was performed. Simple renal cysts are commonly found in the adult population. Increasing age is highly associated with its incidence. When they remain asymptomatic they require neither treatment nor follow-up. When the shape of the cyst is slightly irregular follow-up is mandatory to exclude malignant progression. Symptomatic cysts require intervention. Ultrasound or computed tomography guidance have been effectively used for cyst puncture. However, simple fluid aspiration is ineffective leading to cyst recurrence. Aspiration should be accompanied with the injection of a sclerosing agent to destroy renal cyst epithelium. Several issues such as the ultimate technique and agent remain to be clarified. High rates of cyst disappearance and long-lasting cyst volume reduction have been reported with the use of various sclerosants. Ethanol in high concentrations and multiple injections is more commonly used with new agents showing similar efficacy and better complication profile. Studies comparing radiological intervention to surgical excision are lacking. Simple renal cysts may not require treatment when asymptomatic. Radiological intervention with the use of sclerosants needs further evaluation and comparison with other treatment methods.

What's known on the subject? and What does the study add?
Simple renal cysts are a common entity, which may need observation and follow-up or treatment.

The study, for the first time, systematically reviews the indications for follow-up or radiological treatment of simple renal cysts.

KEYWORDS

simple renal cyst, natural history, conservative treatment, radiological intervention

INTRODUCTION

Renal cysts are acquired lesions of the kidney that more commonly affect the elderly population [1–3]. Autopsy studies reported a 50% incidence of renal cysts after the age of 50 years [2]. However, the actual incidence is difficult to determine. Populations having health screening [4,5] showed lower prevalence of simple renal cyst than populations who were admitted or followed at clinics [6–8], while the prevalence of simple renal cyst detected by CT was higher than the prevalence determined by ultrasonography (US) [9].

It is thought that renal cysts originate by the weakening of the tubular basement membrane of the distal convoluted or collecting duct cells. As a result, a diverticula is formed that can subsequently develop in to a simple renal cyst [10,11]. Risk factors for the formation of renal cysts are serum creatinine, smoking, male gender, hypertension and age. However, given the retrospective nature of the reported studies, these associations could be coincidental. The only persistent cofounder of all reported associations is increasing age [5,12,13]. It is estimated that 20% of the population by the age of 40 years, and >30% by the age of 60 years harbour renal cysts [3].

Simple renal cysts usually remain untreated requiring intervention only when they cause symptoms or undergo a complication [5,14]. Herein, we have performed a systematic review of conservative treatment and radiological intervention for simple renal cysts.

MATERIAL AND METHODS

We performed a systematic literature search using the terms 'renal cyst', 'natural history', 'observation', 'conservative treatment', 'radiological treatment', 'aspiration', 'sclerotherapy', 'sclerosants' and 'sclerosing agent' in the Medline, Embase and PubMed databases. Meta-analyses, randomised controlled trials, systematic reviews, controlled cohort studies and observational studies were reviewed. The literature search revealed >150 studies, of which mainly studies published in English language were reviewed. Excluding the vast majority of case reports and irrelevant studies, ≈100 studies were available for citation. The creation of tables incorporating the results of simple renal cyst aspiration and sclerotherapy for future literature comparison was intended.

RESULTS

CONSERVATIVE TREATMENT OF SIMPLE RENAL CYSTS

The decision to treat or not to treat asymptomatic simple renal cysts should be

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TABLE 1 Bosniak renal cyst classification

Stage	Cyst wall	Septa	Calcification	Enhancement
I	Hairline thin	No	No	No
II	Minimal regular thickening	Few, hairline thin	Smooth, hairline thin	No
IIF*	Minimal regular thickening	Multiple, minimal smooth thickening	Thick, nodular	No
III	Irregular thickening	Measurably thick, irregular	Thick, nodular, irregular	Yes
IV	Gross irregular thickening	Irregular gross thickening	Thick, nodular, irregular	Yes, tissue and cyst

**F in IIF is for follow-up. Cyst size of >3 cm in diameter is another criterion for follow-up and by extension inclusion in class [18].*

based on the natural history of this entity. At diagnosis, 70–80% of simple renal cysts are solitary unilateral and cortical [15]. Renal cysts tend to progress in number and size with age, while spontaneous regression is extremely rare [16]. Long-term follow-up of patients with asymptomatic cysts showed that the diameter of a renal cyst may increase by ≈1.6 mm or about 5% annually, and may double the original size over 10 years [5,7,17]. Simple cysts tend to increase rapidly in size during the first 2 or 3 years after recognition, but their enlargement decelerates with longer follow-up periods. The vast majority of renal cysts increase in size to less than twice their original size [5].

Several studies indicated that cyst aggressiveness is predicted by age, cyst shape and laterality. Renal cysts in younger patients progress more rapidly than those in older patients, while multi-loculated cysts grew more rapidly than simple cysts. Bilateral cysts may also be more aggressive compared with unilateral ones [5,7,17]. Based on the Bosniak renal cyst classification system, multi-loculated cysts are classified into category 2, which do not require further evaluation (Table 1 [18]). Category IIF lesions are well-emarginated containing multiple hairline thin septa or minimal smooth thickening of their wall or septa without measurable enhancement. These lesions are considered to be benign, but require follow-up with CT. Their configuration should be stable over time with changes in the cystic wall shape indicating a cystic renal neoplasm, necessitating further evaluation [18,19].

Only a few studies have reported a clinical course of malignant change from simple renal cysts. These studies mainly presented case reports [20–22]. When pathology was correlated with the Bosniak classification, the risk of malignancy occurring in a simple cystic lesion was 1.7% [23]. In a prospective study of 61 patients with simple renal cysts followed for up to 14 years, only two developed renal neoplasms originating from the renal cyst [5]. Bosniak category II lesions are minimally or moderately complicated cysts for which radiographic surveillance is usually recommended, as the risk for malignancy is 5–10% [23,24]. In all these studies, the total number of patients included was small and it is likely that the real risk of malignancy in simple renal cysts is actually much lower than the aforementioned [5,23]. These studies indicated that neither the actual size nor size changes were specific for the development of a renal neoplasm. The rate of increase in the cyst size in patients with renal cancer was similar to that in other patients of the same age. Based on these data it is extremely difficult to clarify whether the regular follow-up of the renal cysts is of benefit in the early detection of a malignancy. Patient prognosis in the above studies was mainly determined by the histological type of the malignant lesion at diagnosis [5]. Radiographic surveillance is an effective method for managing patients with minimally or moderately complex renal cysts. Malignant lesions can be identified and removed while still of low grade and stage and surgery can be avoided in most patients [24].

Although more and higher level evidence is needed, essentially the current evidence is not to pursue asymptomatic benign renal cysts even when these are increasing in size. Although there no evidence-based guidelines the available data suggests that class II Bosniak cysts are benign but may need periodic evaluation by US for the first 2–3 years, especially in younger patients with cyst diameters of >3 cm. Class IIF cysts should be followed by CT at 3, 6 and 12 months and annually thereafter [13,15]. This follow-up approach has been shown to be safe and has prevented an unnecessary surgical intervention in >95% of patients [18,25].

In 2–4% of the cases, simple renal cysts become symptomatic due to enlargement or the development of a complication such as haemorrhage, infection or rupture. In addition, they may cause calyceal or renal pelvic obstruction [8,13–15]. They may then present with flank pain, abdominal discomfort, a palpable mass, or haematuria. However, in a controlled epidemiological study of 1526 consecutive patients the prevalence of hypertension, flank pain, erythrocytosis, haematuria, and proteinuria was not increased in patients with simple renal cysts. The association of these symptoms with simple renal cysts has to be considered merely coincidental [8]. Clinical symptoms are more common with neoplasm than simple cysts, and the onset of symptoms should always raise the possibility of an associated malignancy and the need for additional diagnostic studies [13].

The association between simple renal cysts and the incidence of hypertension is controversial. Since the initial report about the development of hypertension by simple renal cyst by Farrell and Young [26], several authors reported cure or improvement of hypertension after decompression of a large cyst [27–30]. Most studies currently indicate that when patients are stratified with clinical parameters associated with hypertension, the presence of cyst is related to hypertension but not to renal dysfunction. The number and the size of the cysts are independent risk factors to the prevalence of hypertension [4,11,31,32].

RADIOLOGICAL INTERVENTION

Symptomatic simple renal cysts can be treated in various ways ranging from simple

aspiration with or without the use of sclerotic agents, to surgical excision via open, percutaneous, laparoscopic, or robotic surgery [5]. Imaging guided percutaneous renal cyst aspiration with or without sclerosing therapy has been performed to treat simple renal cysts since 1970s. The method has been considered minimally invasive, safe and of low cost [33–98].

However, the procedure has not been standardized as yet. US and CT have both been used to guide therapy and document its result, but no comparative study exists between the two imaging methods. The ultimate outcome of the procedure has not been clarified. Renal cyst disappearance, reduction of cyst size or fluid volume and elimination of patients' symptoms have all been used separately as endpoints of treatment success. The improvement in symptoms is not necessarily associated with complete resolution of the cyst, while disappearance of the cyst is not always associated with symptom relief. The duration of success and follow-up of the result varies in the published data.

In addition, although favourable therapeutic outcomes have been reported by varying the sclerosing technique and the agent, the optimal technique of treating renal cysts and the best agent for renal cyst sclerotherapy remain to be determined. Several factors in renal cyst sclerotherapy require optimisation. These factors include the choice of the agent, its concentration and volume in relation to cyst volume, the duration of sclerotherapy per session, the number of injections required in relation to cyst volume, patient position after sclerosant administration, whether continuous drainage is needed before and after slcerotherapy, and duration of drainage.

Both US-fluoroscopy combination [33–63,65–92,94,95,97,98] and CT [64,93,96] are used in percutaneous treatment of renal cysts. Real-time US is preferred if the cyst is clearly visualised and a safe access route can be guaranteed. US is cost-effective and without radiation but it is very dependent upon the skill of the operator. CT is preferable in difficult anatomies and body habitus such as the obese patients. In addition, by injecting i.v. contrast medium the presence of a communication between the simple renal cyst and the collecting system can be excluded. Adapting modern CT techniques and keeping the number of CT slices to a minimum reduces the radiation dose to the patient [93,96].

Simple cyst drainage without sclerotherapy is associated with a recurrence rate of 30–80%. The secretory epithelium, lining the cystic wall, leads to the high rate of fluid re-accumulation after simple aspiration [33,35,42]. In fact, the water turnover in simple renal cysts can be as high as 200 mL/24 h [31]. In most cases after simple aspiration cyst fluid re-accumulates so that 24 months after treatment there is no difference in size between cysts that were aspirated and those that had no treatment [43].

Attempts have been made to destroy the secretary epithelium by injection of various sclerosing agents into the cysts to reduce the rate of recurrence. Various slcerosants have been used to provoke inflammation and adhesion of the cystic wall. These agents include ethanol [33–64], glucose [65], phenol [66], pantopaque [35,67,68], bismuth phosphate [69,70], ethanolamine oleate [71–74], quiacrine hydrochloride [71,75], morrhuate sodium [76], tetracycline and mynocycline [77–80], fibrin glue [81], carbon dioxide [82], polidocanol [83], acetic acid [84–89], povidone iodine [90,91], n-butyl cyanoacrylate and iodized oil [92,93], chitosan [94], sodium tetradecyl sulphate (STDS) [95], hypertonic saline [96] and OK-432 [97,98].

Several factors must be considered before selecting the most effective agent with the least complications. Such factors include toxicity, adverse systemic and local effects, secondary infection, availability and cost-effectiveness. Several materials used as sclerosants in the past have been abandoned because of adverse reactions.

Ethanol is the most commonly used sclerosing material for cyst ablation [33–64] (Table 2 [39,41–44,47,48,50,52,54,57–59,63,64]). When injected at 95% or 99% concentrations it rapidly destroys (1–3 min) the secreting cells on the cystic wall, without affecting the renal parenchyma, as it penetrates the fibrous capsule of the cyst in 4–12 h. The time of exposure to the sclerosant varies widely from 10 min to 4 h [58,60]. The volume of alcohol injected after aspiration varies from 20% to 50% of cyst volume, the maximal dose being 75–200 mL in various reports [53,55–60]. Although volumes of ethanol up to 350 mL have been uniquely administered for the treatment of a giant renal cyst without any complication [46], the vast majority of the studies have used <100 mL of ethanol as their upper limit.

Ethanol is most commonly applied in a prolonged 20-min single-session [39,41,42,44,47,53,55,57–59,63,86,96]. However, recurrence rates of >30% have been reported and multiple sessions may be required to achieve a durable result [43–45,47,50,52,59,88,95,97]. Multiple sessions are time-consuming (12-h to 2-day interval between sessions) and may be related with increased ethanol leakage and additional patient discomfort. The latter is associated with the occurrence of infection, the multiple punctures needed for repeated aspiration or with the placement of a catheter in the renal cyst for several days for complete drainage of the transudate by sclerotherapy.

The recurrence of renal cysts after sclerotherapy is attributed to incomplete ablation of the cyst wall. The recurrence is mainly due to the dilution of ethanol by the fluid remaining in the renal cysts. In addition, the collapsed cyst after aspiration of the content might have many folds with pursed areas inaccessible to ethanol. This pertains especially to extremely large cysts (>500 mL liquid evacuated) or when a low volume of the agent is injected [41,88].

The use of a three-way tube to prevent the air from getting into the renal cyst, repetition of fluid aspiration to reduce the presence of debris adherent to the cyst wall [52], continuous-negative pressure catheter drainage [63], continuous drainage of the cyst for 24 h before therapy [54], prolonged contact of the cyst wall with the sclerosing agent for 90 min [53] to 4 h [58], no drainage of the agent after finishing the procedure [57] and multiple injections allow ethanol to reach the entire cyst wall in high concentrations [43–45,48,50,52,59,88,95,97]. Finally, monitoring ethanol concentration with measuring fluid density during CT may increase the success rate of sclerotherapy [64].

There may be a relation between the degree of response and cyst size, with larger cysts

TABLE 2 Simple renal cyst sclerotherapy with ethanol

Reference	No cysts	Cyst size cm/ volume mL	% Ethanol (mL/% of cyst volume)	US/CT, number of sessions	Follow-up, months	Cyst disappearance, %	Cyst size reduction (% of cysts)	Symptoms disappearance, %	Volume reduction,%	Complication (number of patients)
Özgür *et al.* [39]	22	na/190–780	96 (na/25)	US, single	3–6	100	na	na	na	Microscopic haematuria (2)
el-Diasty *et al.* [41]	30	na/170	95	US, single	19	83	17	100	na	Microscopic haematuria (2) Fever (2)
Hanna *et al.* [42]	20	na/25–500	Aspiration	US/fluoroscopy, single	24	20	na	na	na	
	19		95 (na/25)	US, single	24	68	na	na	na	Pain/fever (2) haematuria (1)
	13		95 (na/25)	US, multiple	24	100	na	na	na	
Fontana *et al.* [43]	72	10.8/na	95	US, multiple	48	97	–	56	na	Surgical exploration for bleeding (1)
Chung *et al.* [44]	42	6.12/na	99	US, single	12.9	19	38	71.4	na	0
	40	6.75/na	99	US, multiple	15.4	73	23	91	na	Pain/fever (10)
Paananen *et al.* [50]	32	7.8/na	99 (<100/na)	US, multiple	55	22	na	75 asymptomatic 6 reduction 6 stable 6 increased	na	0
Delakas *et al.* [48]	77	8.62/na	95 (<100/na)	US, multiple	30	83.82	11.76	na	na	Pain (6)
De Dominicis *et al.* [47]	42	9.8/100–570	95 (na/33)	US, single prolonged drainage	36	76	21	100	na	Pain (3) Haemorrhage (1)
Gasparini *et al.* [52]	17	10/na	99.8 (na/15)	US, multiple	12	85.7	14	100	na	Abdominal discomfort fever
Touloupidis *et al.* [54]	252	8.8/357	99 (20/na) instilled 24 h after cyst puncture	US, single multiple injections (for large cysts)	60	71	22	66	na	Na
	238	9.1/394	99 (20/na) instilled with cyst puncture	US, single multiple injections (for large cysts)	60	9	29	na	na	Na
Mohsen and Gomha [59]	64		95 (<150/na)	US, single (small cysts)	19	100	0	100	na	Fever (2)
				US, multiple (large cysts)	19	61.5	38.5	100	na	
Falci-Júnior *et al.* [57]	30	na/280	99.5 (<100/na)	US, single	6	56.6	36.6	93	11.6 mL	0
Lin *et al.* [58]	14	8.3/223	95 (<150/na)	US, single 4 h retained material	28	21.4	57.1	100	97.9	
Zerem *et al.* [63]	46	na/309	95 (<100/na)	US, single	24	28	na	93	18.5 mL	Intoxication (8) Headache (7) Nausea (3)
	46	na/330	95 (<100/na)	US, continuous drainage	24	52	na		0 mL	0
Xu *et al.* [64]	45	6.53/na	99.9 (<100/na)	CT, single	6	55	25	na	na	Flank pain (5) Fever (3)

na, not available .

necessitating multiple injections [48,59,95]. Interestingly, the complete disappearance of the cyst may take as long as 6–12 months, and as a consequence, abdominal US showing residual cyst during this period does not signify failure or recurrence. Initial relapse of a cyst after ethanol sclerotherapy may be secondary to transient, reactive or inflammatory fluid collections, which eventually disappear within several months [57,62].

Alcohol injection is associated with complications, including pain, fever, and systematic reactions, e.g. intoxication and shock. The complications are more common in the management of large cysts, which require more alcohol for sclerosing. Pain can be avoided by injection of a local anesthetic in the cyst before the injection of the sclerosing agent and/or with systemic analgesia 30 min before the procedure, or sedation [42,57].

Alcohol intoxication is an extremely rare complication. When hepatic cysts have been treated by ethanol sclerotherapy the mean (SD) blood alcohol concentration was found to be 0.38 (0.32) g/L in all measured patients and the highest value was 1.02 g/L [40]. Ethanol sclerotherapy of renal cysts may lead to measurable alcohol levels in the blood in 40% of patients. The values are low enough (0.01–0.30 g/L) to treat the patients safely on an outpatient basis. Increased levels were detected in cases with some haemorrhage into the cyst caused by the puncture [50]. When alcohol intoxication occurred, the maximum blood alcohol concentration was 73–120 mg/dL at 3 h after alcohol instillation. All symptoms and signs disappeared during the first 24 h after the procedure [63]. When large cysts are treated and a volume of >100 mL ethanol is anticipated it is recommended that ethanol dose titration with an alcohol breath analyzer should be done in each and every case.

Extravasation of the sclerosing agent is a rare complication. It rarely causes serious problems even when peripelvic cysts have been treated [48,58], although fibrosis of the PUJ and subsequent obstruction have been reported [36].

Bleeding in a voluminous cystic cavity after rapid percutaneous drainage can occur. Some investigators registered up to

TABLE 3 Simple renal cyst sclerotherapy with agents other than ethanol

Reference	No cysts	Cyst size, cm/ volume mL	Sclerosant (mL/% cyst volume)	US/CT, number sessions	Follow-up, months	Cyst disappearance, %	Cyst size reduction, % of cysts	Symptoms disappearance, %	Volume reduction, %	Complication (number of patients)
Holmberg and Hietala [70]	62	3.1/na	Observation		36	0	7	na	0	
	57	5.4/na	Aspiration	US/fluoroscopy, single	36	10	27	na	5	Pain (4) Haemorrhage (3)
	59	5.2/na	Aspiration + 0.1–0.6 g bismuth phosphate	US/fluoroscopy, single	36	44	50.7	na	79	Pain (8) Haemorrhage (2) Fever (5) Eczema (1)
Ohkawa *et al.* [78]	177	5.5/na	Minocycline	US, single	>3	44.8	31.8	na	na	Pain/fever (21)
	30	4.7/na	Aspiration	US, single	>3	0	5	na	na	Fever (2)
Kilinc *et al.* [80]	56	6.9/na	Tetracycline	US, single	9.8	39.3	46.4	89.7	na	na
	20		Aspiration	US, single	9.9	5	20	na	na	na
Ohta *et al.* [83]	15		3% polidocanol	US, single	1–24	93	na	na	na	0
Phelan *et al.* [90]	5	6–15/na	Povidone-iodine	US, single	7.2	60	20	100	na	0
Madeb *et al.* [91]	16	3–10.5/na	Povidone iodine	US, multiple	22	18.5	na	25	33–86	0
Yamamoto *et al.* [74]	4	9 × 6/60–150	Ethanolamine oleate	US, single	3	0	na	100	90–97 (mean 93)	Fever (1)
Kwon *et al.* [87]	32	na/245	50% acetic acid (na/23)	US, single	30.5	66	97.4	100	na	0
	35	na/283	50% acetic acid (na/8)	US, single	27.3	63	96.9	100	na	0
Yoo *et al.* [89]	60	na/244	50% acetic acid (<100/20)	US, single	10	76.7	20	na	na	Pain (9) Nausea/ vomiting (3)
Choi *et al.* [98]	61	8.2/na	OK-432	US, single	12	74	22.9	100	na	Pain (12) Fever (6) Leukocytosis (4)
Baysal *et al.* [93]	27	5.6/na	NBCA and iodized oil	CT, single	9.1	na	2.1	87	na	0

NBCA, n-butyl-cyanoacrylate; na, not available.

TABLE 4 Simple renal cyst sclerotherapy: comparative studies

Reference	No cysts	Cyst size, cm/ volume mL	Sclerosant (mL/% of cyst volume)	US/CT, number sessions	Follow-up, months	Cyst disappearance, %	Cyst size reduction (% of cysts)	Symptoms disappearance, %	Volume reduction, %	Complication (number of patients)
Okeke *et al.* [49]	6	6/90	95% ethanol (<75/20)	US, single	17	na	na	0	na	Pain (1)
	7	8/250	Laparoscopy	de-roofing	17.7	100	na	100	na	Transfusion (1)
Demir *et al.* [95]	34	8.5/252	95% ethanol (na/25)	US, multiple (stratified to cyst size)	9.2	82	9	na	na	Haematuria (2) Fever (2) Pain score 3.8
	34	8.5/256	3% STDS (na/25)	US, multiple (stratified to cyst size)	9.5	26	18	na	na	Haematuria (1) Fever (1) Pain score 2.1
Egilmez *et al.* [96]	36	na/165	95% ethanol (<100/25)	CT, single	6	94	2.7		na	Pain (10)
	36	na/178	20% hypertonic saline (<100/25)	CT, single	6	72	2.7		na	0
Ham *et al.* [97]	50	8.4/359	99% ethanol (na/25)	US, multiple	22	68	16	90.3	na	Pain (13) Fever (4) Leukocytosis (3)
	61	8.2/337	OK-432 (<100/25)	US, single	14	75.4	23	100	na	Pain (6) Fever (3) Leukocytosis (2)
Seo *et al.* [86]	28	na/209	99% ethanol (<100/<25)	US/fluoroscopy, single	>12	32	72.8	na	na	Pain (3)
	32	na/301	50% acetic acid/<100/<25	US/fluoroscopy, single	>12	66	89	na	na	Pain (3)
Cho *et al.* [88]	40	na/168	99% ethanol (<200/24.5)	US, multiple	13	60	30	80	86	Pain (5)
	32	na/208	50% acetic acid (na/<25)	US, single	18	90.6	9.4	97	97.3	Pain (15)

na, not available.

57 cmH_2O at percutaneous puncture of renal cysts [34,38].

It seems that the success rate with ethanol is better (97%) than that reported with pantopaque (23–82%) [67,68], bismuth phosphate (44–81%) [69,70], minocycline and tetracycline (44–71%) [77–80], povidone-iodine (18–60%) [90,91], ethanolamine oleate (65–97%) [71–74], carbon dioxide (71–100%) [84], and chitosan (90%) [94] (Table 3 [70,74,78,80,83,87, 89–91,93,98]). However, other sclerosants such as acetic acid (66–96.7%) [84–89], STDS [95] and OK-432 [97,98] seem equally or more effective than ethanol.

There are several studies directly comparing ethanol with other slcerosing agents [86,88,95–97] (Table 4 [49,86,88,95–97]). Acetic acid has a strong ability to penetrate cells and can dissolve lipids and extract collagen. Acetic acid has been reported to be an effective sclerosing agent for renal cysts owing to its faster and more complete sclerosing effect compared with ethanol. In addition, the amount of sclerosing agent and the frequency of the procedure are decreased when acetic acid is used [86,88]. Demir *et al.* [95] in a randomised study, compared ethanol to STDS, an embolization agent. Both agents were simple noninvasive, cost-effective and well tolerated sclerosants for the treatment of simple renal cysts. STDS caused less pain and it may be preferable. Egilmez *et al.* [96] in a randomised trial reported that ethanol sclerotherapy under CT guidance was more effective than 20% hypertonic saline sclerotherapy. Sclerotherapy was more effective in the ethanol group while hypertonic saline may be an option for patients preferring to undergo a less painful treatment procedure. OK-432 is a lyophilized incubation mixture of the low virulent Su strain of type III, group A *Streptococcus pyogenes* of human origin with penicillin G potassium that has lost its streptolysin S-producing ability. The mechanism of action of OK-432 is probably damage to the endothelial lining which causes obliteration of the cavity and prevents further accumulation of fluid in the lesion. OK-432 does not penetrate the cystic wall, does not cause any scarring of the renal parenchyma and as a result, drainage is not required. Ham *et al.* [97] retrospectively compared the result of ethanol 99% multiple injection sclerotherapy with OK-432 single injection sclerotherapy.

The latter was simpler, safer and more effective for the treatment of simple cysts, especially large cysts.

Ethanol sclerotherapy has been compared with other treatment methods for simple renal cysts. Okeke *et al.* [53] have compared single-session ethanol sclerotherapy and laparoscopic de-roofing in the management of symptomatic simple renal cysts with a limited number (six and seven patients in each group) of patients without randomisation and they found laparoscopic treatment more effective than sclerotherapy. Recurrence of pain was observed in five of six patients in the sclerotherapy group and no recurrence was seen in the laparoscopic group. The patients in the laparoscopy group stayed hospitalised for a significantly longer period, while in one patient 2 blood units were transfused due to haemorrhage. The high recurrence rate of sclerotherapy in this study might be due to the lower ethanol volume which was a maximum of 75 mL and 20% of cyst volume [98]. However, randomised studies with larger patient groups are required to compare effectiveness, complications and costs of laparoscopic and percutaneous sclerotherapy techniques using higher ethanol volumes.

CONCLUSIONS

Asymptomatic simple renal cysts may require neither treatment nor further follow-up. Asymptomatic cysts with minor shape irregularities (Bosniak category IIF) still need no treatment but require regular follow-up preferably with CT.

Although, a causative association between simple renal cysts and patient symptoms is not always justified, the vast majority of studies indicate that symptomatic renal cysts should be treated.

Radiological intervention has stood the test of time. Simple aspiration is ineffective and should be combined with the use of a sclerosing agent. However, many issues such as the best technique and the ultimate sclerosant remain to be clarified. Ethanol in high concentration and multiple injections seems to be highly effective. Newer agents show comparable sclerosing efficacy with a better complication profile. Well-designed randomised studies comparing sclerosing therapy to surgical intervention are still needed.

CONFLICT OF INTEREST

None declared.

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Abbreviations: **US**, ultrasonography; **STDS**, sodium tetradecyl sulphate.