

Ultrasound-guided percutaneous sclerotherapy of simple renal cysts with n-butyl cyanoacrylate and iodized oil mixture as an outpatient procedure

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Abstract

Objective: The aim of this study was to evaluate the efficacy and safety of ultrasound guided percutaneous sclerotherapy of symptomatic simple renal cysts with n-butyl cyanoacrylate (NBCA) and iodized oil mixture as an outpatient single session procedure.

Materials and Methods: A total of ninety two patients with 100 symptomatic simple renal cysts (larger than 5 cm) were treated by ultrasound (US)-guided percutaneous aspiration and injection of NBCA and iodized oil mixture. The patients (68 men and 24 women, mean age, 42.4 ± 10.5 years) were treated with as out-patients. The volume of the treated cysts was calculated with periodic noncontrast enhanced CT examinations 3, 6 and 9, months after the procedure. The procedure was considered successful at follow-up CT when there was total ablation or greater than 80% reduction of size with resolution of symptoms, respectively. Failure was defined as less than 80% reduction and/or persistent symptoms.

Results: The sclerotherapy was technically successful in all patients. The diameter of the cysts ranged between 5.5 and 13.5 cm (mean, 8.8 ± 1.4 cm), and 1.5 and 3.8 cm (mean, 2.1 ± 0.4 cm) before and after sclerotherapy, respectively ($P < 0.001$). Average diameter reduction was 83.7% during the follow-up period. The mean follow-up lasted 7.1 months (3–11 months). Flank pain resolved in 86 of 92 symptomatic patients (93.48%). In six patients, the symptoms decreased slightly. The procedure was successful in 98 of 100 cysts (98%), demonstrated by follow-up CT. The only two failed cyst was larger than 10 cm in diameter and don't required any further treatment. We did not observe any procedure related complications.

Conclusion: Ultrasound guided percutaneous sclerotherapy with NBCA and iodized oil mixture for management of symptomatic simple renal cysts was found to be a real time, effective, safe, well tolerated, alternative and simple technique that can be carried out by urologists as an outpatient procedure.

Key Words: N-butyl cyanoacrylate, renal cyst, sclerotherapy

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INTRODUCTION

Simple renal cysts are common in adults and occur in half of all patients older than 50 years. As the majority of renal cysts are asymptomatic, they are often incidental discovered, however, can be associated with flank pain or palpable renal mass.^[1] They are generally diagnosed incidentally on ultrasonography, computed tomography (CT) scan or urography.^[2] The treatment of

symptomatic renal cyst was based on percutaneous puncture, aspiration (with or with a sclerosing agent), percutaneous marsupialization, and open or laparoscopic cyst decortication.^[3] Percutaneous aspiration and sclerotherapy have been described as safe and effective methods of treatment of symptomatic simple renal cysts without the cost and morbidity associated with conventional therapy and laparoscopy.^[4] Percutaneous aspiration and single or multiple session sclerotherapy have been successfully performed with high success rate. Several sclerosing agents have been used including ethanol, polidocanol, acetic acid, ethanolamine oleate, sodium tetradecyl sulfate and 20% hypertonic saline.^[5] Although favorable therapeutic results have been reported by different technique with different sclerosing agents, the optimal sclerosing agent remains to be determined. N-butyl cyanoacrylate (NBCA) is a well-known tissue adhesive that has been used in different surgical procedures. We conducted this study to evaluate the efficacy and safety of single-session ultrasound-guided sclerotherapy with NBCA as a sclerosing agent for the percutaneous treatment of symptomatic simple renal cysts.

MATERIALS AND METHODS

Our prospective simple observational study including 92 patients with 100 simple renal cysts selected from outpatient clinic of the authors institute over the period from March 2013 to August 2014. All 92 patients complained of abdominal and/or flank discomfort due to growing renal cysts (symptomatic renal cyst). The study protocol was approved by the ethics committee. Informed consents including the procedure and possible complications were taken from all patients. The patients (68 men and 24 women) ranging in age between 36 and 61 years old (mean age, 42.4 ± 10.5 years) were treated as an out-patients in urology department by the authors. All patients were evaluated by detailed clinical history, general and local examination, complete laboratory assessment including urine analysis, serum creatinine, liver function tests, complete blood count, and coagulation profile. The radiological assessment comprised of pelvi-abdominal ultrasound and noncontrast CT examinations for evaluation of initial cyst size, volume, and site. All cysts were type I Bosniak cysts.^[6] We excluded all patients with morbid obesity, uncorrected coagulation profile, active bleeding, and urinary tract infection. In addition to that we exclude any patient with an established communication between a simple renal cyst and the pelvicalyceal collecting system during the procedure. Our procedure was carried out as follow; all patients were advised to fast for 6 h prior to the procedure then under completely sterilized condition a preliminary fixation of Foley's urethral catheter I6 French was done for all patients. Depending on the cyst site; we placed each patient in lateral decubitus or prone position, then local anesthesia with 2% lidocaine hydrochloride was applied to the puncture site. An

18-gauge needle was inserted into the cyst under US guidance. Cyst fluid was aspirated as completely as possible, and the volume of aspirated fluid was measured. When the 1/2 of the estimated cyst volume had been aspirated, 5 ml of methylene blue material is injected in the remaining 1/2 of the estimated cyst volume and wait for 5 min to watch any possible urethral catheter efflux of methylene blue material before completing our procedure which means that there is a possible communication between a simple renal cyst and the pelvicalyceal collecting system during the procedure. The remaining cyst volume with methylene blue material was then aspirated. Immediately before injection of the sclerosing mixture, the needle was flushed with 1 mL of 5% dextrose solution to prevent NBCA contact with tissue fluid in the lumen of the needle. Then, a mixture of 0.5 mL of NBCA and 1 mL of iodized oil (Lipiodol; Laboratoire Guerbet, Roissy, France) was injected. After the injection of the mixture of NBCA and iodized oil, the needle was flushed with 0.5 mL of 5% dextrose water solution to be sure that all the injected mixture leave the needle lumen and enter the evacuated cyst, then the needle was withdrawn, and US image was obtained [Figure 1] then the urethral catheter was removed and the procedure was considered completed. In five cases only of our patients, the initial size of the renal cyst was larger than 10 cm length and so we duplicate the dose of the injected mixture to be 1 mL of NBCA and 2 mL of iodized oil in order to cover the large surface area of the lining epithelium of the evacuated cyst. All patients were not sedated. The procedure was performed on an outpatient basis because it is associated with minimal patient discomfort and inconvenience and less risk of complications. The mixture of NBCA and iodized oil is viscous; therefore, the risk of leakage appears to be minimal. In spite of that we take some technical precautions during the procedure (introducing the mixture of



Figure 1: (a-d) Representative US images of simple left renal cysts in a 61-year-old man. (a) US image shows simple left renal cyst with diameters of 6.5 cm (b). An 18-G Chiba needle was inserted into the cyst (c). Left kidney post complete evacuation of cyst content (d). Shows shrunken cyst filled with the mixture of n-butyl cyanoacrylate and iodized oil

NBCA and iodized oil into the cyst). First, we aspirated cyst fluid as completely as possible. Usually, a few more milliliters of fluid could be aspirated with repeated holding of respiration at inspiration and expiration technique. Second, during the injection of the mixture of NBCA and iodized oil, the needle tip should not be moved, and the syringe should not be disconnected from the needle. Follow-up of the patients was done by noncontrast CT examinations at 3, 6, and 9 months after the procedure to evaluate cyst size and radiopacity of the injected materials. The procedure was considered successful at follow-up CT when there was total ablation or >80% reduction of size with resolution of symptoms, respectively. Failure was defined as <80% reduction and/or persistent symptoms. We also evaluated complications related to the procedure. No patient complained of pain at the time of injection. We use simple random sampling method, data were analyzed by Microsoft Office 2003 (Excel) and Statistical Package for Social Science (SPSS) version 16. Parametric data were expressed as mean \pm standard deviation, and nonparametric data were expressed as number and percentage of the total. Determining the extent that a single observed series of proportions differs from a theoretical or expected distribution was done using the Chi-square test. $P > 0.05$ is considered nonsignificant. $P < 0.05$ is considered significant. $P < 0.01$ is considered highly significant.

RESULTS

In our study, the mean volume of all 100 cysts was 420.5 ± 210.6 ml and mean cyst size was 50.5 ± 130.5 mm before treatment [Table 1]. Average reduction of cyst volume was 83.7. During the follow-up period, 64 cysts disappeared completely [Table 2]. None of the cysts recurred after the disappearance.

Ultrasound-guided sclerotherapy was technically successful in all patients. No patient complained of pain at the time of injection. The diameter of the cysts ranged between 5.5 and 13.5 cm (mean, 8.8 ± 1.4 cm), and 1.5 and 3.8 cm (mean, 2.1 ± 0.4 cm) before and after sclerotherapy, respectively ($P < 0.001$). Average diameter reduction was 83.7% during the follow-up period. The mean follow-up lasted 7.1 months (3–11 months). Flank pain resolved in 86 of 92 patients (93.48%). In six patients, the symptoms decreased slightly. The overall successful rate of our procedure was (98%) 98 of 100 cysts. During the follow-up period, 64 cysts disappeared completely, and 34 cyst show reduction of size for more than 80% demonstrated by follow-up CT. The only two failed cysts were larger than 10 cm in diameter and do not require any further treatment. We did not observe any procedure related complications. The procedure time, we estimated it to be 14–26 min for treating each cyst, excluding the time needed for positioning and draping the patient. The

Table 1: Characteristics of patients and cysts

Characteristics	Number of patients (n=92) Number of cysts (n=100)
Age (years)	42.4 \pm 10.5
Range	36-61
Sex ratio (M/F)	68/24
No. renal cysts	100
Laterality (Rt/Lt)	62/38
Cyst size (mm)	
50-60	55
60-100	38
100-135	7
Mean size (mm)	80.8 \pm 10.4
Cyst volume (ml)	
<500	74
\geq 500	26
Mean volume (ml)	420.5 \pm 210.6

Table 2: Results of treatment and follow up

Characteristics	Number of cysts (n=100)	%
Renal cyst reduction rate		
Successful treatment	98	98
Disappearance	64	64
Reduction over 80%	34	34
Failed treatment	2	2
Complications	0	0

procedure time included; that for US-guided needle insertion into a cyst was approximately 6 min; that for aspiration of the fluid, depending on the amount of fluid removed, was 5–15 min; that for preparation and injection of the mixture of NBCA and iodized oil was approximately 3–5 min.

DISCUSSION

Simple renal cysts are more common as people age. An estimated 25% of people 40 years of age and 50% of people 50 years of age have simple renal cysts.^[7] Simple renal cysts are rarely symptomatic and necessitate no treatment. Sometimes cysts become infected, causing fever, pain and tenderness, in such cases, treatment may be required. Percutaneous aspiration and sclerotherapy have been described as safe and effective methods of managing symptomatic simple renal cysts without the cost and morbidity associated with conventional surgery and laparoscopy.^[8,9] Simple aspiration is associated with a high recurrence rate because the cyst wall epithelium is responsible for active liquid production. Percutaneous aspiration with single or multiple session sclerotherapy has successfully been performed with high success rates.^[7] Ethanol is the most commonly used sclerosing material for cyst ablation, either 95% or 99%.^[7,8,10-12] It rapidly inactivates the secreting cells on the cyst and slowly (4–12 h) penetrates the fibrous capsule of the cyst,^[13] so the cyst can be removed before the renal parenchyma is affected.^[14] Several factors in renal cyst sclerotherapy with alcohol require optimization. These factors include the concentration of ethanol (95% or 99%), its volume in relation to cyst volume, the duration of sclerotherapy per

session, the number of injections required in relation to cyst volume, and whether continuous drainage is needed before and after sclerotherapy, and duration of drainage.^[15] The most commonly applied technique for treatment of a renal cyst is single-session prolonged ethanol retention technique.^[16,17] The investigations confirm that sclerotherapy with a longer time of ethanol retention does achieve a satisfactory therapeutic effect.^[8,12] Since the ethanol is being diluted by residual cystic fluid, especially during the first injection, most investigators consider multiple-session injection mandatory for the prolonged ethanol-retention technique. The disadvantages of preferring a multiple-session technique include the following: It is time-consuming to perform repeated aspiration and injection procedures in each session, multiple sessions result in additional patient discomfort and inconvenience, and in increased risk of ethanol leakage.^[7,8,11] NBCA, which initially was used for sutureless closure of smooth and fresh skin wounds, has been used for embolization of vascular lesions of various parts of the body, and for endoscopic management of bleeding and fistulas.^[18-20] NBCA glue immediately polymerizes into an adhesive solid adherent to tissue, with eventual fibrosis of whatever it contacts.^[21] Recently, NBCA has been used and found effective in renal cyst ablation in patients with autosomal dominant polycystic kidney disease.^[22] Furthermore, successful sclerosis of a case of a recurrent symptomatic hepatic cyst has been reported.^[21] Ionic solutions, such as tissue fluid or blood, immediately polymerize NBCA into a solid substance with a stable connection to the tissue. In most of the previous studies,^[18-20] NBCA was mixed with iodized oil to minimize the exothermic reaction of NBCA, to delay and control the polymerization time, and to provide radiopacity of iodized oil for follow-up imaging. A mixture of NBCA and iodized oil in a ratio of 1:2 was most commonly used in these studies. We also used that same mixture.^[22] Although we observed that 0.5 mL of NBCA glue was sufficient to sclerose cysts in our study, larger amounts of glue might be needed in larger renal cysts. Both US-fluoroscopy combination and CT can be considered in the percutaneous treatment of renal cysts. In obese patients, CT is preferable. Real-time US is preferred if the cyst is clearly visualized and a safe access route can be identified. It is a cost-effective imaging method without radiation. On the other hand, ultrasound is much more dependent upon the skill of the operator than is CT. In our series, ultrasound-guided percutaneous sclerotherapy with NBCA and iodized oil mixture was found to be effective in reducing the volume of renal cysts and relieving symptoms. It was 100% successful technically, 93.48% effective in symptom relief clinically, and 98% successful in reduction of cyst size in imaging follow-up. The only two failed cysts (reduction of size was <80%) were more than 10 cm in initial size and injected with a mixture of 0.5 mL of NBCA and 1 mL of iodized oil and did not require any further treatment. To overcome this failure, we injected the

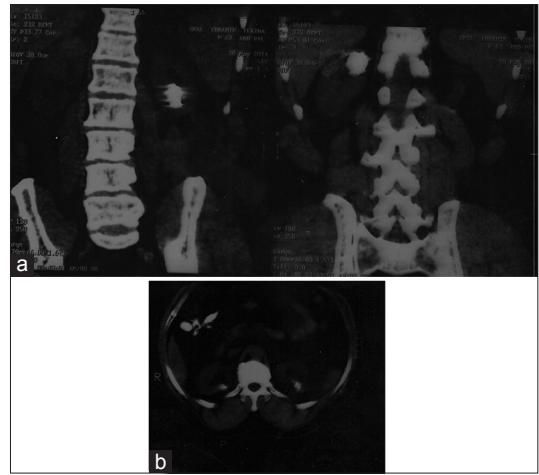


Figure 2: (a and b) Representative follow-up transverse noncontrast CT scan obtained 3 (a) and 6 (b) months after the procedure shows shrunken cysts filled with the mixture of n-butyl cyanoacrylate and iodized oil on CT images of bilateral simple renal cysts in a 53-year-old man

remaining five giant cysts (more than 10 cm) with a mixture of 1 mL of NBCA and 2 mL of iodized oil and so succeed. These success rates were similar to those reported in previous studies in which alcohol and other sclerosing agents used in the treatment of simple renal cysts.^[11,23] In our series, pain was relieved in all presented patients, irrespective of whether there was complete or partial resolution of the cyst. Pain relief after partial regression indicated that the residual cyst did not necessarily require further intervention, as long as the pain or other significant symptoms or signs did not recur. Clinical follow-up was performed at 3, 6, 9 months in all 92 patients [Figure 2].

Our results are similar to others that report percutaneous treatment to have high success rates of reduction of cyst volumes and to have improved the symptoms and signs related to simple renal cysts after their ablation.^[24-26] The limitations of this study include a relatively short follow-up period and that it depends on ultrasonography skills of the urologist, in addition to the radio-opacity caused by lipidol that lasts for more than 9 months in many patients.

CONCLUSION

Ultrasound-guided percutaneous sclerotherapy with NBCA and iodized oil mixture for management of simple renal cysts was found to be a real-time, effective, safe, well-tolerated, alternative, simple and single session technique that can be carried out by urologists as an outpatient procedure.

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