

# Percutaneous treatment of simple renal cysts with n-butyl cyanoacrylate and iodized oil

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## PURPOSE

The aim of this study was to demonstrate the efficacy of n-butyl cyanoacrylate (NBCA) and iodized oil mixture in treatment of simple renal cysts.

## MATERIALS AND METHODS

Twenty-three patients with 27 symptomatic or large (>3 cm) simple cysts were treated by computed tomography (CT)-guided percutaneous aspiration and injection of NBCA and iodized oil mixture. The patients (17 men and 6 women, mean age, 57.2 ± 10.5 years) were treated with as out-patients. The volume of the treated cysts was calculated with periodic noncontrast enhanced CT examinations 1 and 6 months after the procedure. The procedure was considered successful during follow-up when the diameter of the cyst was measured less than 50% of the initial diameter in CT.

## RESULTS

The sclerotherapy was technically successful in all patients. The diameter of the cysts ranged between 3.5 and 8 cm (mean, 5.6 ± 1.3 cm), and 1 and 3.4 cm (mean, 2.1 ± 0.6 cm) before and after sclerotherapy, respectively ( $P < 0.001$ ). Average diameter reduction was 62.5% during the follow-up period. The mean follow-up lasted 9.1 months (6–14 months). Flank pain resolved in 20 of 23 symptomatic patients (87%). In three patients, the symptoms decreased slightly. At follow-up CT, the procedure was successful in 25 of 27 cysts (93%). We did not observe any complications related to the procedure.

## CONCLUSION

Percutaneous sclerotherapy with NBCA and iodized oil mixture was found to be a simple, safe, effective, well tolerated alternative technique for management of simple renal cysts.

**Key words:** • kidney diseases, cystic • sclerotherapy  
• n-butyl cyanoacrylate

Simple renal cysts are common. Autopsy studies have demonstrated simple renal cysts in half of all patients older than 50 years. The incidence is about equal in men and women, and there is no evidence of genetic predisposition. Such cysts are frequently multiple and occur in various sizes. Etiology is uncertain, but tubular obstruction and ischemia in the obstructed area have been postulated (1).

Renal cysts are asymptomatic in most patients, and are usually diagnosed incidentally on imaging studies. If the cyst is large, it may cause pain or manifest as a palpable mass. Infection, hypertension, and obstruction of the ureter may be associated with renal cysts (2, 3). When the cyst causes urinary tract obstruction, or is otherwise symptomatic, treatment should be considered. Symptomatic renal cysts can be managed by a variety of surgical and percutaneous methods, including percutaneous aspiration (with or without a sclerosing agent), percutaneous marsupialization, and open and laparoscopic cyst unroofing (2, 4–7). Percutaneous drainage with single- or multiple-session sclerotherapy has been successfully performed with high success rates; however, with multiple-session sclerotherapy, a decrease in recurrence has been reported by several authors (2, 8–12).

Although favorable therapeutic outcomes have been reported by varying the sclerosing technique and the agent, the optimal technique of treating renal cysts and the optimal agent for renal cyst sclerotherapy remain to be determined.

N-butyl cyanoacrylate (NBCA) (Histoacryl-Blue; Braun, Melsungen, Germany) intracystic injection is a new sclerosing therapy for hepatic cyst and cysts in autosomal dominant polycystic kidney disease (13). The objective of this study was to assess the efficacy and safety of renal cyst sclerotherapy by using NBCA.

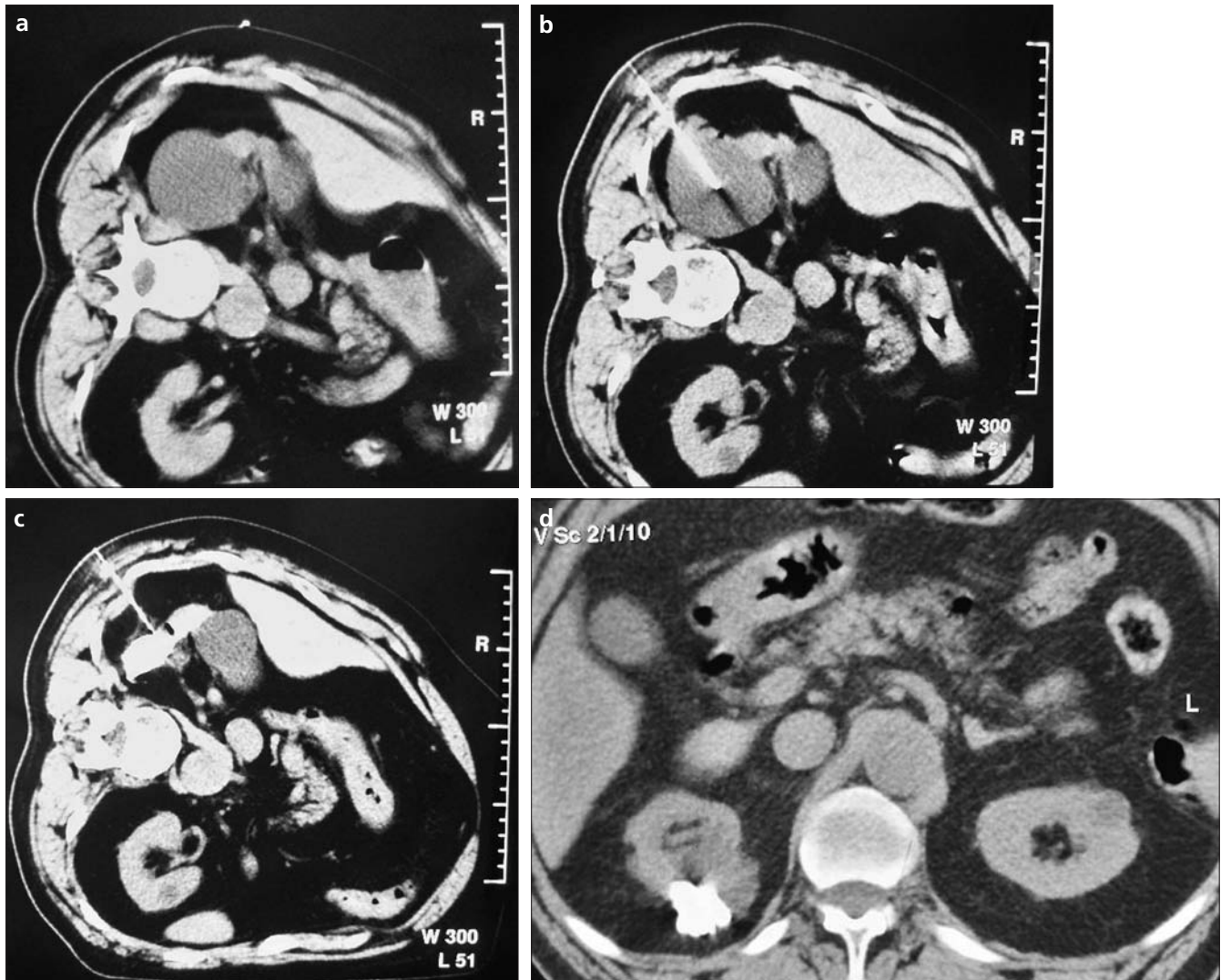
## Materials and methods

In this study, a prospective series of 23 consecutive patients (17 males and 6 females) who presented with symptomatic simple renal cysts underwent sclerotherapy at our hospital between August 2007 and April 2008. NBCA treatment was performed in 27 simple renal cysts.

Written informed consent was obtained from each subject, and our human ethics committee approved the study protocol. The patients were between 45 and 82 years old (mean age, 57.2 ± 10.5 years). Ultrasound (US) examination was accepted as the baseline imaging modality, to make the diagnosis of simple renal cyst. All cysts were type I Bosniak cysts (14).

All patients underwent computed tomography (CT), and the initial volume of the cysts was calculated just before the treatment.

All 23 patients complained of abdominal and/or flank discomfort due to growing renal cysts. Any patient who had relatively acute symp-



**Figure 1. a–d.** Representative CT images of two simple right renal cysts in a 56-year-old man. Axial nonenhanced CT image shows two simple right renal cysts with diameters of 3 cm and 5.5 cm. The patient is in left lateral decubitus position (a). An 18-G Chiba needle was inserted into the 5.5 cm cyst (b). Contrast medium is instilled into the cyst to ensure that there was no communication with the pelvicalyceal collecting system (c). Follow-up transverse nonenhanced CT scan obtained 6 months after the procedure shows shrunken cyst filled with the mixture of n-butyl cyanoacrylate and iodized oil (d).

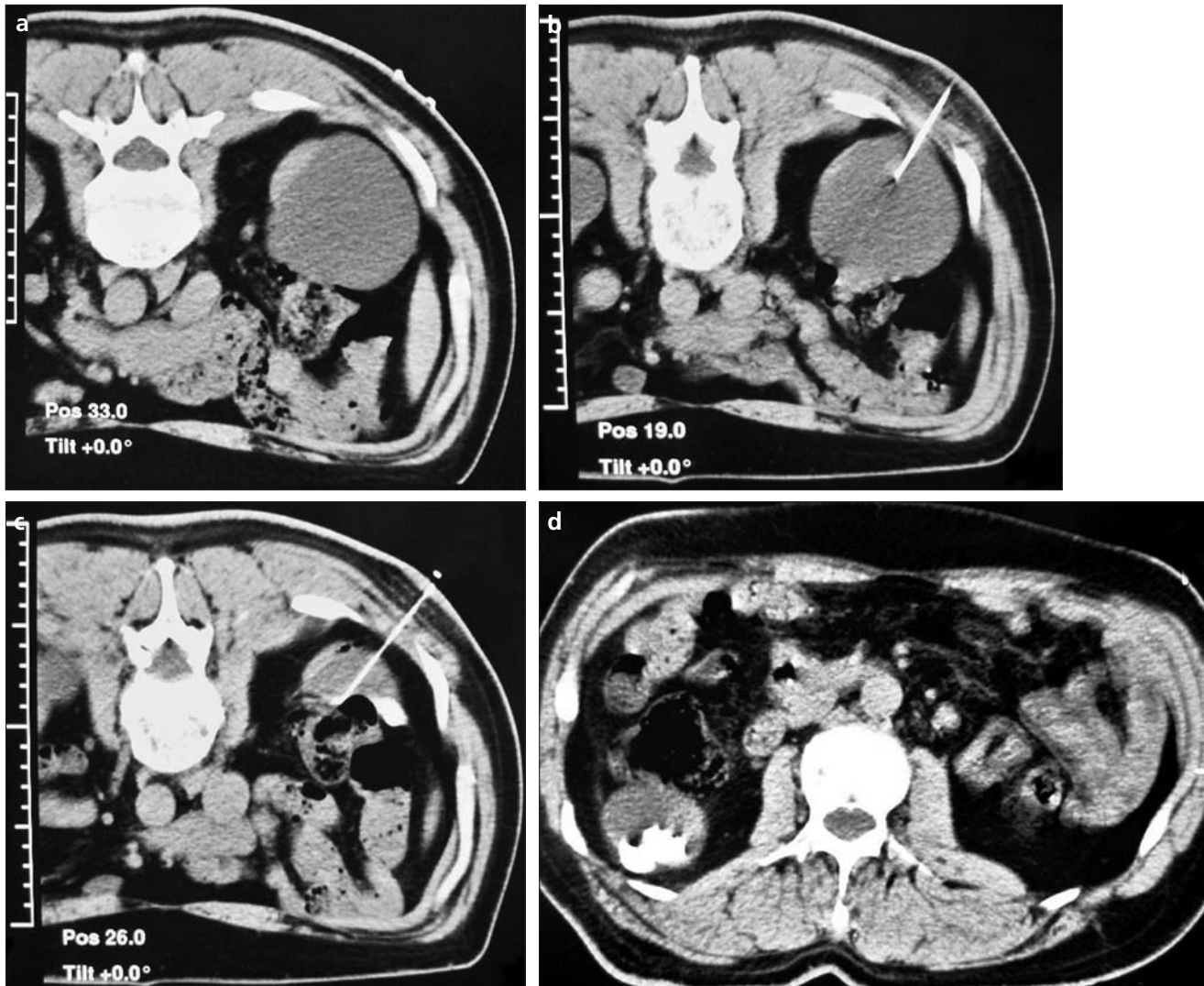
toms, such as bleeding or infection, was not included in the study. Another criterion for exclusion from the study was an established communication between a simple renal cyst and the pelvicalyceal collecting system during the procedure. Eight patients had undergone percutaneous alcohol sclerotherapy in 10 cysts 1–3 years before this treatment.

All procedures were performed on an outpatient basis. The patients were administered nothing by mouth for 4–8 hours prior to the procedure. Each patient was placed either in the prone or lateral decubitus position depending on the location of the cyst, and local anesthesia was achieved with 2% lidocaine hydrochloride that was applied

to the puncture site after sterile preparation. An 18-gauge needle was inserted into the cyst under CT guidance. Cyst fluid was aspirated as completely as possible, and the volume of aspirated fluid was measured. When the 2/3 of the estimated cyst volume had been aspirated, 2–4 ml of contrast medium (iopromide [Ultravist; Schering, Berlin, Germany]) was introduced into the cyst to ensure that there was no communication between the cyst cavity and the pelvicalyceal system. The remaining cyst volume with contrast medium was then aspirated. Then, a mixture of 0.5 mL of NBCA and 1 mL of iodized oil (Lipiodol; Laboratoire Guerbet, Roissy, France) was injected. Immediately prior to the injection of

this mixture, the needle was flushed with 1–2 mL of 5% dextrose water solution to prevent NBCA contact with tissue fluid in the lumen of the needle. After the injection of the mixture of NBCA and iodized oil, the needle was withdrawn, and CT image was obtained (Figs. 1, 2). One to three renal cysts were treated in each patient in different sessions in order to minimize radiation exposure.

The volume of the treated cysts was calculated with periodic noncontrast enhanced CT examinations 1 and 6 months after the procedure. The procedure was considered successful at follow-up CT when the diameter of the cyst was less than 50% of the initial diameter.



**Figure 2.** a–d. Representative CT images of a simple right renal cyst in a 58-year-old man. Axial nonenhanced CT image shows a simple right renal cyst with a diameter of 7 cm. The patient is in prone position (a). An 18-G Chiba needle was inserted into the cyst (b). Contrast medium is instilled into the cyst to ensure that there was no communication with the pelvicalyceal collecting system (c). Follow-up transverse nonenhanced CT scan obtained 6 months after the procedure shows shrunken cyst filled with the mixture of n-butyl cyanoacrylate and iodized oil (d).

We also evaluated complications related to the procedure. No patient complained of pain at the time of injection. Patients were not sedated.

The patients were reevaluated by the same author (A.S.) to determine whether there were any changes in the subjective symptoms after the procedure.

### Results

The sclerotherapy was technically successful in all patients. The diameter of the cysts ranged from 3.5 to 8 cm (mean,  $5.6 \pm 1.3$  cm) prior to therapy. After sclerotherapy, the diameters of the cysts were 1 to 3.4 cm (mean,  $2.1 \pm 0.6$  cm) ( $P < 0.001$ ). The average diameter reduction was 62.5% during the

follow-up period. The mean follow-up was 9.1 months (6–14 months).

Flank pain resolved in 20 of 23 symptomatic patients (87%). In three patients, the symptoms were decreased slightly. No patient complained of worsening of symptoms after the procedure. At follow-up CT, the procedure was successful (i.e., the diameter of the cyst was less than 50% of that before treatment) in 25 of 27 cysts (93%). We did not observe any complications related to the procedure.

### Discussion

Percutaneous treatment of symptomatic simple renal cysts is a minimally invasive and safe procedure that has been increasingly reported in recent

years. Simple drainage without sclerotherapy is associated with a recurrence rate of 30–80% (2, 15) and a high rate of fluid reaccumulation because the cysts are lined with secretory epithelium (7). For a lasting benefit, a sclerosing substance is usually injected after cyst aspiration. Bean (16) was the first to report the use of ethanol as the sclerosing substance for the treatment of a symptomatic renal cyst in 1981; since then, various techniques for sclerotherapy have been proposed (17). Treatment with various agents has been tried, including absolute ethanol (2, 18), iophendylate (19), ethanolamine oleate (20), povidone iodine (21), acetic acid (22), dextrose solution, quiacrine hydrochloride (20, 23), tetra-



cycline (24), minocycline (25), glucose, phenol (16), bismuth phosphate (26), and fibrin glue (13). Despite these investigations, the optimum agent for renal cyst sclerotherapy remains to be determined.

Ethanol is the most commonly used sclerosing material for cyst ablation, either 95% or 99% (2, 7, 8, 10, 11). It rapidly inactivates the secreting cells on the cyst and slowly (4–12 hr) penetrates the fibrous capsule of the cyst (16), so the cyst can be removed before the renal parenchyma is affected (18). 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 (27).

The most commonly applied technique for treatment of a renal cyst is single-session prolonged ethanol retention technique (12, 17). The investigations confirm that sclerotherapy with a longer time of ethanol retention does achieve a satisfactory therapeutic effect (7, 11). 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 (2, 7, 10).

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 (28–30).

NBCA glue immediately polymerizes into an adhesive solid adherent to tissue, with eventual fibrosis of whatever it contacts (31). Recently, NBCA has been used and found effective in renal cyst ablation in patients with autosomal dominant polycystic kidney disease (13). Also, successful sclerosis of a case

of a recurrent symptomatic hepatic cyst has been reported (31).

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 (28–30), 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 (13). 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 percutaneous treatment of renal cysts. 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. In obese patients, CT is preferable. Also, ultrasound is much more dependent upon the skill of the operator than is CT. We preferred CT guidance because of its advantages for determining the presence of a communication between the simple renal cyst and the pelvicalyceal collecting system after contrast medium injection, in order to exclude any leakage and extravasation (32). To reduce radiation dose to the patients, we kept the number of CT slices to minimum.

A few technical precautions were used in introducing the mixture of 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.

The described technique does not require catheter insertion. The procedure might be 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.

The percutaneous sclerosing technique of renal cyst sclerotherapy with NBCA was found to be effective in reducing the volume of renal cysts. It was 100% successful technically, 87% effective in symptom relief clinically, and 93% successful in imaging follow-up. 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 (9, 10).

The limitations of this study include a small number of cysts and of patients, and a relatively short follow-up period. Despite these limitations, we conclude that renal cyst sclerotherapy with NBCA is a simple, safe, effective, well tolerated alternative technique for management of simple renal cysts.

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