

Transcatheter Arterial Embolization Using Ethanol in a Dialysis Patient for Contracting Enlarged Polycystic Kidneys

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The mass effect of nephromegaly in patients with autosomal dominant polycystic kidney disease may cause pain and symptoms by compressing the alimentary tract, lungs, and heart. Conventional therapies exist to contract enlarged polycystic kidneys including surgical and interventional procedures. A surgical nephrectomy is often difficult to perform in dialysis patients due to the associated risks related to surgery. In contrast, renal transcatheter arterial embolization (TAE) with metallic coils, which is a less invasive interventional procedure, can also be utilized to contract enlarged kidneys in dialysis patients as an effective treatment. However, metallic coils present the possibility of recanalization and cost issues. Thus, we used ethanol instead of coils in renal TAE to resolve these issues. We report a dialysis patient with enlarged polycystic kidneys and poor oral intake due to abdominal distention that was successfully treated by TAE with absolute ethanol.

Index terms:

Transcatheter arterial embolization
Autosomal dominant polycystic kidney disease
Ethanol

DOI:10.3348/kjr.2010.11.5.574

Korean J Radiol 2010; 11: 574-578

Received February 2, 2010; accepted after revision March 31, 2010.

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Patients with autosomal dominant polycystic kidney disease (ADPKD) exhibit a characteristic increase in renal size as renal function deteriorates. Renal size usually continues to increase, even after the initiation of dialysis therapy. Many patients suffer from anatomic problems related to nephromegaly. The methods used to reduce the size of enlarged kidneys include needle aspiration and sclerosing of renal cysts (1), cyst decompression surgery (2), laparoscopic fenestration (3), laparoscopic nephrectomy (4), and surgical nephrectomy (5). However, these treatments have not consistently yielded satisfactory results and are often difficult to perform in dialysis patients due to the associated risks related to surgery. In contrast, transcatheter arterial embolization (TAE) with metallic coils has been reported as a renal contraction therapy that is less invasive (6, 7). However, performing the TAE technique with metallic coils requires a high skill level since it involves insertion of coils in smaller branches of the renal arteries. Further, there is a possibility of recanalization caused by the possible migration of coils. To circumvent this issue, the use of ethanol can cause complete cellular death with total vascular occlusion and avoid late revascularization by collateral vessels. Herein, we used ethanol instead of coils in renal TAE and report the results in dialysis patients with enlarged polycystic kidneys.

CASE REPORT

In March 2007, a 65-year-old man with ADPKD, and consequently underwent hemodialysis since June 2001, was admitted to our hospital with symptoms of poor oral intake due to abdominal distention. His daily urine volume was approximately

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300 mL and his abdomen was distended, with a maximum circumference of 105 cm. His weight and height were 63.8 kg and 170 cm, respectively. The laboratory findings were as follows: hemoglobin, 11.7 g/dL; albumin, 3.2 g/dL; BUN, 38 mg/dL; creatinine, 6.5 mg/dL; and total cholesterol, 206 mg/dL. A computed tomography (CT) of the abdomen revealed markedly enlarged polycystic kidneys bilaterally and multiple liver cysts. The renal volumes, appearing as an ellipsoid on CT images, were 3,309 mL and 3,173 mL on the right and left sides, respectively, according to the following formula: $(\pi/6) \times (\text{length} \times \text{width} \times \text{depth})$.

Written informed consent was obtained from the patient. A TAE was performed in March 2007. This procedure was performed through the right femoral artery using the

Seldinger technique, which involved the insertion of a Terumo guide wire (Radiofocus M; Terumo, Tokyo, Japan) and a 5-Fr Cobra catheter (Cook, Bloomington, IN) under local anesthesia. The arteriogram before the renal TAE showed bilateral narrowing (left > right), and stretched the renal arteries. Absolute ethanol was injected via the coaxial catheter (Progreat microcatheter system; Terumo, Tokyo, Japan) into the right renal artery. Seven mL of ethanol with 2 mL of Lipiodol was used to detect reflux of the radiolucent ethanol. After 5 minutes, the right renal artery was completely embolized. At this time, a renal TAE was performed on one side of the kidney only because the patient will only want to repeat the procedure on the contralateral kidney if the results of the first TAE are good. A second TAE of left renal artery was performed

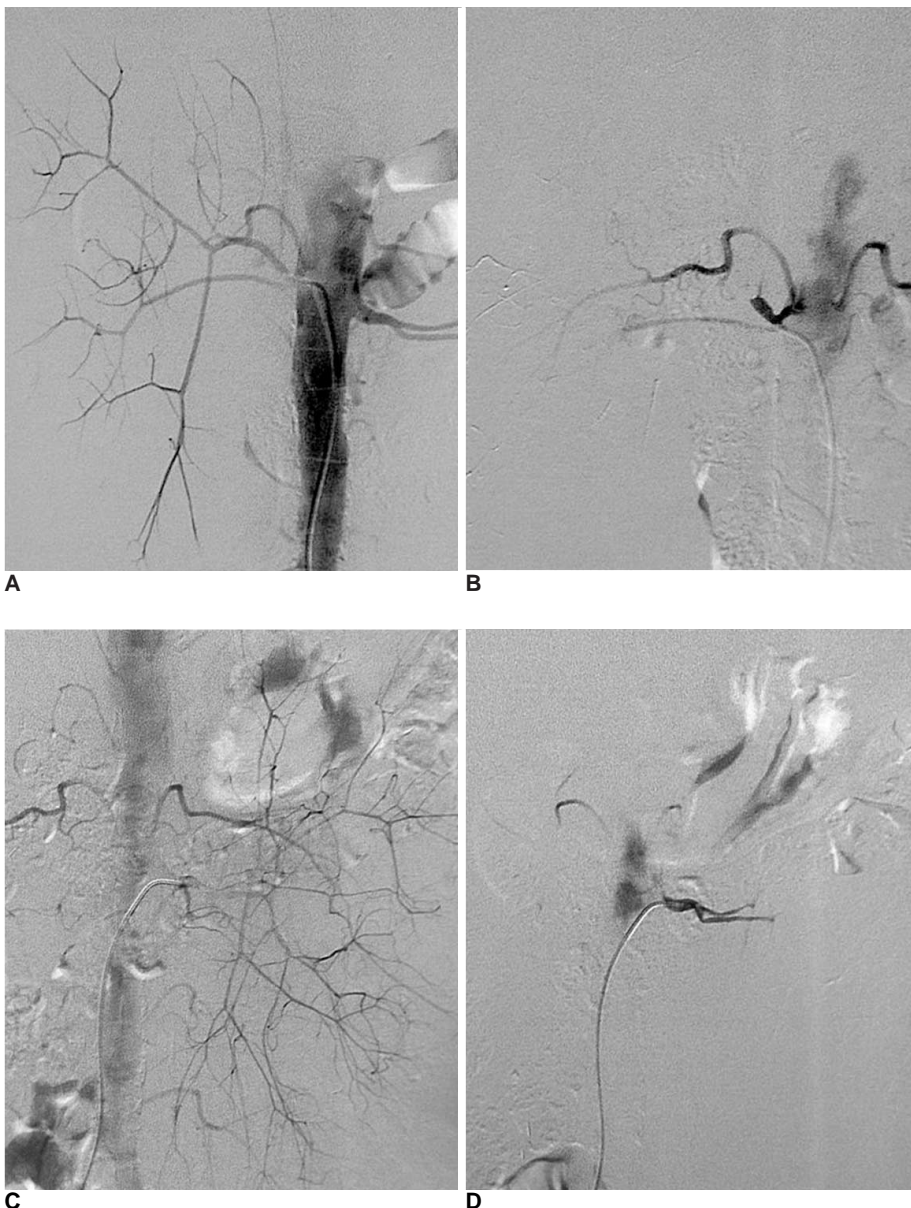


Fig. 1. Ethanol embolization in 65-year-old man with polycystic kidneys.

A. Right renal arteriogram before transcatheter arterial embolization shows narrowed renal arteries.

B. After transcatheter arterial embolization, right renal artery is occluded.

C. Renal arteriogram before transcatheter arterial embolization shows greater narrowing of left than right renal artery.

D. After transcatheter arterial embolization, left renal artery is occluded.

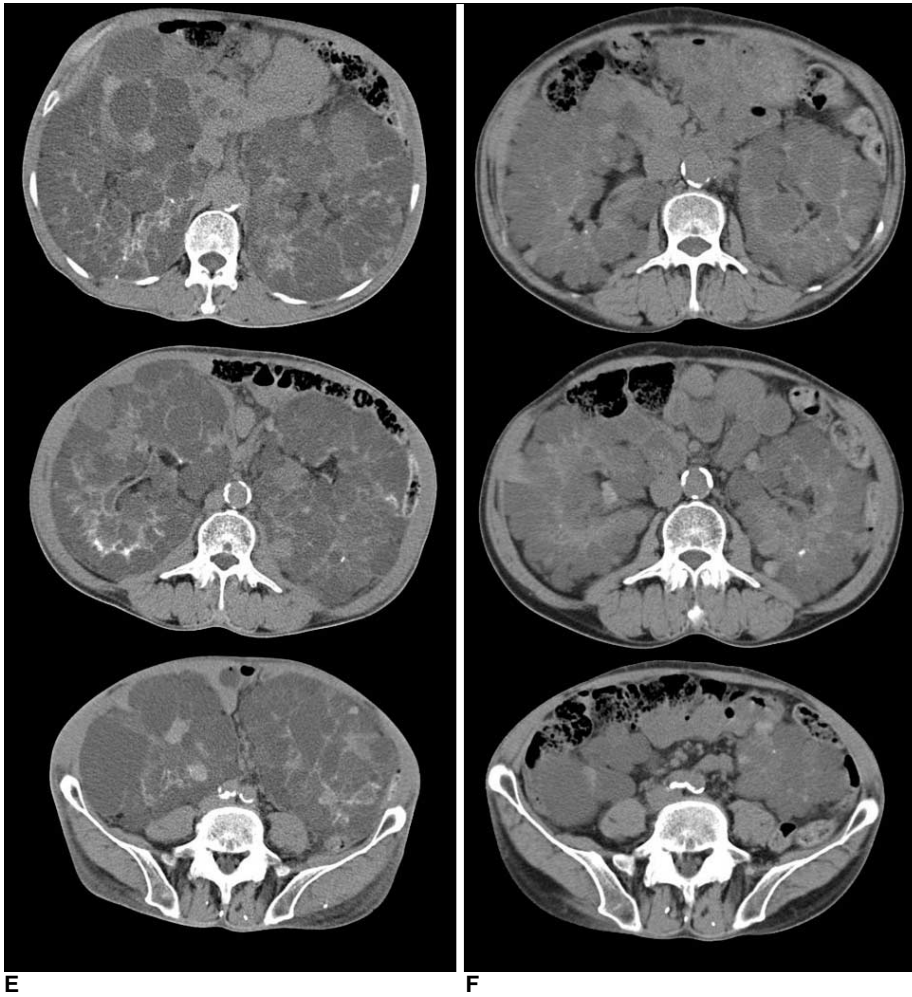


Fig. 1. Ethanol embolization in 65-year-old man with polycystic kidneys. **E, F.** Changes in CT images before transcatheter arterial embolization and at 18 months after transcatheter arterial embolization show marked decrease in volume of both kidneys. **G.** Changes in volume of kidneys, and clinical parameters as function of time after transcatheter arterial embolization.

Hb (mg/dL)	13.1	12.9	13.0
Alb (g/L)	3.2	3.3	3.5
Chol (mg/dL)	206	201	202
Dry Wt (kg)	63.9	62	57.9
Abd Circum (cm)	105	88	85.5
Right Kidney Volume (mL)	3309	1407	1386
Percent of Initial Kidney Volume		42.5	41.9
Left Kidney Volume (mL)			3173
Percent of Initial Kidney Volume			37.9

G

in March 2008. The procedure was the same as the previous TAE. At this time, we used a balloon catheter to prevent the reflux of the ethanol. After performing a selective renal arteriography, a 5-mm-diameter, 2-cm-long,

3-Fr balloon catheter (Savvy; Cordis Europe, Roden, The Netherlands) was positioned in the main renal artery. With the balloon inflated, 3 mL of ethanol was slowly injected for complete embolization (Fig. 1A-D).

After the TAE, the patient experienced abdominal and lower back pain, which were ameliorated with opioids (pethidine - 25 mg three times a day for 2 days). The patient developed a fever the next day, which was controlled by a non-steroidal anti-inflammatory agent. He recovered and was discharged three days after the TAE. The poor oral intake due to abdominal distention was relieved one month after the TAE. Over the course of an 18 month follow-up period, the patient's general condition improved. His kidney size decreased bilaterally after the TAE (Fig. 1E, F). The abdominal maximum circumference was reduced from 105 to 80 cm. The patient's dry weight decreased from 63 to 58 kg and hypertension did not develop. The daily 300 mL urine output did not change. The patient's serum hemoglobin and cholesterol levels did not change, but the albumin level increased slightly (Fig. 1G). In summary, the patient experienced no recurrent symptoms or complications at 18 months after treatment.

DISCUSSION

In 1980, Harley et al. (8) described the TAE technique with a Gianturco-Wallace coil to control recurrent hemorrhage in patients with ADPKD. In 1999, Ubara et al. (9) reported a successful case involving a patient on long-term hemodialysis therapy in whom a TAE of the renal arteries reduced the size of the enlarged kidneys. Ubara et al. (6) evaluated the effectiveness of TAEs with metallic coils in 64 patients with ADPKD. Renal contraction therapy by TAE with metallic coils is effective in decreasing renal size, but great care is needed not to drop the coil into the abdominal aorta and many coils are needed to embolize the renal arteries. Further, there is a possibility of recanalization caused by the migration of coils. Sakuhara et al. (10) reported a case of a TAE performed in combination with ethanol injection for enlarged polycystic kidneys. In this case, the administration of ethanol was shown to be effective in embolizing the peripheral arteries through the recanalized arteries in which the coils had been placed. Ethanol induces complete cellular death with total vascular occlusion and necrosis of perivascular areas, thereby avoiding late revascularization by collateral vessels (11). Contraction of the cystic volume with ethanol occurs by the necrosis of perivascular areas due to the extensive capillary network within the polycystic kidney wall (12). Therefore, we performed a TAE using ethanol in ADPKD patients. Our case is the second reported case of performing a TAE with ethanol in ADPKD patients. But our case is unique in that we attempted a TAE with ethanol to embolize the renal arteries without previous treatment such as coil embolization, and our patient was followed up

for 18 months, which was longer than the previous reported case.

A renal TAE with ethanol has been used for other renal diseases such as the ablation of renal masses. In general, renal ethanol embolization can be safely performed, but there are rare reported complications, such as testicular or colonic infarctions (13, 14). These reported complications can be caused by reflux of injected ethanol. To prevent this complication, we used an occlusion balloon catheter (15). The radiolucency of ethanol can lead to this problem (16), thus we used ethanol mixed with contrast media. In the left renal artery TAE, we used a balloon catheter due to severe narrowing of the renal artery and strong blood flow, but we needed a smaller amount of ethanol than in the right renal artery. Despite the small amount of ethanol, the embolization was performed successfully and there was no reflux of ethanol or ensuing complications.

Ubara et al. (6) reported that a renal TAE was performed in each kidney, but not performed at the same time in the first five patients because two of 64 patients experienced hemorrhage in the contralateral kidney after a renal TAE on one side. However, a renal TAE was performed simultaneously on both sides in the remaining 59 patients and there were no further complications. In our case, we performed a renal TAE with an interval, but the renal TAE can be performed simultaneously also.

There were minor complications associated with the TAE in the patient described herein. Namely, abdominal and lower back pain, and a fever, but all symptoms subsided after a short interval with conservative treatment measures. The patient's presenting complaint, abdominal distention, was relieved one month after the TAE. There may have been a relatively rapid reduction of kidney volume in the early period after the TAE, but renal contraction as evidenced on CT images, continued thereafter. In the case of the right kidney, there was a 43% reduction in kidney volume at nine months and 34% at 18 months. In the case of the left kidney, reduction of the kidney volume was 38% at six months. The cause of the rapid reduction in the left kidney volume may reflect the greater narrowing of the left main renal artery compared to the right renal artery. Increased arteriosclerosis of the left renal artery may have accounted for the difference in narrowing. Ubara et al. (6) reported that a renal TAE was especially effective in patients > 60 years of age and/or individuals with severe arteriosclerosis.

In the current case, ethanol was an effective measure for the embolization of the renal artery. A renal TAE with ethanol in our patient was successful, minimally invasive, and showed no serious side effects for 18 months. To prevent complications associated with the reflux of

ethanol, the use of a balloon catheter and/or ethanol mixed with contrast media are recommended. Although a long-term follow-up study is necessary, these results suggest that the renal TAE with ethanol injection is another reasonable therapy for patients with ADPKD and nephromegaly.

References

1. Bennett WM, Elzinga L, Golper TA, Barry JM. Reduction of cyst volume for symptomatic management of autosomal dominant polycystic kidney disease. *J Urol* 1987;137:620-622
2. Elzinga LW, Barry JM, Torres VE, Zincke H, Wahner HW, Swan S, et al. Cyst decompression surgery for autosomal dominant polycystic kidney disease. *J Am Soc Nephrol* 1992;2:1219-1226
3. Segura JW, King BF, Jowsey SG, Martin P, Zincke H. *Chronic pain and its medical and surgical management in renal cystic diseases*. In: Watson ML, Torres VE (eds). *Polycystic kidney disease*. Oxford: Oxford University Press 1996:462-480
4. Dunn MD, Portis AJ, Elbahnasy AM, Shalhav AL, Rothstein M, McDougall EM, et al. Laparoscopic nephrectomy in patients with end-stage renal disease and autosomal dominant polycystic kidney disease. *Am J Kidney Dis* 2000;35:720-725
5. Elashry OM, Nakada SY, Wolf JS Jr, McDougall EM, Clayman RV. Laparoscopy for adult polycystic kidney disease: a promising alternative. *Am J Kidney Dis* 1996;27:224-233
6. Ubara Y, Tagami T, Sawa N, Katori H, Yokota M, Takemoto F, et al. Renal contraction therapy for enlarged polycystic kidneys by transcatheter arterial embolization in hemodialysis patients. *Am J Kidney Dis* 2002;39:571-579
7. Ubara Y. New therapeutic option for autosomal dominant polycystic kidney disease patients with enlarged kidney and liver. *Ther Apher Dial* 2006;10:333-341
8. Harley JD, Shen FH, Carter SJ. Transcatheter infarction of a polycystic kidney for control of recurrent hemorrhage. *AJR Am J Roentgenol* 1980;134:818-820
9. Ubara Y, Katori H, Tagami T, Tanaka S, Yokota M, Matsusita Y, et al. Transcatheter renal arterial embolization therapy on a patient with polycystic kidney disease on hemodialysis. *Am J Kidney Dis* 1999;34:926-931
10. Sakuhara Y, Kato F, Abo D, Hasegawa Y, Shimizu T, Terae S, et al. Transcatheter arterial embolization with absolute ethanol injection for enlarged polycystic kidneys after failed metallic coil embolization. *J Vasc Interv Radiol* 2008;19:267-271
11. Ellman BA, Parkhill BJ, Marcus PB, Curry TS, Peters PC. Renal ablation with absolute ethanol. Mechanism of action. *Invest Radiol* 1984;19:416-423
12. Bello-Reuss E, Holubec K, Rajaraman S. Angiogenesis in autosomal-dominant polycystic kidney disease. *Kidney Int* 2001;60:37-45
13. Siniluoto TM, Hellström PA, Päiväsalo MJ, Leinonen AS. Testicular infarction following ethanol embolization of a renal neoplasm. *Cardiovasc Intervent Radiol* 1988;11:162-164
14. Uflacker R, Paolini RM, Nobrega M. Ablation of tumor and inflammatory tissue with absolute ethanol. *Acta Radiol Diagn (Stockh)* 1986;27:131-138
15. Golwyn DH Jr, Routh WD, Chen MY, Lorentz WB, Dyer RB. Percutaneous transcatheter renal ablation with absolute ethanol for uncontrolled hypertension or nephrotic syndrome: results in 11 patients with end-stage renal disease. *J Vasc Interv Radiol* 1997;8:527-533
16. Takebayashi S, Hosaka M, Kubota Y, Ishizuka E, Iwasaki A, Matsubara S. Transarterial embolization and ablation of renal arteriovenous malformations: efficacy and damages in 30 patients with long-term followup. *J Urol* 1998;159:696-701