Percutaneous Transcatheter Hepatic Artery Embolization for Liver Cysts in Autosomal Dominant Polycystic Kidney Disease

Ryoji Takei, MD,[1] Yoshifumi Ubara, MD,[2] Junichi Hoshino, MD,[2] Yasushi Higa, MD,[2] Tatsuya Suwabe, MD,[2] Yoko Sogawa, MD,[2] Kazufumi Nomura, MD,[2] Shohei Nakanishi, MD,[2] Naoki Sawa, MD,[2] Hideyuki Katori, MD,[2] Fumi Takemoto, MD,[2] Shigeko Hara, MD,[2] and Kenmei Takaichi, MD[2]

Background: We have achieved renal contraction therapy in patients with autosomal dominant polycystic kidney disease (ADPKD) by means of renal transcatheter arterial embolization (TAE) using intravascular coils, decreasing renal size and improving quality of life in almost all patients. We presently perform hepatic TAE in patients with intractable symptomatic polycystic liver.

Study Design: Uncontrolled trial.

Setting & Participants: 30 patients with ADPKD referred for arteriography to an academic medical center. 22 patients had kidney failure treated by means of dialysis.

Intervention: We embolized arteries supplying hepatic segments replaced by cysts that were associated with well-developed hepatic arteries, but obstructed intrahepatic portal veins.

Outcomes & Measurements: Various volumes before and after TAE were compared by using computed tomography and National Institutes of Health Image software in 30 patients with follow-up computed tomography 18 to 37 months after therapy.

Results: Total liver volume and total intrahepatic cyst volume decreased from 7,882 $\pm$ 2,916 and 6,677 $\pm$ 2,978 to 6,041 $\pm$ 2,282 and 4,625 $\pm$ 2,299 cm^3, respectively ($P < 0.0001$ for both). Fractions of remaining (FR) total liver volume and FR of intrahepatic cyst volume were 78.8% $\pm$ 17.6% and 70.4% $\pm$ 20.9%, respectively. Hepatic parenchyma increased from 1,205 $\pm$ 250 to 1,406 $\pm$ 277 cm^3 ($P = 0.0004$). In 29 of 30 patients, both total liver volume and intrahepatic cyst volume decreased; in 1 patient, total liver volume increased from 5,755 to 7,069 cm^3, whereas cysts enlarged from 4,500 to 5,531 cm^3. No serious complications were experienced. In 24 patients, the post-TAE course was favorable. TAE failed to benefit 6 patients because of unrelated hepatic infection, peritonitis, hepatic failure, acute leukemia, or pelvic fracture.

Limitations: Absence of a control group.

Conclusions: TAE may be an option for patients with ADPKD with symptomatic polycystic liver who are not candidates for surgical treatment.

Am J Kidney Dis 49:744-752.

INDEX WORDS: Autosomal dominant polycystic kidney disease (ADPKD); transcatheter arterial embolization (TAE); intravascular treatment; percutaneous transcatheter hepatic artery embolization; polycystic liver disease.

Editorial, p. 725

From the [1]Department of Radiology and [2]Nephrology Center, Toranomon Hospital Kajigaya, Kanagawa, Japan.

Received October 22, 2006; accepted in revised form March 2, 2007.

Originally published online as doi:10.1053/j.ajkd.2007.03.018 on May 8, 2007.

Support: None. Potential conflicts of interest: None.

Address correspondence to Yoshifumi Ubara, MD, Nephrology Center, Toranomon Hospital Kajigaya, 1-3-1, Kajigaya, Takatu-ku, Kawasaki, Kanagawa, 213-0015, Japan. E-mail: ubara@toranomon.gr.jp

0272-6386/07/4906-0005$32.00/0

doi:10.1053/j.ajkd.2007.03.018

Kidneys of patients with autosomal dominant polycystic kidney disease (ADPKD) typically are supplied by well-developed arteries. Accordingly, we performed renal cyst contraction therapy by means of renal transcatheter arterial embolization (TAE) in patients with renal enlargement, including those with cyst hemorrhage, beginning in 1996.[1,2] Renal TAE was effective in itself for patients with organomegaly that was predominantly renal. Although renal TAE was effective in patients with similar enlargement of both kidneys and liver, additional treatment was required for hepatomegaly. Renal TAE did not benefit patients with primarily hepatic enlargement who similarly required treatment for hepatomegaly.

Several conventional surgical treatments have been performed as therapy for patients with

symptomatic polycystic liver, including percutaneous cyst aspiration and sclerosis, laparoscopic fenestration, open surgical cyst fenestration and partial hepatectomy, and hepatic transplantation.[3-7]

Because renal TAE was successful in treating enlarged kidneys, many symptomatic patients came to our institution seeking other intravascular treatment. In June 2001, we obtained approval from our hospital ethics committee for evaluation of a new treatment for symptomatic enlarged polycystic liver; hepatic TAE. After fully informed consent was obtained, TAE was performed for patients with ADPKD with symptomatic polycystic liver for the first time in the world, beginning in 2001. After success in 2 patients reported in the *American Journal of Kidney Diseases*,[8,9] hepatic TAE was performed in 30 patients with polycystic liver; the last patient included in the present report underwent TAE in October 2004.

METHODS

Patient Characteristics

Considering that very few cadaveric donors for hepatic transplantation are available in Japan and open surgical cyst fenestration and partial hepatectomy were not clinically acceptable because of concomitant renal dysfunction, hepatic TAE was performed in 30 patients with ADPKD who strongly preferred to undergo that procedure to alleviate compression symptoms related to liver enlargement, even after multiple conventional surgical treatments were proposed as alternatives. The latter included hepatic transplantation and open surgical cyst fenestration and partial hepatectomy. Percutaneous cyst aspiration followed by local sclerosing agent injection was performed for cyst mass reduction at other institutions in 6 patients, but this proved ineffective. Patients gave consent after being fully informed about the new procedure, including its frequent complications of fever and pain.

From June 2001 to October 2004, hepatic TAE with microcoil was performed in 5 men and 25 women with ages ranging from 41 to 73 years (mean age, 58 $\pm$ 7 [SD] years). Of 30 patients, 22 were treated with dialysis, showing serum creatinine levels (measured before hemodialysis) ranging from 8.2 to 13.6 mg/dL (725 to 1,202 μmol/L; mean, 10.9 $\pm$ 2.2 mg/dL [964 $\pm$ 194 μmol/L]); 19 patients had undergone renal TAE because of kidney enlargement according to a previously described method.[1,2] Two patients had increased serum creatinine levels of 3.0 and 1.3 mg/dL (265.2 and 114.9 μmol/L). Six patients had serum creatinine levels less than 1.0 mg/dL ($<$88.4 μmol/L). All patients were referred for hepatic TAE from various other institutions in Japan, including dialysis clinics. Massive ascites and severe splenomegaly most likely caused by portal hypertension with hepatocellular dysfunction were observed in 9 patients.

On the basis of a questionnaire survey, we determined the prevalence of several symptoms in patients before they underwent TAE. Patients reported such mass lesion symptoms as abdominal distention and discomfort (86.7%), poor fit of slacks or skirt (86.7%), inability to see the feet and cut toenails (33.3%), and inability to pick up objects from the floor because of loss of balance (36.7%); such upper digestive tract symptoms as heartburn, nausea, vomiting, loss of appetite, and early satiety (70.0%); such intestinal symptoms as constipation (56.7%); such respiratory symptoms as shortness of breath and loud snoring (56.7%); lumbar spine symptoms, including "restless legs" (33.3%) and low-back pain (53.3%); such nutritional problems as thinness of legs and chest (70%); and such disturbances possibly related to anxiety as insomnia (50.0%).

Interventional Procedure for Hepatic TAE

The diagnosis of ADPKD was established by means of computed tomography, magnetic resonance imaging, and ultrasonography. We performed hepatic angiography using Seldinger's technique. After local anesthesia was achieved, the femoral artery was cannulated using a 5-Fr long-sheath catheter (Medikit Super Sheath; Yushima, Tokyo, Japan). Selective angiography of the celiac artery and superior mesenteric artery was performed using a 4-Fr Cobra catheter (Terumo; Shibuya, Tokyo, Japan) inserted through the long-sheath catheter. First, portal venography was performed as the late phase of superior mesenteric artery angiography. Second, hepatic arteriograms were obtained by means of celiac arteriography. A 2.6-Fr microcatheter (Excelsior; Boston Scientific, Boston, MA) was inserted into the smaller peripheral branches of the hepatic artery through an intra-Cobra catheter led by a guidewire (Transend EX; Boston Scientific). After the guidewire catheter was removed, a platinum microcoil (Tornado; Cook Group Co, Bloomington, IN and C-Stopper Coil, Solution Corp, Yokohama, Japan) was introduced using a pusher (Trupush; Johnson & Johnson, Miami Lakes, FL). Coils were 0.018 inch in diameter and 4 to 18 cm in length.

This procedure was performed with coordination between 1 radiologist and 12 physicians.

Target Vessels in Hepatic TAE

Normal liver generally shows hepatic arterial and portal venous branches that course in parallel in the same anatomic segment. However, in polycystic livers, we found hepatic arteries and portal veins to course in a different fashion: almost all hepatic arterial branches were well developed, whereas portal venous branches in hepatic segments replaced by multiple cysts were completely or partially obstructed. By performing TAE superselectively, targeting hepatic arterial branches supplying hepatic regions with neither an intact portal vein nor intact hepatic parenchyma, we sought to minimize damage to the remaining intact liver (Figs 1 and 2). Selection of embolized hepatic regions followed the same judgment process as for resection by