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Use of a micro-balloon catheter in transcatheter arterial embolization of the renal artery for recurrence of symptoms of autosomal dominant polycystic kidney disease

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Abstract

We report a 63-year-old woman who had recurrent symptoms such as remarkable abdominal distension caused by autosomal dominant polycystic kidney disease in spite of previous bilateral renal arterial embolization with microcoils. Renal arterial embolization with trisacryl gelatin microspheres was performed. The embolic agent was infused while the micro-balloon catheter that was coaxially inserted from a 4-F catheter was inflated without any complications. The size of the polycystic kidneys decreased and the symptoms were satisfactorily relieved.

Keywords

Embolization, interventional procedures, polycystic kidney, recurrent disease

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Introduction

Autosomal dominant polycystic kidney disease (ADPKD) is an inherited cystic kidney disease characterized by the presence of renal cysts. Other organs such as the liver, pancreas, and brain are also involved (1). ADPKD affects approximately 1 in 400–1000 live births and accounts for 5% of patients on dialysis and for 10% of end-stage renal disease (1,2). Renal size in patients with ADPKD usually continues to increase even after the initiation of dialysis therapy because numerous cysts replace the renal parenchyma (3). Thus, approximately 60% of patients have refractory abdominal discomfort and flank pain caused by renal enlargement (2).

Traditionally, surgical nephrectomy has been done. Indeed, this therapy would result in the complete disappearance of bulk symptoms; however, its morbidity and mortality rates are high at 11.5% and 5%, respectively (4). Less invasive methods to reduce the size of enlarged kidneys have been needle aspiration and sclerosing of renal cysts (3,5,6). However, these are known to be associated with a high recurrence rate, reported to be 54.5% (5), and rare but with serious complications including perirenal hemorrhage, arteriovenous fistula formation, and infection (3,5). Surgical and laparoscopic fenestration has also been known as an optional less invasive therapy; however, its long-term effects remain unknown (3).

Recently, transcatheter arterial embolization (TAE) of the renal artery has been reported as an effective therapy and a less invasive treatment alternative to surgical therapy for ADPKD (3,7). The present report describes a case of recurrence of symptoms of ADPKD after TAE with coils that was successfully treated by TAE with trisacryl gelatin microspheres

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as the embolic agent infused under inflation of a micro-balloon catheter.

Case report

A 63-year-old woman with ADPKD who, as a consequence, had undergone dialysis was admitted for treatment utilizing techniques of interventional radiology. This patient had undergone embolization of bilateral renal arteries with microcoils eight years and four months previously. At that time, seven microcoils were used in the right renal artery and 11 in the left. The remarkable abdominal distension that had caused a decrease in her activities of daily living had improved, but this symptom gradually worsened again.

Abdominal computed tomography (CT) imaging revealed an increase in the size of multiple cysts in the bilateral kidneys in comparison with CT imaging obtained after the past embolization (Fig. 1a). The renal volume was 1020.65 mL for the right kidney and 1173.04 mL for the left kidney. Calculation of renal volume was done by manually drawing a line around the kidney on every 1-mm slice with the drawing tool, after which data on the rest of the kidney were then automatically added to the datasets on a 3D workstation (Zio Station2, Zio Software Inc., Tokyo, Japan). Thus, full renal images were obtained. When the correct image of the kidney was selected, the renal volume was calculated automatically on the workstation.

Bilateral renal arteriography showed re-canalization of the bilateral renal arterial branches that had been

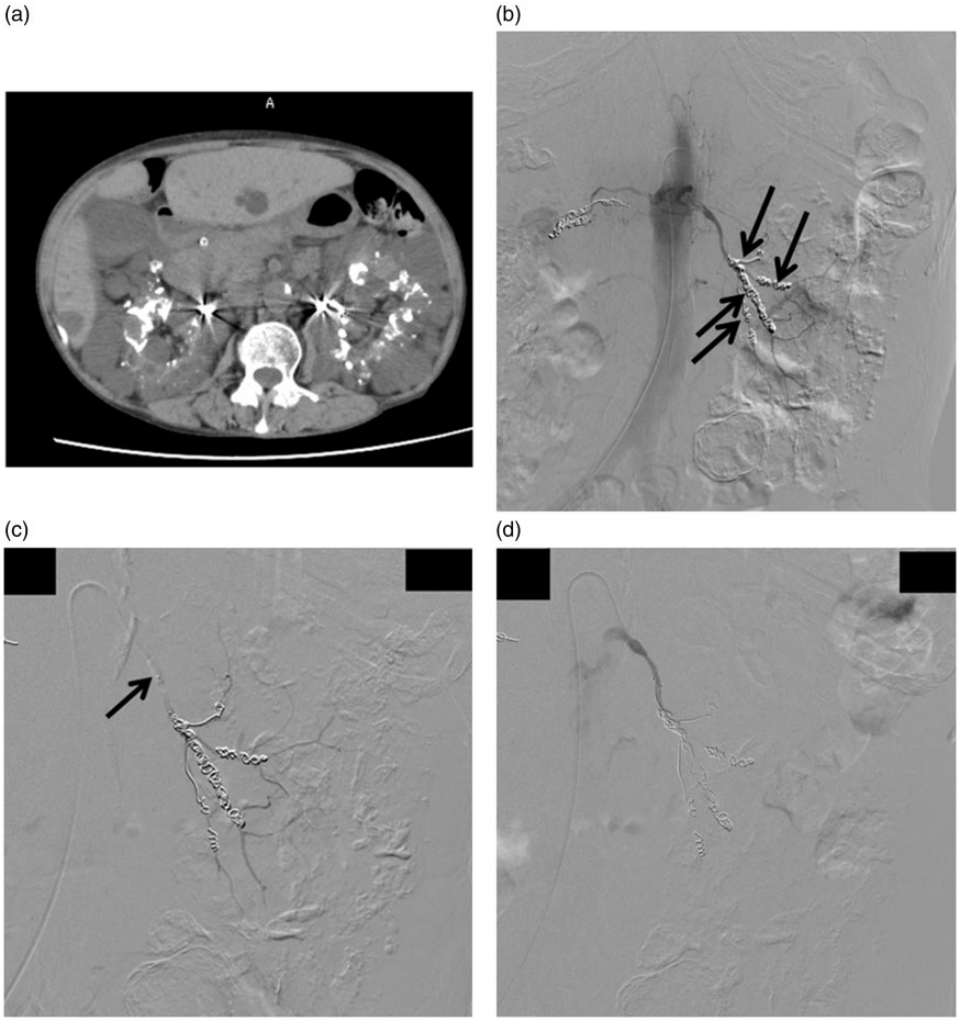

Fig. 1. A woman in her 60s with ADPKD. (e) Enhanced abdominal CT image shows enlarged polycystic kidneys on both the right and left side. (b) Left renal arteriography shows re-canalization of the renal arterial branches previously embolized with microcoils (arrows). Note reflux of contrast agent to the aorta. (c) Arteriography obtained while micro-balloon (arrow) positioned at the origin of the left renal artery was inflated clearly shows renal arterial branches at the distal segments beyond microcoils. Note that no reflux is seen. (d) Left renal arteriography after embolization procedures shows no visualization of renal arterial branches.

previously embolized. These arteries were thin and stretched. The distance between the aorta to the most proximal microcoil previously inserted was longer in the left side than in the opposite side. The length on the left side was sufficient to advance the microcatheter into the left renal artery. Therefore, we decided to embolize the left renal artery at this time. After written informed consent was obtained from the patient, the following procedures were performed. A 4-F hook-shaped catheter (Medikit, Tokyo, Japan) was advanced to the left renal artery. Manual injection of a contrast agent enabled easy reflux of the contrast agent into the aorta (Fig. 1b). To prophylactically avoid migration of the embolization agent to the aorta, a 1.8-F tip micro-balloon catheter (Logos, Piolax, Yokohama, Japan) (8) was coaxially inserted into the left renal artery. Diameter of the balloon was 3 mm (Fig. 1c). After inflating the micro-balloon, trisacryl gelatin microspheres (Embosphere®, Nihonkayaku, Tokyo, Japan) 100–300 μm in size mixed with 300 mgI/mL iopamidol (Iopamiron; Bayer, Osaka, Japan) were slowly infused. In total, 6 mL of trisacryl gelatin microspheres mixed with iopamidol were injected step by step. Finally, arteriography obtained while the contrast agent was being infused after deflating the micro-balloon showed no visualization of the distal branches of the right renal artery. Three microcoils were added to the left renal artery at the proximal site of the previously inserted microcoils (Fig. 1d). The embolization procedure was performed under intravenously administered antibiotics coverage. Subsequently, antibiotics were orally administered for two days.

After embolization, the abdominal distension was immediately relieved; currently 16 months after embolization, there has been no recurrence of that symptom. CT images were obtained eight and 14 months after embolization. The size of the polycystic left kidney has continued to decrease: decreasing to 91.2% and 85.0% of the pre-embolization value at eight months and 14 months after embolization, respectively. Size of the polycystic right kidney for which embolization was not performed at the time of embolization of the left kidney was 94.5% and 95.9%, respectively, of the values on post-interventional follow-up CT images.

Discussion

The use of TAE for ADPKD with coils was first reported by Harley et al. (9) to control recurrent hemorrhage. Several years later, Ubara et al. (3) reported on TAE for patients with ADPKD undergoing long-term hemodialysis therapy to reduce the size of the enlarged kidneys. Since then, reports of the usefulness of TAE for ADPKD have been increasing (7,10,11).

As to the embolic agents used in TAE for ADPKD, various agents have been employed in previous studies (3,7,11–13). These included coils (3,10), absolute ethanol (7,11), and polyvinyl alcohol particles (12). In the earliest reports, coils were used (3,9). Ubara et al. (3) evaluated the effectiveness of TAE with coils and reported a decrease in kidney volume at 12 months after embolization to $53.1\% \pm 11.6\%$ of the pre-therapeutic measurement. Sakuhara et al. (7) reported a case of TAE with ethanol in which bilateral kidney size had decreased 46.0% on the left and 57.0% on the right at 12 months after embolization. Ye at al. (13) described in a systematic review and meta-analysis of the literature on TAE for ADPKD that all studies demonstrated similar success rates in renal volume reduction.

For cases in which once embolized renal arteries with coils were re-canalized like the present case, it was reported that the additional use of coils as a salvage treatment was not effective (3). In a similar situation, usage of ethanol was reported to be effective (7). However, in our case, the contrast agent manually infused into the target renal artery was easily refluxed. If ethanol were injected, there is a possibility of migration of ethanol into non-targeted areas because of the radiolucency of ethanol, which could lead to reported serious complications such as testicular or colonic infarctions (14,15) and spinal cord infarction (16). Considering the seriousness of complications that might occur with the use of ethanol, its usage as a first-line option remains controversial (17). Some researchers have recommended the use of a balloon catheter when using ethanol (18,19).

In the present case, we used a micro-balloon catheter because the renal artery was thin and the contrast agent would easily reflux into the aorta. By infusing particles while the micro-balloon was inflated, dense distribution of the embolic agents in the renal arteries beyond the once embolized segment might be achieved without proximal migration of the embolic agent. Additionally, we used trisacryl gelatin microspheres as the embolic agent. This particle is a non-resorbable and deformable embolic agent with calibrated sizes and uniform shapes. It penetrates significantly deeper into the blood vessel system than do polyvinyl alcohol particles (20), which is another type of particle used as an embolic agent in TAE for ADPKD (12). This particle is made radiopaque by being mixed with a contrast agent. By combining the use of trisacryl gelatin microspheres as the embolic agent and a micro-balloon catheter, sufficient reduction in the volume of the polycystic kidney was obtained.

The 1.8-F tip micro-balloon catheter used in the present case, which can be coaxially advanced from a 4-F catheter, has recently become commercially available and has been initially used for balloon-occluded

transarterial chemoembolization for hepatocellular carcinoma (8). Currently, this micro-catheter has been used for various purposes (8,21,22). However, to our knowledge, there has been no report in the literature of usage of a 1.8-F tip micro-balloon catheter for TAE for ADPKD.

In conclusion, TAE of a re-canalized renal artery, which had been previously embolized with coils, using trisacryl gelatin microspheres infused while a micro-balloon catheter was inflated might be safe and useful as treatment for recurrence of symptoms of ADPKD.

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