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ABOUT COVER

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CASE REPORT

Safety and efficacy of transcatheter arterial embolization in autosomal dominant polycystic kidney patients with gross hematuria: Six case reports

Wei-Fan Sui, Yun-Xin Duan, Jian-Yun Li, Wei-Bin Shao, Jian-Hua Fu

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Abstract

BACKGROUND

To retrospectively report the safety and efficacy of renal transcatheter arterial embolization for treating autosomal dominant polycystic kidney disease (ADPKD) patients with gross hematuria.

CASE SUMMARY

The purpose of this study is to retrospectively report the safety and efficacy of renal transcatheter arterial embolization for treating ADPKD patients with gross hematuria. Materials and methods: During the period from January 2018 to December 2019, renal transcatheter arterial embolization was carried out on 6 patients with polycystic kidneys and gross hematuria. Renal arteriography was performed first, and then we determined the location of the hemorrhage and performed embolization under digital subtraction angiography monitoring. Improvements in routine blood test results, routine urine test results, urine color and postoperative reactions were observed and analyzed. Results: Renal transcatheter arterial embolization was successfully conducted in 6 patients. The indices of 5 patients and the color of gross hematuria improved after surgery compared with before surgery. No severe complication reactions occurred.

CONCLUSION

For autosomal dominant polycystic kidney syndrome patients with gross hematuria, transcatheter arterial embolization was safe and effective.

Key Words: Renal artery; Autosomal dominant polycystic kidney disease; Gross hematuria; Interventional radiology; Embolization; Case report

Core Tip: In this manuscript, we report the retrospective analysis to evaluate efficiency and safety of transcatheter arterial embolization in autosomal dominant polycystic kidney patients with gross hematuria in the Chinese population and currently there is no relevant article published.

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INTRODUCTION

Autosomal dominant polycystic kidney disease (ADPKD) is a genetic disorder caused by mutations in *PKD1* and *PKD2*[1,2]. Its pathological characteristic is a bilateral progressive enlarged kidney filled with multiple renal cysts. With the development of disease, early renal dysfunction changes to end-stage renal disease (ESRD). ADPKD is also associated with external manifestations, such as hypertension, hepatic cysts, pain, infection and intracranial aneurysms[3].

Dialysis is recommended as the first-line renal replacement therapy in ESRD patients with ADPKD[4]. However, kidneys with cysts continue to enlarge during the dialysis period, leading to significant complications[5,6], including dyspnea, abdominal pain, lumbago and persistent hematuria. To treat these problems, nephrectomy and renal transplantation could be performed. However, its drawbacks, namely, high invasiveness, poor prognosis and relatively low efficacy, restrict its application[7,8].

Transcatheter renal artery embolization (renal TAE) is a minimally invasive therapeutic option that is used for relieving the symptoms and reducing kidney volume[9-11], and it is regarded as an alternative to surgery before renal transplantation. However, no previous studies have focused on the treatment of ADPKD patients with gross hematuria. The aim of this study was first to retrospectively assess the safety and efficacy of renal TAE in ADPKD patients with gross hematuria.

CASE PRESENTATION

Chief complaints

Assess the safety and efficacy of renal TAE in ADPKD patients with gross hematuria.

History of present illness

ADPKD patients with gross hematuria. The study population was composed of ADPKD patients who had undergone hemodialysis regularly at Zhenjiang First People's Hospital. All patients underwent routine blood tests, routine urine tests and abdominal no-contrast computed tomography (CT) scans before and after renal TAE.

History of past illness

Kidneys with cysts continue to enlarge during the dialysis period, leading to significant complications, including dyspnea, abdominal pain, lumbago and persistent hematuria.

Personal and family history

ADPKD is a genetic disorder caused by mutations in *PKD1* and *PKD2*.

Physical examination

The pathological characteristic of ADPKD is a bilateral progressive enlarged kidney filled with multiple renal cysts.

Laboratory examinations

All patients underwent routine blood tests and routine urine tests. All 6 patients who suffered from gross hematuria had ESRD. The hemoglobin and erythrocyte levels of all patients were obviously decreased. The levels of erythrocytes in the urine of the 2 included patients were obviously increased.

Imaging examinations

All patients underwent abdominal no-contrast CT scans. An abdominal no-contrast CT scan showed bilateral enlarged kidneys full of cysts of uniform size. Acute hemorrhage was found in the cysts (Figure 1).

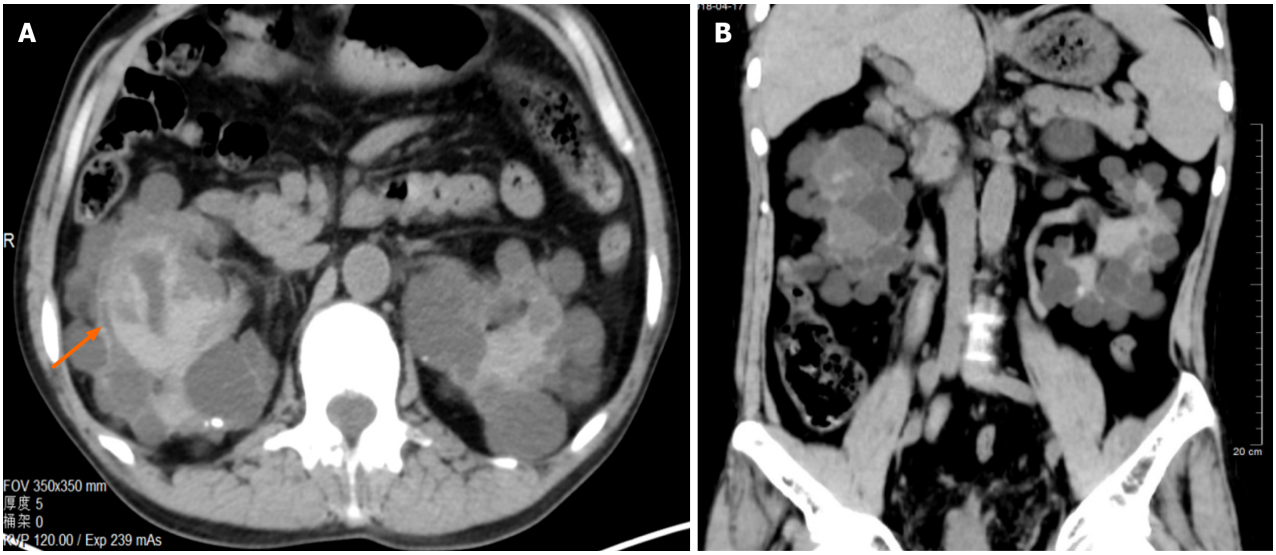

Figure 1 51-year-old male patient with autosomal dominant polycystic kidney disease had gross hematuria for 1 wk. He regularly conducts hemodialysis in hospital. The abdominal no-contrast computerized tomography scan showed bilateral enlarged kidneys which were full of cysts of uniform size. Acute hemorrhage was found in the cysts (orange arrow).

FINAL DIAGNOSIS

Based on the laboratory and Imaging examinations. All 6 patients were diagnosed as ADPKD patients with gross hematuria.

TREATMENT

All 6 ADPKD patients underwent renal TAE successfully. Renal arteriography showed enlarged bilateral kidneys with thin arteries. Selective renal angiography revealed definite hemorrhagic positions in branches of the renal arteries (Figure 2A). For these patients, the branches of the renal vascular bed were embolized with microspheres from the gelatin sponge particle (GSP) in 3 patients (Figure 3A), and the bilateral main renal arteries and branches of the renal vascular bed were embolized with microcoils and microspheres from the GSP in 1 patient. Microcoils were found in the bilateral main renal arteries of 2 patients (Figure 2B). For these patients, embolization of branches of the renal vascular bed were performed with microspheres from the polyvinyl alcohol (PVA) or GSP, and embolization of the bilateral main renal arteries were performed again with microcoils (Figure 3B).

OUTCOME AND FOLLOW-UP

The 1st day after embolization, the gross hematuria in all 6 patients clearly faded. On the 3rd day after embolization, the erythrocyte levels in the urine of 2 patients decreased. Four patients refused routine urine tests. The hemoglobin and erythrocyte levels of all patients were increased (Table 1).

No severe complications occurred from the beginning of embolization to discharge. Two included patients had fever (grade 1) without symptoms of shivering or chills. The highest temperature was 38.8 °C, and the temperature ultimately decreased to normal before discharge. Three patients had lumbago (grade 2), and the highest numerical rating scale was 4. Nonsteroidal anti-inflammatory drugs were used to relieve pain. No complications occurred in 1 patient.

DISCUSSION

Our results showed that renal TAE was safe and effective for ADPKD patients with gross hematuria. The color of the urine faded on the 1st day after embolization and did not recur during the duration of hospitalization. Five patients' blood tests and routine urine test results improved on the 3rd day after embolization. No severe complications occurred in any of the patients. Fever and lumbago after embolization were grade 1-2 without the need for surgical, endoscopic, or radiologic interventions[12]. Ischemia, necrosis and swelling occur in organizations due to embolization of branches of the renal vascular bed; these conditions are called postembolization syndrome. Fever and lumbago are common complications after embolization in ADPKD patients with postembolization syndrome[13].

Table 1 Characteristics of 6 patients including indices, embolic agents and complications

Case	Sex	Age	Hemoglobin in blood in G/L		Erythrocyte in blood as 10^{12}/L		Erythrocyte in urine as U/L		Embolic agents	Complications
			Pre-operation	Post operation	Pre-operation	Post operation	Pre-operation	Post operation		
1	Male	51	65	86	2.4	3.23	/		Microspheres of GSP+ microcoils	Fever
2	Male	51	67	85	2.49	3.16	/		Microspheres of GSP	Fever
3	Female	44	72	76	2.6	2.8	/		Microspheres of GSP	Pain
4	Male	48	56	71	2.03	2.57	/		Microspheres of GSP	Pain
5	Male	64	88	93	2.97	3.11	24376.2	8338	Microspheres of GSP+ microcoils	Pain
6	Male	64	73	81	2.56	2.73	42455.3	3855.5	Microspheres of PVA+ microcoils	None

GSP: Gelatin sponge particle; PVA: Polyvinyl alcohol.

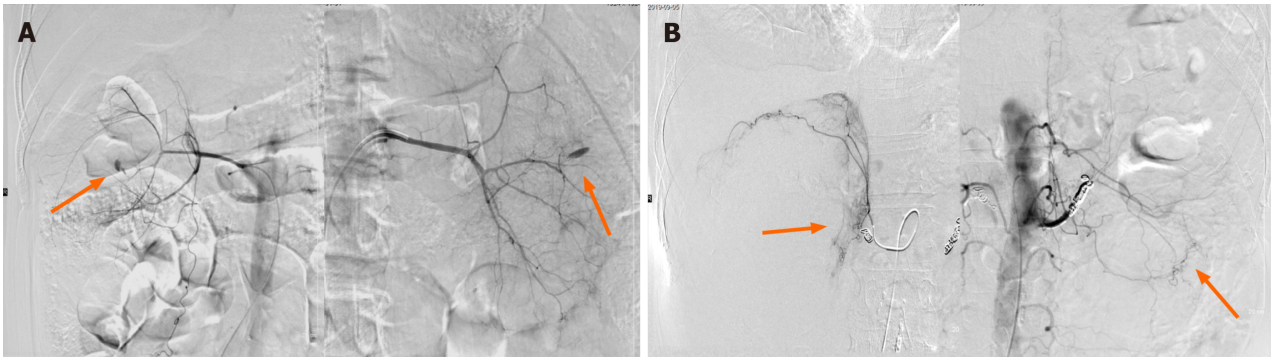

Figure 2 Bilateral renal arteriography. A: Bilateral renal arteriography showed bilateral enlarged kidneys and slender branches of renal arteries with contrast-medium leaking indicating acute hemorrhage (orange arrows); B: Bilateral renal arteriography showed bilateral enlarged kidneys with microcoils positioned at the main renal arterials and contrast-medium leaking indicating acute hemorrhage (orange arrows).

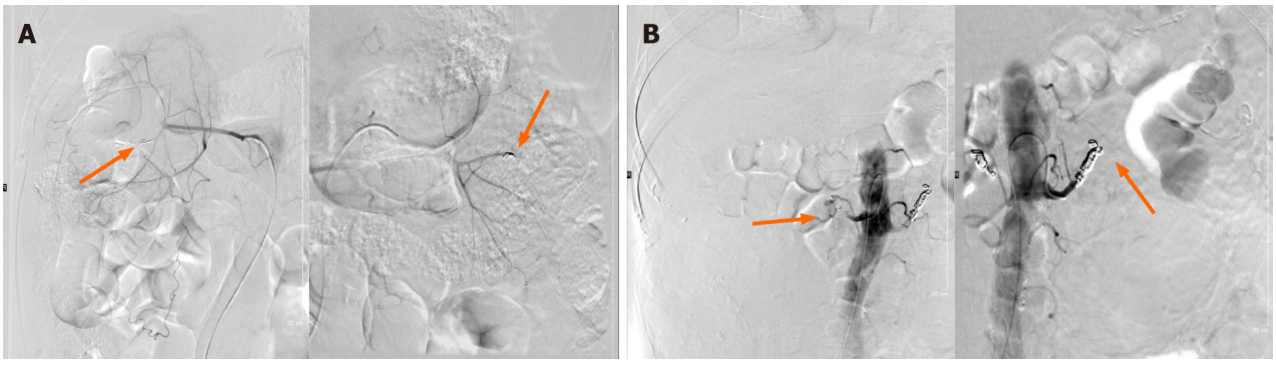

Figure 3 Autosomal dominant polycystic kidney disease patients. Bilateral renoarteriography showed that microcoils positioned at the renal arterial branches and no contrast-medium leaking indicating the success of hemostasis (orange arrows). A: Conducted transcatheter renal artery embolization with microspheres of polyvinyl alcohol (diameter, 350 μm-560 μm) in branches of renal arteries and microcoils; B: Conducted transcatheter renal artery embolization with microspheres of polyvinyl alcohol (diameter, 350 μm-560 μm) in branches of renal arteries and microcoils in main renal arteries.

Gross hematuria is a common complication in ADPKD patients and can occur due to cyst bleeding, urinary tract infection or tumors[14,15]. Gross hematuria is limited and can be alleviated within 1 wk by using etamsylate. Moreover, renal TAE and nephrectomy are the recommended methods for treating this disease. Renal TAE has been gradually recognized in Asia as an option for patients with ADPKD who are not suitable for surgery[16,17]. Previous research confirmed that nephrectomy led to persistent hypotension and aggravated renal anemia[18], which may further increase

the risk for ADPKD patients undergoing dialysis. However, renal TAE rather than surgery is not widely accepted in Western countries because of the higher rate of kidney transplantation in the West[11].

The materials and extent of embolization are considered significant factors for ensuring the safety and efficiency of renal TAE. Owing to the self-specifications of microcoils, which are common mechanical embolic materials, they are usually placed in main renal arteries to reduce the blood flow to the kidneys. Previous studies[19,20] have demonstrated that although microcoils lead to temporary vessel occlusion of renal arteries, later revascularization can lead to renal failure after surgery *via* microcoils alone. Renal TAE was also confirmed in 2 patients in our study. Since revascularization is the main cause of failure, embolization of the renal arterial bed by microspheres or liquid embolic materials is necessary [10,19,21].

With regard to embolization of the renal arterial bed, previous studies[12,19,21] confirmed that the use of liquid embolic materials (anhydrous alcohol) and microspheres of the PVA was safe and efficient. The use of microspheres from the PVA and GSP during embolization was also demonstrated to be effective in our study. Embolization of the renal arterial bed with anhydrous alcohol and microspheres could effectively restrain late revascularization through damaging endothelial tissue, coagulating proteins and inducing microvascular thrombosis and necrosis of perivascular areas[22]. In addition, serious complications linked to anhydrous alcohol and microspheres, such as ectopic embolism, were reported after renal TAE[23]. Such serious complications can be avoided by superselective arterial embolization and detection of nontarget arteries. Because anhydrous alcohol and microspheres are nonradiopaque embolic agents, we emulsified them with radiopaque material, such as contrast media, to monitor the direction of embolic agents. Previous research also suggested that nonradiopaque embolic agents could be mixed with iodized oil and that temporary balloon occlusion catheters could be placed in main renal arteries to prevent backflows of embolic agents[21].

CONCLUSION

For autosomal dominant polycystic kidney syndrome patients with gross hematuria, transcatheter arterial embolization was safe and effective.

FOOTNOTES

Author contributions: Fu JH and Shao WB designed the research study; Fu JH, Li JY, Sui WF and Duan YX performed the research; Sui WF analyzed the data and wrote the manuscript; All authors have read and approve the final manuscript.

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