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Case Report

Acute renal artery thrombosis treated with combination use of multiple interventional techniques

Abstract

Purpose: To describe the combined use of multiple interventional techniques for the treatment of acute renal artery thrombosis.

Case Report: Acute renal artery thrombosis is a rare condition, which is difficult to diagnose accurately and quickly. Failure to restore renal perfusion as quickly as possible may lead to renal dysfunction. Multiple interventional techniques are used as new options to restore renal blood flow and function. Herein we present one case of acute renal artery thrombosis treated with combination use of percutaneous rheolytic thrombectomy, catheter thrombus aspiration and intra-arterial thrombolysis in a very early stage.

Conclusion: Early diagnosis and treatment are essential to preserving the renal function, and the combined use of multiple interventional techniques is safe and effective for the restoration of renal perfusion in treating patients with acute renal artery thrombosis.

Abbreviations

CT: Computer Tomography; CTA: CT Angiography; MRA: Magnetic Resonance Angiography; NOACs: New Oral Anticoagulants; LDH: Lactate Dehydrogenase; APTT: Activated Partial Thromboplastin Time; GFR: Glomerular Filtration Rate; rt-PA: recombinant tissue Plasminogen Activator

Introduction

Acute renal artery thrombosis is a rare condition, which has a high risk of renal dysfunction. With the development of endovascular technology, various options include percutaneous rheolytic thrombectomy, catheter thrombus aspiration, or intra-arterial thrombolysis have been applied for the management of peripheral arterial thrombosis. We present one case of acute renal artery thrombosis treated with combination use of percutaneous rheolytic thrombectomy, thrombus aspiration and intra-arterial thrombolysis in a very early stage.

Case Report

A 67-year-old man with a previous medical history of hypertension and atrial fibrillation was presented to our hospital emergency room, complaining of sudden onset of left flank pain for 8 hours. The pain was severe and sharp, accompanied by nausea and vomiting. He denied any previous episodes of similar events, and also denied chronic kidney disease or acute renal failure. His medications consisted of amlodipine besylate and irbesartan, with no warfarin , NOACs or drugs for kidney disease. His vital signs revealed that the blood pressure was 164/113mmHg, the pulse was irregular, and the temperature was 36.7. The rest of the physical examination was only left flank tenderness. Laboratory analysis revealed that his serum creatinine increased to 129μmol/L (normal range: 40-106μmol/L), LDH was 328U/L(normal range: 248U/L), D-dimer was 1170μg/L (normal range: 500μg/L) and microscopic hematuria. Electrocardiogram indicated atrial fibrillation, but no evidence of intracardiac thrombi was found by echocardiogram and left atrial CTA. Before his admission, he underwent an abdominal CT with contrast at the outside hospital, which revealed left kidney hypoperfusion and left renal artery occlusion. With no delay, we sent him to the operating room for further evaluation and interventional treatment after obtaining his consent.

A 6-Fr sheath was placed percutaneously in the left common femoral artery. Then 3000 units of heparin were given by intra-arterial injection. The initial angiogram of the abdominal aorta revealed that the right renal artery was patent, and the left renal artery was occluded entirely (Figure 1A). Then the selective left renal artery angiogram was performed

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with the aid of a 5-Fr Cobra catheter, which demonstrated a total thrombotic occlusion at the main trunk of the left renal artery with obviously double-track sign (Figure 1B). The thrombotic occlusion was traversed by using the combination of a hydrophilic 0.035-in guidewire and a 5-Fr Cobra catheter to the distal portion of the left renal artery, and the angiogram was again performed that revealed the branch arteries were extensively occluded with no parenchymal enhancement of the nearly total left kidney (Figure 1C).

A 6-Fr AngioJet SOLENT Thrombectomy Sets (Boston Scientific Corporation, Marlborough, MA) was used, which was advanced over the guidewire to the left renal artery. Multiple thrombectomies were made by AngioJet catheter until the main trunk of the left renal artery was fully patent by angiographic confirmation (Figure 1D). Due to the residual thrombus of branch arteries, catheter thrombus aspiration was performed via a 6-Fr guiding catheter via the vacuum effect made by a 50ML syringe, but few thrombi were expelled, and residual thrombus still existed in the most branch arteries. Thus, 200,000 units of urokinase were continuously infused into the arterial lumen via a 5-Fr Cobra catheter every 8 hours, accompanied by unfractionated heparin infusion (APTT range: 60-80 seconds) for 1.5 days. A final angiogram demonstrated that the majority of thrombosis in those branch arteries was eliminated, and the left renal perfusion was significantly improved (Figure 1E).

The patient's flank pain was entirely resolved after the interventional treatment, and the serum creatinine decreased to 123 μmol/L on the sixth day, when nuclear medicine scan revealed that the function of the left kidney was severely damaged (GFR: 6.37ml/min), compared with the right kidney (GFR: 32.68ml/min). The ultrasound of the kidney showed that blood flow was sufficient in the left renal artery and parenchyma, although it was slightly worse than the right kidney. He was discharged with aspirin 100mg/day and an additional prescription of rivaroxaban 20mg/day for anticoagulation, not only for renal artery thrombosis but also for atrial fibrillation according to the score of CHA2DS2-VASC2. Follow-up serum creatinine level at three months postprocedure returned to normal range, at 105μmol/L. However, the patient refused to have another nuclear medicine scan in the follow-up period due to fear of radiation effects.

Discussion

Acute Renal artery thrombosis is a rare condition, which may lead to renal dysfunction, with an incidence of 0.004% to 0.007% reported in the emergency department [1,2], although its postmortem incidence is 1.4% [3]. As reported in other cases, the cause of renal artery thrombosis is usually systemic embolization and rarely secondary to in situ thrombosis [4,5]. The renal artery thrombosis is strongly related to arterial fibrillation that accounts for 64% of these cases [6]. Considering that the patient had a previous medical history of atrial fibrillation, he actual cause of this case was probably secondary to the embolism from atrial fibrillation, despite no findings of intracardiac thrombi by echocardiogram and left atrial CTA [7]. The clinical symptoms include sudden flank/abdominal pain, nausea, vomiting, fever, and hematuria [7]. Since these symptoms are nonspecific, renal artery thrombosis is often misdiagnosed as acute pyelonephritis, acute cholecystitis, nephrolithiasis and myocardial infarction in the acute phase [4,7], resulting in delayed diagnosis and treatment. Various imaging techniques including duplex ultrasound, CT with/without contrast, MRA, and renal artery angiography have been adopted for diagnosis [8]. Although renal artery angiography is the gold standard for diagnosis, abdominal CT with contrast may be the preferred initial test when renal artery thrombosis is highly suspected in this case.

The standard treatment strategy for renal artery thrombosis has not been established. The traditional treatment has been anticoagulation with/without thrombolysis and surgical thrombectomy, which is associated with high morbidity and mortality [9]. With the development of endovascular technology, More and more interventional techniques including percutaneous rheolytic thrombectomy, catheter thrombus aspiration, intra-arterial thrombolysis and so on have been used with enormous success.

Percutaneous rheolytic thrombectomy by AngioJet catheter based on the Bernoulli principle is done by delivering high-velocity saline jets to the tip of the catheter to create a venturi effect that thrombus can be suctioned, fragmented and removed, which has been successfully performed for treatment of deep venous thrombosis [10], pulmonary embolism [11], acute peripheral arterial embolism [12] and hemodialysis-shunt thrombosis [13]. The AngioJet catheter for acute renal

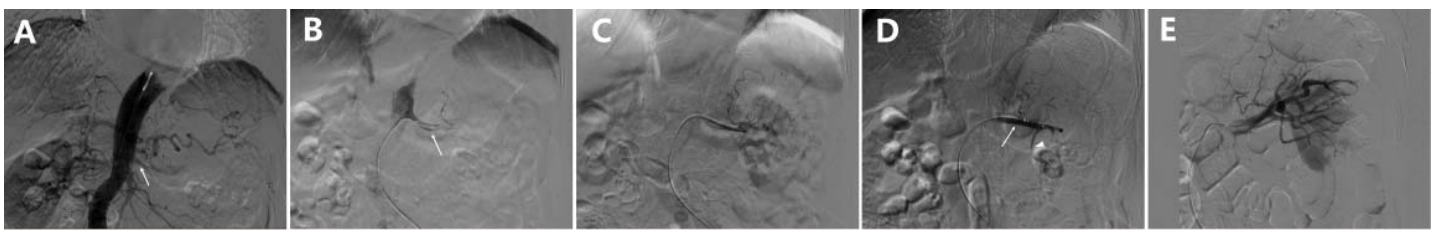

Figure 1: A: Angiogram of the abdominal aorta reveals an abrupt occlusion of the left renal artery (white arrow). **B**. Selective left renal angiogram reveals a total thrombotic occlusion with obviously double track sign (white arrow). **C.** Selective left renal angiogram reveals the branch arteries were extensively occluded with no parenchymal enhancement of the nearly total left kidney. **D.** Selective left renal angiogram following AngioJet thrombectomy shows the full patency of the main trunk of the left renal artery (white arrow), but filling defect in the inferior branch artery (white arrowhead). **E.** The final angiogram demonstrates almost complete resolution of thrombosis except the upper pole.

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artery thrombosis was first reported in 2002 with satisfactory results and no complication [4], which has also been applied for recent similar cases [3,7,8,14]. The most significant advantage is quick restoration of blood flow to preserve renal function, but there exist some problems that should be for cautions, including potential hemolysis, hemoglobinuria, and distal embolization [15], although the procedure time by AngioJet catheter is concise due to the short lesion length of renal artery as in this case only 10 seconds.

Catheter thrombus aspiration is also helpful to restore the renal artery blood flow rapidly, with successful application in the setting of acute myocardial infarction, visceral, and upper/lower limbs arteries [16,17]. Although its advantages include quick revascularization and a lower risk of possible bleeding, there are some limitations, such as fragmenting and advancing the thrombus to distal branch arteries, only partial thrombus aspirated into the catheter, and vascular injuries [16]. In this case, only the inferior branch artery was recanalized after catheter thrombus aspiration.

It is troublesome to deal with the branch arteries thrombosis and thromboembolism after percutaneous rheolytic thrombectomy and catheter thrombus aspiration. Intra-arterial thrombolysis may be the best and last way to overcome this situation, which was first described in 1981 for acute renal artery thrombosis [18]. This interventional technique has achieved success by using the thrombolytic agent of streptokinase, urokinase, or rt-PA in several cases [4,7,8,18]. By intra-arterial thrombolysis, the lower dosage of the thrombolytic agent can be used, and the thrombolytic agent can be delivered directionally to the lesion site, resulting in a lower risk of bleeding, compared with systemic thrombolytic therapy. However, bleeding is still the most worrisome complication, with the occurrence of life-threatening events such as intracranial bleeding and gastrointestinal bleeding in about 6% of patients [19]. Thus, the application of intra-arterial thrombolysis should be individualized for each patient. At last, the extensive thrombosis in-branch arteries of our patient was eliminated and the left renal perfusion was significantly improved by intra-arterial thrombolysis for 1.5 days with no bleeding event. However, the renal function was indeed severely damaged on the basis of the nuclear medicine scan. The prolonged thrombolysis can be helpful for renal perfusion but delays the preservation of renal function.

In humans, the kidney can tolerate approximately 30 minutes of warm ischemia without loss of renal function [20]. Once the warm ischemia time exceeds 2 hours, only 30% -50% of renal function can be recovered [21]. More than 90 minutes of acute warm ischemia has been recommended as a cut point for the recovery of renal function [22].while it is well known that early diagnosis and treatment are essential to preserving renal function, it is controversial to adopt treatment measures after prolonged ischemia time [23]. However, there are some cases that renal function was recovered after renal artery occlusion for several days [4,7,8,23]. Maybe the collateral circulation which arises from lumber, suprarenal, and ureteral vessels plays a significant role in the renal function preservation after prolonged ischemia time for these cases [23,24]. The left renal function of our patient was severely damaged, in spite of only 8 hours of symptom onset and combination use of multiple interventional techniques. The discrepancy might be explained by the following reasons: (1) extensive thrombosis in the left renal artery system leads to more severe renal ischemia than local thrombosis; (2) inadequate collateral circulation can't be able to sustain the renal viability; (3) it has been a long time between symptom onset and full patency of renal artery. Despite damaged renal function, the residual renal function is still beneficial for the patient. The serum creatinine level at three months postprocedure returned to normal range, which might reveal that renal function could be partially regained after a period of time [7].

However, there are some limitations in this case. Firstly, it was not available to acquire a creatinine value before this event due to that the patient did not have regular monitoring of renal function. Through the GFR of the right kidney, it could be inferred that the total kidney function was slightly impaired before this event, probably with a creatinine value in the normal range. Secondly, It is not rigorous to evaluate the left kidney only by the creatinine value. The nuclear medicine scan of the kidney is recognized as an accurate method to evaluate the renal function, however, the patient refused to have this examination in the follow-up period due to fear of radiation effects. Thus, it may be the only way to monitor renal function by regular testing of creatinine in this case. As reported in similar cases, a renal function could recover gradually in a few months[7]. So we considered that the left kidney was partially working after a period of time, with the decrease of creatinine value.

Conclusion

Acute renal artery thrombosis is a rare condition with a high risk of renal dysfunction, and therefore we should pay more attention to this disease. Early diagnosis and treatment are vital to preserving renal function. It is proved that the combined use of multiple interventional techniques is safe and effective for the restoration of renal perfusion in treating patients with acute renal artery thrombosis. Despite good angiographic results, the renal function is still damaged. For those patients with prolonged ischemia, we should also try to preserv their renal function as much as possible.

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