

Successful endovascular treatment for acute renal artery occlusion

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Abstract

Purpose: We report a case of revascularization for a totally occluded renal artery using endovascular renal thrombus aspiration followed by catheter-directed thrombolysis.

Case Report: A 56 years old man presented with sudden onset of severe left-sided abdominal and loin pain for six hours. Urgent computed tomography angiogram showed total occlusion of left renal artery. Emergency selective left renal angiogram and thrombus aspiration using a 5-French Cobra catheter was performed. Catheter-directed thrombolysis with urokinase was initiated after aspiration thrombectomy. Angiogram 24 hours after thrombolysis showed the left renal artery and its segmental branches were successfully revascularized. Patient was on anticoagulation after operation and his renal function recovered well.

Conclusion: Percutaneous aspiration thrombectomy combined with intra-arterial local fibrinolysis are effective in the salvage of renal function.

Introduction

Acute renal embolism (ARE) is an uncommon cause of abdominal and loin pain. Historically, the incidence of acute renal embolism was reported to be 1.4% in 14,411 autopsies.¹ The diagnosis of ARE is often delayed or ignored due to the rarity and unspecific clinical manifestation of the disease. The treatment options include anticoagulation,² with or without thrombolysis,³ catheter aspiration thrombectomy,⁴ or surgical thrombectomy.⁵ However, the optimal therapeutic treatment and timing of intervention remain controversial and challenging.

This is a case report of a patient with atrial fibrillation who presented with acute loin pain, and underwent successful revascularization of a totally occluded renal artery with endovascular renal thrombus aspiration followed by catheter-directed thrombolysis.

Case Presentatoin

A 56 years old man presented to accident and emergency department with sudden onset severe left-sided abdominal and loin pain for six hours, associated with nausea and vomiting. The pain was persistent, non-radiating and without relieving factors. He denied any trauma, fever, chills, dysuria or hematuria. There were no previous similar events or any other symptoms were noted. Past medical history was significant for atrial fibrillation and he was not on any anticoagulation.

He was hypertensive with blood pressure of 156/117mmHg, with an irregular heart rate of 112 beats per minutes on physical examination. There was tenderness in the left lower quadrant and left loin. All the peripheral pulses were palpable. Creatinine was elevated at 113umol/L (normal range, 62-106 umol/L). Electrocardiogram showed atrial fibrillation with a heart rate of 112 beats per minute. Urgent computed tomography (CT) angiogram was performed showing hypodensities in the main trunk of the left renal

artery, and malperfusion of the left kidney (Figure 1). The size of the left kidney was the same as the right. Anticoagulation with heparin was used immediately after diagnosis of renal artery thromboembolism.

Emergency selective left renal angiogram via the right femoral access showed total occlusion of the left renal artery and its segmental branches (Figure 2A). A 5-French Cobra catheter (Cook Medical, United States) was advanced into the left renal artery over a 0.035-inch guidewire. A 20ml syringe was connected to the Cobra catheter to aspirate blood clots from main trunk of the left renal artery. The Cobra catheter was then advanced to the segmental branches and repeated aspiration thrombectomy in the same maneuver was performed. Completion angiogram showed improvement of the blood flow in the main left renal artery with restoration of the majority of the flow to the segmental branches, but there were still some filling defects in the distal arteries (Figure 2B). With the Cobra catheter placed in the left renal artery, catheter-directed thrombolysis was initiated. Urokinase was infused via the catheter at a rate of 20,000 units per hour using a perfusion pump. The plasma fibrinogen level, hemoglobin and platelet count were closely monitored during thrombolysis. The patient's left-sided abdominal and loin pain gradually resolved after the procedure. A total of 480,000 units of urokinase was used. No thrombolysis related bleeding was observed, and the patient did not develop haematuria. An angiogram 24 hours later after aspiration thrombectomy showed the left renal artery and its segmental branches were successfully revascularized (Figure 3), and the catheter was removed. Patient was put on anticoagulation using heparin after thrombolysis, and switched to warfarin with a target international normalized ratio of 2.0 to 3.0 upon discharge. Follow-up CT three weeks later showed left renal artery was patent (Figure 4). His renal function recovered well with a creatinine of 104 $\mu\text{mol/L}$ (normal range, 62-106 $\mu\text{mol/L}$) at 3 months follow-up.

Discussion

The estimated incidence of ARE is of the range of 0.004–0.007% in the emergency setting.^{5,6} The presenting symptom of ARE is usually nonspecific, including abdominal or flank pain, fever, nausea, vomiting and hematuria.^{2,6} ARE is more frequently detected as incidental finding with the liberal use of contrast-enhanced CT. CT features of renal infarction include wedge-shaped hypodense area of renal parenchyma or global infarction of the kidney, depending on the arteries involved.^{7,8} In addition, a rim of capsular enhancement surrounding the infarction area may present on CT, called “cortical rim sign”, which is seen predominantly with global renal infarction.⁷ In a study of 41 patients with renal artery embolism, the main artery was the most frequent location of embolism,⁸ and atrial fibrillation is the most common etiology of ARE.⁹

It was reported that the kidneys can tolerate complete ischemia for 60-90 minutes in human at normothermia.¹⁰ However, in a study reporting 44 cases of renal infarction, more than 80% of the patients presented in excess of 24 hours from onset of symptom.¹¹ As the kidney receives collateral blood flow

from suprarenal, lumbar and ureteral vessels, collateral circulation may be enough to allow the kidney to survive complete obstruction of the main renal artery.¹²

To date, there is no consensus or guidelines on the treatment of choice for ARE as the rarity of this disease. The traditional treatment for renal thromboembolism and in situ thrombosis is anticoagulation, with or without thrombolysis and surgical embolectomy. Patients with renal embolism are at risk of recurrent embolic events, including cerebral infarction and superior mesenteric artery embolism.^{2,11} The aim of systemic anticoagulation is to prevent further thrombosis or embolism and not to preserve the renal function. *Yun et al.*² reported the long-term results of 47 patients treated with anticoagulation, dialysis-free survival rates were 91%, 82%, and 64% at 1 year, 3 years, and 5 years follow-up. *Fort et al.*⁸ reported their therapeutic protocol with surgery for main renal artery embolism and fibrinolytics for intrarenal embolism. Nowadays, open surgical thrombectomy has limited indications because of significant morbidity and mortality. Catheter directed thrombolysis is being increasingly used with satisfactory results as it allows local perfusion of fibrinolytics, thus reduce the dosage of thrombolytic agents and decrease the risk of bleeding.

With the advances of endovascular technique and technology, new devices have been successfully used in the peripheral vascular territory. Aspiration and rheolytic thrombectomy with the AngioJet catheter (Boston Scientific, United States) has been used in ARE with good results.^{13,14} In our patient, the left main renal artery and its segmental branches were totally occluded. We used percutaneous aspiration thrombectomy to reduce the renal clot burden before catheter directed thrombolysis with urokinase for the treatment of in-situ thrombosis in the distal segmental branches. After 24 hours of thrombolysis, the occluded renal segmental branches were revascularized. The main renal artery and segmental branches remained patent on follow-up CT. Complications of aspiration thrombectomy and thrombolysis include access site complications, distal embolization and bleeding. Plasma fibrinogen level is often used for thrombolysis dose adjustment to reduce the risk of bleeding. A variety of distal protection devices used in coronary and carotid interventions maybe helpful to minimize distal embolization.¹⁵

Emergent recanalization of the renal artery would theoretically reestablish perfusion to the kidney and therefore prevent renal loss. Early diagnosis is essential, and percutaneous aspiration thrombectomy combined with local fibrinolysis requires endovascular expertise and experience.

Conclusion

ARE is rare and associated with renal insufficiency. Despite the increasing diagnosis of ARE, the treatment remains challenging. Percutaneous aspiration thrombectomy combined with intra-arterial local fibrinolysis are effective in the salvage of renal function.

Abbreviations

ARE Acute Renal Embolism

Declarations

Acknowledgements

Not applicable.

Authors' contributions

Li HL and Guo Z performed the interventions. Zhou R provided interventional opinion clinically. Li HL and Chan YC wrote the manuscript and Cheng SW gave critical revision on the manuscript. All authors have read and approved the submitted manuscript.

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Availability of data and materials

Not applicable.

Declarations

Ethical Approval and Consent to participate

This study was carried out in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Consent for publication

Written consent for publication has been obtained from the patient involved in this case report.

Competing interests

The authors declare no conflict of interest.

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Figures



Figure 1

Computed tomography angiogram showed obstruction of the left renal artery (White arrow, Figure 1A) and the left kidney was malperfused (Figure 1B).

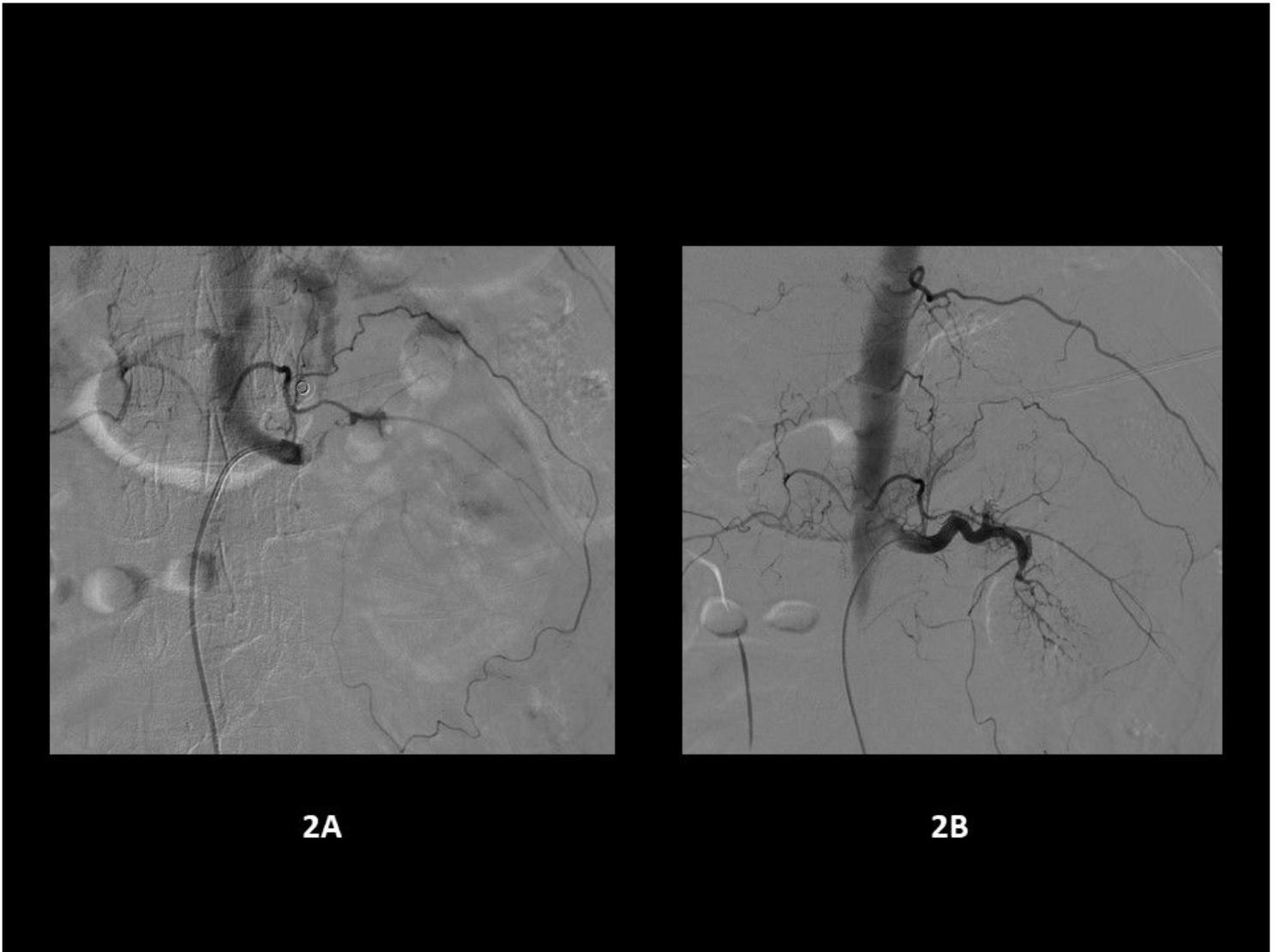


Figure 2

Angiogram confirmed total occlusion of the left renal artery (2A). The main trunk and most of the segmental branches were successfully recanalized after percutaneous aspiration thrombectomy, and some filling defects were noted in the distal arteries (2B).



Figure 3

Angiogram after catheter directed thrombolysis revealed the left renal artery and its segmental branches were revascularized.



Figure 4

The left renal artery was patent and the kidney was well perfused on follow-up computed tomography at 3 weeks.