Renal artery embolism successfully managed by ultrasound enhanced catheter directed thrombolysis

Mohamed Hassanein\textsuperscript{a}, Yehia Saleh\textsuperscript{a,b,*}, Mandeep Randhawa\textsuperscript{a}, Milind Karve\textsuperscript{c}

\textsuperscript{a}Michigan State University, East Lansing, MI, USA
\textsuperscript{b}Department of Cardiology, Faculty of Medicine, Alexandria University, Egypt
\textsuperscript{c}Sparrow Health System, Lansing, MI, USA

1. Introduction

Isolated renal artery thrombosis is a rare disease that usually results from systemic embolization and seldom secondary to in-situ thrombosis.\textsuperscript{1} Management is driven by the clinical presentation, timing and location of the occlusion. Various management options include anticoagulation, systemic thrombolysis, catheter directed thrombolysis or surgery. Recently, ultrasound-enhanced catheter directed thrombolysis has been approved for the management of pulmonary embolism. In our case we have successfully managed isolated renal artery thrombus via ultrasound-enhanced catheter directed thrombolysis.

2. Case report

A 59-year-old female with past medical history significant for hypertension, diabetes mellitus, coronary artery disease (for which she underwent coronary artery bypass surgery accompanied with mitral and tricuspid valve repair) presented with sudden onset of left sided abdominal pain for 5 hours. Vital signs were significant for a blood pressure of 180/90 mmHg. Electrocardiography showed normal sinus rhythm. Computed tomography of the abdomen and pelvis revealed hypoperfusion of the left kidney with suspicion of left renal artery thrombosis (Fig. A). Subsequently, abdominal aortogram and selective left renal angiogram showed a total thrombotic occlusion at the proximal segment of the left renal artery (Figs. B, C Videos 1, 2).
Thrombus aspiration was performed (Fig. D), followed by ultrasound-enhanced catheter directed thrombolysis using tissue plasminogen activator infusion for 24 hours together with intra-venous heparin. The patient’s symptoms were completely relieved after thrombolysis. Follow up selective renal angiogram revealed complete resolution of the main renal artery obstruction. However, a residual thrombus was still visualized in the superior segmental artery (Fig. E, Video 3).

Hypercoagulable workup was negative, transthoracic and trans-esophageal echocardiogram showed a reduced ejection fraction of 35% with bi-atrial dilatation. However, there was no apparent source of the embolus. She was started on oral apixaban and was discharged home with a Holter monitor that later on revealed paroxysmal atrial fibrillation.

3. Discussion

Renal artery embolism can occur secondary to atrial fibrillation, mechanical valve thrombosis, infective endocarditis and thrombi arising from the left ventricular apex or supra renal aorta. Patients usually present with flank pain, generalized abdominal pain, nausea, vomiting, fever or hematuria. On clinical exam, hypertension is common due to acute loss of blood supply to the kidneys leading to the release of excessive renin.

Normal renal function is common with unilateral renal artery thrombosis. However, several studies noted that serum lactate dehydrogenase (LDH) is elevated. It has also been shown that LDH elevation with normal aminotransferases is suggestive of renal infarction. Since symptoms can be misleading and due to the absence of a diagnostic laboratory test, many patients are diagnosed after several days of hospitalization. In patients presenting with acute flank pain, computed tomography without contrast is the preferred initial test since it is the gold standard for the diagnosis of kidney and ureteral stones, however it can miss the diagnosis of a renal infarction, hence in patients with suspected renal
infarction computed tomography with contrast should be done which classically shows a wedge-shaped perfusion defect. Other diagnostic modalities include magnetic resonance imaging or radioisotope scans, however renal angiography remains the gold standard to establish the diagnosis and determine the etiologies leading to renal infarction.

Optimal management of renal artery embolism remains unclear due to the absence of head to head trials of different modalities. The management options include anticoagulation, systemic thrombolysis, catheter directed thrombolysis and surgery.

The time of diagnosis is one of the defining factors indetermination of the therapeutic modality. Several studies showed that the kidney can sustain its viability only for 1–3 hours without any blood supply, other studies showed that intervening within 1–2 days is reasonable and total recovery of the kidney is to be expected due to the presence of collateral circulation. Hence, patients diagnosed several days after the fact or if a shrunken kidney is seen on computed tomography, conservative management via anticoagulation is recommended. However, in patients diagnosed within 2 days of the symptoms a more aggressive approach is recommended.

Use of systemic thrombolytic therapy has been established since the late 1950s for myocardial infarctions. In 1970s streptokinase for management of renal artery embolism was introduced, which was proven to be effective but it comes with a high risk of bleeding. In the early 1980s, catheter directed thrombolysis became available, it became more popular as lower doses of thrombolytic agents were used and at the same time, it secured better deliverability of the thrombolytic agent to the culprit site. In 2008, ultrasound-enhanced catheter directed thrombolysis was FDA approved for management of pulmonary embolism. The idea came after Braaten et al. proved that ultrasound exposure causes a reversible disaggregation of fibrin, which facilitates the thrombolysis effect. In addition, ultrasound pressure waves may increase thrombus penetration of thrombolytic drugs by acoustic streaming.

Very Few cases of renal artery thrombosis treated via ultrasound-enhanced catheter directed thrombolysis, have been reported, we are reporting that it was proven to be very efficient and safe. However, head to head trials are needed to compare between systemic thrombolysis, catheter directed thrombolysis with and without ultrasound.
4. Conclusion

Isolated renal artery thrombosis is rare. The management options include anticoagulation, systemic thrombolysis, catheter directed thrombolysis or surgery. Ultrasound-enhanced catheter directed thrombolysis is currently only approved for management of pulmonary embolism and has rarely been performed for renal artery thrombosis. In this case it was proven to be very effective.

Conflict of interest

We have no conflict of interest to declare.

References

1. Domanovits H, Paulis M, Nikfardjam M. et al. Acute renal infarction. Clinical characteristics of 17 patients. Medicine. 1999;78(6):386–394.
2. Oh YK, Yang CW, Kim YL. et al. Clinical characteristics and outcomes of renal infarction. Am J Kidney Diseases: Off J Natl Kidney Found. 2016;67(2):243–250.
3. Bourgault M, Grimbert P, Verret C. et al. Acute renal infarction: a case series. Clin J Am Soc Nephrol: CJASN. 2013;8(3):392–398.
4. Korzets Z, Plotkin E, Bernheim J, Zissin R. The clinical spectrum of acute renal infarction. Israel Med Assoc J. IMAJ. 2002;4(10):761–764.
5. Bolderman R, Oyen R, Verrijcken A, Knockaert D, Vanderschueren S. Idiopathic renal infarction 356.e9. Am J Med. 2006;119(4).
6. Hazanov N, Somin M, Attali M. et al. Acute renal embolism. Forty-four cases of renal infarction in patients with atrial fibrillation. Medicine. 2004;83(5):292–299.
7. Kim SH, Park JH, Han JK, Han MC, Kim S, Lee JS. Infarction of the kidney: role of contrast enhanced MRL. J Comput Assist Tomogr. 1992;16(6):924–928.
8. Arabi M, Vellody R, Cho K. Acute renal artery occlusion with prolonged renal ischemia: a case of successful treatment with stent placement and catheter-directed thrombolysis. J Clin Imag Sci. 2011;1.
9. Goueffic Y, Carbajal R, Burban M, Blancho G. Successful endovascular treatment of bilateral renal artery paradoxical embolus by a modified standard technique**The authors wish it to be known that, in their opinion, the first two authors contributed equally to this work. Nephrol Dial Transplant. 2006;21(8):2315–2317.
10. Regnier KR, Roman RJ. Role of medullary blood flow in the pathogenesis of renal ischemia-reperfusion injury. Curr Opin Nephrol Hypertens. 2012;21(1):33–38.
11. Blum U, Billmann P, Krause T. et al. Effect of local low-dose thrombolysis on clinical outcome in acute embolic renal artery occlusion. Radiology. 1993;189(2):549–554.
12. Sherry S, Fletcher AP, Alkajersig N, Smyrniotis FE. An approach to intravascular fibrinolysis in man. Trans Assoc Am Phys. 1957;70:288–295, discussion 95–6.
13. Steckel A, Johnston J, Fraley DS, Bruns FJ, Segel DP, Adler S. The use of streptokinase to treat renal artery thromboembolism. Am J Kidney Diseases: Official J Natl Kidney Found. 1984;4(2):166–170.
14. Fischer CP, Konnak JW, Cho KJ, Eckhauser FE, Stanley JC. Renal artery embolism: therapy with intra-arterial streptokinase infusion. J Urol. 1981;125(3):402–404.
15. Braaten JV, Goss RA, Francis CW. Ultrasound reversibly disaggregates fibrin fibers. Thromb Haemost. 1997;78(3):1063–1068.
16. Piffaretti G, Riva F, Tozzi M, Lonazza C, Rivolta N, Carrabelli G, Castelli P. Catheter-directed thrombolysis for acute renal artery thrombosis: report of 4 cases. Vasc Endovascular Surg. 2008;42(4):375–379.