

Original article

Rare Clinical Cases of Renal Artery Thrombosis

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Abstract

Objective: Renal vascular thrombosis is a thrombotic blockage of the major renal arteries resulting in acute damage or chronic kidney disease. The study aims to analyze rare clinical cases of renal artery thrombosis with following renal infarction. **Materials and methods:** The article present a retrospective study of examination and treatment results of patients diagnosed with the renal arteries thrombosis in the urological hospital of the Irkutsk Clinical Hospital No. 1 in the period 2012-2020. **Results and Discussion:** During the entire observation period, there were two clinical cases of acute renal artery thrombosis. The 86-year-old woman developed thrombosis because of atrial fibrillation, which was probably the result of inadequate correction (insufficient dose of anticoagulant). Kidney infarction had complications like rapid suppuration because of chronic urinary infection and calculus of the renal pelvis. It resulted in nephrectomy with subsequent recovery. The second case was the 45-year-old man examined according to existing standards, and the diagnosed-on time in the first hours of the disease. However, complete thrombosis of the right renal artery neutralized the effectiveness of conservative therapy with warfarin. In this case, nephrosclerosis and renal failure were natural. **Conclusion:** Renal artery thrombosis is a rare pathology that requires special attention from the clinician due to the high risk of renal function loss. Timely diagnosis and correct treatment tactics are especially important.

Keywords: renal vessel thrombosis; arterial renal vessel thrombosis; venous thrombosis; renal artery thrombosis; renal vein thrombosis.

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Introduction

Renal vascular thrombosis is a thrombotic blockage of major renal vessels resulting in acute kidney injury or chronic kidney disease.

Compared venous thrombosis to renal artery thrombosis is a rare, but clinically significant variant of renal blood flow disturbance. It may lead to a renal function decrease or complete loss of an organ.

The largest studies describe small series of renal infarction cases due to arterial thrombosis: 10 cases (5 men and 5 women),¹ 17 cases (8 men),² 18 cases³ over 16 years of follow-up (from 1999 to 2015 years). Three-year follow-up in 40 centers in seven regions of Turkey with 121 cases (71 men),⁴ 94 cases from 1989 to 2011,⁵ 42 cases from 2005 to 2015,⁶ and 23 cases (12 men) in Taiwan from 1998 to 2012.⁷ Overall, the incidence is approximately 0.007%

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among emergency patients with kidney damage and hypertension.⁸

The main causes of renal artery thrombosis may be trauma,^{9,10} kidney transplantation,^{11,12} thrombophilia,¹³ systemic lupus erythematosus, and antiphospholipid syndrome.¹⁴⁻¹⁶ Also, renal artery atherosclerosis,¹⁷ polycythemia, iatrogenic damage to the aorta and renal vessels,¹⁸ the use of hormonal oral contraceptives,¹⁹ drug use,²⁰ including intravenous,²¹ bacterial endocarditis,²² caused by spontaneous injury of segmental renal vessels,²³ diabetes and arterial hypertension, obesity and atrial fibrillation.^{3,4}

Only some studies are large enough to represent the most likely causes of renal artery thrombosis, such as diabetes (11-14.9%), hypertension (43.8-44%), obesity (33%), atrial fibrillation (28-30%), peripheral vascular disease (17%), prior thrombosis (11%), estrogen-progesterone therapy (11%) and smoking (17%). At the same time, trauma (7.4%), lupus erythematosus (4.9%), and antiphospholipid syndrome (1%) turned out to be a fairly rare cause of thrombosis, and most cases were not reliably substantiated (57-59%).^{3,4,24} In general, it is possible to divide the causes of renal artery thrombosis into several large groups: cardiac (24.4%), renal (30.8%), hypercoagulable (15.9%), and idiopathic (28.7%).⁵

The gender ratio averages 58% of men to 42% of women, with an average age of 53 ± 1.4 years.⁴

Clinical complaints usually include pain (80%) and hematuria (54-100%).¹⁻³ In most cases, there is no significant difference in the likelihood of thrombosis of the right (37%) and left kidney (41.3%); bilateral thrombosis (21.5%) is also possible.⁴

The standard diagnostics include ultrasound examination with Doppler sonography,^{11,25} to assess the blood flow in the renal parenchyma and renal vessels, inferior vena cava, and aorta. MR-angiography or MSCT-angiography^{26,27} provide the most accurate determination of the degree, extent, and localization of thrombosis, as well as changes in renal parenchyma perfusion.

Laboratory parameters make it possible to suspect arterial thrombosis, ischemia, and renal infarction when the level of lactate dehydrogenase changes (LDH, an increase in 86.9 - 90.5% of cases - more than 600 U \ l), an increase in C-reactive protein (77.6%) and an increase in uremia (40.4%).^{5,7}

The acute renal arterial thrombosis treatment usually consists of thrombectomy (preferably

endovascular) or anticoagulant therapy (possibly with thrombolysis).^{6,28} A combined application of both methods is also possible.²⁹ However, thrombolytic therapy is limited in time (90-180 minutes from the thrombosis development),³⁰ while most cases are diagnosed within the first 24 hours.²² Stenting after thrombectomy is less common.³¹

It is advisable to choose treatment tactics based on the degree of thrombosis. In case of incomplete thrombosis, conservative anticoagulant therapy demonstrates good results (renal function decrease after 2.5 years by 9%), complete thrombosis requires endovascular thrombectomy (renal function decrease after a year by 27%).⁶

The need for hemodialysis is rare (4-7.4%), mortality usually does not occur.^{4,5}

The study aimed to analyze rare clinical cases of renal artery thrombosis with the development of renal infarction.

Materials and Methods

The local ethical committees of the Federal State Budgetary Educational Institution of Higher Education "Irkutsk State Medical University" of the Ministry of Health of the Russian Federation and the Regional State Budgetary Institution of Healthcare "Irkutsk Clinical Hospital No. 1" approved the clinical trial. The retrospective study took place at the urological hospital of the Irkutsk Clinical Hospital No. 1.

The clinical part of the study includes an analysis of examination and treatment results of patients who had a kidney infarction due to renal artery thrombosis in the period from June 2012 to February 2020.

There were two cases of renal artery thrombosis, an 86-year-old woman and a 45-year-old man.

Ethical clearance: This study was approved by Ethics committee of Irkutsk State Medical University, Irkutsk, Russia.

Results

Especially it is important to notice that the presented pathology is quite rare, given the number of visits (about 10,000 per year) to the urological hospital. Below is a detailed overview of clinical cases.

The first case of thrombosis for the specified period was in June 2017, the emergency department received an 86-year-old woman with acute cerebrovascular accident symptoms. The patient got to the neurological department with ischemic cardioembolic stroke. She

suffered from hypertension, vascular atherosclerosis, and atrial fibrillation rhythm disturbances. There were significant concomitant changes (Table 1): mild anemia, thrombocytosis, chronic secondary pyelonephritis, and chronic calculous cholecystitis. A month after treatment, MSCT angiography showed concomitant acute total left kidney infarction due to complete thrombosis of the left renal artery. The doctors decided to transfer the patient to the urology department and to continue anticoagulant therapy.

Table 1. The 86-years-old patient parameters at the time of admission to the hospital

Height, cm	162
Weight, kg	60
Blood pressure, mm Hg	110\70
Hb, g\dl	92
Leukocytes x10 ⁹	5.59
Platelets x10 ⁹	355
Erythrocytes x10 ¹²	3.72
Erythrocytes in urine, in the field of view, pcs	---
Leukocytes in urine, in the field of view, pcs	>100
Protein in urine, g / l	0.018
Blood type	A(II) Rh+positive
Fibrinogen, g / l	3.9
aPTT, sec	30
INR	1.68
PT, %	61
Creatinine, μmol \ L	110
LDH, u\l	620

During the examination, the patient complained of severe pain in the left lumbar area and fever.

Emergency repeated MSCT angiography revealed the left kidney pelvis concretion 13x8 mm, 1228HU, signs of total infarction of the lower and middle thirds of the left kidney (contrast is not received, parenchyma density 12.7 HU), ischemia of the left kidney upper third. Right kidney with unchanged blood flow, 22 mm cyst detected in the middle third, Bosniak I.

Taking into account the stroke, the severity of the patient's condition, fever, and total renal artery thrombosis that occurred under anticoagulant therapy, the thrombosis duration (from 12 to 24 hours), doctors decided to perform an emergency operation. Surgeons performed the left kidney revision, revealed a calculus pelvis 15x10 mm, multiple abscesses and aposteme middle and lower thirds of the kidney, evaluated the possibility to save

the organ, and perform thrombectomy (low, due to multiple abecedarian kidneys), and conducted a nephrectomy.

Postoperative histological examination of the removed kidney revealed renal artery stenosis (annular narrowing of the lumen to 50% by an atherosclerotic plaque with calcinosis), a red blood clot in the stenosis zone (completely obliterating the lumen), and multiple areas of kidney infarction with abscess formation. Also, there was a total atherosclerosis of small renal arteries, nephrosclerosis development, and the formation of small renal cysts.

In the postoperative period, the patient noted a significant improvement in well-being. She left the hospital for 21 days after the operation without regression due to her neurological status. The control ECG showed sinus tachycardia with a heart rate of 90 per minute, the horizontal electrical axis of the heart, signs of incomplete blockage of the right leg of the GIS bundle. The control ultrasound showed normal surgery area (the "bed" of the removed left kidney), the right kidney of normal size and location, normal blood flow, and a 22 mm cyst in its middle third. Table 2 presents the patient's parameters at the time of discharge.

Table 2. The 86-year-old patient parameters at the time of discharge from the hospital

Blood pressure, mm Hg	120\70
Hb, g\dl	106
Leukocytes x10 ⁹	8.7
Platelets x10 ⁹	252
Erythrocytes x10 ¹²	3.53
Erythrocytes in urine, in the field of view, pcs	1-2
Leukocytes in urine, in the field of view, pcs	1-2
Protein in urine, g / l	0.098
Fibrinogen, g / l	4.5
aPTT, sec	28
INR	2.1
PT, %	91
Creatinine, μmol \ L	102
LDH, u\l	151

The second case of thrombosis was in July 2019, when a 45-year-old man came to the emergency department with complaints of pain in the lumbar right area. From the anamnesis, it was clear that he fell ill two hours before; the pain was pronounced and permanent. Previously, he had no urological and other concomitant pathology or thromboembolic diseases. He denied injuries, occupational hazards, and smoking.

The ultrasound established normal shape, size, and location of the kidneys, not expanded collecting system, and no blood flow in the right kidney. Emergency MSCT angiography(Figure 1) revealed total thrombosis of the right renal artery, a critical blood perfusion decrease in the right kidney parenchyma (blood flow was partially preserved due to a 1.5 mm-accessory artery with; 6, 6 mm-renal artery was fully blocked for 17.6 mm in its middle third).



Figure 1. MSCT angiography of a 45-year-old patient Table 3 presents the patient parameters at the time of admission to the hospital.

Table 3. A 45-year-old patient parameters at the time of admission to the hospital

Height, cm	180
Weight, kg	78
Blood pressure, mm Hg	130/80
Hb, g/dL	149
Leukocytes x10 ⁹	13,3
Platelets x10 ⁹	200
Erythrocytes x10 ¹²	4.93
Erythrocytes in urine, in the field of view, pcs	---
Leukocytes in urine, in the field of view, pcs	>100
Protein in urine, g / l	0.096
Blood type	B(III) Rh+positive
Fibrinogen, g / l	4.2
aPTT, sec	29
INR	0.95
PT, %	95
Creatinine, μmol \ L	129.5
LDH, u/l	689

Due to the revealed pathology, the patient underwent further treatment at the Department of Vascular Surgery. He received anticoagulant therapy. Prescribed to take warfarin with adequate dose adjustment (INR with monthly monitoring within 2.0-2.5). Discharged from the hospital on the 7th day after the renal artery thrombosis development.

At the follow-up examination 6 months later, the ultrasound showed signs of the right kidney shrinking, in which there was no blood flow at all. Renal failure persisted (creatinine 128 μmol / l).

Discussion

The analysis of two presented clinical cases revealed some shortcomings in the chosen treatment. In the first clinical observation, an 86-year-old female patient received anticoagulant therapy due to the cardioembolic acute ischemic stroke. Earlier, she had a rhythm disturbance of the atrial fibrillation type and widespread vessel atherosclerosis. However, the target INR value was not achieved (2.0–3.0 is recommended, she had 1.68), which, probably, could cause repeated thromboembolism.³²It is important to notice the rapid development of purulent kidney damage due to the left kidney calculus and chronic urinary infection. In such a situation, nephrectomy became the only adequate treatment option. This clinical example is fully consistent with the data presented in large studies, indicating patients with atrial fibrillation, atherosclerosis, and previous

thrombotic incidents as the most likely risk group.^{4,5} In the second case, it was not difficult to establish the correct diagnosis for the 45-year-old patient. He had a high level of LDH, pain syndrome,^{1,7} and absence of blood flow according to Doppler ultrasound.^{11,25} Additionally, he underwent the MSCT angiography.^{26,27} However, the cause of the thrombosis was not clear. In this case, idiopathic renal artery thrombosis was probable.⁵

Angiosurgeons have chosen a conservative therapeutic tactic that, according to most researchers,^{3,4,6} has the same results as thrombectomy and even surpasses them in terms of the renal function recovery frequency. However, in the long-term period, there were no signs of renal blood flow restoration, the kidney shrinkage led to the functional loss of the organ.

Thus, both clinical cases had a timely diagnosis, the appropriate therapy indications, and the recommended conservative treatment with warfarin. Unfortunately, the therapy did not lead to a positive outcome due to total renal artery thrombosis. In such a situation, it might be more effective to perform thrombectomy.⁶

Conclusions

Renal artery thrombosis is a rare pathology that

requires special attention, due to the high risk of renal function loss because of the disease. Timely diagnosis and correct treatment are especially important.

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Research transparency. The study was not sponsored. Researchers are solely responsible for submitting the final manuscript to print.

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