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CLINICAL CHARACTERISTICS, PROMPT DIAGNOSIS, AND IN-HOSPITAL TREATMENT OUTCOMES OF ACUTE RENAL ARTERY OCCLUSION AT CARDIOVASCULAR CENTER – E HOSPITAL

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ABSTRACT

Objectives: To describe clinical characteristics and evaluate treatment outcomes of patients with acute renal artery occlusion at E Hospital.

Methods: A cross-sectional study on 36 patients diagnosed from Jan 2023 to Oct 2025.

Results: Mean age 58.47 ± 13.24; male/female ratio 16/20. Flank pain presented in 100%, with delayed admission (mean 4.97 days). Major causes: cardiac embolism (44.4%) and idiopathic (41.8% - with 27.8% cancer-related). Treatment: 88.9% conservative (anticoagulation), 11.1% percutaneous revascularization (early admission <24h). Outcomes showed significant renal function improvement at discharge; no mortality occurred. Conclusion: Acute renal artery occlusion is often missed due to non-specific symptoms. Early MSCT diagnosis and individualized strategies (anticoagulation vs. intervention) are crucial for renal salvage.

Keywords: *Acute renal artery occlusion, Renal infarction, Endovascular intervention, Atrial fibrillation.*

1. INTRODUCTION

Acute renal artery occlusion (ARAO) is defined as a sudden reduction or complete cessation of renal arterial blood flow, leading to renal ischemia infarction. It is a rare but serious vascular emergency that can result in acute kidney injury (AKI), refractory hypertension, and, in severe cases, permanent loss of renal function. Early recognition and timely management are critical to preserving renal function and improving clinical outcomes[1,2].

The most common cause of ARAO is cardioembolism, particularly in patients with atrial fibrillation and valvular heart disease. In addition, in-situ thrombosis due to atherosclerosis, trauma-related arterial dissection or thrombosis, and hypercoagulable states associated with malignancy may also lead to ARAO. Identifying the underlying etiology is important for guiding appropriate treatment and secondary prevention[2,3].

Patients with ARAO typically present with acute flank pain, nausea, vomiting, fever, and hematuria. However, these symptoms are non-specific and can easily be misdiagnosed as nephrolithiasis, pyelonephritis, or other abdominal conditions, leading to delays in diagnosis and treatment. The presence of risk factors such as cardiovascular disease, atrial fibrillation, or malignancy should raise suspicion of ARAO[2].

Initial management includes systemic anticoagulation to prevent thrombus propagation. Revascularization strategies such as catheter-directed thrombolysis, mechanical thrombectomy, and stent placement may be considered, particularly in patients with recent onset (<24-48 hours) and occlusion of the main renal artery. However, there remains controversy regarding the selection of patients and the optimal timing for endovascular intervention. Conservative treatment with anticoagulation is often chosen in patients with delayed presentation or branch artery occlusion. Therefore, prompt diagnosis and individualized treatment are essential to optimize outcomes[4].

Acute renal artery occlusion is rarely reported in Vietnam, and there is limited real-world data regarding its clinical characteristics, diagnostic delays, and treatment outcomes. Most available information comes from isolated case reports or experiences from other countries. There is a need for more comprehensive studies to improve early recognition and establish appropriate management strategies in Vietnamese clinical practice. Therefore, this study was conducted to describe the clinical characteristics, identify clues for prompt diagnosis, and evaluate short-term in-hospital treatment outcomes in patients with acute renal artery occlusion treated at the Cardiovascular Center- E Hospital.

2. SUBJECTS AND METHODS

2.1. Study design

This was a cross-sectional descriptive study with retrospective and prospective data collection.

2.2. Setting and population:

The study was conducted at the Cardiovascular Center, E Hospital, Hanoi, Vietnam. Consecutive patients diagnosed with acute renal artery occlusion between January 2023 and October 2025 were enrolled.

• *Inclusion criteria:*

(1) Age ≥18 years.

(2) Clinical manifestations suggestive of

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acute renal ischemia, including acute flank pain, abdominal pain, nausea/vomiting, fever, urinary symptoms, or acute deterioration in renal function.

(3) Contrast-enhanced multislice computed tomography (MSCT) demonstrating:

- Intraluminal filling defect within the renal artery.

- Wedge-shaped renal hypoenhancement or infarction pattern.

- Cortical rim sign or perfusion defect.

(4) Sympton onset ≤14 days before hospital admission.

• *Exclusion criteria:*

(1) Chronic renal artery occlusion (symptom duration >14 days, evidence of collateral circulation, renal atrophy, or chronic ischemic changes).

(2) Previous renal infarction or chronic renal ischemia.

(3) Renal artery pseudoaneurysm or dissection unrelated to thromboembolism.

(4) Incomplete clinical or imaging records.

2.3. Sample size and Sampling

A total of 36 consecutive eligible patients were included using consecutive sampling,

2.4. Data collection.

+ Demographic characteristics: age; sex.

+ Cardiovascular risk factors: Smoking, hypertension, diabetes mellitus, atrial fibrillation, valvular heart disease, malignancy.

+ Clinical manifestation: Flank pain, fever, nausea/vomiting, urinary symptoms.

+ Laboratory findings: (1) white blood cell count (WBC); (2) Serum creatinine; estimated glomerular filtration rate (eGFR); C-reactive protein (CRP); urinalysis (hematuria if available); lactate dehydrogenase (LDH).

+ Imaging characteristics: (1) site of occlusion (main artery or branch artery); (2) unilateral/bilateral involvement; (3) extent of renal perfusion defect.

+ Treatment modality and short-term in-hospital outcomes.

2.5. Data Analysis

Statistical analyses was performed using SPSS software version 20.0.

2.6. Ethical Considerations

This was an observational study and did not interfere with patients'diagnostic or therapeutic management. The study protocol was approved by the Scientific Committee of E hospital. All patient information was anoymized and kept confidential in accordance with applicable regulations.

3. RESEARCH RESULTS

3.1. Baseline and clinical characteristics

Table 1. Baseline characteristics and risk factors (n=36)

Characteristics		N (%)
Age (Mean ± SD, years)		58,47 ± 13,24
Gender (Male/Female)		16 / 20
Risk factor	Smoking (n, %)	13 (36,1)
	Hypertension (n, %)	9 (25,0)
	Diabetes (n, %)	4 (11,1)
Etiology of vascular occlusion	Cardiac Embolism (Atrial fibrillation/ Heart valve disease) (n, %)	16 (44,4)
	Idiopathic (of which cancer: 27,8%) (n, %)	15 (41,8)

Characteristics		N (%)
Etiology of vascular occlusion	Renal vascular injury	4 (11,1)
	Heart failure (EF ≤ 40%)	1 (2,7)

Table 2. Clinical characteristics at admission

Characteristics		N (%)
Mean time from symptom onset (Mean ± SD, days)		4,97 ± 4,6
Subjective symptoms	Abdominal pain / lower back pain (n, %)	36 (100)
	vomiting / nausea (n, %)	14 (38,8)
	Fever (n, %)	7 (19,4)
	Urinary dysfunction (n, %)	7 (19,4)
Pain location	Left lower back (n, %)	14 (39,0)
	Right lower back (n, %)	12 (33,3)
	Others (lower ribs, periumbilical area) (n, %)	10 (27,7)

3.2. Paraclinical characteristics.

Table 3. Blood test and MSCT imaging

Characteristics		N (%)
Blood test (Mean ± SD)	White blood cell count (WBC) (G/L)	11,05 ± 2,74
	Creatinine (µmol/L)	103,5 ± 38,9
	eGFR (mL/min/1 .73m²)	64,3 ± 22,94
	CRP-hs (mg/dL)	11,2 ± 8,2
	LDH (U/L)	854 ± 492
	Hematuria (n, %)	21 (58.3%)
MSCT	Renal artery branch occlusion (n, %)	31(86,2)
MSCT	Renal main artery trunk occlusion (n, %)	5(13,8)
	Bilateral lesions (n, %)	8(22,3)

3.3. Treatment results

Table 4. Treatment methods

Method	N %	Characteristics
Conservative management	32 (88,9)	Initial heparin therapy followed by transition to DOACs (75%) or VKAs (25%)
Endovascular intervention	4 (11,1)	Balloon angioplasty, thrombectomy, and stent placement (for trauma cases or early-presenting main renal artery occlusion)

Table 5. Comparison of renal function before and after treatment (conservative group)

Blood test			
Admission	**Discharge**	**Evaluation**	**P**
Creatinine (µmol/L)			
103,5 ± 38,9	88,6 ± 22,9	Improve	0,524
eGFR (mL/min/1 .73m²)			
64,3 ± 22,94	69,2 ± 19,04	Improve	0,482
CRP-hs (mg/dL)			
11,2 ± 8,2	5,2 ± 2,2	Reduce inflammation	0,002
LDH (U/L)			
854 ± 492	441 ± 112,9	Reduce	0,004

Table 6. Overall outcomes at hospital discharge

Outcomes	Evaluation
Mean length of hospital stay (Mean ± SD, days)	9,3 ± 5,2
Mortality (n, %)	0 (0)

Outcomes	Evaluation
Emergency renal replacement therapy (n, %)	0 (0)
Stable or improved renal function (n, %)	36 (100)

4. DISCUSSION

Clinical characteristics and challenges in early diagnosis. In this cohort of 36 patients, the mean age was 58,47 ± 13,24, with a predominance of female patients (55,5%). These findings are consistent with the study by Vu Hoang Vu et al (2020) at the University Medical Center in Ho Chi Minh City, which reported a mean age of 59 years and a similar female predominance. Abdominal or flank pain was present in 100% of patients, underscoring its role as the most prominent and consistent presenting symptom of acute renal artery occlusion. However, the mean time from symptom onset to hospital admission was 4.97 days, indicating a substantial delay in diagnosis[5,6]. This delay likely reflects the heterogeneous and nonspecific clinical presentation, which is frequently misattributed to more common conditions such as nephrolithiasis, pyelonephritis, or gastrointestinal disorders. The challenge of early and differential diagnosis is particularly important because renal infarction frequently mimics renal colic, especially in patients presenting with flank pain and hematuria. In our cohort, hematuria was detected in 21 patients (58.3%), further contributing to diagnostic confusion with nephrolithiasis and delayed recognition[2,7]. Laboratory investigations may provide important supportive clues for prompt diagnosis. Notably, the mean serum LDH level at admission was markedly elevated (854 ± 492 U/L), significantly decreasing to 441 ± 112.9 U/L at discharge (p=0.004). Elevated LDH reflects tissue ischemia and cellular necrosis and has been reported as a characteristic biochemical marker of renal infarction. Although nonspecific, markedly elevated LDH in the setting of unexplained flank pain, particularly in patients without evidence of urinary tract obstruction, should raise suspicion for acute renal artery occlusion[2,8,9]. Similarly, inflammatory markers demonstrated significant improvement during hospitalization. The mean CRP-hs level decreased significantly from 11.2 ± 8.2 mg/dL at admission to 5.2 ± 2.2 mg/dL at discharge (p=0.002), suggesting resolution of acute inflammatory injury following treatment[2–4]. Among imaging modalities, both Doppler ultrasonography and contrast-enhanced multislice computed tomography (MSCT) play complementary roles in the diagnosis of acute renal artery occlusion, allowing direct visualization of renal artery filling defects, wedge-shaped perfusion abnormalities, and cortical rim signs. Although Doppler ultrasonography is often the initial imaging modality because of its wide availability, non-invasive nature, and lack of radiation or contrast exposure, its diagnostic accuracy is limited by operator dependency, patient body habitus, bowel gas, and difficulty detecting distal or branch renal artery occlusions. Doppler ultrasound may demonstrate absent or reduced renal arterial flow, elevated resistance index, or segmental perfusion abnormalities; however, a normal examination does not exclude acute renal infarction. In contrast, contrast-enhanced multislice computed tomography (MSCT) remains the gold standard for diagnosis by directly demonstrating renal artery filling defects, wedge-shaped renal perfusion abnormalities, and the cortical rim sign[9,10]. Therefore, prompt MSCT should be performed whenever clinical suspicion remains high, particularly in patients presenting with unexplained flank pain and cardiovascular risk factors such as atrial fibrillation, valvular heart disease, or malignancy. During follow-up, Doppler ultrasonography serves as a useful non-invasive tool for evaluating renal perfusion, vascular patency after revascularization, renal size, and the development of renal atrophy, complementing serial assessment of renal function[3,9,10].

Etiology and its association with

cardiovascular disease and malignancy. Regarding etiology, cardioembolism accounted for 44.4% of cases in our cohort, consistent with the literature identifying atrial fibrillation as the leading cause of renal infarction. Cardioembolic mechanisms may result in abrupt interruption of renal blood flow, leading to ischemia and infarction[1–3]. Interestingly, a considerable proportion of patients were categorized as idiopathic, among whom 27.8% had underlying malignancy, suggesting a potential contribution of malignancy- associated hypercoagulability (Trousseau syndrome). This finding highlights the importance of considering occult malignancy in patients without an apparent embolic source. Other etiologies include in situ thrombosis related to atherosclerosis, trauma-related vascular injury, and renal artery dissection, all of which should be considered during diagnostic evaluation[1,2,4,9].

Treatment strategy: Conservative management versus endovascular intervention. Selecting the optimal therapeutic strategy for acute renal artery occlusion remains one of the most challenging aspects of management and should be individualized according to the timing of presentation, anatomical extent of occlusion, ischemic burden, and baseline renal function [3,4,9]. In our cohort, the majority of patients (88.9%) were treated conservatively with systemic anticoagulation because of delayed presentation, branch renal artery occlusion, preserved renal function, or limited ischemic territory. Conservative anticoagulation remains an important therapeutic option in routine clinical practice, particularly when the opportunity for effective revascularization has likely passed[2,9]. Besides conservative anticoagulation, several revascularization strategies have been described, including systemic thrombolysis, catheter-directed thrombolysis, mechanical thrombectomy, and endovascular stenting in carefully selected patients. Systemic thrombolysis has largely fallen out of favor because of its uncertain efficacy and substantial risk of major bleeding. In contrast, catheter-directed thrombolysis, either alone or combined with aspiration thrombectomy or mechanical thrombectomy, enables targeted thrombus dissolution while minimizing systemic bleeding complications. Current evidence suggests that catheter-directed thrombolysis may improve renal reperfusion and preserve renal function in carefully selected patients presenting early with main renal artery occlusion and salvageable renal parenchyma. However, the available evidence is derived mainly from small observational studies, and no randomized controlled trials have established the superiority of one treatment strategy over another[9–11]. In our study, endovascular intervention was reserved for carefully selected patients presenting within 24 hours of symptom onset, those with main renal artery occlusion, bilateral disease, or a solitary kidney with threatened renal function. Potential advantages of endovascular treatment include rapid restoration of renal perfusion and preservation of renal function, although these benefits have not been confirmed in randomized controlled trials[11,12]. Four patients (11.1%) underwent endovascular intervention, all fulfilling predefined clinical criteria, including early presentation and main renal artery occlusion. The procedures achieved successful revascularization without major procedural complications, supporting the feasibility and safety of endovascular therapy in carefully selected patients treated at a tertiary cardiovascular center[1,2,4]. Nevertheless, because of the limited sample size and observational design of the present study, no conclusions can be drawn regarding the comparative effectiveness of conservative anticoagulation, thrombolytic therapy, and endovascular intervention.

Risk of secondary hypertension and the importance of long-term follow-up after renal infarction. An important concern following acute renal infarction is the risk of developing secondary renin-mediated hypertension during the post-acute phase. Persistent renal hypoperfusion may activate

the renin-angiotensin-aldosterone system (RAAS), potentially leading to delayed-onset hypertension, including severe or malignant hypertension[3,9,12]. Although the prevalence of hypertension at admission in our cohort was relatively low (25%), the long-term risk of secondary hypertension remains clinically important. This concern is particularly relevant in patients with unilateral renal lesions, in whom preserved serum creatinine or eGFR may not necessarily indicate adequate recovery of the affected kidney because preserved renal function may be maintained through compensation by the contralateral kidney[2,3,12]. Consequently, the infarcted kidney may remain chronically underperfused and progressively evolve toward renal atrophy, fibrosis, and chronic ischemic injury. Therefore, long-term follow-up is essential, not only to reassess renal function but also to monitor blood pressure control and structural renal changes. Follow-up strategies should include serial evaluation of serum creatinine, eGFR, blood pressure measurements, and repeat imaging when clinically indicated, particularly within 3-6 months after the acute event, to detect persistent malperfusion or progressive renal atrophy[2,9,11,12].

Study limitations. Several limitations of this study should be acknowledged. First, the sample size (n=36) was relatively small, reflecting the rarity of acute renal artery occlusion and limiting the power for subgroup statistical analyses. Second, this was a single-center observational study with both retrospective and prospective components, which may introduce selection bias. Third, follow-up was limited to the in-hospital period, precluding assessment of long-term outcomes such as secondary hypertension, renal atrophy, recurrent embolic events, and chronic kidney disease progression. Therefore, future multicenter studies with larger sample sizes and longer follow-up are warranted.

5. CONCLUSION

Acute renal artery occlusion is an uncommon but clinically important vascular emergency that should be suspected in patients presenting with unexplained flank or abdominal pain, particularly in the presence of atrial fibrillation, valvular heart disease, malignancy, or other cardiovascular risk factors, especially when urinary tract obstruction or nephrolithiasis cannot be identified. Elevated LDH, hematuria, and contrast-enhanced multislice computed tomography (MSCT) may facilitate prompt and definitive diagnosis, thereby improving early recognition of this frequently overlooked condition. In our cohort, conservative anticoagulation was associated with favorable short-term in-hospital biochemical and renal functional improvement in most patients. However, endovascular revascularization may represent a feasible therapeutic option in carefully selected patients, particularly those with early presentation, main renal artery occlusion, bilateral involvement, or solitary kidney, with the potential to preserve renal perfusion and renal function. Long-term follow-up is warranted to assess the risks of secondary hypertension, renal atrophy, and chronic kidney disease progression.

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