International Journal of Surgery Case Reports 129 (2025) 111095

Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.elsevier.com/locate/ijscr

Case report

Life-threatening arteriovenous fistula after percutaneous nephrostomy: A case report

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A R T I C L E I N F O

Keywords:
Arteriovenous fistula
Percutaneous nephrostomy
Embolic stroke
Selective embolization

A B S T R A C T

Introduction: Arteriovenous fistula (AVF) is a rare but serious complication following percutaneous nephrostomy. While more commonly observed after nephrolithotomy, it can also occur with prolonged nephrostomy placement or complicated procedures. Early diagnosis and management are critical for preventing life-threatening complications.

Case presentation: A 59-year-old female with recurrent bilateral urolithiasis, right heart failure, poorly controlled type 2 diabetes, and chronic kidney disease presented with right flank pain, fever, and fatigue. She had previously undergone right double-J stent placement but was lost to follow-up. A CT scan revealed hydronephrosis, a calcified stent, and a 22 mm pelvic stone, leading to the performance of a percutaneous nephrostomy. The patient developed an embolic stroke three days later and subsequently presented with hematuria, hypotension, and significant anemia. CT angiography confirmed an AVF with active bleeding, which was successfully treated with embolization.

Discussion: Post-nephrostomy AVFs are rare, with risk factors including prolonged nephrostomy, diabetes, and complex renal stones. Early detection using Doppler ultrasound or CT angiography is crucial, and selective embolization remains the treatment of choice with a high success rate.

Conclusion: Post-nephrostomy AVF is a rare but potentially fatal complication requiring rapid diagnosis and intervention. Early suspicion, timely imaging, and selective embolization are key to successful management.

1. Introduction

While AVF is more common after PCNL [1], it remains an exceptionally rare but serious complication following percutaneous nephrostomy [2]. We report a rare case complicated by anticoagulation for embolic stroke. Early recognition and selective embolization were crucial in managing the emergency situation.

2. Case presentation

A 59-year-old female with recurrent bilateral urolithiasis presented with right flank pain, fever, and fatigue. A right double-J stent had been placed a year earlier for a symptomatic pelvic stone but was not followed up. She had right heart failure, poorly controlled type 2 diabetes, and chronic kidney disease (creatinine nadir: 18 mg/L).

Clinically stable, she had a Glasgow Coma Scale of 14/15 (slightly altered verbal response), fever (38.3 °C), right flank tenderness, and 800 cc urine output over 24 h.

Laboratory results revealed acute kidney injury, with a serum creatinine level of 107 mg/L (normal: 6–12 mg/L) and blood urea of 3 g/L (normal: 0.15–0.45 g/L). Inflammatory markers were elevated, with a C-reactive protein level of 300 mg/L (normal: <5 mg/L) and a white blood cell count of 17,000/mm^3 (normal: 4000–10,000/mm^3). Additionally, the patient exhibited normocytic anemia (hemoglobin: 7.6 g/dL; normal: 12–16 g/dL) and mild hyperkalemia (serum potassium: 5.4 mEq/L; normal: 3.5–5.1 mEq/L). Urinalysis and urine culture were negative for bacterial infection.

A non-contrast abdominopelvic CT scan revealed right-sided hydronephrosis, a calcified double-J stent coiled at both ends, and a 35 × 28 mm right pelvic stone (588 UH). The left kidney is reduced in size, with hydronephrosis and a 12 × 7 mm pelvic stone (531 UH) (Fig. 1).

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https://doi.org/10.1016/j.ijscr.2025.111095
Received 7 February 2025; Accepted 27 February 2025
Available online 28 February 2025

Due to severe obstructive pyelonephritis, notably caused by the encrusted stent, an urgent bilateral percutaneous nephrostomy was performed, leading to significant clinical improvement and normalization of inflammatory markers and renal function.

Three days later, the patient experienced a generalized seizure associated with dysarthria. Urgent brain CT showed ischemic lesions in the right frontal and left occipital lobes, indicating an embolic stroke. She was started on enoxaparin (0.4 cc daily) and Kardegic (160 mg daily) for stroke prevention.

Despite neurological improvement, four days later the patient developed progressive mucocutaneous pallor, tachycardia (110 beats per minute), hypotension (80/50 mmHg), and gross hematuria from the urinary catheter. Hemoglobin levels dropped from 7.5 g/dL to 4.4 g/dL, raising suspicion of active bleeding. Fluid resuscitation, intravenous vasopressors, and blood transfusions were administered, stabilizing her condition for a contrast-enhanced CT angiography scan.

The CT scan revealed a 17 mm thick, heterogeneous middle polar collection with contrast extravasation in the arterial and portal phases, indicating active bleeding from the upper and middle pole arteries. Intraluminal clots were also present in the renal pelvis and bladder. A diagnosis of post-nephrostomy arteriovenous fistula, exacerbated by anticoagulation therapy for the stroke, was made (Fig. 1).

Urgent renal arteriography via right femoral artery access using a 5-French diagnostic catheter was performed. Selective angiography revealed an AVF at the lower pole of the kidney with early venous drainage into the inferior vena cava, along with a small pseudoaneurysm. Superselective embolization using 3 mm and 5 mm microcoils successfully occluded the fistula, with Gelfoam particles used to prevent retrograde bleeding. A final contrast injection confirmed complete occlusion of the fistula, restoring arterial integrity and halting the hemorrhage (Fig. 2).

Post-embolization, the patient was closely monitored in the ICU. Hemodynamics remained stable, and a collegial decision was made to reintroduce anticoagulation with INR monitoring to manage the ischemic stroke while balancing the bleeding risk. Hematuria resolved, renal function normalized, and the nephrostomy remained functional.

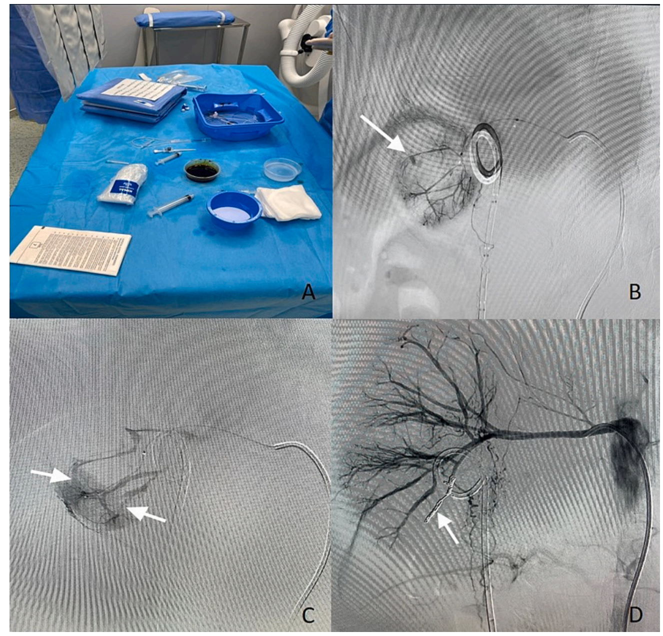

Fig. 2. Embolization: A. Materials used for embolization (including coils, Gelfoam, and microcatheters); B. Discovery of a pseudoaneurysm (white arrow); C. Arteriovenous fistula (AVF) identification (white arrow); D. Embolization with coil (white arrow).

A multidisciplinary approach was taken for definitive treatment. The first stage involved endoscopic laser lithotripsy of the calcified lower loop of the JJ stent, insertion of a second JJ stent in parallel with the encrusted one, and removal of the nephrostomy, which was successfully completed (Fig. 3). The second stage, scheduled six weeks later, included flexible right ureteroscopy to free the upper loop of the calcified JJ stent, fragmentation of the right pelvic stone using laser lithotripsy, and complete removal of the encrusted stent. Unfortunately, the

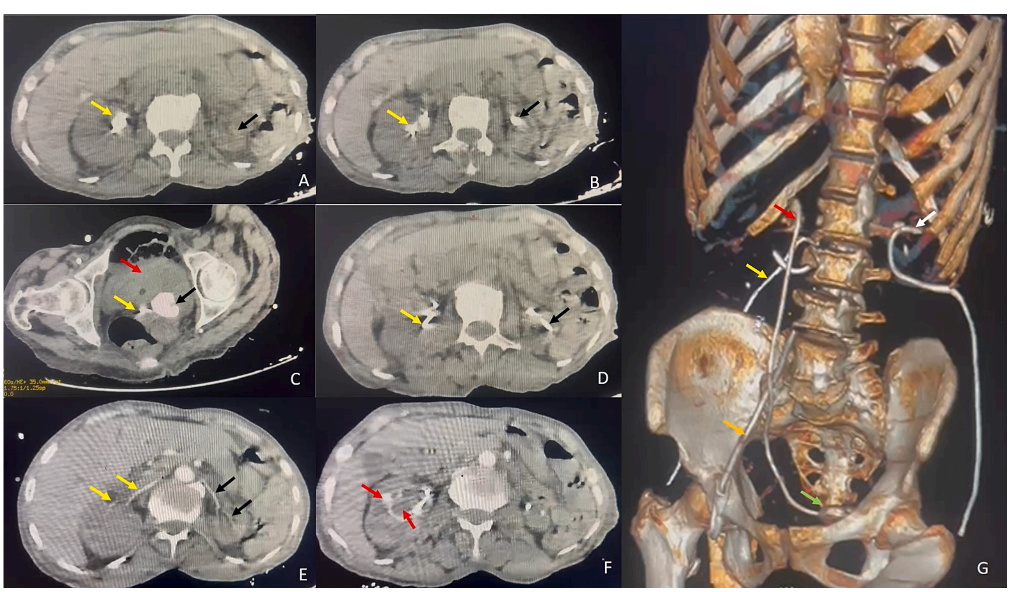

Fig. 1. CT scan: A. Non-contrast CT scan showing a right pelvic stone (yellow arrow) and a small left kidney (black arrow); B. Non-contrast CT scan showing a right double-J stent (yellow arrow) and a left pelvic stone (black arrow); C. Non-contrast pelvic CT scan showing a calcified lower end of the double-J stent (black arrow) with bladder clots (red arrow); D. Non-contrast CT scan showing a right nephrostomy (yellow arrow) and a left nephrostomy (black arrow); E. Contrast-enhanced arterial phase CT scan showing upper pole arteries (yellow arrow) supplying a 17 mm thick, heterogeneous middle polar collection with contrast extravasation, indicative of active bleeding (F, red arrow); G. 3D reconstruction showing the right double-J stent with its calcified upper loop (red arrow) and calcified lower loop (green arrow), the right nephrostomy (yellow arrow), the left nephrostomy (white arrow), and the transfemoral dialysis catheter (orange arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

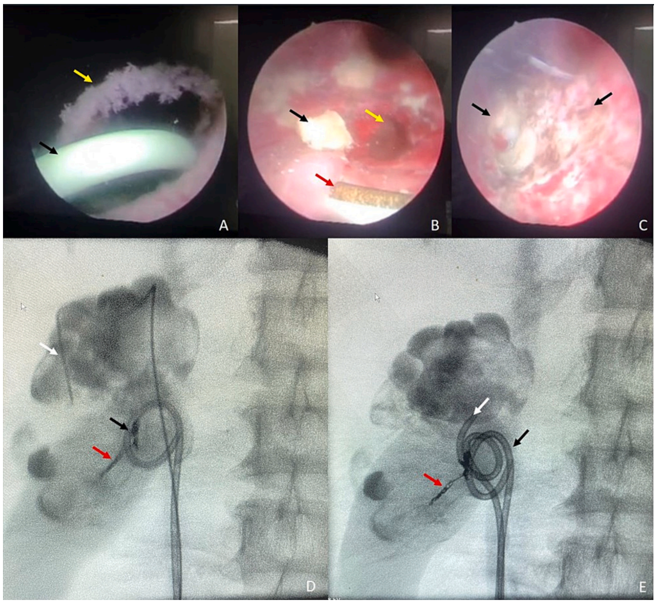

Fig. 3. Peroperative Views: A. Lower loop of the new JJ stent (black arrow) and the old JJ stent after endovesical lithotripsy (yellow arrow); B. Fragment after lithotripsy (black arrow) of the old JJ stent (red arrow) and intravesical blood clot (yellow arrow); C. Mucosal lesion observed on the lateral wall caused by friction from the stone formed by the lower loop of the JJ stent (black arrow); D and E. Insertion of the new JJ stent (red arrow: embolization coil, black arrow: old JJ stent, white arrow: JJ guide and new JJ stent). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

patient's health declined due to multiple factors, including heart failure, poorly controlled diabetes, chronic kidney disease, and a previous stroke, which postponed the completion of the planned second treatment stage.

3. Discussion

Nephrostomy serves three main purposes: therapeutic (draining obstructions, fistulas, or perirenal collections), diagnostic (contrast injection for obstruction detection), and post-PCNL placement [3]. Complications occur in <10 % of cases, with serious complications (e.g., pneumothorax, hemothorax, colon perforation) in fewer than 3 %, making it a safe procedure [2]. AVF after nephrostomy is rare, with fewer than 10 cases on PubMed to our knowledge over 40 years. Literature on AVF after PCNL is more extensive, offering insights relevant to nephrostomy-related AVFs. For instance, Srivastava and al. reported 6 AVFs in 1854 PCNL cases, all treated successfully with embolization [1].

Risk factors for AVF after nephrostomy include prolonged nephrostomy (>4 months, risk ratio 5.5), pyelonephritis (risk increased by 2.05 %), diabetes, staghorn calculi (risk increased by 3.5 %), upper calyx puncture (risk ratio 3.6 compared to lower calyx), and renal anomalies (such as fusion or rotation defects) [4]. Inexperienced practitioners face higher complication rates, though most are minor [5]. No significant association has been found with factors such as PCNL, ESWL, hypertension, or coagulopathies [6].

Symptoms often include hematuria, unexplained anemia, and worsening renal function. Gross hematuria with hemodynamic instability or significant hemoglobin drops should raise suspicion for AVF [7].

Ultrasound (US) is the first imaging choice for suspected AVFs due to its non-invasive nature and availability, with 85 % sensitivity and 92 % specificity [8]. However, it lacks detailed anatomical information. Contrast-enhanced CT angiography is the gold standard, offering 96 % sensitivity and 94 % specificity, providing clear visualization of the fistula and complications [9]. Magnetic resonance angiography is an alternative when CT is contraindicated. Renal arteriography, with 100 % diagnostic accuracy, remains the definitive method for diagnosing and localizing AVFs, especially when embolization is needed, providing real-time guidance [10].

The main differential diagnosis of AVFs is renal pseudoaneurysms. Both share the same symptoms, treatment, and occur in <2 % of cases after nephrostomy or PCNL [11]. AVF are caused by arterial-venous connections, usually near the renal hilum, while PAs result from arterial lumen damage, often in the renal parenchyma [12].

Conservative management may lead to spontaneous closure of AVF in 18 % of cases [5]. This includes nephrostomy repositioning, transfusions, close observation, monitoring of renal function and hematologic parameters, and adjustments to anticoagulants. This approach is only valid for asymptomatic or minimally symptomatic patients with stable hemodynamics, normal renal function, controlled anticoagulation and no infection [13].

For active bleeding or larger AVFs, percutaneous embolization is the primary treatment, with a 94 % success rate, 2.8 % rebleeding rate, and <3 % complications [14]. Supraselective embolization is preferred when possible [15]. Coils are used in 90 % of cases, and Gelfoam (a hemostatic sponge) may be used alone or in combination [14].

In rare cases with significant stenosis or renal artery compromise, renal artery stenting may supplement embolization for complex AVF [15].

Surgery is reserved for complex AVFs or the 6 % of cases unresponsive to embolization, and almost always stops the bleeding [16]. Techniques may include resection of the fistula with vascular repair, partial nephrectomy, or total nephrectomy in cases of major and irreparable damage. Nephron-sparing surgery is preferred when possible [13]. However, surgery carries morbidity risks, including renal infarction and prolonged recovery [2].

Prevention of post-nephrostomy AVF involves several strategies. Lower pole access reduces AVF risk (0.3 % vs. 2.4 % for upper pole) [4]. Using fine needles (21G Chiba), precise imaging (ultrasound/fluoroscopy), and limiting dilation tracts minimize vascular complications [17]. Patients with pre-existing vascular conditions (e.g., atherosclerosis, severe hypertension) are at higher risk and require adjusted procedures [5]. As nephrostomy duration increases AVF risk, early removal is recommended [6]. Educating patients on proper catheter care and preventing accidental dislodgement can reduce complications by 20 % [2]. Clinical surveillance for hematuria or flank pain, along with prompt Doppler or CT evaluation, is essential [7].

4. Conclusion

Post-nephrostomy AVF is a rare but life-threatening event. High suspicion is needed in cases of delayed hematuria and anemia after nephrostomy. Selective embolization remains the gold standard, offering favorable outcomes.

Author contribution

SALIM LACHKAR: Study concept and design, data analysis, writing, and critical revision of the manuscript.

IMAD BOUALAOUI: Data collection, literature review, and drafting of the manuscript.

ADAM EL ABOUDI: literature review.

AHMED IBRAHIMI: Data collection, literature review.

HACHEM EL SAYEGH: Supervision, critical revision, and final approval of the manuscript.

YASSINE NOUINI: Supervision, critical revision, and final approval of the manuscript.

Consent

The patient provided informed consent after receiving detailed information regarding the study and its implications.

Ethical approval

Ethical approval was obtained from our institution. Informed consent was provided by the patient for the publication of case details and images.

This case report is exempt from ethical approval according to the guidelines of the Institutional Review Board (IRB) of Ibn Sina University Hospital. According to our institution's policies, case reports and studies that do not involve clinical trials or interventions are not subject to formal ethical review. Informed consent was obtained from the patient for the publication of this report. As formal ethical approval was not required, no reference number is applicable.

Guarantor

LACHKAR Salim.

Research registration number

Not applicable to this case report.

Methods

This case report has been reported in line with the SCARE criteria [18].

Funding

This research and the publication expenses were solely supported by the author, and no specific grant was received from any public, commercial, or non-profit sectors.

Conflict of interest statement

None.

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