TJVS Turkish Journal of Vascular Surgery

Turk J Vasc Surg XXXX;XX(X):
DOI: 10.9739/tjvs.2025.10.058

Available online at www.turkishjournalofvascularsurgery.org

Case Report

Embolization of renal artery for arteriovenous fistula by cardiothoracic and vascular surgery in Gorontalo: A case report

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Received: October 10, 2025 Accepted: November 12, 2025 Published online: March 04, 2026

Abstract

Percutaneous nephrolithotomy (PCNL) is a standard approach for treating complex and large kidney calculi (>2 cm). In rare cases (0.3-4.7%), vascular complication, such as arteriovenous fistula, results in persistent and continuous hematuria. Artery embolization is the first treatment of choice to stop the bleeding. An 18-year-old male was referred to our center with persistent and continuous hematuria after a PCNL procedure for renal calculi due to arteriovenous fistula. We performed a coil embolization using VortX coils in both feeding arteries to stop the bleeding. No complications were observed after the procedure. No hematuria was observed at three postoperative days. At 1-month follow-up at our outpatient clinic, the patient had no complaints and no hematuria was observed. In conclusion, this case was our first renal artery coil embolization and it was found to be a safe and effective approach to managing persistent and continuous hematuria post-PCNL in resource-limited setting.

Keywords: Embolization, arteriovenous fistula, post-percutaneous nephrolithotomy, hematuria, case report

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is a standard and safe approach for treating complex and large kidney calculi (>2 cm) [1]. In rare cases, vascular complication, such as pseudoaneurysms and arteriovenous fistula, results in persistent and continuous hematuria. Macroscopic hematuria can be seen in 14-24% of cases and severe hematuria manifests only in 0.3-4.7% of patients [2,3].

Most of the cases were treated by conservative treatment, such as hematuria monitoring, serial complete blood count, and blood transfusion. Only small cases of severe hematuria (0.4%) were requiring hemostatic procedure. In the case of severe hematuria with instability hemodynamic, artery embolization is the treatment of choice to stop the bleeding [4]. We report the first experience of renal artery embolization for rare complication after PCNL procedure in cardiothoracic and vascular center in a resource-limited provincial referral hospital in Eastern Indonesia.

CASE REPORT

An 18-year-old male was referred to our center with persistent and continuous hematuria at day 12 after a PCNL procedure of the left kidney for large (>2 cm), multiple, and calcified (886 Hounsfield unit) renal calculi. The patient had complained of hematuria at day 5 after a PCNL procedure. Initially, the patient was treated with conservative treatment, including urine monitoring, catheter spooling, and hemoglobin monitoring. During conservative treatment, hematuria was not resolved, hemoglobin decreased (Hb 8.5 g/dL), platelet decreased (94.000 cells/µL), and hemodynamic was unstable (BP 80/60 mmHg).

CITATION
Pardede JPP, Monoarfa RA, George YAEG. Embolization of renal artery for arteriovenous fistula by cardiothoracic and vascular surgery in gorontalo: A case report. Turk J Vasc Surg. XXXX;XX(X):

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DOI: 10.9739/tjvs.2025.10.058

The patient was given one bag of packed red cells and two bags of thrombocyte concentrate. As a result, the hemoglobin and thrombocyte levels increased, but the hematuria was persistent and continuous. Then, the patient was referred to our center for further diagnosis and treatment. In our center, we performed renal angiography as our initial step to identify the cause of the hematuria. Based on renal angiography, the cause of this persistent and continuous hematuria was an arteriovenous fistula in the inferior and posterior segmental arteries of the ventral rami of the left renal artery (Figure 1). Then, we decided to perform renal artery embolization (RAE). The right femoral artery was punctured by a 5Fr catheter using the Seldinger technique until it reached the left renal. Next, we performed a coil embolization using VortX 4x4.0 millimetre and 6x6.7 millimetre coils in both feeding arteries to stop the bleeding. After coil embolization, we evaluated the coil placement and bleeding using arteriography to ensure total occlusion by the absence of contrast extravasation (Figure 2). No complications were observed after the procedure. No hematuria was observed at three postoperative days. Hemoglobin increased gradually without any blood transfusion which indicates there was no ongoing bleeding. At 1-month follow-up at our outpatient clinic, the patient had no complaints, and no hematuria was observed.

Figure 1. Renal angiography showed contrast extravasation which indicated an arteriovenous fistula in the inferior and posterior segmental arteries of the ventral rami of the left renal artery

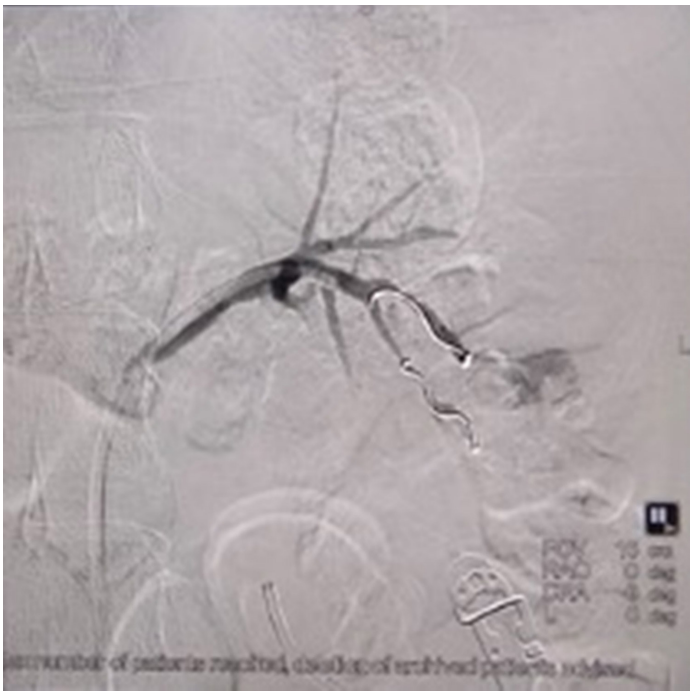

Figure 2. Arteriovenous fistula after coil embolization showed no contrast extravasation

DISCUSSION

In this case report, we reported the first case of post-PCNL hemorrhage due to renal arteriovenous fistula in cardiovascular center in Gorontalo, Eastern Indonesia. As other surgical procedure, one of the PCNL complications was hemorrhage. Most of the hemorrhage cases were successfully managed with conservative treatment, but few number of cases (0.3-4.7%) manifested severe hemorrhage that required invasive intervention [4]. The risk factors of severe hemorrhage are high body mass index, diabetes mellitus, staghorn stones, stone size, Hounsfield units of stone, stone location, and intraoperative factors, such as operative time, puncture selection, and PCNL devices used [5]. In our patient, the hemorrhage most likely caused by the large sized tract and rigid PCNL devices, including, needle, sheaths, and guidewire, that are only available in our city, which required vigorous maneuver to access the stone. In this process, the arterial or venous structure can be damaged, then it forms an arteriovenous fistula. Yamaguchi et al. [6]. found that the bleeding complication increased as the tract size increased [6] .The blood transfusion rates were 1.1% for tract sizes less than 18 Fr and it increased to 12.1% for tract sizes more than 30 Fr [6]. Other risk factors in our patient were large sized stone and high Hounsfield unit of the stone. Our patient had multiple large (>2 cm) sized stone with 886 Hounsfield unit (HU). Arora et al. found that the size of stones was an important factor for severe vessel injury [7]. Gok and Cift et al. also found that the risk of bleeding complication increased as the Hounsfield unit

of stone increased [8]. Large and hard stones increase the risk of bleeding because it requires many maneuvers to break the stone within pelvicalyceal system, which increases the incidence of parenchymal and vessel injury. Besides, it also prolongs the operative time, which increases the risk of complications [2].

Hemorrhage complication after PCNL often manifests as hematuria, unexplained anemia, or decreased renal function. Gross, continuous, and persistent hematuria with hemodynamic instability of hemoglobin drops should raise a suspicion for AVF [2]. These signs and symptoms were found in our patient. Therefore, he referred to our center for further diagnosis and treatment.

In suspected AVF, ultrasound imaging is the first choice due to its availability and non-invasiveness. However, it only offers 85% sensitivity and 92% specificity, also it does not give the anatomical information of the AVF [2]. The gold standard of imaging was contrast-enhanced computed tomography (CT) angiography because it has high sensitivity and high specificity, with the detailed information of anatomical information [2]. If the contrast is contraindicated, magnetic resonance angiography (MRA) can be used as an alternative [2]. However, contrast-enhanced CT angiography and MRA is not available in our center. Therefore, we directly performed renal angiography to diagnose and localize the AVF because it gives 100% diagnostic accuracy and allows direct and real-time guidance to perform embolization if needed.

Based on renal angiography, the cause of persistent and continuous hematuria was an arteriovenous fistula in the inferior and posterior segmental arteries of the ventral rami of the left renal artery [9]. The differential diagnosis was pseudoaneurysms which showed same signs and symptoms. The appearance of the vascular lesion in our patient was contrast extravasation at the abnormal connection between arteries and veins. Therefore, it was concluded as AVF rather than pseudoaneurysms which characterized as blood contained sac or mass [9].

In all cases, conservative management was initiated, and it included urine monitoring, transfusions, hematologic and renal function parameters, and anticoagulants. In 18% of cases, it led to spontaneous closure of AVF [10]. However, invasive intervention is required in active bleeding with haemoglobin drops and instability hemodynamics. The first choice was embolization that appears as a safe and effective approach. Previous studies found that RAE in post-PCNL hemorrhage had 71-100% of success rate. [11] Surgery, including vascular repair and nephrectomy, is only indicated in failed embolization, large hematoma, and severe infection [10]. We decided to perform RAE in our patient. Initially, we performed renal angiography by puncturing the right femoral artery using a 5Fr catheter by using the Seldinger technique until it reached the left renal. Then, we deployed VortX 4x4.0 millimetre and 6x6.7 millimetre coils using a guide wire in both feeding arteries to stop the bleeding. After coil embolization, we evaluated the coil placement and bleeding using arteriography to ensure total occlusion by the absence of contrast extravasation [12]. This is our first experience in performing RAE. We only used limited resources that are available in our center, which are VortX 4x4.0 millimetre and 6x6.7 millimetre coils. Theoretically, coils are used in 90% artery embolization procedure and its size should be 30-40% larger than the vessel diameter [13]. Zhang et al found that larger coil achieved initial occlusion, decreased coil number, and reduced recurrence [14].

Besides its high success rate, RAE offers minimal complications. The most common complication of RAE is postembolization syndrome which only needs supportive treatment, such as analgesics, antipyretics, and antiemetics. The very uncommon complication is arterial rupture and coil migration. Overall, RAE is considered a safe procedure to manage AVF [15].

In our case, no complications were observed after the procedure. No hematuria was observed at three postoperative days. Hemoglobin increased gradually without any blood transfusion which indicated there was no ongoing bleeding. At 1-month follow-up at our outpatient clinic, the patient had no complaints, and no hematuria was observed.

This successful experience of renal artery embolization for post-PCNL hemorrhage due to AVF marks a crucial moment for the cardiothoracic and vascular surgery in Gorontalo. It serves as a powerful demonstration that, even with currently limited resources, our team possesses the capability and expertise to manage complex vascular complications effectively.

CONCLUSION

In conclusion, persistent and continuous hematuria post-PCNL occurs in some cases due to vascular complications, such as pseudoaneurysms and arteriovenous fistula. This is our first experience in performing renal artery coil embolization as a safe and effective approach to managing persistent and continuous hematuria post-PCNL.

Patient Consent for Publication: Informed consent was obtained, and procedures followed institutional ethical standards.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: All authors contributed equally to the article.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

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