



# Endovascular Management of Post-PCNL Vascular Injuries

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## Abstract

**Introduction:** Although PCNL is gold standard treatment for large kidney stones; vascular injuries like Pseudoaneurysm (PA) and Arteriovenous Fistula (AVF) may occur due to renal punctures that need to be detect and manage early. In this study we aimed to evaluate the use of angiography in the detection and management of renal vascular injuries after PCNL and the efficacy of this management.

**Material and Method:** In this prospective study, all patients who underwent endovascular management to identify the vascular pathology after PCNL at Sina Hospital were evaluated. Embolization with coil was done for all of them.

The follow-up included clinical findings especially hematuria, as well as ultrasonography when necessary to detect any collection.

**Results:** Among 14 patients with post-PCNL vascular injury, we identified 10 patients with PA and 4 patients with AVF, 1 patient with both subscapular hematoma and PA. Angiographic embolization was successful in all patients. In cases that parenchymal damage was in peripheral region, the common complication was PA and when the damage was in the hilar region, complication was AVF. No any complication and re-bleeding were detecting embolization.

**Conclusion:** Vascular injury like PA and AVF are frequent complication after PCNL that needs to be detected and managed. Based on our study, angioembolization is the preferred method for the treatment of vascular and parenchymal injury as it can detect and immediately treated once they are detected and also it has high success rate.

**Keywords:** PCNL; PSEUDO-aneurism; Arteriovenous fistula; Angiography; Coil embolization

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## Introduction

Percutaneous Nephrolithotomy (PCNL) is a common and safe treatment for large kidney stones [1]. However the possibility of complications cannot be ignored. It is reported that renal hemorrhage is the most complication after PCNL [2]. The incidence of severe hemorrhage reported to be 11.2% to 17.5% [3].

It is also noted that retroperitoneal and subscapular hematoma are common post-PCNL renal complication [4]. Almost always vascular injuries occur due to renal punctures [5]. Vascular injury can be resolve by its own or lead to Pseudo-Aneurysm (PA) and Arteriovenous Fistula (AVF) that needs to be detected and managed [1,5].

It has shown that conservative treatment like clamping of nephrostomy tube, hydration and blood transfusion are in effective; however, transcatheter arterial embolization has been recommended to be a safe and effective method [6,7]. Although it is effective in management of vascular injuries after PCN, early diagnosis and management are still necessary [6].

It is reported that diagnosis of vascular injuries is based on CT angiogram and then angiography [5]. But in this study, based on severity and continuity of bleeding we use angiography without CT.

In this study we aimed to evaluate the use of angiography in the detection and management of renal vascular injuries after PCNL and the efficacy of this management.

## Material and Methods

In this prospective study all patients who had post-PCNL complications in our center over a period of two years were evaluated.

There were a total of 476 patients who underwent PCNL at Sina Hospital (Tehran University of Medical Sciences) between 2019 to 2021 and 14 patients who had complications, were consulted with the vascular surgery service.

After local anesthesia, arteriography of the renal artery was performed for all patients *via* common femoral artery. Then diagnostic-catheter and micro-catheter was placed *via* renal artery and embolization agent, coil, was used. After this procedure, control angiography was performed to confirm vascular stasis.

Angiographic embolization treatment with coil was done for all of them in the same session. After the embolization, follow-up were done to evaluate complications. The follow-up included clinical findings especially hematuria, as well as ultrasonography when necessary to detect any collection.

## Results

In this study, all 14 patients underwent angiography to identify the vascular pathology of the bleeding after PCNL. Embolization with coil was done for all of them.

Among them, we identified 10 patients with PA and 4 patients with AVF. A combination of PA and AVF was not found in any patient (Figure 1). One of our patients had both subscapular hematoma and PA. Angiographic embolization was successful in all patients (Figure 2).

Based on our study, 9 of the lesions were found in the right kidney and 5 in the left kidney. In cases that parenchymal damage was in peripheral region, the common complication was PA and when the damage was in the hilar region, complication was AVF. None of the patients had re-bleeding in follow-up period. After embolization, none of the patients experienced any complication. Ultrasonography after embolization showed no collection in any patient.

## Discussion

The PCNL is a minimal invasive and golden standard treatment for large kidney stones [1]. The most common complication of PCNL is bleeding that may occur due to renal puncture or renal vascular damage [5]. AVF and PA are frequent endovascular complication and need urgent intervention to be diagnosed and managed early [1]. It is reported that pseudo-aneurysm is the most common cause of intra-renal bleeding after PCNL and it has the incidence rate of 0.6 to 1 [5,8]. Similarly, it is showed in present study that PA is the most common endovascular complication (10 patients).

It is reported that diagnosis of vascular injuries is based on CT angiogram and then angiography [5]. But in this study, based on severity and continuity of bleeding, we use angiography without CT. Angiography is the preferred method and has advantages as it can detect vascular lesions and immediately treated once they are detected, as we used in all of our patients [1].

PA has a structural characteristic that increase risk of rupture, even higher than renal aneurysms [7]. Therefore, all PAs should be diagnosed and treated immediately after detection. By developing interventional techniques, PAs can detect and treat by using embolization materials like coils [3].

In 2020, Roca et al. evaluate hemorrhagic complications after PCNL and the results of their endovascular treatment. All patients with hemorrhagic complications managed with arteriography and

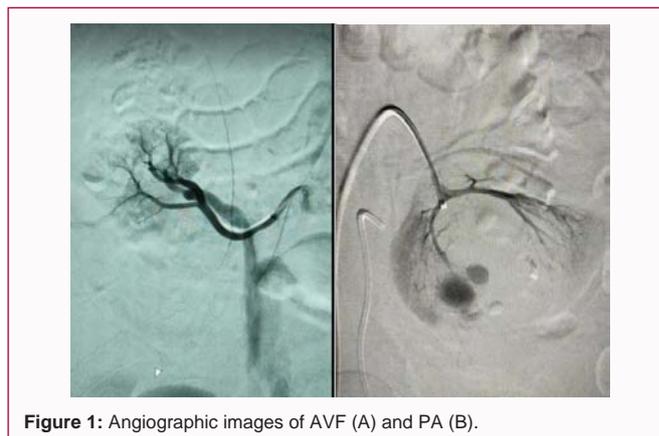


Figure 1: Angiographic images of AVF (A) and PA (B).

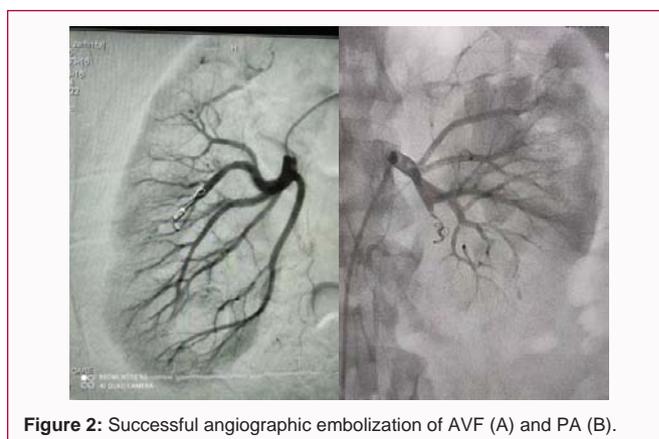


Figure 2: Successful angiographic embolization of AVF (A) and PA (B).

selective embolization. Based on their findings, 54% of their patients had PA, 14% had AVF, 7% had extravasations and 25% had combined PA and AVF. Mean interval time between PCNL and arteriography and selective embolization was 7 days. They concluded that rapid detection and treatment of post PCNL vascular injuries with arteriography and selective embolization an effective and minimally invasive method [1].

In another study, Anand et al. evaluate hematuria causes after PCNL and their best treatment. In their study, 8.3% of patients had AVF. They concluded that early detection and treatment of hematuria causes warranted postoperative outcome [5].

Poyraz et al. retrospectively evaluated endovascular treatment of bleeding after PCNL. Based on their study, 19 patients underwent angiography and embolization to control bleeding. The mean time between PCNL and hemorrhage was 7.2 days. Based on angiographic findings, 14 patients had PA, 5 patients had AVF and 3 patients had PA plus AVF.

Other studies mostly are retrospective, while in current study we prospectively evaluated all patients who had complications after PCNL. As we mentioned earlier, it is very important to detect and immediately treat endovascular complication like PA and AVF. Therefore, using angiography gives us the opportunity to do this immediately and patients receive fewer contrasts and less radiation in contrast to use CT angiography first. A total of 14 patients who experienced post PCNL complications, underwent Angiography and 100% of them been well treated without any complications.

In opposition of other studies who used coil for treatment of AV

fistula and butyl cyanoacrylate for pseudo-aneurysm, in current study we used coil for all of the patients and it has 100% of success and no complications were seen.

## Conclusion

Vascular injuries like PA and AVF are frequent complication after PCNL that need to be detected and managed. Based on our study, angioembolization is the preferred method for the treatment of vascular and parenchymal injuries, as it can detect injuries and them immediately treated once they are detected and also it has high success rate.

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