

Endovascular management of iatrogenic renal vascular injuries complicating percutaneous nephrolithotomy: Role of renal angiography and embolization; an analysis of 159 cases

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Abstract

Objective: To describe the use of renal angiography in the detection of renal vascular injuries following percutaneous nephrolithotomy and to assess the efficacy of endovascular management of these complications. **Materials and Methods:** This was a retrospective review of 159 consecutive patients over a period of 12 years from 2005 to 2016 who presented with significant post nephrolithotomy hemorrhage and who were evaluated by renal angiography as a first-line diagnostic study, followed by embolization of identified renal vascular injuries in the same session. The parameters assessed for each patient included type of renal vascular injury identified, type of embolic material and therapeutic outcome. **Results:** Renal vascular lesions identified in 119 patients were treated with embolization with complete resolution of hemorrhage, no further clinical deterioration and preservation of renal function. **Conclusions:** Renal vascular injury is a rare complication of percutaneous nephrolithotomy. Early renal angiography and selective embolization can play an integral diagnostic and therapeutic role.

Key words: Angiography; embolization, nephrolithotomy; percutaneous; therapeutic

Introduction

Percutaneous nephrolithotomy (PCNL) is a safe and effective treatment modality for the management of renal calculi. This technique is associated with high success rates, decreased morbidity and few complications. The incidence of postoperative hemorrhage complicating PCNL ranges from 0.8% to 7.0%. PCNL has largely replaced open surgery for patients of all ages and for

nearly all types of renal stones. The reported incidence of vascular injury and hemorrhage is lower for PCNL than for open surgery for renal stones.^[1] This study aimed to describe the use of renal angiography in the detection of renal vascular injuries following PCNL, as well as to assess the efficacy of endovascular management of these complications.

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Materials and Methods

Patients

This study was a retrospective review of 159 consecutive patients who were referred to a single interventional radiologist over a period of 12 years from 2005 to 2016. The parameters assessed were type of renal vascular injury identified, embolization technique, and therapeutic outcome.

Design

All patients who presented with significant post-PCNL hemorrhage were evaluated by renal angiography as a first-line imaging study. Patients who had vascular complications identified by renal angiography were subsequently treated with embolization in the same session. Common femoral artery access was followed by an abdominal aortogram to demonstrate the vascular anatomy, to determine the presence of accessory renal arteries [Figures 1-3] and to exclude iatrogenic injury to extrarenal vessels. Selective renal arteriogram on the affected side was then performed following assessment of the anatomical configuration of the ipsilateral renal artery. After the site and type of vascular injury was identified by the renal arteriogram, selective or superselective catheterization of the feeding vessel was then performed using diagnostic or microcatheters. In all affected patients, embolic materials consisting of butyl cyanoacrylate (Glue) [Figure 1], coils [Figures 2-4] and gelfoam [Figures 5 and 6] and were used to exclude the lesion from the renal circulation without

compromising the vascular supply to the rest of the kidney. A completion angiogram was performed after the procedure to document vascular stasis.

Results

Renal angiography in 159 consecutive patients who underwent PCNL from January 2005 to 2016 presented with significant post-PCNL hemorrhage showed pseudoaneurysm 83 (52.2%) [Table 1 and Figure 1], arteriovenous fistula (AVF) 21 (13.2%) [Figures 2 and 3], aneurysm and AVF 8 (5%) active bleeding in 5 (4.2%), perirenal hematoma 2 (1.25%) and normal findings in 40 (25.1%). The mean time to presentation was 11.5 days (range, 1 to 60 days) following PCNL. Renal angiograms were performed as first-line imaging studies except a few patients underwent abdominal ultrasound when there was a suspicion of perirenal hematoma, and a single case who underwent CT angiogram prior to renal angiogram. One hundred and nineteen patients underwent embolization in the same sitting of diagnostic renal angiogram. One technical failure

Table 1: Renal angiogram findings in patients

Renal Lesions	Number of Patients	Percentage
Pseudoaneurysm	83	52.2
Arteriovenous fistula	21	13.2
Aneurysm and AVF	8	5
Perirenal hematoma	2	1.25
Active bleeding	5	4.2
Normal study	40	25.1

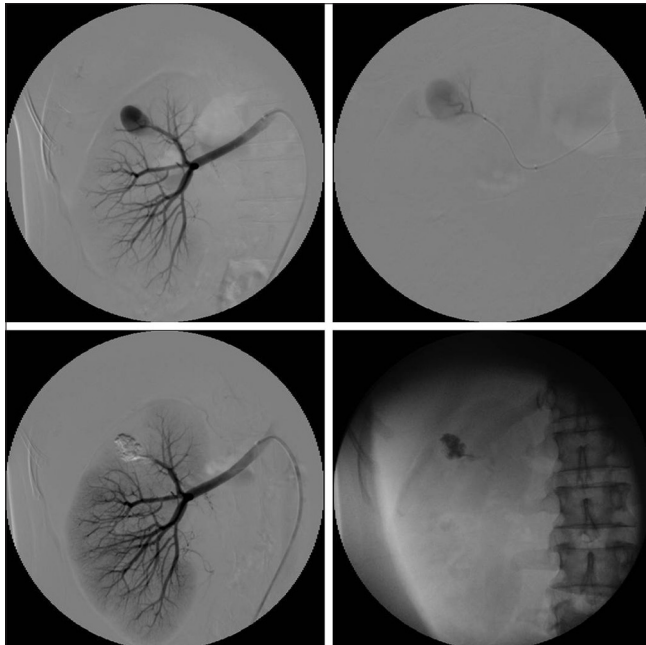


Figure 1: Post-PCNL hematuria in a 45-year-old women showed pseudoaneurysm on digital subtraction angiogram on the right side. Embolized with n butyl cyano acrylate (glue). Check angiogram showed occlusion of aneurysm. Plain radiograph showed glue cast in the aneurysm area

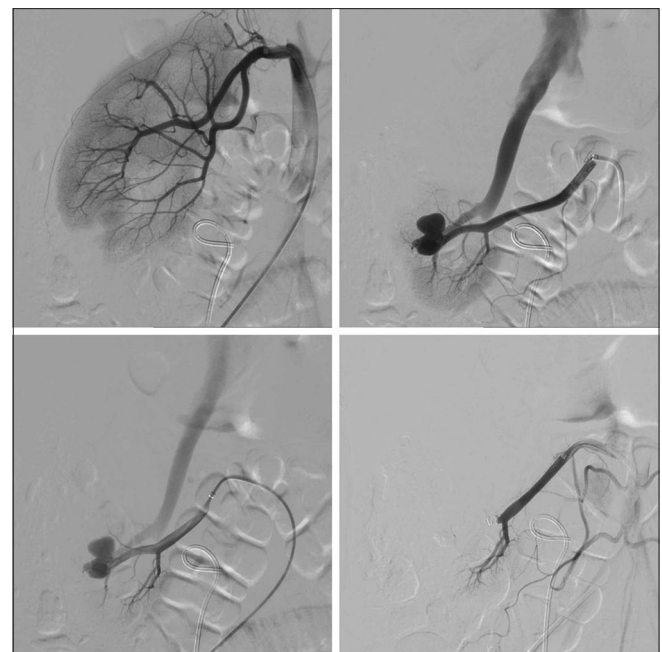


Figure 2: A 31-year-old woman with post-PCNL hematuria showed double renal arteries. AVF from lower polar artery embolized with coil. Control angiogram showed occlusion of AVF

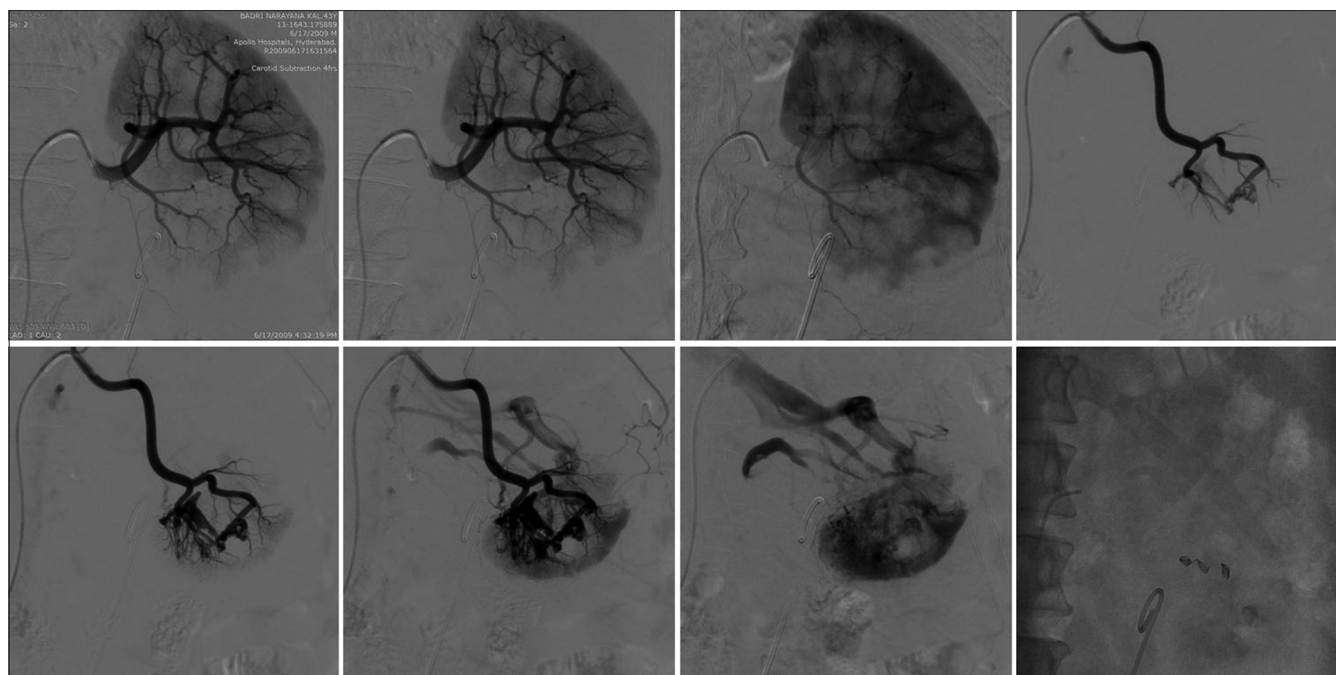


Figure 3: Double renal arteries. AVF from lower polar artery on left side embolized with coils. Control angiogram showed occlusion of AVF

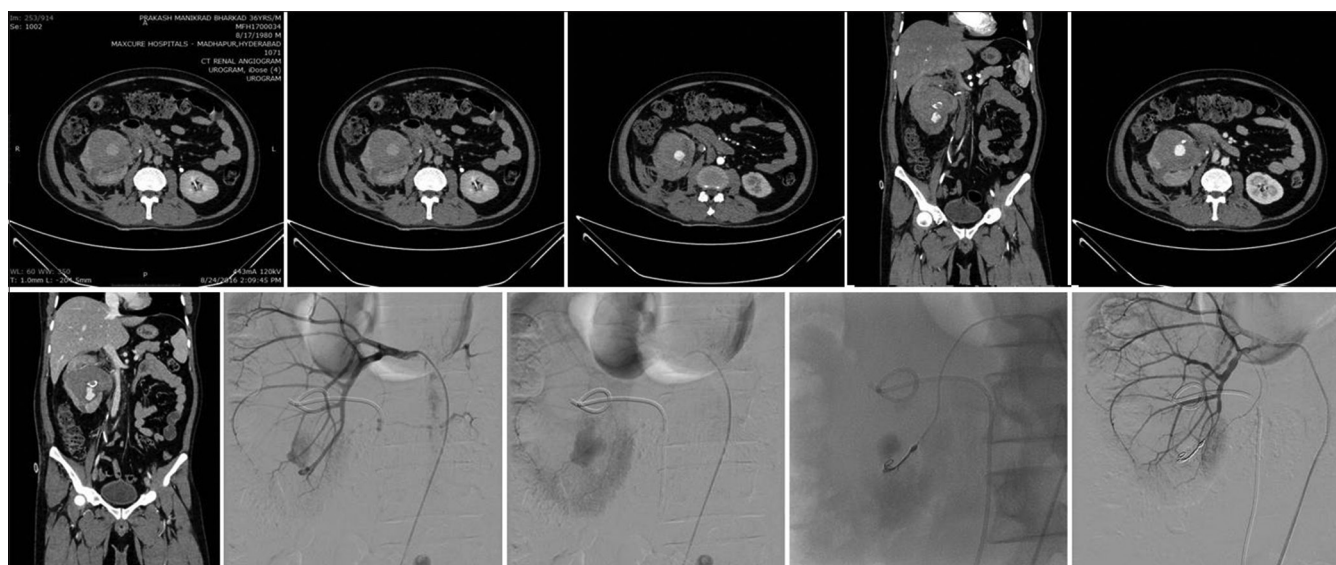


Figure 4: Large stag horn calculus with hydronephrosis with massive hematuria during 2nd postoperative day. CT angiogram showed large pseudoaneurysm in the right lower polar region. Digital subtraction angiogram showed pseudoaneurysm. Control angiogram after coil embolization showed occlusion of the lesion

due to dissection of renal artery, initially undergone successful embolization subsequently. Embolic materials used were gelfoam [Figures 5 and 6], coils [Figures 2-4], glue [Figure 1], or combination of materials. Coils were embolic materials in 51 cases (42.8%), coils in (36.1%), gelfoam in 22 (18.5%) and combination of coils and glue in 3 (2.5%). No recurrence of bleeding was noted in the immediate postprocedural follow-up or in embolized group or in normal angiogram group. No empirical embolization was done.

Discussion

PCNL is the treatment of choice for most renal calculi. Although the technique is safe and effective, complications of significant postoperative hemorrhage have been reported.^[2] Bleeding may also be encountered during puncture and track dilatation, however, this often responds to the tamponade effect provided by placement of the nephrostomy tube. Nephrostomy-related vascular injuries are believed to be the result of trauma to either

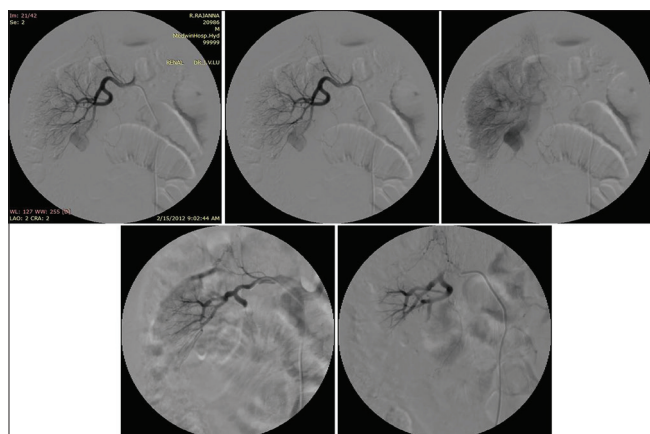


Figure 5: Post-PCNL hematuria in a 42-year-old man showed pseudoaneurysm on digital subtraction angiogram on right side. Embolized with gelfoam. Check angiogram showed occlusion of aneurysm

the anterior or posterior segmental arteries, rather than the smaller peripheral interlobular arteries, which are surrounded by dense parenchyma and therefore easier to tamponade with the nephrostomy tube. Endovascular techniques are increasingly used to accurately diagnose and effectively treat vascular complications arising from percutaneous interventions. The choice of embolic material depends on the site and accessibility of the vessel feeding the pseudoaneurysm or AVF. With the past experience of 30 years in embolization of various renal lesions, choice of embolic material was chosen. For large AVFs coils were choice of embolic material; for aneurysms n butyl cyanoacrylate was the embolic material of choice and for smaller lesions, either a fistula or aneurysm, gelfoam was used. Phadke *et al.*^[3] recommended using steel coils after gelfoam pledgets for medium-sized feeding vessels. We report our experience with transcatheter arterial embolization in a series of 119 consecutive patients with renal bleeding following percutaneous procedures. Treatment was successful in all patients and no complication was observed either at early or late follow-up, confirming the safety and efficacy of this technique. The reported success rate ranges from 80 to 100%.^[4-10] The minimally invasive nature and the rapid cessation of hemorrhage, together with minimal loss of renal function, makes superselective embolization a valuable tool. The authors recognize that renal ultrasonography and CT scans of the kidneys are potentially valuable noninvasive imaging modalities that can also be used to assess pre-angiographic evaluation of lesions for positive or negative findings, which will help in management protocol. Lesions detected on imaging should undergo therapeutic embolization or negative imaging studies may be used to continue conservative treatment.

Conclusion

Our results confirm safety and efficacy of transcatheter renal artery embolization in acute patients with arterial



Figure 6: Active bleeding noted in multiple areas. Control angiogram showed disappearance of bleeding areas

lesions following percutaneous nephrolithotomy. High success rate, low incidence of complications and rapid recovery represent highly appealing reasons for making this technique the first-choice treatment option in cases of severe renal hemorrhage. Hyperselective catheterization and embolization allow parenchymal sparing, thus reducing the incidence of adverse events such as renal dysfunction and hypertension. A close cooperation between interventional radiologists and urologists is mandatory to enable prompt and effective treatment of this rare but severe complication as well as to avoid major surgery.

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Nil.

Conflicts of interest

There are no conflict of interest.

References

1. Al-Kohlany KM, Shokeir AA, Mosbah A. Treatment of complete staghorn stones: A prospective randomized comparison of open surgery versus percutaneous nephrolithotomy. *J Urol* 2005;173:469-73.
2. Kim SC, Kuo RL, Lingeman JE. Percutaneous nephrolithotomy: An update. *Curr Opin Urol* 2003;13:235-41.
3. Phadke RV, Sawlani V, Rastogi H. Iatrogenic renal vascular injuries and their radiological management. *Clin Radiol* 1997;52:119-23.
4. Martin X, Murat FJ, Feitosa LC, Rouvière O, Lyonnet D, Gelet A, *et al.* Severe bleeding after nephrolithotomy; Results of therapeutic embolization. *Eur Urol* 2000;37:136-9.
5. Vignali C, Lonzi S, Bargellini I, Cioni R, Petruzzi P, Caramella D, *et al.* Vascular injuries after percutaneous renal procedures: Treatment by transcatheter embolization. *Eur Radiol* 2004;14:723-9.

6. Wang C, Mao Q, Tan F, Shen B. Superselective renal artery embolization in the treatment of renal hemorrhage. *Ir J Med Sci* 2013;183:5963.
7. Uflacker R, Paolini RM, Lima S. Management of traumatic hematuria by selective renal artery embolization. *J Urol* 1984;132:662-6.
8. Cantasdemir M, Adaletli I, Cebi D, Kantarci F, Selcuk ND, Numan F. Emergency endovascular embolization of traumatic intrarenal arterial pseudoaneurysms with N-butyl cyanoacrylate. *Clin Radiol* 2003;58:560.
9. Chiramel GK, Keshava SN, Moses V, Kekre N, Tamilarasi V, Devasia A. Clinical outcomes of endovascularly managed iatrogenic renal hemorrhages. *Indian J Radiol Imaging* 2015;25:380-90.
10. Martin X, Murat FJ, Feltosa LC. Severe bleeding after nephrolithotomy: Results of hyperselective embolization. *Eur Urol* 2000;37:136-9.