Synchronous endovascular management of post PCNL concurrent pseudoaneurysm and AV fistula

Sri Hari J.[1], Donboklang Lynser[1,2], Chhunthang Daniala[1], Gareth Yobel Lyngwa[1], Cornerstone Wann[1]

[1]Department of Radiology, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences Shillong, 792018, Meghalaya, India

Swiss Journal of Radiology and Nuclear Medicine - www.sjoranm.com - SJORANM GmbH - Rosenweg 3 - CH-6340 Baar - Switzerland

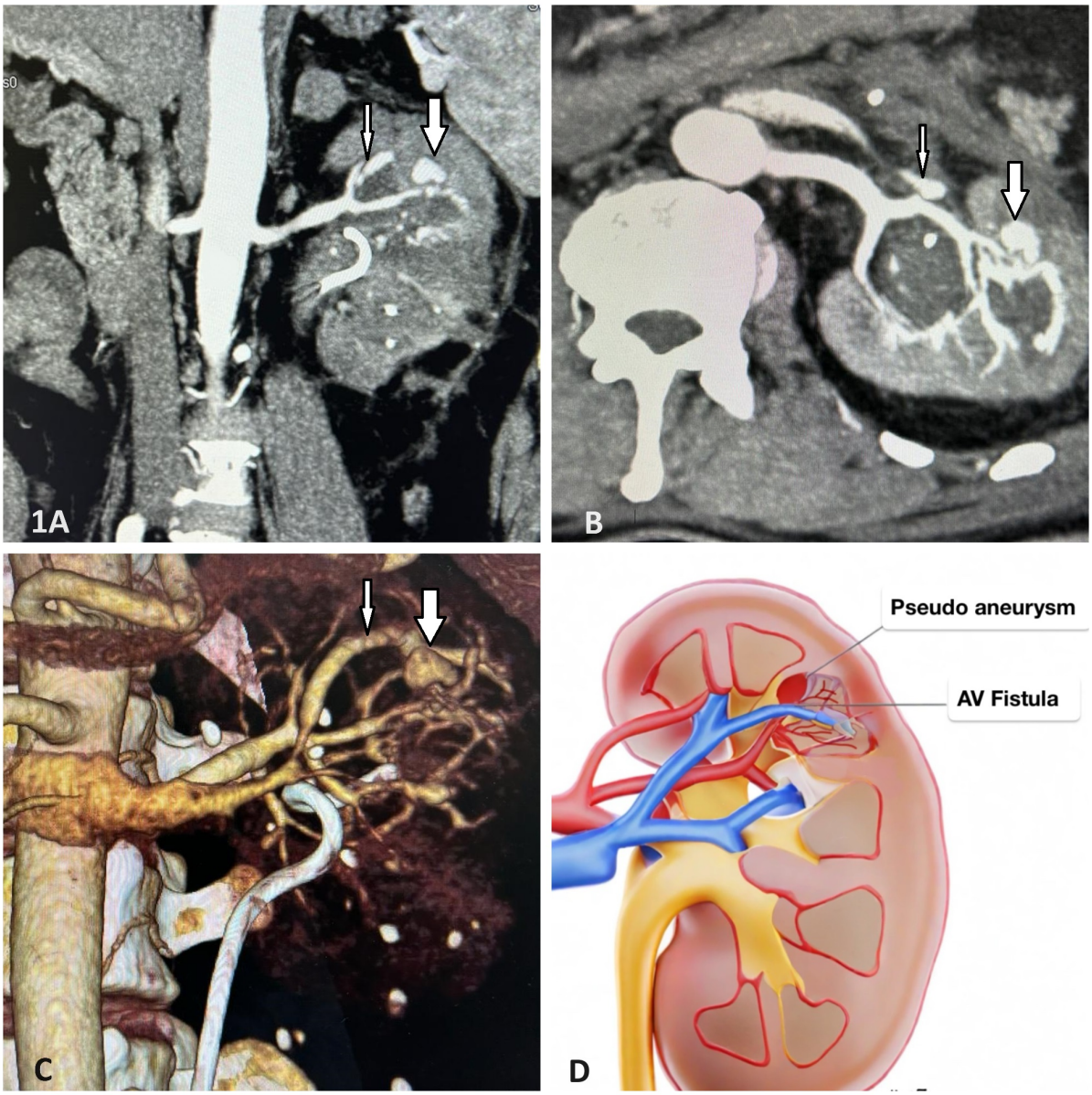


Figure 1: CECT of a post-PCNL renal pseudoaneurysm with arteriovenous fistula in the left kidney. A. CT angiography in coronal section showing the pseudoaneurysm (thick arrow) with early draining vein (thin arrow). B. CT angiography in axial section showing the pseudoaneurysm (thick arrow) with early draining vein (thin arrow). C. Volume rendering showing the pseudoaneurysm (thick arrow) with AVF showing early draining vein (thin arrow). D. Diagrammatic representation of the renal pseudoaneurysm with AVF.

2Corresponding author: Donboklang Lynser - received: 11.09.2024 - published: 25.09.2024

Open Access · CC BY 4.0 · © 2024 The Author(s) · Published by SJORANM GmbH, Switzerland

Abstract

Percutaneous nephrolithotomy (PCNL) is the standard treatment procedure for large stones associated with complications like pseudoaneurysm and arteriovenous fistula with their incidence being < 1%. A post-PCNL case with left flank pain and delayed haematuria presented with macroscopic haematuria and depleting haemoglobin levels. CT angiography with 3-D reconstruction was used for diagnosing and planning of treatment. The patient was successfully treated with super selective angioembolization (SAE) using peripheral coils while preserving the kidney's remaining vascularization. Early diagnosis and active endovascular treatment using angioembolization techniques can be life-saving and resulting in minimal post-procedure complications and early recovery.

Keywords: AV fistula, pseudoaneurysm, therapeutic embolization

Introduction

Percutaneous nephrolithotomy (PCNL) is still considered the standard treatment for the management of staghorn/ large kidney stones, upper pole stones resistant to other treatments, difficult-to-reach lower pole stones, cystine stones, and stones in kidneys with abnormal anatomy. PNL is a safe and time-tested procedure associated with complications ranging from transient peri-nephrostomy catheter urine leakage (15.2%) to vascular injury (1.4%) and sepsis (0.6%) (1). Vascular complications such as Pseudoaneurysm (PA) and AV fistula (AVF) are associated with delayed bleeding and the concomitant occurrence of the same is rare.

Case Presentation

A 58-year-old male patient on maintenance hemodialysis presented with complaints of left flank pain for 1 month and blood in urine for 17 days. The patient had bilateral staghorn calculus and a few secondary smaller calculi with left calculus causing grade 2 hydronephrosis. PCNL procedure for the left renal calculus 1 month back was followed by delayed haematuria suggestive of vascular injury. Clinically, there was macroscopic haematuria, low hemoglobin level (8 gm/dl), and metabolic acidosis with raised serum creatinine (2mg/dl).

CT-Angiography on a Siemens MS-CT Scan (128 Slice), Definition AS+ Excel Siemens showed a saccular out-pouching/puddling of contrast along the distal part of the middle segmental artery of the left renal artery in arterial phase suggestive of PA with early opacification of the left renal vein suggestive of AVF (Figure 1A-B). Multiplanar and 3-D reconstruction confirmation done for embolization planning (Figure 1C). Using a 5F Cobra catheter Digital subtraction angiography (DSA) of left renal artery showed an abnormal tuft of vessels noted distally at the mid-pole of the left kidney with an abnormal vessel (AV Fistula) arching over from this region to drain into the left renal vein (Figure 2 A-B). Selective angiography with a 4F H1 catheter in mid mid-segmental artery was performed followed by coil embolization using a peripheral coil (3mm x 3cm) deployed at this region with its tip at the AVF and proximal end remaining in the supplying mid-segmental artery (Figure 2C). Post-procedure DSA at 5 minutes shows the coil deployed in situ with a reduction in flow across AVF and the absence of tuft of vessels (Figure 2D). Post-procedure day 2 shows no macroscopic hematuria with eventual improvement in the patient's condition.

Discussion

PCNL though less invasive compared to open surgery, can still be associated with a wide range of complications. Vascular injury is a rare and major complication with risk factors like UTI, diabetes mellitus, stone complexity, number of stones, puncture site, and number of punctures (2). Delayed bleeding is defined as bleeding after 24 hours with most frequent angiographic findings being arterial pseudoaneurysms and/or AFV (3). It results in hematuria, hypertension, decreased renal function, and congestive heart failure. Segmental arteries are more commonly involved than their peripheral branches. In a retrospective study of 3878 patients undergoing PNL, 1% of patients had severe bleeding with 5.5% needing transfusion and 1% needing super selective angiography. Renal angiography in this study revealed PA in 20 patients, AVF in 9 patients, and both in 2 patients (4). Although Angiography is the gold standard investigation, CT Angiography is the initial investigation of choice and the modality of choice for follow-up. Studies

have reported a high sensitivity of 86.8 - 90.3% and a high specificity of 83.3 – 100% (5,6) for CT analysis. Active bleeding appears as a focal area of high density on the arterial phase, increasing in size on the venous phase, whereas PA does not increase in size. AVF appears as early contrast filling off the renal vein, thereby assisting in endovascular planning.

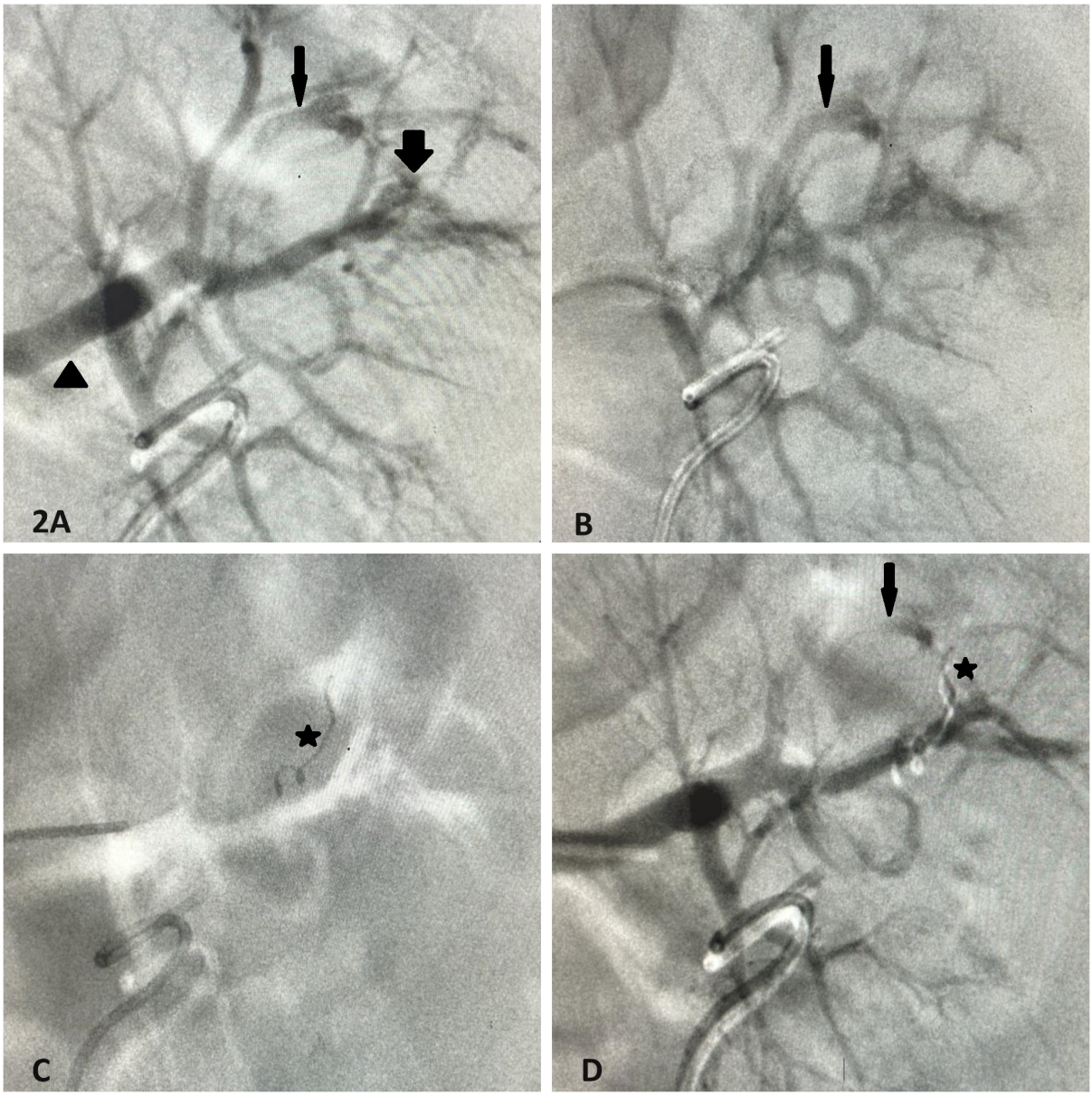


Figure 2: Digital subtraction with embolization of post-PCNL renal pseudoaneurysm with arteriovenous fistula. A. DSA of left renal artery showing normal left renal artery (triangle), with arterio-venous fistula (thin arrow), the pseudoaneurysm (thick arrow) is faintly seen. B. On selective segmental artery injection, the fistula is better seen (thin arrow). C. Endovascular peripheral coil (star) deployment in the feeding vessel done. D. Post-coil deployment (star) showing reduced flow in the AVF (thin arrow).

Selective angio embolization is the treatment of choice, considering the less invasiveness and parenchymal loss. Persistent bleeding, hemoglobin drop of ≥ 3 gm/dl, and hemodynamically unstable patients are the indications for TAE. The success rate of embolization for vascular injuries post PCNL varies from 85% to 100% (7). Though TAE can result in various complications, use of smaller catheters or microcatheters inserted coaxially to the desired target lesion mitigates those risks (5). Different embolizing agents such as particulate agents, liquid agents, and micro coils can be used alone or combined to treat. Simultaneous treatment of PA and AVF in this case, proved to be technically challenging with

the risk of dislodgement and embolization of embolic agents.

Conclusion

In conclusion, CT analysis with the necessary protocols, multiplanar, and 3-D reconstructions aid in the early diagnosis and treatment planning for serious post-PCNL vascular complications such as PA and AVF. SAE is the standard treatment of choice with fewer complications and renal sparing features leading to early recovery.

Correspondence to:
Dr Donboklang Lynser
https://orcid.org/0000-0001-5525-2422
Department of Radiology, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences, Shillong 792018, Meghalaya, India.
https://www.neigrihms.gov.in/



Conflict of interest:

The authors declare that there were no conflicts of interest within the meaning of the recommendations of the International Committee of Medical Journal Editors when the article was written.

Disclaimer/Publisher's Note:

The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of Swiss J. Radiol. Nucl. Med. and/or the editor(s). Swiss J. Radiol. Nucl. Med. and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

License Policy:

This work is licensed under a Creative Commons Attribution 4.0 International License. This license requires that reusers give credit to the creator. It allows reusers to distribute, remix, adapt, and build upon the material in any medium or format, even for commercial purposes.

References

1. Taylor E, Miller J, Chi T, Stoller ML. Complications associated with percutaneous nephrolithotomy. Translational andrology and urology. 2012, Dec; 1(4):223. https://doi.org/10.3978%2Fj.issn.2223-4683.2012.12.01

2. Li Z, Wu A, Liu J, Huang S, Chen G, Wu Y, Chen X, Tan G. Risk factors for hemorrhage requiring embolization after percutaneous nephrolithotomy: a meta-analysis. Translational Andrology and Urology. 2020 Apr;9(2):210. https://doi.org/10.21037%2Ftau.2020.01.10

3. Loffroy R, Rao P, Kwak BK, Ota S, De Lin M, Liapi E, Geschwind JF. Transcatheter arterial embolization in patients with kidney diseases: an overview of the technical aspects and clinical indications. Korean journal of radiology. 2010 May;11(3):257. https://doi.org/10.3348/kjr.2010.11.3.257

4. El-Nahas AR, Shokeir AA, El-Assmy AM, Mohsen T, Shoma AM, Eraky I, El-Kenawy MR, El-Kappany HA. Post-percutaneous nephrolithotomy extensive hemorrhage: a study of risk factors. The Journal of urology. 2007 Feb;177(2):576-9. https://doi.org/10.1016/j.juro.2006.09.048

5. Mao Q, Zhong B, Lin Y, Wang C, Liang W, Tan F, Shen B, Xie L. Clinical application of computed tomographic angiography in patients with renal arterial hemorrhage: Diagnostic accuracy and subsequent therapeutic outcome. Experimental and Therapeutic Medicine. 2015 Aug 1;10(2):508-12. https://doi.org/10.3892/etm.2015.2535

6. Yang BB, Liu WZ, Ying JP, Li C, Huang T, Shi JY, Zheng Z, Yuan HS, Hu JS, Cheng Y, Qian JH. Computed tomography angiography and three-dimensional reconstruction of renal arteries in diagnosing the bleedings after mini-percutaneous nephrolithotomy: a single-center experience of 7 years. Urology. 2022 Nov 1;169:47-51. https://doi.org/10.1016/j.urology.2022.07.028

7. Chakraborty JN, Hatimota P. Same-day angiography and embolization in delayed hematuria following percutaneous nephrolithotomy: an effective, safe, and time-saving approach. Research and Reports in Urology. 2019 Mar 21:83-9. https://doi.org/10.2147/rru.s192175