Case Report

Renal vein injury during percutaneous nephrolithotomy: A surgical catastrophe – Management and lessons learned

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ABSTRACT

Percutaneous nephrolithotomy (PCNL) is the treatment of choice for large and complex renal calculi. We encountered a patient who was planned for PCNL in a peripheral hospital, without a preoperative computed tomography scan but was abandoned during tract dilatation due to intractable bleeding and was referred to our institute with nephrostomy *in situ* in a clamped state. After evaluation, the tip of the nephrostomy tube was found to be in the left renal vein causing secondary thrombosis. Due to the nonfunctional status of the kidney in the dynamic scan, the patient underwent laparoscopic left simple nephrectomy with thrombectomy without any major intraoperative complication and was discharged in stable condition.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) was introduced by Fernström and Johansson in 1976 and with time it has become the treatment of choice for large and complex renal calculi.[1] Puncturing and dilatation are two critical steps in PCNL. The majority of the complications of PCNL occur during these two steps. Injuries to the main renal vessels are uncommon, accounting for 0.5%–2.4%.[2] Bleeding is mainly venous during percutaneous procedures and is usually mild and resolves spontaneously or responds to simple maneuvers such as the placement of a large caliber nephrostomy tube into the tract.[3] Injury of the main renal vein combined with thrombosis is rare clinically and its treatment is troublesome. In this study, we report a case of renal vein injury with secondary thrombosis during PCNL and how it was managed at a tertiary care center.

A 75-year-old female, with no known comorbidity, was diagnosed with multiple left renal calculi and right upper ureteric calculus based on abdominal X-ray and sonography. In another hospital, the patient was taken for left PCNL, without further imaging and the procedure was abruptly terminated during tract dilatation due to severe bleeding. A percutaneous nephrostomy drainage tube (PNDT) was placed to stop the bleeding and was clamped. The patient was transferred to our hospital on a postoperative day (POD) 1, a tertiary referral center, for further management.

The patient was received in the emergency room (ER) in a hemodynamically unstable condition. She was resuscitated and blood products were transfused. The patient responded to the resuscitative measures and emergency exploration was deferred. She had acute kidney injury (AKI) with serum urea and creatinine values of 105 mg/dL and 5.77 mg/dL, respectively and a noncontrast CT abdomen showed the right upper ureteric calculus with multiple left renal calculi and PNDT traversing the renal parenchyma and with suspicion of the tip of the PNDT lying in the renal vein.

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The patient underwent hemodialysis on POD 1 in view of refractory hyperkalemia with electrocardiogram changes after discussion with the nephrologist and considering the bilateral obstructing calculi, the patient was planned for bilateral urinary diversion. Cystoscopy was done and a right-sided double-J stent was placed on POD 2. It was attempted on the left side but was unsuccessful. Hence, percutaneous nephrostomy was placed on the left side without disturbing the already existing PNDT. The patient's condition improved, and sepsis and AKI resolved. The patient was then planned for CT renal angiography (CTRA) on POD 4 and a dynamic renal scan on POD 7. CTRA confirmed the position of PNDT in the renal vein causing secondary thrombosis [Figure 1]. A dynamic scan showed no uptake in the left kidney. The patient was planned for a left nephrectomy. The patient underwent laparoscopic left simple nephrectomy with thrombectomy on day 8 post first surgery. Intraoperatively, there were dense adhesions between mesocolic fat and Gerota's fascia. There were two renal arteries and a tip of PNDT in the renal vein with a thrombus extending up to the interaortocaval groove. After clipping the renal arteries, vein was dissected in the aortocaval groove and was clipped. After clipping the renal vein, PNDT was removed. There were no intraoperative complications. Operative time was 125 min. Evaluation of the specimen showed a direct tract from the renal cortex into the renal vein [Figure 2]. The intra-abdominal drain was removed on POD 2 and the patient was discharged on POD 3 with the plan of right ureteroscopic lithotripsy after 2 weeks. Written, informed consent was taken from the patient for this case report.

DISCUSSION

PCNL forms a major bulk of urological practice in areas with a high incidence of nephrolithiasis, particularly in the "stone belt of India" and is being performed very commonly.[4]

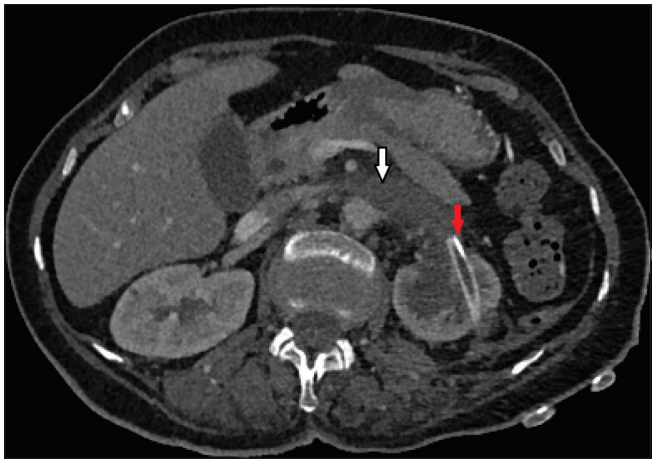

Figure 1: Contrast tomography scan demonstrating left nephrostomy tip in the renal vein – red arrow with secondary thrombosis – white arrow with significant perinephric fat stranding

Performing safe PCNLs is essential for a practicing urologist and none of its steps should be taken lightly. PCNL should ideally be performed in centers with multidisciplinary team (MDT) backup including skilled anesthetists, radiologists, and intensivists, with a facility for an intensive care unit to ensure the best patient outcomes. Preoperative cross-sectional imaging helps surgical planning and guiding initial access, especially in complex renal stones, and may also help in predicting stone clearance.[5] Puncturing the appropriate calyx and tract dilatation precedes the main part of the surgery, i.e., removal of stones, but are the most important steps.

We received our patient in the ER in a critical hemodynamically unstable condition. Apart from the left PNDT being in the renal vein, the presence of a right upper ureteric calculus with AKI also complicated things further. The urinary diversion was performed promptly and the patient improved. Immediate contrast imaging in the ER could have worsened her renal functional status and hence was not performed, and postponed till the patient was stabilized. Subsequently, contrast imaging and a renal dynamic scan were performed and suspicion was confirmed.

Literature on the management of renal vascular injury during PCNL is sparse. PCNL causes grade IV injury according to the American Association for Surgery of Trauma renal injury classification.[6] Grade IV injury also includes injury to the renal vein and artery. According to trauma literature, most of them can be managed nonoperatively with angioembolization even in cases of major vascular injuries. Penetrating grade IV injury has a higher rate of nephrectomy.[7] In our patient, owing to the nonfunctional status of the kidney, multiple renal stones, and renal vein thrombosis, we went ahead with a laparoscopic left simple nephrectomy with thrombectomy and the patient recovered well. There are a few reports of renal vein injury post PCNL with varying management. In the majority, the PNDTs were removed in a single step or a two-step manner under fluoroscopy guidance without requiring surgery.[8-10] Our case

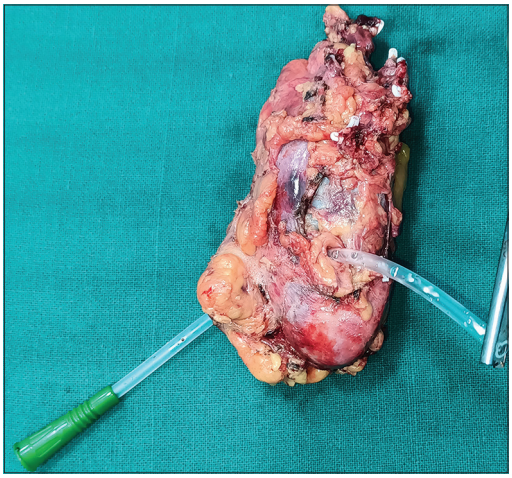

Figure 2: Specimen showing catheter passing from the cortex into the renal vein

was different due to the fact that the opposite side kidney was also obstructed, causing a delay in contrast imaging, and subsequently the presence of a renal vein thrombosis ultimately led to a nonfunctional kidney. Considering the old age of the patient, nephrectomy was a feasible option to avoid major bleeding or thromboembolism which might have occurred with tube displacement or removal.

Post PCNL renal vein injury is a serious complication and should be managed promptly and aggressively when diagnosed timely. Any severe venous bleeding intraoperatively or postoperatively should prompt suspicion of the same. Patients should be transfused blood as per requirement and IV antibiotics should be continued to cover the possible bacteremia with the presence of a foreign body inside the venous system. Reports regarding the requirement of anticoagulation are contradicting, with the renal venous system being a high flow, low-pressure system, with less risk of thrombosis.[9,10]

Multiple techniques have been described to decrease vascular injury rates including confirming the adequate location of the guidewire and avoiding overshooting the dilatation process medially. Routine use of postprocedure antegrade nephrostography and measuring the length of the PNDT inserted also helps minimize vascular injury.[9,10] As a rule of thumb, under dilatation of the tract is better than over dilatation as it is salvageable and without grave complications of over dilatation. Using these techniques with careful, patient selection may help in avoiding such disastrous life-threatening complications.

CONCLUSION

Renal vein injury post PCNL is life-threatening. PCNLs should ideally be performed in centers with MDT backup after proper preoperative cross-sectional imaging. Initial puncturing and dilatation are critical steps and should be performed very carefully. Routinely measuring the length of PNDT and performing antegrade nephrostography may help in decreasing major vascular injuries post PCNL.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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