



Original research

Massive hemorrhage after percutaneous nephrolithotomy: Saving the kidney when angioembolization has failed or is unavailable

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H I G H L I G H T S

- Partial nephrectomy/renorrhaphy can efficiently control massive bleeding after PCNL.
- The principles of such surgery resemble renorrhaphy in the setting of renal trauma.
- Renal vessel control during the surgery provides a bloodless field for kidney repair.
- This procedure is quite effective in saving the kidney function.
- As a demanding procedure, adequate surgical experience in the setting of renal trauma is essential.

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A B S T R A C T

Objectives: To describe the management protocol in cases with massive hemorrhage after percutaneous nephrolithotomy (PCNL) with a failed angioembolization or when angioembolization is not available.

Patients and methods: Between October 2006 and December 2012, the charts of patients who had undergone PCNL and were complicated with massive post procedural bleeding unresponsive to conservative management were reviewed. Those cases in whom angioembolization had failed, or was unavailable, or could not be afforded by the patient were selected and studied. These patients underwent open surgical exploration through a midline transperitoneal or a flank retroperitoneal approach. In both approaches, kidney mobilization outside the Gerota's fascia, temporal renal pedicle clamping and partial nephrectomy or renorrhaphy were done in a stepwise manner.

Results: During the study period, we had 8 patients for whom angioembolization had failed ($n = 4$), was not available ($n = 2$) or the patient could not afford it ($n = 2$). Median patients' age was 31 years (range 16–59 years). We did a partial nephrectomy in 2 and renorrhaphy in 6 of patients with a successful outcome. Median operative time was 2.25 h and median warm ischemia time was 26 min (range 24–42 min). After a median follow up period of 21 months, the involved renal unit, in all cases, remained functional in the postoperative intravenous urography.

Conclusion: Massive hemorrhage after PCNL when angioembolization failed or was not feasible due to any reason could be controlled by partial nephrectomy or renorrhaphy with the same principles as that used for surgical exploration in patients with high grade renal trauma.

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1. Introduction

With great advancements in minimally invasive techniques during the past two decades, the need for open stone surgery has

been markedly reduced. Percutaneous nephrolithotomy (PCNL) is now the standard of care for patients with large renal stones. Although, in general, PCNL is a low morbidity procedure, as many as one in four patients may have complications after PCNL [1,2]. Intraoperative/postoperative hemorrhage is one of the most important complications of PCNL. While the surgeon's experience plays a crucial role in reducing complications after PCNL, the rate of bleeding complications is also related to the patient's age, stone characteristics (stone burden and configuration) and to the

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characteristics of the PCNL procedure (i.e. operative duration, method of dilatation, sites and number of accesses) [2,3]. Intrarenal or perinephric hematoma would be a frequent finding (90–100%) if computerized tomography was performed just after PCNL [2,4–5]. Most of these hematomas are clinically insignificant and they resolve spontaneously. Significant blood loss requiring blood transfusion during or after PCNL has been reported at a rate of 11–23% [1,2,5,6]. The most severe cases of hemorrhage after PCNL are those of intrarenal arterial origin. This complication usually presents a few weeks after PCNL and is a result of arteriovenous fistula (AVF), intrarenal pseudoaneurysm formation, or an injured segmental artery [2–5]. The incidence rate of this unpredictable complication is 1–2% in centers with a high turnover. The treatment of choice in this serious complication is superselective angioembolization which is highly successful and efficient in controlling bleeding [2,7]. Thanks to the high success rate of angioembolization, the rate of nephrectomy after PCNL is extremely low (0.2%) in contemporary series [2,3]. Despite this efficacy, little is known about the management protocol in cases with failed angioembolization. Moreover, in some settings, such as a patient in poor condition (i.e. hemodynamic instability), unavailability of angiography setting or the problems with the cost of this procedure, the patient must undergo emergency laparotomy for control of bleeding. In the current study, we present our experience in the emergency management of severe hemorrhage in these settings.

2. Patients and methods

2.1. Patients

Our institutional review board approved this study. Between October 2006 and December 2012, the charts of patients who had undergone PCNL and were complicated with massive post procedural bleeding unresponsive to conservative management were reviewed. By matching of our PCNL database with our renal angioembolization records and with partial nephrectomy/renorrhaphy database, we selected and studied those cases in whom angioembolization had failed, or was unavailable, or could not be afforded by the patient. These patients underwent renal exploration for control of bleeding. The benefits and risks of such an approach, including the possibility of nephrectomy, were explained prior to the operation.

2.2. Surgical technique

The patients were placed in supine or lateral decubitus position, supported by adequate padding. A midline transperitoneal approach or flank retroperitoneal approach (in patients with massive abdominal pannus; $n = 2$) was used for the operation. In both approaches, the colon (and duodenum on the right side) was medialized to expose the renal pedicle, aorta (on the left side) and inferior vena cava (on the right side). The renal pedicle was meticulously dissected.

Care was taken to keep the Gerota's fascia intact. The kidney was mobilized outside the Gerota's fascia. Then, the renal pedicle was temporarily clamped with a Satinsky clamp. Thirty minutes before renal pedicle clamping, 12.5 g of mannitol was infused and was repeated after release of the clamp. After controlling the renal pedicle, the Gerota's fascia was incised, the perinephric hematoma was drained and the kidney was completely mobilized within the Gerota's fascia. The site of access was found and the necrotic and inflamed renal tissue was debrided. If the access site was in the lower or upper pole, a polar partial nephrectomy was considered; otherwise the site of access was circumferentially sutured with chromic 2–0 running sutures (Fig. 1). In both cases the renorrhaphy was done with frequent running chromic 2–0 or 0 sutures on 37 mm needles. After the renal pedicle was released, the renal perfusion was observed and the site of repair was evaluated for any hemorrhage. Then the ureter was opened and a 6 Fr feeding tube was passed to the kidney to check the presence of any significant intrarenal hemorrhage. After fixing a ureteric stent, an 18 Fr catheter was put in the retroperitoneum as external drainage and the wound was closed in layers. During recovery phase, the patients had complete bed rest for 48 h and were closely monitored for any recurrence of bleeding.

2.2.1. Study outcomes

The demographic characteristics of all patients were recorded. Intraoperative data such as operative time, intraoperative difficulties and complications were also noted. To evaluate blood loss after PCNL and after open surgical exploration, preoperative and postoperative hemoglobin (Hb) levels were compared. The amount of blood transfusion that each patient was received and major perioperative complications (higher than grade 1 according to Clavien classification [8]) were recorded.

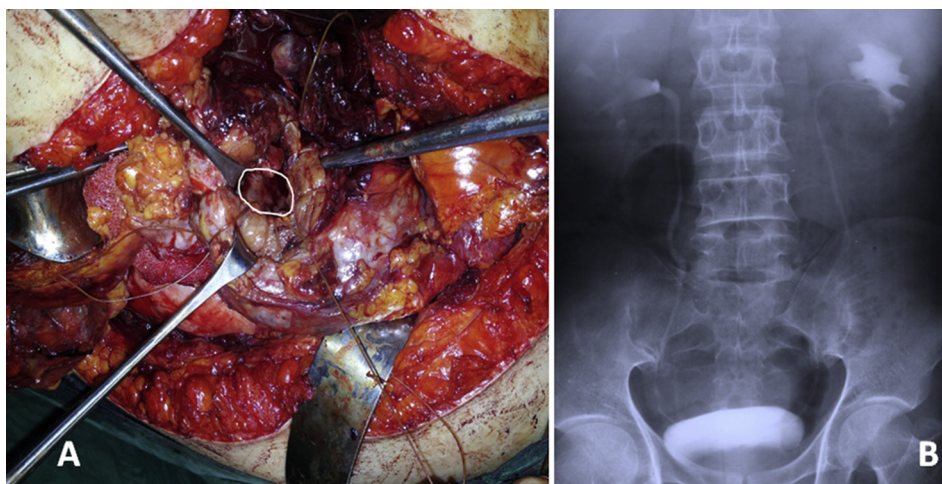


Fig. 1. A) The site of access in the mid part of the kidney was found and the necrotic and inflamed renal tissue was debrided (Encircled zone). The site of access was circumferentially sutured with chromic 2–0 running sutures to be prepared for renorrhaphy. B) Six month- postoperative IVU of the same patient showed completely functional left kidney.

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