OUTCOMES OF SIX PATIENTS WHO WERE TREATED WITH SELECTIVE EMBOLISATION DUE TO ARTERIOVENOUS FISTULA FOLLOWING PERCUTANEOUS NEPHROLITHOTOMY

Cemal Selcuk Isoglu, *Tufan Suelozgen, Mehmet Yoldas, Hakan Turk, Mustafa Karabicak, Batuhan Ergani, Yusuf Ozlem Ilbey

Department of Urology, Tepecik Training and Research Hospital, Izmir, Turkey
**Correspondence to tsuelozgen@hotmail.com*

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ABSTRACT

Objective: Arteriovenous fistula (AVF) is a rare yet serious complication of percutaneous nephrolithotomy (PCNL). The aim of this study was to investigate the preoperative characteristics and postoperative outcomes of patients treated with single-session selective embolisation following a diagnosis of AVF after PCNL.

Methods: Data from 1,200 patients who underwent PCNL in our department between January 2008 and December 2014 were retrospectively reviewed. Overall, six patients who experienced delayed haematuria and were diagnosed with AVF formation were included. Patient characteristics, stone burden, PCNL procedure, and perioperative and postoperative parameters were evaluated.

Results: Six patients with a mean age of 52 years (range: 42-57) were admitted to hospital with delayed intermittent haematuria following PCNL. All pre-PCNL stones in these patients were staghorn in type. Four patients (66%) had multiple access. Three patients needed blood transfusion due to development of hypotension. Following the diagnosis of AVF via angiography, all six patients were treated with selective embolisation during the same session. No additional treatment was required and no complications detected.

Conclusion: AVF formation is one of the causes of delayed haemorrhage after PCNL. Multiple accesses, staghorn stones, and upper calyx entry increase the risk of bleeding and AVF formation. Patients with risk factors should be informed about delayed bleeding and possible complications of PCNL.

Keywords: Kidney stone, nephrolithotomy, delayed haemorrhage, arteriovenous fistula.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is generally considered a relatively safe technique, offering the highest success rates after the first treatment when compared with other minimally invasive lithotripsy techniques.[1] In 1981, the initial series of PCNL was reported by Wickham et al.[2] Increasing experience and developing technology have led to decreased complication rates. However, serious complications may occur following this procedure. Bleeding requiring transfusion is one of the most important complications, and arteriovenous fistulae (AVFs) are a rare cause of bleeding seen in 1-2% of all cases.[3,4] In this study we reviewed the data of six patients who were treated with selective embolisation due to AVF following PCNL.

PATIENTS AND METHODS

Data from 1,200 patients who underwent PCNL procedures between January 2008 and December 2014 were retrospectively reviewed. Overall, six patients who were diagnosed with AVF were included in our study. Preoperative patient evaluation included history, clinical examination, serum creatinine level, complete blood count, coagulation profile, and liver function tests.

All patients were evaluated with non-contrast computed tomography (CT) before the procedures.

After the insertion of a 6 Fr open-ended ureteral catheter with cystoscopy, patients were placed in the prone position. Percutaneous renal access was established under C-arm fluoroscopic guidance through the posterolateral plane of the kidney. A one-shot single dilatation technique with Amplatz dilators was performed for tract dilatation. A 30 Fr amplatz sheet was placed. Stones were removed following fragmentation with an ultrasonic lithotripter and a 22 Fr nephrostomy tube was placed at the end of the procedure. The tube was removed after 24 hours and the patient was discharged if there were no complications. Patients with residual stones <0.4 cm after the PCNL procedure were considered as successful.

Overall, a total of six patients were admitted to our clinic with delayed intermittent haematuria following PCNL procedures. Initially, patients were evaluated with non-contrast abdomen CT. Patients with the diagnosis of AVF by superselective angiography were then treated with selective embolisation. At the end of the procedure, angiography was repeated in order to confirm the occlusion of the vessel. Patients remained in bed with vital signs monitored every 4-6 hours following the procedure. A complete blood count was regularly performed until stabilisation of the condition. All patient characteristics, including age, sex, stone type, operation time, fluoroscopy time, number of renal accesses, access site (subcostal or supracostal), calyx punctures, and number of blood transfusions were recorded. See Table 1 for patient characteristics.

RESULTS

Of the 6 patients who received selective embolisation for AVF, 4 (67%) were male and 2 (33%) were female. Mean age was 52 years (range: 42-57). There was no urinary anomaly identified among the patients. All patients had complex 'staghorn' stones. Mean operation time was 138 minutes (range: 50-300). Four patients (67%) had two accesses and two patients (33%) had one access. Entry to the lower pole was performed via subcostal puncture. Secondary entries were made into the middle and upper poles. Punctures into the middle and upper poles were always performed above the 12th rib.

None of the patients required a blood transfusion pre or perioperatively. All patients were discharged from the hospital 24 hours after surgery and patients were re-admitted to hospital following the complaint of intermittent haematuria. Mean time of haematuria development after PCNL was 4 days (range: 2-7). Four patients required blood transfusion due to haemodynamic instability; the median number of blood transfusion units was 3 (range: 2-6).

Patients were evaluated with non-contrast CT to exclude possible complications of PCNL, such as residual stone, ureteral stone, and the development of peri-renal haematoma. All patients were diagnosed with AVF development in angiography and were treated with selective embolisation during the same session. Haematuria ceased within 24 hours and none of the patients needed blood transfusion after embolisation. No second session procedure was required in any patient.

Table 1: Patient characteristics.

Patient no.	Age (years)	Sex	Stone burden	Access site and number	Urinary anomaly	Operation time (minutes)	Occurrence of postoperative haematuria
1	50	M	Staghorn	Lower calyx (1)	No	110	Day 2
2	57	F	Staghorn	Lower and upper calyx (2)	No	100	Day 6
3	52	M	Staghorn	Lower and upper calyx (2)	No	70	Day 7
4	42	M	Staghorn	Lower calyx (1)	No	50	Day 5
5	54	F	Staghorn	Middle and lower calyx (2)	No	300	Day 2
6	54	M	Staghorn	Middle and lower calyx (2)	No	200	Day 5

DISCUSSION

PCNL is a relatively safe treatment for renal stones, even for multiple and staghorn renal calculi.[1,5] However, it is an invasive procedure with a complication rate of 3-18% according to different studies.[5-7] Bleeding is one of the serious complications of PCNL. Bleeding during PCNL is generally common and considered a complication only when transfusion is required. Transfusion rates vary between 0-20%, with an overall rate of 7%.[1,8]

PCNL-related bleeding can be classified as perioperative, immediate, postoperative, or delayed.[1,9] Delayed bleeding can be noticed a few days after nephrostomy tube removal and the most common reason for delayed bleeding is an unhealed parenchymal vessel. Conservative treatment is generally sufficient in most cases.[9] Other causes of delayed bleeding are AVFs and arterial pseudo-aneurysms.[8-10] The passage of blood from the high pressure of the injured artery to an injured adjacent vein results in AVF and blood passage to the parenchyma, forming a pseudo-aneurysm.[5] These complications are rare and occur in 1-2% of all cases.[3,4] In our study, AVFs occurred in 0.5% of our series. In AVF development, the patient is usually discharged from hospital without any symptoms or signs, and returns back within days, or even within weeks, complaining of persistent mild haematuria and displaying a slow decrease in haemoglobin, or, in rare cases, hypotension or gross haematuria.[5,11] In our study, all patients were admitted to hospital with intermittent mild haematuria. Mean time to the development of delayed haematuria was 4 days after discharge, which is consistent with the literature. Hypotension was detected in three patients and blood transfusion was required.

Transfusion requirement is influenced by many factors, including operative techniques, surgeon experience, stone complexity, and patient status. Lam et al.[12] reported that improved skills and the presence of flexible nephroscopy decreased rates of blood transfusion.[5] We used a rigid nephroscope in our procedures, which is what was available in our hospital.

In some studies it was reported that multiple punctures to the kidney were associated with vascular injuries and increased blood transfusion.[13,14] In our study, 67% of the patients had multiple punctures to the kidney. El-Nahas et al.[5] reported that the success rate of selective embolisation for controlling the bleeding after PCNL was 92.3%, and 72.3% of the patients were successfully treated with a single session of embolisation.[5] In our study, all patients were treated with a single session without any complications.

Stone shape and complexity are directly related to the occurrence of severe bleeding. Meta-analysis regarding the removal of staghorn stones showed higher transfusion rates.[15] Kessaris et al.[7] reported staghorn stones in 8 of 17 patients who required embolisation. El-Nahas et al.[5] observed that staghorn stones and upper calyx punctures were significant risk factors for severe bleeding. In our study, all patients who required embolisation had staghorn stones and two of the patients (33%) had upper calyx entry, which is consistent with the literature.

CONCLUSION

AVF is a rare but severe complication of PCNL and one of the reasons for delayed bleeding. Based on our study and the published literature, multiple renal accesses, the presence of staghorn stones, and upper calyx entries might be associated with late haemorrhage and AVF formation. According to our experience, single-session selective embolisation seems to be effective and generally safe in the clinical management of AVF following PCNL. More studies with larger numbers of patients are needed to characterise the risk factors.

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