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ORIGINAL PAPER

Safety and efficacy of tubeless percutaneous nephrolithotomy in patients on anti-platelet therapy and cirrhotic patients

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Abstract Without the temponade effect over nephrostomy tube, postoperative hemorrhage is a major concern to the safety of tubeless percutaneous nephrolithotomy (PCNL) in patients with bleeding tendency. In this study, we would like to report our experience of performing tubeless PCNLs in these patients. At the end of PCNL, we cauterized the bleeding points in access tract for hemostasis to facilitate the achievement of tubeless PCNL. We identified and reviewed 16 patients under antiplatelet agent therapy and 6 patients with liver cirrhosis from 598 tubeless PCNLs performed in a single institute. Among the 16 patients undergoing anti-platelet therapy, the average stone size was 2.8 cm. The average operation time was 84.7 min. The stone-free rate was 87.5%. The average postoperative hospital stay was 3.8 days. Two patients (12.5%) experienced urinary tract infections after operation. There was no uncontrolled hemorrhage during and after operation and only one patient needed postoperative blood transfusion. No patient experienced any thromboembolic complication. Of the six patients with liver cirrhosis, the average stone size was 3.3 cm. The average operation time was 77.5 min. The stone-free rate is 83.4%. The average postoperative hospital stay was 4.0 days. No patient received blood transfusion after operation. There was no patient experiencing urinary tract infection after operation. Our results suggest that with careful hemostasis, tubeless PCNL is a safety modality in the treatment of urinary stone disease in patients on chronic anti-platelet therapy and cirrhotic patients.

Keywords Calculus · Cirrhosis · Percutaneous

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Introduction

The advantages of percutaneous nephrolithotomy (PCNL) over open urinary stone surgery include lesser morbidity and mortality rates, a faster recovery, easier secondary procedures, and more cost effectiveness [1]. Over the past several years, it has been a consensus that PCNL is a gold standard for the treatment of large or staghorn stones [2]. Placing a nephrostomy tube after the completion of the renal surgery has been considered as an indispensable procedure to provide adequate homeostasis, drainage, and access for further endoscopic procedures. However, this indispensability of postoperative placement of the nephrostomy tube has been altered in recent years. Many reports have verified the safety and efficacy in tubeless percutaneous renal surgery which has demonstrated the benefits of both decrease in hospital stay and reduction in analgesic requirement without an increase in morbidity [3–5].

Many patients with urolithiasis are under anticoagulant therapy for treatment or prevention of various cardiovascular or neurological diseases. Patients undergoing surgery and meanwhile on chronic anticoagulant therapy are at increased risk for perioperative complications. The continuation of anticoagulation throughout surgery tends to increase perioperative hemorrhage, while interrupting of anticoagulant therapy may raise the risk of thromboembolism [6]. Untreated coagulation disorder is a contraindication in

the stone management because major hemorrhagic complication may occur in untreated or unknown clotting disorder [7]. It is not until 2009 was the first report about PCNL performed in patient on chronic anticoagulant therapy published. In this report, Kefer [8] demonstrated that with careful perioperative regulation of anticoagulant therapy, percutaneous nephrolithotomy can be performed safely and efficiently in selected patients.

Patients with cirrhosis are at an increased risk for perioperative bleeding even with minor surgical procedures. Bleeding dysfunction may be due to thrombocytopenia, abnormal coagulation protein, and hyperfibrinolysis. Additionally, the combination of coagulation defects, hypoalbuminemia, and the compromised immunity and change in hepatic blood flow during anesthesia can complicate the endourological procedures [9].

Without the temponade effect of nephrostomy tube, postoperative hemorrhage is a major safety concern to the tubeless PCNL, especially in those patients with potential bleeding tendency. Till now, there is no published report demonstrating the safety and efficacy of tubeless PCNL in patients with coagulopathy such as patients on chronic antiplatelet therapy or cirrhotic patient. Since 2000 we have been conducting the cauterization of the access tract at the end of percutaneous renal surgery and performing tubeless modification in patients without experiencing any severe hemorrhage after the tract cauterization. With the aid of cauterization, more and more patients have become candidates for our tubeless PCNL. Tubeless modality is now a routine procedure for percutaneous renal surgery in our hospital, including patients that underwent anti-platelet therapy or with liver cirrhosis. In this study we retrospectively evaluate the safety and efficacy of tubeless PCNL in these patients.

Materials and methods

Between January 2001 and December, 2009, 880 PCNLs were performed at Chiayi Christian Hospital. The indications for PCNL included a large stone burden, multiple stones, calyceal or diverticula stones, urinary tract anatomic anomaly, and extracorporeal shock wave lithotripsy or ureteroscopy failure. Retrograde insertion of occluding balloon catheter cystoscopically was performed for retrograde saline infusion to create a more hydronephrotic kidney and to prevent downward migration of stone fragments into the ureter during stone manipulation. The renal access tract was obtained under the guidance of ultrasound by the same urologic team. The access tract was dilated with serial coaxial metal dilators to 26–28 F depending on stone size and renal anatomy. The holmium-yttrium–aluminum-garnet laser alone or combining with pneumatic lithotripter was used for stone disintegration. After the completion of stone disintegration and extraction a 6 or 7 F double-J catheter was inserted in antegrade fashion for postoperative urine drainage. The irrigation fluid was then changed from normal saline to distilled water. The collecting system and the access tract were checked carefully for bleeding points. The bleeding points of the kidney were cauterized with a self-made long electrode probe attached to the handpiece of a conventional electric cauterizer carefully as we withdrew the working sheath [4]. The bleeding points of the muscles outside the kidneys were difficult to be ceased by cauterization because the muscles would contract upon cauterization. We left the bleeding points of the muscle alone because these bleeding points usually cease by themselves spontaneously and harmlessly.

Nephrostomy was not conducted in patients having no severe hemorrhage after cauterization. A Penrose drain was inserted into the subcutaneous space for drainage of fluid and extravasated urine in the retroperitoneal space. The wound was closed with two deep stitches for control of subcutaneous bleeding and fixation of the Penrose drain. All patients received insertion of Foley catheter for bladder drainage. The stitches, Penrose drain, and Foley catheter were removed the next morning when the wound became dry, as usual. The indwelled double J catheter was removed 2–3 weeks postoperatively.

Of the 880 PCNLs, 598 PCNLs were performed with tubeless modification. Among the 598 tubeless PCNLs, we identified 16 patients under antiplatelet agent treatment and 6 patients with liver cirrhosis. The anti-platelet therapy was discontinued for 3–7 days before operation according to the judgment of the surgeon. The diagnosis of liver cirrhosis was made by a history of liver disease, along with impaired liver function tests and abdominal computerized tomography scanning or echography imaging. Patient age, past medical history, stone size, operation time, day of postoperative hospital stay, urinary tract infection rate, and postoperative blood transfusion rate were assessed by retrospective chart review.

Results

All of the PCNL were performed by the same experienced urologic team with standard operative procedures. All of these 22 patients (16 underwent anti-platelet therapy and 6 with liver cirrhosis) received single tract access for the removal of the stones. All of these 22 patients had normal prothrombin time, activated partial thrombin time, and international normalized ratio prior to operation. There was no major complication in these 22 patients. Among the 16 patients undergoing anti-platelet therapy, the average age was 59.2 ± 9.6 (49–78) years. Concomitant medical

conditions were not uncommon in these 16 patients, including hypertension in seven patients, ischemic heart disease in four patients, post pacemaker implantation in one patient, and diabetes in one patient (Table 1). The stone size was measured at the maximum diameter on the preoperative X-ray film; the average stone size in these 16 patients was 2.8 ± 1.1 (1.2–4.0) cm. The operation time was estimated since the start of cystoscopy for the occlusion balloon catheter insertion to the complete of Penrose drain fixation. The average operation time was 84.7 ± 24.8 (45–145) min. With the placement of double J catheter to keep patency of urine drainage, patients having residual stones are not considered as contraindicated for tubeless percutaneous renal surgery at our hospital. A plain kidney ureter bladder (KUB) film was taken immediately after operation. Stone free was defined as no stone seen on post operative KUB film. The stone-free rate was 87.5% (14 of 16). The average postoperative hospital stay was 3.8 ± 1.8 (2–9) days. Postoperative fever with temperature elevation above 38.5°C and having no evidence of any other infection source was considered as a urinary tract infection; two patients (12.5%) experienced urinary tract infections after operation. There was no uncontrolled hemorrhage during and after operation and only one patient (6.3%) needed postoperative blood transfusion (Table 2). The anti-platelet therapy resumed 3–5 days after operation. None of these 16 patients experienced deep vein thrombosis, pulmonary embolism, or any other thromboembolic complication.

The average age of the six patients with liver cirrhosis was 55.8. ± 6.0 (49–65) years. Decreased platelet count (less than 150×10^3 mm^3) was noted in every patient, and two patients had their platelet counts less than 100×10^3 mm^3. Both patients received preoperative platelet transfusion. The average stone size was 3.3 ± 1.6 (1.3–5.7) cm. The average operation time was 77.5 ± 29.8 (45–130) min. The stone-free rate was 83.4% (5/6). The average postoperative hospital stay was 4.0 ± 2.8 (2–9) days. None of these six patients received blood transfusion after operation. There was no patient experiencing urinary tract infection after operation (Table 2). The hospital stay was longer in our study and was due to that the government managed insurance in our country pays most of the medical fees. Patients in our country prefer to stay in the hospital longer until they feel substantially better. None of these 22 patients any ancillary treatment for their residual stone and none of them experienced delayed bleeding after operation.

Table 1 Associated medical disease of patients on chronic antiplatelet therapy undergoing percutaneous nephrolithotomy

Associated disease	Number of patients	%
Hypertension	7	34
Ischemic heart disease	4	14
Pace marker implantation	1	6
Diabetes mellitus	1	6

Table 2 Chracteristics and results of tubeless PCNL in patients on antiplatelet therapy and cirrhotic patients

Characteristic	Pts on antiplatelet agents	Cirrhotic Pts
Age (year)	59.2 (49–78)	55.8 (49–65)
Stone size (cm)	2.8 (1.2–4.0)	3.3 (1.3–5.7)
Operative time (min)	84.7 (45–145)	77.5 (45–130)
Stone free	14 (87.5%)	5 (83.4%)
Hospital stay (day)	3.8 (2–9)	4.0 (2–9)
Urinary tract infection	2 (12.5%)	0
Blood transfusion	1 (6.3%)	0

PCNL percutaneous nephrolthotomy

Discussion

Percutaneous renal surgery has become a common urological procedure for the treatment of upper urinary tract stones, tumors, and stricture since its first in 1976 [10]. With the improvements in endourological equipments, surgical techniques and lithotripsy devices in recent decades, PCNL has become the treatment of choice in the management of complicated urinary stone. In recent years, several investigations have focused on improvement of post-operative patient comfort and reduction of morbidity. In selected patients that have minimal bleeding after percutaneous renal surgery, some authors have challenged the need for the post procedure placement of nephrostomy tube. Compared with the traditional procedure, the tubeless modification offers several advantages, including reduction in hospital stay, decrease in analgesia requirement, and an earlier recovery to normal activities [1]. In 2004, we demonstrated that the cauterization of the bleeding points at the end of the PCNL has the benefits of decreasing the transfusion rate and enabling more patients to become suitable for tubeless PCNL without increasing complications [7]. With the accumulation of experience, our tubeless PCNL could be applied even in patients with complicated renal stones and geriatric patients with safely and efficaciously [11, 12].

Improvements in surgical technique and instrumentation have contributed to a high success rate and a low complication rate in PCNL. However, renal hemorrhage is still a major complication of PCNL, especially in patients with coagulopathy such as patients on chronic anti-coagulant therapy and patients with liver cirrhosis. To minimize PCNL-related hemorrhage, mini-PCNL has been suggested in order to decrease renal parenchyma injury [13]. Some authors found no decrease in hemorrhage and the benefits of mini-PCNL is challenged by

the increase in operative time [14]. Patients receiving anticoagulant treatment for the pre-existing medical diseases have more peri-operative risks including hemorrhage, thromboembolism, endocarditis, and impaired cardiopulmonary function [15]. In 2003, Klinger and colleague evaluated the safety and efficacy of the treatment of upper urinary tract stone in patient with clotting disorder. They demonstrated that patients with coagulopathy had a higher complication rate despite normal coagulation parameters and, therefore, endoscopic stone manipulation is favored than shock wave lithotripsy [16]. In 2008, Turna reported their experiences of performing ureteroscopy with laser lithotripsy in 37 renal stone patients under chronic anticoagulant therapy. They demonstrated that ureterorenoscopy and Holmium:YAG lithotripsy can be performed safely and efficaciously for renal calculi in patients on anticoagulation therapy without the need for perioperative manipulation [17]. In 2009, Kefer reported their experience of PCNL performed in 27 patients under chronic anticoagulant treatment. Two patients (7%) had significant bleeding and one (4%) had a thromboembolic complication. They advocated that with careful perioperative regulation of anticoagulation therapy, percutaneous nephrolithotomy can be performed safely and efficiently in patients requiring long-term anticoagulation [8]. In our series there was no severe complication noted in these 16 patients.

The liver is the major site for the production of several coagulation factors. Insufficient liver function may lead to low levels of serum coagulation factors. In patients with liver cirrhosis, thrombocytopenia is not uncommon, which may be attributed to decrease in platelet production and splenic sequestration by portal hypertension and splenomegaly. Furthermore, the platelet function may also be impaired. Combined with the above coagulation defects, patient with liver cirrhosis are at a high risk of perioperative hemorrhage [18]. Perioperative hemorrhage is a major and most concerned complication in PCNL; the experience of performing PCNL in cirrhotic patient has seldom been reported. Beside the coagulopathy, cirrhotic patients have been suggested to be depressed in cell-mediated immunity, altered in drug metabolism and changed in hepatic flow during anesthesia. These defects may lead to infection, encephalopathy, liver failure, and multiple organ failure [19]. In 2008, Pattaras reviewed their experience with endourological procedures for nephrolithiasis in 16 hepatic compromised patients. The procedures included 18 ureteroscopic stone manipulations, 5 percutaneous nephrolithotomies and 1 cystoscopic stone manipulation. They concluded that with careful preoperative evaluation and coagulation reversal, successful endoscopic management of urolithiasis in this complicated group of patients is feasible [9]. No major complication was noted in our 6 cirrhotic patients underwent tubeless PCNL.

With cautious preoperative evaluation, proper correction of coagulation factors and careful intraoperative hemostasis, our data suggest that tubeless PCNL can be performed in patients with bleeding tendency such as patients undergoing chronic anti-platelet therapy and cirrhotic patients.

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