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EVALUATION OF FACTORS AFFECTING DELAYED RENAL BLEEDING AFTER PCNL AND THE ROLE OF CONSERVATIVE MANAGEMENT FOR THAT BLEEDING

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Abstract

Percutaneous nephrolithotomy (PCNL) was reported to cause fewer complications and to reduce the length of hospital stay compared with anatrophic nephrolithotomy. Percutaneous nephrolithotomy does carry a risk of significant morbidity. Moreover, perioperative renal bleeding is one of the most common and worrisome complications of PCNL. Furthermore, delayed renal bleeding seems to be a serious complication. Various factors can increase the risk of bleeding. Delayed renal bleeding after PCNL can be managed successfully by conservative therapy.

This is a retrospective analysis of patients who underwent PCNL. The aim of this study was to evaluate risk factors for development of delayed renal bleeding following PCNL and evaluation of the role of conservative management of that bleeding.

The study included fifty patients who underwent PCNL inside and outside Iraq and were admitted to urology ward at Basrah General Hospital between February 2010 to May 2013. Average age of patients was 45 year. The patients were 40 males and 10 females. They presented with gross hematuria and anemia in the days following PCNL. The presentation varied between 7 up to 14 days following surgery. The patients were admitted to the emergency ward at our hospital and immediate and prompt evaluation and resuscitation was initiated.

Forty five (90%) patients received blood transfusion. Forty seven (94%) patients were successfully managed with conservative treatment and the hematuria resolved. The average stay in the hospital was 5 days. Three patients (6%) needed surgical intervention.

The complication rate of PCNL is up to 83%, but they are generally minor complications. Renal hemorrhage requiring intervention is a rare complication of PCNL, and its frequency is 0.6–1.4%. The bleeding risk was significantly correlated with factors such as renal cortical thickness, location and size of renal stones and the severity of hydronephrosis prior to PCNL. Only minority of patients failed to respond to conservative measures and they needed open surgical exploration which ended with a decision for nehprectomy. Conclusion: Although PCNL is a safe procedure for the treatment of renal calculus, it sometimes results in some complications. Bleeding after PCNL can be treated with conservative measures. However, it is important to determine the time for emergent intervention. It is important to be aware about factors that increase the risk of bleeding.

Introduction

Since the first report of the removal of renal stones via nephrostomy by Rupel and Brown[1] in 1941, there have been significant improvements in techniques, instruments, and experience. Fernastrom and Johansson first reported percutaneous nephrolithotomy (PCNL) in 1976[2], and Alken et al[3] introduced the renal endoscope and ultrasonic lithotripsy to further the development of the technique. Although extracorporeal shock wave lithotripsy (ESWL) and flexible ureteroscopic stone removal are widely used treatment modalities for renal stones, PCNL is still needed for selected cases according to the size, position, shape, and composition of the stones[3]. PCNL was reported to cause fewer complications and to reduce the length of hospital stay compared with anatrophic nephro-

lithotomy. PCNL is recommended for cases with stones larger than 2 cm, cases with struvite or cystine stones, cases in which stone removal failed with ESWL, or cases accompanied by anatomical malformation[4,5]. However, PCNL does carry a risk of significant morbidity; with contemporary series describing a complication rate of 20.5 %[6] and transfusion rates varying enormously between less than 1% and 55 %[7-11]. Moreover, perioperative renal bleeding is one of the most common and worrisome complications of PCNL[8]. Although most bleeding associated with PCNL can be managed conservatively, approximately 0.8% of patients require intervention to control severe bleeding[12]. Thus, a surgeon should notice early the complications during and after the operation and prepare the appropriate management. Traditionally, diabetes, staghorn stone, method of dilatation, and stone size were reported as predictive factors of bleeding[8,13]. The aim of this study was to evaluate risk factors for development of delayed renal bleeding following PCNL and evaluation of the role of conservative management of that bleeding. The study aimed to answer questions including "how long conservative therapy for bleeding after PCNL takes?" and "when emergent intervention should be performed?"

Materials and methods

This study is a retrospective analysis of 50 patients who underwent PCNL inside and outside Iraq and were admitted to urology ward at Basrah General Hospital between February 2010 to May 2013. Average age of patients was 45 year. Thirty five patients were admitted through emergency ward and 15 patients were referred to the hospital from private clinics. The patients were 40 males and 10 females. They were provided with documents that showed their clinical presentation before surgery together with their stone burden, done investigations, surgical techniques and postoperative follow-up and discharge notes. Ten patients were not provided with details of operative techniques. The patients presented with gross hematuria and anemia in the days following PCNL. The presentation varied between 7 up to 14 days following surgery. Forty five patients (37 males and 8 females) presented with a hemoglobin level ≤8 g/dL. Forty patients (35 males and 5 females) presented with severe hematuria with passage of blood clots. Fifteen (13 males and 2 females) patients presented with hemodynamic instability like hypotension. Two of them (both are males) suffered features of shock that necessitated admission to ICU for few days. The radiology investigations done before PCNL showed that 35 patients had staghorn stones and 15 patients had various caliceal stones or large renal pelvic stones. Among the patients, 26 patients presented with right side surgery and 24 patients presented with left side surgery. Pre-operative investigations showed that 17 patients had moderate-severe hydronephrosis, 13 patients with mild hydronephrosis and 20 patients presented with no hydronephrosis. Among the patients, 42 had normal renal cortical thickness prior to PCNL and only 8 had reduced renal cortical thickness prior to PCNL. The history showed that all patients were instructed not to use antithrombotic or antiagregant agents like aspirin for at least 1 week before the procedure. The medical history showed that three patients had hypertension and only two had diabetes mellitus. No other medical chronic illnesses were diagnosed. Three patients had history of previous stone surgery on the same side of PCNL (recurrent stones). Tables I & II show summary of the above mentioned characteristics.

Statistical analyses were implemented by using student t-test to compare the values. Other factors were assessed by chi-square test. A p-value of <0.05 was considered statistically significant.

Management of patients at admission to our hospital

The reports of the patients showed that they had smooth postoperative periods. No major intra- or per- operative complications were encountered. The patients were discharged home after a stay period ranged between 3-5 days following PCNL. The patients were admitted to the emergency ward at our hospital and immediate and prompt evaluation and resuscitation was initiated. Among the patients, 6 (12%) showed evidence of urinary tract infection which was documented by urine culture and they were treated successfully with antibiotics. Conservative therapy included intravenous fluid replacement therapy by crystalloid fluids and parenteral antibiotic therapy as prophylactic cover. Preparation of fresh blood was done for all patients and blood transfused according to need for that. Fresh frozen plasma was administered if there was no initial control of hematuria. Bed rest was advised for all patients. The patients were catheterized and bladder irrigation was needed in 40 patients to evacuate bladder blood clots. Patients were checked for their hemoglobin every day .The patient underwent evaluation of blood urea nitrogen and serum creatinine. In addition they underwent radiology study by abdominal ultrasonography and computed tomography scanning. These investigations showed normal urinary tracts apart from enlargement of the recently treated kidney. No other pathology was detected in other parts of the urinary tracts of patients which may contribute for the occurrence of hematuria. All the patients had normal bleeding profiles with no aberrant bleeding tendencies.

Results

During the course of conservative management, the patients showed variable clinical outcomes. Forty five (90 %) patients received blood transfusion .Among the patients, 15 (30%) presented with hemodynamic instability in the form of hypotension and tachycardia. They respond well to resuscitation. Two (4%) of these patients (both are males) suffered from shock and they were admitted to the ICU for few days for stabilization. They respond well to resuscitation and became hemodynamically stable but they continued to suffer severe hematuria. Beside these two patients, another lady continued to have severe hematuria despite adequate conservative measures. These three patients (6%) were continued up to one weak with conservative treatment, but then there was a decision to perform surgical exploration which ended with nephrectomy. The decision was made on the fact that the hematuria did not resolved and the hematocrit continued to decrease despite adequate conservative therapy. Forty seven (94%) patients were successfully managed with conservative treatment and the hematuria resolved. The average stay in the hospital was 5 days. Among the patients, 26 (52%) patients presented with right side surgery and 24 (48%) patients presented with left side surgery. Patients who underwent surgery, all had their left side involved. Regarding stone location, 8 (16%) patients had lower and /or upper calyceal stones, 7 (14%) with large renal pelvic stones and 35 (70%) patients presented with staghorn calculi. The three patients who underwent nephrectomy, all had renal staghorn calculi. Pre-operative investigations showed that 17 (34%) patients had moderate- severe hydronephrosis, 13 (26%) patients with mild hydronephrosis and 20 (40%) patients presented with no hydronephrosis. Thirty three (66%) patients who presented with severe bleeding (hematuria) had no or mild hydronephrosis prior to PCNL surgery. The three patients who underwent nephrectomy had mild hydronephrosis prior to PCNL surgery. Table III summarizes the above mentioned results.

Discussion

Urolithiasis is a common disease, and percutaneous nephrolithotomy (PCNL) is an effective treatment for especially large and complex renal calculi. PCNL has become a common procedure since it was described in 1976[2]. White and Smith[14] described advantages of the procedure via a comparison of the results of PCNL and laparotomy, including reduced length of stay, smaller incision on the skin, less postoperative pain, quicker return to daily life, and relatively fewer complications. Although PCNL is a common procedure, it can be associated with some mortal or morbid complications. There are some studies investigating the prediction of morbidity and mortality of this surgery[15,16]. The complication rate of PCNL is up to 83%, but they are generally minor complications[17]. Renal hemorrhage requiring intervention is a rare complication of PCNL, and its frequency is 0.6–1.4 %[17]. Renal hemorrhage is generally associated with the nephrostomy tract, operative time, method of tract dilatation and access guidance, number of tract, renal parenchymal thickness, absence of hydronephrosis, intraoperative puncture time, size and location of stones, upper calyceal access, extensive angulation with rigid nephroscope, diabetes mellitus, and the experience of surgeon[18-20]. Because PCNL is accompanied by bleeding during its surgical steps, including calyceal puncture, nephrostomy extension, and lithotripsy, transfusion is needed in some cases; the rate of transfusion is reported to be 3% to 23%[21,22]. In most cases, hemostasis can be achieved by conservative treatment including nephrostomy obstruction, fluid supply, or hemostatics, but in 0.3% to 1.4% of cases, an interventional procedure such as angioembolization is required[23]. The most common vascular lesion is arteriovenous fistula or pseudoaneurysm: arteriovenous fistula is formed by a higher difference in blood pressure between the injured artery and the injured adjacent vein and pseudoaneurysm formed by the bloodstream toward the renal parenchyma[24]. The rupture of the pseudoaneurysm may induce delayed bleeding[25]. In this study, there was a retrospective analysis of patients who underwent PCNL outside our hospital (some in north of Iraq and some outside the country). For this reason; it was not possible to evaluate precisely the steps of surgical procedures and possible intra-operative events. However, reports provided for the patients showed that all of them were discharged well after removal of their nephrostomy tubes with no considerable complaints. The larger number of male patients in this study may be related to the fact that men are affected two to three times more frequently than women by urinary stone disease[26]. The renal bleeding of patients in the current study was diagnosed as delayed bleeding because it was encountered 7-14 days following surgery (PCNL). This study showed that hematuria, anemia and hemodynamic instability were the main clinical presentations of renal bleeding [Table III]. The bleeding was not significantly correlated with factors such as urinary tract infection, associated medical diseases, side of surgery or previous renal surgery [Table II]. However, the bleeding risk was significantly correlated with factors such as renal cortical thickness, location and size of renal stones and the severity of hydronephrosis prior to PCNL [Table III]. These findings were in contrast to results published by other authors as would be mentioned. Gremmo et al[27] retrospectively investigated cases of PCNL to study the frequency of renal bleeding, treatment methods, and predictive factors for renal bleeding and reported that renal bleeding might not be able to be predicted because no significantly different factors between the bleeding group and the non bleeding group were found. Kessaris et al[12] reported that no factors affecting renal

bleeding were found after investigating patients undergoing PCNL. Regarding another point, this study showed that the majority of patients were successfully managed with conservative therapy [Table III]. The clinical improvement was obtained after an average period of 5 days .This finding goes well with what was published by other authors like Kefer et al[28] who stated that during PCNL a grade IV renal injury occurs, and bleeding can appear during every step of the operation. Decrease of hemoglobin can be seen after all PCNL operations; however, this is generally self-limited because of the restrictive effect of the Gerota's fascia and retroperitoneum. Therefore, bleeding is often controlled by conservative measures like monitoring the level of hemoglobin and vital signs with fluid resuscitation therapy or sometimes a blood transfusion[28]. In regard to another point, this study showed that the rate of blood transfusion was high during the course of conservative therapy [Table III]. Only minority of patients failed to respond to conservative measures and they needed open surgical exploration which ended with a decision for nehprectomy [Table III]. Such patients probably were in need for selective renal angiography for detection of renal arteriovenous fistulae or pseudo aneurysms that may be the reason for their severe reluctant bleeding. Selective angioembolization after PCNL to stop severe bleeding shows a relatively higher success rate, a rate that is reported to be 92.3 %[23]. However, this was impossible in our hospital because there was no angiography unit. This was a main reason that made open surgical exploration and nephrectomy the only way to stop bleeding and to save the patients' life. When PCNL becomes widely available in our country, it will be possible to perform further studies to evaluate PCNL with the involvement of larger number of patients.

Conclusion

Although PCNL is a safe procedure for the treatment of renal calculus, it sometimes results in some complications. Bleeding after PCNL can be treated with conservative measures. However, it is important to determine the time for emergent intervention. Staghorn calculi, severity of hydronephrosis, and normal renal cortical thickness are associated with an increased risk of bleeding during and/ or after PCNL. Urologists should take into consideration whether patients have the aforementioned risk factors before performing PCNL. Renal bleeding can present lately as delayed bleeding and the patients should receive prompt and adequate treatment to support their lives.

Table I: Characteristic features of the involved patients (features prior to PCNL)

Characteristics	Number
Number of patients	50
Male/Female	40/10
Average age (years)	45
Stone location	
Staghorn	35
Large renal pelvic stone	7
Caliceal stones	8
Patients with moderate-severe hydronephrosis	
Patients with mild hydronephrosis	
Patients with no hydronephrosis	20
Patients with normal renal cortical thickness	42
Patients with reduced cortical thickness	8

Table II: History of patients

Characteristics	Number	P value
History of right renal surgery	26	0.783
History of left renal surgery	24	
History of previous renal surgery	3	>o.o5
History of diabetes mellitus	2	>o.o5
History of hypertension	3	>o.o5
History of urinary tract infection at admission	6	>o.o5

Table III: Characteristics of patients with hematuria

Characteristics	Number	P value
Patients with hematuria	50	
Patients with passage of clots	40	0.029
Patients with hemodynamic instability	15	
Patients who suffered shock	2	
Patients with low hemoglobin who needed transfusion	45	0.015
Patients who respond well to conservative therapy	47	0.012
Patients who needed surgical intervention	3	
Average stay at hospital (days)	5	
Maximum period of conservative therapy (days)	7	
Patients with mild or no hydronephrosis who present with severe bleeding	33	0.046
Moderate-severe hydronephrosis present with severe bleeding	17	

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