ORIGINAL ARTICLE

Outcome of Percutaneous Nephrolithotomy

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ABSTRACT

Objective: To assess the implementation of Percutaneous Nephrolithotomy (PCNL) in renal stone management and evaluate the factors for efficacy and safety of PCNL.

Study Design: Case series.

Place and Duration of Study: Department of Urology at Jinnah Postgraduate Medical Centre, Karachi, from January 2008 to December 2011.

Methodology: Patients aged above 12 years of age, irrespective of gender with normal renal function, mean stone size > 2 cm, lower pole stones > 1 cm, and ESWL failure were selected. After the procedure, on the first postoperative day, a plain abdominal radiograph was obtained to verify stone clearance. A nephrostomy tube was clamped overnight and subsequently removed when no residual stone which needs second sitting was seen.

Results: In 175 patients, 62.86% (n=110) were male and the mean age was 35 ± 9.56 years. One hundred and seventeen (66.85%) patients were primarily stone free and 13.71% (n=24) patients needed a second look procedure, thus, a total of 80.57% (n=141) patients were stone free in the same admission. Complications included failure in 4.0% (n=7) patients, bleeding in 8.57% (n=15) patients, a small residual stone in 15.43% (n=27) patients; and puncture site pain almost in every patient. Transient fever occurred in 55.43% (n=97) patients, urinary leakage in 8.57% (n=15) patients, urinary tract infections in 5.14% (n=9) patients, ureteric colic in 3.43% (n=6) patients, colonic injury in 0.57% (n=1) patient; and nephrectomy was required in 0.57% (n=1) patient due to severe bleeding. One patient (0.57%) expired due to anaesthesia complications.

Conclusion: Percutaneous nephrolithotomy (PCNL) has a good success rate. There is minimal blood loss, and few major complications.

Key Words: *Percutaneous nephrolithotomy (PCNL). Complications. Outcome. Renal stones.*

INTRODUCTION

Percutaneous approach to kidney was first described in 1955 by Goodwin and colleague.[1] This approach, with the insertion of nephrostomy tube, was used to provide drainage for obstructed renal unit. This example led to recognition that same access could also be used as a working channel for the percutaneous removal of the kidney stone. Thus began era of percutaneous renal surgery.[2]

Previously the surgical options to the urologist for treatment of larger renal calculi were limited to open surgical techniques such as pyelolithotomy and nephrolithotomy with their inherent disadvantages. As these new techniques have been increasingly adopted and the practice perfected, there has been a dramatic reduction in morbidity and mortality from renal urolithiasis.[3]

In countries like Pakistan, the mere unavailability of extracorporeal shock wave lithotripsy (ESWL) and percutaneous nephrolithotomy (PCNL) makes open surgery as the most common modality used for the removal of renal stones.[4] However, it is an established fact that percutaneous surgery can be the best alternative to open surgery, whether alone or in combination with extracorporeal shock wave lithotripsy (ESWL).

PCNL needs a large percutaneous tract into the kidney to enable the passage of the nephroscope, and tract dilation is a major procedure, which can be particularly complicated in certain patients, such as those with scar tissue from previous procedures.[5-9]

In the West, the Radiologist who carries out the initial puncture and tract dilation is followed by a Urologist who performs nephroscopy and retrieval of stones. Whether the access is made by the urologist or the radiologist, the access is as good as the operator's experience. This mainly depends on the caseload and the personal experience. In a tertiary care centre even the most complex cases can be solely managed by urologists.[2]

PCNL is generally a safe treatment option and associated with a low but specific complications rate. Many complications develop from the initial puncture with injury of surrounding organs (e.g. colon, spleen, liver, pleura, and lung). Other specific complications include postoperative bleeding and fever.[5]

The advantages of PCNL are small incision, minimum operative and postoperative complications, short hospital stay and early resumption of daily routine

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work.[10] The disadvantages of PCNL as include, increased blood loss and greater pain.[11]

The objective of this study was to assess the implementation of percutaneous nephrolithotomy (PCNL) in renal stone management and evaluate the factors for efficacy and safety of PCNL.

METHODOLOGY

This study was conducted in Department of Urology and Transplantation, JPMC, Karachi, from January 2008 to December 2011.

Routine preoperative evaluation and all procedures were done by a single team of the urology department.

Inclusion criteria were patients aged above 12 years of age, irrespective of gender with normal renal function, mean stone size > 2 cm, lower pole stones > 1 cm, and ESWL failure.

Exclusion criteria were urinary tract infection, large stag horn calculi, bleeding diathesis, pulmonary disease, cardiovascular disease, obesity/body mass index, habits, multiple caliceal stones, and patients with thin outer renal cortex.

PCNL was performed as the standard technique in prone position and an intracorporeal pneumatic lithotripter (Swiss lithoclast) and ultrasound was used for stone fragmentation. Posterior inferior or superior calyceal puncture was the commonest initial access tract; however, separate punctures were also made as indicated by the stone geometry.

At the end of the procedure, 16 - 20 Fr Foley catheters was used in all cases as nephrostomy. On first post-operative day, a plain abdominal radiograph was obtained in order to verify that the stones had been completely removed; the nephrostomy tube was clamped overnight and subsequently removed if no residual stone was seen.

Data was entered and analyzed in statistical software Statistical Package for Social Sciences (SPSS) version 16. Frequency and percentage were computed for categorical variables and mean and standard deviation were computed for quantitative variables.

RESULTS

The mean size of stones was 2.5 cm (ranging from 1.5-3.5 cm). Out of the 175 patients, 62.86% (n=110) were male and 37.14% (n=65) female. The mean age of the patient population was 35 ± 9.56 years (range: 15 - 70 years). Out of 175 patients, 51.43% (n=90) patients had pelvic stones, 22.86% (n=40) patients had stag horn calculi, 14.28% (n=25) patients had upper pole calyces stones and 11.43% (n=20) patients had lower pole calyces stones.

Regarding operative approach, 51.43% (n=90) patients were approached via Lower pole of calyces, 17.14% (n=30) patients via middle pole of calyces, 12.0% (n=21) via upper pole of calyces, and 19.43% (n=34) required more than one track.

The mean operation time was 90 ± 60.2 minutes (ranging from 40 - 120 minutes). Mean hospital stay was 6 ± 3.1 days (ranging from 3 - 12 days), including one day before surgery. Majority (66.85%, n=117) patients were primarily stone free while 13.71% (n=24) patients required second sitting; thus, a total of 80.57% (n=141) patients were stone free in the same admission (Table I). Procedure failed in 4.0% (n=7) patients while 15.43% (n=27) patients had a small residual stone which was treated by ESWL (extra corporeal shock wave lithotripsy) later.

Track pain was reported by all the patients; transient fever was observed in 55.43% (n=97) patients in the immediate postoperative period, which was subsided in 48 hours with routine postoperative treatment. Nine (5.14%) patients had documented urinary tract infection without signs of urosepsis. They were treated with antibiotics according to their organism sensitivity. Urinary leakage occurred in 8.57% (n=15) patients. Among them, 6 (40.0%) patients needed URS due to small stones in the ureter, while 9 (60.0%) patients were managed conservatively.

Severe bleeding occurred during procedure in 8.57% (n=15) patients (Table II). Foley's catheter temponade was applied for 5 - 10 minutes, which enabled to continue the procedure in 9 (60.0%) patients. In 6 (40.0%) patients, procedure was abandoned initially due to bleeding and PCNL was done in second sitting successfully. In 4.0% (n=7) patients, there was a failure to make track due to minimal hydronephrosis and technical problems so the procedure was converted to pyelolithotomy. Ureteric colic was observed in 3.43% (n=6) patients in the immediate and early postoperative

Table I: Success rates.

	Number of patients	Percentage
Primary clearance	117	66.85%
Clearance in second sitting	24	13.71%
Total clearance	141	80.57%
Residual stone	27	15.43%
Failure	7	4.0%

Table II: Postoperative complications.

Complications	Number of patients	Percentage
Track pain	175	100%
Fever	97	55.43%
Urinary leakage	15	8.57%
Bleeding	15	8.57%
Urinary tract infection	9	5.14%
Track failure	7	4.0%
Ureteric colic	6	3.43%
Colonic injury	1	0.57%
Nephrectomy	1	0.57%
Death	1	0.57%

period, which was managed with analgesics. No ancillary procedure was required. Colonic injury occurred in 0.57% (n=1) patient, which was managed as controlled fistula. In 0.57% (n=1) patient, nephrectomy was required in the early postoperative period due to excessive bleeding. One patient (0.57%) expired due to anesthesia complications.

DISCUSSION

Renal tract stone disease is generally an ailment of the relatively younger people; this was also observed in the present study where the mean age of patients was 35 years. The goal of surgical stone management is to achieve maximum stone clearance with least morbidity to the patient.[12] Percutaneous nephrolithotomy is generally accepted as a safe procedure. The overall morbidity ranges from 7.5% to 18% depending upon the sample size and the presence of complicated renal stones.[13]

PCNL has proved to be a less morbid procedure as compared to open surgery for stone. In a community setting, approximately 90% of targeted stones can be removed successfully, and at experienced subspecialty care centres, this rate can approach to 100%.[10]

According to the American Urological Association (AUA) guideline panel 2004 report, PCNL should be first line treatment for most patients with stag horn/large stones. Stone free rate of 78% (74 - 83%) which was equivalent to open surgery and superior to both SWL monotherapy (54%) and combination therapy SWL plus PCNL (66%). A success rate of 98.3% had been reported from Mayo Clinic in a series of 1000 patients for the small symptomatic calculi of upper ureter and renal pelvis.[14] In the present study, stone clearance rate by PCNL as mono-therapy was 80.57%. In 15.43% (n=27) patients ESWL was needed and total stone free rate was 95.98%.

Overall major complication rate for PCNL was between 4 - 8%. Contemporary rate of transfusion range from 2% to 23%.[15,16] The average haemoglobin drop ranges from 2.1 to 3.3 g/dL.[17] Factors related to blood loss during the procedure includes diabetes mellitus, hypertension, large stone burden multiple tracts and surgeon's experience. In this study, 38.86% (n=68) patients were transfused during surgery. Transfusion rate is higher as compared to international rates, mostly required in initial years probably due to the learning curve.

Injury to other organ is rare, colonic injury being the most common.[18] Injury to adjacent organs are major complications that can be avoided by ultrasound guided puncture. Colonic perforation is usually due to transcolonic percutaneous access. Patients at most risk include those with prior abdominal surgery where colonic adhesions are more likely, those with retro-renal colons (more common on left), and those with history of constipation or other causes of colonic distention. Colonic injury is also more likely with lower pole and lateral renal access. In this series, one patient had right colon injury which was managed conservatively by controlled fistula.

Pulmonary complications, such as hydrothorax and pneumothorax are usually related to percutaneous renal access. Infracostal approach should be used when possible because complication rates of supra costal approach are three-fold greater, ranging from 23% to 100% for supra eleventh rib and 1 - 13% for supra twelfth rib.[19] No such pulmonary complication was noted in this study.

Sepsis and transurethral resection syndrome indicate a poor technique that has resulted in high pressure within the collecting system during manipulation. These problems can be avoided by using continuous flow instruments or an Amplatz system.[20] The most common medical complication associated with PCNL is post-operative fever 23 - 25%.[21] Only a fraction of these patient develops urosepsis, which has an overall incidence of 1 - 2%.[22] In this study, 55.43% (n=97) patients had postoperative transient fever.

Bleeding is generally avoided by an anatomically oriented access, as described above. Major bleeding during the procedure requires termination of the operation, placement of a nephrostomy tube, and secondary intervention at a later date. In most cases, venous bleeding stops when the nephrostomy tube is clamped for some hours. Persistent or late secondary bleeding is caused by an arterial injury and can be managed by super-selective angiographic embolisation. Nephrectomy is rarely necessary while major vascular injuries requiring further intervention occurs in only 2 - 3% of cases.[21-24] One case developed haematuria after 10 days, which was not settled and ended-up with nephrectomy due to unavailability of angio-embolization facilities. Urinary fistulae are also reported in some studies but none was encountered in the present study. Fifteen patients (8.57%) in this study developed urinary leakage in early postoperative period, among them, 6 patients required URS for residual fragment in ureter, while 9 patients were managed conservatively. The overall mortality of PCNL ranges from 0.5% to 1.1%, and is generally attributed to severe haemorrhage, urosepsis or pulmonary embolism. No surgery related mortality was recorded in the present study, but one patient died of anaesthesia complications.

CONCLUSION

Although PCNL is a safe procedure for the treatment of renal calculus, it sometimes results in some complications. Bleeding after PCNL is generally self-limited and can be treated conservatively. However, it is important to determine the time for emergent intervention.

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