Original Article

Percutaneous Nephrolithotomy (PCNL): Comparison of Tubeless versus Conventional Method in terms of Hospital Stay and Duration of Operation

Imran Qadir, Muhammad Ali, Ghulam Mahboob Subhani, Ashraf Ali Jafari, Muhammad Akmal Muhammad Irfan Munir, Safdar Hassan Javed

Abstract

Introduction: Percutaneous Nephrolithotomy (PCNL) is an effective treatment for large renal calculi and usually a nephrostomy tube is placed in the kidney at the end of PCNL. **Objective:** To compare the outcome of conventional percutaneous nephrolithotomy with postoperative PCN tube versus tubeless Percutaneous Nephrolithotomy, in terms of duration of surgery and postoperative hospital stay. **Study Design:** Randomized control trial. **Setting:** Urology Department Punjab Medical College / Allied Hospital Faisalabad. **Materials & Methods:** Sixty patients were taken with non probability consecutive sampling technique. They were divided into group A(n=30) with conventional PCNL having postoperative nephrostomy tube and group B(n=30) with tubeless PCNL by computer generated random number table. They were compared in terms of duration of surgery and post operative hospital stay. **Results:** Age distribution of total patients ranged from 15 to 77 years, mean age was 35.07±15.89. Mean duration of postoperative hospital stay was 6.2±0.81and 4.07±1.2 days (p-value=00001) in group A and group B respectively. The operating time was 80 to 145, minutes, mean time 110.17±15.87 in group A. In group B, operating time was between 65 to 140 minutes mean time 95.18±22.43. **Conclusion:** Tubeless PCNL reduces duration of surgery and postoperative hospital stay significantly as compared to conventional PCNL with postoperative nephrostomy tube. **Key Words:** Percutaneous Nephrolithotomy (PCNL), Tubeless, Hospital Stay, Conventional.

INTRODUCTION

Kidney stone disease, is a cause of a number of complications leading to even renal failure, if untreated. Pakistan falls in the geographic zone of a stone belt including areas like Turkey, Iran, Afghanistan, China and Thailand[1].

Corresponding Author
Dr. Imran Qadir
Medical Officer Urology Department
PMC/Allied Hospital Faisalabad
Tel. +92300-6685995
E-mail: drimranqadir@yahoo.com

There is a higher incidence of stones in lower Punjab and Northern Sindh in Pakistan[2]. More than half of the population lives in rural areas and the climate is moderate to severly hot in summer season which extends from April to September. The general pattern of fluid intake of the people is not according to the recommendations. These factors predispose the population to a greater incidence of urinary calculus disease[3]. Stones usually present with acute onset of pain due to acute obstruction, distention of the upper urinary tract and infection which may necessitate medical

attention, emergency treatment, hospitalization or surgical therapy [4]. Anciently open surgery was the only treatment for renal calculi. Since the clinical introduction of Extra-Corporeal Shock Wave Lithotripsy (ESWL) and endourological techniques, the management of renal stones has changed. By this way urolithiasis management has moved from open surgery to minimally invasive procedures with the aim of achieving maximum stone clearance with minimum morbidity and mortality[5]. PCNL is really a minimally invasive modality for treatment of urolithiasis. It leaves patient with less or no morbid change of renal anatomy as compared to open surgery, minimal scaring, early mobilization and shorter hospital stay [6].

Placement of a nephrostomy catheter after PCNL is considered the standard procedure. The purpose of PCNL is to tamponade bleeding, aid in renal drainage, prevent urinary extravasation and offer access for the future endoscopic procedures. Despite these apparent advantages nephrostomy tubes have been implicated in causing postoperative discomfort and increasing morbidity, prolonging hospital stay and continued urinary leakage. However, in recent years, with a growing realization of significant postoperative pain and morbidity after PCNL because of nephrostomy tubes, attempts have been made to modify standard PCNL [7,8].

OBJECTIVES

To compare the outcome of conventional percutaneous nephrolithotomy with postoperative PCN tube versus tubeless Percutaneous Nephrolithotomy in terms of –

I- Post-operative Hospital stay
II- Duration of Surgery

MATERIAL AND METHODS

Settings and Study Design: The study was conducted in the Urology Department, Punjab Medical College (PMC)/ Allied Hospital Faisalabad (AHF) from March 2012 to June 2013. A total number of sixty consecutive patients from both sexes were studied with non probability consecutive sampling technique.

Inclusion Criteria

Patients with renal stone requiring PCNL, more than 15 Years of age of both sexes, with documented sterile urine, confirmed by Urine Culture and Sensitivity. Also Patients requiring only single percutaneous nephrostomy tract for renal stones greater than 2.5 cm and stone larger than 1.5 cm in lower pole calyx. Stones more than 1 cm size resistant to extracorporeal shock wave lithotripsy were also included. Stone size and location was confirmed on Ultrasonography and intravenous urography.

Exclusion Criteria

Patients with preoperative nephrostomy tube, patients who required redo surgery, patients with non renal pain like rediculitis and patients with any other preoperative illness like Diabetes mellitus and ischemic heart disease confirmed by Blood sugar level and Electrocardiography respectively. Also patients with postoperative illness like atelactasis and urinary tract infection confirmed by X-ray chest and urine for culture and sensitivity which might delay the duration of surgery and hospital stay were also excluded.

Study Protocol

All the patients were admitted in the urology department of PMC/Allied hospital Faisalabad. After subjective evaluation and objective examination the following investigations (complete blood count, prothorombine time, activated partial thromboplastin time, mid stream urine complete examination and culture, renal function test, X-ray chest, electrocardiogram, ultrasonography of abdomen and pelvis and intra venous urogram were carried out. All patients who met inclusion criteria underwent PCNL.

Distribution of Patients

Patients were divided into two groups by computer generated random number table. Group

A (n=30 patients) undewent conventional PCNL with postoperative nephrostomy tube and group B (n=30 patients) underwent tubeless PCNL.
This operation was performed under general anesthesia by the consultants of Urology well experienced in PCNL.

Operative Details

A written informed consent was taken and explanation of risks and benefits of the procedure and research was given to the patient and/or his/her attendants. General anesthesia was given with endotracheal tube. Retrograde ureteric catheterization and retrograde pyelography was done routinely in all patients in a lithotomy position to delineate the anatomy and to fill the pelvicalyceal system with contrast media (Urografin) to facilitate percutaneous access. A ureteric catheter 5 Fr was left in the pelvis, as a point of reference and also if required to refill contrast media at the time of percutaneous access. A 16 Fr Foley catheter was passed per urethra and the ureteric catheter was secured with Foley catheter. Position of patient was changed to prone. Foam padding was placed under the chest and knees and folded pillows under each foot.
Operating site was prepared with disinfectant solution povidone iodine. Access to pelvicalyceal system was acquired through upper, middle or lower calyceal systems according to stone burden, location and dilatation of the particular calyx. Initial puncture for PCNL tract was made with a spinal needle 16-guage. Puncture was made under image intensifier with all axes of the C-arm at zero degree. Position of needle was reconfirmed with antegrade filling of the collecting system with contrast media. Then a guide wire 0.035 inch size was threaded in through the spinal needle into the pelvicalyceal system. The tract was then gradually dilated first with vascular dilator then by metallic facial dilator with seldinger technique. All metallic facial dilators were slided over each other with a gentle downward spiral thrust. Amplatz sheath was slided over the whole set of dilators down to the olive tip dilator as seen with help of image intensifier. Amplatz sheath was confirmed, the dilator set was removed and guide wire was retained through nephroscope. An irrigation system with normal saline as irrigant was connected and light source (xenon) was also attached, Nephroscopes used were 26 Fr through a 30 Fr Coock Amplatz sheath. Guide wire was retained till the end of the surgery. Stones were targeted and fragmented with a pneumatic lithoclast with the single and multiple fires and were retrieved out with forceps. At the end of the procedure final search for any residual stone was made by the image intensifier and nephroscope. A 16 Fr nephrostomy tube was placed only in group A patients. In group B patients no nephrostomy tube was placed.
After completion of the procedure and recovery from anesthesia all patient were shifted to the Urology ward and observed for study purpose. Case sheets of patients, who underwent PCNL through the specified period were studied to evaluate duration of surgery and post operative hospital stay and duration of operative procedure in both groups of patient.

RESULTS

Total 60 patients treated for renal stones with PCNL were included in research work, they were randomized in two groups. Group A was comprising of 30 cases of conventional PCNL (with post operative nephrostomy tube), Group B was comprising of 30 cases of tubeless PCNL. The age distribution of total patients ranged from 15 years to 77 years, mean age was 35.07±15.89. In group 'A' age distribution ranged from 15 years to 77 years, mean age was 34.63±15.62. While In group 'B' age distribution ranged from 15 years to 70 years, mean age was 35.50±16.41. Frequency of male patients was 33 (55%), while frequency of female patients was 27 (45%).
The stone size was between 2.0cm to 3.9cm mean size 2.95±0.46 in group A and 1.8cm to 3.5cm mean size 2.96±0.21 for group B.

Table -1
Distribution of Patients According to age, gender, side of the Body and Size of the Stone in Group A and Group B

Group	n	Mean Age (yrs)	Gender		Side		Mean Stone Size (cm)
			Male	Female	Right	Left	
A	30	34.63± 15.62	17 (28.3%)	13 (21.6%)	17 (56.7%)	13 (43.3%)	2.95± 0.46
B	30	35.50± 16.41	16 (26.6%)	14 (23.4%)	19 (63.3%)	11 (36.7%)	2.96± 0.21

Observing the Side of operation, in group A, 17 patients (56.67%) underwent right sided operation and 13 (43.33%) underwent left side operation.
In group B, 19 patients (63.3%) underwent right sided operation and 11 (36.67%) underwent left sided surgery. The operating time was prolonged 80 to 145 minutes, mean time 110.17±15.87 in group A, while in group B, operating time was between 65 to 140 minutes, mean time 95.18±22.43.
A statistically significant difference was found in the both groups. In total 60 patients, duration of post operative hospital stay ranged from 2 to 8 days, mean duration of post operative hospital stay was 5.1333±0.4805 days (Table-1).

Table-2
Detail of duration of post-operative stay and duration of operative time in Group A and Group B

Variable	Group	Minimum	Maximum	Mean	P-value
Post-operative hospital stay (Days)	A (n=30)	05 (Days)	8 Days	6.2 ± 0.81	< 0.005
	B (n=30)	02 (Days)	7 Days	4.0 ± 1.2	
Operation Time (Minutes)	A (n=30)	80 (Minutes)	145 (Minutes)	110.17± 15.87	< 0.005
	B (n=30)	65 (Minutes)	140 (Minutes)	95.18 ± 22.43	

While in group A, postoperative hospital stay ranged from 5.00 to 8.00 days with mean stay of 6.2 ± 0.81 days. In group B, hospital stay ranged from 2.00 to 7.00 days, mean duration of stay was 4.07±1.2 days with P-value of 0.0001 (less than 0.05). Hospital stay was shorter in group A patients. A statistically significant difference was found in the both groups regarding hospital stay (Table-2).

Figure-1
Post Operative Stay in Days in Group A and Group B Patients

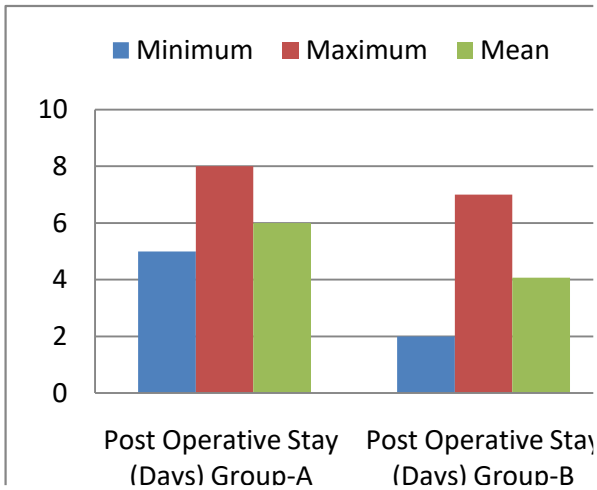
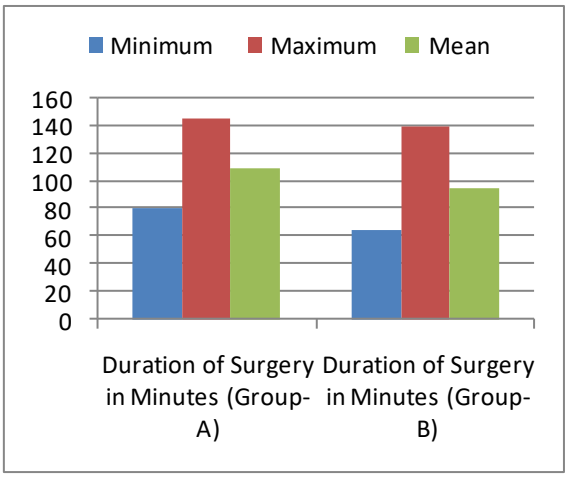


Figure-2
Duration of Operation in Minutes in Group A and Group B Patients



DISCUSSION

Percutaneous nephrolithotomy (PCNL) is considered the most effective treatment and recent modality for large renal calculi.[9] This technique was first used in 1976. PCNL success rate has progressively increased because of the many advances in endoscopic equipment and techniques.[10] The PCNL has the advantages of higher stone clearance and cost effectiveness when compared with other treatment modalities, such as ESWL and open stone removal techniques. Although open surgery has a role in selected cases, apparently PCNL decreases morbidity rates as compared with open surgery.[11] Placement of nephrostomy tube after PCNL is considered the standard procedure. Traditionally a large bore 20-24 Fr nephrostomy tube is used. The advantages of postoperative nephrostomy tube are, tamponading bleeding, aiding in renal drainage, preventing urinary extravasation, and offering access for redo-PCNL. However, in recent years, with a growing realization of significant post-PCNL pain and morbidity because of nephrostomy tubes, attempts have been made to modify conventional PCNL.[7] To reduce discomfort and tube related morbidity different modifications have been made, like the small sized nephrostomy tube of 10-12 Fr or complete avoiding of tube placement in selected cases. [12,13]

Wickham et al published their experience in selected cases in 1984 with percutaneous nephrolithotomy and stated that to place post-operative nephrostomy tube was a safe option [14]. In 1986 Winfield et al reported two patients after tubeless PCNL with prolonged hospitalization and pain. Thereafter, placing a nephrostomy tube after PCNL became standard choice [15].

The modern approach is to make the PCNL a day surgery procedure which would be more convenient and more cost-effective for the patients without compromising safety and efficacy.

Husain studied 90 patients by distributing in to three groups; i- conventional PCNL with large bore tube, ii- with small bore nephrostomy tube and iii- tubeless PCNL. In conventional PCNL duration of hospital stay was 4 to 7 days with mean 5.7±0.75 days, while in tubeless PCNL hospital stay period was reduced to 1 to 4 days with mean post operative Hospital stay 3.17±0.75 days [13].

Sofer and Beri studied 126 patients with 66 (52%) tubeless and 60 (48%) conventional PCNL procedures. Due to a lot of variations in variables (like staghorn stones, supracostal punctures, multiple accesses, anomalous kidneys, previous history of surgeries and single functioning kidneys), so analysis of duration of surgery was not comparable. The median hospital stay in the tubeless PCNL group were significantly shorter than for the conventional PCNL group (1 versus 4 days) with P value <0.001. The author concluded that tubeless approach was reasonably safe in selected patients with uncomplicated percutaneous procedure and low calculus burden[16].

Wang and Zhao performed a meta-analysis of 127 studies (1365 cases) on comparison of conventional PCNL with tubeless PCNL. The mean length of hospital stay for the tubeless PCNL group was significantly shorter than for that of the conventional PCNL group, by a mean value of 23.86 h ($P < 0.05$) [17].

In another study Nalbant compared 85 cases of tubeless PCNL with 110 patients conventional PCNL. In group-I tubeless PCNL, 78 (91.6%) had complete stone removal while in group-II 96 (87.7%) cases with nephrostomy had complete stone removal. Operative time in group-I was 78.8±27.9 minutes and in group-II 81.9±28.7 minutes and P value was more than 0.05. Tubeless technique has less time of duration of surgery and fluoroscopic exposure, but has not significant difference. Length of postoperative hospitalization was 1.6 ± 1.1 and 3.5 ± 1.5 days for tubeless and non- tubeless respectively [18],

In our study of 60 patients which were equally divided into group A with 30 cases of conventional PCNL with postoperative nephrostomy tube and group B 30 cases of

tubeless PCNL. The operating time was 80 to 145 minutes with mean operative time 110.17±15.87 minutes in group A and in group B patients operative time was between 65 to 140 minutes with mean time 95.18±22.43 minutes. Mean duration of postoperative hospital stay was 6.2±0.81 days and 4.07±1.2 days in group A and group B respectively (p-value=00001). In our Institute we usually removed the nephrostomy tube after 48 hours, routine postoperative nephrostomy drainage for 48 hours increases the hospital stay by a couple of days. Thirty patients treated with tubeless PCNL had significantly less morbidity in terms of shorter operation time and shorter postoperative Hospital stay.

CONCLUSION

Tubeless PCNL is associated with the shorter operative time and less postoperative hospital stay and it is a better option after an uncomplicated percutaneous renal procedure.

Conventional PCNL is associated with tube related morbidity and required removal of nephrostomy after 48 hours that can increase hospital stay.

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AUTHORS

- **Dr. Imran Qadir**
  Medical Officer Urology Department
  Allied Hospital Faisalabad
- **Dr. Muhammad Ali**
  Assistant Professor of Urology
  PMC/Allied Hospital Faisalabad
- **Dr. Ghulam Mahboob Subhani**
  Associate Professor of Urology
  PMC/Allied Hospital Faisalabad
- **Dr. Ashraf Ali Jafari**
  Assistant Professor of Urology
  PMC/Allied Hospital Faisalabad
- **Dr. Muhammad Akmal**
  Assistant Professor of Urology
  PMC/Allied Hospital Faisalabad
- **Dr. Muhammad Irfan Munir**
  Senior Registrar Urology
  Allied Hospital Faisalabad
- **Prof. Dr. Safdar Hassan Javed**
  Professor & Head of Department Urology
  PMC/Allied Hospital Faisalabad

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