Research Article

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Post Percutaneous Nephrolithotomy Urinary Tract Infection: A Clinical Dilemma.

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ABSTRACT

Renal stone disease is a global problem with a 12% global prevalence. For the management of renal stones percutaneous nephrolithomy (PCNL) is the urological intervention of choice. There have been several instances of post-PCNL urinary tract infection (UTI) despite a sterile pre-operative urine culture. To look into the possible factors that may be associated with such an outcome, we observed 142 patients undergoing PCNL with a pre-requisite of sterile pre-operative urine culture, no indwelling double J stents, and no fever episodes within the last seven days of admission for PCNL. **Results:** 19% of 142 patients suffered post-PCNL UTI. We noted that the presence of multiple stones, stone burden of greater than 3 cm, and perinephric fat stranding in pre-operative CT scan of the KUB region were the preoperative factors associated with post-PCNL UTI. Intraoperative factors that were found associated were the size of tract dilatation (16 Fr or greater than 16 Fr), number of renal access tracts, and duration of surgery. We also found that patients with controlled diabetes behaved as the non-diabetic population for the incidence of UTI post-PCNL.

INTRODUCTION

Renal stone disease is a global problem with a prevalence of 12% globally[1], and in India, the prevalence is around 15%[2]. For the management of renal stones, percutaneous nephrolithotomy (PCNL) is the urological intervention of choice[3,4]. Although PCNL is a clean-contaminated surgery despite all aseptic precautions, some of the patients suffer from post-operative urinary tract infections (UTI), with incidence ranging from 21-39%[4], in whom the urine had no growth in the pre-operative period. Such an event in a pre-operative sterile setting raises questions directed toward the cause of infection. Theoretically, it may be a result of the liberation of microbe from infectious stone during fragmentation[5], maneuvering, and manipulation inside the pelvicalyceal system[6]. This can cause a systemic infection by the introduction of a pathogen to the host's blood circulation through pyelo-venous and pyelo-lymphatic reflux[7]. There are likely to be some more modifiable and non-modifiable factors which are associated with such an outcome. In our study, we attempted to know the factors responsible for the incidence of such an outcome.

MATERIALS AND METHODS

A prospective observational study was conducted in a tertiary health care center in Pune, India, which included 142 cases undergoing PCNL. The study population ranged between 18 – 82 years (mean 46.05 years).

Inclusion Criteria:

1. Adult patients suffering from renal stone disease.
2. Pre-operative sterile urine
3. No recent history of any urological intervention.

Exclusion Criteria:

1. Presence of indwelling catheters or double J (DJ) stents,
2. History of fever within the last 7 days of admission for PCNL.

For Standardization Of Subjects:

- All patients received an antibiotic prophylaxis regimen as per the hospital protocol i.e. three doses of injection Cefuroxime 1.5 gm iv. q12h, starting with 1st dose during induction of anesthesia.
- All patients underwent prone PCNL under an epidural combined with spinal anesthesia.
- PCNL was performed only if the aspirate obtained after access to the pelvicalyceal system was clear;
- A post-procedure DJ stent was inserted and a

Journal of Infectious Diseases (ISSN 2831-8064)

percutaneous nephrostomy (PCN) drain was placed.

- In the postoperative period on the day of surgery,- an injection of Paracetamol 1 gm iv q12h was used as the standard dose of analgesia.
- For all patients, the PCN tube was removed on postoperative day (POD)-1, subject to clearance of stone, confirmed on X-ray kidney-ureter-bladder region / USG kidney-ureter-bladder region.
- For all patients, per urethral catheter was removed on POD 2 and then a sample for urine culture was sent for microbiological evidence of UTI.

RESULTS

In the following 142 patients, we noted microbiologically proven UTI in 27 patients (19.01%). We analyzed these twenty-seven patients for their preoperative and intraoperative factors that could be associated with such an outcome, the findings of which are depicted in table 1.

Table 1

	No.of Patients	UTI	Percentage
Overall	**142**	**27**	**19**
Preoperative Factors			
Diabetes Mellitus			
Diabetics with good sugar control	23	1	4.3
Non-diabetic	119	26	21.84
Number Of Stones			
Solitary	46	6	13.04
Multiple	96	21	21.87
Stone Burden			
< 3cm	81	12	14.81
> 3cm	61	15	24.59
Perinephric Fat Stranding On CT KUB			
Present	43	12	27.9
Absent	99	15	15.15
Intra-Operative Factors			
Access Tract Dilatation			
16 Fr	21	2	9.5
22 Fr	42	10	23.8
24 Fr	79	15	18.98
Number Of Access			
Single	125	22	17.6
Multiple	17	8	47.05
Duration Of Surgery			
< 65 mins	86	9	10.46
> 65 mins	56	18	32.14

Table 1: Outcomes of 142 patients undergoing PCNL. 19 patients suffered UTI. The pre-operative and intra-operative factors were analyzed against the outcome.

a. Preoperative Factors

1. Diabetes Mellitus

As a protocol in our hospital, for any diabetic patient to undergo any elective surgery, diabetes should be under control. We encountered that out of 142, twenty-three patients were diabetic who underwent PCNL. Out of those twenty-three patients, only one had encountered a post-PCNL UTI (4.3%) which was comparable with a non-diabetic population in the study.

Journal of Infectious Diseases (ISSN 2831-8064)

2. Stone Characteristics

- **Stone Number:** We compared the presence of single stones vs multiple stones for post-PCNL UTI. Out of 142 cases, forty-six had solitary renal stones (32.39%) and the remaining ninety-six had multiple renal stones (67.6%). Among 46 cases of single renal stones who underwent PCNL, six suffered UTI (13.04%). Among the cases of multiple renal stones, twenty-one of ninety-six suffered UTI (21.87%).
- **Cumulative Ntone Size:** On evaluating 142 patients, the mean cumulative stone size was noted to be 32.7 mm. We grouped patients having more or less than a 3 cm stone load. We found eighty-one cases had stone load < 3 cm (57.04%) and in this subgroup twelve suffered post-PCNL UTI (14.81%). While remaining sixty-one cases had a stone load of > 3cm and among them, fifteen suffered post-PCNL UTI (24.59%).

3.Perinephric Fat Stranding

Among 142 cases undergoing PCNL, perinephric fat stranding on CT scan of the KUB region was preoperatively detected in forty-three cases (30.28%). Among these forty-three cases, twelve suffered post-PCNL UTI (27.9%). In comparison, among those who did not have such CT findings i.e. ninety-nine cases (69.72%), fifteen cases developed post-PCNL UTI (15.15%).

b.Intraoperative Factors

1.Tract Dilatation : After needle access into the pelvicalyceal system, the tract dilatation in 142 cases was done up to 16 Fr (21 cases, 14.78%), 20 Fr (42 cases, 29.57%), and 22 Fr (79 cases, 55.63%). Post-PCNL UTI was noted in 2 (9.50%), 10 (23.80%) and 15 (18.98%) cases respectively. On taking together cases with more than 16 Fr of tract dilatation, the incidence of UTI was 25 of 121 patients (20.66%) which is significant.

***2.Number Of Renal Accesses*:** for complete clearance of the stone load in 142 cases of PCNL we noted single access was done in 125 cases (88.02%) while in the remaining 17 cases, multiple accesses were done. In the single access subgroup, twenty-two patients (17.5%) suffered UTI and in the multiple access subgroup, eight patients suffered UTI (47.05%) which was a significant finding.

***3.Total Duration Of Surgery*:** The mean duration of PCNL in 142 cases was 64.79 minutes. In the cases who suffered post-PCNL, the mean duration of surgery was longer (81.29 minutes) versus those who had a non-eventful post-operative course (60.89 minutes) [table-2]. On subgrouping, 142 cases to more or less than 65 minutes of duration of surgery, we noted that in eighty-six (60.56%) cases, the duration of the procedure was less than 65 minutes. In this subgroup, nine patients suffered post-PCNL UTI (10.46%). While the other subgroup (>65 minutes) had fifty-six cases, but eighteen cases suffered post-PCNL UTI (32.14%).

Table 2

	No. of Cases	Mean Duration
All PCNL	142	64.79 mins
Post-PCNL UTI	27	81.29 mins
Post-PCNL no UTI	115	60.89 mins

Table 2: The mean duration of procedures as noted in 142 cases.

On microbiological analysis of the post-operative urine cultures, out of 142, twenty-seven patients had developed bacteriuria (19.01%). E. coli was noted to be the most common isolate, found in twenty-one cases (77%), next common was Klebsiella spp– noted in five (18.51%) followed by Enterobacter spp in one case (3.7%).

DISCUSSION

After the inception of PCNL in 1978 by Fernstoom and Johansson[8], various observations have been noted in the course of the outcomes of surgery. One such complication is post-procedure urinary tract infection or sepsis, which is documented in the range of 21-39%[4,9] in the available literature. In our study, we noted it to be 19% which is an acceptable finding. Several factors have been critically analyzed in the last three decades in order to improve such an outcome[10]. The factors that we focused on were grouped under two categories: i. pre-operative or patient's factors, and ii. intra-operative or surgeon's factors.

Upon analyzing the pre-operative factors for post-PCNL urinary tract infection, we noted that although the pre-existence of diabetes mellitus is an important risk factor for uro-sepsis[4,11,12], good pre-operative control of blood sugar made the outcomes comparable with non-diabetic population. The K.Y. et al[11] observed that post-operative urinary tract infection was noted in 21.7% of the diabetic population undergoing PCNL but their finding did not show a significant association. Our findings show that if the blood sugar is controlled pre-operatively, the post-operative course is likely to be the same as that of a non-diabetic population. We analyzed the renal stone-related features of multiplicity and stone burden for post-PCNL urinary tract infection[12]. The presence of single renal stones had better outcomes as compared to multiple renal stones (13.04% vs 21.87%) for the outcome of post-PCNL UTI which was also concluded by Rivera M. et al[13]. Peng C et al considered the stone size to be a predictor of post-PCNL SIRS[14], we found that with an increase in stone size, the incidence of post-PCNL UTI increases, and for stones larger than 3 cm, 24.59% of cases suffered urinary tract infection.

Journal of Infectious Diseases (ISSN 2831-8064)

As computer tomography of the KUB region is a must investigation in the work-up of the patient undergoing PCNL, sometimes the radiologists find the presence of fat stranding in the perinephric fat zone (PFS). While such fat-stranding is a feature of the presence of pyelonephritis, it can also be noted in patients without any clinical feature of the presence of pyelonephritis (i.e. the absence of any flank pain, fever or chills, renal angle tenderness, and leukocytosis). PFS has been studied for its association with urinary tract infection post-ureterorenoscopic procedures[15]. We analyzed the significance of such a radiological finding for the outcome of post-PCNL urinary tract infection. We noted that patients having perinephric fat stranding had a higher incidence of UTI than those who had normal perinephric fat planes (27.9% vs 15.15%). For the intra-operative factors, we studied the duration of surgery, PCNL tract dilatation, and total number of renal accesses taken for complete clearance of stones. Our hospital being a teaching institute, 142 PCNLs were performed by various trainees under the direct supervision of an experienced Urologist or by the experienced Urologists only. Thus, whether a longer duration of procedure leads to a higher incidence of urinary tract infection was studied. Some of the available studies associate prolonged operative time to cause post PCNL UTI[12, 16], some studies do not correlate the risk of infection with the duration of procedure[14], we noted that even in the experienced hands the duration of PCNL was indeed longer in the cases when the patients had suffered post-PCNL UTI. Our findings were significantly comparable in the two subgroups of less than or more than 65 minutes, 10.46% vs 32.14% respectively. This finding is also supported by the meta-analysis by Zhou G et al[10].

The duration of PCNL is also dependent on the number of accesses taken and dilatation of the PCNL tract, we analyzed both of these parameters. While multiple access puncture was also noted to be an independent risk factor for post-PCNL infection by Teh KY et al[11] which was also noted in a meta-analysis by Zhou G et al[10], it supports our significant finding of 47.05% of cases suffered UTI in the multiple access subgroup. Various studies have been done to evaluate minimal invasive PCNL vs standard PCNL but the differences in the post-procedural infectious events remain the same[17]. However, our comparison of the PCNL tract dilatation of 16 Fr vs > 16 Fr gave us a significant outcome of 20% incidence of UTI in those with >16 Fr of dilatation done (20 Fr or 22 Fr).

The finding of E. coli in the culture isolate, which was the most common culprit of post-PCNL urinary tract infection resonates with the literature available.

Limitations:

1. Single centre study
2. Better analytical outcomes could be achieved with a larger study population.
3. Being a teaching institute and procedure performed by different urologists, a complete uniformity in the approach was difficult which affected the intra-operative factors.

CONCLUSION

The pre-operative factors are non-modifiable and guide us with a better understanding of the expected outcome. They help to educate the patient and the family about a factor-based outcome and the expected occurrence of such an event. A good control of blood sugar levels preoperatively has a positive effect on the outcome with a reduction in the chances of urinary tract infection. The presence of multiple stones and higher stone load is associated with negative outcomes. Thus, medical professionals should counsel the patient for the expert opinion of a Urologist, even in the presence of an incidentally detected solitary renal stone. On the other hand, the intra-operative factors can be modified to a certain extent based on the intra-renal anatomy, location of the stone, and experience of the operating Urologist. The efforts should be directed towards the reduction of the duration of the surgery, appropriate dilatation of the tract, and if possible, to attempt for a single access for complete clearance of the stone.

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