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Infective complications after percutaneous nephrolithotomy in relation to preoperative urine culture status

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Abstract

Introductions: Fever and sepsis after percutaneous nephrolithotomy (PCNL) secondary to urinary tract infection is a major determinant of overall post PCNL complications. This study aims to analyse infective complications after PCNL in relation to pre-operative urine culture status.

Methods: A comparative analysis of post PCNL infective complications in pre-operative urine culture positive (Group A) and negative (Group B) was done for one year during June 2017 to May 2018 in department of urology, Bir Hospital, National Academy of Medical Sciences, Kathmandu, Nepal. Demographics, stone characteristics, mean operative time, post-operative hospital stay and post-operative complications as per Modified Clavien classification were compared between the two groups.

Results: Out of total 136 PCNL patients, 51 were in Group A and 85 in Group B. Infective complications were significantly high, 28 (54.90%) in group A compared to 20 (23.53%) in group B, p=0.004. The most common isolate was Escherichia coli 19 (37.25%), sensitive to amikacin 37 (72.55%). The mean operation time, transfusion and hospital stay was not statically different in two groups. Morality occurred in 1 (1.96%) in group A.

Conclusions: Infective complications were significantly high after PCNL in patients with preoperative positive urine culture, even when it was treated to sterile with sensitive antibiotics, compared to patients with preoperative negative urine culture.

Keywords: modified Clavien classification, percutaneous nephrolithotomy PCNL, sepsis, urine culture

Introductions

Percutaneous nephrolithotomy (PCNL) is the standard treatment modality for larger renal stones (>2cm).[1] Fever (>38^{0}C) is reported in 21-39.8% of patients after PCNL.[2] Post PCNL fever secondary to urinary tract infection is a major determinant of post PCNL sepsis.[3]

The reported incidence of urosepsis is 0.25-4.7% and can lead to multi-organ dysfunction syndrome with high mortality rate if not treated adequately on time.[4] Septicemia can still occur in PCNL despite antibiotic prophylaxis and sterile preoperative urine culture.[5] The incidence of septic shock following PCNL is low at about 1% but the mortality rate is high around 66-80%.[6]

This study compared preoperative urine culture status and post-operative infective complications after PCNL, so that, aggressive management can be done preoperatively to prevent infective complications.

Methods

A comparative analytical study was performed in patients with known preoperative urine culture status who underwent PCNL for renal, pelvic-ureteric junction and upper ureteric calculi in department of urology, Bir Hospital, National Academy of Medical Sciences (NAMS), Kathmandu, Nepal, from June 2017 to May 2018. Ethical clearance from institutional review board (IRB NAMS) was obtained. Written informed consent was obtained from patients.

Data were collected prospectively in a structured proforma. Patient's demographics gender, age, BMI), co-morbid conditions (hypertension, diabetes mellitus, chronic obstructive pulmonary disease), history of previous interventions (ipsilateral open/minimal invasive renal surgery), history of recurrent urinary tract infections, routine urine analysis, urine culture and sensitivity reports, renal function tests (urea, creatinine, sodium, potassium) and complete blood counts were collected. Stone burden, location, number and attenuation value (Hounsfield unit) and degree of hydronephrosis were noted as per CT scan of kidney-ureter-bladder (mostly non-contrast and occasionally contrast-enhanced as required).

Patients with positive pre-operative urine culture received culture specific antibiotics to make the urine sterile before performing PCNL. In case of persistent unsterile urine culture, patients received culture specific antibiotics for at least three days before performing the procedure and continued post-operatively as required.

Patients were classified in two groups based on whether the pre-operative urine cultures were positive (Group A) or negative (Group B). As per our hospital practice, all PCNL were performed under spinal anaesthesia. Six French ureteral catheter was placed in ipsilateral pelvicalyceal system by rigid cystoscope in lithotomy position under fluoroscopic guidance. Foley catheterization was done and fixed with ureteric catheter with silk thread. In prone position, transpapillary puncture was done under fluoroscope using 18 gauze two-parts needle after retrograde opacification of the pelvicalyceal system via the ureteral catheter. Tract was dilated by single shot technique. Nephroscopy was done with a 21 French rigid nephroscope. Stones were fragmented with pneumatic lithoclast (Richard Wolf GMBH, Germany). Small stones and fragments were removed either by continuous normal saline irrigation using a pump or removed with stone grasping forceps. The exit strategies were total tubeless, tubeless or standard.

Intra- and post-operative complications were classified as per Modified Clavien classification system for PCNL. Where patients had more than one complications, only the highest Clavien score was included.

Statistical analysis was performed by using the Statistical Package for Social Sciences version 20. Data were expressed as

mean±standard deviation. Fisher exact test and students T-test were applied to find out the significant differences between the two groups. All p values were 2-tailed, and p<0.05 was considered statistically significant.

Results

Out of 136 PCNL, 51 were in Group A and 85 in group B. The post-operative fever occurred in 24 (47.06%) in group A, and 20 (23.53%) in group B; bleeding in 9 (17.65%) and 7 (8.23%). Infective complications were 28 (54.90%) in group A and 20 (23.53%) in group B, significantly high in Group A (p=0.004), Table 1. The one mortality in group A was due to sepsis, and is added in total infective complications (i.e. 28).

Both groups were comparable in terms of mean age, stone size and stone density, Table 2. Most of the patients were between 20 to 60 years of age group, Table 3. In urine culture positive patients, Escherichia coli was isolated in 19 (37.25%), Table 4. Amikacin was sensitive in 37 (72.55%), Table 5.

Mean operation time was 48.88±21.67 min in Group A and 45.43±18.32 min in Group B (p=0.34). Multiple tracts were required in 12 patients in Group A and in 19 patients in Group B (p=1.00). Mean hospital stay was 3.98±2.43 days in Group A and 3.29±2.08 days in Group B (p=0.096).

Table 1. Post-operative complications after Percutaneous nephrolithotomy (PCNL) as per modified Clavien classification system

Complications	Group A, n=51	Group B, n=85	p-value
Grade 1	Fever (n=17)* 33.33%	Fever (n=18) 21.17%	0.1558
Grade 2	Fever (n=7)*13.72% Blood transfusion (n=7): 13.72% Severe stent symptoms (n=1): 1.96%	Fever (n=2): 2.35% Blood transfusion (n=4): 4.70%	0.0010
Grade 3a	Bladder clot evacuation (n=2): 3.92% Tube thoracostomy (n=1): 1.96%	Bladder clot evacuation (n=3): 3.52%	0.67
Grade 3b	Pseudoaneurysm/Angioembolization (n=1):1.96%	Pseudoaneurysm/Angioembolization (n=2): 2.35%	1.00
Grade 4a	Septic shock (n=3)*: 5.88%		0.0508
Grade 4b	-	-	-
Grade 5	Mortality (n=1)* 1.96%	-	0.3750

Note: septic complications include one mortality due to sepsis, making total infective complications 28 (54.90%) in group A.

Table 2. Demography and Stone characteristics of patients who underwent PCNL (n=136)

	Culture positive group (Group A)	Culture negative group (Group B)	p-value
No. of patients	51 (37.5%)	85 (62.5%)	-
Mean age (±SD)	40.90±14.23	40.69±13.78	0.93
Male/Female	23/28	58/27	0.0111
Mean stone size (mm^2)±SD	564.26±519.95	524.72±318.53	0.62
Mean stone density (HU)±SD	1105.33±292.12	1117.78±222.88	0.79

Table 3. Age distribution of patients who underwent PCNL

Age (Yr)	Group A (n=51)	Group B (n=85)	Total (n=136)	p-value
<20	5	4	9	0.29
20-40	22	39	61	0.85
41-60	19	36	55	0.59
>60	5	6	11	0.74

Table 4. Urine culture growth pattern in culture positive (n=51) of patients who underwent PCNL

Organism	Number (n)	Percentage (%)
Escherichia coli	19	37.25
Citrobacter koseri	10	19.60
Klebsiella pneumoniae	9	17.64
Acinetobacter species	6	11.76
Pseudomonas aeruginosa	4	7.84
Citrobacter freundii	1	1.96
Staph epidermidis	1	1.96
Streptococcus faecalis	1	1.96

Table 5. Antibiotic sensitivity pattern among pre-operative urine culture positive group (n=51) of patients who underwent PCNL

SN	Sensitive Antibiotics	Number (n)*	Percentage (%)
1	Amikacin	37	72.55
2	Nitrofurantoin	34	66.66
3	Ciprofloxacin	24	47.05
4	Norfloxacin	20	39.21
5	Levofloxacin	16	31.37
6	Cefixime	14	27.45
7	Ceftriaxone	13	25.49
8	Ofloxacin	13	25.49
9	Cotrimoxazole	11	21.56
10	Nalidixic acid	9	17.64
11	Gentamicin	9	17.64
12	Cephalexin	7	13.72
13	Amoxycillin	7	13.72
14	Polymyxin B	2	3.92
15	Cefoperazone	2	3.92
16	Piperacillin/Tazobactam	2	3.92
17	Ceftazidime	2	3.92
18	Imipenem	1	1.96
19	Meropenem	1	1.96
20	Vancomycin	1	1.96
21	Tigecycline	1	1.96
22	Cefoperazone/Sulbactam	1	1.96

*more than one antibiotics were sensitive, thus total number and percentage more than 100%

Discussions

Our results showed the most common post-operative complications after PCNL was fever, 24 (47.06%) in group A with positive preoperative urine culture and 20 (23.53%) in group B with negative culture, significant high in Group A patients with positive urine culture, p=0.0076. Total numbers of infective complications were significantly high (p=0.004) in group A, 28 (54.90%) than in group B, 20 (23.53%). Similar association of preoperative positive urine culture and post-operative infective complications are reported in literature.[7,8] Thus, it is important to control urinary tract infection before surgical intervention to reduce post-operative fever and infective complications after PCNL.

In our study, Escherichia coli were the most common organism isolated in urine culture in 19 (37.25%), similar to the study reporting E. coli as commonest (6.5%) organism.[8]

Our study shows, 7 (13.72%) patients in group A and 4 (4.70%) in group B received blood

transfusion, difference was not significant, p=0.1007. A 10 years single center retrospective analysis of 568 PCNL has shown increased risk of blood transfusion in 23.8% with preoperative urinary tract infection compared with 16.1% without infection.[9] However, in a large volume center from China, in 284 patients during one year period from Jan 2012 to January 2013 in patients who underwent mini-PCNL (mPCNL) for staghorn calculi, there was no difference in blood transfusion rate in patients with positive or negative pre-operative culture once the positive urine culture was treated adequately pre-operatively.[10] The less demand of blood transfusion in this large volume center may be due to less trauma in mPCNL compared to conventional PCNL.

In our study, 3 (5.88%) in positive urine culture group developed septic shock and none in culture negative group, a significant difference in two groups, p=0.0508. There was no difference in requirement for selective renal artery embolization, 1 (1.96%) in positive urine culture group and 2 (2.35%) in negative urine culture group, p=1.00. Similarly, reports on post mPCNL infective complications of fever and septic shock between preoperatively positive and negative urine culture groups were statistically not significant.[10] In their study, 1 (1.4%) in positive culture and 4 (1.9%) in negative culture group developed septic shock. Selective renal artery embolization for severe hemorrhage was required in 3 (1.4%) in negative urine culture group.[10] These findings highlights the need of aggressive management of fever in patients with preoperatively negative urine culture.

In our study, hospital stay was 3.98±2.43 days in Group A and 3.29±2.08 days in Group B, the difference was statistically not significant, p=0.096. Similar findings of no significant difference in hospital stay is reported after mPCNL in culture positive and culture negative groups (p=0.226).[10] Other study reports longer hospitalization in patients with positive pre-operative urine culture.[11]

In our study, overall grade-5 complication and mortality occurred in 1 (1.96%) in group A (n=51) out total PCNL (n=196), higher than other reported series in larger sample size 0.3% (n=582) from China[12] and Turkey.[13]

Our single center study of high volume PCNL (n=196) during one year period shows comparable findings with published literature. The infective complications of fever and sepsis in PCNL were significantly high in patients with positive pre-operative urine culture compared to negative culture status, even when positive pre-operative urine cultures were treated and made negative. Combined Grade 1 and Grade 2 complications were higher in culture positive group compared to negative. The most common micro-organism isolated from pre-operative urine culture was Escherichia coli and the most sensitive antibiotic was Amikacin.

Studies involving multi centers and larger sample size may further verify our results in local scenario.

Conclusions

Post percutaneous nephrolithotomy (PCNL) infective as well as overall complications were high in patients with positive pre-operative urine culture compared to negative culture status, even when positive cultures are treated and made negative. Escherichia coli sensitive to amikacin was common isolate in urine.

Conflict of Interests

The authors declare no conflict of interests.

Fundings

None.

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