



Comparative Study between Initial Positive and Negative Preoperative Urine Culture for Postoperative Fever in PCNL Patients

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Abstract

Background: The exact mechanism of fever after PCNL has not been established.². This research studied the frequency of post-PCNL fever and UTI in both initial preoperative positive and negative urine culture group of patients.

Objectives: To compare the frequency of post PCNL fever and UTI in initial positive and negative preoperative urine culture patients.

Method: This was a prospective observational study on a total sixty patients who underwent single PCNL at the Department of Urology, Sir Salimullah Medical College Mitford Hospital, Dhaka and National Institute of Kidney Diseases and Urology, Dhaka from March 2013 to October 2014. There were two groups of patients, Group-I, with initial positive preoperative urine culture and another Group-II with initial negative preoperative urine culture. But the operation deferred until the positive urine culture became negative. Both groups received prophylactic antibiotic.

Results: The frequency of fever and UTI after PCNL was 53.33% in Group-I (n=30) but only 23.33% was found in Group-II (n=30). Significant correlations were observed between post-PCNL fever with initial positive preoperative urine culture group ($p=0.017$), female sex ($p=0.02$), prolong hospital stay ($p=0.018$).

Conclusion: The frequency of postoperative fever and UTI is more than two times in preoperative positive urine culture patients than culture negative patients. Risk of post-PCNL fever increased in patients who had initial positive preoperative urine culture.

Introduction

Urinary calculi are the third most common affliction of the urinary tract.²⁶. The peak incidence of stone occurrence is in the fourth to sixth decades of life and the lifetime prevalence of renal stone disease is estimated at 1% to

15%. The primary goal of surgical stone management is to achieve maximal stone clearance with minimal morbidity of patients.²¹ Percutaneous Nephrolithotomy (PCNL) is the preferred method of removing renal calculi resulting in stone free rate exceeding 90%.¹⁵

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Upto one third of PCNL patients develop some postoperative complications. The most common is postoperative fever due to urinary tract infection (UTI) which occur in 21-39.8% of patients. Although this vast majority of postoperative fever is transient in nature. This is caused by a bodily reaction to the operation and resorption of haematoma.¹⁵ But some time it may turn into a life threatening urosepsis in up to 9.3% patients.¹¹

Fever after 1st P.O.D (post operative day) is of bacterial origin.¹¹ Preoperative positive urine culture, that is a chronic UTI is expected to be the most important factor.¹¹ The pathogenesis of urinary tract infection after PCNL is thought to begin with bacterial release from surgical manipulation and/or fragmentation of renal stone, introduction of bacteria via the nephrostomy tract, reabsorbed leaking infected fluid from kidney.^{15,11} Additionally many patient characteristics and operation related factors have been reported to augment the risk of postoperative fever & UTI in PCNL.^{2,11} These risk factors are positive preoperative urine culture, female sex, infected stones, hydronephrosis, prolong operative time, use of a nephrostomy tube, DJ stents.^{2,11}

Preoperative urine culture is considered as standard practice in all PCNL patients.³⁰ Prophylactic antibiotic is administered even in the face of negative urine culture and bacteriologic studies are routinely obtained when fever occurs.¹ Despite antibiotic prophylaxis fever develops in more than 39% of patients after PCNL.¹¹

This study is designed to compare the occurrence of post PCNL fever & UTI in between initial positive and negative urine culture patients and find out other risk factors for post operative fever and UTI in PCNL patients.

Method:

This was a prospective observational study done on forty (40) male and twenty(20) female patients with renal stone age range varied from 25-68 years. This study was carried out in the *Department of Urology, Sir Salimullah Medical College Mitford Hospital, Dhaka and National Institute of Kidney Diseases & Urology, Dhaka* from March 2013 to October 2014. Before starting the study approval was obtained from ethical committee.

Inclusion criteria: Unilateral (single/multiple) renal stone, large renal stone(size ≥ 2 cm),sterile urine before PCNL.

Exclusion criteria: Patients with indwelling catheter, bilateral renal stone, concomitant ureteral and urinary

bladder stone, bleeding disorder, diabetes mellitus , renal failure and heart failure.

There were two groups of patients, Group-I with initial positive preoperative urine culture on admission and another group, Group-II with negative preoperative urine culture. Both groups of patient were selected by using purposive sampling technique. But the operations were deferred until the (Group-I) preoperative positive urine culture became negative according to the use of culture sensitive antibiotic. Both group of patients received prophylactic antibiotic either according to previous urine culture sensitivity or empirical broad spectrum antibiotic intravenously before the induction of general anaesthesia.

A standard PCNL was performed with the patient under General Anesthesia. Access to the kidney was achieved through one puncture in 52 patients and two puncture in 8 patients. Pneumatic lithotripsy was used for stone fragmentation. Rigid nephroscope was used for visualization and fragmentation of stones. At the end of the procedure 22 or 24 Fr nephrostomy tube was left in puncture site and DJ stent (6Fr) was kept in ureter. Radiological evaluation was done postoperatively. Patients who were completely cleared of stones were considered stone free.

Vital signs were recorded in each patients postoperatively routinely. But the presence of postoperative fever (body temperature $\geq 101^{\circ}\text{F}$ / 38.33°C) were especially recorded in both groups (Group-I & Group-II) after first 24 hours by thermometer. Reflection of postoperative fever hematologically by white blood cell count and bacteriologically by urine culture were also done. Urine sample of post-PCNL fever patients (body temperature $\geq 101^{\circ}\text{F}$ / 38.33°C) were sent for culture and sensitivity after 48 hours of stopping antibiotics. After sending urine sample, previous antibiotic was again continued till arrival of urine c/s report. Then either previous antibiotic was continued or new antibiotic instituted according to urine c/s report. Indwelling foley catheter was removed after 1st post operative day or after haematuria subsided. Nephrostomy tube was removed on 1st postoperative day. Injectable antibiotic was continued till removal of nephrostomy tube or when patients became afebrile. For each case, clinical, operative chart and bacteriological study was reviewed to find out relationship with postoperative fever after PCNL.

Results:**Table I:** Demographic profile of the study population (n=60)

	Group-I (initial positive preoperative urine culture) (n=30)	Group-II (initial negative preoperative urine culture) (n=30)
Age in year (mean±SD)	45.1 ± 11.7	44.7± 12.9
Male	19(63.33%)	21(70.00%)
Female	11(36.66%)	09(30.00%)
Male : Female	19:11	7:3

In this study mean age of the patients was 45.1 ± 11.7 years in Group-I and 44.7± 12.9 years in Group-II. Among 60 cases 66.66% (40cases) patients were male and 33.33% (20cases) were female. But in group-I among 30cases, 63.33% (19cases) patients were male and 36.66% (11cases) were female. Again in Group-II among 30 cases 70% (21cases) were male and 30% (09 cases) were female. Total male to female ratio was 2:1. But in Group-I it was 19:11 and in Group-II was 7:3.

There was significant association of postoperative fever with female sex found. In initial positive preoperative urine culture group 63.63% of female patients (07 out of 11) developed postoperative fever and only 47.36% of male patients (09 out of 19) developed postoperative fever. In group-II that is preoperative sterile urine group, 44.44% of female patients (04 out of 09) developed postoperative fever whereas only 14.28% of male patients (03 out of 21) developed postoperative fever. Female sex had statistical significant (p<0.05) with postoperative fever after PCNL.

Table II : The association of gender in post PCNL fever

	Male	Female	χ^2 value	p value
Group-I (initial positive preoperative urine culture) (n=30)	09(47.36%) (n=19)	07(63.63%) (n=11)	5.57	0.02(S)
Group-II (initial negative preoperative urine culture) (n=30)	03(14.28%) (n=21)	04(44.44%) (n=09)		

p value measured by χ^2 test (Chi-square test).

S : significant

Table III : The association of initial preoperative urine culture on post operative fever after PCNL

Parameters		Postoperative fever(p C) <38.33	χ^2 value χ^2 38.33	p value	
(Initial positive preoperative urine culture)	Group-I (n=30)	14(46.66%)	16(53.33%)	5.71	0.017(S)
(Initial negative preoperative urine culture)	Group-II (n=30)	23(76.66%)	07(23.33%)		

p value measured by χ^2 test (Chi-square test)

S: significant

The association of initial preoperative urine culture with postoperative fever shown in table III. The present study observed that only 23.33% of patients of initial negative preoperative urine culture developed postoperative fever, while 53.33% of patients of initial positive preoperative urine culture developed postoperative fever after PCNL. The study revealed that the presence of initial positive preoperative urine culture had statistical significant correlation with the subsequent occurrence of postoperative fever after PCNL ($p < 0.05$).

The risk of postoperative fever among the patients with a positive urine culture depend on the specific micro-organisms found in their urine. Table IV shows isolated microorganism found in urine culture of sixteen post PCNL fever patients in Group-I. Here gram negative

micro-organism such as E.coli represents over 25% of positive culture, Klebsiella sp., Proteus sp. and Pseudomonas sp. are 18.75% , 12.5% and 6.25% respectively. Gram positive micro-organisms such as Staphylococcus sp. and Enterococcus sp. found 18.75% and 6.25% respectively. Mixed bacterial colony was 6.25%.

This table V shows the total micro-organism found in both group (Group-I & Group-II) of patients urine who developed postoperative fever. Here Escherichia coli was 30.43% of total micro-organism , the rest was Klebsiella spp(17.39%), Proteus spp.(13.04%) , Pseudomonas spp.(08.69%), Staphylococcus spp.(13.04%) and Enterococcus spp.(04.34%).

Table IV: Isolated microorganism found in urine culture of post PCNL fever patients (n=16) among initial positive preoperative urine culture patients of Group-I (n=30).

Gram negative microorganism	Initial positive preoperative urine culture (Group-I) (n=30)	Post operative urine culture in febrile patients among in Group-I (n=16)
Escherichia coli	16(53.33%)	04(25%)
Klebsiella sp.	04(13.33%)	03(18.75%)
Proteus sp.	03(10%)	02(12.5%)
Pseudomonas sp.	02(06.66%)	01(6.25%)
Enterobacter sp.	01(03.03%)	01(6.25%)
Gram positive microorganism		
Staphylococcus sp.	02(06.66%)	03(18.75%)
Enterococcus sp.	01(03.33%)	01(6.25%)
Mixed	01(03.33%)	01(6.25%)

Mixed : A colony contained a positive culture with more than one micro-organism

Table V : Total isolated microorganism found in urine culture of post PCNL fever patients (n=23) in both Group-I & Group-II

Micro-organism	Number (percentage)
E.coli	07 (30.43)
Klebsiella sp.	04 (17.39)
Proteus sp.	03 (13.04)
Staphylococcus sp.	03 (13.04)
Enterobacter sp.	01 (04.34)
Enterococcus sp.	01 (04.34)
Pseudomonas sp.	02 (08.69)
Mixed	02 (08.69)

Mixed- Presence of more than one microorganism

Table VI: The effect of preoperative urine culture with post operative Hospital stay

Parameters	Group-I (initial positive preoperative urine culture)	Group-II (initial negative preoperative urine culture)	t value	p value
Postoperative Hospital stay (Days) (mean±SD)	5.13± 1.07	3.57 ± 0.77	2.442	0.018 (S)

p value measured by unpaired 't' test

Table VI shows the effect of postoperative fever on postoperative hospital stay. The duration of postoperative hospital stay in Group-I was 5.13(±1.07) days and in Group-II this duration was 3.57(±0.77) days. Positive preoperative urine culture had statistical significance ($p < 0.05$) with prolong hospital stay.

Discussion:

Percutaneous nephrolithotomy (PCNL) is the preferred method of removing renal calculi with many advantages (Chowdhury A et al.).⁹ However about 40% of patients experienced fever secondary to UTI which is one of the most common sequelae of PCNL (Draga et al.).¹¹ Risk of postoperative fever increased in the presence of positive preoperative urine culture, female sex, operative time, use of nephrostomy tube, volume of irrigation fluid and postoperative transfusions (Vorrakitpokatorn et al.).²⁹

The approach of this study was to explore demographic variation of age and sex, occurrence of post operative fever in relation with initial positive and negative urine culture, causative micro-organisms, hospital staying. In this prospective, hospital based, observational study a total 60 patients with renal stone who underwent single PCNL at the Department of Urology, Sir Salimullah Medical College Mitford Hospital, Dhaka and National Institute of Kidney Diseases and Urology, Dhaka from March 2013 to October 2014 were included. The mean age of the patient in this study in Group-I (initial positive preoperative urine culture) was 45.1 ± 11.7 years and in Group-II (initial negative preoperative urine culture) was 44.7 ± 12.9 years. The mean age of both groups (Group-I and Group-II) were 47.3(±9.1) years. It is similar to the age group mentioned by Gutierrez et al.¹⁵ and Draga et al.¹¹ where mean age were 49.2(±15.6) years and 46.3(±15.3) years respectively.

In this study there is dominance of male over female with a ratio 2:1. This findings correlate with Aghdas et al.² where the ratio was 67.7% : 32.3%. It is well established that women are generally at greater risk of

UTI in comparison with men probably because of the greater propensity to urinary tract infection (Foxman, B., 2002).¹² There is a significant relationship find between the female sex and risk of postoperative fever in the present study ($p < 0.05$, Table II). A similar result also found by Aghdas et al.²

The next common encountered part of the study was to find out the frequency of micro-organism found in Group-I (initial positive preoperative urine culture) was as follows E.coli (53.33%), Klebsiella spp.(13.33%), Proteus spp.(10%), Pseudomonas (6.66%) , Staph sp.(6.6%), Enterococcus sp. (3.33%) and mixed (3.33%). Approximately similar frequency was found in a study done by Hasan et al.[16] at BIRDEM hospital, Dhaka, Bangladesh where E.coli, Klebsiella spp., Proteus spp., Pseudomonas spp. , Staphylococcus spp. , and Enterococcus spp. were 62%, 17%,6%, 3%, and 1% respectively. In the PCNL Global Study by Gutierrez et al.¹⁵ in Asia almost similar frequency of microorganism were found in positive urine culture patients. The frequency was E.coli (57.4%), Klebsiella spp. (12%), Proteus spp. (5.3%) Pseudomonas spp. (7.7%), Staphylococcus spp.(5.3%) respectively.

Postoperative fever among the patients of initial positive preoperative urine culture depends on the specific micro-organisms in their urine. Gram negative micro-organisms such as E.Coli (25%), Klebsiella spp. (18.75%), Proteus spp.(12.5%) ,Pseudomonas spp.(6.25%) , Enterobacter spp. (6.25%) and Gram positive micro-organisms such as Staphylococcus spp.(18.75%), Enterococcus spp.(6.25%) found in this study which was almost similar in Gutierrez et al.¹⁵

In present study group-I and group-II patients received prophylactic antibiotic. PCNL was done in culture negative state in both groups. But 53.33% patients developed postoperative fever in group-I whereas only 23.33% of patients developed fever in group-II patients. A similar result was found in the study done by Aghdas et al.² where 50% patients developed postoperative fever

in group-I and 33.3% in group-II. In another study done by Draga et al.¹¹ where 39.8% of patients developed postoperative fever in preoperative positive urine culture group.

Fever $e''38.33^{\circ}\text{C}$ (101°F) was regarded as *temperature cut-off value* in this present study. Temperature cut-off value varies with study to study according to place of the study such as Draga et al.¹¹ in their study used a temperature $e''38^{\circ}\text{C}$, Aghdas et al.^[2] used temperature $>38^{\circ}\text{C}$ and Gutierrez et al.⁽²⁰¹²⁾ used a temperature of $>38.5^{\circ}\text{C}$. But there is someone who did not specify a temperature cut point also. In perspective of Bangladesh we are familiar with fahrenheit ($^{\circ}\text{F}$) scale to record temperature. So temperature cut-off point select as 101°F (38.33°C) in this study.

There is a wide variation in the incidence of post-PCNL fever found across different studies. This is because firstly, various temperature cut-off used which is described above. Secondly, the time between PCNL and subsequent temperature assessment may influence the prevalence of fever. Draga et al.¹¹ found that 39.8% of patients developed a fever within 24 hours of PCNL, this rate fell to just 13% when assessed beyond 24 hours postoperatively. In contrary Aghdas et al.² in their study found that temperature rose in the first 24 hours after surgery 7.4% and after 24 hours postoperatively this rate increased to 18.4%. Most body temperature elevation after PCNL occurs in first 24 hours and are most likely transient in nature. Hasan et al 2007¹⁶ Fever after 24 hours of surgery is of bacterial origin. Draga et al.¹¹ Therefore, it would be worthwhile to investigate the factors contributing to fever after 24 hours of surgery (Draga et al, 2009).¹¹ In this study I have recorded temperature after 24 hours of surgery.

The most common complication of PCNL is postoperative UTI developed in 38.33% patients of both group-I (initial positive preoperative urine culture) & group-II (initial negative preoperative urine culture) together but 53.33% in group-I alone. Post-PCNL fever patients urine culture revealed *E.coli* was the most common organism (30.43%). Next common pathogen are *Klebsiella* sp. (17.39%), *Proteus* sp. (13.04%), *Staphylococcus* sp.(13.04%), *Pseudomonas* sp. (8.69%), Mixed(8.69%) respectively. A similar result was found in a study done by Gutierrez et al.^[15] where *E.coli* was the most common organism(25.3%) followed by *Klebsiella* (23.1%), *Pseudomonas* sp.(20.6%), *Proteus*(19.4%), Mixed (11.8%), *Staphylococcus* sp.(9.7%) respectively..

The most time honored concern of the study was to reveal the effect of postoperative fever on postoperative duration of hospital staying. In Group-I(initial positive preoperative urine culture), the postoperative hospital staying was $5.13(\pm 1.07)$ days and in Group-II(initial negative preoperative urine culture) this duration was $3.57(\pm 0.77)$ days that was statistically significant ($p=0.018$). This result is also comply with Aghdas et al.² where postoperative hospital stay prolonged in postoperative fever patient than postoperative afebrile patients. Their mean postoperative hospital stay was $5.42\pm 2.3(\text{SD})$ and $3.35\pm 1.68(\text{SD})$ respectively. Hussein et al.¹⁷ and Vorrakipokatorn et al.²⁹ also found that preoperative positive urine culture group had longer hospital stay than culture negative patients that was statistically significant ($P=0.027$ & $p=0.032$).

Conclusion:

Initial preoperative positive urine culture in PCNL patients have more than two fold risk of developing postoperative fever than initial negative urine culture patients despite giving prophylactic antibiotic. Predictor of postoperative fever after PCNL is initial positive preoperative urine culture. Prophylactic antibiotic or even sterile urine had no effect on the prevention of post PCNL fever. So we can take measures to limit resource utilization, infection control and limit other risk factors. Postoperative fever also prolongs hospital stay. For limited earned people though prolong hospital staying is a misuse of resource and time but there is a light of hope to develop a good doctor-patient relationship, ultimately which is our optimum goal to serve the nation.

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