



Sepsis in Post-PCNL Patients; Risk Factors and Influence of Stone Cultures.

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ABSTRACT

Objective

Post-operative sepsis is a well known complication of various endourologic procedures especially PCNL and it is caused by stone fragmentation containing toxins and bacteria with subsequent toxemia and bacteremia. The present study was to determine clinical role of stone culture in modifying treatment and assess the factors that may increase the risk to develop sepsis after PCNL .

Methods

A total of 211 patients (119 males and 92 females) with a mean age of 38.2 years were enrolled in this study at our single centre tertiary care institute . Patients with preoperative positive urine culture and sensitivity were excluded . All patients received prophylactic 3rd generation cephalosporin intravenously at the time of anaesthesia induction. Stone culture was taken from all patients after puncturing the pelvicalyceal system and sent for culture and sensitivity. Patients were monitored closely in the postoperative period for the development of SIRS. Risk factors such as diabetes, age, degree of hydronephrosis, residual fragments, number of access points PCNL type (standard versus mini) and stone burden were evaluated for the association with SIRS.

Results

Mean duration of the operations was 82.7 min (30 to 110 min.).19 patients(9.0 %) developed post PCNL SIRS

Stone culture identified organisms in 8 patients(42% of patient cohort). Treatment plan was changed as per antibiotic culture sensitivity in only one patient with culture sensitivity report in three patients being multi drug resistant and rest responded to antibiotics they were receiving already. Statistically significant factors for post PCNL fever were diabetes mellitus (DM) ($p = 0.001$), stone burden ($p = 0.004$), and degree of hydronephrosis ($p = 0.04$).

Conclusion

Doing intraoperative stone cultures sensitivity does not confer additional benefit for antibiotic change in majority of cases. DM, staghorn stones, degree of hydronephrosis, duration of the operation and

number of tracts are risk factors for post PCNL SIRS.

I. INTRODUCTION

Sepsis/SIRS has been established as an important complication of PCNL, focus has shifted to trying to predict its occurrence based on risk factors. Determining which patients are at greatest risk is extremely important^{1,2}. Fever may also originate from the release of the inflammatory mediators during surgical manipulation, systemic inflammatory response syndrome (SIRS)³ or sepsis. Several studies showed post-PCNL urosepsis occurs in 0.3%–9.3% of patients^{4,5}. Factors found to increase the risk of urosepsis are female sex, diabetes mellitus (DM), stone burden, pre-op cultures and pelvicalyceal system dilatation⁶. Several intraoperative factors are average renal pressure sustained during PCNL, operative time, and number of tracts used for access⁵. Urosepsis that occur as a result of manipulation during PCNL can be catastrophic despite negative preoperative bladder urine culture and prophylactic antibiotic⁷. One of the most important aspects of study in the management of complications of PCNL is the use of prophylactic antibiotic for prevention of sepsis^{8,9}. The use of short course of preoperative antibiotic has been found to significantly decrease the rate of post-PCNL fever and sepsis. American Urological Association (AUA) guidelines¹⁰ recommend the use of prophylactic antibiotic preoperatively for a duration of less than 24 hours. Although role of stone culture in reduction of post-operative sepsis has been documented in numerous studies, its role in preventing sepsis is limited. We conducted our study to confirm same and association of risk factors with it.

METHODS: The present study was carried out in Sher-I-Kashmir Institute of Medical Sciences Srinagar from August 2019 to January 2022. Patient selection was based on patients eligible for PCNL . Patients excluded from study were patients at extremes of age < 15 and > 70, patients with positive urine cultures, history of recent urological intervention, instrumentation and severely



immunocompromised patients. All patients with negative preoperative urine culture or were treated with antibiotics for 1 week prior to surgery for a positive preoperative urine culture were included in study.

Single dose of third generation cephalosporins was given one hour prior to surgery PNL was done using standard or mini technique. After ureteric catheter placement, fluoroscopy guided tract was established and dilated. Stone fragmentation was done using pneumatic lithotripsy. Antibiotics were continued in the post of period till tubes were removed.

Stone fragments were obtained during procedure and sent for culture and antibiotic sensitivity. Stone culture was collected during the operation in a sterile container. The crushed calculus was cultured in 5 ml thioglycolate broth which was incubated at 37°C for 18-24 hours, and then subcultures were made on blood agar and MacConkey's agar plate for isolation of etiological agents. Cultures were incubated at 37°C for 24 hours. The colony was picked up and inoculated into peptone water for study of morphology, motility, biochemical reactions. The identification of bacterial isolates were done by conventional methods. Also the antibiotic sensitivity of bacterial isolates was done by using disc diffusion (Kirby Baur) method¹¹. Significant growth was defined as CFU > 10⁵. The primary end point was sepsis/Systemic Inflammatory Response Syndrome (SIRS). SIRS is defined as patients having any two of following temperature < 36°C or > 38°C, Heart rate > 90/min WBC count < 4000 or > 12000, Respiratory rate > 20/min¹².

Statistician analysis all variables that affect SIRS were evaluated using univariate analysis chi-square test for categorical variables and T test for continuous variables

II. RESULTS

211 patients (119 males and 92 females) were included in this study, their mean age was 38.2 years. 42 (19.9 %) had severe hydronephrosis, 117 patients (55.4 %) had moderate hydronephrosis and 52 patients (23.7 %) had mild hydronephrosis. 22 patients (10.4 %) had staghorn calculi, 25 (11.8 %) had partial staghorn calculi and 164 (77.7 %) had non staghorn calculi. Number of tracts created were: (75.0%) one tract, 23.3%) two tracts and one (1.7%) had three tracts. DJ stent was inserted in all patients. Mean duration of operation was (80.2 ± 15) min. Results are depicted in table 1.

SIRS occurrence

SIRS developed in 19 (9.0%). SIRS with a p value statistically significant occurs in diabetic patient

(p=0.01), staghorn stone burden (p=0.004) and degree of hydronephrosis (p=0.04).

III. DISCUSSION

There are several studies reported on post PCNL SIRS^{13,14,15,2}, all with different results ranged incidence between 5-19%. A number of factors may explain the wide variation in the incidence of post PCNL SIRS as already described among studies. In our study 19 patients (9.0 %) developed post PCNL sepsis. Female sex is a risk factor for the development of post PCNL SIRS⁹ while others have not confirmed it¹⁶. In this study female sex was not a significant risk factor p = 0.890. DM is regarded as a risk factor for fever post PCNL^{17,18} and in the current study DM has been shown to be a risk factor for SIRS. Among 40 diabetic patients 12 (30% of patient cohort) developed SIRS with a (p = 0.01). The impact of stone burden as a risk factor for post PCNL SIRS is clear and confirmed by several studies^{17,19} and in this study stone burden was a major risk factor facilitating the development of post PCNL SIRS.

Hydronephrosis is regarded as a risk factor for post PCNL fever.^{7,19} In the current study the degree of hydronephrosis was also a risk factor for post PCNL SIRS development (p = 0.004). Duration of the operation is a risk factor for post PCNL fever^{17,19} though in our study it was not statistically significant. Present study demonstrated *Pseudomonas aeruginosa* (34.6 %) was most frequently isolated from stone culture. Gault M. H. & co-workers found more frequent isolations of *Pseudomonas*, from the stone culture.²⁰

Sepsis after PCNL is uncommon but potentially life threatening condition caused by injury to renal parenchyma and is caused by puncture and dilatation together with high-pressure fluid leading to toxemia and bacteremia. The incidence of post PCNL fever ranges from 10 to 32% and in majority resolves spontaneously without any additional interventions. The incidence of postoperative sepsis differs between studies, some reported incidence of 2.4%, others reported incidence of 0.3%–4.7%¹ and 1.4%¹³. In the current study the incidence of post PCNL SIRS was 9.0 %, with no sepsis related mortality in post of period. Potential risk factors for Post PCNL SIRS include sex with females having higher propensity, underlying diabetes mellitus, degree of hydronephrosis, number of access points and residual fragments if any although positive preop of urine culture has been reported as predictor of overall complications during PCNL, its role in preventing septic complications is debatable.



In present study stone culture were found positive in 35.0% out of total 211 stones examined. Those using the Nemoy and Stamey method for culturing stones have described the incidence of infected stones as 5.6% to 77.3%.^{20,21}

Previously multiple studies have highlighted role of stone/ pelvic urine culture as predictors of sepsis with cultures revealing significant positivity in 3 to 50% references^{3,7} and most studies agreeing that stone culture was predictive of post-PCNL sepsis^{22,23}. Subsequently Koertes et al²⁴ and Cadeu et al²⁵ found no correlation of fever with infectious/non-infectious stones and their composition. Osman et al reported that stone culture and sensitivity was clinically useful in only one patient with positive stone culture²⁶.

Stone cultures should have had a clinical impact on post of management in our study. 19 patients(9%) developed SIRS. Stone culture was positive in 7 out of 19 patients(36.8% of patient Cohort) SIRS developed from 4 to 12 hours in most of the patients and cultures where available within 72 hours so broad spectrum antibiotics were continued empirically till the results became available. Patients who had SIRS and did not initially respond where added aminoglycosides and those who are already on it were given meropenem. Antibiotic upgrade as per antibiotic culture sensitivity in only one patient. Rest all patients responded well to above management except three who had multidrug resistant culture sensitivity profiles who settled after five days. Low penetration of antibiotics in the stone prevents complete eradication of UTI by conventional antibiotic therapy and thus development of resistant organisms. Rampant use of antibiotics has also led to multidrug resistance. Possible advantage of the Study focuses on clinical utility of stone culture and sensitivity rather than it is theoretical prediction for change in management.

In conclusion, we do not support implementation of stone culture sensitivity as it did not change outcome in our cases. Barely, do the stone culture results make any difference with unnecessarily subjected patients to additional cost for less useful investigations. Three patients were re-admitted for sepsis with cultures depicting different organism and responded well to broad-spectrum antibiotics.

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