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# COMPARISON OF STONE CULTURE AND URINE CULTURE IN THE PREDICTION OF POST PCNL UROSEPSIS

Urology

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## ABSTRACT

**Objective:** To compare the utility of preoperative urine culture with intraoperative stone culture findings, in predicting and treating post-PCNL systemic inflammatory response syndrome.

**Methods:** A prospective study of 60 patients treated with PCNL between August 2016 and December 2017 who had both pre-operative urine cultures and intraoperative stone cultures were included. Statistical analysis was done using chi-square and Fischer exact test.

**Results:** A total of 60 patients were included in our study. The Mid-stream culture & Sensitivity was positive in 10% and stone Culture and Sensitivity in 35% of the patients. Eighteen patients had systemic inflammatory response syndrome (SIRS) and only one patient had septic shock. Out of the 18 with SIRS, 16 cases were stone C and S positive and only one patients had positive mid-stream culture and sensitivity

**Conclusion:** Stone culture and sensitivity is a better predictor of potential urosepsis than mid-stream culture. Stone culture may be the best guide for antibiotic therapy in case of sepsis. Obtaining an intra-operative stone culture is an easy, inexpensive, and valuable practice that should be a routine part of any PCNL surgery

## KEYWORDS

### Introduction

Percutaneous nephrolithotomy (PCNL) is one of the most commonly performed surgeries for renal stone disease. PCNL is generally a safe procedure, associated with few complications, some of which include sepsis, bleeding, pneumothorax, haemothorax and injury to adjacent organs. Urosepsis is one of the most common causes of morbidity and mortality following PCNL. Sepsis can occur in spite of prophylactic antibiotics, negative urine culture and sterile aseptic precautions and can cause significant morbidity. Renal calculi requiring percutaneous nephrolithotomy (PCNL) commonly harbour infectious organisms even when the stone is metabolic in origin and further, sterile voided urine does not preclude the presence of pathogens within the stone. It has been hypothesised that residing microbes in the stone may be responsible for systemic infection.

The objective of this study was to compare the utility of preoperative urine culture with intraoperative stone culture findings in predicting and treating post-PCNL systemic inflammatory response syndrome.

### Materials and Methods

A prospective clinical study on 60 consecutive patients undergoing PCNL at Saint John's Medical College between August 2017 and December 2017 was performed. Patients with stones greater than 2 centimetres, multiple renal stones and failed extra corporal shock wave lithotripsy (ESWL) undergoing PCNL were included in our study. Patients with altered coagulation profile, morbid obesity (body mass index > 30) and with bilateral obstruction were excluded from our study. All patients had their urine culture and sensitivity tested one week prior to surgery and treated with appropriate antibiotics if urinary tract infection was diagnosed. A mid-stream urine (MSU) sample was sent for culture and sensitivity one day prior to surgery. Antibiotic prophylaxis with third generation cephalosporin was given intravenously prior to induction of general anaesthesia.

Under general anaesthesia with the patient placed in lithotomy position, cystoscopy was done with a 21 Fr cystoscope and the corresponding ureteric orifice was cannulated with a sterile 0.0035 inch guidewire. A 5 Fr ureteric catheter was threaded over the guide wire under fluoroscopic guidance and tied to a 16 Fr foley catheter. Patient was then turned to prone position and under strict aseptic precautions; percutaneous access to the desired calyx was obtained with an 18Fr LP needle under fluoroscopic guidance using bull's eye technique. A 0.0035 inch guide wire was passed into ureter and PCNL tract dilatation was performed with Alken's metal dilators, following which a 30 Fr Amplatz sheath was placed. Nephroscopy was then performed under low pressure irrigation with normal saline and stone was fragmented with pneumatic lithotripsy. Stone fragments were extracted with a grasper and sent for culture and sensitivity (C & S). Placement of a nephrostomy tube was under the discretion of operating surgeon.

Post operatively, patients were monitored meticulously for signs of

- fever
- SIRS (systemic inflammatory response syndrome) , defined as development of two of the following four criteria :
- Fever (> 38 degree C) or hypothermia ( < 36 degree C)
- tachycardia ( heart rate > 100 beats/ min)
- tachypnea ( respiratory rate > 20 breaths/ min)
- abnormal total count (>12000 $mm^3$ or < 4000 $mm^3$)
- Septic shock which was defined as systolic blood pressure (SBP) < 90 mm Hg or a decrease on SBP of 30% below the baseline in the presence of SIRS.

Patients with SIRS and septic shock were categorized as urosepsis. The subjects were divided into two main groups based on presence and absence of post PCNL – SIRS. These groups were further stratified based on MSU C and S and stone culture results.

Statistical analysis was performed using the SPSS (Statistical package for the Social Sciences) version 17 software. Fischer exact test and Chi-Square tests were applied to determine associations between presence of SIRS and results of MSU C and S and stone culture. A p value < 0.05 was considered statistically significant. The sensitivity, specificity, positive and negative predictive values of MSU and stone c & S were calculated.

### Results

A total of 60 patients undergoing PCNL from August 2017 to December 2017 were included in our study. Details of patient demographics and surgery are presented in table 1. No mortality was reported in our study.

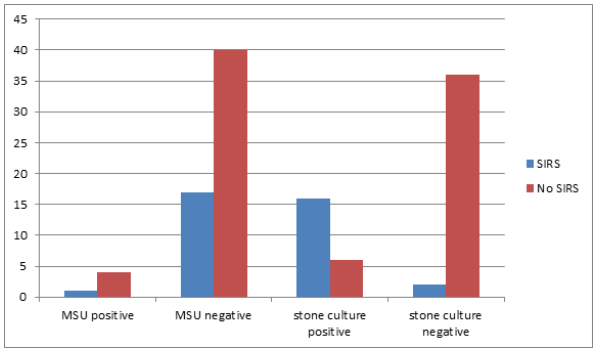
**Table 1 :- Table showing patient demographics and surgical details**

| Age | Number |
|---|---|
| < 40 years | 42 |
| 40- 60 years | 15 |
| > 60 years | 3 |
| **Duration of surgery** | **Number** |

| | |
|---|---|
| < 60 minutes | 25 |
| 60-90 minutes | 29 |
| > 90 minutes | 6 |
| **Gender** | **Number** |
| Male | 38 |
| Female | 22 |
| **Mean stone size** | 4.2 cms + 2.2 cms |

Eighteen patients (30%) of our study population developed SIRS and only one patient (1.6%) developed septic shock. Mid-stream urine culture was positive in 5 (10%) of the patients and stone culture was positive in 21 (35%) of the patients as shown in Figure 1. Stone culture was found to be a better predictor of SIRS compared to mid-stream urine culture which was statistically significant (p value 0.047)

**Figure 1**

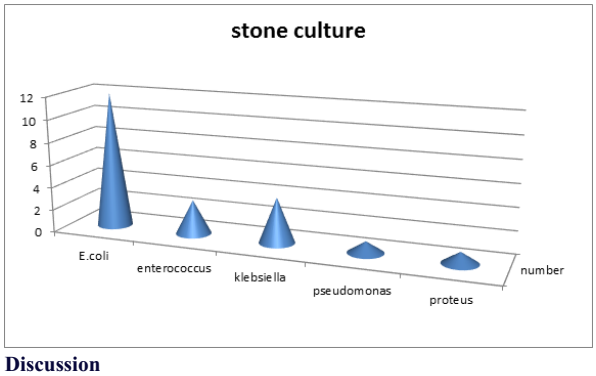



Out of the 21 cases of stone culture positive patients, 13 patients developed SIRS. However, only 1 patient with Mid-stream urine C and S positivity developed SIRS. Stone culture had a better sensitivity, specificity, positive predictive value and negative predictive value than mid-stream urine culture in predicting SIRS as shown in table 2

| Table 2 | Mid-stream urine C & S | Stone C & S |
|---|---|---|
| Sensitivity | 5.55 % | 88.9% |
| Specificity | 90.90% | 85.71% |
| Positive predictive value | 20% | 72.72% |
| Negative predictive value | 70.17% | 94.74% |

The most common bacteria isolated in the stone culture was E. coli (14/21), followed by Klebsiella (4/21), Enterococci (3/21), Pseudomonas (1/21) and Proteus (1/21) as shown in Figure 2

**Figure 2**




## Discussion

Majority of complications after PCNL are minor, the most frequent of which are fever and bleeding(1)(2). Sepsis is a rare but devastating complication of PCNL accounting for 0.3%-4.7% of the complications(1) . The American Urological Association Best Practice Policy Statement on urologic surgery antimicrobial prophylaxis (2008) makes recommendations regarding peri-operative antibiotics for PCNL(3). Despite careful preoperative preparation such as sterile urine culture, prophylactic antibiotics and strict aseptic precautions, patients still have systemic and sometimes catastrophic infection. The incidence of septic shock in our series was 1.6% which co relates well with sepsis rates reported in literature

The common risk factors associated with sepsis include long duration of the procedure, urinary bacterial load, severity of obstruction by stone and infection in the stone(4). Other risk factors described in literature include use of nephrostomy tube, renal insufficiency and amount of irrigation fluid used(5)(6)(7).

Presence of infection is usually ruled out by performing a mid-stream urine culture however, several authors have reported a poor correlation between infection in the stone and bladder urine specimens(8). In the series by Fowler et al, stone culture was positive in 77% of the patients whereas a simultaneous bladder urine sample was positive in only 12.5% of the patients(9).Other studies such as Mariappan et al. reported that MSU C and S was positive in 11.2% whereas stone culture was positive in 35.2%(10) , and Devraj et al reported stone culture positive in 30.1% and MSU positive in 10.8% of the patients(11). The findings of the present study are similar with stone culture positivity in 35% and MSU positivity in 10% of the patients.
A significant cause for failure of mid-stream culture in prediction of SIRS may be because stones could be a source of endotoxins and/or bacteria(11).

Microbiology of stone disease has changed dramatically over the past generation from predominantly gram-negative to now predominantly gram-positive organisms.(12)(9)(13). In this series however the most common organism isolated in stone culture was E.coli (12/21). Enterococcus was positive in 3/21 patients. This is of significance as enterococcus is often not covered by cephalosporins and is resistant to fluoroquinolones(14)

The process of obtaining a stone culture at the time of PCNL is easy and the cost of a stone culture is minimal compared to the cost of treating a single event of sepsis. This study brings to light the importance of per operative stone culture as a predictor of urosepsis and as a guide to treat the same.

## Conclusion

Stone culture and sensitivity is a better predictor of potential urosepsis than mid-stream culture and sensitivity, which often fail to grow stone colonizing bacteria. Pre-operative urine culture is an unreliable predictor for the presence of a positive stone culture. Discordance between pre-operative urine culture and stone culture is common. Stone culture may be the best guide for antibiotic therapy in case of sepsis. Obtaining an intra-operative stone culture is an easy, inexpensive and valuable practice that should be a routine part of any PCNL surgery

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