

# A prospective Comparative Clinical Study on Bladder Urine, Pelvic Urine and Renal Stone Culture & Sensitivity in Predicting Urosepsis Following Percutaneous Nephrolithotomy

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## Abstract

**Background:** Urosepsis means a severe infection of urinary tract (UTI) and/or male genital tract (prostate) with features consistent with systemic inflammatory response syndrome. UTI may occur among all the age groups and produce a broad range of clinical syndromes ranging from asymptomatic bacteriuria to acute pyelonephritis with gram negative sepsis to septic shock. It is estimated that the mortality rate due to urosepsis ranges from 30 to 40 p.c respectively. Urosepsis may also cause multiple organ dysfunction, hypoperfusion or hypotension. Urosepsis due to percutaneous nephrolithotomy may be catastrophic despite prophylactic antibiotic coverage and negative midstream urine culture and sensitivity testing (C&S) and bacteria in the stone can be responsible for systemic infection. The aim of the study is to compare bladder urine (culture & sensitivity) and collecting system urine and stone (culture and sensitivity) in predicting urosepsis following percutaneous nephrolithotomy. **Subjects and Methods:** A hospital-based, analytical prospective clinical study was conducted among thirty cases who were present during the study period and had undergone percutaneous nephrolithotomy (PCNL). Cases were included irrespective of gender with renal calculi in whom percutaneous nephrolithotomy was about to be done at Narayana Medical College & Hospital, Chintareddypalem, Nellore, Andhra Pradesh during 1<sup>st</sup> February 2014 to 31<sup>st</sup> January 2015. Data collected was divided into three main groups Midstream urine (C&S); Pelvic urine (C&S); and Stone (C&S) respectively. Data obtained was entered in Microsoft Excel-2013 and analyzed in SPSS version-22 trial. Appropriate statistical tests were applied and p-value less than 0.05 was considered as significant. **Results:** Bladder urine (C&S) was positive in 3/30 (10.00 %) patients, Pelvic urine (C&S) in 5/30 (16.66 %) patients and Stone (C&S) in 8/30 (26.66 %) patients. Most of the infected specimens grew Escherichia coli followed by pseudomonas, klebsiella, enterococcus. Systemic Inflammatory Response Syndrome (SIRS) was reported among 26.7 p.c (8) of the patients. In one patient (3.33%) septic shock developed but no deaths were reported. **Conclusion:** Stone (C&S) and Pelvic urine (C&S) are better predictors of urosepsis than Bladder urine (C&S).

**Keywords:** Percutaneous nephrolithotomy, Urosepsis

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## Introduction

Urosepsis means a severe infection of urinary tract (UTI) and/or male genital tract (prostate) with features consistent with systemic inflammatory response syndrome. [1] UTI may occur among all the age groups and produce a broad range of clinical syndromes ranging from asymptomatic bacteriuria to acute pyelonephritis with gram negative sepsis to septic shock. [2] Urosepsis may also cause multiple organ dysfunction, hypoperfusion or hypotension. [2] A severe sepsis condition may be usually associated with abdominal and pulmonary infections with UTIs which account for about 5 p.c of the cases. [3] About 40 p.c of the urinary tract infections

were due to nosocomial infections. [4] About 25 p.c of the sepsis cases originate from urogenital

system. [5] A percutaneous nephrolithotomy is a minimally invasive surgical procedure performed to treat patients with a large and complex renal calculi. [6]

Urosepsis is a complication which occur after a percutaneous nephrolithotomy among 0.3 to 2.5 p.c cases. [7] Staghorn urinary calculi may harbor bacteria. The fragmented stones, despite sterile urine, may release bacterial endotoxins and viable bacteria that place the patient at risk for septic complication. [8,9] It is estimated that the mortality rate due to urosepsis ranges from 30 to 40 p.c respectively. [10] The most

common pathogens causing UTIs (and in turn urosepsis) are Escherichia coli (50%), Proteus (15%), Enterobacter (15%), Klebsiella (15%), Pseudomonas aeruginosa (5%) and gram-positive bacteria (15%) respectively. [11]

The clinical presentation of urosepsis includes fever, tachycardia, tachypnea, respiratory alkalosis which were earlier considered to be mandatory for the diagnosis of sepsis, are now considered to be the alerting symptoms. [2] Systemic inflammatory response syndrome includes body temperature ( $\geq 38^{\circ}\text{C}$  / ( $\leq 36^{\circ}\text{C}$ ); tachycardia ( $\geq 90$  beats/min); tachypnea ( $\geq 20$  breaths/min); respiratory alkalosis ( $\text{PaCO}_2 \leq 32$  mm Hg); leucocytes ( $\geq 12000$  or  $\leq 4000$  cells/ $\mu\text{L}$ ). [2] Risk factors for urosepsis include surgical patients, weakened immune system, kidney transplant recipients, chronic illness, recent diagnosis of UTI, H/o recurrent UTI, H/o urosepsis, urinary tract disorders, elderly, diabetic, frequent catheterization, recent catheterization, inability to fully empty the bladder and indwelling (long-term) catheter. [12] Urosepsis due to percutaneous nephrolithotomy may be catastrophic despite prophylactic antibiotic coverage and negative midstream urine culture and sensitivity testing (C&S) and bacteria in the stone can be responsible for systemic infection.

### Aim & Objectives

- To compare bladder urine (culture & sensitivity) and collecting system urine and stone (culture and sensitivity) in predicting urosepsis following percutaneous nephrolithotomy.

### Subjects and Methods

A hospital-based, analytical prospective clinical study was conducted among thirty cases who were present during the study period and had undergone percutaneous nephrolithotomy (PCNL). Cases were included irrespective of gender with renal calculi in whom percutaneous nephrolithotomy was about to be done. Patients with a stent, nephrostomy tube or indwelling catheter, concomitant bladder stone, contralateral ureteral stone, previous manipulation or procedure and immuno compromised state were excluded from the study. The study was conducted for a period of 1 year from 1<sup>st</sup> February 2014 to 31<sup>st</sup> January 2015 at Narayana Medical College & Hospital, Chintareddypalem, Nellore, Andhra Pradesh. A prior permission from the institutional ethics committee and written consent from the patients and their family members were obtained. Patient was placed in lithotomy position; betadine preparation of perineum and cystoscopy was done. Through a ureteric orifice of 0.0035 inch terumo guidewire was introduced into pelvicalyceal system. A 5fr ureteric catheter was guided into the pelvicalyceal system over the guidewire and the position was confirmed by fluoroscopic guidance. Later the patient was turned to prone position, after an aseptic preparation percutaneous puncture was

done by chiba needle and its position was confirmed by aspiration of urine, which was sent for culture. Nephroscopy was performed and stone was visualized & fragmented with a pneumatic lithotripter. Stone fragments were retrieved and collected into a sterile bottle. Nemoy and Stamey method was used for stone culture and sensitivity. Patients were monitored closely during post-operative period for any signs of sepsis. Data collected was divided into three main groups Midstream urine (C&S); Pelvic urine (C&S); and Stone (C&S) respectively. Data obtained was entered in Microsoft Excel-2013 and analyzed in SPSS version-22 trial. Appropriate statistical tests were applied and p-value less than 0.05 was considered as significant.

### Results

In the present study 30 patients were included based on the selection criteria. Table-1 reports that majority 73.3 p.c (22) were males followed by 26.7 p.c (8) were females respectively. Majority of the patients were above 30 years of age, two were pediatric patients. Figure-1 reports that maximum number of isolates were from stones followed by pelvic urine and least from bladder urine. Bladder urine (C&S) was positive in 3/30 (10.00 %) patients, Pelvic urine (C&S) in 5/30 (16.66 %) patients and Stone (C&S) in 8/30 (26.66 %) patients. Most of the infected specimens grew Escherichia coli followed by pseudomonas, klebsiella, enterococcus. Systemic Inflammatory Response Syndrome (SIRS) was reported among 26.7 p.c (8) of the patients. In one patient (3.33%) septic shock developed but no deaths were reported. Table-2 & Figure-2 reports the Systemic Inflammatory Response Syndrome (SIRS) among the patients. Correlation between the various specimens and SIRS revealed that infected stone (C&S) and pelvic urine (C&S) carried a 4-fold risk of urosepsis. A total of 20 patients had radiological evidence of a dilated pelvicalyceal system (hydronephrosis or caliectasis) and the incidence of positive pelvic urine (C&S) in this subgroup was significantly higher than in those without obvious dilatation (p-value=0.046). Despite this, hydronephrosis did not correlate with SIRS (p-value=0.529). Operative time had a positive linear relationship with stone bulk ( $r=0.723$ , p-value=0.01). Infected stones appeared to be larger than non-infected ones. About 7 stones greater than 30 mm size were culture positive compared with 1 stone that was 30 mm or less (p-value=0.039), which may have reflected their etiology. There was a similarly poor correlation between SIRS and age (p-value=0.66), gender (p-value=0.44), difficult access (p-value=0.903) and residual stones postoperatively (p-value=0.857). Table-3 reports distribution of patients based on hydronephrosis & SIRS. Table-4 reports prediction of SIRS using different specimens.

Table 1: Showing Demographic Factors

Demographic Factors		Number Of Patients	% Of Patients
Gender	Male	22	73.3
	Female	8	26.7
Age (Years)	<10	1	3.3
	11-20	4	13.3
	21-30	7	23.3
	31-40	10	33.3
	41-50	5	16.8
	>50	3	10

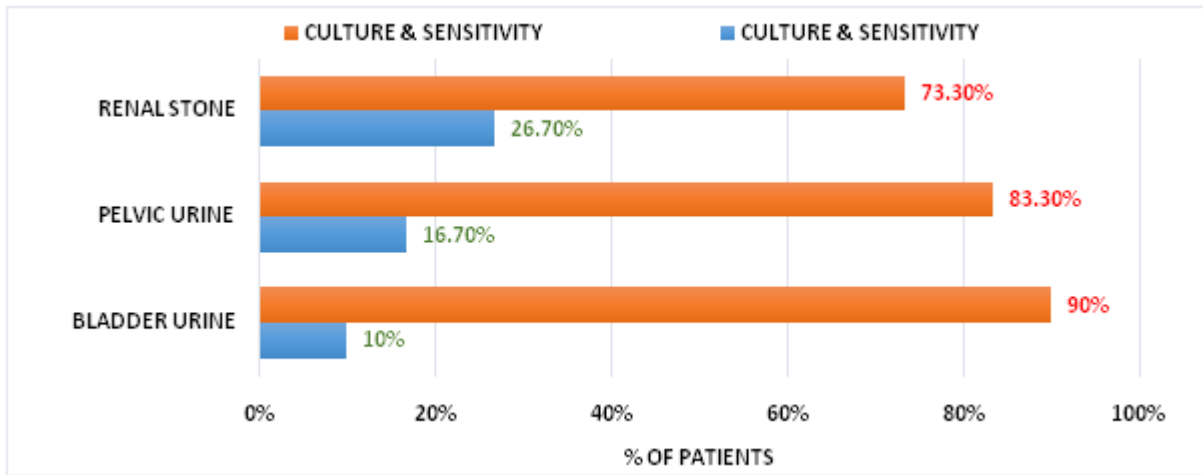


Figure 1: Showing Comparison of culture Results

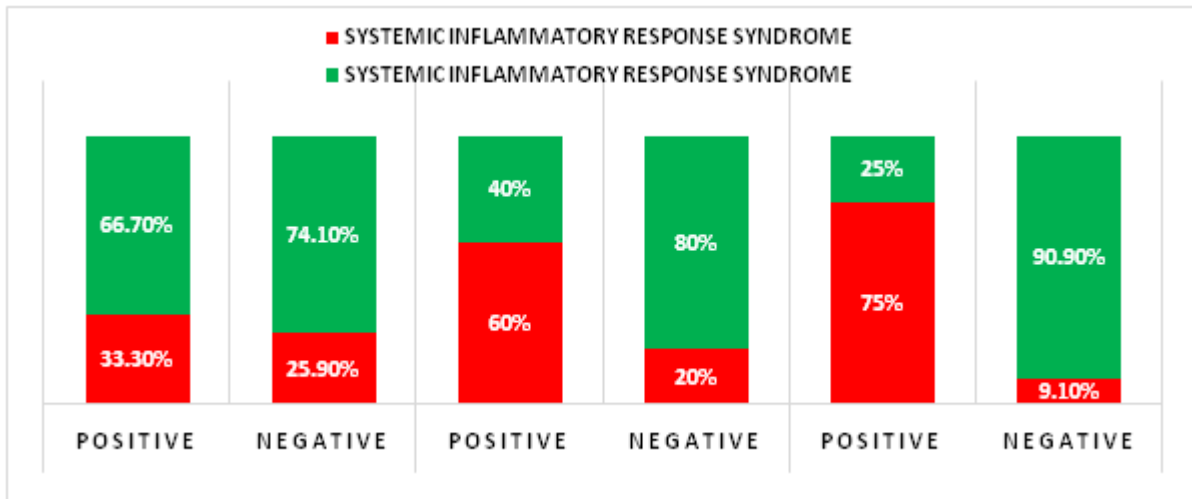


Figure 2: Showing Systemic Inflammatory Response Syndrome

**Table 2: Showing Systemic Inflammatory Response Syndrome (SIRS) in Various Samples Tested**

Sample		Systemic Inflammatory Response Syndrome	
		Present (%)	Absent (%)
Bladder Urine	Positive	1 (33.3)	2 (66.7)
	Negative	7 (25.9)	20 (74.1)
Pelvic Urine	Positive	3 (60)	2 (40)
	Negative	5 (20)	20 (80)
Renal Stone	Positive	6 (75)	2 (25)
	Negative	2 (9.1)	20 (90.9)

**Table 3: Showing Distribution of Patients Based on Hydronephrosis & SIRS**

SIRS	Dilated Pcs		Normal Pcs	
	Pelvic Urine (C/S)		Pelvic Urine (C/S)	
	Present	Negative	Present	Negative
Present	2	4	1	1
Absent	2	12	0	8

**Table 4: Showing Prediction of SIRS Using Different Specimens**

	Bladder Urine C/S	Pelvic Urine C/S	Stone C/S
Sensitivity	12.5	37.5	87.5
Specificity	90.9	90.9	95.45
PPV	0.33	0.6	0.87
NPV	0.74	0.8	0.95
RR(95% CI)	1.37 (0.14-13.17)	4.12 (0.83-20.34)	19.5 (2.7-132.9)

## Discussion

In our study Stone (C&S) was positive in 26.7 p.c and Mid-Stream urine (MSU) (C&S) was positive in only one of them (12.5 p.c). Fowler et al who reported a stone positive rate of 77.3 p.c and found that urine (C&S) was simultaneously positive in only 12.5 p.c of patients with infected stones.<sup>[13]</sup> Similarly Bratell et al<sup>[14]</sup> and Mc Cartney et al<sup>[15]</sup> confirmed a poor correlation between infection in the stone and in bladder urine specimens.

Cadeddu et al<sup>[16]</sup> study reviewed 66 records of patients with PCNL who had sterile urine preoperatively. Of the 28.8 p.c of patients in whom fever greater than 38°C developed none had positive blood or postoperative urine (C&S). In our study also none of the patients with SIRS (26.7%) had positive blood (C/S). Cadeddu et al<sup>[16]</sup> reported no correlation between fever and stone composition, although stone culture was not performed. Fever alone cannot be used as an indicator of systemic infection, as noted in the study of Rao et al<sup>[17]</sup>, in which 74 p.c of patients with PCNL had fever postoperatively but only 41 p.c had endotoxemia.

## Conclusion

Stone (C&S) and Pelvic urine (C&S) are better predictors of urosepsis than Bladder urine (C&S).

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