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# Predictors of Risk Factors for Urosepsis After Percutaneous Neprolithotomy

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*Aim: To describe the clinical parameters of urinary stones and investigate the preoperative predictors of sepsis in patients following percutaneous nephrolithotomy (PCNL).*
*Materials and Methods. A retrospective study of patients who underwent PCNL between September 2019 and December 2021 was performed. The patients were divided into the sepsis and nonsepsis groups, their data were compared for further analysis.*
*Results. The multivariate analysis demonstrated that the staghorn calculi (OR: 12.206, P < 0:001) and positive midstream urine culture (OR: 16.505, P < 0:001) were independent risk factors of sepsis, while preoperative percutaneous nephrostomy (OR: 0.122, P < 0:001) was a protective factor of sepsis.*
*Conclusions. Our study reveals that patients with complex stones and positive bacteriuria are associated with a significantly high risk of sepsis after surgery. The removal of obstruction before operation under certain conditions might be a reliable protective factor of sepsis.*

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## I. Introduction:

Urinary stones are one of the most common diseases, with an incidence of approximately 5-15% around the world [1, 2] and a recurrence rate reaching 50% in a decade [3, 4]. percutaneous nephrolithotomy (PCNL) is now recognized as the first-line choice for the removal of renal stones, especially for complex stones with a high burden [5–7]. Nevertheless, PCNL can also induce severe adverse events occasionally.

Sepsis, a systemic inflammatory response syndrome (SIRS) clinically confirmed or highly suspicious by documented evidence of bacterial pathogens, is a notable postoperative complication after PCNL with an incidence of about 0.3% to 7.6% [8]. Based on the Sequential Organ Failure Assessment (SOFA) scoring system, sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection [9]. It is the most common cause of perioperative death in PCNL in large series [7]. Some important risk factors of infection after PCNL, including the stone size and operation time, have been well identified [10]. Therefore, in the present study, the related factors for urinary sepsis were evaluated.

## II. Methods:

*1.1. Study Design and Data Collection.* This paper retrospectively reviewed the data of consecutive patients with the renal calculi or upper ureteral calculi who underwent PCNL at Government Rajaji Hospital, Madurai Medical College from September 2019 to December 2021. All operations were performed in standard procedure by experienced urologists. Patients who had tumor, blood diseases, urinary tract tuberculosis, paediatric patients and incomplete medical records were excluded. Patients' preoperative factors including age, sex, diabetes, surgery time, serum creatinine (S.Cr), midstream urine culture, stone location, the urinary sediment microscopy WBC (+ ~ ++++), and staghorn calculi were recorded. Appropriate antibiotics would be administered as empirical therapy when patients had any focus of infection, and the use of sensitive antibiotics was guided by the positive urine culture report before operation. Sepsis was defined by a SOFA score of 2 or more consequent upon confirmed or suspected infection [9].

## III. PCNL Technique:

PCNL is a complicated procedure where each step is technically demanding and should be completed with precision. The main steps are positioning of the patient, renal access, safe tract dilatation, intra- corporeal lithotripsy, fragments evacuation and upper system drainage.

**3.1. Patient positioning**

Patient positioning influences not only the endourological approaches but also the cardiovascular and ventilation status of the patient during the procedure. Three main options exist for positioning,include prone, supine and lateral decubitus positions. The pros and cons of prone versus supine PCNL are in debate. Prone position is still considered as the standard approach. The advantages are easier identification of renal anatomy and selection of the appropriate puncture site. It also provides a wider surface area for percutaneous access with a low risk of abdominal visceral injuries [21]. The main concern with the prone position is anesthesiological safety affecting patient's cardiovascular status, especially in cases of obese patients. The supine position has been introduced to deal with these drawbacks. With regards to the advantages, cardiovascular and respiratory risks are diminished, easier for the anesthesiologist to manage the patient, no need to reposition the patient following initial retrograde ureter catheter insertion [21]. However, Siev et al. [22] addressed the ventilatory issues and concluded that obese patients have higher baseline peak inspiratory pressure regardless of position and that prone positioning does not impact peak inspiratory pressure and remains a safe and viable option. The disadvantages of the supine position are a limited surface area for puncture, increased skin to kidney distance and potential risk for visceral and vascular injuries [23].Alongside safety concerns, stone-free rates were lower in supine group. An obvious advantage was the reduction of the mean operative time. No effect on the average length of hospital stay was observed. The lateral decubitus position [25] might overcome these disadvantages and still preserve most of the benefits of the supine position that were noted.

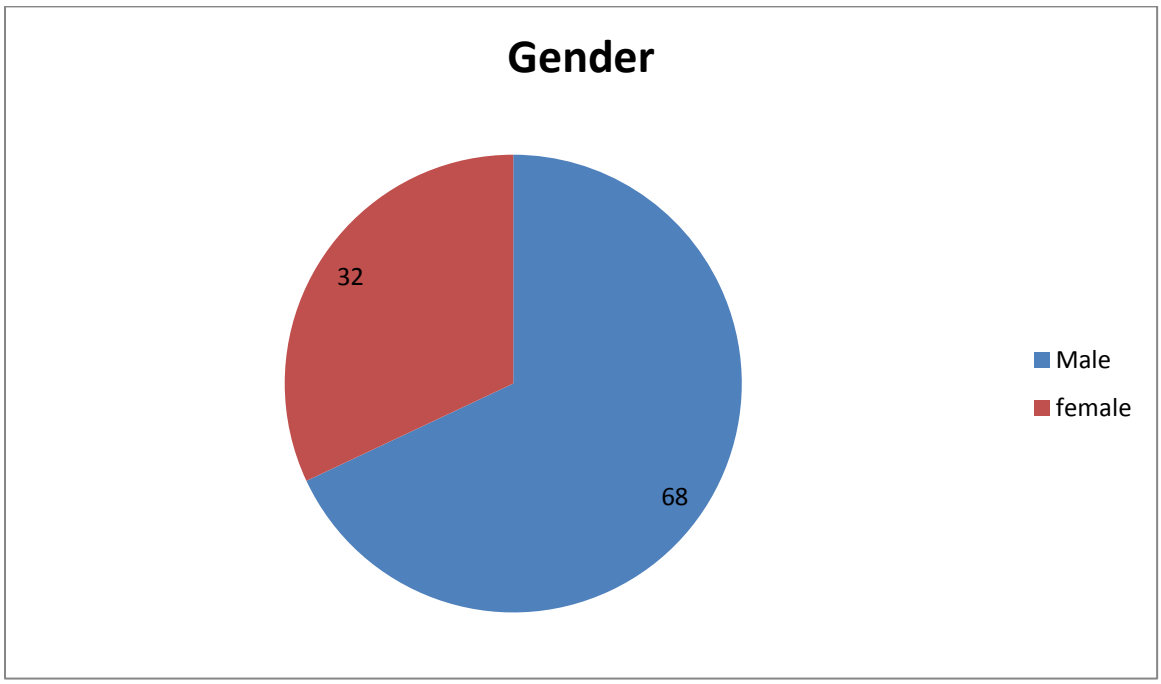
**3.2. Access**

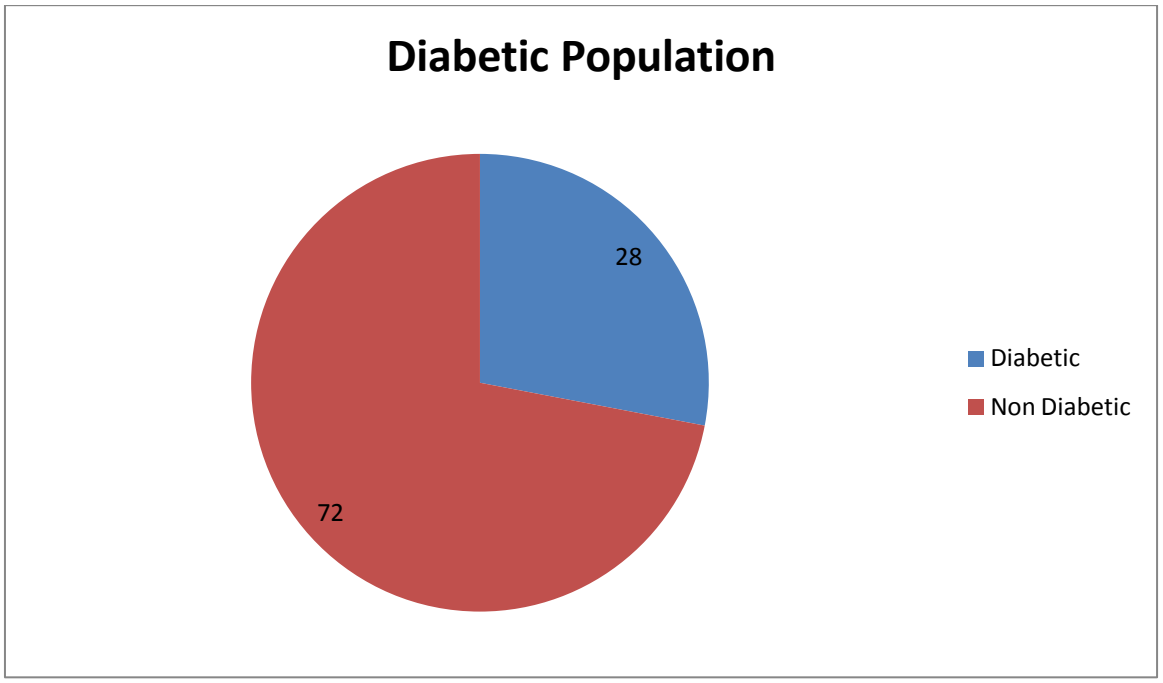
Performing the renal access during PCNL is the most crucial step of the procedure with the steepest learning curve. There are several guidance options for renal puncture during PCNL.

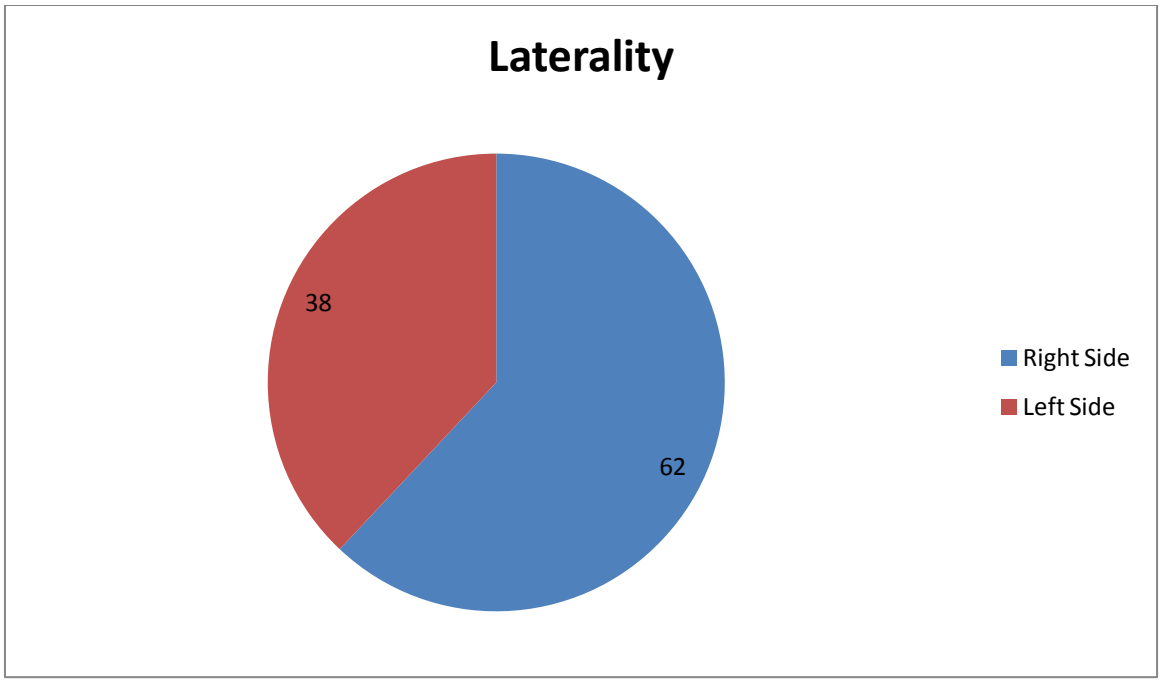
**3.2.1. Fluoroscopy-guided access**

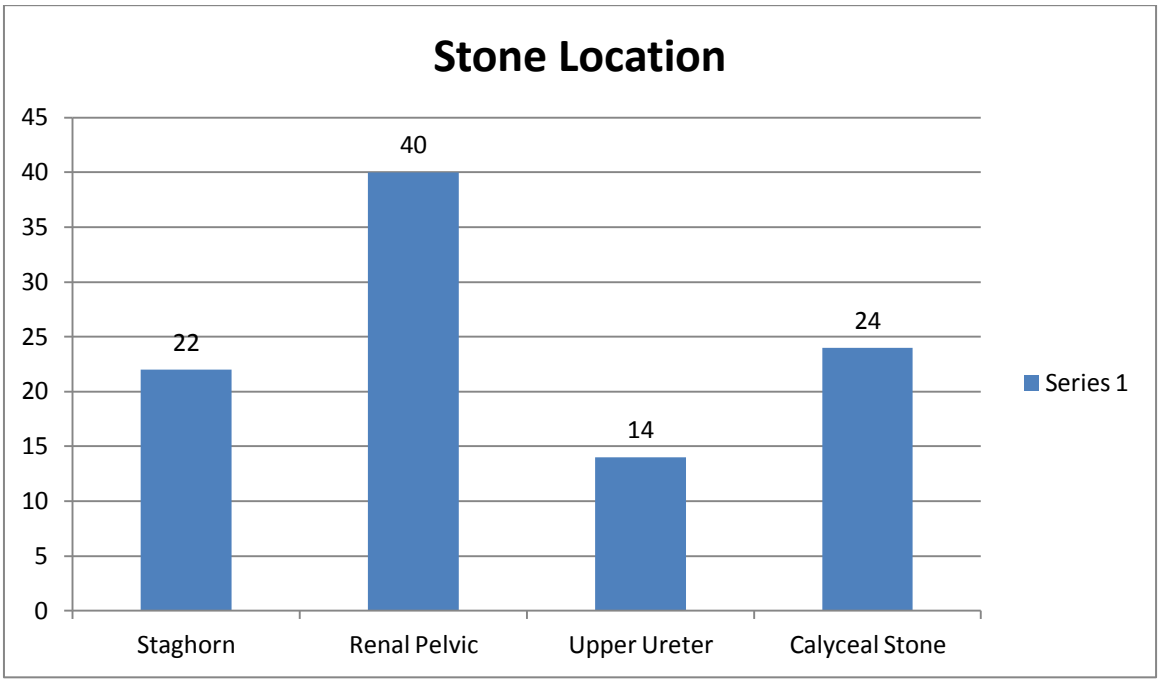
The "bull's eye" or "the eye of the needle" technique for renal access gaining is an established, well-known technique that is widely applied. It incorporates alignment of C-arm fluoroscopy image with an imaginary line to the desired calyx. C-arm rotation confirms the proper depth of the needle and its secure advancement to the fornix of the preferred calyx. Another technique is the "triangulation" using two known points of reference to locate a third unknown point and guided by biplanar fluoroscopy [28]. Most updates of access techniques that are discussed are focusing on two main principles: Increasing target accuracy and decreasing radiation exposure of the patient and the medical staff. In accordance with that goal, a mono-planar access technique was described [29]. It is different from the biplanar method in the fact that only fluoroscopic projections maintained on a vertical plane are utilized.

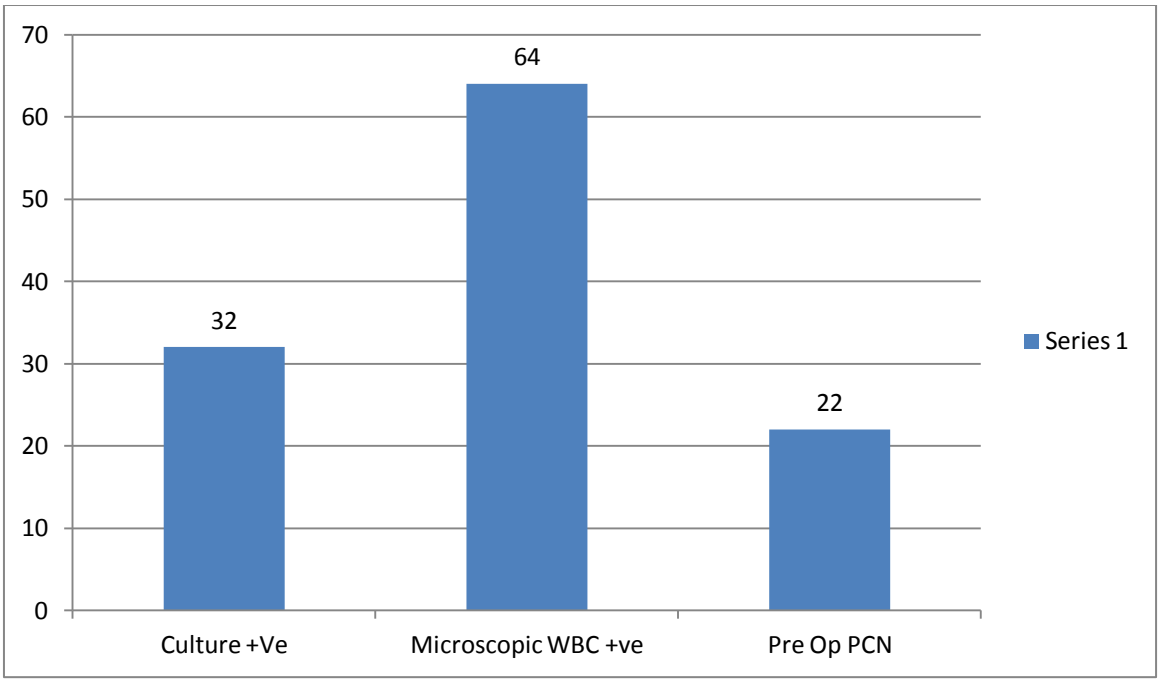
**IV. Table:**

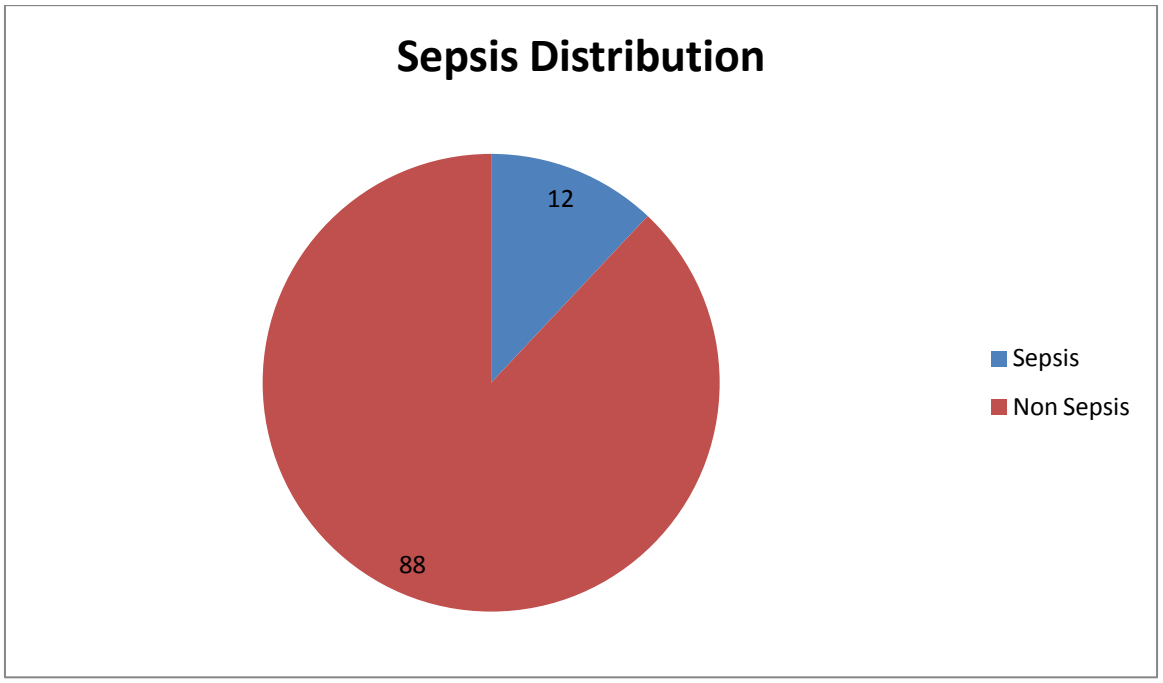



Diabetic Population
28
72
Diabetic
Non Diabetic


Laterality
38
62
Right Side
Left Side


Stone Location
45
40
35
30
25
20
15
10
5
0
40
22
14
24
Staghorn
Renal Pelvic
Upper Ureter
Calyceal Stone
Series 1


70
60
50
40
30
20
10
0
64
32
22
Culture +Ve
Microscopic WBC +ve
Pre Op PCN
Series 1




## V. DISCUSSION:

In our study, out of 100 patients. 12 patients had urosepsis. Of which complex stones were 9, microscopic WBC positive were 10, culture positive were 9. PCN prior to PCNL were 3. Out of 22 total PCN, 19 patients recovered without urosepsis. Complex stones, bacteriuria were independent risk factors for urosepsis. PCN placement in specific cases reduces urosepsis in most patients.

In this retrospective study, the multivariate logistic regression analysis of patients' clinical data collected showed that staghorn calculi, preoperative positive midstream urine culture, and preoperative PCN were independently related to postoperative sepsis, whereas no significant association microscopy WBC was observed.

Aimed at removing stones, relieving obstruction, and protecting renal function, the PCNL surgery needed to reach the renal pelvic, renal calyx, or upper urinary tract, possibly resulting in an increased chance of infections [15, 16]. Compared with small calculi, the large calculi caused relatively prolonged operation time and increased incidence of sepsis, as confirmed by our single factor analysis, but the results of the multivariate logistic regression analysis indicated that the stone location and stone size were not independent risk factors. This result was consistent with that obtained by the study of Lojanapiwat et al. [17].

Staghorn calculi are defined as the stones with multiple branches occupying a part or all of the renal pelvis and renal calyces [18]. Recently, Rivera et al. have retrospectively investigated 277 patients who underwent PCNL and identified 37 (16%)patients with infectious complications. Their result demonstrated that the presence of a staghorn calculus remained independently associated with the increased risk of fever/SIRS/sepsis (OR: 3.14) [10, 19] .Our multivariate analysis suggested that the staghorn calculi probably evolved into sepsis (OR: 12.206

The preoperative midstream urine culture and intraoperative renal pelvic urine culture have been indicated as significant risk factors for post-PCNL sepsis [20]. Consistent with the result of previous studies, the positive urine culture was found to be associated with urosepsis and identified as an independent risk factor in the multivariate analysis of this study (OR: 16.505). Therefore, to avoid sepsis after PCNL patients with positive preoperative bacteriuria must be accurately treated by antibiotics sensitive for the detected pathogens before the surgical treatment.

Preoperative infections can be caused by kidney swelling (hydronephrosis) that may be associated with high renal pelvis pressure, especially in patients with serious hydronephrosis or basic kidney diseases. These patients are often suggested to remove obstruction before surgery, which may reduce the incidence of postoperative infections. As it was speculated, our results revealed that the preoperative PCN independently associated with sepsis. In addition, it was worth noting that preoperative PCN would be a protective factor of sepsis (OR: 0.122), which may be attributed to the removal of the bacteria culture medium. The protective role of preoperative renal fistula has not been reported in previous studies [10, 14], but it only applies to specific patients

## VI. Conclusion:

Preoperative leukocyte elevation, positive urine nitrite, positive urine culture and complex stones are independent risk factors for urosepsis after PCNL. The removal of obstruction before operation under certain conditions might be a reliable protective factor of sepsis.

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