MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218\makrjms.2023.914.918

Prognostic Implication of Contributory Factors for Systemic Inflammatory Response Syndrome Following Percutaneous Nephrolithotomy

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ABSTRACT

Percutaneous nephrolithotomy (PCNL) has gradually replaced open surgery as the first choice for the treatment of upper urinary calculi in clinical setting, but there are still complications such as bleeding, fever, sepsis, and so on. Among them, postoperative fever is the most common complication, and the incidence of postoperative fever can be as high as 21.0% to 39.8%. Previous studies 4,5 have shown that postoperative fever is closely related to sepsis and septic shock. Therefore, for patients undergoing PCNL, it is very important to manage the patient's body temperature after surgery and take appropriate treatment in time. To analyse prospectively the preoperative and intraoperative factors that predict the occurrence of Systemic Inflammatory Response Syndrome in patients undergoing Percutaneous Nephrolithotomy for renal calculus disease. This Prospective study was conducted in the Department of Urology RG Kar Medical College & Hospital, Kolkata from April 2020 - September 2021. Our study showed that, in Pre-Operative Bladder Urine C/S, Growth was only observed in patients who developed SIRS post op [12 (80.0%)] and we also observed that patients without SIRS post op had No Growth in Pre-Operative Bladder Urine C/S which was statistically significant ($p<0.0001$). It was found that, in our study, Growth in Intra Operative Pelvic Urine C/S was significantly positive in patients who developed SIRS post op [9 (60.0%)] compared to patients who didn't develop SIRS post op ($p<0.0001$). In our study need for Blood transfusion was significantly more in patients who went on to develop SIRS post op [5 (33.3%)] compared to patients who didn't develop SIRS [6(9.2%)]. ($p=0.0145$).Present study showed that No. of Stones and Pre-Operative Stone Size were significantly high in patients who developed SIRS post op [(1.7333± .4577) and (3.3400± .4852) respectively] compared to patients who didn't develop SIRS post op [(1.0462± .2115) and (2.7523± .3886) respectively]. ($p<0.0001$). In a univariate analysis, SIRS was significantly predicted by the patient's age at blood transfusion, the size of the stone, the number of access tracts, the length of the operation, According to a multivariate analysis, SIRS is statistically predicted to occur postoperatively by size of the stones and the quantity of access tracts, the length of the operation, and stone culture. Age, gender, type 2 diabetes, and bladder urine culture, and elevated serum levels of creatinine not associated in this research with the development resulted in a statistically significant amount of SIRS way. As a result, individuals who have the aforementioned risk factors might be prescribed the proper antibiotics to stop sepsis from developing postoperatively.

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Key Words

Percutaneous nephrolithotomy, systemic inflammatory response syndrome, diabetes mellitus, hydronephrosis

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Received: 2 August 2023
Accepted: 16 August 2023
Published: 17 August 2023

Citation: Arnab Maity, Ranjan Kumar Dey, Anand Biyani, Sudipta Singh and Shashikant Tiwary, 2023. Prognostic Implication of Contributory Factors for Systemic Inflammatory Response Syndrome Following Percutaneous Nephrolithotomy. Res. J. Med. Sci., 17: 914-918, doi: 10.59218\ makrjms.2023.914.918

INTRODUCTION

Urinary stone disease has been known to affect humans since times immemorial. The incidence of stone disease has shown a gradual shift with regard to site of stones from lower to upper urinary tract. Also even though stone disease is two to three times more common in young adult males in comparison to females the gender divide is fast disappearing. The prevalence of renal stone disease is estimated to be varying somewhere around 1% to 15%. The peak age incidence of stones is in the fourth to sixth decades of life. Stones are more common in hot arid climates, obese individuals and in those with sedentary life style.

The management of stone disease has also evolved in parallel to development in evaluation and imaging. Early open procedures have given way for less invasive endourological management with reduced morbidity and mortality. Percutaneous nephrolithotomy is considered the standard of care in the management of renal calculous disease. In the early days the procedure had considerable morbidity and at times mortality. With advances in technology and improved surgical technique the mortality is very low and morbidity has come down.

Percutaneous nephrolithotomy (PCNL) has gradually replaced open surgery as the first choice for the treatment of upper urinary calculi in clinical setting, but there are still complications such as bleeding, fever, sepsis, and so on[1]. Among them, postoperative fever is the most common complication, and the incidence of postoperative fever can be as high as 21.0% to 39.8%. Previous studies 4,5 have shown that postoperative fever is closely related to sepsis and septic shock. Therefore, for patients undergoing PCNL, it is very important to manage the patient's body temperature after surgery and take appropriate treatment in time. Therefore, we aimed to analyze the characteristics of patients undergoing PCNL, to investigate the potential risk factors of postoperative fever by logistic regression analyses, thereby providing evidence to the corresponding preventive strategies of postoperative fever in patients undergoing PCNL.

Sepsis is a systemic inflammatory response to a confirmed or suspected infection. Clinically, the Systemic Inflammatory Response Syndrome (SIRS) is the occurrence of at least two of the following criteria: fever >38.0°C or hypothermia <36.0°C, tachycardia >90 beats/minute, tachypnea >20 breaths/minute, leucocytosis >12*109/l or leucopoenia <4*109/l[2].

The development from sepsis to septic shock represents a continuum with increasing mortality. The in-hospital/28-day mortality in severe sepsis is 10%-40% and in septic shock it is 30%-60% 8-16. Early treatment with antibiotic and fluid resuscitation has been found to be strongly related to increased survival, which makes severe sepsis a condition which is important to identify and treat as early as possible[3].

MATERIALS AND METHODS

Study site: Department of Urology, RG Kar Medical College and Hospital, Kolkata.

Study population: All patients with renal stone disease who underwent Percutaneous Nephrolithotomy in our Institution during the above mentioned period.

Study design: A Prospective study.

Period of study: April 2020-September 2021.

Sample size: 80 patients.

Inclusion criteria: Patients with renal stone disease requiring Percutaneous Nephrolithotomy.

Exclusion criteria:

- Patients with infected collecting system
- Patients with synchronous ureteric stones
- Patients on Stents or Percutaneous Nephrostomy drainage

RESULTS AND DISCUSSIONS

From April 2020 to September 2021, the Department of Urology at RG Kar Medical College and Hospital in Kolkata conducted this prospective study.In this study, patients with renal stone disease who needed percutaneous nephrolithotomy were included. In all, 80 patients participated in this trial.

Chen *et al*.[4] found that 132 (63.2%) with a mean age of 49.05 years (range: 17-79), were male patients. Despite the fact that there were no ruptures of the pelvis, colon, or pleura, 13 patients (6.2%) needed blood transfusions.

In our study, out of 80 patients, 24 (30.0%) were between the ages of 41 and 50, however this group did not have SIRS statistically significantly (p = 0.8682). The remaining patients were divided into four age groups: 30 years old (15.8%), 31-40 years old (18.5%), 51-60 years old (17.3%) and >60 years old (6.5%). The patients' average age was 42.9750 12.4798 years (Table 1).

Prasad *et al*.[5] (2019) showed that 250 patients made up the study population, of which 102 (40.8%) were women and 148 (59.2%) were men. SIRS was formed in 27 (18.2%) of the males and 24 (23.5%) of the females. It was discovered that there was no statistically significant difference in gender between individuals who acquired SIRS and those who did not (p = 0.308).

We discovered that there were 50 more males than females (62.5% vs. 37.5%), however this difference was not statistically significant (p = 0.4158).

Table 1: Distribution of Intra operative pelvic urine C/S

Intra operative pelvic urine C/S	Frequency	Percentage
Growth	9	11.3
No growth	71	88.8
Total	80	100.0

Table 2: Association between post-operative stone C/S: SIRS

SIRS post-operative stone C/S	No	Yes	Total
Growth	0	10	10.0
Row (%)	0.0	100.0	100.0
Col (%)	0.0	66.7	12.5
No growth	65	5	70.0
Row (%)	92.9	7.1	100.0
Col (%)	100.0	33.3	87.5
Total	65	15	80.0
Row (%)	81.3	18.8	100.0
Col (%)	100.0	100.0	100.0

Chi-square value: 49.5238 and p-value: <0.0001

Table 3: Difference of mean age: SIRS

Age	No.	Mean	SD	Minimum	Maximum	Median	p-value
No	65	42.5846	12.2448	20.0000	65.0000	45.0000	0.5636
Yes	15	44.6667	13.7720	18.0000	65.0000	5.0000	

SD: Standard deviation

Table 4: Difference of mean pre-operative creatinine: SIRS

Pre-operative creatinine	No.	Mean	SD	Minimum	Maximum	Median	p-value
No	65	1.1569	0.4750	0.6000	2.7000	1.1000	<0.0001
Yes	15	2.0000	0.6059	1.1000	2.9000	1.9000	

SD: Standard deviation

Pre-Operative DM was considerably higher in patients who developed SIRS post-op [8 (53.3%)] than in individuals who did not [5 (7.7%)], according to our observations (p<0.0001) (Table 2).

Chen *et al*.[4] found that Urine from 84 patients contained a colony. Pathogens that colonized urine most frequently (53.6%) were Gram-negative. However, Staphylococcus, It was Gram-positive and the most abundant organism (25.0%). Gram-negative bacteria made up the majority of the colonization in patients with high-grade bacteriuria (61.5%). However, there was a higher chance of Gram-positive bacteria colonization in patients with low-grade bacteriuria (68.4%).

Prasad *et al*.[5] found There was no correlation between the presence of growth in pre-operative urine culture and sterile urine in patients who had SIRS (p = 0.043).

Our research revealed that Pre-Operative Bladder Urine C/S Growth was only seen in patients who later had SIRS in 12 (80.0%) individuals. Additionally, we saw that patients without SIRS post-op did not have any growth in their pre-operative bladder urine C/S, which was statistically significant (p>0.0001).

Growth in Intra Operative Pelvic Urine C/S was shown to be considerably positive in our study's patients who developed SIRS post-op [9 (60.0%)] compared to those who did not (p<0.0001).

We discovered that lower calyces+pelvis was where stones were most frequently identified in individuals who experienced SIRS after surgery [7 (46.7%)]. The remaining 3 (20.0%) SIRS post-op patients had stones in the Lower Calyces, 3 (20.0%) SIRS post-op patients had stones in the lower calyces+middle calyces and 2 (13.3%) SIRS post-op patients had stones in the middle calyces, which was statistically significant (p>0.0001).

The current investigation revealed that patients who experienced SIRS post-operatively [10 (66.7%)] were substantially more likely to have more than one calyceal involvement by stone than patients who did not have SIRS (p>0.0001). Patients who did not experience SIRS after surgery were more likely to have single calyceal involvement [65 (100.0%)] (Table 3).

In patients who developed SIRS post-op, we discovered that the presence of a single stone was substantially less common [4 (26.7%)] than the presence of two stones [11 (73.3%)] (p<0.0001) (Table 4).

In contrast to patients who did not develop SIRS post-op, our study found that patients with more than one intraoperative tract had a substantial correlation with developing SIRS [10 (66.7%)] compared to patients with just one intraoperative tract [3 (4.6%)]. As compared to patients who did not acquire SIRS post-op [62 (95.4%)], patients with SIRS post-op [5 (33.3%)] had substantially fewer single intraoperative tracts (p<0.0001).

Mariappan *et al*.[6] found that a total of 54 procedures were available for review. Stone C and S was found to be positive in 35.2% of patients, pelvic urine C and S in 20.4% of cases and midstream urine C and S in 11.1% of cases (p = 0.009). Pelvic urine C and S predicted infected stones more effectively than bladder urine C and S. Patients with contaminated stones or pelvic urine had a relative risk of urosepsis that was at least four times higher (p = 0.0009). Stone C and S had the highest positive predictive value with a grade of 0.7. Preoperative hydronephrosis was linked to infected pelvic urine.

The current study found that individuals without systemic inflammatory response syndrome after surgery saw less growth in post-operative stone C/S than patients who did [10 (66.7%)]. Furthermore, this was statistically significant. (p<0.0001).

Chen *et al*.[4] showed in According to the multivariable logistic analysis, the presence of pyelocaliectasis (OR = 3.35, 95% confidence interval [CI] = 1.44-7.81, p = 0.005), the size of the stone (OR = 1.10, 95% CI = 1.05-1.14, p<0.001), the greatest risk variables for the development of SIRS following PCNL were and the number of tracts. When compared to the non-transfusion and single tract groups, the chance of developing SIRS was more than 20 times higher when the patient had multiple tracts or received a blood transfusion.

In our study, patients who went on to develop SIRS post-op [5 (33.3%)] required considerably more blood transfusions than patients who did not acquire SIRS [6(9.2%)] (p = 0.0145).

Pre-Operative Creatinine and the number of calyces involved were considerably lower in patients who did not go on to develop SIRS post-op [(1.1569.4750), (1.0000.0000), respectively] than in patients who did [(2.0000.6059), (1.6667.4880), according to our research (p<0.0001).

Prasad *et al*.[5] found that the mean stone size in the study population was 3.78 (SD = 0.94) for patients without fever/SIRS and 4.47 (SD = 0.81) for individuals who did develop fever/SIRS. The difference in mean size for the development of fever/SIRS between the two groups is statistically significant (p<0.001).

According to the current study, patients who developed SIRS after surgery had considerably more stones and larger pre-operative stones than patients who did not (1.7333.4577 and 3.3400.4852 vs. (1.0462.2115) and (2.7523.3886, respectively) (p<0.0001).

We found that Intra Operative No. of Tracts was significantly less in patients who didn't develop SIRS post op [1.0462±0.2115] compared to patients who developed SIRS post op [1.6667±0.4880] (p<0.0001).

We also found that Intra Operative Time was significantly more in patients who developed SIRS post op [110.3333±14.0746] compared to patients who didn't develop SIRS [66.8769±15.7426] (p<0.0001).

CONCLUSION

In our investigation, the majority of the 80 patients were between the ages of 41 and 50, which was not statistically significant with the postoperative development of SIRS. The patients' average age was 42.9750 years. We discovered that there were more male patients with renal stone disease than female patients but given the post-operative occurrence of SIRS, this difference was not statistically significant. We found that patients who experienced SIRS after surgery had considerably higher pre-operative levels of diabetes mellitus than patients who did not have SIRS after surgery. Our research revealed a statistically significant correlation between the existence of growth in pre-operative bladder urine C/S and the development of SIRS after surgery. There was a statistically significant link between the development of SIRS postoperatively and the existence of growth in intraoperative pelvic urine C/S in our study. In our analysis, we discovered that Lower Calyces+ Pelvis was the most frequently identified stone location before to surgery in individuals who later had SIRS and this finding was statistically significant. The current investigation shown that patients with SIRS post-operatively had considerably greater multiple calyceal involvement of stones than patients without SIRS post-operatively. Patients who had SIRS after surgery had a much higher prevalence of multiple stones prior to surgery. A substantial correlation existed between the development of SIRS postoperatively and several intraoperative tracts. The current investigation demonstrated a statistically significant correlation between the development of SIRS postoperatively and the existence of growth in post-operative stone C/S. In our study, patients who experienced post-operative SIRS had a considerably higher requirement for blood transfusions than patients who did not have the same post-operative SIRS. Pre-Operative Creatinine and No. of Calyces Involved were significantly less in patients who did not develop SIRS post operatively compared to patients who developed the same post operatively. Present study showed that More No. of Stones, High Pre-Operative Stone Size and More Number of Intra Operative Tracts had a significant association with development of SIRS post operatively. We also found that Intra Operative Time was significantly more in patients who developed SIRS post operatively than those who did not.

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