Predictors of Systemic Inflammatory Response Syndrome Following Percutaneous Nephrolithotomy

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Abstract

Introduction and Objectives: Sepsis remains one of the dreaded complications of percutaneous nephrolithotomy (PCNL). To analyze prospectively the preoperative and intraoperative factors that predict the occurrence of systemic inflammatory response syndrome (SIRS) in patients undergoing PCNL so that we can aggressively manage those patients from the preoperative period itself and avert the dangerous complications. Materials and Methods: A prospective study was carried out between Septembser 2016 and April 2018 including all patients who underwent PCNL. Patients with infected collecting system, synchronous ureteric stones, stents, or percutaneous nephrostomy drainage were excluded from the study. Patients were evaluated with physical examination, urine analysis, urine culture and sensitivity, complete blood count, renal function test, X-ray kidney, ureter, and bladder (KUB), and plain and contrast-enhanced computerized tomography KUB. Patients who developed any two or above of the following in the postoperative period were considered to have developed SIRS. (1) Temperature >100.4°F (38°C) or < 96.8°F (36°C). (2) Pulse rate > 90/min. (3) Respiratory rate > 20/min. (4) White blood cell count > 12,000/ml or < 4000/ml. Materials and Methods:A prospective study was carried out between Septembser 2016 and April 2018 including all patients who underwent PCNL. Patients with infected collecting system, synchronous ureteric stones, stents, or percutaneous nephrostomy drainage were excluded from the study. Patients were evaluated with physical examination, urine analysis, urine culture and sensitivity, complete blood count, renal function test, X-ray kidney, ureter, and bladder (KUB), and plain and contrast-enhanced computerized tomography KUB. Patients who developed any two or above of the following in the postoperative period were considered to have developed SIRS.

Index terms— percutaneous nephrolithotomy, post PCNL complications, systemic inflammatory response syndrome.

1 Introduction

ercutaneous nephrolithotomy (PCNL) 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. Sepsis remains one of the dreaded complications of the procedure. We need factors to predict who all are more likely to develop sepsis so that we can aggressively manage those patients from the preoperative period itself and avert the dangerous complications from occurring.

In this endeavor, analysis of both preoperative and intraoperative factors is essential to identify the risk factors since both can play a role in the development of sepsis. [1,7]

2 a) Aim and objective

To analyze prospectively the preoperative and intraoperative factors that predict the occurrence of systemic inflammatory response syndrome (SIRS) in patients undergoing PCNL for renal calculus disease.

3 II.

4 Materials and Methods

5 E. Exclusion criteria:

? Patients with infected collecting system.
? Patients with synchronous ureteric stones.
? Patients with stents or percutaneous nephrostomy drainage.

6 a) Method of study

All patients who presented to our department with renal stone disease were evaluated with physical examination, urine analysis, urine culture and sensitivity, complete blood count, renal function test, X-ray KUB, and plain and contrast-enhanced computerized tomography.

All patients were subjected to percutaneous nephrolithotomy after obtaining anesthetic fitness.

All patients were administered 1 g of ceftriaxone and 500 mg of amikacin as a standard antibiotic P prophylaxis for a period of 3 days including one preoperative dose. Patients with preoperative serum creatinine <1.4 were not administered amikacin.

All patients underwent PCNL under general anesthesia. Patients were placed in lithotomy position, and a 5 Fr ureteric catheter was introduced. Contrast was used to identify the collecting system and to select the calyx for puncture. After prone positioning with adequate padding, the posterior calyceal puncture was done under fluoroscopic guidance. The level of puncture was decided as per the location of stone to ensure complete clearance.

Puncture was done using 18 G three part needle, and a guide wire was placed within the system. Guide rod was introduced and serial coaxial dilatation of tract was done with co-axial metal dilators. Access sheath was placed. Using 26 Fr nephroscope and pneumatic lithotriptor stone fragmentation was done.

After fragments were evacuated, antegrade 4 Fr ureteric stent is placed. A 20 Fr nephrostomy tube is also placed.

Intraoperative parameters such as operative time, no of access tracts used, and need for blood transfusion were recorded. Pelvic urine collected on puncture and stone were sent for culture and sensitivity.

Patients were followed up in postoperative period with daily complete blood count including white blood cell (WBC) count, serial pulse rate, temperature, and respiratory rate monitoring.

Postprocedure check X-ray KUB was taken before removing the nephrostomy tube in the 1 st postoperative day. Ureteric stent was removed after 14 days.

Patients who developed any two or above of the following in the postoperative period were considered to have developed SIRS.

1. Temperature >100.4°F (38°C) or <96.8°F (36°C). 2. Pulse rate >90/min. 3. Respiratory rate >20/min. 4. WBC count >12,000/ml or <4000/ml.

7 b) Statistical analysis of the study

For discrete data, proportion is computed, and the mean and standard deviation are computed for the continuous data. The Chi-square test was applied to compare the proportions between the groups. To examine the association between the outcome (SIRS) and several variables, logistic regression analysis was done. All analyses were two-tailed, and $P < 0.05$ was considered statistically significant.

8 III.

9 Observation and Results

10 a) Descriptive statistics

A total of 250 patients underwent PCNL in our institute during the study period. All the patients were evaluated both preoperatively and postoperatively as described above. Of these 250 patients, 51 (20.4%) of them developed features of SIRS in the postoperative period.

The patient characteristics are as shown in Tables 1, 2 and Figure **??**.

Univariate analysis showed a significant association between age of the patient, blood transfusion, stone size, number of access tracts, operative time, pelvic urine culture [2] showing growth, and stone culture showing growth as predictors of SIRS [Table 3].

On multivariate regression analysis, stone size, no of access tracts, operative time, and stone culture were found to be statistically significant [Table 4] with regard to the occurrence of SIRS.

11 Discussion

Renal stone disease is a common urological problem. Medical management may not be possible in all situations. In certain situations like increasing stone burden or in specific type of stones like infective stones, surgical management is warranted. Moreover, medical management is more useful to prevent recurrences following surgical removal rather than as primary therapy.

Surgical management as described includes both open and endourological procedures. In the modern era of minimally invasive surgery, renal calculous surgery is no exception.

The procedure of PCNL has gained widespread acceptance and is the standard of care to treat renal calculous disease.

The procedure when attempted initially was time-consuming, tedious for both patient and treating surgeon, and with considerable morbidity and some mortality.

With advances in imaging, optics, and improved understanding of the pathology behind the considerable morbidity, the procedure has been standardized.

Initially obtaining an access was considered a vital step in the success of the procedure.

With good preoperative imaging particularly reconstructed computerized tomography, it paved the way for better localization and defining the extent of calculi. Moreover, better delineation of pelvicalyceal anatomy has helped us in obtaining an access to the pelvicalyceal system with ease. Further understanding of the way of obtaining an access with both fluoroscopic and ultrasonographic guidance has helped us in successfully creating a tract into the pelvicalyceal system.

Even though both antegrade and retrograde techniques of access are available, the most commonly practiced access is through the antegrade access.

Developments in creating a tract sufficient for the procedure have also lend a helping hand in the success of the procedure. Various methods of tract dilatation such as coaxial Alken dilators, Amplatz Advances in optics and miniaturization of endo instruments have also reduced the morbidity and improved the success rate. Introduction of flexible instruments has also greatly improved access to all the parts of collecting system without a need for additional tracts.

Advances in intracorporeal lithotripters have also improved the success rate of PCNL. Smaller size lithotripter probes and efficient retrieval of stone fragments have improved the outcome of the procedure.

In spite of all the advances and resultant improvements, certain morbidities of the procedure continue to affect the patients. Even though the procedure is being done under standard antibiotic prophylaxis, still patients develop a postoperative fever. [4][5][6] The procedure is usually done after sterilizing the urine in patients with preoperative urine culture showing growth. Still 15-30% of patients develop postoperative SIRS of which 1-2% of patients develop sepsis. The likelihood of patients developing sepsis cannot be predicted as of now.

However, the likelihood of developing SIRS in patients undergoing PCNL can be determined by identifying certain preoperative and intraoperative factors associated with the patients.

Our study comprising of 250 patients who underwent PCNL showed that 51 (20.4%) of them developed SIRS postoperatively. A study by Korets et al. [3] showed SIRS incidence of 9.8%. Another study by **??**hen et al. [9] showed SIRS incidence of 23.4%.

On analysis of data collected before, during, and after surgery, it showed certain factors associated significantly in developing SIRS.

Univariate analysis showed a significant association between age of the patient (>42 years), need for blood transfusion, stone size (>2.893 cm), number of access tracts (1 or >1), operative time (>70 min), pelvic urine culture showing growth, and stone culture [8] showing growth.

With regard to gender distribution, diabetes mellitus, bladder urine culture showing growth, and raised serum creatinine, the association was found to be statistically insignificant.

On multivariate analysis, only stone size, number of access tracts, operative time, and stone culture were found to be statistically significant in predicting the occurrence of SIRS postoperatively.

12 V.

13 Conclusion

In patients undergoing PCNL, the following factors were found on analysis to be significantly associated with developing SIRS and thereby helping to identify those likely to develop sepsis.

? Univariate analysis showed a significant association between, blood transfusion, stone size, number of access tracts, operative time. ? Multivariate analysis showed stone size, number of access tracts, operative time, and stone culture as statistically significant in predicting the occurrence of SIRS postoperatively. In this study, no statistically significant association was found between gender, diabetes mellitus, bladder urine culture, and stone culture and pelvic urine culture raised serum creatinine in developing SIRS postoperatively.

151 # 14 Financial support and sponsorship

152 # 15 Nil.

153 # 16 Conflicts of interest

There are no conflicts of interest. [1]

1

	Age (years)	Serum creatinine (mg/ml)	Stone size (cm)	Operative time (min)	Number of tracts
Mean	42.18	1.196	2.893	70.32	1.10
Minimum	18	0.6	2.2	40	1
Maximum	65	3.4	5.1	125	2

Figure 1: Table 1 :

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Sex	No SIRS	SIRS	Total
Male	121	27	148
Female	78	24	102
Total	91	29	250

SIRS: Systemic inflammatory response syndrome

Figure 2: Table 2 :

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Parameter	P	Statistical significance
Gender	0.829	Not significant
Diabetes mellitus	0.062	Not significant
BloodurineC/S	0.200	Not significant
Bloodtransfusion	0.009	significant
Number ofaccesstracts	0.001	significant
Pelvicurineculture	0.3	Not significant
Stoneculture	0.4	Not significant
Serumcreatinine	0.340	Not significant
Stone size	0.004	significant
Pre op pyelocaliectasis	0.005	significant
Operative time	0.829	significant

SIRS: Systemic inflammatory response syndrome, C/S: Culture and sensitivity

Figure 3: Table 3 :

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	B	SE	Wald	df	Significant	Exp (B)	95.0% CI for Exp (B)	
							Lower	Upper
Diabetes mellitus	0.481	0.598	0.647	1	0.421	1.618	0.501	5.229
Bladder urine C/S	0.364	0.531	0.469	1	0.493	1.439	0.508	4.077
Blood transfusion	1.368	0.764	3.202	1	0.074	3.927	0.878	17.564
Pelvic urine C/S	?0.086	0.561	0.024	1	0.878	0.917	0.305	2.756
Stone C/S	?0.958	0.658	2.120	1	0.345	0.384	0.106	1.393
Serum creatinine	0.385	0.756	0.259	1	0.611	1.470	0.334	6.471
Age distribution	0.842	0.604	1.944	1	0.163	2.321	0.711	7.582
Stone size	1.498	0.509	8.672	1	0.003	4.473	1.650	12.124
Operative time	1.268	0.542	5.475	1	0.019	3.552	1.228	10.271
Number of tracts	3.238	0.650	24.828	1	0.000	0.039	1.332	11.112

[Note: SE: Standard error, C/S: Culture and sensitivity, CI: Confidence interval IV.]

Figure 4: Table 4 :

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