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Original Research Article

An observational study of predictive factors for fever and sepsis following percutaneous nephrolithotomy

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ABSTRACT

Background: Although percutaneous nephrolithotomy is considered a safe procedure, it is not without complications. Certain preoperative and intraoperative factors if not identified and adequately treated in time can lead to complications ranging from post operative fever to urosepsis which may seldom lead to mortality. The aim of our study is to identify those factors so as to prevent complications and promote patient safety.
Methods: Retrospective analysis of medical records of the patients undergoing PCNL from January 2020 to January 2023 was done. A total of 235 patients were included in the study and associated factors analyzed statistically. Statistical analysis was performed by Chi-square test.
Results: We found five factors which significantly correlated with postoperative sepsis, namely, stone size >30 mm, staghorn calculus, prolonged operative time >120 min, significant bleeding requiring transfusion and pre operative urine culture positive.
Conclusions: Sepsis following PCNL is not uncommon. Progression to urosepsis maybe life threatening. Decreasing operative time decreases bleeding and related complications as well. Prophylactic antibiotics is recommended in PCNL procedure owing to its clean contaminated/contaminated surgical procedure.

Keywords: Fever, Percutaneous nephrolithotomy, Sepsis, Complications, Stone

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is one of the treatments for large renal stones and is the treatment of choice for stones more than 2 cm and staghorn calculus.[1] Stone free rates for PCNL range from 80-85% with fewer complications.[2] However, it can infrequently lead to post operative fever and urosepsis. Although post operative fever may occur without much clinical significance, but its progression to urosepsis carries a high mortality rate. Of the common complications following PCNL, major complications are noted in 1.1-7% of the patients and minor complications in 11-25% of the patients.[3] Urosepsis may progress to multiorgan dysfunction syndrome and even mortality. Hence prediction of factors for sepsis is important to prevent such deadly complications which is the objective of our study. This would guide us in identification of at-risk patients and better management both intra operatively and post operatively. Our analysis of 235 patients over a period of 2 years throws light on few of such factors which

contribute to sepsis in patients who undergo Percutaneous Nephrolithotomy.

METHODS

It was a Retrospective Study which was conducted after Institutional Ethics Committee approval. Analysis was based on data collected retrospectively over a period of 3 years from January 2020 to January 2023 at Lokmanya Tilak Municipal Medical College and General Hospital, Mumbai and all patients who underwent PCNL during this time period were included in the study. The number of patients was affected due to COVID-19 pandemic during 2020-21. The following exclusion criteria were used: Pyonephrosis, Untreated urinary tract infection, Concomitant upper tract/lower tract malignancy and Ureteric strictures. Patients were assessed based on the following factors: age, sex, co-morbidities, pre-operative creatinine, pre-operative urine culture and need for antibiotics pre-operatively, stone size, operative time, number of punctures, tract dilatation, need for blood transfusion, post-operative heart rate, respiratory rate, leucocyte count, temperature and need to keep percutaneous nephrostomy tube open post-operatively, if inserted.

Documentation of stone size was based on CT urography or CT KUB (plain) and average diameter of stone was taken if multiple stones were present. Staghorn calculus if present was also documented separately as calculus occupying pelvis and two or more calyces. All positive urine cultures were treated pre-operatively with antibiotics according to sensitivity. Prophylactic pre-operative antibiotics were given for all patients based on culture reports and if negative preferred antibiotic given was Injection Ceftriaxone. PCNL was done in prone position or supine position. Based on the stone size and pelvicalyceal system dilatation conventional (22Fr-26Fr) or mini PCNL (16Fr) was done. Before patient positioning, ureteric catheter was kept and foleys catheter inserted. After Retrograde pyelography, puncture was taken with 18G initial puncture needle. Based on the type of PCNL planned, tract was dilated over glidewire with Alkens metal dilator or single step dilator followed by insertion of Amplatz sheath (22Fr-26Fr) for conventional PCNL or mini PCNL sheath (16Fr) respectively. Time of procedure was noted from puncture of tract till removal of sheath. For conventional PCNL a 22Fr rigid nephroscope was used and for mini PCNL a 15Fr rigid mini perc scope was used.

Post-operatively patients were given antibiotics and if course was uneventful percutaneous nephrostomy was removed the next day followed by foleys removal the following day and discharge of patient. Post-operatively sepsis was assessed by the following parameters: Body temperature <36°C or >38°C, HR >90 beats/min, RR >20 breaths/min or PaCO2 <32 mmHg and White blood cell >12,000/dl <4,000/dl. Sepsis was diagnosed if two or more of the above factors were present. Severe sepsis was termed in case of systolic blood pressure (BP) <90 mmHg OR systolic BP drop >40 mmHg. Statistical analysis was done with Chi-square test, and $p<0.05$ was considered statistically significant.

RESULTS

This study included a total of 235 patients which included 158 (67.23%) males and 77 (32.77%) females. The age of patients ranged from 5 to 83 years (mean=40.77 years). Among these, 37 (15.74%) patients were diabetic. Totally, 19 (8.08%) patients had a stone size more than 30 mm, and 26 (11.06%) patients had a staghorn stone. Forty-one (17.44%) patients had a positive urine culture preoperatively. Eighteen (7.6%) patients had creatinine more than 2mg/dl. The (Table 1) demonstrates significant pre-operative findings.

Table 1: Comparison of pre operative factors.

Pre-operative factors	N (%)
Total patients	235 (100)
Age (mean; range)	40.77; 5-83
Sex	
Male	158 (67.23)
Female	77 (32.77)
Comorbidity (diabetes)	37 (15.74)
Stone size >3cm	19 (8.08)
Staghorn Calculus	26 (11.06)
Urine culture positive	41 (17.44)
Creatinine	18 (7.6)

Table 2: Comparison of post operative factors.

Post-operative factors	N (%)
Operative time >120 mins	6 (2.5)
Multiple tracts	24 (10.21)
Dilatation >24 Fr	3 (1.2)
Bleeding	5 (2.12)

The operative time taken was from 30 to 150 min (mean=90 min). In 6 (2.5%) patients, an operative time of more than 120 min was taken. Multiple access tracts were used in 24 (10.21%) patients. Blood transfusion was required in 5 (2.12%) patients. Three (1.2%) patients had tract dilatation more than 24Fr. The (Table 2) demonstrates these intra-operative findings. We found the following factors to be significantly correlated with postoperative sepsis after statistical analysis using Chi-square test: stone size >30 mm, staghorn calculus, prolonged operative time >120 min, significant bleeding requiring transfusion and pre-operative urine culture positive. All patients with sepsis had percutaneous nephrostomy tube opened post operatively. Severe sepsis was noted in 1 patient which responded to supportive management. No mortality was noted. The comparison of factors associated with sepsis between all patients and those with sepsis and depicted in (Table 3, Figure 1).

Table 3: Comparison of Factors predisposing to sepsis.

Parameters	All patients	Sepsis	P value
Total patients	235	31	0.569
Sex			
Male	158	15	-
Female	77	16	
Diabetics	37	6	0.711
Stone >3cm	19	8	0.0004
Staghorn calculus	26	10	0.001
Pre-op urine culture positive	41	11	0.009
Operative time >120 mins	6	3	0.007
Multiple punctures	24	5	0.244
Bleeding	5	3	0.017
Pre-op creatinine >2	18	5	0.057
Dilatation >24Fr	3	1	0.301

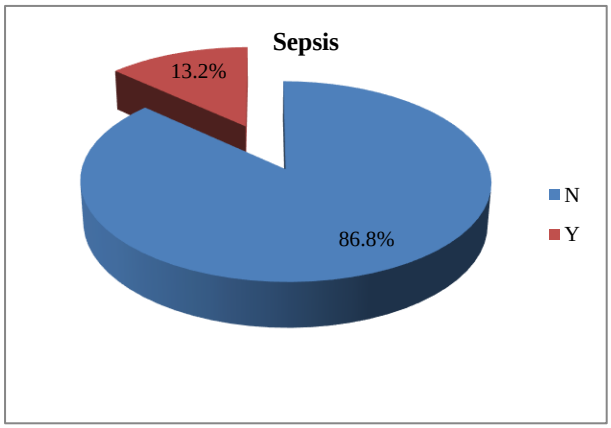

Figure 1: Depiction of sepsis in our study group.

DISCUSSION

PCNL is a widely used procedure for surgical management of renal calculi. However, it is not without complications. Caution towards certain pre operative and intra operative factors has to be put to make it a safe procedure for the patient. Urosepsis is one of the dreaded complications of PCNL. It occurs due to trauma to the kidney, cytokines and ischaemia-reperfusion injury. Factors contributing to sepsis have been evaluated in a study of 580 patients by Bansal et al[(4)]. They found stone size >2.5 cm, prolonged operative time >120 mins and significant bleeding requiring transfusion as contributing factors for severe sepsis with incidence of 8%. In our study, we found a stone size of >3 cm and staghorn calculus to be significantly associated with sepsis. Large stones increase operative time and manipulation which leads to increased trauma to kidney and release of inflammatory mediators. In our study 31 patients had postoperative sepsis out of 235 patients accounting for an incidence of 13.2% as shown in (Figure 2).

Among 425 cases of PCNL performed, 16 (3.76%) developed sepsis postoperatively in a study by Khai et al.[5] Patients with positive preoperative urine cultures were almost four times as likely to develop post-PCNL sepsis compared to those with negative cultures (8.41% vs. 2.2%). Among patients with positive urine leukocytes and positive urine cultures, the presence of Staghorn calculi and multiple PCNL punctures both predicted significantly higher risks of postoperative sepsis. In our study, we found pre operative cultures positive to be significantly associated with sepsis. Patients who have positive preoperative cultures, and either harbor staghorn calculi or are deemed to require more than one puncture on PCNL, were at an increased risk of developing post-PCNL sepsis. Similarly, Gonzalez-Ramirez et al in a study of 280 patients found the incidence of severe sepsis to be 2.14%.[6] Bleeding, staghorn calculus, body mass index <18.5 and prolonged surgical time were associated with fever. Significant Intraoperative bleeding can lead to transfusions, hampers vision, and leads to prolonged operative time which increases chances of sepsis.

Prolonged operative time is one of the factors studied by Wang et al and in their study they found 90 min to be the upper limit of safety in 303 patients.[7] However, in our study, we found 120 mins as the upper limit of normal starting from turning the patient prone. A case control study by Gravas and coworkers concluded that, in patients with negative preoperative culture results, antibiotic prophylaxis led to decreased rates of fever and other postoperative complications.[8]

At present, there is still controversy about the association between diabetes and post-PCNL infection. Some studies believed that there was a connection between them, but some researchers noted that the connection was not obvious.[9] We found diabetes not to be significantly associated with sepsis. Falahatkar et al concluded that multiple punctures during PCNL were also predictive factors for complications.[10] However, in our study we did not find multiple punctures to be significantly associated with sepsis. This study was affected due to the COVID pandemic which resulted in decreased number of study subjects and the data being affected due to retrospective analysis.

CONCLUSION

Sepsis following PCNL is not uncommon. Progression to urosepsis maybe life threatening. Factors such as pre operative urine culture, stone size and type, and intraoperative time have to be kept in mind before and during the procedure. Decreasing operative time decreases bleeding and related complications as well. In general, patients who underwent PCNL at our centre had a high incidence of staghorn calculi, preoperative ureteric stent placement and positive findings in preoperative voided urine samples. Prophylactic antibiotics is recommended in PCNL procedure owing to its clean contaminated/contaminated surgical procedure.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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