

A Comprehensive Case Study on the Clinical Profiles and Management of Renal and Perirenal Infections

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Abstract

Background: Kidney infections, or pyelonephritis, are often caused by bacteria from the urinary tract and primarily affect females and pregnant individuals. Advances in imaging and treatment have improved diagnosis and reduced complications, yet managing upper urinary tract infections remains challenging.

Aim: This study investigates the incidence of renal and perirenal infections and evaluates medical and surgical strategies to reduce morbidity and mortality.

Methodology: A retrospective, observational study was conducted at Department of General Surgery, Jannayak Karpoori Thakur Medical College and Hospital, Bihar, India, involving 70 patients with suspected infections. Patients with terminal illnesses or chronic kidney diseases were excluded. Data was collected through clinical assessments, laboratory tests, and imaging, with analyses performed using SPSS.

Results: Most patients were males aged 20 to 60, with urinary tract infections as the leading risk factor. Fever was common, and perirenal abscesses were found in 47.14% of cases. E. coli was the most frequently identified pathogen (40%). DJ stenting was the most common treatment (25.71%), followed by PCNL and open drainage. A notable link was observed between diabetes mellitus and perirenal abscesses.

Conclusion: The study highlights key demographics and risk factors for renal infections, emphasizing the importance of targeted management strategies. Findings suggest that specific antibiotics should be used against prevalent pathogens like E. coli to improve patient outcomes.

Keywords: Kidney infections, pyelonephritis, perirenal abscess and urinary tract infection,

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Introduction

Renal infection, also known as kidney infection or pyelonephritis, occurs when bacteria ascend through the urethra from the urinary tract and affect one or both kidneys. These bacteria typically originate from other areas within the urinary system, such as the bladder, ureters, or urethra. Kidney infections are most frequently seen in individuals with pre-existing bladder infections, as well as in females and pregnant patients [1]. Upper urinary tract infections (UTIs) are classified as pyelonephritis, which involves the renal parenchyma, or pyelitis, which is characterized by the absence of parenchymal involvement on imaging studies. Imaging techniques are the most reliable method for detecting renal scarring. Acute pyelonephritis manifests with clinical symptoms including renal tenderness, flank pain, fever with rigors, and is

typically associated with bacteriuria and pyuria. The condition usually results either from bacteremia seeding the kidneys or from ascending infections due to fecal contamination. Gram-negative organisms, particularly Enterobacteriaceae, are the most common pathogens, with Escherichia coli being the most frequently isolated bacterium [2].

Perirenal and Renal abscesses are uncommon conditions that arise from infections within or adjacent to the kidneys. Historically, these conditions were linked to considerable morbidity and mortality, partly attributable to their ambiguous symptoms and the inadequacy of low-quality imaging systems for detection [3]. The increased accessibility of magnetic resonance imaging (MRI) and computed tomography (CT), along with improvements in the quality of renal ultrasound

examinations, have significantly enhanced the early detection of renal and perirenal abscesses. Furthermore, the development of novel antibiotics and advances in percutaneous drainage techniques have contributed to a reduction in the morbidity and mortality rates associated with surgical interventions [4].

Renal ultrasonography examinations have improved in quality because of increased accessibility to magnetic resonance imaging and computed tomography in recent decades. Advancements in imaging techniques have enabled earlier identification of perirenal and renal abscesses. Furthermore, the adverse health effects and fatality rates linked to surgery have dramatically declined as a result of the discovery of novel antibiotics and improvements in percutaneous draining techniques [5].

The treatment of upper urinary tract infections remains contentious, likely due to variations in the incidence of severe parenchymal lesions across different studies. Consensus has been achieved regarding the potential risks associated with kidney abscesses, which necessitate hospitalization and prolonged antibiotic therapy. The seriousness of the illness is contingent upon the degree of contamination and the patient's comorbidities. [6] Key predictors of unfavorable prognosis and extended hospital duration encompass abscess size, diabetes mellitus, renal insufficiency, lethargy, and advanced age. Surgery is justified in cases of anatomic abnormalities and when the abscess exceeds the size suitable for effective percutaneous catheter drainage and antibiotic therapy.

Surgery is indicated in cases of structural anomalies and when the abscess exceeds a size that precludes effective drainage via catheter or treatment with antibiotics alone. The selection of therapy must be informed by the causative organism and should incorporate antibiotics effective against gram-negative pathogens and *Staphylococcus aureus*. Parenteral administration is advised for initial antimicrobial therapy. The duration of fever may last for four to five days with applicable antibiotic treatment. Parenteral treatment should continue until the final weaknesses are available. Oral antibiotics may be administered 48 hours following the resolution of fever symptoms to adjust the treatment regimen. Immediate imaging testing is warranted for these individuals, in addition to referrals to a nephrologist and an infectious illness specialist for additional treatment. Postponing analysis or dealing may lead to considerable mortality and morbidity rates [7].

The current study aimed to examine the prevalence and frequency of perirenal and renal infections, as well as to identify systematic procedures, both

surgical and medical, to reduce mortality and morbidity.

Methodology

Study Design

This prospective observational study conducted over 12 months. A total of 70 individuals with clinically suspected patients with renal and perirenal infection were involved.

Study Area

The retrospective, observational study was conducted in the Department of General Surgery at Jannayak Karpoori Thakur Medical college and Hospital, Madhepura, Bihar, India.

Inclusion and Exclusive Criteria

The inclusion criteria are set to focus on individuals experiencing signs and symptoms of UTI that coincide with infections in the kidney (renal infections) or the surrounding tissues (perirenal infections). However, certain patients were excluded from the study to ensure a more targeted analysis. Terminally ill patients, except those suffering from urosepsis, were excluded, along with individuals diagnosed with malignancy or polytrauma. Additionally, patients with medical renal diseases such as chronic kidney disease (CKD) or nephritis were not considered in the study. This approach allowed for a detailed exploration of the treatment outcomes and clinical progression specific to renal and perirenal infections without interference from complicating factors such as advanced systemic illnesses or unrelated kidney conditions.

Data Collection and Procedure

Data was collected through detailed patient histories and comprehensive clinical examinations. Routine laboratory investigations (CBC, BSL, LFT, RFT, urine and pus culture sensitivity) and radiological assessments (CT, CECT, local USG, abdomen and pelvis ultrasound, chest x-ray) were performed. When showed, patients underwent either open surgical or laparoscopic procedures, with the latter being utilized based on the availability of infrastructure. Patients were closely monitored for both immediate and delayed postoperative complications. The collected data, including demographic details, pre-existing conditions, symptom onset, clinical findings, laboratory and radiological results, and abscess characteristics, were analyzed with respect to the study's aims and objectives. The microorganisms responsible for the infections, their antibiotic susceptibility, and the clinical outcomes were also documented. In cases where both renal and perirenal abscesses were present, they were referred to as mixed abscesses.

Data analysis

The statistical analysis was performed by SPSS software, specifically version 27. The t-test was employed to compare the mean values of data conforming to a parametric distribution. The Chi-square test was employed to analyse categorical data. A p-value below 0.05 indicates statistical significance of the result.

Result

Table 1 shows the distribution of patients categorized by age, gender, side, and predisposing factors. The largest proportion of patients (57.14%)

falls within the age range of 20 to 60 years, followed by those aged over 60 years (35.71%), and a smaller segment under 20 years (7.14%). Regarding gender distribution, 57.14% of the population is male, whereas 42.86% is female. The left side is predominantly affected, accounting for 54.28%, followed by the right side at 37.14%. Only 8.57% of cases involve both sides. The primary predisposing factor is urinary tract infection (31.43%), succeeded by renal calculi (20.00%), immunocompromised status (15.71%), diabetes mellitus (12.86%), ureteric calculi (8.57%), prior operative procedures (4.29%), and additional factors (7.14%).

Table 1: Age, gender, Side, and Predisposing factor-wise distribution

Category	Frequency	Percentage
Age in years		
>60	25	35.71%
20 to 60	40	57.14%
<20	5	7.14%
Gender		
Female	30	42.86%
Male	40	57.14%
Side		
Both	5	8.57%
Left	38	54.28%
Right	26	37.14%
Predisposing Variables		
Previous Operative Procedure	3	4.29%
Ureteric Calculi	6	8.57%
Diabetes Mellitus	9	12.86%
Other	5	7.14%
Renal Calculi	14	20.00%
Urinary Tract Infection	22	31.43%
Immunocompromised	11	15.71%

Table 2 presents clinical findings, diagnoses, and management strategies pertinent to a specific patient population. Fever emerged as the most prevalent symptom among clinical findings, occurring in 37.14% of cases, while the combination of fever and a palpable abdominal lump was noted in 34.28% of instances. Costovertebral tenderness was observed in 12.85% of patients. The diagnosis with the highest frequency was perirenal abscess, affecting 47.14%

of patients, whereas renal abscesses constituted 37.14%. Management techniques exhibited variability, with DJ stenting as the predominant method at 25.71%, succeeded by PCNL at 18.57% and percutaneous pigtail drainage at 17.14%. Additional management strategies comprised open surgical drainage (14.28%) and percutaneous nephrostomy (10%).

Table 2: Clinical findings, Diagnosis, and Management-wise distribution

Category	Finding	Frequency	Percentage
Clinical findings	Fever, costovertebral tenderness	9	12.85
	Costovertebral tenderness	9	12.85
	Fever	26	37.14
	Fever, Abdominal lump palpable	24	34.28
	Abdominal lump palpable	2	2.85
Diagnosis	Xanthomata's Pyelonephritis	5	7.14
	RENAL TB	2	2.85
	Renal Abscess	26	37.14
	Perirenal abscess	33	47.14

Management	Emphysematous pyelonephritis	4	5.71
	Percutaneous pigtail	12	17.14
	Cystourethroscopy with DJ stenting	5	7.14
	PCNL	13	18.57
	Partial Nephrectomy	1	1.42
	Open surgical Drainage	10	14.28
	Percutaneous Nephrostomy	7	10
	DJ stenting	18	25.71
	Cystourethroscopy	4	5.71

The table 3 describe the identification of different microorganisms, including their frequency and percentage of occurrence. *Escherichia coli* is the most commonly identified organism, occurring 28 times, representing 40% of the total. *Staphylococcus aureus* is observed with a frequency of 18 (25.71%), while *Klebsiella* is identified 10 times (14.29%).

Staphylococcus agalactiae and *Mycobacterium tuberculosis* each exhibited a frequency of 5, accounting for 7.14% of the total. Finally, *Proteus mirabilis* and *Staphylococcus saprophyticus* were the least frequently identified, each occurring twice (2.86%).

Table 3: Identification of Microorganisms

Organism	Frequency	Percentage
<i>Proteus mirabilis</i>	2	2.86
<i>Klebsiella</i>	10	14.29
<i>Staph Aureus</i>	18	25.71
<i>E. coli</i>	28	40
<i>Staph Agalactiae</i>	5	7.14
<i>Mycobacterium tuberculosis</i>	5	7.14
<i>Staph Saprophyticus</i>	2	2.86

Table 4 shows the correlation among various predisposing factors and distinct types of renal conditions. Diabetes Mellitus is a significant factor, linked to 10 cases of perirenal abscess, 3 cases of emphysematous pyelonephritis, 5 cases of renal abscess, and 3 cases of xanthomatous pyelonephritis. Renal calculi demonstrate a significant correlation, evidenced by 6 cases of perirenal abscess and 6 cases of renal abscess. Ureteric calculi were associated with five instances of perirenal abscess and four instances of renal

abscess, whereas immunocompromised patients were linked to four cases of renal tuberculosis. Additional factors, such as prior operational protocols and urinary tract infections, exhibited differing effects, with urinary tract infections significantly linked to seven instances of renal abscess. The total number of cases for each diagnosis reveals that perirenal abscess (28 cases) and renal abscess (25 cases) are the most prevalent, whereas xanthomata's pyelonephritis (8 cases) is the least common.

Table 4: Correlation between final diagnosis and predisposing factors

Predisposing Factor	Perirenal abscess	Emphysematous pyelonephritis	RENAL TB	Renal Abscess	Xanthomata's Pyelonephritis
Ureteric Calculi	5	0	0	4	0
Immunocompromised	2	0	4	0	0
OTHER	1	0	0	1	0
Renal Calculi	6	2	0	6	5
Previous Operational Protocol	2	0	0	2	0
Urinary Tract Infection	2	0	0	7	0
Diabetes Mellitus	10	3	0	5	3
Total	28	5	4	25	8

Discussion

In this study the age distribution, the majority of patients (57.14%) were between the ages of 20 to 60 years, followed by those over 60 years (35.71%), and a small percentage (7.14%) were under 20 years. Gender distribution revealed a slight male predominance, with 57.14% of the patients being male and 42.86% female. In terms of laterality, the left side was affected in the majority of cases (54.28%), followed by the right side (37.14%), and a minority had bilateral involvement (8.57%). Regarding predisposing factors, urinary tract infection was the most common, affecting 31.43% of patients, followed by renal calculi (20%) and diabetes mellitus (12.86%). Coelho et al. [8] indicated that the mean age of patients in their study conducted in Brazil was 41.1 years. Piccoli et al. [9] observed that 12.6 percent had involvement on both sides. Kolla PK et al. [10] found that 50% of patients exhibited bilateral EPN accompanied by hydronephrosis and urinary obstruction.

In the present study, the clinical findings revealed that fever was the most common symptom, reported by 37.14% of patients, while 34.28% exhibited both fever and palpable abdominal masses. Costovertebral tenderness was observed in 12.85% of patients, suggesting a notable occurrence of renal involvement. Liu et al. [11] reported that 76.5% experienced lumbar pain, 53.1% had fever, and 11.2% suffered from abdominal pain. According to Engelskjerd et al. [12], the most frequently observed symptoms included decreased urine output (44%), facial and lower limb swelling (45%), and vomiting (34%). Piccoli, G.B et al. [9] found that 6.7% had no fever, 17.8% had no pain, and 52.9% exhibited lower urinary tract symptoms. Additionally, Coelho et al. [8] identified fever as the most prevalent presentation. Regarding diagnosis, perirenal abscesses were the most commonly identified condition, accounting for 47.14% of cases, followed by renal abscesses at 37.14%. Similarly, Piccoli et al. [9] noted that 79.8% of patients had numerous abscesses. Management strategies differed, with DJ stenting being the most frequent intervention (25.71%), followed by percutaneous nephrolithotomy (PCNL) at 18.57% and open surgical drainage at 14.28%. Liu et al. [11] indicated that intravenous antibiotic treatment was essential, while interventions, involving both non-surgical and surgical methods, were set aside for patients who did not react to the first round of treatment, bigger abscesses, numerous abscesses, and PNAs.

The identification of microorganisms revealed that *E. coli* was the most prevalent pathogen, isolated in 40% of cases, followed by *Staph aureus* (25.71%) and *Klebsiella* (14.29%). Research by Liu et al. [11] found that *E. coli* was present in 51.4% of cases, with 10% having *Staph aureus* and 8.6% with *Klebsiella pneumoniae*, among others. Another

research by Mathew et al. [13] indicated that 22% of patients had leptospira illness. This underscores the bacterial spectrum linked to the conditions being treated. Ultimately, the correlation between predisposing factors and final diagnoses demonstrated that diabetes mellitus was particularly associated with perirenal abscesses (10 cases), marking it as a significant risk factor. Additionally, ureteric and renal calculi showed connections to diagnoses of renal abscess and perirenal abscess, highlighting the relationship between underlying conditions and renal complications. A study by Deo et al. [14] indicated that patients arriving at the emergency department (ED) with multiple comorbidities and risk considerations, such as Diabetes mellitus, HIV, sepsis, and hypertension, may be diagnosed with renal impairment. Therefore, it is recommended that ED practitioners maintain a low threshold for screening these patients for renal impairment.

Conclusion

In conclusion, this comprehensive case study highlights the significant clinical profiles and management strategies for renal and perirenal infections, with particular emphasis on patient demographics, common clinical findings, and prevalent microbial agents. Many patients affected were within the age range of 20 to 60 years, with a higher prevalence in males. Notably, urinary tract infections and renal calculi were identified as major predisposing factors. Clinical presentations frequently included fever and costovertebral tenderness, leading to diagnoses primarily of perirenal abscesses and renal abscesses. Management strategies varied, with a predominant use of DJ stenting and percutaneous nephrostomy. The study also revealed *E. coli* as the most commonly identified microorganism, underscoring the need for targeted therapeutic approaches in managing these infections. Overall, this study provides valuable insights into the clinical characteristics and effective management strategies for renal and perirenal infections, informing future clinical practice and research.

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