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A Case Report on Perinephric Abscess Caused by Extended-Spectrum Beta-Lactamase-Producing *Klebsiella pneumoniae*

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Abstract

Perinephric abscess is a rare life-threatening condition. It can complicate a urologic infection or occur secondary to hematogenous seeding. We report a case of a 49-year-old diabetic female who came to the outpatient department with complaints of right-sided abdominal pain for 2 days. It was associated with fever, headache, vomiting, and generalized weakness. Non-contrast computerized Tomography (NCCT) showed a subcapsular collection measuring 6.1× 5.7 × 4.4 cm noted adjacent to the lateral aspect of the right kidney. Following percutaneous nephrostomy, thick pus was drained from the abscess and sent for culture and sensitivity in the microbiology laboratory. Culture grew extended-spectrum beta-lactamase-producing (ESBL) *Klebsiella pneumoniae* which was sensitive to Carbapenems, Piperacillin Tazobactam, Fluoroquinolones, Netilmicin, Amikacin, and Tetracycline. The patient improved on treatment with the appropriate antibiotics. Perinephric abscesses should be considered as a differential diagnosis of fever with abdominal pain or flank pain since its non-specific nature can delay the diagnosis. Underlying diabetes mellitus (DM), urinary tract abnormalities, and immunodeficiency should be considered in a patient with a perinephric abscess. Ultrasonography (USG) and Computerized Tomography with contrast enhancement are crucial for diagnosis. The drainage of the abscess, either percutaneous or open, should be done. *Klebsiella pneumoniae* is a frequent cause of perinephric abscesses and mostly follows a complicated urinary tract infection. With high mortality rates, early diagnosis, and effective treatment of perirenal abscesses are required to improve the prognosis of patients.

Keywords: USG- Ultrasonography, NCCT- Non-Contrast Computerized Tomography, DM- Diabetes mellitus, CT- Computerized Tomography, ESBL – Extended-spectrum beta-lactamases, UTI – Urinary tract infection, Perinephric abscess.

INTRODUCTION

Perinephric abscess is a rare life-threatening, pus collection between the renal capsule and Gerota's fascia, due to a bacterial infection in the perirenal fat, resulting in necrosis. It is usually a complication of a urologic infection. It can occur through the hematogenous spread of infection from a focus outside the kidney or the local spread of a related urologic infection (Okafor C. N *et al*., 2023). It is a condition with non-specific signs and symptoms such as fever, chills, and flank pain, whereas pyuria, the elevation of leukocyte count, glucose, blood urea nitrogen, and creatinine were the common laboratory feature (Okafor C. N *et al*., 2023). The most common predisposing factors associated with it were diabetes mellitus (58%), urolithiasis (25%), and immunosuppression (17%).

Early diagnosis may help in the initiation of early treatment and that will lead to a good clinical outcome. A delay in perinephric abscess diagnosis may lead to higher morbidity and mortality, which has been reduced to 12% since the accessibility of computed tomography (CT) scan and magnetic resonance imaging (MRI) scan (Dubey *et al*., 2013). In fact, the simply invasive treatment appeared in the early 1970s, and the trend toward conservative treatment is frequent due to the progress in imaging techniques and new antibiotics (Raharja *et al*., 2018). Perinephric abscesses are usually due to gram-negative enteric bacilli or a polymicrobial infection (Hao *et al*., 2014). *Escherichia coli* and *Klebsiella pneumoniae* are the most frequently encountered organisms. *Escherichia coli* accounts for 51.4% of perinephric abscesses (Mohan *et al*., 2020). Perinephric abscesses due to *Staphylococcus aureus* are

usually secondary to hematogenous seeding of infection (Rubilotta *et al*., 2014). Here we describe an unusual case of a perinephric abscess due to extended-spectrum beta-lactamase-producing *Klebsiella pneumoniae.*

MATERIALS AND METHOD

A 49-year-old female came to the outpatient department with progressively worsening fever, headache, right-sided abdominal pain, nausea, and vomiting for two days. She has diabetes mellitus, hypertension, and chronic renal disease. A non-contrast computerized tomography was performed which showed a right renal subcapsular collection measuring 6.1 x 5.7 x 4.4 cm adjacent to the lateral aspect of the right kidney with medial compression of parenchyma, suggestive of a perinephric abscess. She had low hemoglobin (7.7 mg/dL) and elevated creatinine (3.4 mg/dL). The other routine blood investigations were within normal limits. The following day she underwent ultrasonography-guided percutaneous nephrostomy. Thick pus was drained from the abscess and sent for microbiological culture and sensitivity.

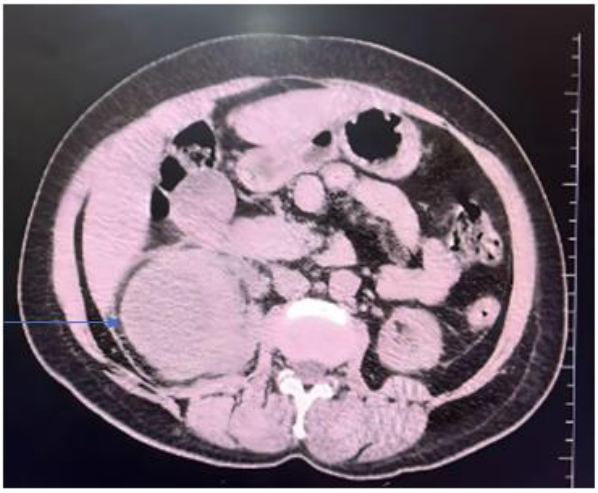

Fig 1: NCCT Image of right kidney showing the perinephric abscess

The direct Gram stain of the pus sample showed plenty of pus cells and a few short, plump, straight Gram-negative bacilli. The specimen was cultured on blood agar, MacConkey agar, and Thioglycollate broth. After overnight incubation, blood agar showed heavy growth of non-hemolytic greyish moist mucoid colonies and MacConkey agar grew pink mucoid lactose fermenting colonies. The biochemical identification revealed the organism as *Klebsiella pneumoniae.*

Antibiotic susceptibility testing using the Kirby Bauers disk diffusion method was performed and the organism was susceptible to Carbapenems, Piperacillin Tazobactam, Fluoroquinolones, Netilmicin, Amikacin, and Tetracycline. It was resistant to cephalosporins, aztreonam, and trimethoprim-sulfamethoxazole.

Cefotaxime and ceftazidime are indicators of cephalosporins for screening potential extended-spectrum beta-lactamase producers and the isolate was found to be resistant to both. Confirmation for ESBL production was done using a combination disk test (CDT) as per the Clinical and Laboratory Standards Institute's (CLSI) recommendation with ceftazidime (30 µg) and cefotaxime (30 µg) disks with and without clavulanic acid.

Fig 2.1: Growth on Blood agar

Fig 2.2: Growth MacConkey agar of pus specimen

RESULTS AND DISCUSSION

Renal and perinephric suppurations (or abscesses) commonly share similar clinical manifestations, but their pathophysiology, complications, and treatment are not identical. A

perinephric abscess usually forms as a sequela of pyelonephritis that causes disruption of the renal parenchyma and hematological seeding from a primary infected site outside the kidney, which is most associated with *Staphylococcus aureus*. Moreover, in case of high pressure on the urinary tract due to conditions such as bladder outlet obstruction, voiding dysfunctions, and urinary stones, the occurrence of a urinary tract infection (UTI) can lead to the extension of the infection beyond the renal capsule and hence cause a perinephric abscess (Park *et al*., 2021).

Currently, the Klebsiella pneumoniae is a frequent cause of renal or perirenal abscess (25% of the cases) in Asian areas and it is associated with major complications, such as bacteremia, emphysematous pyelonephritis, and metastatic septic infection (Chen *et al*., 2010). *Klebsiella pneumoniae*, a member of the Enterobacteriales family, is a virulent Gram-negative organism that has a higher tendency to infect immunocompromised patients including those with diabetes. Commonly attributed infections to *Klebsiella pneumoniae* include urinary tract infections (UTIs) and cases of pneumonia (Tiffany Lee *et al*., 2020). Rarely, the incidence of abscess formation secondary to *Klebsiella pneumonia* infection has been reported in organs like the liver, lungs, kidney, and brain.

Perinephric abscess poses a great diagnostic challenge, considering its non-specific clinical presentation (Lee *et al*., 2008). It should be considered in any patient with fever and flank pain. However, only 52% of patients with perinephric abscesses are accompanied by fever (Lee *et al*., 2008). In our case, the patient complained of worsening fever, headache, right-sided flank pain, nausea, and vomiting. She had no urinary symptoms during the presentation. The microbiological culture result revealed that ESBL *Klebsiella pneumoniae* was growing.

Intravenous antimicrobial therapy may be a good alternative treatment if therapeutic drainage is believed to have considerable risk (Hyun M *et al*., 2019). Large abscesses, obstructive uropathy, severe vesicoureteral reflux, diabetes, old age, and urosepsis with gas-forming organisms are the factors associated with antimicrobial treatment failure (Ko W *et al*., 2002). Percutaneous nephrostomy should be considered when there is a large abscess or obstructive uropathy, and no clinical improvement occurs after 48 to 72 hours of appropriate antibiotic therapy (Takebayashi K *et al*., 2005). Incision and drainage are preferred when open drainage is required. Nephrectomy is reserved for patients whose renal parenchyma is diffusely damaged and for elderly patients whose survival depends upon urgent surgical intervention (Nadasy KA *et al*., 2007).

In our case, the patient underwent non-contrast computerized tomography was also performed and showed subcapsular collection measuring 6.1x5.7x4.4cm adjacent to the lateral aspect of the right kidney suggestive of a perinephric abscess. The patient underwent percutaneous nephrostomy and thick pus was drained from the abscess. She was treated with intravenous Ciprofloxacin for 5 days as an inpatient and discharged after became stable with the advice of oral Ciprofloxacin 500mg for 5 days.

We suggest due to the emerging increase of ESBL and MDR strains the selection of antimicrobial therapy ideally should be based on culture findings, however, there is an inevitable delay in obtaining results. We recommend that empirical broad-spectrum intravenous antibiotics should be initiated for critically ill patients after admission. Once the blood or abscess fluid cultures and bacterial isolation tests are confirmed, targeted antibiotic regimens should be prescribed accordingly.

In the present study, interventional approaches helped to detect the cause of disease and confirm the diagnosis, and culture of pus/aspirates helped guide selection of an antibiotic regimen. The diagnostic and therapeutic value of percutaneous drainage has been confirmed since early years. The application of interventional procedures contributed to a lower case-fatality rate and lower risk for intensive care unit (ICU) admission. Patients subjected to interventional treatment achieved a better clinical outcome than those received conservative treatment and the cure rate of interventional treatment was 27 times higher than that of conservative treatment.

CONCLUSION

Due to the possibility of increased morbidity and mortality, it is crucial to diagnose a patient with a perinephric abscess as soon as possible. Ultrasound and CT with contrast enhancement are the main keys to diagnosis. The drainage of the abscess, either percutaneous or open, should be done.

In conclusion, the present case study demonstrates that the frequency of ESBL-producing bacteria in perinephric abscess cases is increasing and is associated with poor clinical outcomes. The use of carbapenems is on the increase, and there is concern regarding the occurrence of resistance to the same. Accordingly, global efforts to reduce resistance in bacteria and newer treatment modalities are required. Early diagnosis and treatment can prevent complications like a complex renal cyst, Renal abscess, Renal antibioma, and renal cell carcinoma. Identification and antimicrobial susceptibility of the isolate in the above case have warranted the importance of microbiological culture for the successful treatment of a perinephric abscess.

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