Pyelonephritis in Pets: The Silent Kidney Killer You Can't Ignore

Abubakar Amjad*[1], Muhammad Shahzaib Ashfaq[2], Farooq Aamin[3], Iqra Ishaq[4], Wasi Ullah[5] and Nouman Tariq[1]

1. Faculty of Veterinary Science, University of Agriculture Faisalabad, Pakistan
2. Department of Veterinary Clinical Sciences, University of Poonch Rawalakot, Pakistan
3. Faculty of Veterinary and Animal Sciences (FV&AS), The Islamia University of Bahawalpur, Pakistan
4. Department of Pathology, Faculty of Veterinary Sciences, University of Agriculture Faisalabad, Pakistan
5. Fuculty of Animal Husbandry and Veterinary Sciences, Agriculture University, Peshawar, Pakistan

*Corresponding Author: **amjadabubakar970@gmail.com**

ABSTRACT

Pets frequently suffer from pyelonephritis, a dangerous bacterial infection of the kidneys and renal pelvis that primarily affects dogs and cats. Pregnant and immunocompromised animals are more likely to experience serious consequences, and it is most frequently linked to urinary tract infections. It manifests as flank pain, fever, and systemic disease. Despite the possibility of hematogenous spread, the illness is mainly caused by ascending infections from the lower urinary tract. Escherichia coli, Staphylococcus species, Proteus species, and *Klebsiella* species are common causal pathogens that are frequently made easier by immune suppression, diabetes mellitus, urinary tract anomalies, and catheterization. Clinical evaluation, urinalysis, culture, and, in more complex situations, imaging techniques like CT or ultrasound are also necessary for the diagnosis. In addition to supportive care, treatment entails the timely administration of antibiotics customized based on culture results. Addressing underlying risk factors, practicing good hygiene, and using prophylactic medication in high-risk situations like pregnancy are examples of preventive measures. For pets to have positive results and avoid chronic kidney impairment, early detection and effective therapy are essential

Keywords: pyelonephritis, urinary tract infection, renal infection, antibiotic therapy, veterinary infectious diseases, cats and dogs

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Introduction

Pyelonephritis is kidney and renal pelvis bacterial infection and is usually diagnosed in pets who have pain in flank accompanied by urinary tract infection which is confirmed through laboratory testing. Pets such as cats and dogs who are pregnant show more fatal symptoms (such as high fever, anorexia) and should be treated with more concentration [1]. Pathophysiology shows that Pyelonephritis mostly involves upper urinary tract but it can be followed by manifestation of lower urinary tract infection. It may involve a foreign body (such as urethral catheter) and can alter the normal urinary flow in pets body or cause suppression of immunity. It occurs due to presence of bacteria in urine due to retention of bacteria in urinary tract following loss of urinary tract function to reduce bacteria through secretions. Additionally, an increase in polymorphonuclear leukocyte counts can promote inflammation even in the absence of bacteria. This can lead to kidney stones or tuberculosis in the kidney [2]. Common route of pyelonephritis includes emerging of bacteria from urethra to the urinary bladder a less common route for infection is bacterial hematogenous spread. In female pets like bitch or cat urinary tract infections are more common as a result pyelonephritis also occurs more in females [2]. Acute pyelonephritis is classified as either complex or simple. Pregnant pets, animals with uncontrolled diabetes, kidney transplant recipients, animals with acute or chronic kidney failure, pets with immunocompromised bodies, and those with hospital-acquired bacterial infections are all at risk for developing complicated pyelonephritis. Because it influences how pets are cared for and treated, it is essential to distinguish between severe and simple pyelonephritis. The phrase "chronic pyelonephritis" describes the long-term inflammatory alterations and pyogenic scarring caused by repeated or persistent kidney infections. In kitten or puppies, this condition is typically linked to vesicoureteral reflux or other serious urological anatomic abnormalities. In adults, it can refer to a persistent or uncontrollable kidney infection that is linked to calculi, an aberrant inflammatory response, or a significant urinary tract anatomical defect, like in xanthogranulomatous pyelonephritis [3].

Causes

There are bacterial causes of pyelonephritis (such as *Staphylococci, E. coli*). The illness might enter through the urinary tract even if hygiene precautions are not taken. In this way, pyelonephritis happens six times. More quickly in females than in males. The short and wide urethra's anatomical features determine the cause of this. Occasionally, only one bacterial pathogen is found. Numerous pathogens are frequently detected by the tests (*Staphylococci, E. coli, Proteus, Enterococcus, Klebsiella*). The sickness may also emerge as a result of the following pathological conditions: Urolithiasis history, genitourinary system tumors, intestinal disorders, uneven urine flow, compromised immune function, diabetes mellitus, and prostate adenoma. Kidney, bladder, and urinary system abnormalities; diabetes mellitus; AIDS; age (risk rises with age); disorders of the prostate gland that cause it to enlarge; kidney stone disease; damage to the spinal cord; The bladder urinary system surgeries, catheterization, and uterine prolapse. Pathogenic and opportunistic microflora are the primary cause of pyelonephritis. *Escherichia coli, Staphylococci, Streptococci, Enterococci, Proteus, and Pseudomonas aeruginosa* are the most common pathogens. The majority of these microbes are constantly present in the human body without posing a health risk [4]. Abnormalities of the kidneys and urinary tract; disorders of urine output from the kidney (urolithiasis, prostate adenoma, nephroptosis, prostatitis); kidney blood flow disorders; acute and chronic infection foci (caries, sore throat, flu, sinusitis, otitis, bronchitis, cystitis, colitis, etc.); decreased immunity; systemic diseases (diabetes mellitus, gout, hypercortisolism, atherosclerosis); kidney and urinary tract damage; hormonal status violation, taking hormonal drugs and contraceptives); and pregnancy in women are among the contributing factors that cause the disease. The development of pyelonephritis and its recurrence are influenced by stress, hypothermia, and spicy and salty diets. Women may get pyelonephritis as a result of inadequate vaginal hygiene. Urine retention is a hazardous condition that fosters the growth of harmful microorganisms from the environment. The same detrimental effect occurs when the kidney's blood flow is impaired. The ascending path of infection is the most frequent one, leading to the bladder, urinary system, and ultimately the kidneys [4].

Signs and Symptoms

Pyelonephritis can be distinguished from other urinary tract infections by flank pain and soreness, which are strongly diagnostic of the condition when accompanied by pyuria although it is not always present, fever is usually present [5]. In up to 20% of individuals, lower urinary tract symptoms (such as urgency, frequency, and dysuria) may not be present. The following are other possible indications of pyelonephritis: Symptoms of the constitution, such as chills, and malaise. Abdominal pain, nausea, and vomiting. Tenderness in the abdomen or suprapubic area, hypotension or tachycardia [6]. There may also be symptoms similar to cystitis, including suprapubic irritation, urgency and frequency of the bladder, and dysuria [7].

Diagnosis

Pyelonephritis should be diagnosed based on both test results and clinical symptoms. Clinically, pyelonephritis patients may exhibit costovertebral discomfort, flank pain, increased micturition frequency, dysuria, and a high-grade fever (over 38.5°C). It is possible to link the fever to rigors. It is anticipated that a urinalysis will reveal pus, germs, red blood cells, and white cell casts. Typically, urine culture is positive. However, the severity and scope of the illness cannot be determined only by the clinical and laboratory results. Therefore, in order to appropriately treat the true nature of the disease, imaging is also required. The latest guidelines, however, discourage the routine use of radiological imaging in cases of simple pyelonephritis, particularly in female patients. Imaging is advised in patients with immunocompromised conditions, urinary tract abnormalities, and suspected complex pyelonephritis, particularly in male patients. It is also advised if, after 72 hours of starting antibiotic treatment, there is no improvement [8]. Computed tomography (CT) and ultrasound are the suggested imaging modalities. Although ultrasound is beneficial, CT is the primary imaging modality due to its ability to reveal extremely specific results. A common first-line method for assessing the urinary tract and searching for any encouraging results is ultrasound. However, the majority of clinically suspected pyelonephritis cases may show negative results. The main reason for this is because greyscale pictures of interstitial nephritis are difficult to distinguish. In situations of pyelonephritis, ultrasound can identify a number of favourable findings, including renal parenchyma alterations and congenital abnormalities. Renal hypertrophy, oedema, hemorrhages, hydronephrosis, and abscesses are examples of alterations in the renal parenchyma. When it comes to reliably forecasting the progression of perinephric infections and distinguishing between intraparenchymal gas and calcification, ultrasound is still thought to be limited [8]. Using magnetic resonance imaging to diagnose EPN is challenging. The presence of gas in the peri-renal tissues or renal parenchyma remains the typical feature. Both T1-weighted and T2-weighted images show signal voids representing the free gas. To determine the extent of kidney damage, a contrast injection may be helpful. The assessment of kidney structure and abscess is the most useful MRI finding in these individuals. At first, the abscess may show up as a small, circular, no enhancing region that resembles a wedge. Frequently, the margin is not well defined. On T1-WI, the signal intensity is usually low and irregular, while on T2-WI, it is high. The abscesses typically exhibit a high apparent diffusion coefficient value and diffusion-weighted imaging signal. With multi-planar MRI, the extent of the abscess and the extent of kidney damage could be accurately assessed [9].

Treatment

Cefepime, enmetazobactam, plazomicin, cefiderocol, fosfomycin, meropenem, vaborbactam, and ceftazidime, avibactam were more efficient than carbapenems at completely eliminating the bacterial infection from the urine. When it came to overall success, bacterial elimination, and clinical cure, cefepime, enmetazobactam performed noticeably better than a number of more recent and well-established therapies [10].

Prevention

Outpatient treatment is an option for young, healthy, non-pregnant women with simple pyelonephritis. Antibiotics, analgesics, and antipyretics are the cornerstones of treatment for acute pyelonephritis. Nonsteroidal anti-inflammatory medications (NSAIDs) are effective in treating acute pyelonephritis-related fever and discomfort. Every hospital or institution should have access to local antibiotic resistance patterns, or antibiograms, which should serve as the basis for the initial empirical selection of antibiotics. The results of the urine culture should then be used to modify antibiotic treatment.

If the organism is responsive, fluoroquinolones are generally the recommended oral antibiotic drug. They can be used empirically in situations where the level of community resistance is 10% or less. In certain circumstances, cephalexin for 7–10 days or sulfamethoxazole-trimethoprim for 14 days may be suitable; nevertheless, increasing bacterial resistance reduces the empirical utility of these antibiotics. In general, ceftriaxone is a good option for the first empirical parenteral treatment of pyelonephritis. Generally speaking, carbapenems ought to be saved for the sickest patients or in situations where no other medications are suitable. Gentamicin achieves high renal tissue levels, has little effect on kidney function, and enhances results; thus, a single dose can be considered in addition to any other treatment that is chosen. Depending on patient characteristics and local resistance patterns, cefotaxime, ceftazidime, and piperacillin-tazobactam may also be taken into consideration. Without waiting for culture results, treatment should start right away and last for 14 days. Depending on the patient's clinical improvement and culture results, antibiotics should be modified.Pregnancy-related pyelonephritis should not be treated with fluoroquinolones, nitrofurantoin, or Fosfomycin. Since up to 25% of pregnant patients will otherwise experience recurrent pyelonephritis, post-pyelonephritis prophylaxis with nitrofurantoin 100 mg or cephalexin 250 mg to 500 mg daily may be taken into consideration. Once initiated, this type of prophylactic should be continued for the duration of the pregnancy and for an extra 4–6 weeks following delivery. The optimal time to safely stop antibiotic therapy can be determined by procalcitonin levels. According to a multicenter randomized study, compared to standard therapy, a procalcitonin reduction of at least 80% or any level below 0.5 µg/L by 5 or more days after admission was more cost-effective, medically and clinically sufficient, required fewer hospital inpatient days, and eliminated antibiotic-related complications like pseudomembranous colitis. One to two weeks after medication ends, follow-up urine cultures should be conducted for complicated cases, patients with a higher risk of infection, and all patients who were hospitalized or took parenteral antibiotics. If imaging hasn't been done already, it should be explored. For certain higher-risk patients, monthly urine cultures have been recommended [3].

Conclusion

Pyelonephritis is a serious kidney infection that can quietly put pets' lives at risk if it goes unnoticed. Because the symptoms can be slow to appear and often resemble other urinary problems, it's easy for this condition to be overlooked. Pregnant pets, those with diabetes, weak immune systems, or existing kidney issues are especially vulnerable. That's why early diagnosis—through careful vet examination, lab tests, and sometimes imaging—is so important. The good news is that with the right antibiotics, proper care, and steps to prevent repeat infections, many pets can fully recover and keep their kidneys healthy. Awareness and education, both for pet owners and veterinarians, play a huge role—because catching pyelonephritis early can mean the difference between a healthy, happy pet and lifelong kidney damage.

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