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Candidal Pyelonephritis in an Immunocompromised Child

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Description

Candidal pyelonephritis, a rare but serious infection of the renal parenchyma caused by *Candida* species, poses a significant clinical challenge in immunocompromised pediatric patients. Although *Candida* species are common commensals of the gastrointestinal and genitourinary tracts, they can become opportunistic pathogens in hosts with impaired immune function. In immunocompromised children, such as those undergoing chemotherapy, receiving prolonged antibiotic therapy, or living with congenital immunodeficiencies, *Candida* can invade the urinary tract, leading to severe infections that range from candiduria to invasive renal disease. Candidal pyelonephritis, while uncommon, is an important clinical entity due to its potential to cause renal abscesses, obstructive uropathy, sepsis, and permanent renal impairment.

The pathophysiology of candidal pyelonephritis involves two principal mechanisms of renal involvement: ascending infection from colonization of the lower urinary tract and hematogenous dissemination in the setting of systemic candidemia. In the ascending pathway, *Candida* colonizes the urethra and bladder and ascends to infect the renal pelvis and parenchyma. This is

more likely in patients with urinary catheters, structural abnormalities of the urinary tract, vesicoureteral reflux, or after instrumentation. Hematogenous spread, on the other hand, results from candidemia originating from another source, such as the gastrointestinal tract or indwelling central venous catheters. In neonates and immunosuppressed children, hematogenous spread is particularly dangerous due to the immature or suppressed host defenses. The clinical presentation of candidal pyelonephritis in immunocompromised children is variable and often nonspecific. However, candiduria alone does not necessarily imply upper urinary tract infection and must be interpreted in the context of clinical signs, imaging findings, and risk factors. In severely immunocompromised children, candidal pyelonephritis can progress rapidly to systemic infection and septic shock.

Laboratory investigations often reveal nonspecific markers of infection, such as elevated inflammatory markers (e.g., C-reactive protein, ESR) and leukocytosis or leukopenia depending on immune status. Blood cultures may be positive for *Candida* species, particularly in cases of hematogenous dissemination. However, candidemia is not always present, and negative blood cultures do not rule out renal candidiasis. Urinalysis typically shows pyuria, hematuria, and fungal elements. Urine culture remains a cornerstone of diagnosis, and multiple samples may be needed due to intermittent shedding.

Radiological evaluation plays a key role in diagnosing and assessing the extent of renal involvement. Renal ultrasound may reveal enlarged kidneys, increased echogenicity, hydronephrosis, or the presence of fungal balls (mycetomas) in the collecting system.

These fungal masses can obstruct urine flow and lead to hydronephrosis or caliectasis. In some cases, renal abscesses or cortical necrosis may be seen. While ultrasound is noninvasive and readily available, it may be supplemented by contrast-enhanced Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) for better visualization of parenchymal changes, abscess formation, and obstruction. Imaging is also essential for monitoring treatment response.

Management of candidal pyelonephritis in immunocompromised children requires a multidisciplinary approach involving pediatric infectious disease specialists, nephrologists, and often urologists. Prompt initiation of antifungal therapy is essential. First-line treatment typically includes intravenous amphotericin B or an echinocandin such as caspofungin or micafungin, particularly in critically ill patients or those infected with azole-resistant strains. Amphotericin B deoxycholate remains effective against most *Candida* species but is associated with significant nephrotoxicity, which can be particularly concerning in children with already compromised renal function. Liposomal formulations offer similar efficacy with reduced renal toxicity and are often preferred in pediatric patients.

In cases of obstructive uropathy due to fungal balls, surgical or endoscopic intervention may be necessary to relieve obstruction and remove fungal debris. Percutaneous nephrostomy or ureteral stenting may be employed to drain the collecting system. Persistent or worsening obstruction can result in renal failure, and early urologic evaluation is critical. In rare cases, nephrectomy may be required if there is nonviable renal tissue or failure of medical and conservative surgical management. Concurrent management of underlying immunosuppression is also important, including adjustment of immunosuppressive medications, optimization of neutrophil counts, and nutritional support.

The prognosis of candidal pyelonephritis in immunocompromised children depends on early recognition and initiation of appropriate antifungal

therapy. Delays in diagnosis can result in irreversible renal damage, systemic dissemination, and increased mortality. However, with prompt and aggressive treatment, many patients recover fully, although they may require long-term monitoring for renal sequelae. Prevention strategies such as minimizing unnecessary catheterization, rational use of antibiotics, and early detection of candiduria in high-risk patients play a critical role in reducing the incidence of candidal urinary tract infections.

Conclusion

Candidal pyelonephritis, while rare, should be considered in immunocompromised pediatric patients presenting with unexplained fever, urinary symptoms, or candiduria, particularly when unresponsive to antibiotics. Timely diagnosis through urine culture, imaging, and clinical suspicion, combined with effective antifungal therapy and supportive care, can significantly improve outcomes and prevent serious complications. Heightened awareness, multidisciplinary management, and preventative measures are essential in addressing this potentially life-threatening infection in vulnerable pediatric populations.

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