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A Systematic Review

Genitourinary Tuberculosis - A Comprehensive Review

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Abstract

Background: Genitourinary tuberculosis (GUTB) is one of the most common forms of extrapulmonary tuberculosis, particularly in endemic regions. Despite its prevalence, diagnosis is often delayed due to nonspecific clinical presentation. **Objective:** This review aims to provide a comprehensive overview of the epidemiology, pathogenesis, clinical features, diagnostic approaches, and management of GUTB, with emphasis on recent advances. **Methods:** A narrative review of the literature was conducted using PubMed, Scopus, and Google Scholar databases for studies published between 2000 and 2023. **Results:** GUTB commonly arises from hematogenous dissemination of Mycobacterium tuberculosis and primarily affects the kidneys, with potential spread to other genitourinary structures. Clinical manifestations are variable, with persistent sterile pyuria being an important diagnostic clue. Advances in molecular diagnostics, including polymerase chain reaction and GeneXpert, have improved early detection. Standard anti-tubercular therapy remains the cornerstone of treatment, supplemented by surgical intervention in advanced cases. **Conclusion:** Early recognition and timely management of GUTB are essential to prevent irreversible complications. Integration of modern diagnostic tools and multidisciplinary care significantly improves outcomes.

Keywords: Genitourinary tuberculosis, extrapulmonary TB, renal tuberculosis, GeneXpert, MDR-TB, infertility

Introduction

Tuberculosis continues to pose a major global health challenge, particularly in developing countries where the disease burden remains high. According to the World Health Organization, extrapulmonary tuberculosis constitutes a significant proportion of total tuberculosis cases, with genitourinary tuberculosis (GUTB) being one of the most prevalent forms. GUTB primarily involves the kidneys but may extend to the ureters, bladder, prostate, epididymis, and female reproductive organs. Owing to its insidious onset and nonspecific symptomatology, the condition is frequently underdiagnosed or diagnosed late, resulting in complications such as ureteric strictures, infertility, and progressive renal dysfunction.

Materials and Methods

A comprehensive narrative review of the literature was performed using PubMed, Scopus, and Google Scholar databases, focusing on studies published between 2000 and 2023. The search strategy included keywords such as "genitourinary tuberculosis," "renal tuberculosis," "urogenital tuberculosis," and "extrapulmonary tuberculosis." Only English-language articles with clinical relevance were included. Additional studies were identified through manual screening of reference lists from selected articles to ensure completeness of the review.

EPIDEMIOLOGY

Genitourinary tuberculosis accounts for approximately 20-40% of extrapulmonary tuberculosis cases and most commonly affects individuals between the ages of 20 and 50 years. The disease is more prevalent in regions with high tuberculosis burden, including India, where socioeconomic factors, delayed diagnosis, and limited healthcare access contribute to sustained transmission. Predisposing factors include a history of pulmonary tuberculosis, immunocompromised states such as human immunodeficiency virus infection, diabetes mellitus, malnutrition, and other conditions that impair host immunity.

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CLINICAL FEATURES

The clinical presentation of genitourinary tuberculosis is highly variable and often nonspecific, which contributes to delays in diagnosis. Renal involvement may manifest as dysuria, hematuria, flank pain, and persistent sterile pyuria, which is considered a key diagnostic indicator in endemic settings. Ureteric disease may lead to obstruction and hydronephrosis, presenting with colicky pain. Bladder involvement is typically associated with irritative lower urinary tract symptoms such as frequency, urgency, nocturia, and reduced bladder capacity. In males, genital tuberculosis may present with epididymal swelling, scrotal sinus formation, and infertility. In females, the disease frequently manifests as infertility, menstrual irregularities, and chronic pelvic pain, often mimicking other gynecological conditions.

DIAGNOSTIC EVALUATION

The diagnosis of GUTB requires a high index of suspicion and is based on a combination of laboratory investigations, imaging studies, and endoscopic evaluation. Urine microscopy often reveals sterile pyuria, while acid-fast bacilli staining and culture remain important diagnostic tools, although culture methods are limited by prolonged turnaround time. Molecular diagnostic techniques such as polymerase chain reaction and GeneXpert have significantly improved the speed and sensitivity of detection, with the added advantage of identifying drug resistance. Imaging plays a crucial role in evaluating structural involvement, with ultrasonography useful for detecting hydronephrosis and renal scarring, while computed tomography urography provides superior visualization of calcifications, cavitory lesions, and ureteric abnormalities. Cystoscopy enables direct visualization of bladder lesions and allows for biopsy to achieve histopathological confirmation.

RECENT ADVANCES

Recent advances in the diagnosis and management of GUTB have significantly improved clinical outcomes. The introduction of GeneXpert MTB/RIF has revolutionized rapid diagnosis by enabling simultaneous detection of *Mycobacterium tuberculosis* and rifampicin resistance. Advanced imaging modalities such as computed tomography urography have largely replaced intravenous urography due to their higher sensitivity and ability to detect early parenchymal changes. In addition, minimally invasive surgical techniques, including laparoscopic and robotic approaches, are increasingly being employed for reconstructive procedures, resulting in reduced morbidity and faster recovery.

DRUG-RESISTANT GUTB

The emergence of multidrug-resistant tuberculosis represents a major challenge in the management of GUTB. Resistance to first-line agents such as isoniazid and rifampicin necessitates the use of second-line drugs, including fluoroquinolones, bedaquiline, and linezolid. Early identification of drug resistance through molecular diagnostics is essential to guide appropriate therapy and prevent treatment failure. Management of drug-resistant cases often requires prolonged treatment durations and close monitoring for adverse effects.

DIFFERENTIAL DIAGNOSIS

Genitourinary tuberculosis can mimic several other conditions, making accurate diagnosis challenging. Common differential diagnoses include urinary tract infections, urolithiasis, bladder carcinoma, and interstitial cystitis. Careful clinical evaluation combined with appropriate investigations is essential to distinguish GUTB from these conditions, particularly in endemic areas.

MANAGEMENT

The management of GUTB involves a combination of medical and surgical approaches. Anti-tubercular therapy remains the cornerstone of treatment and typically consists of a combination of isoniazid, rifampicin, pyrazinamide, and ethambutol administered for a duration of six to nine months. In complicated cases, extended treatment may be required. Early initiation of therapy is critical to prevent irreversible organ damage. Surgical intervention is indicated in patients with advanced disease, including those with non-functioning kidneys, severe ureteric strictures, or contracted bladder. Procedures such as nephrectomy, ureteric reconstruction, and augmentation cystoplasty may be necessary depending on the extent of involvement. Advances in minimally invasive surgery have improved postoperative outcomes and reduced recovery time.

COMPLICATIONS

Delayed diagnosis or inadequate treatment of GUTB can lead to significant complications. These include progressive renal failure, ureteric strictures, contracted bladder, infertility, and fistula formation. Many of these complications are irreversible, underscoring the importance of early detection and timely management.

PROGNOSIS AND FOLLOW-UP

The prognosis of GUTB largely depends on the stage at which the disease is diagnosed and the promptness of treatment initiation. Early-stage disease responds well to medical therapy, whereas advanced disease is often associated with permanent structural damage. Long-term follow-up is essential to monitor renal function, assess treatment response, and detect recurrence, particularly in patients with extensive disease involvement.

PREVENTION

Preventive strategies focus on early detection and effective treatment of pulmonary tuberculosis, ensuring adherence to anti-tubercular therapy, and screening high-risk populations. Public health measures aimed at improving awareness and access to healthcare are also critical in reducing the burden of disease.

Conclusion

Genitourinary tuberculosis remains a diagnostically challenging condition due to its insidious onset and nonspecific clinical features. Early recognition, supported by modern diagnostic techniques and appropriate therapeutic interventions, is essential to prevent long-term complications. A multidisciplinary approach involving urologists, radiologists, and infectious disease specialists plays a crucial role in optimizing patient outcomes.

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