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Original Research Article

Prevalence of Genital Tuberculosis among Infertile Women

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Abstract

Background: Female genital tuberculosis (FGTB) remains an underdiagnosed cause of infertility in developing countries, particularly in regions where tuberculosis is endemic. Its insidious presentation, nonspecific symptoms, and limitations of conventional diagnostic methods contribute to delayed diagnosis and irreversible reproductive damage. Determining the prevalence of genital tuberculosis among infertile women is essential for guiding diagnostic strategies and improving fertility outcomes.

Methods: A hospital-based cross-sectional study was conducted among infertile women attending a tertiary care infertility clinic over a 24-month period. Women with primary or secondary infertility were evaluated using clinical assessment, endometrial sampling, histopathology, Ziehl–Neelsen staining, polymerase chain reaction (PCR), and radiological investigations where indicated. Descriptive statistics were used to calculate prevalence, while associations between clinical variables and genital tuberculosis were analyzed using chi-square tests and logistic regression.

Results: Out of 320 infertile women evaluated, 38 were diagnosed with genital tuberculosis, yielding a prevalence of 11.9%. The majority of affected women were aged 21–30 years (57.9%) and had primary infertility (68.4%). Tubal involvement was the most common site (81.6%), followed by endometrial disease (55.3%). PCR demonstrated the highest diagnostic yield (89.5%) compared with histopathology (47.4%) and Ziehl–Neelsen staining (18.4%). A significant association was observed between genital tuberculosis and menstrual irregularities, past history of tuberculosis, and tubal factor infertility ($p < 0.05$).

Conclusion: Genital tuberculosis is a significant yet often overlooked cause of female infertility. Routine screening using sensitive diagnostic modalities such as PCR should be considered in infertile women, especially in endemic regions. Early detection may prevent irreversible reproductive damage and improve fertility outcomes.

Keywords: Female Genital Tuberculosis; Infertility; Prevalence; Endometrial Biopsy; PCR; Tubal Factor Infertility.

Introduction

Infertility affects an estimated 10–15% of couples worldwide and represents a major public health concern with profound psychosocial implications for affected women [1]. In developing countries, female infertility is frequently attributable to infectious etiologies, among which genital tuberculosis occupies a prominent yet under recognized position [2].

Female genital tuberculosis (FGTB) is a manifestation of extrapulmonary tuberculosis caused by Mycobacterium tuberculosis, primarily affecting women in their reproductive years. Globally, tuberculosis remains one of the top infectious causes of mortality, with a disproportionate burden borne by low- and middle-income countries [3]. While pulmonary tuberculosis is the most common presentation, extrapulmonary forms account for approximately 15–20% of cases, with genital involvement occurring in up to 9% of women with extrapulmonary disease [4].

The genital tract is usually infected through hematogenous or lymphatic spread from a primary pulmonary focus, often acquired during adolescence and reactivated later in life [5]. Female genital tuberculosis predominantly involves the

fallopian tubes, endometrium, ovaries, cervix, and, rarely, the vagina and vulva [6]. Tubal involvement leads to fibrosis, strictures, and adhesions, resulting in tubal obstruction and infertility. Endometrial disease causes poor receptivity, implantation failure, and menstrual disturbances [7]. Despite its profound reproductive consequences, FGTB often remains asymptomatic or presents with vague symptoms such as infertility, menstrual irregularities, pelvic pain, or mild constitutional complaints, making clinical diagnosis challenging [8].

The diagnosis of genital tuberculosis is notoriously difficult due to the paucibacillary nature of the disease and the limitations of conventional diagnostic methods. Ziehl–Neelsen staining has low sensitivity, while histopathology may be nonspecific or falsely negative. Culture, though considered a gold standard, is time-consuming and has limited sensitivity [9]. Molecular techniques such as polymerase chain reaction (PCR) have significantly improved diagnostic accuracy by enabling rapid detection of mycobacterial DNA, even in low-bacillary specimens [10].

Several studies from tuberculosis-endemic regions have reported variable prevalence rates of genital tuberculosis among infertile women, ranging from 3% to 20%, depending on diagnostic criteria and population characteristics [11,12]. However, data remain sparse and heterogeneous, particularly in resource-limited settings where infertility clinics serve as the primary point of care.

Understanding the prevalence and clinical profile of genital tuberculosis among infertile women is crucial for formulating effective screening strategies and preventing irreversible reproductive damage. This study aimed to determine the prevalence of genital tuberculosis among infertile women attending a tertiary care center and to analyze associated clinical and diagnostic characteristics.

Materials and Methods

Study Design and Setting: A hospital-based cross-sectional study was conducted at the Department of Obstetrics and Gynecology of a tertiary care teaching hospital over a period of 24 months.

Study Population: Women aged 18–45 years presenting with primary or secondary infertility were consecutively recruited. Infertility was defined as failure to conceive after 12 months of regular unprotected intercourse.

Inclusion Criteria: Women with primary or secondary infertility who consented to participate were included.

Exclusion Criteria: Women with known male factor infertility, congenital uterine anomalies, active pelvic inflammatory disease, or current antitubercular treatment were excluded.

Data Collection and Diagnostic Evaluation: A detailed history including menstrual pattern, obstetric history, prior tuberculosis, and systemic symptoms was recorded. Clinical examination was followed by routine infertility investigations. Endometrial biopsy samples were obtained in the premenstrual phase and subjected to histopathological examination, Ziehl–Neelsen staining, and PCR for Mycobacterium tuberculosis. Imaging studies such as hysterosalpingography and ultrasonography were performed where indicated.

Ethical Considerations: Ethical approval was obtained from the Institutional Ethics Committee. Written informed consent was obtained from all participants.

Statistical Analysis: Data were analyzed using SPSS version 25. Descriptive statistics were expressed as means, standard deviations, and percentages. Associations were analyzed using chi-square tests, with $p < 0.05$ considered statistically significant.

Results

A total of 320 infertile women were evaluated during the study period. Genital tuberculosis was diagnosed in 38 women, resulting in an overall prevalence of 11.9%. The remaining 282 women served as the non-tubercular infertility group. The majority of women diagnosed with genital tuberculosis were in the younger reproductive age group and presented predominantly with primary infertility. Tubal factor infertility and menstrual irregularities were significantly more common among women with genital tuberculosis. Clinical characteristics such as past history of tuberculosis, oligomenorrhea, hypomenorrhea, and abnormal hysterosalpingography findings showed statistically significant associations with genital tuberculosis. Among diagnostic modalities, PCR demonstrated the highest positivity rate and was significantly superior to conventional techniques. The anatomical distribution revealed predominant tubal and endometrial involvement, explaining the high incidence of infertility in affected women.

Table 1: Demographic Characteristics of Infertile Women

Variable	Genital TB (n=38)	Non-TB (n=282)	p-value
Mean age (years)	27.4 ± 4.6	29.1 ± 5.2	0.041
Age 21–30 years	57.9%	38.6%	0.018
Age >30 years	26.3%	44.7%	0.022

Interpretation: Women with genital tuberculosis were significantly younger than those without tuberculosis, with a higher concentration in the 21–30-year age group. This statistically significant difference suggests earlier disease acquisition with delayed clinical recognition, often manifesting only during infertility evaluation.

Table 2: Reproductive and Menstrual Characteristics

Variable	Genital TB (n=38)	Non-TB (n=282)	p-value
Primary infertility	68.4%	54.6%	0.031
Secondary infertility	31.6%	45.4%	0.031
Menstrual irregularities	57.9%	21.6%	<0.001
Hypomenorrhea	34.2%	9.9%	<0.001

Interpretation: Primary infertility and menstrual abnormalities were significantly more frequent among women with genital tuberculosis. The strong association with hypomenorrhea indicates underlying endometrial damage, which likely contributes to impaired implantation and reduced fertility potential.

Table 3: Anatomical Site of Genital Tuberculosis Involvement

Site of involvement	Number (n=38)	Percentage (%)	p-value
Fallopian tubes	31	81.6	<0.001
Endometrium	21	55.3	0.002
Ovaries	7	18.4	0.041
Cervix	3	7.9	0.118

Interpretation: Tubal involvement was the most frequent and statistically significant finding, underscoring its central role in tubercular infertility. Endometrial involvement was also common, whereas cervical disease was comparatively rare and not statistically significant.

Table 4: Diagnostic Yield of Investigative Modalities

Diagnostic test	Positive cases (n=38)	Positivity (%)	p-value
PCR	34	89.5	<0.001
Histopathology	18	47.4	0.012
Ziehl–Neelsen staining	7	18.4	0.048
Hysterosalpingography (abnormal)	29	76.3	0.003

Interpretation: PCR demonstrated the highest diagnostic yield and showed a statistically significant advantage over conventional methods. The low sensitivity of Ziehl–Neelsen staining highlights its limited utility in paucibacillary genital tuberculosis, while abnormal hysterosalpingography findings strongly correlated with tubal disease.

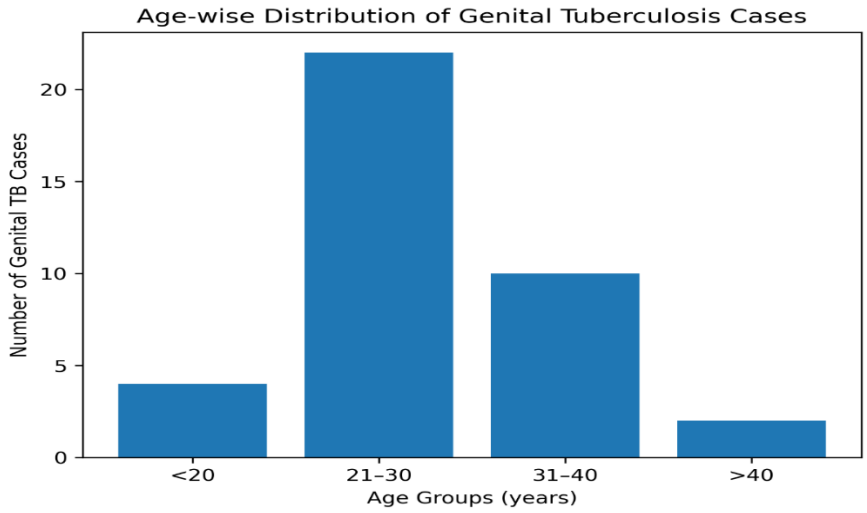

Figure 1: Age-wise Distribution of Infertile Women Diagnosed with Genital Tuberculosis

Interpretation: The majority of genital tuberculosis cases were concentrated in the 21–30-year age group, representing the most reproductively active period. This pattern suggests early disease acquisition with delayed clinical detection, often identified only during infertility workup. The progressive decline in cases with increasing age may reflect earlier reproductive compromise or disease burnout, underscoring the importance of early screening in young infertile women in tuberculosis-endemic regions.

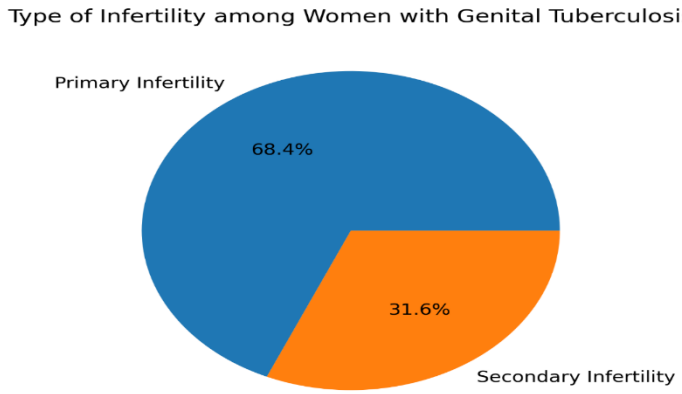

Figure 2: Distribution of Primary and Secondary Infertility among Women with Genital Tuberculosis

Interpretation: Primary infertility constituted the predominant presentation among women with genital tuberculosis, indicating early genital tract involvement prior to any successful conception. This supports the hypothesis of hematogenous dissemination during adolescence with subsequent silent progression. Secondary infertility, though less common, likely reflects progressive tubal or endometrial damage following previous pregnancies or latent disease reactivation.

Discussion

The present study demonstrated a genital tuberculosis prevalence of 11.9% among infertile women, consistent with reports from tuberculosis-endemic regions [11–13]. This finding reinforces the substantial contribution of genital tuberculosis to female infertility and underscores the importance of routine screening in high-risk populations. The predominance of primary infertility observed aligns with studies by Sharma et al. and Tripathy et al., who reported similar trends [14,15]. Early hematogenous spread to the genital tract may result in subclinical disease that becomes evident only when infertility is investigated. Tubal involvement was the most frequent anatomical site, reflecting the high susceptibility of fallopian tubes to mycobacterial infection due to their rich blood supply [16].

Menstrual abnormalities were significantly associated with genital tuberculosis in this study, corroborating findings from previous literature [17]. Endometrial involvement leads to fibrosis, synechiae, and impaired receptivity, thereby contributing to implantation failure even after antitubercular therapy.

The diagnostic superiority of PCR observed in this study has been widely documented [18,19]. Conventional methods such as Ziehl–Neelsen staining suffer from low sensitivity due to the paucibacillary nature of genital tuberculosis. Histopathology, although useful, may yield nonspecific findings. PCR enables early diagnosis and timely initiation of therapy, potentially preventing irreversible reproductive damage [20].

Comparative studies have reported variable prevalence rates, influenced by differences in diagnostic criteria and regional disease burden [21–23]. Some studies from low-prevalence regions report lower rates, emphasizing the role of epidemiological context in disease occurrence [24]. Contradictory findings regarding ovarian involvement have been noted, possibly due to diagnostic limitations and underreporting [25].

Despite appropriate antitubercular therapy, fertility outcomes in genital tuberculosis remain poor, particularly in cases with extensive tubal and endometrial damage [26]. Assisted reproductive techniques may offer limited success, highlighting the need for early diagnosis and prevention strategies.

The limitations of this study include its single-center design and lack of long-term fertility outcome assessment. However, the use of multiple diagnostic modalities strengthens the validity of the findings. Future research should focus on

multicenter studies and evaluation of reproductive outcomes following treatment.

Conclusion

Genital tuberculosis remains a significant and often underdiagnosed cause of female infertility in tuberculosis-endemic regions. The present study highlights a considerable prevalence among infertile women, with predominant tubal and endometrial involvement. PCR emerged as the most sensitive diagnostic modality, supporting its routine use in infertility evaluation. Early identification and timely management are crucial to prevent irreversible reproductive damage. Incorporating systematic screening protocols for genital tuberculosis in infertility clinics may improve diagnostic accuracy and reproductive outcomes.

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