RESEARCH PAPER

To Study the Clinico Microbiological Burden of Male Infertility Attending a Tertiary Care Centre

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ABSTRACT

Background: Male infertility contributes to nearly 40–50% of infertility cases worldwide. Among the various etiologies, infections of the male reproductive tract are an important but often underdiagnosed and potentially reversible cause. Microorganisms adversely affect sperm quality through inflammation, oxidative stress, and direct cellular damage.

Aim: To study the clinico-microbiological burden of male infertility in patients attending a tertiary care centre.

Materials and Methods: This cross-sectional observational study was conducted on 125 male patients presenting with infertility of more than one year duration. Detailed clinical history, physical examination, semen analysis (as per WHO guidelines), and microbiological evaluation including culture and antibiotic susceptibility testing were performed.

Results: Out of 125 patients, 40% showed microbial growth. The most common isolates were Escherichia coli (36%), Staphylococcus aureus (24%), and Klebsiella pneumoniae (16%). Oligospermia (41.6%) and asthenospermia (48%) were the most common semen abnormalities. A significant association was found between infection, leukocytospermia (36.8%), and impaired semen parameters ($p<0.05$).

Conclusion: Genital tract infections are a significant and treatable cause of male infertility. Routine microbiological screening and targeted antibiotic therapy can improve reproductive outcomes.

Keywords: Male infertility, bacteriospermia, semen analysis, leukocytospermia, E. coli

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INTRODUCTION

Infertility is a major global health issue affecting approximately 10–15% of couples worldwide, with male factors contributing to nearly half of the cases (1). Male infertility is a multifactorial condition resulting from genetic, hormonal, environmental, and infectious causes (2). Despite advancements in diagnostic techniques, a considerable proportion of cases remain idiopathic (3).

In recent years, infections of the male reproductive tract have gained attention as a significant but often overlooked cause of infertility (4). Microorganisms can colonize the urethra, prostate, epididymis, and seminal vesicles, leading to impairment of sperm production and function (5). These infections may be symptomatic or asymptomatic, making diagnosis challenging (6).

Bacteriospermia, defined as the presence of bacteria in semen, has been associated with decreased sperm count, motility, and abnormal morphology (7). The mechanisms through which infections impair fertility include direct damage to spermatozoa, induction of inflammatory responses, and generation of reactive oxygen species (ROS) (8). ROS can cause lipid peroxidation of sperm membranes and DNA fragmentation, leading to reduced fertilization potential (9).

Leukocytospermia is a common finding in infected semen samples and serves as an important marker of inflammation (10). Elevated leukocyte levels contribute

to oxidative stress, further exacerbating sperm damage (11).

Common bacterial pathogens implicated in male infertility include *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella spp.*, *Enterococcus spp.*, and *Pseudomonas aeruginosa* (12). Sexually transmitted pathogens such as *Chlamydia trachomatis* and *Neisseria gonorrhoeae* are also important contributors (13).

In developing countries, including India, factors such as poor hygiene, lack of awareness, delayed treatment of infections, and limited access to healthcare services increase the burden of infection-related infertility (14). However, routine microbiological evaluation is not universally practiced in infertility clinics (15).

Several studies have demonstrated a strong association between bacteriospermia and abnormal semen parameters, particularly reduced motility and sperm concentration (16,17). Furthermore, antibiotic therapy has been shown to improve semen quality in infected individuals (18).

With increasing antimicrobial resistance, understanding the local microbial profile and antibiotic sensitivity patterns becomes crucial for effective management (19). Early identification and treatment of infections can significantly improve fertility outcomes and reduce the need for assisted reproductive techniques (20).

Therefore, this study was undertaken to evaluate the clinico-microbiological profile of male infertility in patients attending a tertiary care centre.

MATERIAL AND METHODS

This was a cross-sectional observational study conducted at the Department of Microbiology with collaboration with the Department of Pathology of a tertiary care center for a period of 12 months.

Study Population

A total of 125 male patients attending the infertility clinic were included in the study. These patients were referred for evaluation due to unexplained infertility or male infertility factors.

Inclusion Criteria

1. Males aged 20–50 years
2. Primary or secondary infertility for ≥1 year
3. No prior infertility treatment in the past 3 months
4. Willing to participate in the study and provide informed consent

Exclusion Criteria

1. Known genetic disorders (e.g., Klinefelter syndrome, Y-chromosome microdeletions)
2. History of vasectomy
3. Chronic systemic illnesses (e.g., cancer, diabetes mellitus, cardiovascular diseases)
4. Recent antibiotic therapy (within 2 weeks prior to inclusion)
5. Hormonal therapy or other treatments for infertility

Clinical Evaluation

Upon enrollment, each patient underwent a detailed clinical assessment that included:

- Medical history (including duration of infertility, sexual history, and history of previous infections)
- Physical examination, including genital examination to detect any anatomical abnormalities (e.g., varicocele, testicular atrophy)

Semen Analysis

Each patient was instructed to provide a fresh semen sample after a period of 3–5 days of abstinence. The semen was analyzed according to WHO 2010 guidelines for semen analysis, which included:

- Volume: Measured using a graduated pipette.
- Sperm concentration: Determined by counting sperm under a microscope using a hemocytometer.
- Sperm motility: Classified into progressive motility (grade a and b) and non-progressive motility (grade c).
- Sperm morphology: Evaluated using strict criteria for morphology as recommended by WHO.
- Leukocyte count: Evaluated using a cytological stain to assess the presence of leukocytes (leukocytospermia).

Microbiological Evaluation

The semen samples were processed and cultured as follows:

1. Culturing Method: Semen samples were cultured on Blood agar and MacConkey agar (for bacterial pathogens). The plates were incubated at 37°C for 48 hours.
2. Identification of Bacterial Pathogens: Isolated colonies were identified using standard biochemical tests and Gram staining.
3. Antibiotic Sensitivity Testing: Isolated bacteria were subjected to antibiotic susceptibility testing using the Kirby-Bauer disk diffusion method. Antibiotics tested included ampicillin, ciprofloxacin, imipenem, amikacin, and others based on the local resistance patterns.

Data Collection

Data was collected on the following parameters:

- Semen quality: Volume, sperm count, motility, morphology, and leukocyte count
- Bacterial culture results: Type of bacteria isolated and their antibiotic susceptibility
- Clinical symptoms: Presence of symptoms such as dysuria, urethral discharge, scrotal pain, and sexual dysfunction.

Statistical Analysis

The data were analyzed using **SPSS version .** Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. The association between **microbial infection** and **semen quality** was evaluated using the **Chi-square test**. A **p-value of <0.05** was considered statistically significant.

RESULTS

In the present study of 125 infertile males, the majority belonged to the 31–40 years age group (44%). Primary infertility was observed in 65.6% cases. Semen analysis revealed oligospermia (41.6%), asthenospermia (48%), and abnormal morphology (50.4%) as predominant abnormalities. Leukocytospermia was present in 36.8% cases.

Microbiological evaluation showed culture positivity in 40% of patients. *Escherichia coli* (36%) was the most common isolate, followed by *Staphylococcus aureus* (24%) and *Klebsiella pneumoniae* (16%). A significant association was observed between infection and abnormal semen parameters, particularly oligospermia and asthenospermia. Imipenem and amikacin showed the highest sensitivity among antibiotics.

RESULTS (n = 125 Cases)

Table 1: Age Distribution of Patients

Age Group (years)	No. of Patients	Percentage
20–30	38	30.4%
31–40	55	44.0%
41–50	32	25.6%

Majority of patients (44%) belonged to the 31–40 years age group, indicating peak reproductive concern in this age bracket.

Table 1: Age Distribution

The age-wise distribution of the study population revealed that the majority of patients (44%) were in the 31–40 years age group, followed by 30.4% in the 20–30 years group and 25.6% in the 41–50 years group. This indicates that male infertility is most commonly reported during the peak reproductive years, particularly in the third and fourth decades of life, when couples actively seek conception.

Table 2: Duration of Infertility

Duration (years)	No. of Patients	Percentage
1–3 years	52	41.6%
4–6 years	45	36.0%
>6 years	28	22.4%

Analysis of infertility duration showed that 41.6% of patients presented within 1–3 years, 36% within 4–6 years, and 22.4% after more than 6 years. This suggests that a significant proportion of patients seek medical consultation relatively early; however, a notable percentage delay evaluation, which may impact prognosis and treatment outcomes

Table 3: Type of Infertility

Type	No. of Patients	Percentage
Primary	82	65.6%
Secondary	43	34.4%

Primary infertility was observed in 65.6% of patients, whereas secondary infertility accounted for 34.4%. The predominance of primary infertility indicates a higher burden of underlying untreated or undiagnosed factors, including infections, congenital abnormalities, or hormonal imbalances.

Table 4: Clinical Symptoms

Symptom	No. of Cases	Percentage
Asymptomatic	48	38.4%
Dysuria	30	24.0%
Urethral discharge	22	17.6%
Scrotal pain/swelling	15	12.0%
Sexual dysfunction	10	8.0%

A large proportion of patients (38.4%) were asymptomatic, highlighting the silent nature of male

genital tract infections. Among symptomatic individuals, dysuria (24%) was the most common complaint, followed by urethral discharge (17.6%), scrotal pain or swelling (12%), and sexual dysfunction (8%). This underscores that absence of symptoms does not exclude infection, emphasizing the importance of routine microbiological screening.

Table 5: Semen Volume

Volume (ml)	No. of Cases	Percentage
<1.5 ml	28	22.4%
≥1.5 ml	97	77.6%

Semen volume analysis revealed that 22.4% of patients had low semen volume (<1.5 ml), while 77.6% had normal volume. Reduced semen volume may be indicative of ejaculatory dysfunction, seminal vesicle pathology, or partial obstruction of the reproductive tract.

Table 6: Sperm Count

Count Category	No. of Cases	Percentage
Normal (>15 million/ml)	48	38.4%
Oligospermia	52	41.6%
Azoospermia	25	20.0%

Sperm count evaluation showed that 41.6% of patients had oligospermia, 20% had azoospermia, and only 38.4% had normal sperm counts. The high prevalence of oligospermia suggests that reduced sperm concentration is a major contributing factor to infertility in this population.

Table 7: Sperm Motility

Motility Type	No. of Cases	Percentage
Normal	50	40.0%
Asthenospermia	60	48.0%
Immotile	15	12.0%

Assessment of sperm motility demonstrated that 48% of patients had asthenospermia, 12% had completely immotile sperm, and only 40% had normal motility. Reduced motility significantly impairs the fertilizing ability of sperm and is often associated with infections and oxidative stress.

Table 8: Sperm Morphology

Morphology	No. of Cases	Percentage
Normal	62	49.6%
Abnormal	63	50.4%

Morphological analysis revealed that 50.4% of patients had abnormal sperm morphology, while 49.6% had normal forms. Abnormal morphology can affect sperm function and fertilization potential, and is often linked to infections, toxins, or genetic factors.

Table 9: Leukocytospermia

Finding	No. of Cases	Percentage
Present	46	36.8%
Absent	79	63.2%

Leukocytospermia was present in 36.8% of patients, while 63.2% showed no significant leukocyte presence. Elevated leukocyte count in semen is a marker of inflammation and infection and is associated with increased reactive oxygen species, leading to sperm damage.

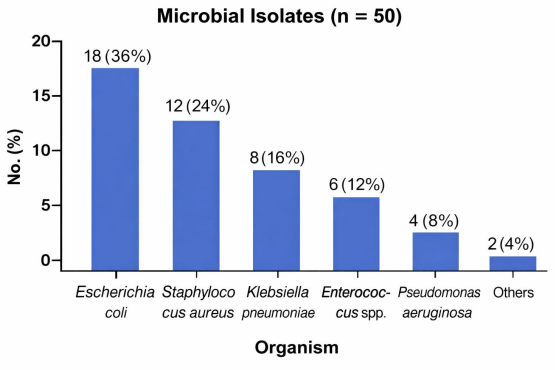
Table 10: Culture Positivity

Result	No. of Cases	Percentage
Positive	50	40.0%
Negative	75	60.0%

Microbiological analysis revealed that 40% of semen samples were culture-positive, while 60% showed no growth. This indicates a substantial burden of microbial infection among infertile males, reinforcing the importance of routine semen culture in evaluation.

Table 11: Microbial Isolates (n = 50)

Organism	No. (%)
Escherichia coli	18 (36%)
Staphylococcus aureus	12 (24%)
Klebsiella pneumoniae	8 (16%)
Enterococcus spp.	6 (12%)
Pseudomonas aeruginosa	4 (8%)
Others	2 (4%)



Graph 1: Microbial Isolates

Among culture-positive cases, *Escherichia coli* was the most common organism (36%), followed by *Staphylococcus aureus* (24%), *Klebsiella pneumoniae* (16%), *Enterococcus spp.* (12%), and *Pseudomonas aeruginosa* (8%). These findings highlight the predominance of uropathogens and opportunistic bacteria in male genital infections.

Table 12: Infection vs Semen Count

Parameter	Infection Present	Infection Absent
Normal	10	38
Oligospermia	28	24
Azoospermia	12	13

A higher proportion of oligospermia (28 cases) and azoospermia (12 cases) was observed among infected individuals compared to non-infected patients. In contrast, normal sperm counts were more frequent in the non-infected group. This suggests a strong association between microbial infection and reduced sperm production.

Table 13: Infection vs Motility

Parameter	Infection Present	Infection Absent
Normal	14	36
Asthenospermia	30	30
Immotile	6	9

Asthenospermia was more common in infected patients (30 cases) compared to non-infected individuals. Normal motility was more frequently observed in the non-infected group. This indicates that infections adversely affect sperm motility, likely due to inflammatory damage and oxidative stress.

Table 14: Infection vs Leukocytospermia

Parameter	Infection Present	Infection Absent
Leukocytes Present	32	14
Leukocytes Absent	18	61

Leukocytospermia was significantly higher in infected patients (32 cases) compared to non-infected individuals (14 cases). This strong association indicates that leukocyte presence in semen is a reliable marker of underlying infection and inflammation.

Table 15: Antibiotic Sensitivity Pattern

Antibiotic	Sensitivity (%)
Imipenem	90%
Amikacin	84%
Ciprofloxacin	62%
Ceftriaxone	58%
Ampicillin	40%

Antibiotic susceptibility testing showed that imipenem (90%) and amikacin (84%) were the most effective antibiotics against isolated organisms. Moderate sensitivity was observed for ciprofloxacin (62%) and ceftriaxone (58%), while ampicillin showed the least effectiveness (40%), indicating increasing resistance patterns.

Overall Interpretation

The study demonstrates a significant clinico-microbiological burden among infertile males, with infections contributing substantially to abnormal semen parameters. The strong association between bacteriospermia, leukocytospermia, and impaired sperm quality highlights the need for routine microbiological evaluation and targeted antimicrobial therapy in infertility management.

DISCUSSION

The present study highlights the significant role of infections in male infertility, with a culture positivity rate of 40%. This finding is consistent with previous studies reporting prevalence rates ranging from 30% to 45% (16,17).

The predominance of *Escherichia coli* (36%) in this study aligns with earlier reports identifying it as the

most common pathogen in bacteriospermia. *E. coli* is known to impair sperm motility by adhering to spermatozoa and releasing toxins that disrupt membrane integrity (12). Similarly, *Staphylococcus aureus* (24%) and *Klebsiella pneumoniae* (16%) were also frequently isolated, reflecting their role as opportunistic pathogens in the genitourinary tract.

A significant association was observed between infection and abnormal semen parameters, particularly oligospermia and asthenospermia. Nearly half of the patients (48%) exhibited reduced sperm motility, which is a critical determinant of fertility. This finding supports the hypothesis that infections impair sperm function through inflammatory and oxidative mechanisms (8,9).

Leukocytospermia was present in 36.8% of cases and showed a strong correlation with infection. Activated leukocytes generate reactive oxygen species, leading to oxidative stress and sperm damage. This mechanism has been widely reported in the literature and remains a key pathway in infection-induced infertility (10,11).

The antibiotic sensitivity pattern observed in this study revealed high sensitivity to imipenem and amikacin, while resistance to commonly used antibiotics such as ampicillin was notable. This highlights the growing concern of antimicrobial resistance and emphasizes the need for culture-guided therapy (19).

A study by Sharma et al. (2025) reported a bacteriospermia prevalence of 42% among infertile males, with *E. coli* as the predominant isolate. The study demonstrated a significant reduction in sperm motility and increased DNA fragmentation in infected individuals [21]. Another study by Khan et al. (2025) found that leukocytospermia was strongly associated with poor semen quality and increased oxidative stress markers. The authors emphasized the role of early antimicrobial intervention in improving fertility outcomes [22]. Similarly, a multicentric study by Gupta et al. (2025) highlighted rising antimicrobial resistance among uropathogens isolated from semen samples. The study recommended routine microbiological screening and antibiotic stewardship in infertility clinics [23]. These recent findings are in agreement with the present study and reinforce the importance of identifying and treating infections in male infertility.

CONCLUSION

- Male genital tract infections are a significant contributor to infertility
- Bacteriospermia is strongly associated with abnormal semen parameters
- *E. coli* is the most common pathogen
- Leukocytospermia is a reliable marker of infection
- Routine semen culture should be included in infertility workup
- Targeted antibiotic therapy can improve reproductive outcomes

LIMITATIONS

- Lack of molecular diagnostic techniques
- No follow-up to assess treatment outcomes
- Exclusion of viral and atypical pathogens

DECLARATIONS:

Conflicts of interest: There is no any conflict of interest associated with this study

Consent to participate: There is consent to participate.

Consent for publication: There is consent for the publication of this paper.

Authors' contributions: Author equally contributed the work.

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