RESEARCH PAPER

Microbiological Analysis of Semen in Male Infertility: Impact of Antibiotics on Semen Quality and Bacterial Resistance Patterns

Hafiz Muhammad Muzammil Khan[1], Abdul Nafeh[2], Muhammad Idris Mazhar[3], Saleh Muhammad[4], Maimona Saleh[5], Hira Javed[6]

[1]Senior Embryologist, Department of Reproductive Medicine, Lahore Garrison University, Lahore, Pakistan.
[2]Assistant Professor, Department of Pathology, Sialkot Medical College, Sialkot, Pakistan.
[3]Professor, Department of Pediatrics, Imran Idrees Teaching Hospital, Sialkot, Pakistan.
[4]Professor, Department of Medicine, Imran Idrees Teaching Hospital, Sialkot, Pakistan.
[5,6]Senior Registrar, Department of Pediatrics, Imran Idrees Teaching Hospital, Sialkot, Pakistan.

***Corresponding:** Hafiz Muhammad Muzammil Khan,
Senior Embryologist, Department of Reproductive Medicine, Lahore Garrison University, Lahore, Pakistan.
Email: khanm081@gmail.com

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ABSTRACT

Background: Infertility is a key issue affecting mood and behavior in men. Microorganisms are one of the primary etiological agents that may be associated with infertility.

Objective: To identify bacterial causative agents from the semen of infertile subjects and determine the effect of bacterial infections on sperm quality, as well as determine the susceptibility of these bacteria to drugs.

Methodology: Two hundred semen samples from 90 infertile patients and 110 fertile individuals were collected. The pH, volume, motility, and concentration of semen were analyzed. The samples were processed and identified by biochemical testing. The antibiotic susceptibility pattern was determined using the disc diffusion method.

Results: Abnormal sperm quality was observed. The mean age of the individual and their sperm morphology, concentration, progressive motility, and pH level were 31.9 years, 2.7%, 10.4 million/ml, 27.3%, and 8.3%, respectively. Among the tested samples, oligoasthenozoospermia was found to show the highest occurrence, at 37/40 samples, followed by teratozoospermia, at 35/40 samples, and asthenozoospermia, at 32/40 samples. Of the tested infertile patients' sperm, 31 isolates were identified as Escherichia coli, and 9 isolates of Staphylococcus aureus, and 50 samples showed contamination. Compared to other tested antibiotics, tetracycline showed higher activity against all isolated bacteria in the laboratory.

Conclusion: The bacteria exhibited maximum resistance against gentamicin and bacterial infections might be responsible for sperm abnormalities.

Keywords: Semen, Male infertility, Antibiotics, Bacterial resistance, Microbiological analysis

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INTRODUCTION

Male infertility is a significant issue, often linked to infections in the male reproductive tract. Bacteriospermia, the presence of bacteria in semen, is not always indicative of infection but can be caused by contamination or infection in various parts of the urogenital system. Typically, healthy males are free from bacteria in the vas deferens, epididymis, and testes. However, infections in the male reproductive tract, including urogenital infections caused by bacteria like Escherichia coli and Staphylococcus aureus, can negatively affect sperm count, motility, and morphology, leading to infertility.[1]

Infertility is defined as the inability of a couple to conceive after one year of unprotected intercourse, affecting approximately 15% of couples globally. Male infertility can be caused by several factors, including hormonal disorders, lifestyle, environmental influences, and infections, which account for about 15% of male infertility cases. Urogenital infections, including those caused by bacteria, can disrupt sperm production and function. For instance, infections with Ureaplasmaurealyticum or Neisseria gonorrhoeae can decrease sperm count and motility.[2]

Microorganisms such as Escherichia coli, Chlamydia trachomatis, and Mycoplasma hominis can also affect sperm quality by impairing sperm motility, causing agglutination, or altering sperm function. The role of infections in male infertility is complicated by the fact that many of these infections are asymptomatic, making diagnosis difficult. For instance, Chlamydia trachomatis is one of the most common sexually transmitted infections but often does not show symptoms yet can lead to infertility if left untreated. The impact of bacteria on semen quality is not limited to motility and morphology; the

infection can also lead to increased oxidative stress, which further damages sperm function. Antibiotics are often used to treat these infections, but their impact on semen quality is debated. While some studies suggest that antibiotic treatment can improve sperm parameters, others indicate that antibiotics may negatively affect sperm function and fertility.[3]

This study investigates the microbiological causes of male infertility by analyzing semen samples from infertile men, identifying bacterial pathogens, and assessing their effects on sperm quality. Additionally, it explores the antibiotic susceptibility of the isolated bacteria and their potential impact on sperm parameters such as motility, morphology, and concentration. By understanding the microbial profile of semen and the effects of antibiotics, this research aims to provide insights into the role of infections in male infertility and help optimize treatment strategies. Despite advances in understanding the microbiological causes of male infertility, significant gaps remain. The classification of pathogens as "certain," "likely," or "potential" contributors to infertility is often subjective, influenced by lifestyle, hygiene, and environmental factors. Moreover, the long-term effects of antibiotics on sperm and the mechanisms underlying bacterial resistance require further exploration. Male infertility, a significant global health concern, is often linked to urogenital infections. These infections impair sperm function, reduce spermatogenesis efficiency, and obstruct seminal pathways. Escherichia coliis among the most prevalent pathogens associated with male infertility, negatively impacting sperm motility and morphology. Other common isolates include Staphylococcus aureus, Neisseria gonorrhoeae, and Candida albicans, which influence sperm quality through various mechanisms.[4]

Bacteriospermia refers to the presence of bacteria in semen, which can arise from infection, contamination, or colonization of the distal urethra. While the proximal male reproductive tract is typically sterile, infections can ascend through the urethra, impacting structures such as the vas deferens, epididymis, and testicles. Gram-negative bacteria like E. coli and Gram-positive bacteria like S. aureus disrupt sperm quality, primarily by producing toxins, altering semen pH, and inducing reactive oxygen species (ROS).[5]

Escherichia coli is a dominant pathogen implicated in male infertility. It binds to sperm, causing agglutination and motility reduction. High bacterial concentrations ($\geq 10^6$ CFU/mL) amplify these effects, damaging sperm membranes and disrupting function. Inflammatory responses triggered by E. coli further exacerbate infertility, as cytokines and oxidative stress diminish sperm viability.[6]

Urogenital infections are strongly associated with inflammation, manifesting as leukocytospermia and elevated ROS levels. Chronic infections lead to oxidative damage, impaired mitochondrial activity, and DNA fragmentation in sperm. These processes are particularly severe in patients with male accessory gland infections (MAGI), such as prostatitis and vesiculitis. STIs like Chlamydia trachomatis and Mycoplasma hominis contribute to infertility by disrupting sperm parameters. C. trachomatis, often asymptomatic, impairs sperm motility, morphology, and viability through intracellular infection and immune evasion. Similarly, M. hominis is associated with negative semen outcomes, including decreased motility and increased ROS production.[7]

Antibiotics are widely used to treat infections in infertile males, but their effects on semen quality remain controversial. Drugs like tetracycline and gentamicin, while effective against pathogens, can harm sperm motility, morphology, and viability. Empirical treatment strategies often involve broad-spectrum antibiotics, yet resistance to commonly used drugs like gentamicin is rising, complicating infection management. Semen analysis is critical in diagnosing infertility, but contamination during sample collection and processing remains a challenge. Common contaminants include skin flora, urethral commensals, and environmental microbes. Proper aseptic techniques and cryopreservation methods are essential to minimize contamination and preserve sample integrity.[8]

Cryopreservation is a standard technique in assisted reproductive technologies. However, pathogens like E. coli and S. aureus can survive freezing and impair sperm quality post-thaw. Resistance mechanisms, such as biofilm formation and antibiotic resistance, further complicate the eradication of these pathogens from cryopreserved semen.[9]

Oxidative stress plays a pivotal role in infection-induced infertility. ROS generated by leukocytes and bacterial activity damages sperm membranes and nuclear DNA. This redox imbalance compromises sperm integrity and function, contributing to poor reproductive outcomes. Male infertility is a significant health issue affecting approximately one in seven couples, with male factors contributing to up to 50% of cases. Among the causes, infections of the male urogenital tract play a crucial role. Bacteriospermia, the presence of bacteria in semen, often results from contamination, colonization, or infection and can impair sperm function, leading to infertility.[10]

Microbial infections such as those caused by Escherichia coli, Staphylococcus aureus, and sexually transmitted pathogens (Chlamydia trachomatis, Mycoplasma hominis) are linked to reduced sperm motility, abnormal morphology, and sperm agglutination. E. coli, the most frequently isolated microbe, can adhere to sperm, reduce motility, and disrupt morphology. Similarly, C. trachomatis infections often go unnoticed due to their asymptomatic nature but can lead to significant reproductive health issues. Studies have shown a direct correlation between elevated leukocyte counts in semen (leukocytospermia) and poor sperm quality.[11]

Pathogenic bacteria and their toxins, such as lipopolysaccharides (LPS), generate reactive oxygen species (ROS), which damage sperm DNA and cell membranes, impair mitochondrial function, and induce apoptosis. Prolonged infections may also alter the genital tract's secretory processes, creating an unfavorable environment for spermatogenesis.[12]

Antibiotic resistance among uropathogens, exacerbated by improper and extensive antibiotic use,

complicates the treatment of male infertility. Studies highlight multi-drug resistance in bacteria like E. coli and S. aureus, reducing treatment efficacy. Moreover, while antibiotics aim to eliminate infections, they may inadvertently affect sperm quality, altering motility, count, and morphology.[13]

The diagnosis of infection-related infertility involves semen analysis, microbial culture, and advanced molecular techniques for identifying asymptomatic pathogens. Quantitative cultures and antibiotic susceptibility testing are critical in guiding effective treatments. However, contamination during sample collection and variations in diagnostic standards pose challenges to accurate assessments.[14]

The therapeutic approach includes targeted antibiotic therapy to eradicate infections and mitigate inflammation. Empirical use of broad-spectrum antibiotics has shown varied success, emphasizing the need for personalized treatment based on culture results and sensitivity testing. Adjunct therapies like antioxidants are being explored to counteract oxidative stress caused by infections.[15]

Recent studies have identified emerging pathogens, such as Waddliachondrophila, with potential impacts on sperm quality. Investigations into the effects of specific bacterial metabolites on sperm function and their mechanisms of action remain areas of active research.[16]

MATERIALS AND METHODS

This experimental study was conducted at Lahore Institute of Fertility and Endocrinology (LIFE), Hameed Latif Hospital, Lahore from February 2025 to February 2026. Among the collected samples, 90/200 samples were found to be having bacterial growth. 50/90 samples showed over growth indicating contamination, 40/90 showed significant bacterial growth which can be further tested and confirmed using biochemical tests. Out of 40 tested samples, 31 and 09 were identified as E. coli and S. aureus, respectively. All the samples were collected in sterile containers and stored accordingly.

Semen preservation: After the samples' collection, the samples were liquified at 370 C, for 30-40 minutes. For initial analysis of semen quality, 40x lens of light microscope was used. After that, sample was preserved for bacterial isolation and later experimentation. This was done by using cryo-preservation method. In this method, a lit is used with two types of media are used known as SpermGradTM kit, containing Bicarbonate and HEPES buffered medium containing silane coated collide silica particles, 45% upper ii) 90% lower gradient, which separates the sperm on the basis on gradient difference.

Procedure: In a test tube, firstly 90% media was poured and in the same tube, the second media of 45% was layered and above 45% media, the sample was poured in the same tube and centrifuged at 1600-1800 rpm for 20 minutes. After centrifuge, the top two layers were discarded and the remaining layer (initially with 90% media) was separated in a new tube, the cryo-vials and then 0.5 mL of sperm freezing media was added, drop by drop. These cryo-vials were then kept at liquid nitrogen fumes for 10 minutes and then stored at -1800°C. For thaw, the cryo-vials were taken out from -1800°C and kept at room temperature for 15 minutes and then at 370°C, until experiments were undergoing.

Semen culture: Sperm culture enables for the etiological diagnosis and the discovery of microbes that were causing infection in one or more male accessory sex glands. In order to check for male infertility, the cultural investigation of the ejaculate is helpful. Within an hour after specimen collection, Samples of semen were grown on agar plates and incubated aerobically at 370°C for 24-48 hours. Isolated colonies were found when the bacterial concentration was more than 103 Cfu/ mL for certain pathogens and greater than 104 Cfu/ mL for sporadic pathogens.

Preparation of glycerol stock: Bacterial strains were kept in glycerol stock for a long time. The medium for tryptic soy broth (TSB) was made and autoclaved. Inoculated pure culture into broth and incubated at 30°C overnight. A 50% glycerol solution was made by combining 50% glycerol with 50% water and then mixing 300 µL of this solution with 700 µL of bacterial culture. Glycerol stock was made and kept at -80°C.

Inoculum preparation: Preserved at -800°C Escherichia coli was revived using MacConkey agar, at 370°C, for incubation period of 48 hrs. Preserved at -800°C S. aureus was revived using Blood agar and MacConkey Agar, at 370°C, for incubation period of 48 hours.

Isolation of different bacteria was done using single streak colony forming technique and also to make pure cultures. Identification was done on the bases of morphological characters on agar plates.

- MacConkey agar for E. coli
- Blood agar and MacConkey agar for S. aureus

Identification

Gram staining for the microscopic identification, Gram staining was used:

Procedure: After the smear was prepared, the main stain, crystal violet, was used, and it was left on for one minute. Next, Gram iodine was added and allowed to sit for 1 minute. After 30 seconds of decolorizer addition, washing with distilled water was performed. Finally, safranine (a secondary stain) was applied for 30 seconds, and distilled water was used for washing. The prepared specimen was afterwards given cedar wood oil, and the microscope's 100x lens was used to study it.

Biochemical tests for the purpose of confirmation of E. coli, some biochemical tests were also performed as:

Indole test: A tiny quantity of a pure culture was added to the tube of tryptone broth to inoculate it. Incubate for 24 to 48 hours at 35°C (±2°C). Directly into the tube, 5 drops of the Kovács reagent were added to check for the formation of indole. Within seconds of introducing the reagent to the medium, the reagent layer changed turn pink to red (a "cherry-red ring"), which is a sign of a positive indole test.

Triple sugar iron (TSI) test: It was done by touching the top of a carefully separated colony with a straight inoculation needle. By first inserting a needle into the middle of the medium and all the way to the bottom of the tube, TSI was infected. Next, the agar slant's surface was streaked. For 18 to 24 hours, the tube was incubated at 35°–37°C in free air with the cap left loosely on.

Catalase test: This test was purposely performed for the identification and also to differentiate staphylococcus for streptococcus. A drop of 3% hydrogen peroxide was introduced to the culture on slide for the reaction.

Coagulase test: To confirm the presence of S. aureus in the samples that were obtained, a coagulase test was run. The cultures were cultured in brain heart infusion broth for this purpose overnight. Then, 0.5 mL of coagulase plasma ethylenediaminetetraacetate and 0.2 mL of infusion broth were added to the coagulase tube (EDTA). The consistent mixing was done with a vortex machine. The tube was then incubated for 24 hours at 350°C.

Effect of antibiotics on semen quality was checked by doing cryo-preservation of semen at first and then antibiotics were added in it and check the results i.e., qualitatively and quantitatively.

Procedure: Sperm kinematic characteristics were measured as part of the study's design, and sperm fertilization potential was evaluated. Donor sperm cells that have been cryopreserved and thawed were employed in the study since they have been examined and shown to be free of contaminants such potentially seasonal influences and sexually transmissible pathogens. In vitro fertilization, micro epididymal sperm aspiration, artificial insemination, and other assisted reproductive technologies can all benefit from the knowledge based on cryopreserved sperm.

Samples of cryopreserved donor sperm were thawed and mixed together. Using the two-layer Percoll method, the combined sperm were separated and cleaned.[8] The semen was layered on top of a continuous two-layer Percoll gradient in a 15 mL centrifuge tube as part of the Percoll wash operation. 1.5 mL of 48% isotonic Percoll made up the top layer, which was followed by 1.5 mL of 95% isotonic Percoll at the bottom. The gradients were centrifuged at 300 x g for 20 minutes, and then the bottom layer (1.5 mL) with the pellet was added with an equal volume of HEPES-buffered synthetic human tubal fluid (HTF) medium, supplemented with 0.5% human serum albumin and containing the antibiotic drug(s). The mixtures were recently centrifuged, and the resulting pellets were resuspended in the respective antibiotic-containing medium at a concentration of 10x106 sperm per mL and incubated at 37°C. After 48 hours of incubation, analyses based on aliquots of the sperm were performed.

Antibiotic susceptibility test of the organisms, antibiotic disk method was used. In this method, multiple antibiotics were used to check the sensitivity and resistivity of the organisms towards specific antibiotics and to confirm if the organisms were methicillin resistant.

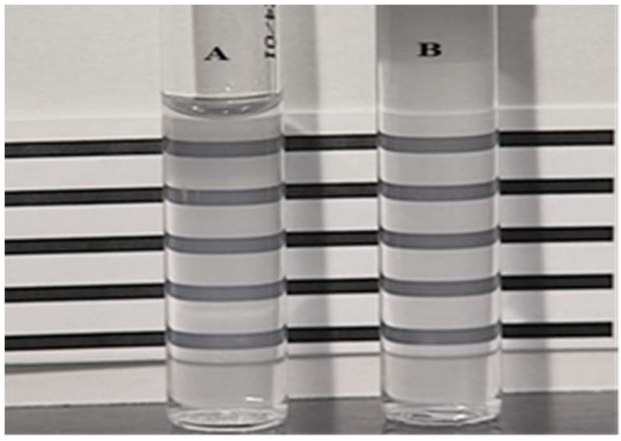
Procedure: It was initially necessary to obtain pure E. coli cultures. These pure cultures were later cultivated on Mueller Hilton Agar. On the plates, antibacterial discs were put. Following that, the plates were all incubated for 48 hours at 370 C. Following incubation, sensitive zones were identified, monitored, and evaluated in accordance with recommendations from the Clinical and Laboratory Standards Institute (CLSI).

Antibiotics discs used for Escherichia coli and Staphylococcus aureus are Clindamycin, Fosfomycin, Oxacillin, Doxycycline, Gentamycin, Erythromycin, Linezolid, Cefoxitin, Penicillin, Azithromycin, Moxifloxacin, Amoxicillin, Cephradine, Teicoplanin, Cefotaxime, Tetracycline, Chloramphenicol, Norfloxacin, Nitrofurantoin

Preparation of McFarland standard: To create a barium sulphate precipitate, barium chloride was added to sulfuric acid to create McFarland standards. Standards with various levels of turbidity representing a range of bacterial concentrations were created by changing the amounts of these two solutions (Fig. 1).

Figure 1

McFarland standard



RESULTS

Culture was made of using single streak colony method for the isolation of pure culture and then pure culture was grown on MacConkey agar. Figure 2 shows the growth on MacConkey agar. Gram staining was performed for the identification of Gram-negative cocci, E. coli. Figure 3 shows the gram negatively stained organisms for initial identification.

Culture growth was made of using single streak colony method for the isolation of pure culture and then pure culture was grown on Blood agar and MacConkey agar. Figure 4 shows the growth on Blood agar and MacConkey agar. Gram staining was performed for the identification of Gram-positive cocci, S. aureus, Figure 5 shows the gram positively stained organisms for initial identification.

Indole test: For further confirmation of the presence of E. coli, and ruling out the possibility of presence of any other gram-negative cocci, Indole test was performed, as shown in Figure 6. Triple sugar iron (TSI) test: After the confirmation of E. coli by Indole test, TSI

test was also performed (Fig. 7). Biochemical tests for confirmation of E. coli (Tables 1-2).

Catalase test is used for confirmation of the presence of S. aureus, and ruling out the possibility of presence of any other gram-positive cocci, catalase test was performed (Fig. 8). Coagulase test, after the confirmation of S. aureus by catalase test, coagulase test was also performed (Fig. 9).

Effect of antibiotics on semen quality: To check the effect of antibiotic drug(s) on semen quality in the laboratory two commonly used antibiotic drugs were used including tetracycline and gentamycin. For such purpose, a control sample was taken and powdered drugs were mixed with semen sample with the concentration of 1 mg/ mL and incubated for 24 hours which showed the decrease in the sperm quantity as well as quantity (Figs. 10-13).

Antibiotics susceptibility tests on laboratory scale were performed to check the resistance and sensitivity of the isolated E. coli and S. aureuscultures towards some specific antibiotics (Figs. 14-15).

Figure 2
Growth of E. coli on MacConkey agar

Figure 3
Pink-colored stained cocci indicating the presence of Gram-negative cocci

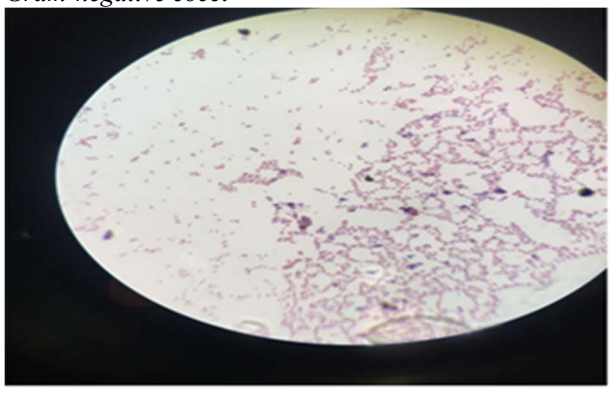


Figure 4
Growth on blood agar and MacConkey agar

Figure 5
Gram positively stained cocci, suspected as S. aureus

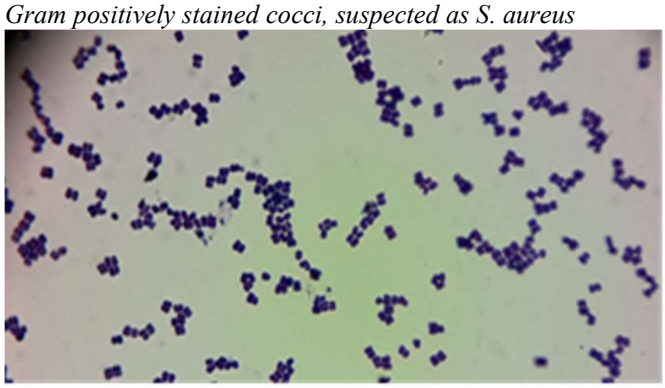


Figure 6
Formation of red ring, thus confirming the presence of E. coli

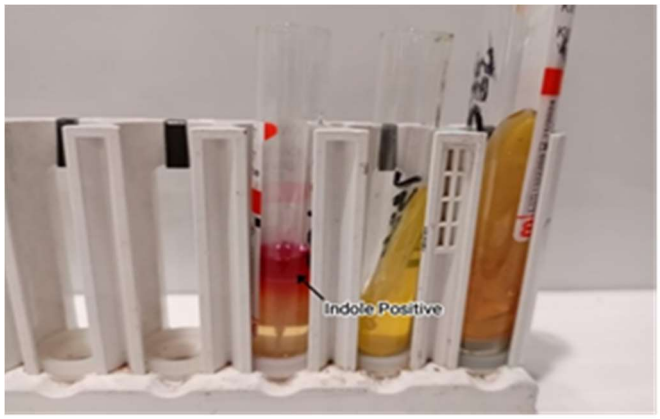


Figure 7
Yellow slant, yellow butt and no H2S gas production, thus confirming the presence E. coli

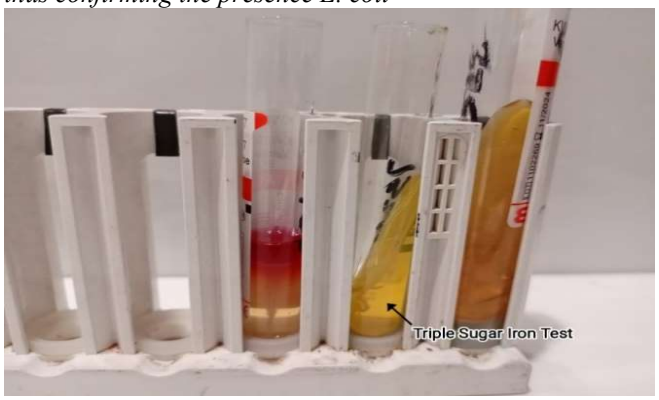


Figure 8

Catalase positive result for three different samples indicating presence of gram-positive cocci, S. aureus

Figure 9
Positive coagulase test and negative control of the test, confirming S. aureus

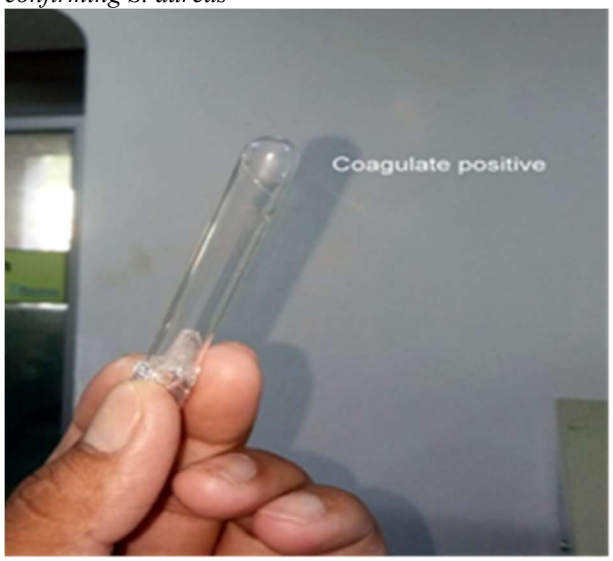


Figure 10
Control sample with no antibiotics contact

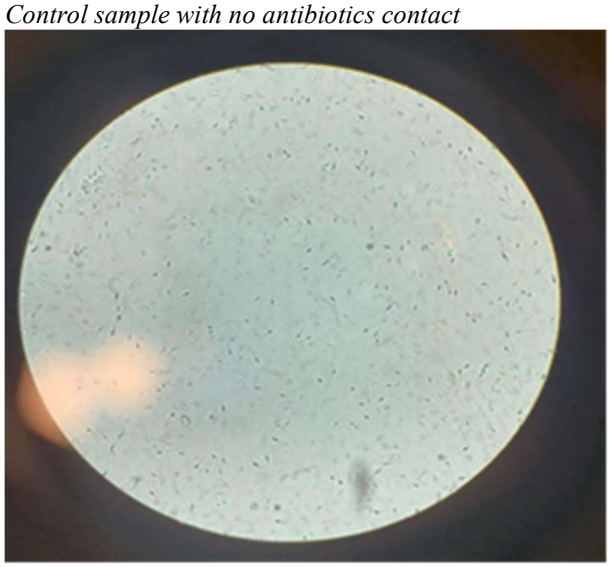


Figure 11

control sample under of fertile patient with no antibiotics contact, makler chamber

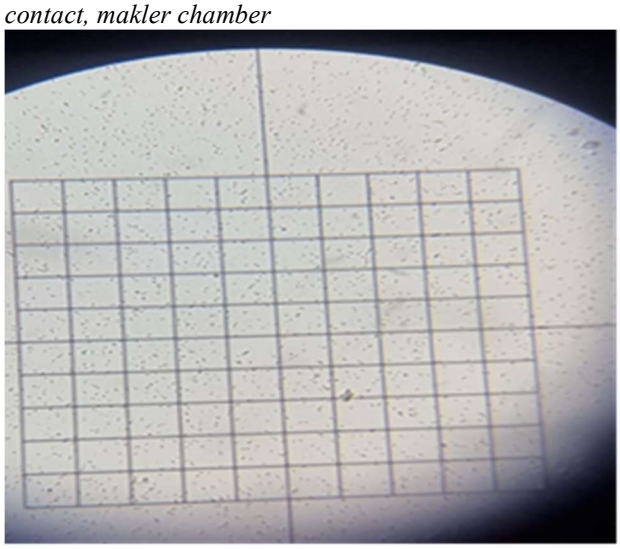


Figure 12
The sample treatment with tetracycline with reduced quality and quantity of sperm in the sample.

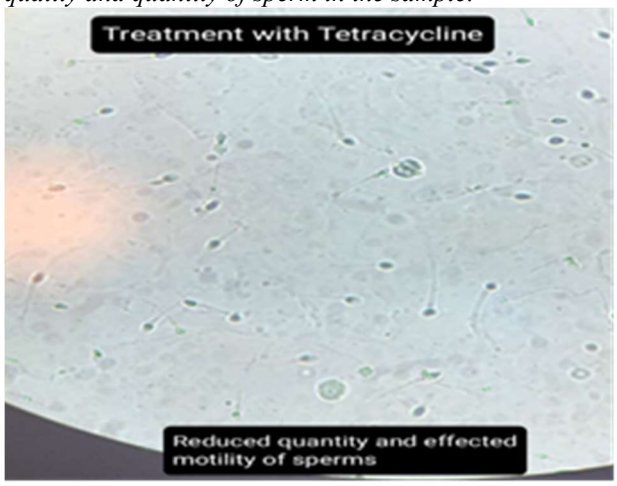


Figure 13
The sample treatment with gentamycin with reduced quantity of sperm in the sample

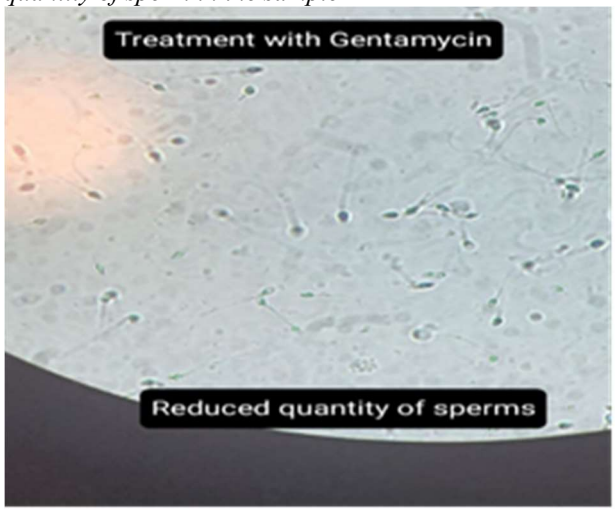


Figure 14

Multi-drug-resistant E. coli resistance to many antibiotics

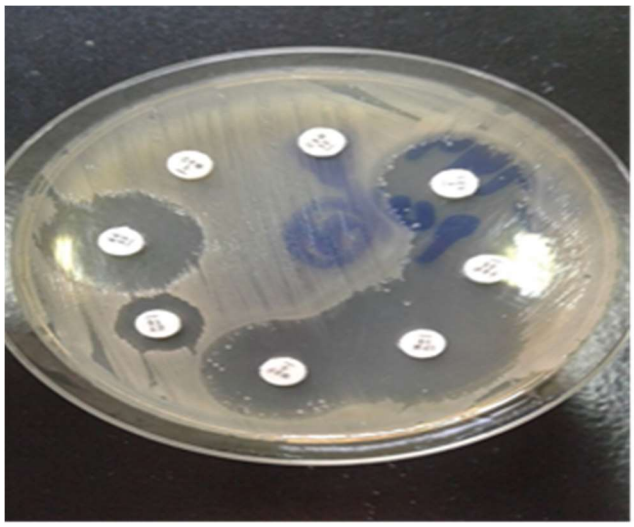


Figure 15

Multi-drug-resistantS. aureus resistance to many antibiotics

Table 1

Biochemical tests for E. coli

Indole Test	+
Triple Sugar Iron Test	+

Table 2

Biochemical Tests for confirmation of S. aureus

Catalase Test	+
Coagulase Test	+

Table 3

Antibiotic profiling of E. coli and S. aureus

Antibiotics	E. Coli	S. aureus
Clindamycin	S	R
Fosfomycin	S	S
Oxacillin	S	S
Doxycycline	S	S
Gentamycin	R	R
Erythromycin	S	S
Linezolid	S	S
Cefoxitin	R	S
Penicillin	S	R
Azithromycin	S	S
Moxifloxacin	S	R
Amoxicillin	S	R
Cefradine	R	S
Vancomycin	S	S
Cefotaxime	R	S
Tetracycline	R	R
Chloramphenicol	S	S
Norfloxacin	S	S
Nitrofurantoin	S	S

Table 4

Classification of sperm

Classification	Control group (n=10)	Patient group (n=40)
Normozoospermia	10 (100%)	-
Oligoasthenozoospermia	-	37 (92%)
Asthenozoospermia	-	32 (80%)
Teratozoospermia	-	35 (87%)

DISCUSSION

Male infertility is significantly influenced by infections of the urogenital tract, which can impair spermatogenesis, reduce sperm functionality, and block seminal ducts.[6,7] This study revealed a strong correlation between bacteriospermia and impaired semen quality, with Escherichia coli and Staphylococcus aureus identified as the primary bacterial culprits. E. coli, in particular, was prevalent and showed substantial effects on sperm motility and morphology, as well as resistance to multiple antibiotics. A high prevalence of bacterial contamination in semen, with 40 out of 90 samples from infertile men showing significant bacterial growth. E. coli was isolated in 31 cases, while S. aureus was found in 9. Antibiotic susceptibility tests indicated that these strains exhibited multidrug resistance, complicating treatment options. Gentamicin and tetracycline, commonly used antibiotics, were found to have limited efficacy against these pathogens, with tetracycline showing relatively better results in vitro.[8]

Bacterial contamination not only reduces sperm quality but also challenges the use of assisted reproductive techniques (ART) such as cryopreservation and artificial insemination.[10,11] This study highlighted that bacteria such as E. coli can survive cryopreservation processes and impair sperm viability during storage. Contaminants, likely originating from improper collection methods or environmental exposure, were a significant factor in semen quality deterioration.[13]

E. coli's impact on sperm quality includes reduced motility, morphological abnormalities, and sperm agglutination. Its ability to bind to sperm cells via mannose-binding receptors leads to functional impairments, as previously noted in other studies.[14-16] Similarly, S. aureus, though less impactful than E. coli, showed moderate effects on sperm motility, consistent with findings in animal models. The study emphasized that bacterial concentrations and the sperm-to-bacteria ratio are crucial factors in determining the extent of sperm impairment.

Interestingly, this study also examined the direct impact of antibiotics on sperm quality. Both tetracycline and gentamicin were found to reduce sperm count,

motility, and morphology when introduced into semen samples. This suggests that while antibiotics are essential for treating infections, their direct effects on sperm quality need further exploration to ensure effective and safe treatment regimens.

The role of bacterial endotoxins, such as lipopolysaccharides (LPS) from gram-negative bacteria, in inducing oxidative stress and impairing sperm functionality was also noted. LPS exposure can lead to increased reactive oxygen species (ROS) production, which compromises sperm motility and viability.[8,15] This mechanism underlines the importance of targeting bacterial infections early to mitigate their long-term effects on male fertility.

This study aligns with previous research highlighting the multifaceted impact of infections on male infertility. Bacterial species such as Chlamydia trachomatis and Ureaplasmaurealyticum, although not the focus of this research, are known to similarly impair sperm functionality and semen parameters through chronic infections and immune responses. E. coli, however, remains the most frequently isolated bacterium in male infertility cases, as confirmed in this study.[17]

The findings underscore the necessity for meticulous semen collection and storage protocols to minimize contamination. Routine microbiological screening of semen samples is vital for identifying pathogens and tailoring appropriate antibiotic treatments. Furthermore, advancements in ART must address bacterial contamination risks to improve success rates.[6]

The present study also raises concerns about the widespread use of antibiotics and the emergence of multidrug-resistant bacterial strains. Overuse and misuse of antibiotics have contributed to the resistance observed in pathogens such as E. coli and S. aureus. A more judicious approach to antibiotic prescription, alongside the development of alternative antimicrobial therapies, is imperative.

CONCLUSION

The significant impact of bacterial infections, particularly Escherichia coli on male infertility and identifies E. coli as a major contributing factor to abnormal semen quality and emphasizes the role of multidrug-resistant bacteria in complicating treatment. The antibiotic treatments, while targeting infections, can adversely affect sperm count, motility, and morphology. The findings underscore the necessity for further research to refine antibiotic usage and minimize its detrimental effects on semen quality, alongside efforts to prevent cross-contamination during clinical procedures.

REFERENCES

1. McClure RD, Nunes L, Tom R. Semen manipulation: Improved sperm recovery and function with a two-layer Percoll gradient. Fertil Steril 1989;51(5):874-7.
2. Denton M, Kerr KG. Microbiological and clinical aspects of infection associated with Stenotrophomonas maltophilia. Clin Microbiol Rev 1998;11(1):57-80.
3. Sanocka D, Frączek M, Jędrzejczak P, Szumala-Kąkol A, Kurpisz M. Male genital tract infection: An influence of leukocytes and bacteria on semen. J Reprod Immunol 2004;62(1–2):111-24.
4. Huwe P, Diemer T, Ludwig M, Liu J, Schiefer HG, Weidner W. Influence of different uropathogenic microorganisms on human sperm motility parameters in an in vitro experiment. Andrologia. 1998;30(SUPPL. 1):55-9.
5. Gimenes F, Souza RP, Bento JC, Teixeira JJV, Maria-Engler SS, Bonini MG, et al. Male infertility: A public health issue caused by sexually transmitted pathogens. Nat Rev Urol 2014;11(12):672-87.
6. Poongothai J, Gopenath TS, Manonayaki S, Poongothai S. Genetics of human male infertility. Singapore Med J 2009;50(4):336-47.
7. Pagliuca C, Cariati F, Bagnulo F, Scaglione E, Carotenuto C, Farina F, et al. Microbiological evaluation and sperm dna fragmentation in semen samples of patients undergoing fertility investigation. Genes (Basel) 2021;12(5).
8. Rusz A, Pilatz A, Wagenlehner F, Linn T, Diemer T, Schuppe HC, et al. Influence of urogenital infections and inflammation on semen quality and male fertility. World J Urol 2012; 30: 23-30.
9. Eggert-Kmse W, Gerhard I, Hofmann H, Runnebaum B, Petzoldt D. Influence of microbial colonization on sperm-mucus interaction in vivo and in vitro. Human Reprod 1987; 12.
10. Mahadevan M, Baker G. Assessment and preparation of semen for in vitro fertilization. Clinical in vitro fertilization. Springer 2003; 83-97.
11. La Vignera S, Condorelli RA, Vicari E, Salmeri M, Morgia G, Cimino S, et al. Microbiological investigation in male infertility: a practical overview. Med Microbiol 2014;63(Pt 1):1-14.
12. Prabha V, Sandhu R, Kaur S, Kaur K, Sarwal A, Mavuduru RS, et al. Mechanism of sperm immobilization by escherichia coli. Adv Urol. 2010; 45.
13. Shah V, Doncel GF, Seyoum T, Eaton KM, Zalenskaya I, Hagver R, et al. Sophorolipids, microbial glycolipids with anti-human immunodeficiency virus and sperm-immobilizing activities. Antimicrob Agents Chemother 2005; 49(10): 4093-100.
14. Merino G. Infection and male infertility: effect of different antibiotic regimens o n semen quality. Arch Androl 1995; 35.
15. Kass Z Al, Spergser J, Aurich C, Kuhl J, Schmidt K, Johannisson A, et al. Sperm quality during storage is not affected by the presence of antibiotics in equiplus semen extender but is improved by single layer centrifugation. Antibiotics 2018;7(1).
16. Althouse GC, Kuster CE, Clark SG, Weisiger RM. Field investigations of bacterial contaminants and their effects on extended porcine semen. Theriogenology 2000; 53.

17. Anel-Lopez L, Riesco MF, Montes-Garrido R, Neila-Montero M, Boixo JC, Chamorro C, et al. Comparing the effect of different antibiotics in frozen-thawed ram sperm: is it possible to avoid their addition? Front Vet Sci 2021;8(May):1-11.