

IDENTIFICATION AND ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF NEISSERIA GONORRHOEAE ISOLATED AMONG PATIENTS ATTENDING STI CLINIC IN A TERTIARY CARE HOSPITAL

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Received : 29/03/2026
Received in revised form : 05/05/2026
Accepted : 23/05/2026

Keywords:

Gonorrhoea; Neisseria gonorrhoeae; Antimicrobial resistance; STI; Ceftriaxone; Azithromycin; Surveillance; India.

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DOI: 10.47009/jamp.2026.8.3.91

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (3); 501-508



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ABSTRACT

Background: Sexually Transmitted Infections (STIs) are the most common infectious diseases worldwide, with over 350 million new cases occurring each year, and they have far-reaching health, social, and economic consequences. Failure to diagnose and treat STIs at an early stage may result in serious complications and sequelae. Gonorrhoea remains one of the most common sexually transmitted infections (STIs) in developing countries and is a major global public health concern, contributing significantly to morbidity and economic burden. According to the World Health Organization (WHO), an estimated 82.4 million new *Neisseria gonorrhoeae* infections occur annually among adults aged 15–49 years, with an increasing trend over the past decade. In India, gonococcal infections account for approximately 10–13% of total STIs in clinical settings. The prevalence is highest among vulnerable populations, including men who have sex with men, sex workers, transgender women, adolescents, and young adults. Transmission occurs through vaginal, oral, or anal sexual contact. While women are often asymptomatic, untreated infections may lead to infertility and adverse pregnancy outcomes. Laboratory diagnosis plays a crucial role in the early detection and management of gonococcal infections. Early diagnosis and prompt treatment are essential not only for preventing complications and interrupting transmission but also for limiting the spread of antimicrobial-resistant strains. **Materials and Methods:** A prospective study was conducted at Government Stanley Medical College and Hospital, Chennai, Tamil Nadu, India, from October 2025 to March 2026. A total of 36 samples (30 males and 6 females) taken from symptomatic patients, men presenting with symptoms, a burning sensation while urinating, and a discharge from the urethra, and women presenting with discharge from the vagina due to cervicitis and lower abdominal pain of the reproductive age group attending the STI clinic after getting informed consent during the study period, were included. Antimicrobial susceptibility testing of *Neisseria gonorrhoeae* was performed using the Kirby–Bauer disc diffusion method using CLSI guidelines 2025. **Results:** Out of 36 specimens, 4 were smear positive, of which 2 were culture positive for *Neisseria gonorrhoeae*. Antimicrobial susceptibility testing showed 50% resistance to penicillin, ciprofloxacin, and tetracycline. Ceftriaxone, cefixime, and azithromycin demonstrated 100% susceptibility, with no resistance detected. **Conclusion:** The study highlights the presence of resistance to commonly used antibiotics such as penicillin, ciprofloxacin, and tetracycline, while ceftriaxone, cefixime, and azithromycin remain effective. Continuous antimicrobial surveillance is essential to detect emerging resistance patterns and guide treatment strategies. Routine screening for associated STIs is crucial to reduce transmission and prevent complications, including HIV infection.

INTRODUCTION

Sexually transmitted infections (STIs) continue to represent a major global public health problem because of their high prevalence, associated morbidity, socioeconomic burden, and increasing antimicrobial resistance. According to the World Health Organization (WHO), more than one million curable sexually transmitted infections are acquired every day worldwide, with infections caused by *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, *Treponema pallidum*, and *Trichomonas vaginalis* accounting for the majority of cases. In developing countries, including India, STIs remain an important cause of reproductive morbidity, infertility, ectopic pregnancy, chronic pelvic pain, adverse pregnancy outcomes, and enhanced transmission of Human Immunodeficiency Virus (HIV). The burden of STIs is particularly high among sexually active young adults, men who have sex with men (MSM), commercial sex workers, individuals with multiple sexual partners, and immunocompromised patients, including those infected with HIV.

Among bacterial STIs, gonorrhoea caused by *Neisseria gonorrhoeae* is one of the most common and clinically significant infections. Gonorrhoea remains a global concern because of its increasing incidence, asymptomatic carriage, complications, and rapidly emerging antimicrobial resistance. The World Health Organization estimated that approximately 82 million new gonorrhoea infections occur annually worldwide among adults aged 15–49 years. In India, the exact prevalence is difficult to determine due to underreporting, asymptomatic infections, limited laboratory facilities, and syndromic management practices; however, gonorrhoea continues to be one of the major bacterial STIs encountered in sexually transmitted disease clinics. The infection is more commonly reported among sexually active individuals aged 15–35 years, MSM, female sex workers, transgender populations, individuals with multiple sexual partners, and HIV-positive patients.

Neisseria gonorrhoeae is a fastidious Gram-negative intracellular diplococcus that primarily infects the mucosal epithelium of the urethra, cervix, rectum, pharynx, and conjunctiva. The incubation period of gonorrhoea generally ranges from 2–7 days, although it may occasionally extend up to 14 days. Acute gonorrhoea commonly presents in males with urethral discharge and dysuria, whereas females frequently present with cervicitis, vaginal discharge, or lower abdominal pain or may remain asymptomatic. Acute infection, if untreated or inadequately treated, can progress to chronic infection due to persistent mucosal colonization and subclinical inflammation. Asymptomatic individuals act as silent reservoirs for disease transmission and contribute significantly to the persistence of infection in the community. In females particularly, untreated asymptomatic infection may ascend into the upper

genital tract, resulting in pelvic inflammatory disease, infertility, ectopic pregnancy, and chronic pelvic pain. Chronic gonococcal infection may also lead to disseminated gonococcal infection presenting with arthritis, dermatitis, and tenosynovitis.

The high proportion of asymptomatic infections is one of the major challenges in gonorrhoea control. Several factors contribute to asymptomatic carriage, especially among women and HIV-positive individuals. Limited inflammatory response at mucosal sites, immune evasion mechanisms of *N. gonorrhoeae*, antigenic variation, phase variation, and biofilm formation enable the persistence of infection without overt clinical manifestations. HIV-positive individuals are particularly susceptible because of impaired mucosal immunity, high-risk sexual behavior, altered genital tract microbiota, and increased exposure to multiple STIs. Gonorrhoea further enhances HIV transmission by increasing genital shedding of HIV and recruitment of CD4 lymphocytes to infected mucosal surfaces, thereby creating a bidirectional synergistic relationship between both infections.

Laboratory diagnosis of gonorrhoea plays a critical role in early detection, treatment, antimicrobial resistance monitoring, and epidemiological surveillance. Conventional diagnostic methods include direct Gram staining, culture, antigen detection tests, and nucleic acid amplification tests (NAATs). Gram stain examination of urethral smears in symptomatic males showing Gram-negative intracellular diplococci is rapid, inexpensive, and highly specific, with specificity exceeding 95% and sensitivity ranging from 90% to 95% in symptomatic men. However, sensitivity decreases significantly in asymptomatic individuals and endocervical samples from females. Culture remains the gold standard method for diagnosis because it allows definitive identification and antimicrobial susceptibility testing. Selective media such as Modified Thayer–Martin medium or chocolate agar supplemented with antibiotics are commonly used. The sensitivity of culture ranges from 85–95% under optimal conditions, while specificity approaches 100%. However, culture requires strict transport conditions, viable organisms, enriched media, and immediate processing, limiting its utility in resource-limited settings.

Molecular diagnostic methods, particularly nucleic acid amplification tests (NAATs), have revolutionized gonorrhoea diagnosis because of their superior sensitivity and specificity. NAATs demonstrate sensitivity ranging from 95 to 99% and specificity above 98% for urogenital infections. These assays can be performed on non-invasive specimens such as first-void urine, endocervical swabs, urethral swabs, rectal swabs, and pharyngeal specimens. Molecular methods offer several advantages, including rapid turnaround time, high sensitivity in asymptomatic infections, ease of specimen collection, and simultaneous detection of co-infections such as *Chlamydia trachomatis*.

However, NAATs have certain limitations, including inability to provide antimicrobial susceptibility data, high cost, requirement for sophisticated laboratory infrastructure, and occasional false-positive results due to cross-reactivity with commensal *Neisseria* species.

Urine-based NAAT testing has gained significant importance because it is non-invasive, acceptable to patients, suitable for large-scale screening programs, and highly sensitive in detecting urethral gonococcal infection, especially in males. Nevertheless, urine culture has limited significance because *N. gonorrhoeae* is highly fragile and survives poorly outside the host environment. Culture from urethral or endocervical swabs remains superior for antimicrobial susceptibility testing and surveillance purposes.

The emergence of multidrug-resistant *N. gonorrhoeae* has become a serious public health concern globally. Progressive resistance to sulfonamides, penicillin, tetracycline, fluoroquinolones, macrolides, and extended-spectrum cephalosporins has significantly limited therapeutic options. To monitor antimicrobial resistance trends, the World Health Organization established the Gonococcal Antimicrobial Surveillance Programme (GASP) in 1992. GASP is a global laboratory-based surveillance network that monitors antimicrobial susceptibility patterns of *N. gonorrhoeae* isolates from participating countries. However, limitations such as inconsistent data collection, lack of epidemiological linkage, variable laboratory methodologies, and inadequate clinical information led to the development of the Enhanced Gonococcal Antimicrobial Surveillance Programme (EGASP).

EGASP was initiated to strengthen sentinel surveillance by integrating microbiological, epidemiological, behavioral, and clinical data with standardized laboratory protocols. The programme particularly focuses on consecutive recruitment of men presenting with urethral discharge syndrome at sentinel clinics. EGASP also facilitates monitoring of treatment failures and emerging cephalosporin resistance. According to recent WHO reports, EGASP has been implemented in several countries across different WHO regions, including Cambodia, Thailand, Vietnam, the Philippines, India, and other participating nations.

Condom usage remains one of the most effective preventive strategies against gonorrhoea and other STIs. Correct and consistent condom use significantly reduces transmission by preventing mucosal exposure to infected secretions. Public health interventions including awareness programs, behavioral counseling, routine screening of high-risk populations, partner notification, early diagnosis, and appropriate treatment are essential for controlling the spread of gonorrhoea.

Current treatment recommendations emphasize prompt therapy to prevent complications and transmission. According to the Centers for Disease

Control and Prevention guidelines, uncomplicated urogenital, rectal, and pharyngeal gonorrhoea in adults is treated with ceftriaxone 500 mg intramuscularly as a single dose for individuals weighing less than 150 kg; for persons weighing ≥ 150 kg, 1 g ceftriaxone is recommended. If a chlamydial infection has not been excluded, doxycycline 100 mg orally twice daily for 7 days is added. Alternative regimens include cefixime 800 mg orally when injectable therapy is not feasible. Disseminated or complicated gonococcal infections require prolonged parenteral therapy with ceftriaxone under specialist supervision. The National AIDS Control Organisation syndromic management guidelines in India also recommend ceftriaxone-based therapy for gonococcal infections, with simultaneous management of coexisting chlamydial infection and partner treatment. Although the Clinical and Laboratory Standards Institute (CLSI) primarily provides antimicrobial susceptibility breakpoints rather than treatment protocols, CLSI recommendations remain essential for interpreting antimicrobial susceptibility testing and guiding appropriate therapy.

Considering the increasing burden of asymptomatic gonococcal infections, antimicrobial resistance, association with HIV infection, and limitations in routine diagnostic practices, continued surveillance and microbiological confirmation are essential. The present short study was therefore undertaken to determine the occurrence of gonorrhoea among clinically suspected STI patients, evaluate diagnostic methods, assess antimicrobial susceptibility patterns, and analyze its association with HIV infection in the study population.

INCLUSION CRITERIA:

Samples taken from symptomatic patients, men presenting with symptoms, a burning sensation while urinating, and a discharge from the urethra, and women presenting with discharge from the vagina due to cervicitis and lower abdominal pain of the reproductive age group attending the STI clinic after getting informed consent during the study period were included.

EXCLUSION CRITERIA:

Samples from children age < 14 and adults age > 50 were not included. Patients who denied consent were not included.

Sample size: 36

Study place: Department of Microbiology, Government Stanley Medical College and Hospital, Chennai.

MATERIALS AND METHODS

The study was conducted after obtaining consent from the Institutional Ethics Committee (IEC). A total of 36 samples (30 males and 6 females) were taken from symptomatic patients, men presenting with symptoms like a burning sensation while urinating and a discharge from the urethra, whereas

women presenting with discharge from the vagina due to cervicitis and lower abdominal pain of the reproductive age group attending the STI clinic after getting informed consent during the study period were included. Two swabs were collected from each patient presenting with urethral discharge or vaginal discharge (i.e., two urethral swabs from males and two endocervical swabs from females). One swab was used for direct Gram staining by preparing a smear on a clean glass slide, followed by microscopic examination after Gram staining. The second swab was used for culture and was immediately inoculated at the bedside into Amies transport medium, in which gonococci can survive for at least 6–12 hours. The specimen was inoculated onto a modified Thayer Martin medium (MTM); plates were held in a CO₂ -enriched atmosphere using a candle jar. The plates were examined after 48 hours, and if there was no growth, the plates were further incubated and read after 72 hours. Small pinpoint colonies of 0.5 to 1 mm in diameter with a greyish glistening appearance on MTM; those colonies were further processed with a Gram stain, which showed Gram-negative, kidney-shaped diplococci. Oxidase-positive colonies were identified presumptively as *N. gonorrhoeae*. The antimicrobial susceptibility testing was done for *N. gonorrhoeae* by the Kirby-Bauer disc diffusion method. Antimicrobial susceptibility for Penicillin G (10 units), Ciprofloxacin (5 mcg), Ceftriaxone (30 mcg), Cefixime (5 mcg), Tetracycline (30 mcg), and Azithromycin (15 mcg) was tested according to Clinical and Laboratory Standards Institute (CLSI) 2025 guidelines. End results were informed to the clinicians for clinical correlation and further treatment.

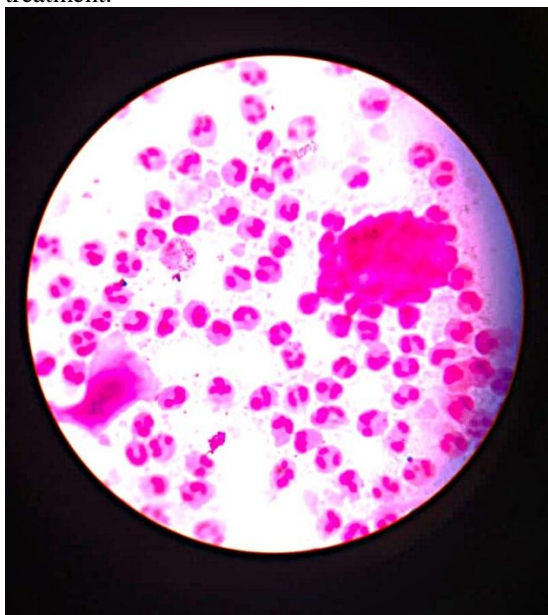


Figure 1: Gram stain of smear from urethral discharge showing Gram-negative intracellular diplococci.

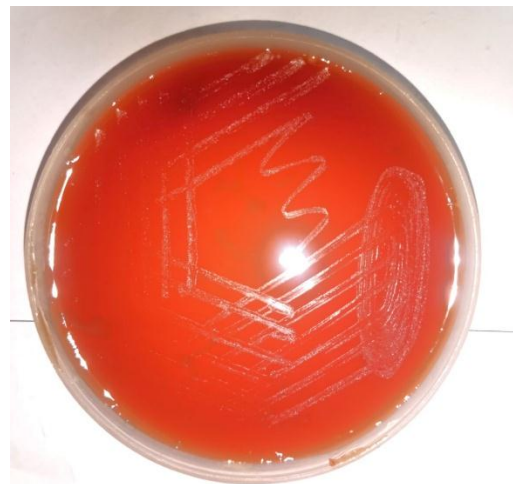


Figure 2: Colonies of Gonococcus after 48 hours of incubation.



Figure 3: Antimicrobial susceptibility test—Kirby Bauer disc diffusion method.

RESULTS

The age-wise distribution of among males and females, indicated higher prevalence in the 21–30 years age group. The gender distribution of study participants showed a predominance of male patients attending the STI clinic.

Table 1: Age-Wise and Gender Wise Distribution (N=36)

	MALES (N=30)	FEMALES (N=6)	TOTAL
14–20	2	0	2

21-25	11	1	12
26-30	9	4	13
31-35	5	1	6
36-40	3	0	3
41-45	0	0	0
46-50	0	0	0
Total	30	6	36

Table 2: Socio-Demographic and Behavioural Characteristics of Study Participants (N = 36)

CHARACTERISTICS	CATEGORY	NUMBER (N = 36)	PERCENTAGE (%)
Occupation	Skilled	10	27.8
	Unskilled	18	50
	Unemployed	8	22.2
Education Level	Illiterate	9	25
	Literate	27	75
Marital Status	Married	20	55.6
	Unmarried	12	33.3
	Divorced	2	5.6
	Widowed	2	5.6
Sexual Orientation	Heterosexual	32	88.9
	Homosexual	4	11.1
Number of Sexual Partners	Single	14	38.9
	Multiple	22	61.1
Type of Sexual Practice	Oral	8	22.2
	Anal	6	16.7
	Vaginal	12	33.3
	All	10	27.7
Condom Use	Yes	13	36.1
	No	23	63.9

The Sociodemographic characteristics and sexual behaviour of study participants. Majority were unskilled workers (50%) and literate (75%). Most participants were married (55.6%) and identified as heterosexual (88.9%). A higher proportion reported multiple sexual partners (61.1%). Vaginal

intercourse was the most common sexual practice (33.3%), followed by engagement in all forms of sexual practices (27.7%). Condom use was reported by 36.1% of participants, while 63.9% did not use condoms.

Table 3: Distribution Of Clinical Symptoms Among Male Patients (N = 30)

Clinical Symptom	Number (n = 30)	Percentage (%)
Urethral discharge	27	90%
Burning micturition	3	10%
Total	30	100%

The Distribution of clinical symptoms among study participants. Majority of cases presented with

urethral discharge (90%), while burning micturition was observed in a smaller proportion of cases (10%).

Table 4: Distribution Of Clinical Symptoms Among Female Patients (N = 6)

Clinical Symptom	Number (n = 6)	Percentage (%)
Vaginal discharge	3	50%
Lower abdominal pain	3	50%
Total	6	100%

The distribution of clinical symptoms among study participants, vaginal discharge and lower abdominal

pain were observed in a equal proportion of cases (50% each).

Table 5: Smear And Culture Positivity for Neisseria Gonorrhoea

SEX	SMEAR POSITIVE	CULTURE POSITIVE
Males (n=30)	4 (13.3%)	2 (6.7%)
Females (n=6)	0	0

Comparison of Gram smear positivity and culture positivity among male and female patients, highlighting lower diagnostic yield in females.

Table 6: Correlation Of Gonorrhoea with Age

AGE GROUP (YEARS)	GONORRHOEA POSITIVE MALES	GONORRHOEA POSITIVE FEMALES	TOTAL
14-20	0	0	0

21-25	1	0	1
26-30	1	0	1
31-35	0	0	0
36-40	0	0	0
41-45	0	0	0
46-50	0	0	0
Total	2	0	2

Correlation of gonorrhoea among different age groups showing predominance among male patients with 21-30years of age.

Table 7: Distribution Of Gonorrhoea Cases in Relation to HIV Status (N = 36)

HIV STATUS	MALES GONORRHOEA POSITIVE N (%)	MALES GONORRHOEA NEGATIVE N (%)	FEMALES GONORRHOEA POSITIVE N (%)	FEMALES GONORRHOEA NEGATIVE N (%)	TOTAL (N)
HIV Positive(n=5)	0 (0%)	4 (80%)	0 (0%)	1 (20%)	5
HIV Negative(n=31)	2 (6.45%)	24(77.4%)	0 (0%)	5 (16.1%)	31
Total(n=36)	2 (5.6%)	28 (77.7%)	0 (0%)	6 (16.7%)	36

Gonococcal infection was observed exclusively among HIV-negative males (6.45%), This indicates a lack of association between HIV status and gonorrhoea in the present study.

Table 8: Association Of Gonorrhoea with Risk Factors Among Study Participants (N = 36)

CHARACTERISTICS	CATEGORY	GONORRHOEA POSITIVE n (%)	GONORRHOEA NEGATIVE n (%)	TOTAL N
Occupation	Skilled	1(10)	9(90)	10
	Unskilled	1(5.6)	17(94.4)	18
	Unemployed	0(25)	8(100)	8
Education Level	Illiterate	1(11.1)	8(88.8)	9
	Literate	1(3.70)	26(96.3)	27
Marital Status	Married	2(10)	18(90)	20
	Unmarried	0(0)	12(100)	12
	Divorced	0(0)	2(100)	2
	Widowed	0(0)	2(100)	2
Sexual Orientation	Heterosexual	1 (3.12)	31 (96.9)	32
	Homosexual	1 (25.0)	3 (75.0)	4
Number of Sexual Partners	Single	0 (0)	14 (100)	14
	Multiple	2 (9.09)	20 (90.9)	22
Type of Sexual Practice	Oral	1 (12.5)	7 (87.5)	8
	Anal	0 (0)	6 (100)	6
	Vaginal	1 (8.33)	11 (91.7)	12
	All	0(0)	10 (100)	10
Condom Use	Yes	0 (0)	13 (100)	13
	No	2 (13)	20 (87)	23
Total		2 (5.6)	34 (94.4)	36

Gonococcal infection was more commonly observed among individuals with multiple sexual partners and those not using condoms. A higher proportion of

cases were seen among heterosexual individuals, consistent with known transmission patterns.

Table 9: Correlation Of Gonococcal Infection Among Males with Clinical Symptoms

CLINICAL SYMPTOM	NUMBER	GONORRHOEA POSITIVE CASES
Urethral discharge	27	2
Burning micturition	3	0
Total	30	2

The distribution of clinical symptoms in relation to gonorrhoea positivity among study participants.

Urethral discharge was the predominant clinical presentation.

Table 10: Correlation Of Gonococcal Infection Among Females with Clinical Symptoms

CLINICAL SYMPTOM	NUMBER	GONORRHOEA POSITIVE CASES
Vaginal discharge	3	0
Lower abdominal pain	3	0
Total	6	0

The Distribution of clinical symptoms in relation to gonorrhoea positivity among study participants.

None of the cases were positive for gonorrhoea across all clinical presentations. Antimicrobial

susceptibility for *Neisseria gonorrhoeae* for Penicillin G (10 units), Ciprofloxacin (5mcg), Ceftriaxone (30 mcg), Cefixime (5mcg),

Tetracycline(30mcg) and Azithromycin (15mcg) was performed.

Table 11: Antimicrobial Susceptibility Pattern

ANTIBIOTIC DISK	RESISTANT (%) (n=2)	SENSITIVE (%) (n=2)
Penicillin	50%	50%
Ciprofloxacin	50%	50%
Tetracycline	50%	50%
Ceftriaxone	0%	100%
Cefixime	0%	100%
Azithromycin	0%	100%

Antimicrobial susceptibility pattern of two *Neisseria gonorrhoeae* isolates showing resistance to penicillin, ciprofloxacin, and tetracycline, with complete sensitivity to ceftriaxone, cefixime, and azithromycin.

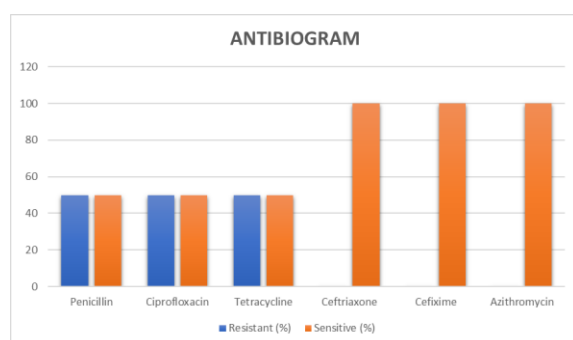


Chart 1: Antibiogram Of *Neisseria Gonorrhoeae* Isolates

DISCUSSION

Gonorrhoea continues to be a significant public health concern globally, particularly in developing countries, due to its high transmissibility, asymptomatic presentation in certain populations, and the increasing challenge of antimicrobial resistance. The present study provides insights into the epidemiological profile, diagnostic findings, and antimicrobial susceptibility patterns of *Neisseria gonorrhoeae* in a tertiary care setting.

As per Table 1, clear male predominance (83.3%) was observed in this study, consistent with previous Indian reports by Bala *et al.* and Sharma *et al.* [9, 10]. This may be attributed to higher healthcare-seeking behaviour among symptomatic males, whereas females are often asymptomatic and underdiagnosed. As per Table 1, the age distribution showed that the majority of cases occurred in the 21–30-year age group, representing the sexually active population. This finding is in agreement with studies by Sharma *et al.*, Bilal *et al.*, and global surveillance data [10, 11], indicating higher susceptibility among adolescents and young adults due to behavioral risk factors. The absence of cases above 40 years further supports this trend.

As per Table 2, the majority of participants were unskilled workers (50%) and literate (75%). Most were married (55.6%), but a significant proportion

had multiple partners (61.1%). Heterosexual behavior predominated (88.9%), though a small proportion reported homosexual exposure. High-risk behavior is evident with multiple partners and low condom usage (63.9% non-users). Combined sexual practices (oral + anal) were commonly reported (61.1%), indicating increased transmission risk. This finding is in agreement with studies by Prashanth *et al.*, in which the majority of participants in the age group of 21-30 years were skilled, literate, married, heterosexual, and constant use of condoms, and by Shariff *et al.*, the majority of the participants were in the age group of 20-40 years, married, literate, employed, heterosexual and constant usage of condoms.

As per table 3 and 4, the majority of the males presented with urethral discharge, and females presented with vaginal and lower abdominal pain. This is in agreement with NACO, Sharma *et al.*, Shariff *et al.*,

Laboratory diagnosis was based on Gram staining and culture. **Figure 1** demonstrated Gram-negative intracellular kidney shaped diplococci, characteristic of *Neisseria gonorrhoeae*, while **Figure 2** showed typical colony morphology after 24 hours of incubation in the presence of CO₂. A discrepancy between smear and culture positivity was noted among male patients (**Table 5**), where only a subset of smear-positive cases was culture positive. In the present study, all female patients were negative by both smear and culture (**Table 5**),

As per Table 6, age-wise distribution of *Neisseria gonorrhoeae* infection shows clustering of cases in young adult males, particularly between 21–30 years, which is in concordance with, Sharma *et al.*, Singh V, *et al.* indicating higher STI prevalence among sexually active age groups.

As per Table 7, Gonococcal infection was observed exclusively among HIV-negative males (12.9%), with no cases among HIV-positive individuals or females. This indicates a lack of association between HIV status and gonococcal infection in the present study. This is in concordance with Bilal *et al.*, (15) who documented max cases of gonorrhoea among HIV negative patients.

As per Table 8, gonococcal infection was more commonly observed among individuals with multiple sexual partners and those not using condoms. A higher proportion of cases were seen among

heterosexual individuals, consistent with known transmission patterns, in agreement from Shariff et al. (16).

As per Table 9, gonococcal infection was strongly associated with urethral discharge among clinically suspected male patients, which is consistent with established clinical patterns, while other symptoms such as lower abdominal pain were not predictive of infection.

None of the female patients presenting with vaginal discharge and lower abdominal pain were confirmed to have a gonococcal infection (Table 10). Clinical diagnosis was based on presenting symptoms; however, laboratory confirmation is essential due to overlapping features with other sexually transmitted infections.

Antimicrobial susceptibility testing using the Kirby–Bauer disc diffusion method (Figure 3) was performed for 2 culture-positive cases; all isolates were sensitive to ceftriaxone, cefixime, and azithromycin (Table 11, Chart 1), supporting current treatment recommendations. Guidelines from the World Health Organization and Centres for Disease Control and Prevention, as cited by Workowski *et al.*, advocate ceftriaxone-based therapy as the standard of care [11,13]. The antibiogram (Chart 1) in this study demonstrates preserved efficacy of these agents. However, emerging reports of reduced susceptibility to extended-spectrum cephalosporins globally, as noted by Shariff et al, Sharma et al., and Unemo *et al.*, warrant continued vigilance [13,16]. Notably there was a significant resistance to penicillin, ciprofloxacin, and tetracycline (50% each) (Table 11, Chart 1). These findings are consistent with global and Indian trends reported by Unemo *et al.* and Juhi *et al.* [13,14], indicating widespread resistance to these antibiotics. The persistence of such resistance reflects the impact of irrational antibiotic use and underscores the need for antimicrobial stewardship.

All patients in this study achieved clinical cure with no treatment failures, indicating the effectiveness of current therapeutic regimens when appropriately administered. Nevertheless, the presence of resistance to multiple antibiotics highlights the importance of continuous antimicrobial surveillance. In conclusion, this study emphasizes the need for improved diagnostic strategies, particularly in females, targeted interventions in high-risk age groups, and sustained monitoring of antimicrobial resistance. Integration of clinical findings with microbiological data, supported by clear representation through tables and figures (Tables 1–12, Figures 1–3, Charts 1–2), is essential for effective disease management and control. Strengthening surveillance systems and adherence to treatment guidelines are critical to limiting the spread of resistant *Neisseria gonorrhoeae* strains.

CONCLUSION

The present study demonstrates a significant burden of gonococcal infection among young, sexually active individuals, with a male predominance. Conventional diagnostic methods showed limitations, particularly among female patients, highlighting the need for more sensitive diagnostic approaches such as molecular techniques.

A high level of resistance to commonly used antibiotics, including penicillin, ciprofloxacin, and tetracycline, was observed, indicating the persistence of multidrug-resistant *Neisseria gonorrhoeae* strains in this region. However, ceftriaxone, cefixime, and azithromycin remained highly effective.

These findings underscore the importance of continuous antimicrobial surveillance, adherence to standard treatment guidelines, and strengthening of national resistance monitoring programs. Early diagnosis, appropriate therapy, and routine screening of sexually transmitted infections are essential to reduce transmission, prevent complications, and limit the spread of antimicrobial resistance.

REFERENCES

1. World Health Organization. Global progress report on HIV, viral hepatitis and sexually transmitted infections. Geneva: WHO; 2023.
2. National AIDS Control Organisation (NACO). National Guidelines for STI/RTI Management. New Delhi: Ministry of Health and Family Welfare; 2023.
3. Singh V, et al. Antimicrobial resistance patterns in *Neisseria gonorrhoeae* in India: A recent update. *Indian J Med Microbiol.* 2024;42(2):145–150.
4. Workowski KA, et al. Sexually transmitted infections treatment guidelines. *MMWR Recomm Rep.* 2021 (updated guidance cited by CDC 2023).
5. Wasserheit JN. Epidemiological synergy between HIV and other STIs. *Sex Transm Dis.* 2023 update.
6. Unemo M, et al. Global antimicrobial resistance in *Neisseria gonorrhoeae*: current status and future challenges. *Lancet Infect Dis.* 2023;23(4):e123–e135.
7. Centers for Disease Control and Prevention. Antibiotic-resistant gonorrhea threat report. CDC; 2024.
8. Kumar P, et al. Emerging cephalosporin resistance in *Neisseria gonorrhoeae* isolates from South India. *J Clin Diagn Res.* 2025;19(1):DC01–DC05.
9. Bala M, et al. Epidemiology and antimicrobial resistance of *Neisseria gonorrhoeae* in India. *Indian J Med Res.* 2016.
10. Sharma D, et al. Risk factors and antimicrobial susceptibility of *Neisseria gonorrhoeae* among adolescents. *Indian J Sex Transm Dis AIDS.* 2024;45(1):15–18.
11. Centers for Disease Control and Prevention. Sexually Transmitted Infections Treatment Guidelines. CDC; 2021 (updated 2023–2024).
12. Unemo M, et al. Laboratory diagnosis of gonorrhoea. *Lancet Infect Dis.* 2017.
13. World Health Organization. Global Gonococcal Antimicrobial Surveillance Programme (GASP) report. WHO; 2023.
14. Juhi, et al. Antimicrobial susceptibility patterns of *Neisseria gonorrhoeae* isolates. *J Pure Appl Microbiol.* 2024;18(3):1580–1592
15. Mir, Bilal Ahmad; Sirwar, Siddesh Basawaraj; Vijayaraghavan, *Research Journal of Pharmacy and Technology; Raipur Vol. 8, Iss. 9, (Sep 2015): 1217-1220.*
16. Shariff VNSA, Balamurugan L, A study on antimicrobial sensitivity pattern in *Neisseria gonorrhoeae* in a tertiary care hospital. *Int J Res Med Sci* 2017;5:3960-5.