GENETRACK Diagnostics

Chlamydia and Gonorrhea

WHAT ARE CHLAMYDIA AND GONORRHEA ?

Chlamydia and gonorrhea are common sexually transmitted diseases (STDs) caused by bacterial infections. They are transmitted through sexual contact with the penis, vagina, mouth, or anus of an infected individual, and can also be transmitted from a mother with an untreated infection to her newborn during childbirth (1).

Chlamydia is caused by infection with the obligate intracellular bacterium *Chlamydia trachomatis*, a non-motile, gram-negative bacterial species of at least 15 serovars that can cause disease in humans. *C. trachomatis* has two distinct forms during its life cycle. Reticulate bodies are found only within host cells, while smaller elementary bodies surrounded by a rigid cell wall allow the bacteria to survive (but not replicate) outside a host cell, enabling the initiation of a new infection when it comes into contact with a susceptible host cell (2).

Gonorrhea is caused by infection with the bacterium *Neisseria gonorrhoeae*, which are gram-negative diplococci capable of moving using twitching motility. A process called antigenic variation enables *N. gonorrhoeae* to alter antigenic determinants on its surface to evade the immune system (3). This also contributes to the lack of an effective vaccine for gonorrhea (4).

SYMPTOMS

Many individuals with chlamydia or gonorrhea do not show any symptoms. For chlamydia, only an estimated 10% of infected males show symptoms and 5-30% of infected females (5). For gonorrhea, an estimated 85-90% of infected males show symptoms, but only ~20% of infected females (6).

The symptoms of chlamydia and gonorrhea can be very similar. Females may experience abnormal vaginal discharge, endocervical bleeding, increased urinary frequency, and dysuria (5, 7). Males can suffer from dysuria, frequent urination, abnormal urethral discharges, and testicular pain and swelling (8, 9).

Chlamydia and gonorrheal infections of the rectum may lead to rectal pain, discharge, itching, and bleeding (8, 10). Sexually acquired chlamydial conjunctivitis can also occur in both males and females (11). Pharyngeal gonorrheal infections are generally asymptomatic but may cause a sore throat (12).

COMPLICATIONS

Untreated chlamydial and gonorrheal infections in females can lead to pelvic inflammatory disease (PID), and PID-associated infertility, ectopic pregnancy, and chronic pelvic pain. Untreated chlamydia during pregnancy has been associated with preterm delivery (13), and untreated gonorrhea during pregnancy increases the risk of miscarriage and inflammation of the lining of the uterus (14).

Chlamydial and gonorrheal infections can be passed to newborns during delivery, increasing the risk of chlamydial conjunctivitis and pneumonia (15), and gonorrhea-associated eye infections and sepsis (16).

Complications in untreated males can include epididymitis, infertility, and prostatis (1). Other potential complications include gonococcal bacteremia, pharyngitis, and reactive arthritis. Chlamydial and gonorrheal infections also facilitate the transmission of HIV infection (1, 17)

PREVALENCE

Any sexually active individual is at risk of chlamydial and gonorrheal infection, with an increased risk among younger individuals. This is due to less consistent condom use (18), increased sexual partners, and reduced access to STD prevention services due to a lack of transportation, cost, and perceived stigma (19). In addition, cervical ectopy is more common among younger women, which may increase the susceptibility to infection (20).

Chlamydia is one of the most prevalent STDs in the US with 1,758,668 cases reported to CDC in 2018, corresponding to a rate of 539.9 cases per 100,000 population (1). However, due to many individuals remaining asymptomatic and not undergoing testing, annual chlamydia cases are estimated to be closer to 2.86 million (21). Gonorrhea is also a common STD in the US with 583,405 cases reported to the CDC in 2018, corresponding to a rate of 179.1 cases per 100,000 population (22).

50-60% of new chlamydia and gonorrhea infections occur in individuals aged between 15 and 24 years. Reported chlamydia rates are approximately two times higher in females compared to males, while gonorrhea rates are higher in males (22).

The prevalence of chlamydial and gonorrheal infections varies between racial and ethnic groups, with significantly higher rates among blacks compared to whites (22).

DIAGNOSIS

Historically, cell culture was considered the “gold standard” for detection of *C. trachomatis*, as it is quite specific, while gonorrhea was diagnosed by isolation of *N. gonorrhoeae* on selective media or observation of diplococci in Gram stained smears. Nowadays, modern nucleic acid amplification testing (NAAT) provides the most sensitivity and specificity for chlamydial and gonorrheal diagnoses. These can be performed on vaginal swabs (either clinician- or patient-collected) or urine (23).

TREATMENT

Chlamydia and gonorrhea are easily cured with antibiotics. However, repeat infections from sexual contact with an infected partner are common, which increase the risk of serious reproductive health complications, and antibiotics do not repair any permanent damage done by the disease. Condom use reduces, but does not eliminate, the risk of chlamydia and gonorrhea.

TESTING RECOMMENDATIONS FOR FEMALES

The CDC recommends that sexually active females aged 25 years and younger should be tested annually for chlamydia and gonorrhea. Annual testing is also recommended in females over 25 years of age who have risk factors for chlamydia and gonorrhea, such as a new partner or multiple sexual partners. The CDC also recommends chlamydia and gonorrhea screening in all pregnant women (16).

TESTING RECOMMENDATIONS FOR MALES

The CDC does not recommend routine chlamydia screening for males, aside from sexually active men who have sex with men, or in clinical settings with a high prevalence of chlamydia. However, annual gonorrhea screening is recommended for sexually active men aged 25 years and younger, and in males over 25 years of age who have risk factors for gonorrhea, such as a new partner or multiple sexual partners (16).

TEST PROCEDURE

Correct specimen collection and handling is required for optimal assay performance.

This test requires a first-void urine specimen collected at least 1 hour after previous urination. All supplies for sample collection are provided in this kit.

Collect 20-30 mL of first-void urine in the sterile urine collection container and transfer 2 mL to the urine specimen transport container using the disposable pipette provided. Transfer to the urine transport container must occur within 24 hours of collection, and liquid level must fall between the two black indicator lines on the tube label. Re-cap the urine transport container tightly. Seal in the transport bag and return to the laboratory in the provided prepaid return shipping envelope.

Maintain specimen at temperatures between 2°C and 30°C during storage and transport.

Upon receipt at the laboratory, the urine sample is analyzed by fully automated nucleic acid amplification testing procedures. *C. trachomatis* and *N. gonorrhoeae* rRNA is detected using nucleic acid hybridization, where single-stranded chemiluminescent DNA probes are combined with the rRNA amplicon to form stable RNA:DNA hybrids. Light emitted from the labeled RNA:DNA hybrids is measured as photon signals in a luminometer.

SPECIAL INSTRUCTIONS

- Repeat urine collection (at least 1 hour after previous urination) if more than 60ml of first-void urine is collected.
- Females should not clean the labial area prior to urine collection.
- Do not apply the transport medium directly to skin or mucous membranes or take internally.

TEST INTERPRETATION

- A positive result indicates that nucleic acid (rRNA) from the corresponding bacterium (*C. trachomatis* or *N. gonorrhoeae*) is present in the specimen tested and strongly supports a chlamydia or gonorrhea diagnosis.

- A negative result indicates that nucleic acid (rRNA) from the corresponding bacterium (*C. trachomatis* or *N. gonorrhoeae*) was not detected in the specimen tested. Additional specimens should be collected for testing if clinical symptoms strongly suggest a chlamydial or gonorrhea infection.

- An indeterminate result indicates that a new specimen should be tested.

DISCLAIMERS/LIMITATIONS

This report is not intended for use in medico-legal applications. These results are intended for screening and monitoring for chlamydia and gonorrhea and should be interpreted in conjunction with other laboratory and clinical information.

Correct specimen collection and handling is required for optimal assay performance. Blood, lubricants, spermicides, anti-fungal creams, human feces, cold sore medication, lip balm, toothpaste, anti-diarrheal medication, and antacids are not expected to cause interference in this assay.

The effects of tampon use, douching, and specimen collection variables have not been assessed for their impact on the detection of chlamydia or gonorrhea.

A negative result does not exclude the possibility of infection. False-negative test results may occur due to improper specimen collection, concurrent antibiotic therapy, presence of inhibitors, or organism levels below the sensitivity of this assay (which is common within 2 weeks post-exposure).

False-positive results are rare, but may be more frequent in low-prevalence populations. A false-positive result may also occur directly after successful antimicrobial therapy, as *C. trachomatis* and *N. gonorrhoeae* nucleic acids may persist for 3 weeks or more. For this reason, this test cannot be used for determining therapeutic success or failure.

The performance of this assay has not been evaluated in adolescents less than 14 years of age.

Female urine specimens may detect up to 10% fewer chlamydia and gonorrhea infections when compared with vaginal and endocervical swab specimens.

REFERENCES

(1) Sexually Transmitted Disease Surveillance, 2018. *CDC*.
(2) Elwell C, Mirrashidi K & Engel J (2016). Chlamydia cell biology and pathogenesis. *Nat Rev Microbiol*, 14 (6), 385-400.
(3) Stern A, et al. (1986) Opacity genes in Neisseria gonorrhoeae: control of phase and antigenic variation. *Cell*, 47 (1), 61-71.
(4) Hill SA, Masters TL, Wachter J (2016) Gonorrhea - an evolving disease of the new millenium. *Microb Cell*, 3 (9), 371-389.
(5) Farley TA, Cohen DA, & Elkins W (2003). Asymptomatic sexually transmitted diseases: the case for screening. *Prev Med*, 36 (4), 502-509.
(6) Gonorrhea Gonococcal Infection (clap, drip). *New York State Department of Health*. [Online] November 2006.
(7) McCormack WM, et al. (1977). Clinical spectrum of gonococcal infection in women. *Lancet*, 1 (8023), 1182-1185.
(8) Quinn TC, et al. (1981). Chlamydia trachomatis Proctitis. *N Engl J Med*, 305 (4), 195-200.
(9) Gonorrhea - Detailed Fact Sheet. *CDC*. [Online] November 2019.
(10) Klein EJ, et al. (1977). Anorectal gonococcal infection. *Ann Intern Med*, 86 (3), 340-346.
(11) Kalayoglu MV (2002). Ocular chlamydial infections: pathogenesis and emerging treatment strategies. *Curr Drug Targets Infect Disord*, 2 (1), 85-91.
(12) Wiesner PJ, et al. (1973). Clinical Spectrum of Pharyngeal Gonococcal Infection. *N Engl J Med*, 288 (4), 181-185.
(13) Rours GI, et al. (2011). Chlamydia trachomatis infection during pregnancy associated with preterm delivery: a population-based prospective cohort study. *Eur J Epidemiol*, 26 (6), 493-502.
(14) Gonorrhea. American Sexual Health Association. [Online]
(15) Hammerschlag MR, et al. (1982). Longitudinal studies of chlamydial infection in the first year of life. Pediatr Infect Dis, 1 (6), 395-401.
(16) Workowski KA & Bolan GA (2015) Sexually Transmitted Diseases Treatment Guidelines, 2015. *MMWR Recomm Rep*, 64 (RR-03), 1-137.
(17) Fleming DT & Wasserheit JN (1999) From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. *Sex Transm Infect*, 75 (1), 3-17.
(18) Eaton DK, et al. (2011) Youth risk behavior surveillance – United States, 2011. *CDC*.
(19) Kraut-Becher JR & Aral SO (2003). Gap length: an important factor in sexually transmitted disease transmission. *Sex Trans Dis*, 30 (3), 221-225.
(20) Singer A (1975). The uterine cervix from adolescence to the menopause. *Br J Obstet Gynaecol*, 82 (2), 81-99.
(21) Satterwhite CL et al. (2013). Sexually transmitted infections among US women and men: prevalence and incidence estimates. *Sex Trans Dis*, 40 (3), 187-193.
(22) Sexually transmitted Disease Surveillance 2018. *CDC*. [Online] October 2019. https://www.cdc.gov/std/stats18/.
(23) APHL. Laboratory Diagnostic Testing for Chlamydia trachomatis and Neisseria gonorrhoeae. *Expert Consultation Meeting Summary Report.* Atlanta : 2009.