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Opinion Article

Modern Approaches to Diagnosing Chlamydia trachomatis Infection

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DESCRIPTION

Chlamydia trachomatis remains the most frequently reported bacterial sexually transmitted infection worldwide, affecting millions of people annually. Its public health impact is largely driven by its ability to remain asymptomatic in the majority of infected individuals, resulting in under diagnosis, continued transmission and preventable long-term complications. Because untreated infections can lead to pelvic inflammatory disease, infertility, ectopic pregnancy, chronic pelvic pain and reproductive morbidity, accurate and accessible diagnostic methods are essential. Modern diagnostic strategies integrate highly sensitive molecular tools, expanded specimen options and broader screening approaches to ensure early identification and timely treatment.

The clinical presentation of Chlamydia varies, with many individuals experiencing no symptoms at all. Women may present with abnormal vaginal discharge, dysuria, lower abdominal pain, or postcoital bleeding, while men may experience urethral discharge or dysuria. However, due to the high proportion of asymptomatic infections, clinical symptoms alone are insufficient for diagnosis. This underscores the importance of routine testing in populations at elevated risk, including sexually active women under age 25, men who have sex with men, individuals with new or multiple partners and those with a history of other sexually transmitted infections.

Nucleic Acid Amplification Tests (NAATs are the gold standard for diagnosing *Chlamydia trachomatis*. These assays detect bacterial genetic material and offer superior sensitivity and specificity compared with older diagnostic methods. NAATs can be performed on a variety of specimen types, contributing to increased screening uptake and improved patient comfort. For women, vaginal swabs either clinician-collected or self-collected are considered the optimal sample type due to their excellent diagnostic performance. Self-collected specimens have become increasingly important in community-based testing initiatives and telemedicine settings. Endocervical swabs remain an option when pelvic examinations are performed for other clinical indications.

For men, first-void urine is the preferred specimen type and provides high sensitivity while offering convenience and noninvasive collection. Urethral swabs can also be used but are generally less favored due to discomfort. NAATs are also validated for extragenital specimens, including rectal and oropharyngeal swabs. Extragenital testing is particularly important for men who have sex with men and for individuals whose sexual practices place them at risk for infections outside the urogenital tract. These infections are frequently asymptomatic and would be missed without intentional site-specific testing.

Rapid Point-Of-Care Tests (POCTs) for Chlamydia have evolved significantly. Earlier antigen-based assays were hindered by low sensitivity, but newer rapid molecular tests now offer performance comparable to laboratory-based NAATs while providing results within 30 minutes. Although not yet as widely implemented due to cost and equipment considerations, rapid molecular POCTs hold promise for improving same-day diagnosis and treatment, reducing loss to follow-up and enhancing STI management in urgent-care settings, remote areas and resource-limited environments.

Other diagnostic methods, such as culture and direct fluorescent antibody tests, once played a larger role in Chlamydia detection but have largely been replaced by NAATs due to their lower sensitivity and more demanding laboratory requirements. Nevertheless, culture remains important in specific contexts, such as forensic investigations of child sexual abuse or research requiring viable organisms. Serologic tests have limited value for diagnosing acute infection because antibody responses develop slowly and cannot reliably distinguish between past and current infection. They are mainly used in research or in evaluating chronic complications, such as suspected Chlamydia-related infertility.

Interpreting Chlamydia test results requires attention to timing, specimen quality and potential coinfections. Testing too soon

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after exposure may lead to false-negative results, as bacterial loads may be insufficient for detection. Coinfection with Neisseria gonorrhoeae is common, prompting routine dual testing in many clinical settings. Because reinfection after treatment is frequent, CDC guidelines recommend retesting approximately three months after treatment, regardless of symptoms or perceived risk.

Advances in diagnostic technologies have also expanded access to screening. Home-based collection kits, mobile testing units and digital health platforms have reduced barriers related to stigma, privacy and clinic access. Multiplex molecular panels, which simultaneously test for multiple STIs, are increasingly used in clinical practice and allow for comprehensive evaluation from a single specimen. These innovations support public health strategies aimed at early diagnosis, expanded screening and improved linkage to care.

In conclusion, diagnosing *Chlamydia trachomatis* infection today relies on sensitive molecular techniques, diverse specimen collection methods and targeted screening strategies that address the silent nature of the infection. NAATs remain the cornerstone of diagnosis, offering exceptional accuracy and versatility. Continued advancements in rapid testing technologies and expanded access to screening will further strengthen efforts to reduce transmission, prevent complications and improve sexual health outcomes across diverse populations.