Chapter

Chlamydia Infection from Androgical Perspective

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Abstract

Chlamydia trachomatis is a microorganism known for years to cause ocular, urogenital, and neonatal infections in humans. It usually causes urogenital system infections. The pathogen, which is the most common cause of urethritis in males, is one of the sexually transmitted microorganisms. As most males are asymptomatic, they do not realize they are infected and act as reservoirs. This causes the incidence of urethritis due to chlamydia to increase day by day. Chlamydia urethritis, which poses a risk to sexual partners, can cause serious complications if left untreated. In this section, we assess the approach to male urethritis due to chlamydia, which is very common in urology practice and can cause serious problems if left untreated.

Keywords: Chlamydia, male urethritis, sexually transmitted disease

1. Introduction

Urethritis is an inflammation of the urethra, a fibromuscular tube through which urine and semen pass. The main cause of urethral inflammation is infection by sexually transmitted bacteria. Bacterial agents associated with urethritis are classified as gonococcal and nongonococcal [1]. Nonspecific urethritis is a term used for urethritis caused by nongonococcal and nonchlamydial pathogens [2]. *Chlamydia trachomatis* is one of the leading causes of nongonococcal urethritis [3]. Together with the gonococcal pathogen *Neisseria gonorrhoeae*, they are the most common causes of sexually transmitted infections in men and women [4].

Other common pathogens of nongonococcal urethritis are *Mycoplasma genitalium*, *Ureaplasma urealyticum*, and *Trichomonas vaginalis* [5]. The role of *Ureaplasma parvum* and *Mycoplasma hominis* in urethritis is controversial. There is strong evidence that *M. hominis* can cause urethritis at high microbial loads. However, *U. parvum* is regarded more as a commensal bacterium of the normal microflora and is not considered a urethritis pathogen [6].

Pathogens that are occasionally detected in patients with urethritis but rarely identified as causes of infectious urethritis include herpes simplex virus, adenoviruses, *Treponema pallidum* (endourethral chancre), *Haemophilus influenzae*, *Candida*, *Neisseria meningitis*, *Escherichia coli*, and streptococci. These are transmitted by direct contact *via* the oral, anal, or vaginal route, depending on their location [7].

In some men with urethritis, no known pathogen can be detected. Some of these cases are noninfective. However, there may not be sufficient clinical and laboratory findings to clearly distinguish them from possible infective urethritis [8].

Rare causes of noninfectious urethritis include trauma caused by urethral catheterization and instrumentation, foreign body insertion, or cycling; friction due to tight clothing or sexual intercourse; and exposure to irritants such as soap, powder, and spermicide [9].

C. trachomatis is a small, gram-negative obligate intracellular microorganism in the chlamydial bacterial family. It preferentially infects squamocolumnar epithelial cells. *C. trachomatis* has many serotypes, and serovars D-K infect the genital tract [10].

Unlike other bacteria, *C. trachomatis* has a biphasic life cycle. During this life cycle, they assume two forms called the elementary body (EB) and reticular body (RB). The EB is a metabolically inactive, infective form that is resistant to environmental conditions. In contrast, the RB is a metabolically active form that is not infective but has the ability to multiply within host cells. Between 48 and 72 h after infection, the host cell ruptures and *C. trachomatis* returns to the EB form to infect other cells. Once inside the epithelial cells, there is a neutrophilic response followed by lymphocyte, macrophage, plasma cell, and eosinophilic invasion. Infected epithelial cells release cytokines and interferon, initiating an inflammatory cascade. Thus, *C. trachomatis* induces a humoral and cellular response and causes the symptoms of urethritis [10].

2. Epidemiology

C. trachomatis was first isolated in the genital tract in the 1950s. However, it was not assigned much importance until the 1990s because of the high asymptomatic rate in both genders [11]. Since the late 1990s, *C. trachomatis* has been the most frequently reported sexually transmitted disease in Europe and America. In 2017 in the United Kingdom (UK), 203,116 people were diagnosed with new *C. trachomatis* infections, while 44,676 were diagnosed with *N. gonorrhoeae* infections and 7137 were diagnosed with syphilis [12].

The actual number of people infected with *C. trachomatis* is believed to be much higher due to the fact that the disease is mostly asymptomatic and goes undiagnosed. Its prevalence is 1–40%, depending on the population [11]. In the UK, a screening of people aged 15–24 conducted by the National Chlamydia Screening Programme detected more than 126,000 genital chlamydia infections [12].

In 2018, the incidence of chlamydial urethritis was 381 per 100,000 men in the United States of America (USA), making *Chlamydia* the most commonly detected and reported urethritis pathogen. In the same study, the incidence of gonococcal urethritis was 213 per 100,000. Every year, 4 million Americans are affected by urethritis. About 600,000 of these are gonococcal, while 3 million are nongonococcal urethritis, half of which are caused by *Chlamydia* [9]. In one study, *N. gonorrhoeae* was detected in 127 (30%) of 424 male patients with acute urethritis, while *Chlamydia* was detected in approximately 143 (33%) [13]. The reported rate of urethritis increased by 36% between 2008 and 2018. This rising trend is also being observed in Europe according to a report from the European Centre for Disease Prevention and Control [14]. The rate of newly diagnosed chlamydial infections continues to rise. In a study conducted in the USA, the rate of newly diagnosed chlamydial infections increased by 4.7% between 2015 and 2016 [15].

This rapid increase in the prevalence of *Chlamydia* is also related to technological advances in diagnostic methods since the 1990s. Advancements in polymerase chain reaction technologies in particular led to the development of nucleic acid amplification tests (NAATs) [16]. With this method, extracted *Chlamydia* DNA fragments can be replicated to achieve sufficient samples for colorimetric evaluation, increasing the applicability and sensitivity of the test [17]. These assays are more effective than culture-based methods and could be used more widely in screening and diagnosis, resulting in a higher *Chlamydia* detection rate. However, the high rate of asymptomatic infection causes problems in the evaluation of infected individuals in health centers, leading to delays in diagnosis and treatment [18]. Therefore, the actual prevalence is much higher [19].

In a similar study, it was determined that the prevalence of *Chlamydia* infection peaked between the ages of 16 and 24 and was comparable in men and women [20]. The prevalence of *Chlamydia* infection was reported to be highest in women between the ages of 15 and 30, while in men it is seen between the ages of 20 and 29 [19]. The prevalence decreases rapidly after the age of 30 [20].

In a meta-analysis spanning 9 European countries, the prevalence of *Chlamydia* infection was found to be 2.7%, and there was no statistically significant difference in prevalence between men and women [19]. *Chlamydia* has been detected at a higher rate in African-Americans than in whites [15].

In a study conducted by Sonnenberg et al. on the British population, the rate of *Chlamydia* infection was found to be higher in those with gonorrhea. This was attributed to the fact that people with risky sexual behavior are more likely to encounter different pathogens. For this reason, gonococcal and nongonococcal infections can often occur concurrently [14]. There may be two pathogens in nongonococcal urethritis. The association of *M. genitalium* and *C. trachomatis* is not uncommon [7]. In some studies, dual infection was identified in up to 10% of cases [21].

In a study by Newbernet et al., adolescents with sexually transmitted diseases had twice the risk of contracting HIV infection compared to those without. Similarly, those who had a previous genital herpes infection were at increased risk of chlamydial, gonorrheal, and human papillomavirus (HPV) infection [14]. Other risk factors for urethritis include having multiple sexual partners at the same time, insufficient condom use, and having more than three different partners who are homosexual or bisexual. In addition, alcohol and other drug use can increase urethritis rates by contributing to risky sexual behaviors in young people [14].

3. History and physical examination

Chlamydial urethritis is asymptomatic in 75% of women and nearly 50% of men [11]. As men are more likely to be symptomatic than women, the diagnosis rate is reported to be higher in males [9]. The factors that determine whether the infection will be symptomatic or not remain unclear. The more common serovar E is known to cause more asymptomatic infections than other less common serotypes. For this reason, it is not uncommon for diagnosis and treatment to be delayed and the infection to persist for months or years. These patients are reservoirs for the disease [11]. In chronic chlamydial infection, RBs do not transform into EBs. When the environmental conditions change, *Chlamydia* can resume its life cycle [22].

Most patients are young and have history of unprotected sexual intercourse, previous urethritis, and antibiotic use. Transmission occurs through direct tissue contact during

vaginal, anal, or oral intercourse. Symptoms begin 1–3 weeks after transmission [10] and generally include burning, urethral discharge, urethral itching, frequent urination, urgency, and/or lower abdominal and groin pain. The most common symptom of chlamydial urethritis is painful urination. More rarely, it may cause fever, testicular pain and tenderness, sore throat, and rectal pain and discharge. These must be differentiated from other infectious processes such as epididymitis, pharyngitis, and prostatitis [15].

Ideally, genital examination should be performed 2 h after last urination to detect urethral discharge. If discharge is not seen in the urethra, the clinician can attempt to express it by placing the thumb on the ventral root and the other four fingers on the dorsal surface of the penis and applying gentle pressure toward the urethral meatus. Although it is difficult to make a differential diagnosis based on clinical examination of discharge, a gray-white mucoid or clear discharge is more common in nongonococcal urethritis, whereas purulent discharge is typically seen in gonococcal infections. However, generalization is not reliable. Discharge may be seen continuously or only when the penis is milked, in the morning, or the form of underwear staining [15].

In addition, scrotum and testicle examination is performed to assess for epididymitis and orchitis. If prostatitis is suspected, rectal examination should be performed [7]. As it can also cause ulcers and lymphadenitis and coexist with other sexually transmitted diseases, the skin, pharynx, lymph nodes, and neurological system should also be evaluated in addition to the genital area in men with urethritis [23].

Urethritis is usually diagnosed based on history and physical examination, but laboratory tests should be used to confirm the diagnosis and identify the causative pathogen.

4. Evaluation

In patients whose history and physical examination suggest urethritis, Gram staining of urethral discharge is the first-line laboratory test, and detection of >5 white blood cells (WBC)/per oil immersion field allows a rapid diagnosis of urethritis. In some publications, >2 WBC/high power field (HPF) was used as the threshold value based on the argument that this would provide a more sensitive diagnosis. However, this has not been supported by other studies. The cut-off value accepted by the European Association of Urology (EAU) is >5 polymorphonuclear lymphocytes (PMNL)/HPF. This method has high specificity and sensitivity both for the diagnosis of urethritis and determining the presence or absence of gonococcal infection [24].

A positive leukocyte esterase test of first-void urine or >10 WBC/HPF in the sediment of first-void urine is also diagnostic criterion for urethritis [25].

Chlamydia is not detectable by Gram staining because it is a small obligate cell-borne parasitic bacteria. In a patient with pyuria and suspected urethritis based on history and physical examination, detecting no bacteria on Gram staining raises a strong suspicion of nongonococcal urethritis pathogens, most of which are *Chlamydia* [26].

All male patients with suspected urethritis should undergo NAATs, which are the gold standard for the diagnosis of *N. gonorrhoeae* and *C. trachomatis*, the most common urethritis pathogens. *N. gonorrhoeae* should be included in the NAAT panel even if it was not detected in Gram staining [25]. Even if gonococci were detected in Gram staining, there may be a concurrent chlamydial infection, so evaluation with NAATs should still be done [7].

Methods used in the diagnosis of *C. trachomatis* infection include cytological examination, cell culture, antigen quantification, direct fluorescent antibody tests, enzyme

immunoassays, and NAATs if nucleic acid from the pathogen is detected. Among these, NAATs have the highest sensitivity [27]. This method has found widespread use worldwide [16]. Whereas, only urethral swab samples can be used for cultures and hybridization tests, NAATs can also be done using a first-void urine sample, with similar efficacy. NAATs work by amplifying and detecting chlamydial DNA from a very small number of organisms in clinical samples using specific primers and enzymes [10].

C. trachomatis culture is mostly used in treatment failure and to assess resistance to administered treatment [2]. As obligate intracellular parasites, *Chlamydia* cannot be grown in culture media. The living cell environment is necessary for their reproduction [28]. Therefore, as cell culturing requires an experienced team and a well-equipped laboratory, is difficult, and takes time, the use of this technique in the diagnosis of *C. trachomatis* has been replaced in recent years by nucleic acid screening tests, which are molecular techniques that provide faster results and have high specificity and sensitivity. NAAT is the gold standard diagnostic method for urogenital chlamydial infection and can be performed using urethral swab samples collected with a Dacron- or rayon-tipped plastic swab or cytobrush, or using first-void urine. Other swabs containing cotton may inhibit *C. trachomatis* [29]. Sampling is done by inserting a dry swab 3–4 cm into the anterior urethra and rotating it within the urethra before withdrawing. However, the patient should not have urinated in the last 1–2 h [20]. Likewise, for NAATs of first-void urine, the patient should not have urinated within the last 20–60 min. A sample of 10–20 mL is collected at the start of urination without cleaning the urethra. Some publications indicate that urethral swabs are less sensitive than urine in men but have the same specificity [10].

In men who have sex with men, samples for *Chlamydia* and *N. gonorrhoeae* testing should be obtained from the sites of possible sexual contact [2]. Although a normal urine sample is negative in these patients, it should not be forgotten that 70% of extragenital (oral and/or anal) sites may yield positive NAAT results [3].

If the urethral smear is normal and symptoms are inconclusive, repeating the smear in the morning with first-void urine is recommended. The patient should be advised to avoid excessive fluid intake the day before to ensure that urination is not urgent in the morning and they can give a first-void urine sample in the laboratory. If a symptomatic man has a negative smear, a positive leukocyte esterase test of first-void urine aids in the diagnosis of urethritis [2].

The EAU guideline also strongly recommends NAATs for chlamydia and gonorrhea before empirical treatment, if possible. However, treatment should be initiated immediately upon diagnosing urethritis in men with severe symptoms, without waiting for the results of chlamydia, gonorrhea, and *M. genitalium* tests. Patients with mild symptoms and microscopically low leukocyte counts (5–15 PMNL/HPF) are reevaluated after 3–7 days. A urethral smear is obtained early in the morning. NAAT and gonorrhea culture results are also examined when available. Urethritis can sometimes resolve spontaneously without treatment. If laboratory tests are positive and the urethritis persists according to microscopic findings, appropriate antibiotic treatment targeting the microorganism isolated at this second visit should be initiated, bearing local resistance patterns in mind [2]. If symptoms do not resolve in 3–4 weeks, urethritis is classified as persistent. In this case, evaluation with NAATs (including for *T. vaginalis*) should be repeated 4 weeks after the end of treatment [25]. Because men with chlamydial, gonorrheal, or trichomonal infections are at high risk of reinfection, they should be reevaluated by repeating the tests 3 months later. Although it is not an FDA-approved test for *Trichomonas* and *Mycoplasma*, NAAT is performed in many reference and commercial laboratories [7].

The immune response can affect the development of nongonococcal urethritis. A high microbial load (>1000/copies/mL in first-void urine) is a strong predictor of nongonococcal urethritis [2].

5. Treatment/management

The treatment of uncomplicated chlamydial infection aims to cure the patient and prevent complications and partner transmission. Sexual partners are also treated to prevent reinfection and transmission to other partners. Risk-reduction counseling should be provided and retesting performed to detect recurrent or persistent infection [10].

As *Chlamydia* is only metabolically active in host cells, it is treated with antibiotics that have intracellular activity. Antibiotics that accumulate intracellularly are tetracyclines, macrolides, and quinolones. Patients who are diagnosed and treated generally have a high cure rate and excellent prognosis [20].

For uncomplicated urethral chlamydial infection, single-dose azithromycin 1 g or doxycycline 100 mg twice daily for 1 week is recommended as the primary treatment and is reported to have a 95% cure rate [10]. However, a Cochrane study in 2019 indicated that 7-day doxycycline yielded higher cure rates than single-dose azithromycin [3]. However, because the use of azithromycin 1 mg causes resistance in *M. genitalium*, doxycycline 100 mg twice a day is now recommended as first-line treatment. If azithromycin is administered, it is recommended to give 500 mg on the first day, followed by 250 mg daily for 4 days [2]. However, no difference has been observed between single-dose azithromycin and 7-day doxycycline in terms of the resolution of persistent urethritis symptoms. Due to the worse adverse effect profile of doxycycline and better patient adherence to single-dose azithromycin, the latter continues to be used in clinical practice [3].

In two recent randomized controlled studies conducted in the USA, the efficacy of azithromycin and doxycycline in achieving a clinical cure was found to be less than 85% [2]. The use of lymecycline 300 mg twice daily for 10 days or tetracycline 500 mg twice daily for 10 days provided >95% clinical cure rate in *Chlamydia*-positive patients. In addition, these antibiotics did not increase photosensitivity, unlike doxycycline [2]. It seems that new approaches may emerge in this direction. Other alternative antibiotic regimens for *Chlamydia* are oral tetracycline 500 mg 4 times a day for 7 days, oral erythromycin 500 mg twice a day for 7 days, or oral ofloxacin 200–400 mg 2 times a day for 7 days [29].

Chlamydial infection is often accompanied by gonococcal infection [29]. If NAAT or Gram staining demonstrates the presence of gonococci, a single-dose 250 mg intramuscular injection of ceftriaxone is added to the 1 g of azithromycin [15].

Empirical therapy should not be initiated without clarifying a diagnosis of urethritis, because this can cause the symptoms to become permanent [2]. In addition, antibiotic resistance and urethritis caused by different microorganisms are other reasons to avoid empirical therapy [14]. Empirical treatment can only be given in exceptional cases. If the test cannot be performed or if a man with a high risk of infection is severely symptomatic, empirical therapy can be initiated based on a presumed diagnosis. Treatment should cover *Chlamydia* and gonorrhea [2].

It is difficult to evaluate the effectiveness of treatment because persistent inflammation does not equate to continuing infection. Detectable inflammation can persist for an unforeseeable period even if the causative pathogen is eliminated [2]. NAATs performed in the first 3 weeks after completing treatment may yield false positive results. Therefore, follow-up testing is not recommended in this period [3].

Men who have frequent unprotected sexual relations with men have a high risk of chlamydial urethritis and should be screened more frequently. In one study, it was found that single-dose doxycycline decreased the prevalence of chlamydial infection after suspicious intercourse between men without a condom [3]. However, this approach has not yet gained widespread acceptance. It may be beneficial to screen treated patients after 3 months and include patients in a follow-up program after discussing with them, by this has not been incorporated into routine care [10].

Partner therapy is recommended for patients with urethritis. The partners with whom the patient has had sexual intercourse within the last 60 days should be evaluated for sexually transmitted diseases and administered the same treatment regimen as the primary patient. The sexual partner should be treated in accordance with the principles of patient confidentiality [25].

Expedited treatment without examining the partner is legal in many countries and was found to be more effective than recommending partner treatment [3]. In chlamydial, gonorrheal, and trichomonal infections, partners should be called for follow-up testing after 3 months if possible because of the high reinfection rates [14].

Nevertheless, relapse and untreated reinfections from old or infected new partners are common [29]. Recurrent nongonococcal urethritis is defined as recurrence of symptoms within 30–90 days after acute treatment and occurs at a rate of 10–20% [2]. One study indicated that up to 20% of chlamydial infections were persistent or recurrent despite initial treatment [14].

Patients with recurrent or persistent symptoms should be reevaluated to determine whether they completed the full course of initial treatment and whether they were re-exposed to the pathogen. The same initial treatment should be repeated for untreated patients, received incomplete treatment, or encountered the pathogen again [7].

If only *Chlamydia* and gonorrhea were initially tested for in men with persistent nongonococcal urethritis, NAATs for *M. genitalium* and *T. vaginalis* should also be performed [2]. *M. genitalium* is the most common cause of recurrent and persistent nongonococcal urethritis. Therefore, a treatment regimen targeting this pathogen is important [15]. Coinfection and less common pathogens should also be investigated in persistent urethritis. The possibility of a persistent postinfectious immune response should be kept in mind. If a cause cannot be identified, underlying urinary tract anomalies and urethral pathologies should be evaluated [14].

6. Complications

Reinfection is common, and sequelae associated with complications are likely to increase with multiple infections. Untreated or inadequately treated patients may develop epididymitis and orchitis. These conditions can develop after urethritis or in the absence of urethritis. Symptoms are milder than with other causes of epididymitis [20]. It manifests with unilateral testicular pain, tenderness, and palpable swelling along with hydrocele and fever, whereas lymphogranuloma venereum presents clinically as a painless genital ulcer. The ulcer is typically small and star-shaped. After ulcer formation, inguinal lymphadenitis is also characteristic [29]. Testicular involvement can cause pyogranulomatous changes in the testicle. This may lead to testicular degeneration, resulting in serious andrological sequelae [20].

It can also cause serious complications such as chronic prostatitis/chronic pelvic pain and infertility. *C. trachomatis* has been the focus of attention in cases of chronic prostatitis/chronic pelvic pain of unclear etiology. Although the evidence is debatable,

significantly more *Chlamydia* bacteria were reportedly detected in the urine, semen, and prostate fluid and tissue of patients with chronic prostatitis compared to the control group [10]. Studies on this subject are still ongoing, and its etiological role has not been fully clarified due to the diagnostic challenges.

Another serious complication of incomplete or untreated chlamydial infection is infertility. Asymptomatic persistent infection can negatively affect fertility in couples by causing chronic inflammation [11]. Studies evaluating the relationship between chlamydial infection and sperm quality have yielded conflicting results. Recent studies have generally demonstrated lower ejaculate quality in infected individuals. Persistent infection has been observed to cause scarring in the ejaculatory ducts and loss of stereocilia. In addition, some studies have associated infection with DNA fragmentation and sperm dysfunction, and death [10].

It should be kept in mind that chlamydial infections in women can also cause serious complications such as infertility, pelvic inflammatory disease, ectopic pregnancy, and Fitz-Hugh-Curtis syndrome [9]. *C. trachomatis* is also a common cause of symptomatic proctitis and proctocolitis in homosexual men [29].

7. Prevention and patient education

The high prevalence of asymptomatic chlamydial urethritis is gradually increasing the rate of undiagnosed or untreated infections. Therefore, screening is protective. At least annual follow-up of all sexually active women under 25 years of age and women over 25 years of age who are at risk for sexually transmitted infections is also recommended to reduce the rate of male infection. These screening programs have been shown to decrease the prevalence of infection and rates of complications. There is insufficient evidence for the efficacy and cost-effectiveness of routine *Chlamydia* screening in sexually active young men. However, in risky and high-prevalence areas, performing this screening to the extent allowed by clinical conditions is beneficial [29].

Risk groups include:

- people who have sex with people who have multiple sexual partners.
- people with new or multiple sexual partners.
- people in nonmonogamous relationships who have inconsistent condom use.
- people who pay for sex.
- people who have sex with people who are infected or have a history of infection.
- men who have sex with men.
- HIV carriers.
- women up to 35 years of age and men under 30 years of age who go to prison [29].

Patients with chlamydial infection should also be evaluated for other sexually transmitted diseases such as gonorrhea, syphilis, and HIV. The diagnosis and treatment of sexual partners are also important [29].

In many countries, notification of *C. trachomatis* infection is mandatory. The sexual partner must be informed, examined, and treated. Partner antibiotic therapy can also be performed in some cases without face-to-face contact with the patient to expedite treatment.

Patients should be informed about the serious risks of chlamydial infection and the importance of screening. Those who feel uneasy about urethral swap sampling for diagnosis should be tested using a first-void urine sample and prevented from leaving without being screened.

In the USA and other developed nations, the prevention of sexually transmitted genital infections and their complications is based on annual screening and treatment of nonpregnant women under the age of 25. In the presence of a risk factor, other women should also be screened. High-risk young men should also be screened if resources allow [29].

Health workers and nurses should educate patients about the importance of using condoms during sex and provide information about safe sex. Candid communication with the patient and helping them feel comfortable are essential in diagnosis, treatment, and follow-up [9].

Early treatment and full-dose antibiotics provide a near-perfect cure rate. Urethral infection with *C. trachomatis* produces a low-level immunological response [20]. The rise of chlamydial infections, for which there is not yet a vaccine, can be prevented by completed treatment, patient education, and screening.

The American Centers for Disease Control and Prevention (CDC) recommend that a sexual history should be obtained from patients and risk reduction strategies recommended when deemed necessary. In addition, the U.S. Preventive Services Task Force recommends that all sexually active adolescents and adults at risk of sexually transmitted infections be provided intensive counseling [3].

Patients should not engage in sexual intercourse for at least 7 days after the completion of treatment and sex should only be allowed after their partner has also completed treatment and symptoms have fully resolved [3].

Patients with urethritis should be vaccinated for other infectious diseases for which vaccines are available (hepatitis A/B, HPV).

The use of condoms reduces the risk. Selective sexual intercourse should be practiced and uncontrolled intercourse avoided. Circumcision was found to be beneficial in terms of genital ulcers and HPV, but ineffective in terms of transmission of *C. trachomatis* and gonorrhea [3].

When a sexually transmitted infection is detected, the patient should be educated by a team including physicians and trained healthcare professionals. Adequate sensitivity should be shown to patients regarding partner treatment and recurrence. An environment where patients feel safe and comfortable should be provided to enable the patient to ask questions and ensure accurate history-taking. If the patient does not feel safe, it will be difficult to obtain a detailed sexual history. This causes delays in diagnosis and treatment. Providing diagnosis and treatment with a professional approach will help curb the rapid rise of this disease [9].

8. Conclusion

Chlamydial urethritis involves difficulties in diagnosis and treatment [14]. *C. trachomatis* is an important pathogen in male urogenital system disease. There is robust evidence that the bacterium is a cause of epididymitis and orchitis, and also

plays a role in the etiopathogenesis of chronic prostatitis and infertility. Early diagnosis, complete treatment, and prevention methods are essential for this infection, which also poses a serious risk for sexual partners. As its prevalence continues to rise substantially, a well-coordinated team approach has become imperative for patients infected with *C. trachomatis*.

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References

[1] Sarier M et al. Microscopy of Gram-stained urethral smear in the diagnosis of urethritis: Which threshold value should be selected? Andrologia. 2018;**50**(10):1. DOI: 10.1111/and.13143

[2] Horner PJ, Blee K, Falk L, van der Meijden W, Moi H. 2016 European guideline on the management of non-gonococcal urethritis. International Journal of STD AIDS. 2016;**27**(11):928-937. DOI: 10.1177/0956462416648585

[3] Sell J, Nasir M, Courchesne C. Uretritis rapid evidence. American Family Physician. 2021;**103**(9):553-558

[4] Burstein GR, Zenilman JM. Nongonococcal urethritis-A new paradigm. [Online]. Available from: https://academic.oup.com/cid/article/28/Supplement_1/S66/412243

[5] Jordan SJ et al. No pathogen-specific sign or symptom predicts the etiology of monomicrobial nongonococcal urethritis in men. Sex Transmitted Diseases. 2020;**47**(5):329-331. DOI: 10.1097/OLQ.0000000000001158

[6] Sarier M, Kukul E. Classification of non-gonococcal urethritis: A review. International Urology and Nephrology. 2019;**51**(6):901-907. DOI: 10.1007/s11255-019-02140-2

[7] Perkins MJ, Decker CF. Non-gonococcal urethritis. Disease-a-Month. 2016;**62**(8):274-279. DOI: 10.1016/j.disamonth.2016.03.011

[8] Sarıer M, Duman İ, Göktaş Ş, Kukul E. Results of multiplex polymerase chain reaction assay to identify urethritis pathogens. Journal of Urological Surgery. 2017;**4**(1):18-22. DOI: 10.4274/jus.1328

[9] Young A, Toncar A, Wray AA. Urethritis. Treasure Island (FL): StatPearls; 2022. Available from: https://www.ncbi.nlm.nih.gov/books/NBK537282/

[10] Murray PR, Baron EJ. Manual of Clinical Microbiology. 9th ed. Washington D.C: ASM Press; 2007

[11] Mackern-Oberti JP, Motrich RD, Breser ML, Sánchez LR, Cuffini C, Rivero VE. *Chlamydia trachomatis* infection of the male genital tract: An update. Journal of Reproduction Immunology. 2013;**100**(1):37-53. DOI: 10.1016/j.jri.2013.05.002

[12] Worboys M. Chlamydia: A Disease without a History. In: Szreter S, editor. The Hidden Affliction: Sexually Transmitted Infections and Infertility in History. Rochester (NY): University of Rochester Press; Oct 2019. Chapter Five. PMID: 31580630

[13] Bradshaw CS. et al. Etiologies of nongonococcal urethritis: Bacteria, viruses, and the association with orogenital exposure. 2006. [Online]. Available from: https://academic.oup.com/jid/article/193/3/336/2191545

[14] Bartoletti R et al. Management of urethritis: Is it still the time for empirical antibiotic treatments? European Urology Focus. 2019;**5**(1):29-35. DOI: 10.1016/j.euf.2018.10.006

[15] Territo H, Ashurst JV. Nongonococcal Urethritis. Treasure Island (FL): StatPearls; 2022. https://www.ncbi.nlm.nih.gov/books/NBK535411/

[16] Sarier M. Polymerase chain reaction assay in acute urethritis. Andrologia. 2019;**51**(8):1. DOI: 10.1111/and.13366

[17] Meyer T. Diagnostic Procedures to Detect Chlamydia trachomatis Infections. Microorganisms. 5 Aug 2016;**4**(3):25. DOI: 10.3390/microorganisms4030025. PMID: 27681919; PMCID: PMC5039585

[18] Sarier M et al. New approach to microscopy of gram-stained urethral smear: The Kissing Slide Method. Sex Transmitted Diseases. 2020;**47**(10):712-715. DOI: 10.1097/OLQ.0000000000001228

[19] Fischer N et al. Prevalence estimates of genital *Chlamydia trachomatis* infection in Belgium: Results from two cross-sectional studies. BMC Infected Diseases. 2021;**21**(1):2. DOI: 10.1186/s12879-021-06646-y

[20] Wagenlehner FME, Weidner W, Naber KG. Chlamydial infections in urology. World Journal of Urology. 2006;**24**(1):4-12. DOI: 10.1007/s00345-005-0047-x

[21] Sarıer M. Prevalence of polymicrobial infection in urethritis. Journal of Urological Surgery. 2019;**6**(3):180-183. DOI: 10.4274/jus.galenos.2019.2405

[22] Morrison RP. New insights into a persistent problem- Chlamydial infections. Journal of Clinical Investigation. 2003;**111**(11):1647-1649. DOI: 10.1172/JCI18770

[23] Barrow RY, Ahmed F, Bolan GA, Workowski KA. Recommendations for Providing Quality Sexually Transmitted Diseases Clinical Services, 2020. MMWR Recomm Rep. 2020;**68**(No. RR-5):1-20. DOI: 10.15585/mmwr.rr6805a1

[24] Moi H, Hartgill U, Skullerud KH, Reponen EJ, Syvertsen L, Moghaddam A. Microscopy of stained urethral smear in male urethritis; which cutoff should be used? Sex Transmitted Diseases. 2017;**44**(3):189-194. DOI: 10.1097/OLQ.0000000000000565

[25] Bonkat G, Bartoletti R, Bruyère F, Cai T, Geerlings SE, Köves B, et al. Guidelines on urological infections. European Association of Urology. 2022;**3**:30-34. Available from: http://uroweb.org/guideline/urological-infections

[26] Bachmann LH et al. Advances in the understanding and treatment of male urethritis. Clinical Infectious Diseases. 2015;**61**:S763-S769. DOI: 10.1093/cid/civ755

[27] Sarier M et al. Prevalence of sexually transmitted diseases in asymptomatic renal transplant recipients. Experiment in Clinical Transplantation. 2018;**2018**:1, 4. DOI: 10.6002/ect.2017.0232

[28] Mabey DCW, Solomon AW, Foster A. Trachoma. Lancet. 2003;**362**:223-229

[29] Mohseni M, Sung S, Takov V. Chlamydia. Treasure Island (FL): StatPearls; 2022. Available from: https://www.ncbi.nlm.nih.gov/books/NBK537286/