



Prevalence of *Chlamydia trachomatis* in vaginal swab samples from women diagnosed with pelvic inflammatory disease or presenting with clinical complaints

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ABSTRACT

Objective: *Chlamydia trachomatis* (CT) represents a major global health concern with over 130 million annual infections. Epidemiological data remain limited in Eastern Anatolia, Türkiye. This study determined CT prevalence among women presenting with pelvic inflammatory disease (PID) or genital symptoms in this region.

Materials and Methods: Vaginal and cervical specimens from 100 female patients attending gynecology services at a university hospital in Eastern Anatolia during 2025 were examined. Participants presented with genital discharge, burning during urination, and pain during sexual intercourse. DNA extraction utilized the NucleoGene kit, followed by polymerase chain reaction (PCR) amplification targeting the cryptic plasmid with primers KL1 and KL2. Products showing 241 bp bands were considered positive.

Results: Among 100 participants (mean age 36.3 years), PCR identified CT in 14 samples (14%). The mean age of CT-positive cases was 34.5 years. Clinical presentations included 5 PID diagnoses, 90 vaginal discharge complaints, and 5 routine examinations. CT was detected in one PID case (20%) and thirteen genital discharge cases (14.4%).

Conclusion: This investigation demonstrates 14% CT prevalence in Eastern Anatolia, confirming a substantial regional health issue. The relatively higher positivity observed in younger women suggests a potential benefit of targeted screening. Expanding molecular diagnostics and establishing screening programs are essential for identifying asymptomatic infections and preventing reproductive complications.

Keywords: Chlamydia trachomatis; PID; vaginal swab; PCR; Türkiye

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INTRODUCTION

Chlamydia trachomatis (CT) is one of the most common sexually transmitted infections worldwide, estimated to be responsible for over 130 million new cases annually.¹ Its prevalence, particularly among women aged 15-25, makes it a significant public health issue.² As an obligate intracellular bacterium, CT can cause ocular, genital, and systemic infections through its various biovars. Genital serovars (D-K) are primarily responsible for urogenital infections and are associated with urethritis, cervicitis, pelvic inflammatory disease (PID), and serious reproductive system complications.³ Systemic inflammatory indices are increased in many different diseases such as celiac disease and hepatosteatosis, as well as in infectious conditions and malignancies.^{4,5}

Untreated genital CT infections in women can lead to serious consequences such as PID, ectopic pregnancy, infertility, and chronic pelvic pain. Furthermore, chlamydia infection is reported to increase susceptibility to other sexually transmitted infections, particularly human immunodeficiency virus (HIV).⁶ The fact that the infection is often asymptomatic or presents with mild symptoms leads to delayed diagnosis and silent spread of the infection.⁷

PID is a clinical syndrome that causes significant morbidity in women. Although its etiology is multifactorial, CT is considered one of the most important pathogens in the development of PID.⁸ The limited specificity of the clinical diagnosis of PID necessitates the use of sensitive laboratory methods in identifying the underlying agents. Currently, nucleic acid amplification tests (NAATs), especially polymerase chain reaction (PCR), are considered the gold standard methods for diagnosing CT due to their high sensitivity and specificity.⁹

Despite the clinical significance of CT infection, epidemiological data are limited in some regions of Türkiye, such as the Eastern Anatolia Region. Therefore, this study aimed to determine the prevalence of CT in vaginal swab samples taken from women diagnosed with PID or presenting with genital symptoms in the Eastern Anatolia Region. The hypothesis that CT infection occurs with a clinically significant frequency in this patient group was tested.

MATERIALS AND METHODS

The study was conducted using vaginal and cervical swab samples taken from 100 female patients who presented to the Obstetrics and Gynecology Outpatient Clinics of a Ağrı İbrahim Çeçen University, Ağrı Training and Research Hospital in the Eastern Anatolia Region of Türkiye in 2025 with complaints of genital discharge, burning during urination, and pain during

sexual intercourse, and who were suspected of having genital infections. Ethical approval for the study was obtained from the Kafkas University Ethics Committee on May 29, 2024, with decision number 2024/472, within the scope of the research titled "Investigation of Chlamydia Prevalence in Vaginal Swab Samples Taken from Women with PID and Clinical Complaints", and the study was conducted in accordance with the principles of the Declaration of Helsinki. Exclusion criteria were defined as: Individuals under 18 years of age, those who did not sign the voluntary consent form, those who refused to participate in the study, and individuals who received antibiotic treatment in the last 3 months.

DNA isolation from swab samples for PCR studies was performed according to the NucleoGene Genomic DNA Extraction kit (Türkiye) manufacturer's instructions. For the PCR amplification reaction, 4 µL of master mix (10 × PCR buffer, 3.5 mM MgCl₂, 200 µM dNTPs, 1 U Taq DNA polymerase), 0.6 µL of forward primer (0.5 µM), 0.6 µL of reverse primer (0.5 µM), and 8 µL of template DNA were added to each sample, and the total volume was completed to 20 µL with nuclease-free water. For the detection of CT DNA, primers KL1 (5'-TCCGGAGCGAGTTACGAAGA-3') and KL2 (5'-AATCAATGCCCGGGATTGGT-3') targeting the cryptic plasmid, were used. PCR amplification was performed with an initial denaturation of 95 °C for 5 minutes; this was followed by 40 cycles of denaturation at 94 °C for 45 seconds, annealing at 58 °C for 1 minute, and extension at 72 °C for 1 minute. Amplification was completed with a final extension step of 5 minutes at 72 °C. PCR products were analyzed by 1.8% agarose gel electrophoresis, performed at 120 V for 30 minutes, and samples exhibiting a 241 bp amplicon were considered positive.¹⁰

Statistical Analysis

The PCR results obtained in the study were transferred to a computer environment, and the data were analyzed using descriptive statistics. Categorical variables were presented as numbers and percentages, while continuous variables were presented as mean and range (minimum-maximum) values. No statistical comparisons were made; the findings were evaluated at the descriptive level.

RESULTS

A total of 100 female patients aged between 18-55 years, with an average age of 36.3 years, were included in the study. Ninety-eight of the patients were married, and 2 were single. As a result of PCR analyses, CT positivity was detected in 14 (14%) of the vaginal swab samples (Figure 1). The age range of the entire patient group participating in the study was 18-55 years, with an average age of 36.3. The age range of CT positive cases was 23-

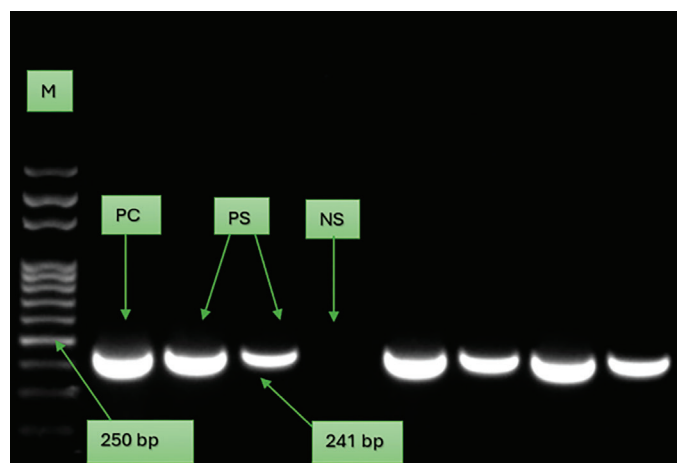


Figure 1. Agarose gel electrophoresis of CT isolates

M: marker; PC: positive control; PS: positive sample; NS: negative sample; bp: base pair; CT: *Chlamydia trachomatis*

48 years, with an average age of 34.5. The age range of negative cases was 18-55 years, with an average age of 37.3. When the distribution of patients according to their reasons for clinical presentation was examined, it was determined that 5 patients were diagnosed with PID, 90 patients presented with complaints of vaginal discharge, and 5 patients presented to the center for routine check-ups. According to PCR results, *CT* was detected in 1 of the 5 cases (20%) diagnosed with PID and in 13 of the 90 cases (14.4%) presenting with complaints of vaginal discharge. No positivity was determined in the asymptomatic group (n=5). The findings reveal the descriptive distribution of age and clinical characteristics of *CT* positive cases (Table 1).

DISCUSSION

In this study, the prevalence of *CT*, detected by PCR, was determined to be 14% in women diagnosed with PID or presenting with genital symptoms in the Eastern Anatolia Region of Türkiye. This rate is consistent with the prevalence range reported in low- and middle-income countries. A systematic meta-analysis reported a chlamydia prevalence of 6.9% (95% confidence interval: 5.2-8.7%, n=169 observations) in women of reproductive age in Sub-Saharan Africa.¹¹ A study in pregnant

women in Brazil reported a *CT* prevalence of 18%.¹² Similarly, the prevalence of *CT* was reported as 15.6% in Vietnamese women experiencing infertility problems.¹³ A limited number of studies in different regions of Türkiye have reported variable prevalence rates. In the Marmara Region, the prevalence of *CT* among individuals with sexually transmitted diseases in İstanbul was 11.1%,¹⁴ while in a study conducted in Ankara, Central Anatolia, among HIV+ men with sexually transmitted diseases, the rate of *CT* was 2.5%,¹⁵ and a similar study reported this rate as 1%.¹⁶ In addition, a study in the Black Sea Region of Türkiye (Samsun) involving an equal number of HPV+ and non-HPV patients presenting with vaginal discharge complaints found the rate of *CT* to be 2%, and these patients were reported as HPV+.¹⁷ In a study conducted in the Aegean Region (Manisa) with patients presenting with a preliminary diagnosis of vaginitis, the rate of *CT* was found to be 4%.¹⁸ In another study involving male patients from whom urethral discharge and ejaculate fluid samples were taken, and which retrospectively examined ten years of data, the rate of *CT* was found to be 5.2%.¹⁹ The 14% positivity rate detected in our study, considering regional differences, shows that *CT* infection is a significant public health problem in the Eastern Anatolia Region.

The fact that the average age of positive cases (34.5 years) is lower than that of negative cases (37.3 years) is an important finding supporting the idea that genital chlamydia infections are more common, especially in the younger age group. According to the World Health Organization and the Centers for Disease Control and Prevention (CDC), *CT* infections are observed in women aged 15-49 years, but the incidence is significantly higher in women under 25 years of age and decreases with age.^{20,21} This is associated with the higher prevalence of cervical ectopia in young women, differences in immunological responses, and behavioral risk factors.²² The age distribution observed in our study is consistent with these findings in the literature and emphasizes the importance of screening programs for younger age groups. In our study, the vast majority of *CT* positive cases (92.9%; 13/14) consisted of patients who presented with complaints of vaginal discharge. Although the number of cases

Table 1. Demographic and clinical features of CT positive and negative cases			
Variable	Positive (n=14)	Negative (n=86)	Total (n=100)
Age range (years)	23-48	18-55	18-55
Mean age (years)	34.5	37.28	36.3
PID	1 (20%)	4 (80%)	5 (5%)
Vaginal discharge	13 (14.4%)	77 (85.6%)	90 (90%)
Asymptomatic	0	5 (100%)	5 (5%)

PID: pelvic inflammatory disease; CT: *Chlamydia trachomatis*

diagnosed with PID was limited (n=5), the positivity rate of 20% (1/5) in this group is noteworthy. In the literature, chlamydia positivity rates in women diagnosed with PID are reported to range widely from 5.8% to 41.6%.^{23,24} These differences are related to the heterogeneity of diagnostic criteria, the characteristics of patient populations, and the sensitivity of the laboratory methods used. Studies have reported that 30-34% of women diagnosed with PID are positive for *CT*.^{25,26} Although a definitive comparison is not possible due to the limited sample size in our study, the clinical importance of investigating the etiology of chlamydia in PID cases is clear.

One of the most important characteristics of genital *CT* infections is that approximately 70% of cases in women are asymptomatic.²⁷ This can lead to the infection remaining undetected for a long time and causing serious complications such as PID, tubal infertility, ectopic pregnancy, and chronic pelvic pain. Mathematical modeling and cohort studies show that approximately 10-15% of untreated chlamydia infections progress to PID over time.²⁸ Although no positive cases were detected in the asymptomatic group (n=5) in our study, it is not possible to draw a definitive conclusion about the true prevalence of asymptomatic infections due to the small sample size of this subgroup. However, literature data show that focusing only on symptomatic cases may underestimate the actual disease burden. In this context, it is clear that implementing routine screening programs could contribute to the early detection of asymptomatic infections and the prevention of complications.

NAATs are considered the gold standard in the diagnosis of *CT* due to their high sensitivity (60-85%) and specificity (97-99%).⁹ In our study, cryptic plasmid targeting was performed using the PCR method, and the presence of a 241 bp amplicon was evaluated.²⁹ Since the cryptic plasmid is found in 7-10 copies in the *CT* genome, it provides higher analytical sensitivity compared to single-copy genes such as *ompA* or *16S rRNA* genes.³⁰ The use of NAATs provides a significant advantage, especially in the detection of subclinical and low bacterial load infections. Approximately 20-50% more positive cases can be detected compared to culture methods.³¹ These results are consistent with previous reports supporting molecular diagnostics in subclinical infections. Given the high prevalence and complications of *CT* infection, cost-effectiveness analyses of screening programs are crucial. A study in the United States reported that annual chlamydia screening in sexually active women under 25 years of age resulted in savings of approximately USD 2.500 per preventable PID case.³² Population-based screening programs implemented in some countries have been linked to decreased PID incidence in young women.³³ Currently, a nationwide

chlamydia screening program has not been implemented in Türkiye. The 14% prevalence rate was found in our study suggests the potential benefit of targeted screening strategies, particularly in regions with limited healthcare resources, such as the Eastern Anatolia Region.

Although the treatment of *CT* infection is relatively simple, the high rate of reinfection (17.24%) is a significant problem.³⁴ Partner treatment and reporting are critical for preventing reinfections and controlling community transmission. The CDC guidelines recommend treating all sexual partners of *CT* positive cases within the last 60 days, and increasing access to partner treatment can reduce reinfection rates.³⁵ Strengthening partner reporting and treatment systems in Türkiye is a significant deficiency with respect to infection control.

High treatment success rates have been reported with first-line tetracycline and macrolide antibiotics (azithromycin and erythromycin) in *CT* infections;³⁶ however, resistance-associated mutations have been identified mainly *in vitro* and in limited clinical samples.³⁷ Treatment failure varies between 5% and 23%, depending on many factors and the population studied.³⁸ Therefore, adherence to treatment guidelines and the performance of follow-up tests (test of cure) at appropriate indications are important.

The Eastern Anatolia Region is a region characterized by relatively lower socioeconomic indicators, and access to health services is more limited compared to other regions.³⁹ In this context, the 14% chlamydia prevalence detected in our study highlights the need to review regional health policies and strengthen sexual health services. In populations with low health literacy, strategies to raise awareness about sexually transmitted infections and increase early diagnosis opportunities should be fundamental components of public health interventions.

Study Limitations

This study has some limitations. The relatively small sample size (n=100) and the fact that the data were obtained from a single center limit the generalizability of the results. In particular, the small number of patients diagnosed with PID (n=5) prevented statistical analyses from being performed in this subgroup. The fact that only vaginal and cervical samples were evaluated may have led to the underdiagnosis of urethral or rectal infections. The study did not evaluate patients' sexual behavior characteristics, number of partners, contraceptive methods, and other sociodemographic risk factors. In addition, post-treatment follow-up data and serotype determination were not performed.

CONCLUSION

In this study, the prevalence of *CT* in women diagnosed with PID or exhibiting genital symptoms in the Eastern Anatolia Region was determined to be 14%. This rate suggests that *CT* infection may represent an important public health concern in the region. *CT*-positive cases had a lower mean age compared to negative cases, highlighting the need for risk-based screening strategies. Widespread adoption of molecular diagnostic methods may improve early detection of asymptomatic infections and the prevention of serious reproductive health complications. Strengthening regional health policies, increasing sexual health education, and improving partner treatment systems may contribute to the control of *CT* infection.

ETHICS

Ethics Committee Approval: Ethical approval for the study was obtained from the Kafkas University Ethics Committee on May 29, 2024, with decision number 2024/47.

Informed Consent: Informed consent was obtained.

FOOTNOTES

Contributions

Surgical and Medical Practices: H.B., Concept: F.Ç.A., Design: F.Ç.A., Data Collection or Processing: F.Ç.A., H.B., Analysis or Interpretation: F.Ç.A., Literature Search: F.Ç.A., Writing: F.Ç.A.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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