Chlaymdia

Microbiology lecture 4

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Introduction

Chlamydiaceae is a family of gram-negative coccobacilli, obligate intracellular bacteria that includes 3 organisms pathogenic to humans: Chlamydia trachomatis, Chlamydophila pneumoniae, and Chlamydophila psittaci.

C. trachomatis can be differentiated into serotypes A–C, D–K, and L1–L3. Serotypes A–C mainly affect the eyes and cause trachoma. An infection with serotypes D–K can result in genitourinary infections (e.g., cervicitis, PID, urethritis), conjunctivitis, and infant pneumonia. Serotypes L1–L3, in turn, lead to sexually transmitted lymphogranuloma venereum. While both C. pneumoniae and C. psittaci primarily affect the respiratory system.

General characteristics

Gram-negative organisms that Gram stain poorly

Obligate intracellular bacteria (unable to produce its own ATP)

Absent peptidoglycan (muramic acid) in the cell wall, which makes beta-lactam antibiotics ineffective

Visible as cytoplasmic inclusion bodies on Giemsa stain or fluorescent antibody-stained smear

Very difficult cultivation

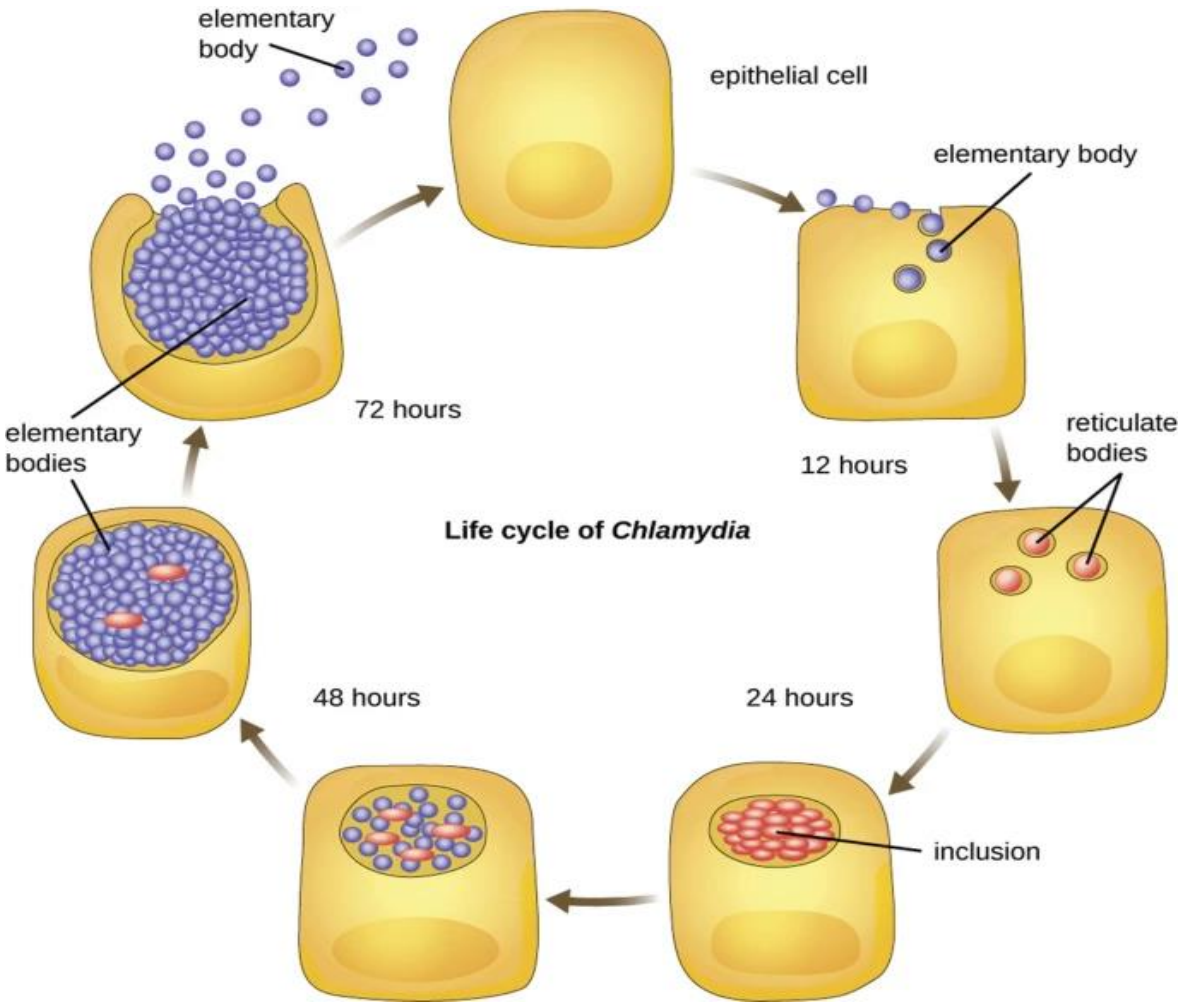
Life cycle

First phase: elementary bodies (small and dense bodies that characterize the infectious stage of Chlamydiaceae; stable in the extracellular environment and almost inactive metabolically)

- Attachment of extracellular elementary bodies to target cells (mostly on the respiratory or urogenital epithelium)
- Endocytosis
- Transformation into reticulate bodies in the endosome

Second phase: reticulate bodies (represent the obligate intracellular, replicative, and metabolically active form of Chlamydiaceae)

- Replication by splitting and aggregation of various reticulate bodies in the endosome (at which point they are called inclusion bodies)
- Transformation of reticulate bodies into elementary bodies
- Lysis of endosomes
- Release of newly formed elementary bodies and exit from cell
- New start of cycle



The developmental cycle begins with the attachment and parasite-mediated endocytosis of the elementary body (EB). After internalization the EB is found within a membrane-bound vacuole, termed the inclusion. The EB differentiates into the reticulate body (RB). Between 8 and 10 h p.i. the RBs begin to replicate and between 18 and 24 h p.i. some of the RBs begin to dedifferentiate back into infectious EBs. The cycle ends with host cell lysis, resulting in release of infectious EBs.

Features

Characteristics of Chlamydiaceae				
Bacteria	**Serotypes**	**Organ**	**Transmission**	**Disease**
Chlamydia trachomatis	**A–C**	Eyes	Contact with discharge from the eyes or nose of infected persons. Can be transmitted by direct contact, clothes, or insects.	• Trachoma
	D–K	• Eyes • Genitourinary tract • Lungs	Sexual intercourse Vaginal birth (in which the mother is infected)	• Inclusion conjunctivitis • Chlamydial genitourinary infections • Pelvic inflammatory disease • Neonatal chlamydial conjunctivitis • Infant pneumonia • Reactive arthritis • Proctitis
	L1–L3	• Urinary tract • Anorectal area • Genitourinary tract	Sexual intercourse	• Lymphogranuloma venereum (LGV)
Chlamydophila pneumoniae		• Lungs	Person-to-person transmission of respiratory secretions via aerosols	• Atypical pneumonia (especially in older adults)
Chlamydophila psittaci		• Lungs	Airborne transmission	• Atypical pneumonia

Presentation

Sexually transmitted infections

Chlamydia trachomatis predominantly affects the genitourinary tract although it can cause pneumonia and neonatal conjunctivitis in infants born vaginally to infected mothers.

Disease presentation depends on the serotype involved:

- Serotypes D–K cause genitourinary chlamydia (nonlymphogranuloma venereum), which presents with urethritis, proctitis, cervicitis, pelvic inflammatory disease, epididymitis, and prostatitis.
- Serotypes L1–L3 cause lymphogranuloma venereum, which presents with either rectal infection (proctitis) or ulceration and inguinal lymphadenopathy.

Genitourinary chlamydia (Nonlymphogranuloma venereum)

Etiology: Chlamydia trachomatis serotypes D–K

Transmission: May be transmitted through genital-to-genital contact.

Epidemiology: One of the most common STIs in the US. One of the most common causes of pelvic inflammatory disease

Clinical features:

- The majority of infected individuals are asymptomatic.
- Patients may present with urethritis (can cause dysuria or polyuria) or proctitis
- Female patients may additionally present with salpingitis, cervicitis, or symptoms of pelvic inflammatory disease:
    - (Muco)purulent vaginal discharge
    - Abnormal uterine bleeding
    - Postcoital bleeding
    - Dyspareunia
- Male patients may additionally present with epididymitis or prostatitis.
- Symptoms of reactive arthritis may also be present.

Diagnostics of genitourinary chlamydia

Preferred test: Nucleic Acid Amplification Test (NAAT). It detects Chlamydia trachomatis RNA or DNA, e.g., by PCR.

Specimen collection: in females: vaginal swab (preferred), cervical swab, or first-void urine.

In males: first-void urine (preferred) or urethral swab.

Management of genitourinary chlamydia:

- Start antibiotic therapy (even if asymptomatic), e.g., doxycycline or azithromycin.
- Evaluate and treat partners.
- Test for common sexually transmitted coinfections. All patients: HIV testing, gonorrhea testing, syphilis testing
- Report all cases of genitourinary chlamydia to the local health department.

Complications:

- Pelvic inflamatory disease → Fitz-Hugh-Curtis syndrome (inflamation of the liver capsule; periheptitis)
- Ectopic pregnancy
- Infertility
- Reactive arthritis
- Perinatal transmission causing: Neonatal chlamydial conjunctivitis, infant pneumonia due to Chlamydia trachomatis.

Lymphogranuloma venereum

Etiology: Caused by Chlamydia trachomatis serotypes L1–L3.

Epidemiology: Globally: more common in tropical and subtropical regions.

In high-income countries: increasing incidence among homosexual males.

Clinical features:

- Rectal infection (most common): proctitis or proctocolitis
  - ~ 50% of cases may be asymptomatic or mild.
  - Mild symptoms: constipation, mucous streaking of stool.
  - Severe symptoms: rectal pain, bleeding, and discharge; tenesmus, and systemic symptoms.

- Genital or anal infection: genital and inguinal disease:
    - Primary infection (after approx. 1 week): Small, painless genital ulcers (herpetiform) that heal spontaneously within a few days. May be accompanied by mucopurulent discharge.
    - Secondary infection (2–6 weeks after onset of primary infection): Painful swelling of the lymph nodes in the inguinal region (buboes).
- In one-third of cases, an abscess forms and may rupture, discharging pus.

Diagnostics:

Genotyping (e.g., by PCR) of sample taken for NAAT to identify the C. trachomatis serotypes associated with LGV.

If clinical suspicion for LGV is high, start antibiotic treatment immediately rather than waiting for the results of diagnostic testing.

Management:

- Start antibiotic therapy (preferably doxycycline).
- Evaluate and treat the partner.
- Testing for common sexually transmitted coinfections is recommended: HIV testing, gonorrhea testing, syphilis testing.
- Report all cases of LGV to the local health department.

Infant pneumonia due to Chlamydia trachomatis (serotypes D–K)

Transmission: perinatal transmission during delivery via contact with the genital flora of an infected mother.

Incubation period: 4–12 weeks after delivery.

Clinical features:

- Staccato cough, tachypnea, nasal congestion
- Typically afebrile, although a mild fever is possible
- Accompanied by neonatal conjunctivitis in up to 50% of all cases

Diagnostics:

- Culture from the nasopharyngeal specimen
- Nonculture tests, such as direct fluorescence antibody and nucleic acid amplification tests (NAATs), may be performed.

- CBC may reveal eosinophilia.

Prevention: maternal screening and treatment before birth

Treatment: oral erythromycin, azithromycin

Complications: respiratory failure

Infectious Vulvovaginitis

(Gardnerella vaginalis)

Introduction

Vulvovaginitis refers to a large variety of conditions that result in inflammation of the vulva and vagina. The causes may be infectious (e.g., bacterial vaginosis in most cases) or noninfectious such as allergic vulvovginitis, and genitourinary syndrome of menopause.

Physiologically, the normal vaginal flora (mainly lactobacilli) keeps the pH levels of the vaginal fluids low, thus preventing the overgrowth of pathogenic and opportunistic organisms. Disruption of that flora (e.g., due to sexual intercourse) predisposes to infection and inflammation.

Infectious vulvovaginitis: Bacterial vaginosis

Epidemiology: most common vaginal infection in women (22–50% of all cases)

Pathogen: Gardnerella vaginalis (a pleomorphic, gram-variable rod)

Pathophysiology: lower concentrations of Lactobacillus acidophilus lead to overgrowth of Gardnerella vaginalis and other anaerobes, without vaginal epithelial inflammation due to absent immune response

Risk factors:

- Sexual intercourse (primary risk factor, but it is not considered an STD)
- Intrauterine devices
- Vaginal douching
- Pregnancy

Clinical features:

- Commonly asymptomatic
- Increased vaginal discharge, usually gray or milky with fishy odor
- Pruritus and pain are uncommon.

Diagnostics: diagnosis is confirmed if three of the following Amsel criteria are met:

- Clue cells: Vaginal epithelial cells with a stippled appearance and fuzzy borders due to bacteria adhering to the cell surface. Identified on a vaginal wet mount preparation.
- Vaginal pH > 4.5
- Positive amine test (sometimes referred to as the "whiff test"): The addition of 1–2 drops of 10% potassium hydroxide to a sample of infected vaginal discharge emits a characteristic amine odor.
- Thin, homogeneous gray-white or yellow discharge that adheres to the vaginal walls

Treatment:

Asymptomatic: reassurance; often resolves without treatment

Symptomatic: First-line in nonpregnant and pregnant patients: Oral metronidazole OR intravaginal metronidazole

Treatment of partner is not recommended.

Complications

Adverse pregnancy outcomes: Preterm delivery, spontaneous abortion, postpartum endometritis.