

Chapter XI

Genus Chlamydia

Learning objective:

At the end of this chapter the students will be able to:

- List the medically-important species of Genus Chlamydia
- Describe general characteristics of Genus Chlamydia
- Recognize diseases caused by Genus Chlamydia
- Describe the virulent factor of pathogenic species of Genus Chlamydia
- Discuss pathogenicity, clinical manifestations, laboratory diagnosis, prevention & control of members of the Genus Chlamydia

Genus Chlamydia

- Small, gram negative, obligate intracellular bacteria
- Cell wall similar to that of gram negative bacteria
- cell wall contain Lipopolysaccharide (LPS) but doesn't have a peptidoglycan layer
- They lack the ability to produce their own ATP therefore, they use host's ATP
- Multiply by binary fission
- Non motile and stain poorly with gram stain but readily with Giemsa stain
- Can also be demonstrated by direct immunofluorescence staining
- Multiply in the cytoplasm of the host cell forming microcolonies or inclusion bodies.
- infect a wide spectrum of vertebrate hosts including birds, mammals and humans
- susceptible to a wide range of antibiotics such as Tetracycline, erythromycin, macrolides and rifampicin

- Chlamydia species consists
 - C. trachomatis
 - C. psittaci
 - C. pneumoniae
- All chlamydiae have a replicative cycle different from that of all other bacteria
- They exist in two morphological distinct forms / stages, namely
 - Elementary body (EB)
 - infectious, non-reproductive particle
 - The environmentally stable infectious particle
 - Metabolically inert
 - Small (1250-350 nm in diameter)
 - Spherical body in case of C .trachomatis and C .psittaci
 - Pear-shaped in case of C .pneumoniae

- Reticulate (Initial) body (RB)
 - noninfectious, intracytoplasmic, reproductive form
 - Intracellular
 - Metabolically active form
 - Divide by binary fission to form EBs
 - Larger (800-1200nm in diameter)

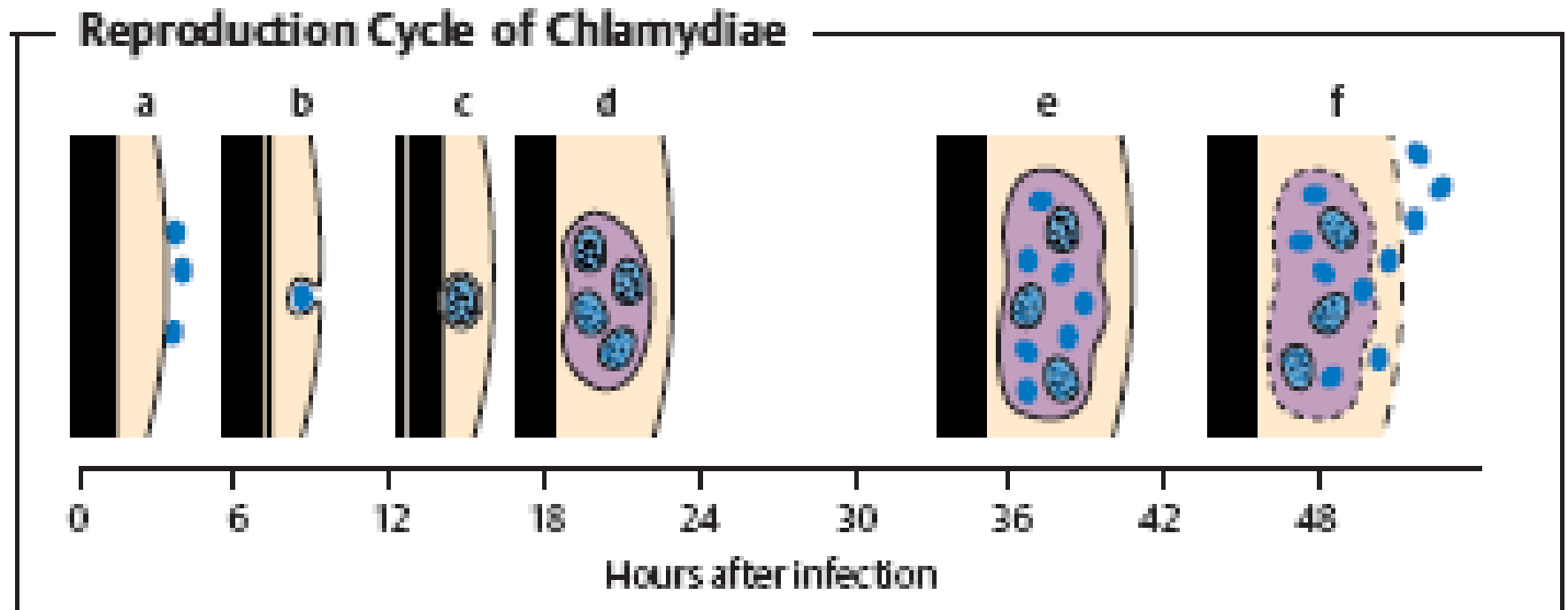


Fig. Two chlamydial stages: elementary body and initial body.

a Attachment of elementary body to cell membrane.

b Endocytosis.

c Transformation of elementary body into initial body inside the endosome.

d Reproduction of initial bodies by transverse fission.

e Transformation of some initial bodies back into elementary bodies.

Virulence factor

- Intracellular replication
- Exotoxin and endotoxin

Pathogenesis and clinical manifestation

- Human infections are caused by:
 - *Chlamydia trachomatis*
 - *Chlamydophila pneumoniae*
- *Chlamydophila psittaci* is mainly a pathogen of birds. Occasionally it causes disease in humans.

C. trachomatis causes:

- Eye disease:
 - Trachoma (by serovars A, B, Ba, C)
 - Inclusion conjunctivitis (by serovars D to K)
 - Neonatal ophthalmia (by serovars D to K)
- Genital tract infections (serovars D-K)
- Lymphogranuloma venereum, or LGV, (serovars L1–L3).
- Pneumonia and pneumonitis (serovars D–K)

Chlamydophila pneumoniae causes:

- Atypical pneumonia,

Trachoma is a serious eye disease in which acute inflammatory changes in the conjunctiva and cornea lead to scarring and eventual blindness.

Inclusion conjunctivitis

- This causes inflammation of the conjunctiva (follicular conjunctivitis) with a mucopurulent discharge and occasionally keratitis.
- It mainly affects children and occasionally adults following contaminated hand to eye contact.

Neonatal ophthalmia

- Also known as inclusion blennorrhoea, neonatal ophthalmia occurs in newborn infants (about 7–12 days after delivery) following infection from cervical secretions during birth.
- It is thought up to 50% of infants born of mothers with *Chlamydia* cervicitis, develop mucopurulent conjunctivitis.
- Some infants also develop pneumonia.

- **Genital tract infections (serovars D-K)**

- In men, *C. trachomatis* causes urethritis (nonspecific urethritis), which can lead to epididymitis and occasionally prostatitis.
 - *Chlamydia* urethritis in men is accompanied by urethral discharge, frequency, and dysuria.
- In women, *C. trachomatis* causes mainly cervicitis and endometritis which can lead to salpingitis, pelvic inflammatory disease (PID), and infertility.
 - primary infections are often without symptoms (60% or more). Some patients have vaginal discharge, dysuria and frequency.

- **Lymphogranuloma venereum, or LGV, (serovars L1-L3).**
 - LGV is a sexually transmitted disease. It is also known as tropical, or climatic bubo, because it is found mainly in tropical countries
- **Pneumonia and pneumonitis (serovars D-K)**
 - Most infections occur in newborn infants 2–12 weeks after birth (particularly in those with neonatal ophthalmia), or as opportunistic infections in immunocompromised persons and those already in poor health.

- ***Chlamydophila pneumoniae***

causes:

- Atypical pneumonia, usually a mild respiratory infection with sore throat, cough, fever, and symptoms associated with asthma.
- It is transmitted by inhaling infected aerosols.

Lab. Diagnosis

- Ocular, urethral, vagina and cervical specimen (by scraping the mucosa)
- Blood, respiratory secretion, sputum.
- In case of LGV pus from the bubo should be collected

Lab diagnosis for Trachoma

Microscopic examination

- Smears from conjunctiva stained by Giemsa or iodine stained smears show inclusions
 - Inclusion bodies are intracytoplasmic vacuoles, usually close to nucleus, that contain replicating organism

Culture

- In the early stages of the disease and on the upper tarsal conjunctiva,
 - Typical cytoplasmic inclusions are found in epithelial cells of conjunctival scrapings stained with fluorescent antibody or by the Giemsa method.

- Inoculation of conjunctival scrapings into cycloheximide-treated McCoy cell cultures permits growth of *C trachomatis*.
- Centrifugation of the inoculum into the cells increases the sensitivity of the method.
- The diagnosis can sometimes be made in the first passage after 2–3 days of incubation by looking for inclusions by immunofluorescence or staining with iodine or Giemsa stain.

Serology

- Infected individuals often develop both group antibodies and serovar-specific antibodies in serum and in eye secretions.
- Immunofluorescence is the most sensitive method for their detection.

Lab diagnosis for Genital Infections & Inclusion Conjunctivitis

Microscopic examination

- Smears from conjunctiva, scraping of urethra, cervix or vagina stained by Giemsa stained smears show inclusions

Culture

- The swab specimens should be placed in a chlamydiae transport medium and kept at refrigerator temperature before transport to the laboratory.
- McCoy cells are grown in monolayers on coverslips in dram or shell vials.
- The McCoy cells are treated with cycloheximide to inhibit metabolism and increase the sensitivity of isolation of the chlamydiae.
- The inoculum from the swab specimen is centrifuged onto the monolayer and incubated at 35–37 °C for 48–72 hours.
- A second monolayer can be inoculated, and after incubation it can be sonicated and passaged to another monolayer to enhance sensitivity.
- The monolayers are examined by direct immunofluorescence to visualize the cytoplasmic inclusions.

Direct Cytologic Examination (Direct Fluorescent Antibody or DFA) and Enzyme-Linked Immunoassay (EIA)

- Specimens are collected with techniques similar to those used to collect specimens for culture.
- Urine specimens may be used with some of the tests.
- The DFA uses monoclonal antibodies directed against a species-specific antigen on the chlamydial major outer membrane protein (MOMP).
- The EIA detects the presence of genus-specific lipopolysaccharide antigens extracted from elementary bodies in the specimen.

Serology

- A titer rise occurs during and after acute chlamydial infection.
- Because of the high prevalence of chlamydial genital tract infections in some societies, there is a high background of antichlamydial antibodies in the population;
 - serologic tests to diagnose genital tract chlamydial infections generally are not useful.
- In genital secretions (eg, cervical), antibody can be detected during active infection and is directed against the infecting immunotype (serovar).

Lab diagnosis of Lymphogranuloma Venereum

Microscopic examination

- Pus, buboes, or biopsy material may be stained, but particles are rarely recognized.

Culture

- Suspected material is inoculated into McCoy cell cultures.
- The inoculum can be treated with an aminoglycoside (but not with penicillin) to lessen bacterial contamination.
- The agent is identified by morphology and serologic tests

Serology

- Antibodies are commonly demonstrated by the Complement Fixation (CF) reaction.
- The test becomes positive 2–4 weeks after onset of illness, at which time skin hypersensitivity can sometimes also be demonstrated.
- In a clinically compatible case, a rising antibody level or a single titer of more than 1:64 is good evidence of active infection.
- If treatment has eradicated the lymphogranuloma venereum infection, the CF titer falls.
- Serologic diagnosis of lymphogranuloma venereum can employ immunofluorescence, but the antibody is broadly reactive with many chlamydial antigens.

Treatment

- **Trachoma**

- azithromycin has replaced erythromycin and doxycycline in the mass treatment of endemic trachoma.
- Topical therapy is of little value.

- ***Chlamydia trachomatis* Genital Infections & Inclusion Conjunctivitis**

- Tetracyclines (eg, doxycycline) are commonly used in nongonococcal urethritis and in nonpregnant infected females.
- Azithromycin is effective and can be given to pregnant women.
- Topical tetracycline or erythromycin is used for inclusion conjunctivitis, sometimes in combination with a systemic drug.

- **Lymphogranuloma Venereum**

- The sulfonamides and tetracyclines is used, especially in the early stages.

Prevention and control

- Improved socioeconomic conditions enhance the disappearance of endemic trachoma.
- Safe sex practices and early diagnosis and treatment of infected persons.