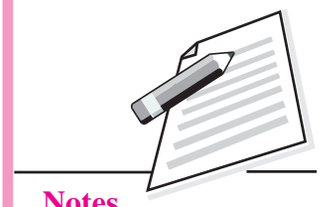


33

CHLAMYDIA

33.1 INTRODUCTION

Chlamydiae are obligate, aerobic, intracellular parasites of eukaryotic cells. They are small Gram-negative coccoid or rod shaped, non-motile bacteria. *Chlamydiae* exhibit characteristics intermediate between bacteria and viruses. They are widespread in the natural world, being parasites of people, animals and birds with tropism for squamous epithelial cells and macrophages of the respiratory and gastrointestinal tract.

They are recognized as bacteria as

- They have both DNA and RNA.
- They have cell wall (that resembles that of GNB) and ribosomes
- Replicate by binary fission
- Susceptible to antibiotics

OBJECTIVES

After reading this lesson, you will be able to:

- distinguish characteristics of *Chlamydia*.
- describe the diseases produced by it.
- explain the laboratory diagnosis.

33.2 CLASSIFICATION

Classification of *Chlamydiae* is as follows:

Order *Chlamydiales*

Notes

Family *Chlamydiaceae*

Genus *Chlamydia,Chlamydophila*

Species There are three species *C. trachomatis, Chlamydophila psittaci, Chlamydophila pneumoniaae*

C. trachomatis has two biovars; TRIC and LGV.

33.3 CELL STRUCTURE

Chlamydiae have a cytoplasmic membrane and an outer membrane similar to Gram-negative bacteria but lack a peptidoglycan cell wall. *Chlamydiae* cannot synthesize their own ATP and require intracellular abode to remain viable. *Chlamydiae* exist in two forms: the elementary body and the reticulate body. Both of them play a pivotal part in the life cycle of chlamydia. Although Gram negative, Chlamydiae stain better with Castaneda, Machiavello or Gimenez stains.

33.4 ELEMENTARY BODY (EB)

The elementary body is the dispersal form, which is analogous to a spore. This dispersal form is about 0.3 μm or 200-300 nm in diameter. It is the extracellular infective form. It induces its own endocytosis upon exposure to target cells.

33.5 RETICULATE BODY (RB)

Reticulate body is the intracellular, multiplicative form. It represents the non-infectious growing form.

33.6 LIFE CYCLE

The life cycle of *Chlamydia trachomatis* consists of two stages: elementary body and reticulate body. Upon endocytosis into the host cell EB prevents phagolysosomal fusion enabling intracellular survival of the bacteria. Once inside the endosome, the elementary body transforms into the larger reticulate body (500 – 1000 nm) as a result of the glycogen that is produced. The reticulate body is the reproductive form. It divides through binary fission at approximately 2-3 hours per generation. It contains no cell wall and is detected as an inclusion in the cell arranged as a mantle around the nucleus. The inclusion bodies are basophilic. They can also be stained by Lugol's iodine because of the presence of glycogen matrix. After division, the reticulate body transforms back to the elementary form and is released by the cell by exocytosis. One phagolysosome usually produces 100-1000 elementary bodies. The entire process takes 24 – 48 hours. The EB may infect new cells and the cycle continues.

33.7 ANTIGENIC STRUCTURE

Chlamydia antigens consist of 3 groups: genus-specific antigen, species-specific protein antigen, serotype-specific. The sero type-specific antigens are located on MOMP and on the basis of this chlamydiae have been divided into many serovars or serotypes.

33.8 CULTURE

Chlamydiae can be isolated by the following methods:

(a) **Animal inoculation:** Mice can be inoculated through intranasal, intraperitoneal or intracerebral route. Mice die within 10 days. Smears made from lung, spleen, brain or peritoneal exudate demonstrate elementary bodies.

(b) **Egg inoculation:** Organisms can be isolated by egg yolk inoculation of the specimen. Impression smears can be stained by Giemsa or Gimenez.

(c) **Tissue culture:** McCoy cells treated with cycloheximide are the most commonly used cell lines. Irradiated or metabolically inhibited cell lines can also be used for isolation of chlamydia. Inclusion bodies can be visualized by staining the cell lines.

33.9 DISEASES PRODUCED BY *CHLAMYDIA*

(a) **Ocular infections:** *C. trachomatis* serotype A,B,Ba,C- is the leading cause of preventable blindness (caused by a chlamydia infection called trachoma) in the world. Other diseases produced are inclusion conjunctivitis (serotype D to K) and ophthalmia neonatorum.

(b) **Genital infections:** *C. trachomatis* is also the leading cause of sexually transmitted disease worldwide. It is associated with non- gonococcal urethritis and lymphogranuloma venereum (serotype L1, L2, L3). *C. trachomatis* is one of the major causes of pelvic inflammatory disease (PID) and infertility in women.

(c) **Respiratory infections:** *C. pneumoniae* causes pneumonia. *C. psittaci* causes *psittacosis.*

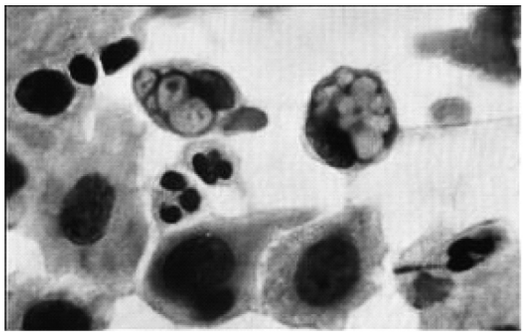
33.10 LABORATORY DIAGNOSIS

***Specimen collection*:** Specimen should be collected by scraping the mucosa. Discharge should *not* be collected. Depending on the site of infection, ocular, urethral, cervical, sputum, respiratory secretions can be collected. In suspected Psittacosis, blood and sputum are collected for microscopy and culture and serum for serology.

Notes

***Direct detection of antigen*:** Antigen detection is a rapid method of diagnosing chlamydial infection.

1. *Light Microscopy:* Inclusion bodies of *C. trachomatis* can be detected by staining with Lugol's iodine. Iodine can be used because inclusion bodies contain a glycogen matrix. Giemsa, Castaneda, Machiavello and Giminez methods are better and can be used to stain ocular, cervical or urethral specimen.
2. *Immunofluoresence:* Direct fluorescent antibody test detects major outer membrane proteins. It is now considered by many the test of choice for diagnosis.



ELISA: Antigen and antibodies can be detected by ELISA. Antigen detection is more specific than antibody detection.

Isolation: Mice, fertilized hen's egg and tissue cultures can be used for isolation of chlamydia. The clinical specimen can be inoculated into the yolk sac of 6 to 8 day old eggs. Irradiated or cycloheximide treated McCoy cell culture is the preferred isolation method.

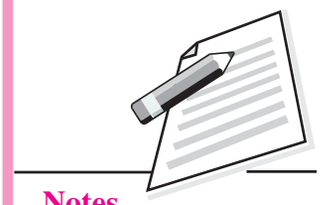
Molecular tools: Polymerase chain reaction, ligase chain reaction can be used for detection of chlamydia

33.11 TREATMENT

Sulphonamides and tetracycline are the drugs of choice. Single dose azithromycin is the drug of choice for non-gonoccocal urethritis.

INTEXT QUESTIONS 33.1

1. Chlamydiae are ..... parasites
2. Chlamydiae are gram ..... cocci
3. ..... body enables intracellular survival of the bacteria
4. ..... body is the reproductive form
5. C.trahomatis causes ..... & .....



WHAT YOU HAVE LEARNT

- Chlamydiae are obligate, aerobic, intracellular parasites of eukaryotic cells.
- They are small Gram-negative coccoid or rod shaped, non-motile bacteria.
- Chlamydiae has elementary body which is similar to a spore.
- Life cycle of Chlamydia trachomatis consists of two stages namely elementary and reticulate body.
- Chlamydiae can be isolated by animal inoculation, egg inoculation & tissue culture
- Chlamydia trachomatis causes preventable blindness, conjunctivitis & ophthalmia neonatorum, non- gonococcal urethritis and lymphogranuloma venereum, inflammatory disease, infertility in women.
- Inclusion bodies of C. trachomatis can be detected by staining with Lugol's iodine
- Giemsa, Castaneda, Machiavello methods are used to stain ocular, cervical or urethral specimen.
- Direct fluorescent antibody is test of choice for diagnosis.

TERMINAL EXERCISES

1. Describe the life cycle of *chlamydia*.
2. Name the various staining techniques used for *chlamydia*.
3. Enumerate the diseases caused by *Chlamydia trachomatis*.
4. How can we cultivate *chlamydia*?
5. What are the rapid diagnostic methods for detecting chlamydia?

ANSWERS TO INTEXT QUESTIONS

33.1

1. Intracellular
2. Negative
3. Elementary
4. Reticulate
5. Blindness & lymphogranuloma venerum