CHAPTER- XII
Mycoplasma and *Ureaplasma*

Learning objective

Upon completion of this unit of instruction, the student will be able to:

- Discuss the basic characterisic of Mycolplasma and ureaplasma
- Describe the virulent factor of Mycolplasma and ureaplasma
- Discuss pathogenicity, clinical manifestations, laboratory diagnosis, prevention & control of members of the Mycolplasma and ureaplasma

- *Mycoplasma* and *Ureaplasma* are unique microbes in that they lack a cell wall.
- They are ubiquitous in nature as the smallest of free-living microorganisms.
- Numerous *Mycoplasma* species have been isolated from animals and humans, but only three species have been associated with human diseas.
- *Mycoplasma pneumoniae* is a lower respiratory tract pathogen.
- *Mycoplasma hominis* and *Ureaplasma urealyticum* cause genitourinary tract infections

- The organisms have diameters of about 0.2 to 0.3 mm, but they are highly plastic and pleomorphic and may appear as coccoid bodies, filaments, and large multinucleoid forms.
- They do not have a cell wall and are bounded only by a single triplelayered membrane that, unlike other bacteria, contains **sterols**.
- The sterols are not synthesized by the organism but are acquired as essential components from the medium or tissue in which the organism is growing.
- Lacking a cell wall, *Mycoplasma* and *Ureaplasma* stain poorly or not at all with the usual bacterial stains.

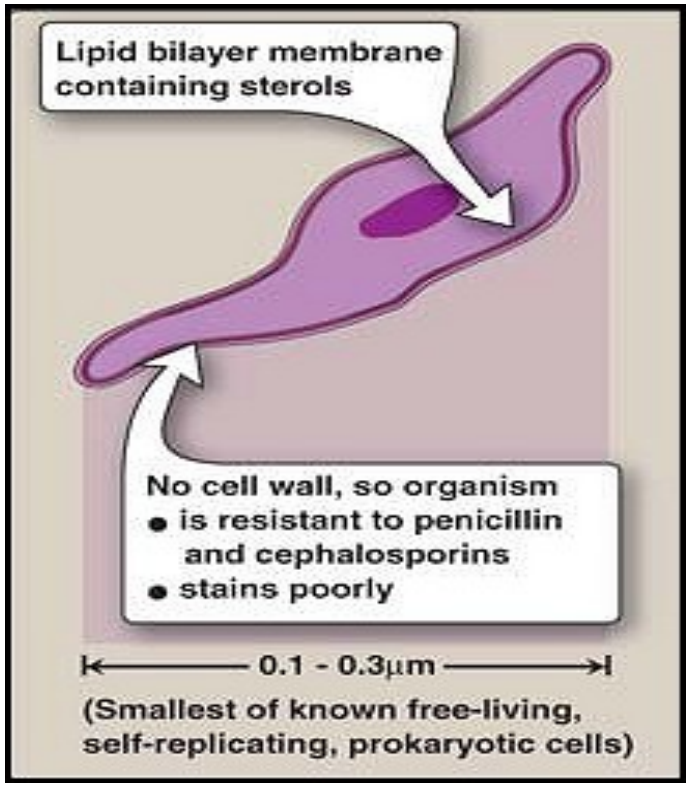


Figure: Structural features of Mycoplasma

- *M. pneumoniae* is an aerobe, but most other species are facultatively anaerobic.
- All grow slowly in enriched liquid culture medium and on special *Mycoplasma* agar to produce minute colonies only after several days of incubation.
- The center of the *M. pneumoniae* colony grows into the agar and appears denser,giving the appearance of an inverted “fried egg.”
- Colonies of *M. pneumoniae* bind red blood cells (RBCs) onto the surface of agar plate cultures (hemadsorption). This is due
- to binding by the mycoplasma to sialic acid – containing oligo-saccharides present on the RBC surface.

TABLE : Pathogenic *Mycoplasma* and *Ureaplasma* Species of Humans

Organism	Site	Prevalence	Disease
M. pneumoniae	Upper and lower respiratory tract	Common	Primary atypical pneumonia
M. hominis	Genitourinary tract	Common	Postpartum fever; pelvic inflammatory disease
U. urealyticum	Genitourinary tract	Very common	Nongonococcal urethritis

MYCOPLASMA PNEUMONIAE

- *M. pneumoniae* produces a common form of pneumonia, which tends to occur in any season and has a predilection for younger individuals.
- The illness is characterized by a nonproductive cough, fever, and headache, with radiologic and clinical evidence of scattered areas of pneumonia.
- The course is almost always benign,but improvement is accelerated by treatment with non–cell wall–active antimicrobials.

EPIDEMIOLOGY

- *M. pneumoniae* accounts for approximately 10% of all cases of pneumonia. Infection is acquired by droplet spread.
- Experimental challenges indicate that the human infectious dose is very low, possibly less than 100 colony-forming units.
- The most common age for symptomatic *M. pneumoniae* infection is between 5 and 15 years, and the disease accounts for more than one third of all cases of pneumonia in teenagers, but is also seen in older persons.

PATHOGENESIS

- *M. pneumoniae* infection involves the trachea, bronchi, bronchioles, and peribronchial tissues, and may extend to the alveoli and alveolar walls.
- Initially, the organism attaches to the cilia and microvilli of the cells lining the bronchial epithelium.
- This attachment is mediated by a surface mycoplasmal cytadhesin (P1) protein that binds to complex oligosaccharides containing sialic acid found in the apical regions of bronchial epithelial cells.

- The oligosaccharide receptors are chemically similar to the I antigen on the surface of erythrocytes and are not found on the nonciliated goblet cells or mucus, to which *M.pneumoniae* does not bind.
- The organisms interfere with ciliary action and leads to desquamation of the involved mucosa and a subsequent inflammatory reaction and exudate.
- Organisms are shed in upper respiratory secretions for 2 to 8 days before the onset of symptoms, and shedding continues for as long as 14 weeks after infection.

CLINICAL MANIFESTATIONS

- A mild tracheobronchitis with fever, cough, headache, and malaise is the most commonsyndrome associated with acute *M. pneumoniae* infection.
- The pneumonia is typically less severe than other bacterial pneumonias.
- The disease is of insidious onset, with fever, headache, and malaise for 2 to 4 days before the onset of respiratory symptoms.
- Pulmonary symptoms are generally limited to a non- or minimally productive cough.

- Small pleural effusions are seen in up to 25% of cases.
- Pharyngitis with fever and sore throat may also occur.
- Nonpurulent otitis media or myringitis occurs concomitantly in approximately 15% of patients with *M. pneumoniae* pneumonitis.
- The presence of nonpurulent otitis media and lower respiratory illness in ateenager suggests *M. pneumoniae* infection

LABORATORY DIAGNOSIS

- Gram-stained sputum usually shows some mononuclear cells, but, because it lacks a cell wall, *M. pneumoniae* is not seen.
- The absence of organisms, however, may help to suggest the etiology.
- The organism can be isolated from throat swabs or sputum of infected patients using special culture media and methods, but because of its slow growth, isolation usually requires incubation for a week or longer.
- Thus, serologic tests rather than cultures are more commonly used for specific diagnosis.
- A fourfold rise of serum antibody titer in acute and convalescent sera indicates *M. pneumoniae* infection.
- The most widely used serologic method is complement fixation.

TREATMENT

- Erythromycin or tetracycline are the usual agents used for treatment of *M. pneumoniae* infections.
- They shorten the course of infection, although eradication from the nasopharynx may take much longer. Azithromycin and clarithromycin are comparable to erythromycin, but clindamycin is not effective.
- Most quinolones are also active.

MYCOPLASMA HOMINIS

- *M. hominis* is a common inhabitant of the genitourinary tract.
- Although some strains grow on ordinary blood agar as nonhemolytic pinpoint colonies, the organism is best detected on *Mycoplasma* agar, on which it grows rapidly.
- *M. hominis* and *Ureaplasma* can be differentiated by demonstrating arginine breakdown by the former and urease activity by the latter.
- *Mycoplasma hominis* is isolated from the blood of about 10% of women with postabortal or postpartum fever.

- Occasional infections of the central nervous system or joints primarily in patients with antibody deficiency syndromes or premature infants.
- The diseases appear to be self-limiting, although antibiotic therapy may decrease theduration of fever and hospitalization.
- Serologic studies and animal experiments have also
- The organism is sensitive to tetracycline.
- In contrast to *U. urealyticum* and *M. pneumoniae, M. hominis* is resistant to erythromycin.

UREAPLASMA UREALYTICUM

- The genus *Ureaplasma* contains a single species, *U. urealyticum*, of which some 14 serotypes have been described.
- *Ureaplasma* is distinguished from *Mycoplasma* by its production of urease.
- On special *Ureaplasma* agar media, colonies are small and circular and grow downward into the agar.
- In liquid media containing urea and phenol red, growth of *Ureaplasma* results in production of ammonia from the urea, with a resultant increase in pH and a change in color of the indicator.

EPIDEMIOLOGY

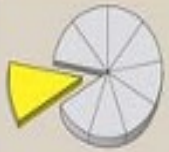
- The main reservoir of human strains of *U. urealyticum* is the genital tract of sexually active men and women; it is rarely found before puberty.
- Colonization, which probably results primarily from sexual contact, occurs in more than 80% of individuals who have had three or more sexual partners.

MANIFESTATIONS

- Because of the high colonization rate, it has been difficult to associate specific illness with *Ureaplasma*; however, studies suggest that approximately one half of cases of nongonococcal, nonchlamydial urethritis in men may be caused by *U. urealyticum.*
- In women, *Ureaplasma* has been shown to cause chorioamnionitis and postpartum fever.
- The organism has been isolated from 10% of women with the latter syndrome.

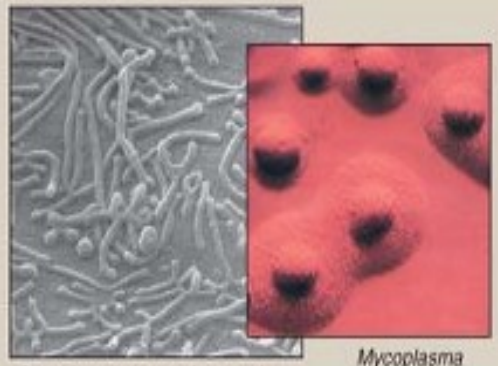
DIAGNOSIS AND TREATMENT

- Men with nongonococcal urethritis should be treated since *Ureaplasma* infection may be involved.
- Tetracycline is the treatment of choice because it is also active against *Chlamydia*, but tetracycline-resistant strains of *Ureaplasma* have been reported that have been associated with recurrences of nongonococcal urethritis in men. In such cases, spectinomycin
- treatment or treatment with quinolone antimicrobics is also effective.
- Women with postpartum fever due to *U. urealyticum* may respond to tetracycline treatment.



Mycoplasma

Mycoplasma species



Scanning electron micrograph of *Mycoplasma pneumoniae*

Mycoplasma pneumoniae colonies

- Not seen with Gram stain because it lacks peptidoglycan cell walls
- Plastic, pleomorphic shape (neither rods nor cocci)
- Cell membrane is a sterol-containing lipid bilayer
- Colonies may have "fried egg" appearance
- Rarely cultured for diagnostic purposes

Mycoplasma pneumoniae

- Primary atypical pneumonia

PENICILLINS
CEPHALOSPORINS

Tetracyclines **1** Doxycycline

AMINOGLYCOSIDES

Macrolides **1** Azithromycin or Clarithromycin

FLUOROQUINOLONES
OTHER



Radiograph of patient with *Mycoplasma pneumonia* showing patchy consolidation in both lungs