content

- Pyogenic gram positive cocci
- Bacterial infection of childhood
- Sexually transmitted bacterial disease
- Enteropathogenic bacteria
- Clostridial infection
- Bacterial infection with animal reservoirs or insect vectors
- Bacterial infection with immunocompromised host
- Filamentous bacteria
- Mycobacterial infection
- Clamydia infection
- Mycoplasma infection
- Rickettsia infection
Pyogenic gram positive cocci

- Staphylococcal infection
  - coagulase positive (S. aureus)
  - coagulase negative (S. epidermidis, S. saprophyticus)
- Streptococcal infection
  - S. pyogenes (group A)
  - S. agalactiae (group B)
  - S. pneumoniae
  - S. mutans
Staphylococcus spp.

Streptococcus spp.
Staphylococcus aureus

- Furuncles
  - infection in and around hair follicles
  - common in scalp, face, axillary
- Carbuncles
  - infection around hair follicle and produce draining sinuses
- Hydradenitis suppurativa
  - infection in sweat gland
Staphylococcus aureus

- Osteomyelitis  
  - infection in bone
- Toxic shock syndrome (TSS)  
  - infection in surgical wound, tampons produce high fever, nausea, vomiting and shock

Staphylococcus aureus

- Food poisoning  
  - diarrhea, nausea, vomiting  
  - symptom present < 6 hours after contaminated food
Staphylococcus aureus

- Staphylococcal scalded skin syndrome (SSSS)
  - severe skin infection
  - organism produce exfoliatin that destroys granulosa of epidermis → bullae, rupture, skin scald
  - other organs: lung, heart valve, bone

SSSS
Staphylococcus epidermidis

- causes opportunistic infections in catheterized patients, patients with prosthetic cardiac valves, and drug addicts.

Staphylococcus saprophyticus

- common cause of urinary tract infections in young women.
Streptococcal infection

3 types
- α hemolytic streptococci
eg. S. pneumoniae, S. viridans, S. mutans
- β hemolytic streptococci
eg. S. pyogenes (group A), S. agalactiae (group B)
- γ hemolytic streptococci (non-hemolytic)
eg. S. faecalis (group D)

α-hemolytic streptococci

S. pneumoniae is a common cause of community-acquired pneumonia and meningitis in adults
S. viridans are part of the normal oral flora but are also a common cause of endocarditis
S. mutans is the major cause of dental caries
**β-hemolytic streptococci**

- **S. pyogenes (group A)**
  - pharyngitis
  - scarlet fever
  - erysipelas
  - impetigo
  - cellulitis

**Pharyngitis**

- Infection in throat (tonsillitis)
- Clinical: high grade fever, sore throat
- Complication:
  - glomerulonephritis, rheumatic fever
  - cross reaction of immune system to M protein of bacteria
Pharyngitis

Scarlet fever

- Common in childhood
- Erythematous rash at trunk, extremities and face **except** around the mouth (circumoral pallor), strawberry tongue
- Cause by erythrogenic toxin
Scarlet fever

- strawberry tongue
- circumoral pallor

Erysipelas

- Erythematous rash, rapid distribution at face, particularly both cheek
- Rash at trunk, extremities (uncommon)
**Impetigo**

- Infection in epidermis
- Erythematous papule → pustule or honey crust
- May be caused by S. pyogenes or S. aureus

**Cellulitis**

- Infection in deep dermis
- S. pyogenes invade through wound
- Pustule in deep dermis
- Clinical: fever, erythematous skin lesion
β-hemolytic streptococci

- S. agalactiae (group B)
  - meningitis
  - chorioamnionitis
  - septicemia

Bacterial infection of childhood
Bacterial infection of childhood

- Diphtheria
- Pertussis (Whooping cough)
- Haemophilus influenzae infection
- Neisseria meningitidis infection

**Diphtheria**

- Caused by Corynebacterium diphtheriae (gram positive bacilli)
- Transmitted as respiration
- Immunization with diphtheria toxoid (formalin-fixed toxin) does not prevent colonization with C. diphtheriae but protects immunized people from the lethal effects of the toxin.
Diphtheria

- Tracheal colonization may lead to
  - Mucosal erosion, exudate
    (pseudomembrane) → obstruct airway
- Toxin-mediated damage to the heart, nerves, liver, or kidneys

Pertussis

- Bordetella pertussis infection (gram negative coccobacilli)
- Common in childhood (<5 yrs)
- Causes as laryngotracheobronchitis, ciliated respiratory epithelium necrosis
- Clinical: severe cough (whooping)
**Haemophilus influenzae infection**

- Gram negative coccobacilli
- 6 serotype (a-f), type b causes as severe disease
- Caused by
  - Pneumonia
  - Meningitis
  - Upper respiratory infection (otitis media, sinusitis, epiglottitis)

**Neisseria meningitidis infection**

- Gram negative diplococci
- Caused by
  - Meningitis (fever, stiff neck, headache, shock and dead)
  - Vasculitis (petechiae and purpura at skin and internal organs)
Meningitis

Bacterial meningitis เชื้อที่เป็นสาเหตุ

- Streptococcus pneumoniae 50%
- Neisseria meningitidis 25%
- Group B streptococci 15%
- Listeria monocytogenes 10%
- Haemophilus influenzae (type b) <10%

From Harrison ed. 16th
Sexually transmitted bacterial disease

- Gonorrhea
- Chancroid (soft chancre)
- Syphilis
Gonorrhea

- Nesseria gonorrhoeae (gram negative diplococci)
- Caused by
  - male: urethritis, epididymitis
  - female: endometritis, salpingitis, PID
  - neonatal infection: conjunctivitis, blindness
Chancroid (soft chancre)

- Haemophilus ducreyi (gram negative bacilli)
- Clinical feature:
  - Painful multiple genital ulcer and dirty based ulcer
  - 50% inguinal lymphadenitis
**Syphilis**

- Treponema pallidum (spirochete)
- 3 stages
  - primary syphilis
  - secondary syphilis
  - tertiary syphilis

**Syphilis**

- Primary syphilis
  - chancre: painless, a clean based ulcer and regression 3-6 weeks
  - inguinal lymphadenopathy
  - microscopic: chronic inflammation and organisms
Syphilis

- Secondary syphilis
  - systemic dissemination to many organs eg. skin, LN, meninges, liver, mucous membrane
  - common presentation: rash at trunk, extremities, palm, sole appears from 2 wks to 6 months after chancre heals

Syphilis

- Secondary syphilis
  - condyloma lata (exudative plaques in perineum, vulva, scrotum)
  - white mucous patch (rash at mucous membrane at mouth, genital organs)
  - fever, anorexia, alopecia
Secondary syphilis

Syphilis

- Tertiary syphilis
  - 1/3 of untreated patient develop tertiary syphilis (no organisms)
  - syphilitic aortitis (80%) → aortic regurgitation, aneurysm
  - neurosyphilis → paralysis, seizure
  - gumma : granulomatous inflammation in any organs eg. skin, bone, liver
Tertiary syphilis

syphilitic aortitis with aneurysm

Congenital syphilis

- Intrauterine infection of fetus
- Common in primary and secondary syphilis (many organisms) of pregnant women
- Organisms transferred to fetus by placenta
- Causes late abortion, stillbirth, or death soon after delivery
- 2 stages
  - early syphilis
  - late syphilis
Congenital syphilis

- early syphilis (< 2 yrs)
  - extensive cutaneous rash containing many spirochetes
  - Osteochondritis with collapse of the bridge of the nose (saddle nose)
  - Periostitis with bowing of the tibia

Congenital syphilis

- late syphilis (> 2 yrs)
  - Hutchinson triad
    - eighth nerve deafness
    - interstitial keratitis (blindness)
    - notched central incisors (hutchinson teeth)
**Laboratory diagnosis**

- **Nontreponemal antibody test**
  - detect Ab against cardiolipin in blood
  - RPR, VDRL
  - screening test, follow up
  - false positive: SLE, acute infection, leprosy
  - cure → negative result

**Laboratory diagnosis**

- **Antitreponemal antibody test**
  - detect Ab against T. pallidum
  - FTA-Abs, MHATP
  - positive after infection 4-6 wks and continuous positive until cure
Enteropathogenic bacteria

- Salmonella infection and typhoid fever
- Shigella infection
- Campylobacter infection
- Cholera
- Helicobacter pylori
- Escherichia coli
Salmonella infection and typhoid fever

- Gram negative bacilli
- Salmonella typhi
  - caused by typhoid fever
  - contaminated food and water
  - organisms contaminates in feces of carrier

Salmonella typhi (typhoid fever)
- septicemia, fever, abdominal pain
- bacterial replication in macrophages of Peyer patches of terminal ileum → nodule
- ulcer along the intestine → mucous bloody diarrhea → shock
Typhoid fever

- Gram negative bacilli
- S. boydii, S. flexneri, S. dysenteriae
- Infection small and large intestine
- Transmitted by fecal-oral route
- s/s: dysentery (cramping, tenesmus, mucous bloody diarrhea)
- Microscopic: ulcer of intestine covered by neutrophils, enlarged mucosal lymphoid follicles

Shigella infection

- Gram negative bacilli
- S. boydii, S. flexneri, S. dysenteriae
- Infection small and large intestine
- Transmitted by fecal-oral route
- s/s: dysentery (cramping, tenesmus, mucous bloody diarrhea)
- Microscopic: ulcer of intestine covered by neutrophils, enlarged mucosal lymphoid follicles
Campylobacter infection

- Comma shaped, flagellated gram negative
- Common pathogen: C. jejuni
- Transmitted by contaminated food
- Inflammation of jejunum continues to anus
- s/s: diarrhea, fever
- Microscopic: ulcer, neutrophils

Cholera

- Vibrio cholerae (comma shaped, flagellated gram negative)
- Many serotypes (01 serotype=pathogen)
- s/s: massive rice-watery diarrhea
- Gross: non-specific
Mechanism of cholera

Escherichia coli

- Gram negative bacilli
- Flora in lower intestines (colon)
- Assists with waste processing, vitamin K production, and food absorption
- Cause several intestinal and extra-intestinal infections eg. urinary tract infections (UTI), meningitis, pneumonia, abdominal pain and diarrhea
Helicobacter pylori

- Curvilinear gram negative bacilli
- Caused by chronic gastritis, peptic ulcer
- Clinical features: epigastric pain, nausea, vomiting
- Associated with gastric carcinoma and lymphoma

Helicobacter pylori
Clostridium infection

- Clostridium perfringens
- Clostridium tetani
- Clostridium botulinum
- Clostridium difficile
Clostridium perfringens

- Gas gangrene (myonecrosis)
  - organisms invade through ulcer
  - toxin destroy RBC, platelet, muscle
  (myonecrosis with gas forming)

Clostridium perfringens

- Food poisoning
- Necrotizing enteritis
  - enterotoxin of C. perfringens (type C)
    induces necrosis and hemorrhage of small intestine
  - s/s: abdominal pain, n/s, bloody diarrhea, dead (24 hrs)
**Clostridium tetani**

- Caused by tetanus
- Organisms invades to the wound
- Tetanus neonatorum: contaminated instruments

**Mechanism of C. tetani**

Organisms produces neurotoxin (tetanospasmin)

Toxin travel along peripheral nerve to anterior horn cells of spinal cord

Inhibit neurotransmitter from inhibitory neuron

Continuous muscle contraction

Trismus or lockjaw, risus sardonicus, opisthotonos, dysphagia, dyspnea
Clostridium botulinum

- grows in inadequately sterilized canned foods and releases a potent neurotoxin (botulinum) that blocks synaptic release of acetylcholine and causes a severe paralysis of respiratory and skeletal muscles

Clostridium difficile

- overgrows other intestinal flora in antibiotic-treated patients, releases toxins, and causes pseudomembranous colitis
Pseudomembranous colitis

Bacterial infection with animal reservoirs or insect vectors
Bacterial infection with animal reservoirs or insect vectors

- Plague
- Anthrax
- Leptospirosis

Plague

- Caused by Yersinia pestis (gram negative intracellular bacilli)
- Reservoir: fleas
- Infected by fleas bite
- 3 syndrome
  - bubonic plague
  - septicemic plague
  - pneumonic plague
**Plague**

- Bubonic plague
  - enlarged LN with hemorrhagic necrosis → involved skin → shock
- Septicemic plague
  - septicemia → DIC, no enlarged LN → dead
- Pneumonic plague
  - respiratory droplet transmission → pneumonia with hemorrhagic necrosis and pleuritis → dead

**Anthrax**

- Bacillus anthracis (gram positive bacilli)
- Reservoirs: goat, sheep, cattle, dog, pig
- Spores form in soil, dead animals
- 3 group
  - cutaneous anthrax (95%)
  - inhalational anthrax
  - gastrointestinal anthrax
Anthrax

- cutaneous anthrax (95%)
  - spores invade wound → painless papule and vesicle → ulcer, regional enlarged LN → cure
- inhalational anthrax
  - inhaled spores → hemorrhagic mediastinitis → sudden dead
- gastrointestinal anthrax (rare)
  - eating spores contaminated meat → GI symptom → high mortality rate

Leptospirosis

- Leptospira interrogans (spirochete)
- Reservoir: rodent, cattle, cat, dog
- Bacteria secrete in animal urination and contamination in environment
- Transmitted by abrasion wound
Leptospirosis

- Composed of 2 symptom
  1. Anicteric leptospirosis
     - leptospiremic phase: fever, headache, myalgia, hepatosplenomegaly
     - leptospiruric phase: aseptic meninigitis

2. Severe leptospirosis (Weil syndrome)
   - severe jaundice, hepatosplenomegaly
   - acute renal failure (dead)
   - bleeding in GI, skin, brain
Bacterial infection with immunocompromised host

- Pseudomonas infection
- Legionnaires infection
Pseudomonas infection

- Pseudomonas aeruginosa (gram negative bacilli)
- Nosocomial infection
- Common in severe burn, cystic fibrosis, leukopenia

Pseudomonas aeruginosa

- Necrotizing pneumonia
- Keratitis (contact lens)
- Vulvular disease (IVDU)
- Otitis externa (swimming)
- Ecthyma gangrenosum (severe burn)
Legionnaires infection

- Legionella pneumophila (gram negative bacilli)
- Reservoir: water source, air condition
- 2 symptom
  - pontiac fever (URI, fever → cure)
  - legionnaires disease (severe pneumonia)

Filamentous bacteria
Filamentous bacteria

- Actinomycosis
- Nocardiosis
- Mycetoma (actinomycotic mycetoma)

Order Actinomycetales (Actinomycetes)

- Aerobic actinomycetes
  - cell wall with mycolic acid
    - Nocardia, Mycobacterium, Corynebacterium
  - cell wall without mycolic acid
    - Actinomadura, Streptomyces
- Anaerobic actinomycetes
  - cell wall without mycolic acid
    - Actinomyces, Propionibacterium, Lactobacillus

* เชื้อที่ cell wall มี mycolic acid จะย้อมสี AFB และ modified AFB
- Actinomycosis ภูมิแพ้เชื้อ
  - Actinomyces spp.
- Nocardiosis ภูมิแพ้เชื้อ
  - Nocardia spp.
- Actinomycotic mycetoma ภูมิแพ้เชื้อ
  - Actinomadura, Streptomyces, Nocardia spp.
  - organism pass the wound

Actinomycosis

- Actinomyces israelii
- Flora in oral, pharynx, GI, vagina
- Caused by lump jaw, osteomyelitis, intra-abdominal infection, pelvic inflammatory disease (IUD)
Actinomycosis

- Gross: sulfur granules (grains)
- Microscopic: organisms surrounded by neutrophils, histiocytes, giant cells
- Special stains (GMS): filamentous shaped bacteria

sulfur granules
**Actinomycosis**

- Cluster of filamentous bacteria
- Filamentous bacteria by GMS

**Nocardiosis**

- Oppotunistic infection in immunocompromised host
- Nocardia asteroides
  - lobar pneumonia or abscess
  - organisms found in soil
  - transmitted by inhaled organisms
  - s/s : fever, cough, dyspnea
Nocardiosis

- Microscopic: neutrophil, macrophage, necrosis, organisms and may be giant cells
- Special stains: modified acid fast stain (red filament or branching)

Nocardia spp. (Modified AFB stain)
Mycetoma

- Actinomycotic mycetoma: caused by
  - Actinomadura spp.
  - Streptomyces spp.
  - Nocardia spp.
- Eumycotic mycetoma: caused by
  - Fungi e.g. Pseudallescheria spp., Madurella spp.

Actinomycotic mycetoma

- Localized multiple nodules with sinuses and swelling lesions
- Involving cutaneous and subcutaneous tissues, fascia and bone
- Occurs on foot or hand
- Results from traumatic implantation of soil organisms into the tissues
Actinomycotic mycetoma

- Lesions are composed of suppurating abscesses and sulfur granules (grains)
- Microscopic: organisms surrounded by neutrophils, histiocytes, giant cells
- Special stains (GMS): filamentous shaped bacteria
Actinomycotic mycetoma

Cluster of filamentous bacteria

Filamentous bacteria by GMS

Mycobacteria infection
Mycobacterium spp.

- Mycobacterium tuberculosis complex
  - *M. tuberculosis*, *M. bovis*, *M. africanum*, *M. microti*
  - causes pulmonary and extrapulmonary tuberculosis
- Nontuberculous mycobacteria (NTM)
  - Mycobacterium avium complex (MAC) (M. avium, M. intracellare)
  - Mycobacterium causes leprosy
  - *M. leprae*

Pulmonary tuberculosis

- Caused by *M. tuberculosis*
- Classified 2 types
  - Primary pulmonary tuberculosis
  - Secondary pulmonary tuberculosis
Primary pulmonary tuberculosis

- Primary infection at lungs composed of “Ghon complex”
  - Lung infection → Ghon focus
  - Infection of hila node
- Most of infected persons → healed scar
- Clinical : non specific
Secondary pulmonary tuberculosis

- Reactivation or reinfection of primary TB with asymptomatic
- Common infection at high O2 (apex of lung)
- Severe lung damage and produces cavity

Secondary pulmonary tuberculosis

- Clinical course
  - chronic cough, low grade fever, weigh loss, anorexia
  - recovery if normal immune or treatment
  - lymphatic or hematogenous spread to other organs eg, liver, spleen, pancreas → miliary TB
Secondary pulmonary tuberculosis

Miliary TB
Caseous granulomas

Pulmonary TB

AFB stain
Extrapulmonary tuberculosis

- TB at any organs eg. LN, GI, skin, meninges, bone, liver spleen etc.
- Transmitted by TB lung spreading or direct invasion to any organs
- Gross and microscopic similar to TB lung
Diagnostic test for TB

- Special stains
  - AFB: reddish bacilli
  - Gram stain: indistinct gram positive bacilli
- Culture
- PCR

Nontuberculous mycobacteria

- Common in immunocompromised host eg. AIDS, leukemia
- Organisms contain in soil and water
- M. avium complex (MAC)
- Infection in any organs eg. lung, GI, bone
- s/s: depend on location
Nontuberculous mycobacteria

- Gross: non-specific
- Microscopic: clusters of macrophages contain many organisms (AFB stain)

![AFB stain](image)

Leprosy

- Mycobacterium leprae
- Transmitted by respiration
- Causes skin lesion
  - tuberculoid leprosy
  - lepromatous leprosy
Tuberculoid leprosy

- Asymmetry erythematous plaque with sharp outer margins fading centrally to a flattened clear zone of healing that is rough, anhidrotic, hairless, hypopigmented, and anesthetic
- Muscle atrophy, ulcer, contracture
- Slow progressive
- Micro: granulomatous inflammation, rare organisms
Lepromatous leprosy

- More severe
- The early lesions of lepromatous leprosy are multiple, symmetrically distributed, erythematous ill-defined macules and papules
- Muscle atrophy
- Micro: clusters of macrophages containing organisms (AFB stain)
Chlamydia infection

- Chlamydia trachomatis
- Chlamydia psittaci
- Chlamydia pneumoniae
**Chlamydia trachomatis**

- trachoma
- acute inclusion conjunctivitis
- urogenital infection
- lymphogranuloma venereum

**Chlamydia psittaci**

- Caused by animal disease
- Human infected by respiration of secretion of affected animal
- Clinical features: upper respiratory tract infection, atypical pneumonia
Chlamydia pneumoniae

- Transmitted by respiration
- Caused by atypical pneumonia

Mycoplasma infection
M. pneumoniae

- No cell wall → no Gram staining
- Transmitted by respiration
- Common in child, young adult
- Caused by
  - pharyngitis
  - sinusitis
  - laryngotracheobronchitis
  - atypical pneumonia

Rickettsia infection
Rickettsia infection

- Animal reservoirs: tick, mite, flea, louse
- 3 groups:
  - spotted fever group
  - typhus group
  - scrub typhus group

Spotted fever group

- Rocky Mountain spotted fever
  - R. rickettsii
  - Tick bite
- Rickettsiapox
  - R. akari
  - Mite bite
Typhus group

- Epidermic typhus (Brill-Zinsser disease)
  - R. prowazekii
  - Louse feces
- Murine typhus
  - R. typhi
  - Rat flea feces

Scrub typhus group

- Scrub typhus
  - Orientia tsutsugamushi
  - Chigger bite
Rickettsia infection

- Pathology
  - destroy arteriole and capillary
  - necrotizing vasculitis
- Spotted fever and scrub typhus groups: eschar
- Typhus group: no eschar

Eschar
THE END