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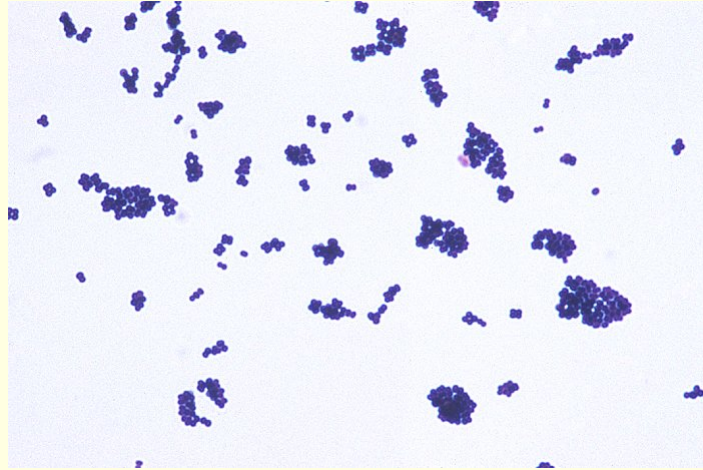
Pyogenic gram positive cocci



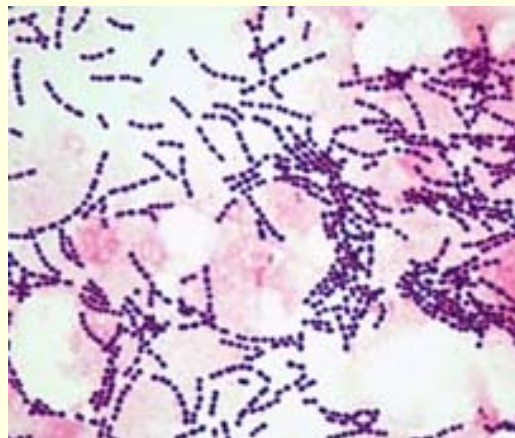
Pyogenic gram positive cocci

- 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



furuncles



carbuncles

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 granulososa 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

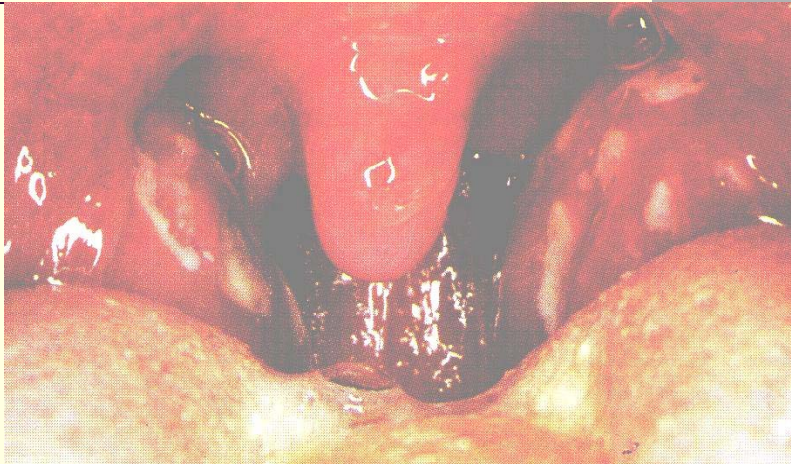
β -hemolytic streptococci

- *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



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Pertussis

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

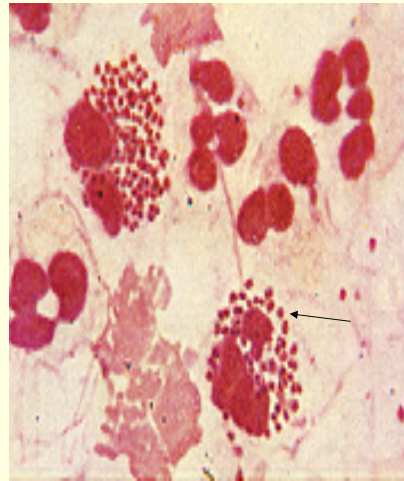
Haemophilus influenzae infection

- 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



N. meningitidis

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



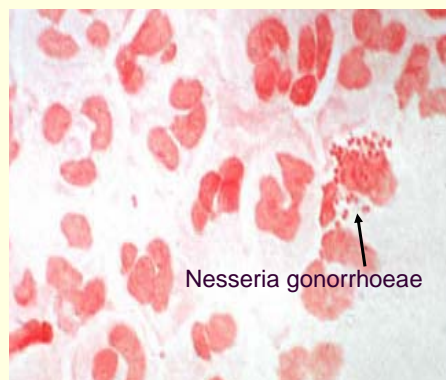
Sexually transmitted bacterial disease

- Gonorrhea
- Chancroid (soft chancre)
- Syphilis

Gonorrhea

- *Nisseria gonorrhoeae* (gram negative diplococci)
- Caused by
 - male: urethritis, epididymitis
 - female: endometritis, salpingitis, PID
 - neonatal infection: conjunctivitis, blindness

Gonorrhea



Chancroid (soft chancre)

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

Chancroid (soft chancre)



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

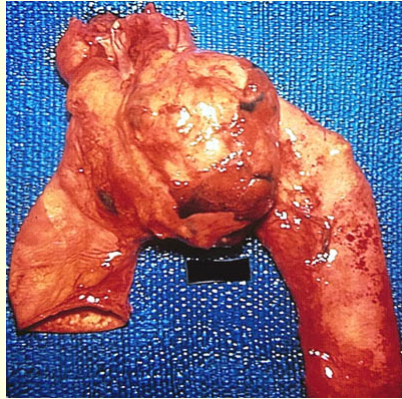
Secondary syphilis



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

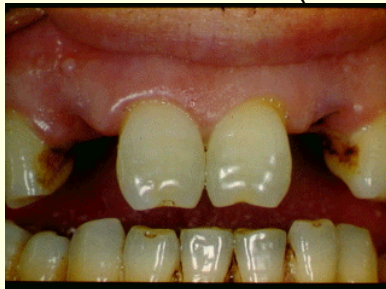
- Intrauterine infection of fetus
- Common in primary and secondary syphilis (many organisms) of pregnant women
- Organisms transferred to fetus by placenta
- Causes late abortion, stillbirth, or death soon after delivery
- 2 stages
 - early syphilis
 - late syphilis

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

Enteropathogenic bacteria

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

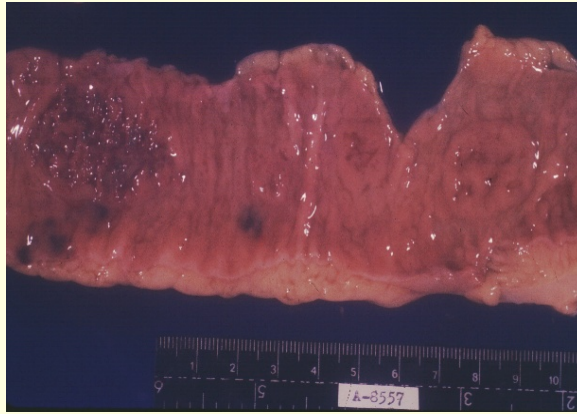
Salmonella infection and typhoid fever

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

Salmonella infection and typhoid fever

- 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



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, tenemus, mucous bloody diarrhea)
- Microscopic: ulcer of intestine covered by neutrophils, enlarged mucosal lymphoid follicles

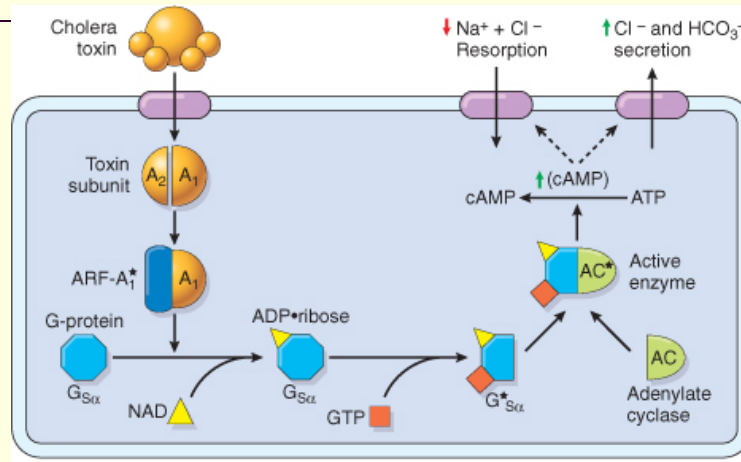
Campylobacter infection

- 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

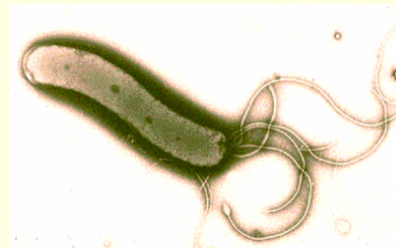


Escherichia coli

- 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

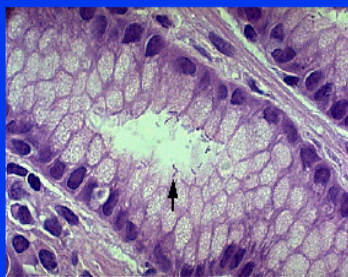
Helicobacter pylori

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

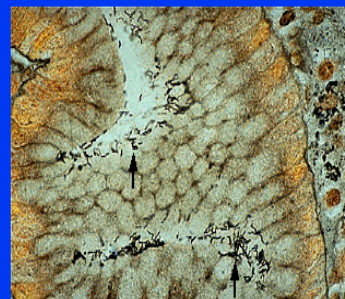


Helicobacter pylori

HELICOBACTER PYLORI



HELICOBACTER PYLORI
(SILVER STAIN)



Clostridium infection

Clostridial 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 death
- 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 meningitis

Leptospirosis

2. Severe leptospirosis (Weil syndrome)

- severe jaundice, hepatosplenomegaly
- acute renal failure (dead)
- bleeding in GI, skin, brain

Bacterial infection with immunocompromised host



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 จะข้อมติ AFB และ modified AFB

- Actinomycosis เกิดจากเชื้อ
 - Actinomyces spp.
- Nocardiosis เกิดจากเชื้อ
 - Nocardia spp.
- Actinomycotic mycetoma เกิดจากเชื้อ
 - 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

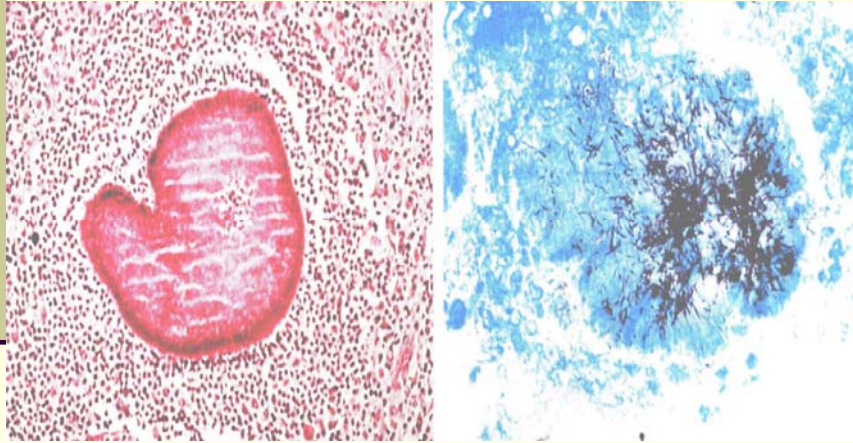
- Gross: sulfur granules (grains)
- Microscopic: organisms surrounded by neutrophils, histiocytes, giant cells
- Special stains (GMS): filamentous shaped bacteria

Actinomycosis



sulfur granules

Actinomycosis



Cluster of filamentous bacteria

Filamentous bacteria by GMS

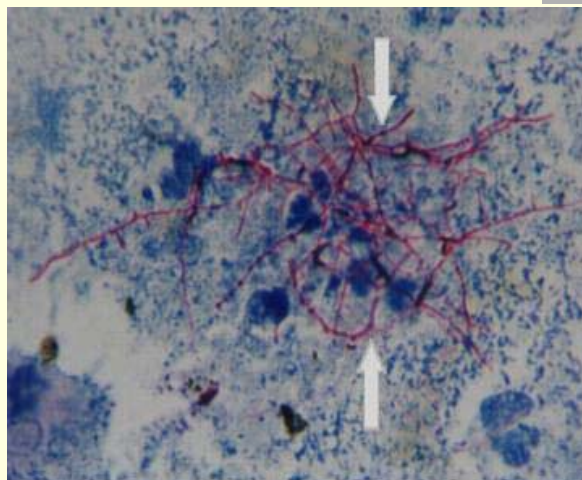
Nocardiosis

- Opportunistic 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.

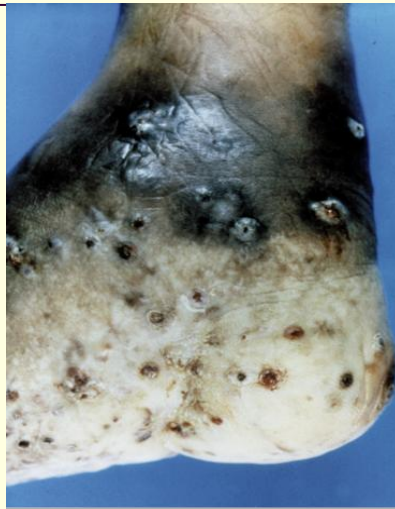
Actinomycotic mycetoma

- 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

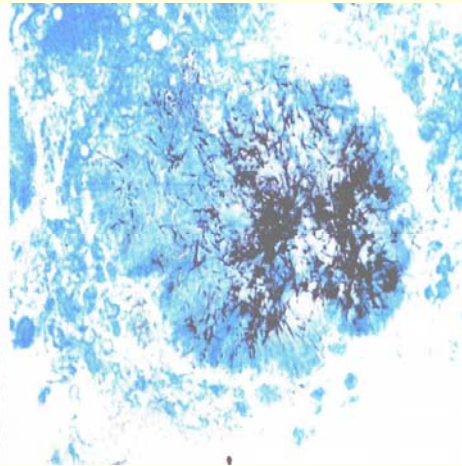
Actinomycotic mycetoma



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

Primary pulmonary tuberculosis



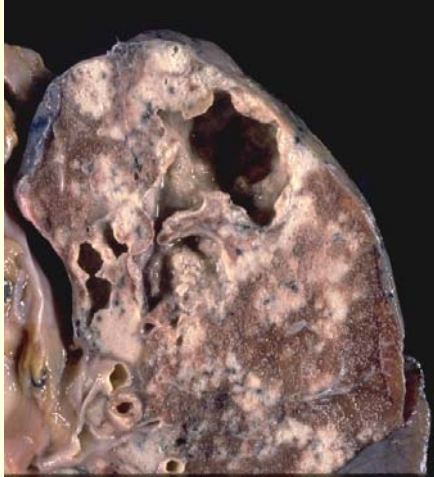
Secondary pulmonary tuberculosis

- 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

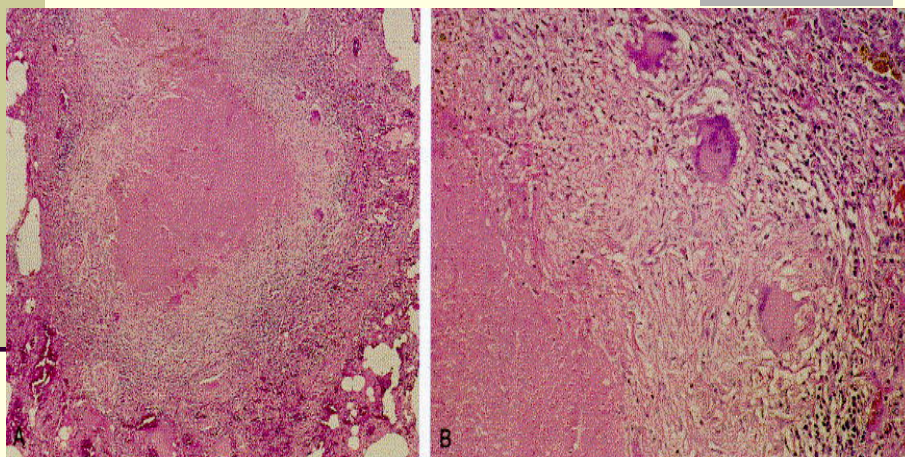
Secondary pulmonary tuberculosis



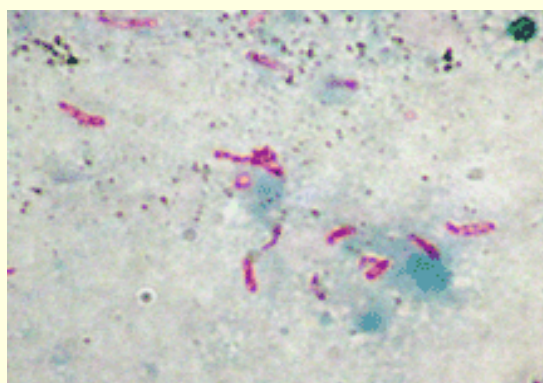
Miliary TB



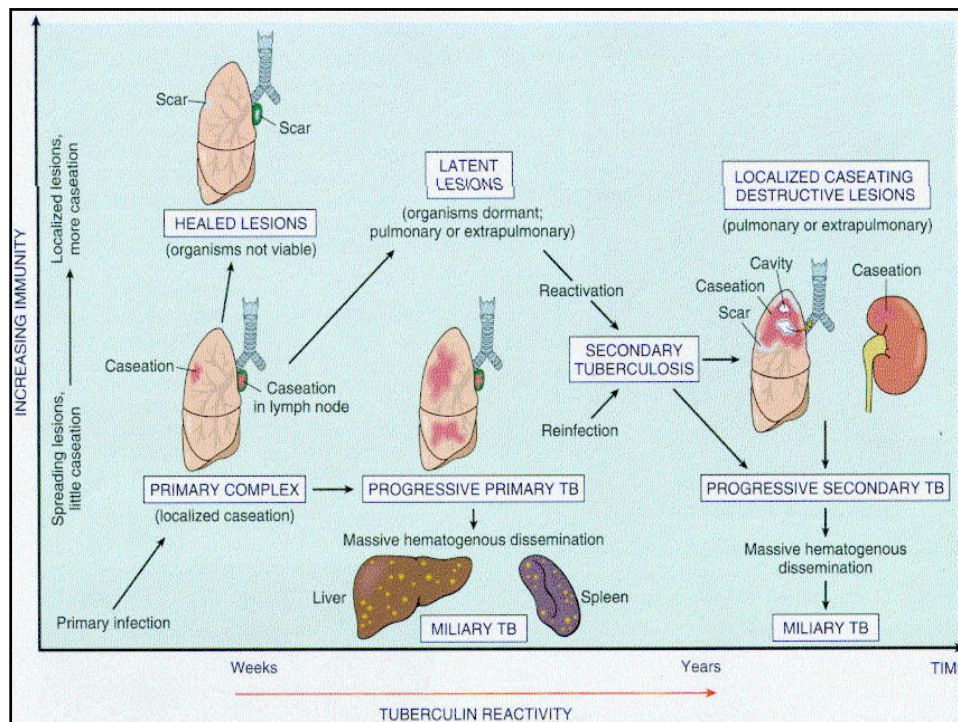
Caseous granulomas



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

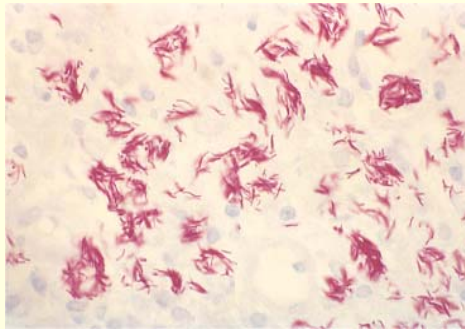
- Special stains
 - AFB : reddish bacilli
 - Gram stain : indistinct gram positive bacilli
- Culture
- PCR

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

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

Tuberculoid leprosy



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)

Lepromatous leprosy



Chlamydia infection

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

- Epidemic 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

