

DEFINITIONS and plan:

Diagnosis—symptoms, lab tests-antigens, antibodies, growth on selective media

Control-sanitation for fecal/oral route, vaccines

Treatment (Rx)-antitoxins, gamma globulin, antibiotics

Diseases: I will describe

organisms,

disease

Treatment

Control

Complications

Make a table of ones that are on the 213 homepage under diseases

Organism	shape/Gram stain	Disease(s)	Treatment	Control	Complications
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GRAM POSITIVE COCCI-two cause several diseases, considered separately

A. STAPHYLOCOCCUS AUREUS

Staph epidermidis(Non pathogenic)

G+ve coccus = clumps- aureus means "yellow"

white

90% path produce alpha and delta hemolysins

no

coagulase positive- reliable

no

anaerobic fermentation of mannitol

no

80% strains have penicillinase

phage typing: (phage 80 or phage 81) 80/81=hospital pathogens, type 71 = impetigo

hardy- can survive 60°C 1 hr, 80° 30 min, **high salt**

Control: sanitation, aseptic technique

Treatment: (Rx)- Penicillin, methicillin, oxacillin- determine Minimal Inhibitory Concentration (MIC)

Diag.- Mannitol Salts agar, blood agar, coagulase test

Diseases: Skin: boils, pimples, impetigo

Enteric- food poisoning --enterotoxin

Systemic- pneumonia

meningitis

cystitis

brain abscesses, endocarditis

puerperal fever- (childbed fever)

uterine infections

phlebitis, osteomyelitis

Spread- Dangerous triangle--nose mouth

Nosocomial infections (hospital caused)

B. STREPTOCOCCUS PYOGENES

S. pyogenes - Lancefield **group A β** (beta)-hemolytic- cause 90% of strep disease in humans

Diseases:

impetigo- skin infection, blisters

Pharyngitis (strep throat)

Puerperal fever

Erysipilas- skin- spreading inflammation

Scarlet fever- erythrogenic toxin (lysogenic phage)

Complications

Rheumatic fever- after strep throat infections, heart muscle damage- valves

Similarity of heart muscles with group A antigens=autoimmune

Glomerulonephritis--if skin infection strain has a nephritic toxin,

I. SKIN DISEASES:

1. Furuncles & Carbuncles

Staph access in pilosebaceous gland (lipase) - pus, inflammation, necrosis,
near surface = **pimple** → in dermis **boil (furuncle)** spreads w. pressure → deeper, **carbuncles**-
most dangerous --heart, bone, brain

2. **Impetigo**- *Staph aureus*, *Strep progenes* superficial lesions, blisters, crust, weeps,

3. **Acne**- *Propionibacterium acnes*-

Rx:-dry out sebaceous glands- benzyl peroxide, tetracycline

4. **Burn Infections**--*Pseudomonas aeruginosa*, *Serratia marcescens* -crusts allow
Microorganisms to grow

VIRAL SKIN DISEASES

1. **Smallpox (Variola)** virus-brick shaped

scourge- centuries- wiped out Massachusetts Indians 1617

red spots ---blisters, fever, headache crusts in about 10 days - scarring

Transfer = person-person

Diagnosis- serology

Success story: Eradicated Oct. 1977-last case, a Somali in 1978-England lab accident

No carrier--no reservoirs except humans

Control: Vaccine: Jenner- first vaccination: milkmaids were immune because of **cowpox (Vaccinia)**

2. **Chicken Pox (Varicella virus)**- type of Herpes virus

disease- inhaled (URT--->blood(epidermis-->nerves- thoracic, lumbar, facial

blister, scab, crust- little scarring

Rx- - now--new vaccine

Zoster- (Shingles) same virus- latent- children who had chicken pox < 2 years old

Dormant in nerves erupts along nerve trunks on torso-very painful

3. **Measles (Rubeola)** (red)--paramyxovirus very infectious- respiratory involvement

Rx- antibiotics for secondary infection

Control- live attenuated vaccine **MMR vaccine** 2 Measles, Mump

Complications- Mental retardation if --encephalitis 1/1000 cases

Before vaccine 4 Million cases annually 4000 encephalitis, 500 deaths

after vaccine, down to about 25-50 cases/year

BUT--coming back--young parents not getting children immunized

6. **German Measles (Rubella)** togavirus enveloped

milder, incubation 14-21 days

Control- live attenuated vaccine (MMR)

Rx- none

Complications- congenital infections

1. **1st trimester**, 90% chance fetus infected, damage to 30-50% including
miscarriages, cataracts, heart, deafness, encephalitis, limb malformation

II. DISEASES OF UPPER RESPIRATORY TRACT (URT)

A. Bacterial Infections

1. **Strep Throat**-*Strep pyogenes* (A beta) (also by *Hemophilus influenzae* &
Strep. pneumoniae)

sore throat, fever, cough, lymph nodes swell ~1 wk.

Erythrogenic toxin -- scarlet fever -

Control- throat swabs--inoculate blood agar + bacitracin -look for beta hemolysis and sensitivity

Rx - penicillin or vancomycin

Complication- rheumatic fever= autoimmune disease (see Strep above) - Group A antigen

2. Diphtheria- *Corynebacterium diphtheriae*

G+ve rod-pleomorphic, obligate aerobe-metachromic granule, "Chinese characters" cells

Not invasive--uses its toxin to damage host--

Toxin is main virulence factor-carried by phage

kills epithelial cells, forms white membrane (PMNs, desquamated cells)

victim smothers, or heart failure

Diagnosis: bloody nasal discharge, fever, chills, enlarged cervical nodes

Control-toxoid (DPT)

Treatment: antitoxins, antibiotics--erythromycin and penicillin

B. Viral Infections

1. Cold- 120 known viruses, myxoviruses- influenza viruses, parainfluenza

30-40% by rhinovirus enteroviruses=- ECHO, Coxsackie, small RNA picornavirus adenovirus

Spread- close contact, inhalation

Control-wash hands often-don't touch nose, eyes, mouth

Treat symptoms

2. Sore Throat- Adenovirus- 30 strains cause

Diagnose-cold, sore throat, cough, fever - like strept. throat

can get pneumonia, conjunctivitis

III. LOWER RESPIRATORY TRACT DISEASE (LRT)

LRT = Trachea, bronchi, bronchiole, alveoli, pleura, cilia

cough reflex decreases with alcohol, narcotics. Cilia are paralyzed with nicotine

A. Bacterial

1. Pneumonia

a) **Streptococcal pneumonia** lancet shaped Diplococcus, needs incrsd CO₂, fastidious

G pos, **Capsule** major virulence factor (prevents phagocytosis)

Diag – G pos, alpha (green) hemolytic, flat translucent colonies, bile soluble

Disease – fever, chest pain, increased sputum

URT → LRT → alveoli, then multiply, inflam response, bloody sputum, PMN's, RBC

if infects nerve endings = & membrane around lungs = pain = pleurisy

if infects blood stream → endocarditis, meningitis

84 capsule types 12 most prevalent

Control – vaccine (against the 12),

Rx: erythromycin, penicillin, tetracycline

b) **Klebsiella pneumoniae** alcoholics, pediatrics wards in hospital -serious → permanent lung

damage -Pathogenicity – endotoxin – damages lung tissue

Diag – G neg rods, non motile, lac+ on EMB, large mucoid colonies

c) **Hemophilus influenzae** 0-4 years old Major cause of meningitis at this age
Diag. – coccobacillus in CNS fluid, **Capsule** =major virulence factor

d) **Legionella pneumophila** – 1976 Am. Legion convention– Philadelphia

Rod shaped – aerobic, fastidious, up to 20µ long

transmission through standing water cooling systems.air conditioners??

Disease:high fever, chill, diarrhea, severe pneumonia. Endemic in Vermont

Rx – erythromycin, lots of ampicillin

e) **Mycoplasma pneumoniae** “primary atypical pneumonia, PAP, mild

Diag – no cell wall, filamentous--Colonies = fried egg appearance

Rx – not penicillin (WHY?) but erythromycin, tetracycline

f) **Staphylococcus-see above**

g)

Viral pneumonias– many-of URT-antibiotics no good

Other LRT Infections

2. **Whooping Cough – Bordetella pertussis** G neg rod, encapsulated.

Obligate aerobe, fastidious,

Infects tracheobronchial surfaces = thick mucous toxin → epithelial cells, adheres to surfaces
don't invade blood

Disease – spread – inhale droplets, Nasal cong, mild cough → 1 wk **violent cough**

Whoop = inhaltn – most contagious Can last 8 wks w. vomiting, convulsions
10% deaths in infant

Control – **Vaccinate** infants = DPT killed cell vaccine., 70% effective

1934- 265,000 cases

Rx-erythromycin, tetracycline.

3. **Tuberculosis - Mycobacterium tuberculosis**

acid fast rods, high lipid (wax), aerobic, slow growing, non motile

Spread = inhalation

Disease – depends on host – HS, immunity, dose, can infect any organ

Chronic – fever, wt. loss, cough, sputum, months-years
early 1900's 200/100,000 died

Tests for exposure – Old Tuberculin (Koch) interdermal injection

Delayed hypersensitivity reaction (24-48 hrs) -“induration”

PPD skin test (Mantoux) 1-5 mm neg , 5-9 doubtful, 10-33 mm positive

Treat– drugs INH (isoniazid) PABA, str, rif

Control– early X ray, PPD tests – 1 yr

Scandinavia = vaccinate w. BCG (Bacillus Calmette Guerin) 80% effective

Dispose of sputum – don't let dry—very infective

B. Viral Diseases of LRT

1. **Influenza** URT → LRT orthomyxovirus (RNA) Lipid envelope

types A – pandemics

B, C – local epidemics

Pandemics every 8-10 years 15-50 age

worst 1918 – 500 million people infected in 6-8 wks worldwide

Virus type?? Abs later similar to swine virus A/New Jersey/76 H sw/N/

Changes – because of recombination and mutations 78

Disease – inhaled, → mucous (neuramidase in envelope)

Kills ciliated cells, inflam response, plasma leakage

Deaths high mainly from secondary infectn (Staph)

Diag – isolate virus → chick embryos complement fixation test

Control – Immunity 1-2 yrs

New – purer vaccine European live attenuated virus—fewer reactions

IV. GASTROINTESTINAL TRACT DISEASES

Two types:

Infections: The bacteria grow inside host after being ingested

Food poisonings: Ingestion of the toxins

Most caused by *Enterobacteriaceae*—all are Gram neg rods, all spread fecal-oral route, water, food

1. **Gastroenteritis:** diarrhoea and vomiting—Infants and travelers

a. *Escherichia coli*—Gneg rod, lactose positive, motile, EMB medium

b. *Salmonella typhimurium*—most prominent, many species”

Identify: G neg, lactose neg., motile, H and O antigens

Spread: food, feed large crowds, held at RT (dairy products), Pet turtles

Disease—Disease—1-2 days after infection→lining of colon, small intestine, inflammatory response

Rx control electrolytes, antibiotics

Control—increased sanitation, refrigeration

Problem—R factors spread among enterobacteriaceae-abtic resistance

c. *Campylobacter jejuni* and *fetus*—increasingly a cause of diarrhea in infants and compromised patients

2. **Dysentery—*Shigella dysenteriae***—most virulent(also *S. sonnei* and *S. flexneria*)

Diagnosis: G neg. lactose neg, non motile, EMB, SS media and.

Spread—fecal oral, food, water

Disease—“explosive diarrhea”, blood, mucus-caused by an **endotoxin** and potent **exotoxin** (enterotoxin) invades intestinal villi—necrosis, ulceration

Rx -symptoms, antibiotics (R factor problem)

Control-increased sanitation

3. **Typhoid Fever (Enteric fever) *Salmonella typhi***

Diag: G neg, lactose neg, motile Increased ab titer to **Vi (K) antigen**

Isolate from urine, feces, blood, contaminated food

Disease—contaminated food→intestinal lining 1-2 weeks-multiplies inside phagocytes

Endotoxin ruptures lining, Fever, headache, cramps, shock, loss of blood

20% untreated are fatal.

Control—sanitation, vaccine—killed cells-military

Rx—Chloramphenicol, ampicillin, amoxicillin

Problem—R factors, Carriers (**Typhoid Mary**—Irish cook, NYC, 1900)

1900's--350,000 cases/yr, now about 300

4. **Cholera—*Vibrio cholera***

Diag—spirillum, comma shaped, G neg, aerobic, motile in stools

Disease –endemic in India, SE Asia— **Enterotoxin** increases permeability of intestine

Profuse outpouring of fluids "rice water stools"

Spread—contaminated food/water in a few hours can lose 15% body wt, 25 L fluid

Rx—replace fluids and electrolytes (NaCl, NaHCO₃, K⁺)

Control—reservoir—humans, Well-nourished, resistant -6 Amer. Travelers in 10 years have contracted cholera)

Vaccine—killed cells, only good about 1 yr

FOOD POISONINGS—

Ingest preformed toxins (as opposed to infections)

Gram positives

1. a. *Staphylococcus aureus* 2-8 hrs-nausea, projectile vomiting, diarrhea

Recover-few hours growth usually in dairy products, produces enterotoxin

b. *Bacillus cereus*—enterotoxin

2. **Botulism**—*Clostridium botulinum* type A toxin—heat labile, boil 15 min destroys it

Gram pos. spores, anaerobe

Disease—powerful **neurotoxin**→bloodstream→ nerves 24-72 hrs=blurred vision,

paralysis—swallowing, respiratory muscles= 25% fatal

toxin one of most potent known—a few mg could kill all people in NYCity

Rx-antitoxin types A (most powerful), B, E

Control—good canning—pressure, can't count on spoilage or taste to detect

B. VIRAL

1. **Mumps**—mumps virus (paramyxovirus)

Disease—spread by saliva →URT→parotid glands

Incubation 16-21 days

Complications—encephalitis, sterility in adult males if infects testes (25% unilateral)

Control=live vaccine—good, part of MMR shot

2. **Hepatitis**

Infectious Hepatitis -A Virus (HAV) = 15-50 days incubation

Serum Hepatitis- B Virus (HBV) = 43-180 days

Disease- inflammation of the liver, decreased appetite, vigor, increase fever, jaundice

Diagnosed-antigens, liver function enzymes abnormal

a. **Infectious Hepatitis (HAV)** spread-raw shellfish, fecal oral route

Mild to severe

Rx—if exposed, given human gamma globulin (antibodies from immune individuals)

Weeks of bedrest if sick

Control-New genetically engineered vaccine

b. **Serum Hepatitis (HBV)** injected blood, wounds

More severe 1-10% fatal--Incidence is increasing with needles-drug users, ears pierced, tattooing, shared towels, razors

Control—hygiene, no sharing of needles, etc.New genetically engineered vaccine

c. **Hepatitis C, D—New, on the rise**

V. GENITOURINARY INFECTIONS

1. Urinary Tract-Kidneys, bladder, ureter, urethra

more prevalent in females (urethra shorter, closer to vagina)

severe in kidney

Cause—normal flora. 50% E. coli, also Strep faecalis, Proteus, Ps. aeruginosa-hard to treat.

2. Genital Tract

Puerperal Fever (childbed fever) *Streptococcus pyogenes* group A beta

1850's Dr. Simmelveiss introduced Drs to washing hands—decreased deaths dramatically

VI. VENEREAL DISEASES (VD) OR SEXUALLY TRANSMITTED DISEASES (STD)

Spread by sexual contact

1. Gonorrhea—*Neisseria gonorrhoea*, Gneg diplococcus, oxidase positive, can see within WBCs

Male—pain, urethritis, mucoid discharge. If blocks urethra-urinary infections, if blocks vas deferens-sterility

Female-asymptomatic. If in uterus or fallopian tubes=scarring=sterility or extopic pregnancies

Newborn—blindness—controlled by AgNO₃ or penicillin

Pathogenicity: attaches to epithelial tissue by pili

Control now—very high doses of penicillin and tetracyclines - New vaccine-anti-pilin

2. Syphilis—*Treponema pallidum*-spirochaete, very thin, must see with special stains

Can be cultured only in rabbit testes.

spread 90 % by sexual contact (other 10% from mother or contact with lesions like in mouth)

Diagnosis: VDRL, Kahn tests—serology—or Rapid Plasma Reagin (RPR test)

Disease: 3 stages-mimics many diseases

Tertiary stage—anytime-20 years, Hypersensitive reaction, depends on where it is bone --deformities

CNS-insanity, paralysis

blood vessel walls-rupture=death

eyes-blindness

People who have had: Henry VIII, Ivan the Terrible, Catherine the Great, Mussolini, Idi Amin

Non-infectious, hard to treat or diagnosis

Other Venereal Diseases:

Granuloma inguinale

Soft chancere

Herpes type 2

Chlamydia

VII. CENTRAL NERVOUS SYSTEM

A. BACTERIAL

1. Meningococcal Meningitis—*Neisseria meningitidis*, G neg diplococcus within wbc endotoxin—damages nerves

Disease-mild cold, headache, fever, stiff neck and back, spots, shock, death within 24

hrs—usually in 0-2 year olds

Control: vaccine, rifampicin if exposed

2. **Leprosy-*Mycobacterium leprae*** (Hanson's disease)—acid fast, culture only in armadillo and mouse foot pads. Mainly in 3rd world countries 10-20 mil cases/yr

Depends on Hypersens. reaction—

Diagnose-acid fast, spread nasal secretions. Not very contagious

Disease of peripheral nerves, lepromatous=worst kind—disfigures

Treat-Dapsone (sulfone)

B. VIRAL

1. **Poliomyelitis** -poliovirus I, II, III (picornavirus) spread by contaminated food, water kills nerves=paralytic

control—inactivation, chlorination

Salk vaccine-1954-formalin killed

Sabine vaccine, 1956-attenuated (weakened) oral vaccine

in 1954 there were 18,000 cases. In 1973, only 7 cases. Now almost eradicated

2. **Rabies**—rabies virus (Rhabdovirus-bullet shaped, large)

diagnose—brain smears-- Negri bodies in nerve cells

Disease—infected saliva-bite, incubates 30-60 days, get spasms in throat peripheral nerves to CNS to saliva to, change in temperament, drooling, excitable, seizures, coma, death.

Control-reservoirs= skunks, bats, foxes, raccoons, dogs-1 million bites/rear quarantine 7-14 days (if in saliva, will die within that time)

Vaccines-Pasteur-dried brains used (attenuated virus) many reactions

New vaccines-viruses from human tissue culture

can vaccinate after exposure, since virus takes so long to work (and is in CNS, so doesn't elicit an immune response naturally).

Treat-clean wound, immediate antirabies serum in wound and intramuscularly, then start vaccination

VIII. WOUND INFECTIONS

Aerobic: *Staph. aureus*—most surgical

Strep pyogenes

Pseudomonas aeruginosa-burns—new treatment, immunize with killed Ps.

Vaccine

Anaerobic: *Clostridium* (Gram positive spore forming rods)

2. **Tetanus** (lockjaw) *Clostridium tetani*—normal in soil, 50% fatal in nonimmunized

exotoxin →nerve cells, contracts counteracting muscles = agony

deep wounds (anaerobic) 4-6 days to 6 weeks-become restless, irritable, stiff jaw,

Treat-clean wounds, damaged tissue, give antitoxin (human gamma globulin best)

penicillin

once the toxin is in nerve, can't reverse—then treat with barbituates

control DPT-booster every 10 years

3. **Gas Gangrene- *Clostridium perfringens*** (and others) -non motile, battlefield or surgical abortions, accidents

Diagnose—wounds—see spores or "box car Bacillus" (very rectangular)

Treat: remove dead tissue, antiserum, penicillin, tetracycline, increase oxygen to wound

IX. ARTHROPOD BORNE DISEASES

Many diseases carried by insects such as:

Mosquitoes— **malaria**—(protozoa), **equine encephalitis** and **yellow fever** (viruses)

Flea- **plague** *Yersinia pestis* (bacterial)

Louse— **typhus** (*Rickettsia* (bacterial))

Ticks— **tularemia** (parrot fever)-*Francisella tularensis* (bacterial)

Rocky mountain spotted fever -*Rickettsia*(bacterial)

Lyme Disease- *Borrelia burgdorferi*—(bacterial)-deer tick bite, bulls eye
rash in about 50% of cases

Treat with doxycycline and amoxicillin

Controls—vaccines, rat poisons, DDT, insect control