Infection Control
Common Infectious Agents and Their Control Part 2

Review from workshop #5

Scabies: parasitic dx caused by mite through direct contact.
  Human reservoir.
  - Papules in linear burrows
  - Incubation period 2-6 wks
  - Ivermectin - one dose
  - Lindane or Kwell lotion over body and repeat
  - Wash bedding, clothing; clean surfaces

Lice: parasitic dx caused by louse-head-body-crab through direct/sexual contact or indirect infected contact. Human reservoir.
  - Head: hair shaft, eye brows, lashes
  - Body: clothing seam and folds
  - Pubic: genitals
  - Pyrethrin (RID), Permethrin (NIX)

Workshop Review

Shingles: unilateral viral reactivation of latent herpes zoster (chickenpox) infection. Human > 60 yrs. reservoir.
  - Shingles vaccine (Zostavax)
  - Antivirals: Acyclovir (Zovirax), Valacyclovir (Valtrex), Famciclovir (Famvir)
  - Complications: post herpetic neuralgia
Review from Workshop #5

- Influenza: Seasonal and H1N1
  - Acute viral respiratory infection
  - H1N1 includes GI s/s + respiratory s/s.
  - Prevention: seasonal/H1N1 vaccine
  - Treatment: Antivirals- Tamiflu, Relenza
  - Report ICN, NYSDOH.

Review Workshop

- Pneumococcal Dx: leading cause of bacterial respiratory infection. Persons > 65 yrs at risk.
- Prevention: Pneumovax 23-valent vaccine.
- Treatment: PCN family, Erythromycin, TMP-SMX.
- Report: ICN, local and NYSDOH.

Review Workshop

- Lyme Dx: tick-borne spirochete systemic illness.
  - ELISA test for IgM antibodies.
  - Prevention: avoid tick areas.
  - Treatment: Doxycycline 100mg x 14-21 days. Chronic Lyme dx increasing in prevalence.
Workshop #5 Review

- Salmonellosis: rod-shaped Gram-negative non-spore-forming enterobacteria; causing sudden onset of diarrhea.
  - Reservoir: birds, reptiles domestic animal.
  - Mode of transmission: ingestion of contaminated food, water, feces.
  - Prevention: Good hand washing!
  - Treatment: rehydration, electrolyte replacement

Questions from Workshop #5

- Questions?

Workshop #6 Objectives

The learner will be able to:

- Describe the less common infectious agents (IA) in OMRDD facilities.
- Discuss prevention of less common IA.
- Differentiate modes of transmission of IA.
- List incubation period of IA.
- Describe laboratory testing for IA.
- Assess appropriate treatment for IA diagnosis.
- Describe management of consumer/staff with IA diagnosis.
Infectious Agents

- This workshop will cover:
  - Varicella
  - Hepatitis A
  - Hepatitis B
  - Mononucleosis
  - Legionellosis
  - Norwalk Virus
  - West Nile Virus

Varicella Zoster

Identification: Human (alpha) Herpesvirus 3

- Acute, generalized viral disease with sudden onset of slight fever, mild malaise, myalgia and skin eruptions.
- Skin eruptions: maculopapular (hours)-to- vesicular (3-4 days) to granular scab.
- "dew drop on a rose petal" lesion is very characteristic
- Lesions commonly occur in two or three waves, mainly on the body and head rather than the hands and become itchy raw pockmarks (small open sores)
- Crust usually falls off after seven days, sometimes leaving a scar
- Children- typically mild dx
- More severe in adult males than in adult females
- Pregnant women and those with a suppressed immune system are at highest risk of serious complications
Varicella Chickenpox

- Diagnosis primarily clinical
- Laboratory tests: visualization by electron microscope (EM). Or by viral culture or viral DNA by PCR.
- Less common today b/c of Varicella vaccine. 90% of children have had chickenpox by age 15.
- Reservoir: Humans

Varicella Chickenpox

- Mode of Transmission: person-to-person direct contact of vesicles or droplet
- Droplet or airborne spread of vesicle fluid or secretions of respiratory tract of infected cases
- One of most communicable dx (especially before skin eruption

Varicella Chickenpox

- Incubation Period: 10-21 days; commonly 13-17 days.
- Period of communicability: 1-2 days before onset of rash and until all of the blisters have dried and crusted over. Second attack rate of others 70-90%.
Varicella prevention

- Primary prevention-vaccine-live-attenuated varicella: Varivax. (live virus which has been altered in such a way as to prevent it from actually causing disease).
- Children’s schedule:
  - 1st Dose: 12-15 months of age
  - 2nd Dose: 4-6 years of age (may be given earlier, if at least 3 months after the 1st dose)
- Varicella-Zoster Immune Globulin (VZIG). High antibody titer to varicella-zoster virus.

Varicella: prophylaxis

- Vaccine within 3-5 days of exposure to rash
- VariZIG for those with contraindication to vaccine

Varicella complications

- In children:
  - Impetigo
  - Cellulitis
  - Erysipelas (acute streptococcus infection of dermis)
- In adults:
  - Pneumonia
  - Encephalitis
  - Hepatitis
- Most common late complication of chickenpox is shingles, caused by reactivation of the varicella zoster virus decades after the initial episode of chickenpox.
Varicella Chickenpox

- Treatment:
  - Isolation/Activity restriction
  - Protection of others/contacts
  - Antiviral medications
    - Children:
      - Not routinely recommended
      - shorten disease by about one day
    - Adults: recommended
    - Acyclovir (Zovirax), Famiciclovir (Famvir).
  - Meds shorten duration of s/s.

Management in OMRDD facilities

Before there is a problem:
- Know the immune status of all staff and consumers
- Vaccinate eligible individuals

After exposure:
- Identify all contacts in residence, day program, on bus, etc
- Ill individuals and those without immunity remain at residence
- Administer VariZIG to susceptible individuals within 96 hours of exposure
- Residents with immunity may go to program
- Staff with immunity may continue to work both at the site as well as OT and ES
- Monitor all individuals for s/s consistent with hepatitis

Hepatitis A
Hepatitis A (HAV)

- Identification: viral, foodborne, infectious hepatitis.
- It is a picornavirus (non-enveloped, positive-stranded RNA viruses with an icosahedral (a polyhedron having 20 faces) capsid (protein shell)
- Once called infectious hepatitis.

Hepatitis A symptoms

- Symptoms usually not severe
- Most common symptoms:
  - Nausea
  - Vomiting
  - Diarrhea, especially in children
  - Low-grade fever
  - Loss of appetite
  - Rash
  - Tiredness, fatigue
  - Jaundice - A yellow discoloration of the skin and the whites of the eyes
  - Urine is dark brownish in color, like cola or strong tea.
  - Pain in upper right quadrant
- Symptoms usually last less than two months,
- Symptoms may last as long as nine months.

Hepatitis A

- Diagnosis: Laboratory results-
  - LFTs
    - IgM antibodies against hepatitis A virus. May continue to be detectable for 4-6 months.
    - ELISA testing for virus or antibody.
  - Reservoir: Humans (primates).
  - Mode of Transmission: Person-to-person by fecal-oral route.
    - Contaminated H2O,
    - Food by infected handlers,
    - Raw shellfish from contaminated water
Hepatitis A sources

- Sexual or household contact: 14%
- Unknown: 46%
- International travel: 5%
- Men who have sex with men: 10%
- Injection drug use: 6%
- Child/employee in day-care: 2%
- Food- or waterborne: 4%
- Other: 8%

Hepatitis A

- Incubation Period: 15-50 days; depending upon dose-average 28-30 days
- Period of Communicability: Max infectivity during later half of incubation period (15-30 days) and continuing after onset of jaundice.
- No carrier state.
- Does not cause permanent liver damage
- Have immunity against future infection

Hepatitis A Pathogenesis

- Ingestion
- Replication in oropharynx/GI tract
- Transported to liver - major site of replication
- Shed in bile, transported to intestines
- Shed in feces
- Brief viremia
- Cellular immune response: clinical disease and control
Hepatitis A Prevention

- Prevention: Meticulous handwashing
- Wash surfaces with bleach solution
- Do not eat raw or undercooked seafood or shellfish.
- Hepatitis A vaccine
  - Havrix and VAQTA
  - No live virus
  - 2 injections 6-18 months apart
  - Thought to confer immunity for 20 yrs

Hepatitis A

- Treatment: symptomatic only
  - Plenty of rest
  - Drink plenty of clear fluids
  - Avoid
    - Acetaminophen
    - Alcohol
    - Prolonged, vigorous exercise
- Prophylaxis: Immunoglobulin (IG) IM
  - 0.02ml/kg body wt.
  - ASAP after exposure
  - w/in 2 wks to ALL household and sexual contacts
- For diagnosed Hep A, enteric precautions during first 2 wks of illness and/or 1 wk after onset of jaundice.

- Virus is resistant to
  - detergent
  - acid (pH 1),
  - solvents (e.g., ether, chloroform),
  - drying, and
  - temperatures up to 60oC.
- It can survive for months in fresh and salt water.
Hepatitis A

- Report Hep A to DDSO ICN, local, state health officials.
- Investigate contacts. Concentric circles.
- Determine mode of transmission.

Hepatitis B

Identification: Once called serum hepatitis.

A hepadnavirus
- outer lipid envelope (HBsAG)
- icosahedral nucleocapsid core (HbcAG) composed of protein
- Replicates in liver then spreads to blood
Hepatitis B Diagnosis

- Laboratory tests (called asasys):
  - Serum or blood
  - Detect either viral antigens (proteins produced by the virus) or antibodies produced by the host.
- Interpretation is complex

Hepatitis B surface Antibody (anti-HBs)

- Most common test.
- Done
  - To determine need for vaccination
  - Following the completion of vaccination
  - Following an active infection
    - Titer > 10 milli-international units/ml plus negative HBsAg = recovery
- Positive test indicates immunity to HBV
  - Successful vaccination
  - Past exposure to HBV

The hepatitis B surface antigen (HBsAg)

- Most frequently used to screen for infection
- Positive means person is infectious
- Appears 6 weeks to 6 months after infection and always prior to onset of symptoms
- Presence indicates
  - Acute HBV infection or
  - Chronic HBV infection or
  - Asymptomatic carrier state
- Usually disappears during recovery
- If present/persistent after 6 months = chronic or carrier HBV.
- Hep B vaccine will NOT cause +HBsAg.
- +HBsAg = NEVER donate blood
Antibody to hepatitis B core Antigen (anti-HBc)

- None-specific marker of acute, chronic or resolved HBV
- Not a marker of vaccine-induced immunity
- This marker occurs with + HBsAg within 4-10 wks of acute HBV.
- This marker may persist for years.
- +Anti-HBc = DO NOT give blood

Hepatitis B e antigen (HBeAg)

- Appears about 1 week after HBsAG
- Only found in blood when viruses present
- Presence in host's serum is associated with much higher rates of viral replication
- Used as a marker of infectivity
- May be used to monitor effectiveness of treatment
- Effective treatment leads to elimination of HBeAg and development of anti-HBe
- If positive after 10 weeks = chronic carrier state

Anti-HBe

- Antibody produced in response to Hepatitis B e antigen
- Becomes positive
  - Already recovered from infection
  - Chronic hepatitis B
- Low levels in chronic infection indicates:
  - lower risk of liver complications and
  - Lower degree of infectivity
Summary of HBV testing

- Hep B surface Antigen (HBsAG) in 2 wks thru acute phase.
- If + HBsAG after 6 mos = chronic or carrier. NEVER give blood.

- Antibody to Hep B surface Antigen (Anti-HBs) in 12 wks.
- + Anti-HBs = recovery. Immunity to HBV.

Summary of HBV testing

- Antibody to core Antigen (Anti-HBc) with Hep B surface Antigen (HBsAG) appears in 4-10wks acute phase.
- + Anti-Hbc persists yrs. DO Not give blood.

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**HBV testing levels in the blood**

- HBsAg
- HBeAg
- IgM anti-core
- Anti HBs
- Anti-HBe
- total anti-HBe core
- HBV DNA

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0 5 10 15 months
HBV Symptoms

- Half of all persons infected have no s/s
- Symptoms appear 30-180 after exposure
- Insidious onset of s/s:
  - Anorexia
  - Often first symptom,
  - May last for short time then replaced with nausea and vomiting
  - Fatigue
  - Generalized itching
  - Vague abd pain,
  - Mild aches and pains, rash,
  - Dark colored urine
  - Grayish or clay colored stools
  - Lastly jaundice.

HBV

- Persons at risk include:
  - IV drug users, persons w/ multiple sex partners, clients and staff of OMRDD facilities, hemodialysis centers, health care providers, tattoo recipients.
  - Reservoir: Humans.
  - Mode of Transmission: direct contact with blood, saliva, semen, vaginal fluid.

HBV

- Incubation period: 45-180 days (average 60-90 days).
- Period of communicability: All persons who are +HBsAg are infectious.
HBV Treatment

- Treatment: symptomatic
  - bedrest,
  - increased fluids,
  - NO EtOH,
  - NO fried or fatty foods.

HBV Prevention

- Prevention: Hep B vaccine.
  - Engerix-B, Recombivax HB
  - A total of 3 doses of the vaccine are given over several months.
  - Do Anti-HBs titer to check response
  - If not adequate response, repeat 3-shot series
- Practice safe sex
- Think about health risks of tattoos and body piercings
- All HCW use standard precautions
- Don’t share items that may be contaminated with blood

HBV Post-exposure

- HBIG along with the hepatitis B vaccine to unvaccinated people who have been exposed to hepatitis B. asap after exposure.
- prevents transmission of the disease in 80-90 percent of cases.
HBV

- Report HBV to DDSO ICN, local and state health officials.
- Standard precautions to prevent blood/body fluid exposures.
- Clean/disinfect high touch areas and equipment w/ 1/10 bleach solution.

Questions?

- Questions?
  - Related to Varicella?
  - Hep A?
  - Hep B?

Mononucleosis
Mononucleosis

- Identification: acute viral syndrome with fever, sore throat, lymphadenopathy, splenomegaly.
- Epstein-Barr virus (EBV). Accounts for 80% of mononucleosis.
- Laboratory results: Increased WBC, lymphocytosis > 50% with >10% abnormal forms. Abnormal AST liver function.

Mononucleosis

- Caused by the Epstein-Barr virus (a type of herpes virus)
- Reservoir: humans
- Mode of Transmission: Person-to-person spread by oropharyngeal contact saliva, “kissing” disease.
- Occurs most often in teenagers and young adults
- Incubation Period: 4-6 weeks.
- Period of Communicability: Prolonged; oropharyngeal excretions may persist >1 year after infection.

Main symptoms of Infectious mononucleosis

- Central
  - Fatigue
  - Malaise
  - Loss of appetite
  - Headache
- Throat
  - Soreness
  - Reddening
- Respiratory
  - Cough
- Systemic
  - Lethargy
  - Fever
  - Aches
- Visual
  - Photophobia
- Tonsils
  - Reddening
  - Swelling
  - White patches
- Lymph nodes
  - Swelling
- Epigastic
  - Enlargement
  - Abdominal pain
- Gastrointestinal
  - Nausea
Mononucleosis Symptoms

- Characterized by:
  - Fever
  - Sore throat and fatigue/malaise
  - Weight loss
  - Pharyngeal inflammation with petechiae
  - Loss of appetite
  - Lymphadenopathy
  - Splenomegaly
  - Hepatitis and hemolysis
- Primarily diagnosed by observation of symptoms.

Mononucleosis Diagnosis

- Most commonly used diagnostic criterion is the presence of 50% lymphocytes with at least 10% atypical lymphocytes resembling monocytes in a person with fever, pharyngitis and adenopathy.
- Should be confirmed by a serological test. A heterophile antibody test (monospot test)
- Newer tests including IgG and IgM for mononucleosis
  - More accurate for ruling out mono
- One key in diagnosis is to differentiate between infectious mononucleosis, influenza, the common cold, strep throat, acute cytomegalovirus infection and Toxoplasma gondii infections

Mononucleosis

- Generally self-limiting
- Symptomatic and/or supportive therapies
  - Rest during acute phase
  - Avoid heavy lifting and contact sports until one month after initial infection and/or until splenomegaly resolves
  - NSAIDs for fever
  - May use corticosteroids to reduce symptoms of pharyngeal pain, odynophagia or enlarged tonsils
- Prevention:
  - No kissing
  - Do not share dishes, utensils, cups or drinks with infected persons.
  - Do not donate blood
  - Report to DDSO ICN, local health officials.
**Legionella**

*Legionella* is a Gram negative bacterium

- lives within amoebae in the natural environment
- traditionally detected by culture on buffered charcoal yeast extract (BCYE) agar takes 5-10 days
- *Legionella Urinary Antigen* test for initial detection
  - advantages
    - results can be obtained in a matter of hours rather
    - urine specimen is generally more easily obtained than
      a sputum specimen.
  - disadvantage: only detects anti-bodies towards
    *Legionella pneumophila*; not other *Legionella species*.
- New rapid detection with PCR and rapid immunological assay.

**Fever**

**Cough**

**Nausea**

**Headache**

**Shortness of Breath**

**Muscle Aches**
Legionellosis *Legionellae*

- Acute bacterial disease
- Initially characterized by:
  - anorexia,
  - malaise,
  - aches and pains,
  - HA.
- Within 1 day:
  - increase fever and chill
  - Non-productive cough,
  - Abdominal pain,
  - diarrhea.

Legionellosis

Transmission is via aerosols

Common sources:
- **cooling towers**
- **domestic hot-water systems,**
- **Air conditioning systems**
- **Hot tubs**
- **fountains,** and
- **similar disseminators that tap into a public water supply**

- Incubation Period: 2-14 days after being exposed (average 5-6 days).
- No person-to-person transmission
- High risk individuals:
  - persons > 65
  - smokers, DM,
  - chronic lung dx,
  - Immunocompromised individuals
- Males > Females

Legionnaire Disease

- 5-30% death rate
- Treatment:
  - Erythromycin - drug of choice.
  - azithromycin (Zithromax),
  - ciprofloxacin (Cipro),
  - levofloxacin (Levaquin)
Legionella Prevention

- Prevention focuses on source control
- Chemical or thermal methods
  - Copper-silver ionization - chemical process that disperses and destroys biofilms and slimes that can harbor \textit{Legionella} over the long term.
  - Hyperchlorination with chlorine dioxide or monochloramine
- Short term treatments:
  - Ultraviolet light,
  - Thermal eradication (temperature over 131°F)

Questions?

- Questions? Related to Mono?
- Related to Legionnaire Disease?

Norovirus (formerly called Norwalk Virus)
Norovirus (previously Norwalk Virus)

- highly contagious RNA-virus-calicivirus
- causes approximately 90% of epidemic non-bacterial outbreaks of gastroenteritis around the world,
- may be responsible for 50% of all foodborne outbreaks of gastroenteritis in the US
- Reservoir: humans

Norovirus

Mode of Transmission:
- transmitted by fecally contaminated food or water
- person-to-person contact (fecal/oral route)
- may be airborne due to aerosolisation of vomit
- Incubation Period: 24-48 hours; range maybe 10-50 hours.
- Laboratory Tests: routinely made by polymerase chain reaction (PCR) assays or real-time PCR assays, give results within a few hours.
- very sensitive and can detect concentrations as low as 10 virus particles

Norovirus

Self-limited mild-to-moderate viral gastroenteritis
- N/V,
- diarrhea,
- abdominal pain,
- aches and pains,
- HA,
- malaise and
- low-grade fever.
- GI s/s last 24-60 hours
**Norwalk Virus**

- **Period of Communicability:**
  - From onset of symptoms
  - during acute phase
  - up to three days after recovery
  - Some people may be contagious for as long as 2 weeks after recovery.
- **Treatment:** symptomatic
- Do not give antiperistalsis medication

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**Norovirus prevention**

- Good hand washing! After bathroom use; before and after eating.
- Thoroughly clean and disinfect contaminated surfaces immediately after an episode of illness by using a bleach-based household cleaner.
- Clean/disinfect bathroom areas on regular schedule.
- Immediately remove and wash clothing or linens that may be contaminated with virus after an illness (use hot water and soap).

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**Norovirus Prevention**

- Carefully wash fruits and vegetables
- Cook shellfish; no raw shellfish/sushi.
- Persons who are infected with norovirus should not prepare food while they have symptoms and for 3 days after they recover from their illness
- Food that may have been contaminated by an ill person should be disposed of properly.
Norwalk Virus

- Investigate contacts. Report to DDSO ICN, local health officials.
- Activity restriction: enteric precautions.
- Use of PPE for consumer/staff.

West Nile Flaviviruses

West Nile Virus

- Identification: vector-borne (mosquito) viral illness caused by flavivirus
- Reservoir: Birds are source of mosquito infection for West Nile virus.
- Birds are amplifying hosts
Modes of Transmission

- Primarily: vector borne-bite of infected mosquito.
  - Carry highest viral load in the fall
  - Outbreaks common August to early September
- Novel transmission methods
  - Blood transfusion,
  - Organ transplant,
  - Intrauterine exposure,
  - Breast feeding

West Nile Fever

- Three levels of disease
  - Asymptomatic infection
  - Mild febrile syndrome called West Nile Fever
- Fever,
- Headache,
- Chills,
- Diaphoresis
- Weakness,
- Lymphadenopathy
- Drowsiness, pain in the joints
- Symptoms like those of influenza or the flu
- S/S may last weeks to neuro s/s permanent.

West Nile Fever

- Short-lived truncal rash
- Some patients experience gastrointestinal symptoms including
  - Nausea,
  - Vomiting,
  - Loss of appetite,
  - Diarrhea.
- All symptoms are resolved within 7 to 10 days
- Fatigue can last for some weeks
- Lymphadenopathy can take up to two months to resolve
West Nile Virus

Meningitis/encephalitis

- Neuroinvasive disease
- similar early symptoms
- decreased level of consciousness, sometimes approaching near-coma
- Deep tendon reflexes are hyperactive at first, later diminished
- extrapyramidal disorders
- Recovery is marked by a long convalescence with fatigue

West Nile Virus

- Laboratory Tests: Viral culture.
- Incubation Period: 2-8 days
- Period of Communicability: not directly transmitted from person-to-person.

West Nile Virus

- Treatment: No specific treatment
  - analgesia for the pain
  - rehydration for nausea, vomiting, or diarrhea
  - encephalitis may require
    - Hospitalization
    - IVs,
    - nursing care
    - airway protection
    - seizure management
Prevention

- No vaccine for humans
- Avoiding mosquito bites is the most straightforward means to avoid infection
- remain indoors (while preventing mosquitoes from entering) at dawn and dusk.
- wear light-colored clothing that covers arms and legs as well as trunk,
- use insect repellents on both skin and clothing

Questions?