

## STATISTICS & PATHOPHYSIOLOGY

*The course presenter has chosen to replace PowerPoint note pages with this handout. Please use it to prepare for competency evaluation.*

1. Bloodborne pathogen (BBP) definition
  - a. Bloodborne – reservoir
  - b. Pathogen – Disease or infection causing microbe
  - c. Bloodborne pathogen – Infection causing microbe that lives and thrives in blood
2. Other potentially infectious material (OPIM)

***If these fluids in the host come in contact with the blood of another, infection will pass on!***

  - a. Cerebrospinal fluid (surrounds brain and spinal cord)
  - b. Synovial fluid (within joints)
  - c. Pericardial fluid (surrounds heart)
  - d. Pleural fluid (surrounds lungs)
  - e. Sperm and vaginal secretions (foreplay and oral sex also a risk)
  - f. Breast milk
  - g. Amniotic fluid (surrounds baby in womb)
3. Not OPIM:

***Only infectious if visibly contaminated with blood***

  - a. Tears
  - b. Feces or urine
  - c. Saliva
  - d. Nasal secretions
  - e. Sputum
  - f. Sweat
  - g. Vomit

Which would put you at GREATEST risk of contracting a bloodborne pathogen?

- Will had a little too much to drink last night and vomits on the break room table right in front of you.
- Rebecca forgets to cover her cough...and you're standing across from her.
- John has a heart attack and requires mouth to mouth resuscitation until the ambulance arrives.
- Sally's water broke and you are assigned to stay with her until the ambulance arrives.
- You are holding something in place for Mike when your arm comes in contact with Mike's forehead, covered in sweat.

4. Anthrax passed from gravesite of anthrax victims to crop decades later – infected those who consumed crop – Blood or OPIM of deceased still infectious!
5. Examples of BBP: Syphilis, Epstein-Barr, rabies, hepatitis, HIV
6. Focus of this part of presentation: Hepatitis & HIV
  - a. Most common & devastating
  - b. *Rules that apply to these apply to other BBPs*
7. Pathophysiology – Seven categories of information about a disease

- a. General information
  - b. Causes and risk factors
  - c. Normal structure of affected organ
  - d. Normal function of affected organ
  - e. Disease effects on normal structure and function of affected organ
  - f. Signs and symptoms
  - g. Diagnosis and treatment
8. Pathophysiology of hepatitis B
- a. General information
    - i. Hepatitis definition: Inflammation of liver
    - ii. Most common cause is hepatitis virus, although other causes like extreme alcoholism
    - iii. Five types: A, B, C, D, E
      1. A/E – fecal/oral – restaurant/school lunchroom/worker’s hands
      2. E rare in US
      3. B/C/D – blood/OPIM
      4. D needs B
      5. D rare in U.S.
      6. Focus: Types passed by blood/OPIM and common in U.S. – B & C
  - b. Causes and risk factors:
    - i. Similarities: Ways one can be exposed – blood and body fluids (needle stick, cut, sexual contact, perinatal (birth))
    - ii. Differences:
      1. Incubation period
        - a. B – 6-24 weeks
        - b. C – 5-12 weeks
      2. Most common population infected
        - a. B – Men who have sex with men (MSM) & multiple sex partners – *Monogamous MSM at no greater risk*
        - b. C – IV drug users
      3. Length of infection & development of chronic form
        - a. B – infectious longer
        - b. C – 85% risk of becoming chronic – Likely to lead to cirrhosis (requires liver transplant)
    - iii. Hepatitis stats
      1. 100 more people die from hepatitis each year than die from HIV
      2. National
        - a. New cases 2007
          - i. Hep B – 43,000
          - ii. Hep C – 17,000
        - b. Chronic hepatitis 2007
          - i. Hep B – 1.2 million
          - ii. Hep C – 3.2 million
        - c. Ages 25-44
        - d. Men > women

- e. Americans of African descent or Asian descent (this population reducing)
- 3. Idaho follows the national trend
- 4. Occupational exposure to hep B
  - a. Needle sticks – 30% rate of infection if exposed to blood infected with a bloodborne pathogen
  - b. Greater risk of infection than other bloodborne pathogens
  - c. SURFACE CONTACT, even if dry – Lives over a week in dry state!!
- 5. Occupational exposure to hep C
  - a. Needle sticks – 2% rate of infection if exposed to blood infected with a bloodborne pathogen
  - b. Lives on surfaces?
- 6. Why is occupational exposure higher for B than C?
  - a. B more 'virulent' – more capable of causing disease
  - b. Vulnerable host
    - i. Eat nutritiously?
    - ii. Get adequate sleep?
    - iii. Suffer too much stress?
    - iv. Have a disease that impairs your immune system?
    - v. Take medications that impair your immune system?
- c. Normal structure of affected organ
  - i. Three pounds; size of football; right upper abdomen
  - ii. Two lobes; over 100,000 cells
  - iii. Two veins
  - iv. Connected to gall bladder, which is connected to bowel (duodenum)
- d. Normal function/Disease effects/Signs & symptoms
  - i. One of most complex organs – Over five hundred functions(!)
  - ii. Four categories:
    - 1. Metabolism of toxins/drugs/alcohol – May OD on normal amounts with diseased liver
    - 2. Fluid balance through breaking down protein to albumin – Absence of albumin in blood vessel causes fluid to move from blood vessel to tissues (ascites)
    - 3. Conversion of reproductive hormones to usable form – No conversion leads to fertility problems, opposite sex characteristics, no interest in sex
    - 4. Metabolism of nutrients
      - a. Bile production – Reduced or no production leads to fat not being metabolized, resulting in weight loss
      - b. Storage of vitamins & minerals – No storage leads to signs of deficiency
        - i. A – Bone, reproduction, vision
        - ii. D – Bone/teeth formation; aids in calcium/phosphorus absorption
        - iii. E – Reproduction, muscle formation, anti-oxidant (prevents cell damage)

- iv. K – Clotting (hemorrhage from small nick)
- v. Iron – Form red blood cells, which take oxygen to cells
- c. Metabolizes protein, carbohydrates and fat – Reduced or no metabolism – Malnourished
- d. Bile storage – Swelling blocks flow to gall bladder. Bile backs up to blood vessel. Wherever blood flows tinted yellow. Jaundice (skin/whites of eyes yellow), brown urine, clay-colored bowel movement result.
- e. Diagnosis and treatment
  - i. Diagnosis:
    1. Physical exam – enlarged liver, complaints of pressure/pain right upper abdomen
    2. History – any complaints shown in last portion of presentation
    3. Blood test & liver biopsy
  - ii. Treatment
    1. Long duration!
    2. Medication
    3. Rest
    4. Good nutrition
    5. Adequate fluids
    6. Frequent doctor visits for monitoring progress
    7. Hospitalized?
    8. Substance abuse treatment if appropriate
    9. Evaluate for chronic hepatitis & complications
    10. Treat chronic hepatitis & complications

**Which type of hepatitis is:**

- Bloodborne?
- Common in the U.S.?
- Most at risk population: MSM?
- Infectious longer?
- Less likely to become chronic?

**Which of the following is NOT associated with hepatitis effects on the liver?**

- Dehydration
- Bleeding
- Jaundice
- Overdose on normal amounts of medication

- f. Continued learning resources:

One in twenty:

<http://www.hepb.org/about/1in20/index.htm>

Samuel So, MD, FACS: "How Serious is Hepatitis B?"

[http://www.hepb.org/expforum/speaker.aspx?speakerID=drSo\\_07&language=English](http://www.hepb.org/expforum/speaker.aspx?speakerID=drSo_07&language=English)

Hillel Tobias, MD, FACS: "What is the impact of hepatitis B in the US?"

<http://www.hepb.org/expforum/speaker.aspx?speakerID=drTobias&language=English>

9. Pathophysiology of HIV/AIDS

a. General information

- i. HIV isolated in 1984 – now a worldwide epidemic
- ii. Ban on people with HIV infected people entering U.S. lifted – Useless

b. Causes and risk factors

- i. MSM (non monogamous) & IV drug users
- ii. Heterosexual – Multiple sex partners, exposure during birth/breast feeding, those past menopause thinking it's safe to have unprotected sex
- iii. Race
  1. Americans of African descent (45%) – less likely to use protection?
  2. Latino Americans (17%)
  3. All other races (38%)
- iv. ALL: higher risk if exposed and also have: Another STD, trauma to the genitalia (rape), on menstrual period
- v. HIV/AIDS stats

1. **National:**

- a. 1 million HIV cases in the US (1/5 unaware)
- b. Approximately 56,000 new HIV cases in the US each year
- c. Approximately 18,000 people in the US die from AIDS each year
- d. Nearly 600,000 people have died since onset in the US
- e. 75% of new HIV cases are men

Link: Interactive U.S. map

<http://www.pbs.org/wgbh/pages/frontline/aids/atlas/us.html>

- Living with HIV
- New diagnoses of HIV
- Death from AIDS

2. **Idaho**

- a. Does NOT follow national trends
  - i. less cultural/sexual diversity
  - ii. More conservative populations
- b. 4% of national HIV cases
  - i. About 1000 people HIV positive
    1. 79% male
    2. 79% Caucasian
    3. 40% 20-29 years of age
    4. MSM most common (<50%) – also IDU and multiple sex partners
- c. 5 pediatric HIV cases between 1984-2007
- d. AIDS – Same except age – older
- e. Pocatello DHW HIV clinic

3. **International:**

- a. Africa/Asia – 80% of people infected with HIV
- b. U.S. one of top six nations for HIV infections

- c. ~25 million in the world have died from AIDS
- d. ~33 million in the world are HIV positive
- e. December 1<sup>st</sup> is World AIDS Day

Link: Interactive WORLD map

<http://www.pbs.org/wgbh/pages/frontline/aids/atlas/world.html>

- Living with HIV
- Receiving drugs
- Death from AIDS

- 4. Occupational exposure to HIV/AIDS
  - a. Only 57 documented (140 possible) occupational infections in US 1981-2006:
    - 48 puncture or cut injuries
    - 5 mucous membrane or broken skin exposure
    - 2 a combination of the above
    - 2 unknown
    - Those regularly working with blood body fluids highest risk, but 12 of 140 possible were EMS personnel
  - b. No new confirmed HIV sero-conversion between 2000-2006 from occupational exposure
  - c. Many possible exposures under investigation
  - d. Virus does not survive on surfaces outside the body
  - e. Not transmitted by surface contact with dried blood
  - f. Why worry with such low risk?
    - i. No vaccine!
    - ii. No cure!
    - iii. End result – DEATH!
    - iv. Costly therapy with bad side effects if exposed
      - 1. More than one antiretroviral drug given
      - 2. Some strains resist antiviral therapy
- c. General information addition: Not the disease that cause signs & symptoms, but immune system response to microbe
- d. Normal structure & function of immune system
  - i. Very complex
  - ii. Exposure to pathogen = body wide response:
    - 1. Fever leads to weakness, loss of appetite, not feeling well
    - 2. White blood cell production increases
      - a. T-cell – stimulates immune response
      - b. Macrophage – envelops microbe; takes out of body
      - c. Others can:
        - i. Learn makeup of microbe so next time exposed ‘antibody’ binds to & disables it
        - ii. Secrete toxic substances into cell
    - 3. Fluid shifts to bring immune system components to wound
    - 4. Signs & symptoms of impaired immune system:

- a. ALL – Pain, swelling
- b. Skin wound – Red/warm/pus
- c. Lungs – Sputum production increases
- d. Stomach/Bowel – Vomiting & diarrhea
- e. Kidneys/Bladder – Increased urine production
- 5. First exposure – Little response
- 6. After first exposure – Big response
- e. Disease effects/Signs & symptoms/Diagnosis of HIV/AIDS
  - i. At first: No effects/signs/symptoms
  - ii. Carrier – HIV negative up to six months...a few longer (contagious all this time)
    - Most who will convert do so in this time (very rare, but some never convert – blood being studied for cure)
  - iii. HIV positive – can be years before AIDS (no signs or symptoms, contagious)
  - iv. Full blown AIDS
    - 1. 80's – 13 month death sentence
    - 2. Now – 20 years or longer if:
      - a. Treatment available
      - b. Treatment complied with (expensive!!)
    - 3. Prevention in infants born to HIV infected mothers?
    - 4. Little or no normal immune response – Allows microbes to overgrow and infect multiple body systems
    - 5. Progression from HIV to AIDS – monitor T cells (will lower and lower)

Late HIV:	Early AIDS	Late AIDS
Multiple opportunistic infections <input type="checkbox"/> Pneumonia <input type="checkbox"/> Yeast infection <input type="checkbox"/> Herpes simplex/zoster	<input type="checkbox"/> Meds to slow virus no longer effective <input type="checkbox"/> Virus count climbs <input type="checkbox"/> T cells drop	<input type="checkbox"/> Serious infections occur <input type="checkbox"/> Cancer occurs – Kaposi's sarcoma, non-Hodgkin's lymphoma <input type="checkbox"/> Virus begins to affect body, not just immune system <ul style="list-style-type: none"> <li>○ Nervous: Dementia, meningitis, reduced movement progressing to paralysis</li> <li>○ Lungs: Pneumonia, TB</li> <li>○ GI: Nausea, vomiting and diarrhea; extreme weight loss</li> <li>○ Urinary: Kidney failure</li> </ul>

- f. Treatment:
  - i. No cure
  - ii. No vaccine
  - iii. Kill HIV...kill host cell
  - iv. Medications to slow progression & treat symptoms
    - 1. HAART – anti viral therapy
      - a. VERY EXPENSIVE & harsh on the body
    - 2. Medications to ease symptoms
- g. Social stigmatism, expense and disease side effects – risk of severe depression

h. Continued learning resources:

When HIV Becomes AIDS <http://www.youtube.com/watch?v=68I7JlVhuhY>

HIV Vaccine: One Step Closer

<http://www.youtube.com/watch?v=dwHlw8QGUUnY&feature=fvw>

HIV Scare Hits High School

<http://www.youtube.com/watch?v=N80A6rgfVHM&feature=channel>

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