HIV Epidemiology and Post Exposure Prophylaxis

MCVH

PACU Nursing In-service

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HIV/AIDS

- AIDS is caused by the human immunodeficiency virus (HIV), a retrovirus
- The result of HIV infection is relentless destruction of the immune system
- HIV primarily infects cells with CD4 cell-surface receptor molecules
  - Replicates within the CD4 cell and ultimately results in their depletion
Modes of HIV transmission

- Sexual
  - Heterosexual
  - Homosexual
- Blood transfusion
- Vertical
  - Mother to child
- IVDU
- Occupational exposure
  - Percutaneous
  - Mucous membrane
The HIV epidemic in 2006
HIV Statistics

• Worldwide
  – Over 22 million people have died from AIDS
  – Over 42 million people are living with HIV/AIDS, and 74 percent of these infected people live in sub-Saharan Africa
  – Over 19 million women are living with HIV/AIDS

http://www.until.org/statistics.shtml
HIV Statistics

• United States
  – An estimated one million people are currently living with HIV in the United States
  – There are approximately 40,000 new infections occurring each year
  – 70 percent of these new infections occur in men and 30 percent occur in women.

http://www.until.org/statistics.shtml
HIV Statistics

• United States
  – 54 percent of the new infections in the United States occur among African Americans
  – 64 percent of the new infections in women occur in African American women
  – 75 percent of the new infections in women are heterosexually transmitted
  – Half of all new infections in the United States occur in people 25 years of age or younger

http://www.until.org/statistics.shtml
Estimated Incidence of AIDS and Deaths of Adults and Adolescents with AIDS*, 1985 - 2001, United States

*Adjusted for reporting delays
Natural History of HIV Infection
Viral Dynamics

• 10 billion new virions created and cleared daily

• 200 million CD4 cells destroyed daily (twice the rate of replacement by the hematopoietic system)
Natural History of HIV Infection

Figure 1. Typical Course of HIV Infection.

Pantaleo NEJM 1993;328:327
Likelihood of Developing AIDS Within 3 Years

## Stages of HIV Infection

<table>
<thead>
<tr>
<th>Seroconversion</th>
<th>Asymptomatic</th>
<th>Symptomatic</th>
<th>AIDS</th>
</tr>
</thead>
</table>
| • Precedes the appearance of antibodies to HIV in the blood. | • Initially any damage caused by HIV has no outward effect.  
• This may last for many months or years | • Weight loss  
• Fever  
• Night sweats  
• Neuropathy  
• Diarrhea  
• Progressive drop in CD4 cells | • Opportunistic infections and AIDS related malignancies  
• CD4 count < 200 |
Acute Retroviral Syndrome

**Common** signs and symptoms of acute retroviral syndrome (occurring in >50% of patients):
- fever
- adenopathy
- pharyngitis
- rash
- myalgias arthralgia

**Less common:**
- diarrhea, headache, nausea, weight loss, thrush
<table>
<thead>
<tr>
<th>Symptom/sign</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>96</td>
</tr>
<tr>
<td>Lymphadenopathy</td>
<td>74</td>
</tr>
<tr>
<td>Pharyngitis</td>
<td>70</td>
</tr>
<tr>
<td>Rash</td>
<td>70</td>
</tr>
<tr>
<td>Erythematous maculopapular with lesions on face, trunk and sometimes extremities, including palms and soles; mucocutaneous ulceration involving mouth, esophagus or genitals</td>
<td></td>
</tr>
<tr>
<td>Myalgia or arthralgia</td>
<td>54</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>32</td>
</tr>
<tr>
<td>Headache</td>
<td>32</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>27</td>
</tr>
<tr>
<td>Hepatosplenomegaly</td>
<td>14</td>
</tr>
<tr>
<td>Weight loss</td>
<td>13</td>
</tr>
<tr>
<td>Thrush</td>
<td>12</td>
</tr>
<tr>
<td>Neurologic symptoms</td>
<td>12</td>
</tr>
<tr>
<td>Meningoencephalitis or aseptic meningitis; peripheral neuropathy or radiculopathy; facial palsy; Guillain-Barré syndrome; brachial neuritis; or cognitive impairment or psychosis</td>
<td></td>
</tr>
</tbody>
</table>
Opportunistic Infection Defined

Opportunistic Infection

An infection by a microorganism that normally does not cause disease but pathogenic when the body's immune system is impaired and unable to fight off infection, as in AIDS, neutropenia, and congenital or iatrogenic host defense defects.
HIV/AIDS Opportunistic Infections Summary

AIDS & OPPORTUNISTIC INFECTIONS

BRAIN
- Toxoplasmosis [Toxo]
- Cryptococcal meningitis

EYES
- Cryptococcal meningitis

MOUTH & THROAT
- Candidiasis

LUNGS
- Pneumocystis carinii pneumonia (PCP)
- Tuberculosis (TR)
- Histoplasmosis

GUT
- Cytomegalovirus (CMV)
- Cryptosporidiosis
- Mycobacterium avium complex (MAC)

SKIN
- Herpes simplex
- Shingles

GENITALS
- Genital Herpes
- Human papillomavirus (HPV)
- Vaginal Candidiasis (Yeast)

Opportunistic Infections
Opportunistic Infections
Opportunistic Infections
Treatment of HIV Infection
Treatment goals

- Preserve immune function
- Avoid an AIDS diagnosis and to avoid opportunistic infections
- Decrease the viral load (serum) to undetectable
- Minimize and control medication side effects
- Improve quality of life
## Treatment of HIV

<table>
<thead>
<tr>
<th>Nucleoside reverse transcriptase inhibitors</th>
<th>Non-nucleoside reverse transcriptase inhibitors</th>
<th>Protease inhibitors</th>
<th>Fusion inhibitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>AZT</strong> (ZDV, zidovudine, Retrovir®)</td>
<td>• <strong>Nevirapine</strong> (NVP, Viramune®)</td>
<td>• <strong>Saquinavir</strong> (SQV, Invirase®)</td>
<td>• <strong>Enfuvirtide</strong> (T-20, Fuzeon®)</td>
</tr>
<tr>
<td>• <strong>ddI</strong> (didanosine, Videx®)</td>
<td>• <strong>Delavirdine</strong> (DLV, Rescriptor®)</td>
<td>• <strong>Indinavir</strong> (IDV, Crixivan®)</td>
<td></td>
</tr>
<tr>
<td>• <strong>d4T</strong> ( stavudine, Zerit®)</td>
<td>• <strong>Efavirenz</strong> (EFV, Sustiva®)</td>
<td>• <strong>Ritonavir</strong> (RTV, Norvir®)</td>
<td></td>
</tr>
<tr>
<td>• <strong>3TC</strong> ( lamivudine, Epivir®)</td>
<td></td>
<td>• <strong>Nelfinavir</strong> (NFV, Viracept®)</td>
<td></td>
</tr>
<tr>
<td>• <strong>Abacavir</strong> (Ziagen®)</td>
<td></td>
<td>• <strong>Amprenavir</strong> (APV, Agenerase®)</td>
<td></td>
</tr>
<tr>
<td>• <strong>Tenofovir</strong> (Viread®)</td>
<td></td>
<td>• <strong>Lopinavir</strong> (LPV, Kaletra®)</td>
<td></td>
</tr>
<tr>
<td>• <strong>Combivir®</strong> (AZT/3TC combination)</td>
<td></td>
<td>• <strong>Atazanavir</strong> (TAZ, Reyataz®)</td>
<td></td>
</tr>
<tr>
<td>• <strong>Trizivir®</strong> (AZT/3TC/Abacavir combination)</td>
<td></td>
<td>• <strong>Fosamprenavir</strong> (908, Lexiva®)</td>
<td></td>
</tr>
<tr>
<td>• <strong>Emtricitabine</strong> (FTC, Emtriva®)</td>
<td></td>
<td>• <strong>Tipranavir</strong> (PNU140690, Aptivus®)</td>
<td></td>
</tr>
<tr>
<td>• <strong>Epzicom™</strong> (3TC/abacavir combination)</td>
<td></td>
<td>• <strong>Darunavir</strong> (TMC114, Prezista®)</td>
<td></td>
</tr>
</tbody>
</table>
Population based data correlates HAART -PI use with decreased HIV mortality

Palella et al NEJM 1998;338:853
Nucleoside/tide Analogs: Toxicity

• zidovudine – GI, anemia, leukopenia, myositis
• didanosine – PN, pancreatitis, diarrhea
• zalcitabine – PN, aphthous ulcers
• stavudine – PN
• lamivudine, emtricitabine – (uncommon)
• abacavir – GI, hypersensitivity reaction, rash
• tenofovir – (uncommon)
• nucleosides as a class – lactic acidosis with hepatic steatosis

DHHS Guidelines, 1/28/00

DHHS Guidelines 11/10/03 <www.aidsinfo.nih.gov>
PI: Toxicity

- SQV: GI
- RTV: GI, circumoral paresthesias
- IDV: nephrolithiasis, incr. indirect bilirubin
- NFV: diarrhea
- APV: GI, rash
- LPV: GI, diarrhea
- ATV: increased indirect bilirubin
- PIs as a class: increased hepatic transaminases, hyperglycemia, lipodystrophy and lipidemia, increased bleeding in hemophiliacs
## When To Start Treatment? – Summary of Current Guidelines

<table>
<thead>
<tr>
<th>Guidelines</th>
<th>symptoms or CD4 &lt;200</th>
<th>CD4 200-350</th>
<th>CD4 &gt;350</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHHS: 7/14/03 update</td>
<td>treat</td>
<td>offer treatment</td>
<td>defer if VL &lt;55K; treat or defer if VL &gt;55K</td>
</tr>
<tr>
<td>&lt;www.aidsinfo.nih.gov&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IAS-USA: JAMA 2002</td>
<td>treat</td>
<td>consider treatment</td>
<td>consider if VL &gt;50-100K</td>
</tr>
</tbody>
</table>
HIV Treatment summary

• Combination ARV therapy is effective in preserving immune function and limiting viral replication
• Treatment is not without side effects
• Goals is to treat such that the benefits of therapy outweigh the risk/discomfort
HIV and bloodborne pathogen exposures for healthcare workers
Potential Bloodborne Pathogens

- Human Immunodeficiency Virus (HIV)
- Hepatitis Viruses
- As well as agents that cause...
  - Babesiosis
  - Brucellosis
  - Leptospirosis
  - Creutzfeldt-Jakob Disease
  - HTLV-1 Infections
  - Arboviral Infections
  - Malaria
  - Relapsing Fever
  - Viral Hemorrhagic Fever
  - Syphilis
Transmission of these agents in the workplace can occur through the following routes:

• **Parenteral exposure** - The pathogen is introduced directly into the body through a break in the skin, needlestick, or through a cut with a contaminated instrument or glass.

• **Mucous membrane exposure** - Exposure through contact of a mucous membrane in the eye, nose or mouth.
Risk of Infection after Contact with Infected Blood

Percutaneous exposure:

Prospective studies of several thousand HCWs indicate that the risk of seroconversion:

HIV-infected blood is approximately 0.3%.

Hepatitis B depends on the e antigen (e Ag) status of the patient.
   If the patient's blood is positive for the e Ag
      the risk of transmission -30% or about 100 times that of HIV.

HCV infection is 3% to 10% or about 10 times the risk following a single exposure to HIV-infected blood.
Risk of Infection after Contact with Infected Blood

• Mucous Membrane Exposure:
  – Risk of HIV Transmission
    • 0.09 % risk of transmission after a mucous membrane exposure to HIV infected blood.
  – Hepatitis B and C
    • Risk of transmission not well documented
    • Presumed to be less than in percutaneous injury
  – *Although the risk of transmission associated with mucous membrane exposures is less, it is not negligible*
Personal Protective Equipment

PPE includes masks, masks with faceshields and goggles.

PPE equipment can be found in isolation carts, and wall mounted PPE storage units.
Mucous Membrane Exposures Can be Prevented!!!!!!!

- PPE: Masks, faceshields / goggles
  - MUST BE WORN IN ANY PROCEDURE OR PATIENT CARE ACTIVITY THAT POSES A RISK OF BLOOD OR BODY FLUID SPLASH/SPLATTER/AEROSOLIZATION.
  - The include:
    - Phlebotomy and blood cultures
    - Suctioning of gastric or respiratory secretions
    - Removal of medical devices
      - CVC, ET tubes, Foley catheters, IV lines
Reveal: Rapid HIV Test
MedMira Laboratories

- Rapid HIV test performed on patient serum
  - HIV antibody test
    - SENSITIVITY: 99.8%
      - All positive tests are confirmed by western blot
    - Processing time for the test (upon receipt by the laboratory) is about 20-30 minutes.
  - It is critical that the source blood be drawn immediately and delivered to the laboratory in an expeditious manner
**New PEP Algorithm**

Did a percutaneous or MM exposure occur that carries significant risk of transmission of HIV?

- **Yes**
- **No**

Have fewer than 36 hours elapsed since the exposure occurred?

- **Yes**: Proceed with Rapid HIV Testing
- **No**

Is the source patient HIV infected as determined by rapid testing?

- **Yes**: Proceed with Rapid HIV Testing
- **No**

PEP not indicated; no follow-up needed

PEP not optimal but should be considered. If considered - proceed with rapid HIV testing of source and follow algorithm accordingly.

Source patient's serologic test is confirmed HIV negative and there is no evidence of acute retroviral syndrome in the source patient.

- **Stop PEP**

Source patient's serologic test is confirmed HIV positive or indeterminate, or serology is unable to be obtained.

- **Continue PEP for 4 weeks**

Initiate HAART (IF SOURCE IS POSITIVE - 3 DRUGS ARE PREFERRED)

**These are standing orders:**
- Recommended regimen: zidovudine 300 mg po bid + lamivudine 150 mg po bid (or Combid 1 bid)
- Kaletra 400/200 mg ii po bid with food
- Perform baseline confidential HIV testing of the exposed healthcare worker within 72 hours of initiating HAART
- Refer to Employee health for additional management: HAART, Hepatitis B and C

Sample must be obtained STAT (serum separator) and sent via pneumatic tube to Immunology Lab

PEP Team Member will be notified of both POSITIVE and NEGATIVE results by the lab.

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- **Continue PEP for 4 weeks**

**PEP not indicated; no follow-up needed**
PEP at VCUMC

• New PEP protocol
  – Rapid HIV testing is now employed
    • Processing time is about 20-30 minutes upon receipt of the source patient’s blood
    • Blood must be obtained from the source in an expeditious manner
    • Rapid HIV test results will be reported back to the PEP member
  – Standing orders for Antiretrovirals; 3 regimen HAART
Conclusion

• Despite public awareness and available treatment, the HIV epidemic continues in the USA and worldwide
  – 40,000 new cases per annum in the USA
• The natural history of HIV is protracted and ultimately leads to destruction of the immune system, with the consequent appearance of opportunistic infections
Conclusion

• Treatment is not curative yet it is effective in halting immune destruction and improving the quality of life
• Treatment is initiated at the point when the benefits outweigh the toxicity
Conclusion

• Percutaneous and mucous membrane blood and body fluid exposures are known risk factors for the transmission of HIV and Hepatitis B/C

• *PPE* (masks, faceshields or goggles) must be worn when a patient care activity poses a risk of BBF splash, spray or aerosolization