HIV – Occupational Transmission and Exposure

Marsh Gelbart 2010
Rationale for Post Exposure Prophylaxis (PEP)

• It was estimated that the risk for HIV transmission after percutaneous exposures involving larger volumes of blood, particularly if the source patient's viral load was likely to be high, exceeds the average risk of 3 per 1,000.
• In established HIV infection, the use of combinations of antiretroviral drugs are more potent than zidovudine alone in suppressing viral replication. This, together with the increased prevalence of zidovudine resistance amongst HIV infected people, has led to the introduction of combination antiretroviral drug prophylaxis following exposure to HIV.
• Results from animal studies suggest that HIV PEP is most likely to be efficacious if started within the hour
Dynamics of infection

24 hours

48 – 72 hours

5 days

Regional lymph node

blood

Mucosa

CD4

CCR5

Mucosal exposure to HIV-1 quasispecies

Selectively infection by R5 strains

Fusion of dendritic cells and CD4+ lymphocytes

Transport of virus to regional lymph nodes
Transport of virus to regional lymph nodes

Spread of infection to activated CD4+ lymphocytes

Entry of virus-infected cells into bloodstream

Widespread dissemination

Brain  Spleen  Gut-associated lymphoid tissue  Lymph nodes
## Risks by exposure

<table>
<thead>
<tr>
<th>Type of exposure</th>
<th>Estimated risk of HIV transmission per exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receptive anal intercourse</td>
<td>0.1-3.0%</td>
</tr>
<tr>
<td>Insertive anal intercourse</td>
<td>0.06%</td>
</tr>
<tr>
<td>Receptive vaginal intercourse</td>
<td>0.1-0.2%</td>
</tr>
<tr>
<td>Insertive vaginal intercourse</td>
<td>0.03-0.09%</td>
</tr>
<tr>
<td><strong>Needle–stick injury</strong></td>
<td>0.3%</td>
</tr>
<tr>
<td>Sharing injecting equipment</td>
<td>0.67%</td>
</tr>
<tr>
<td>Mucous membrane exposure</td>
<td>&lt;0.1%</td>
</tr>
</tbody>
</table>
Risk reduction

• Do not resheath needles, do not disassemble after use
• Use needleless IV access systems
• Reduce use of lancets and scalpels
• Report all sharps injuries
• Personal protective equipment
• Universal procedures and precautions
• Inform and educate workers
No matter how careful you may be…
Immediate action post exposure

- Decontaminate the exposed skin or wound by washing with soap and water.
- Application of antiseptics is of no proven benefit
- If mucous membrane exposed, site should be rinse with clean water.
- Eyes should be flushed with sterile saline eye washes
Transmission risks

- HIV is the least transmissible of blood borne viruses
- Following inoculation incident
  - HIV: $1 : 300$ (approx’ 0.1-0.5%) will sero-convert

- HBV: $1 : 3$ (approx’ 30%) of patients exposed will convert
- HCV: $1 : 30$ (approx’ 3%) become infected
TABLE 5. Expected frequency of associated signs and symptoms among persons with signs and symptoms of acute retroviral syndrome

<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>
</tbody>
</table>
| Rash
  Erythematous maculopapular with lesions on face, trunk and sometimes extremities, including palms and soles; mucocutaneous ulceration involving mouth, esophagus or genitals | 70 |
| Myalgia or arthralgia                 | 54 |
| Diarrhea                              | 32 |
| Headache                              | 32 |
| Nausea and vomiting                   | 27 |
| Hepatosplenomegaly                    | 14 |
| Weight loss                           | 13 |
| Thrush                                | 12 |
| Neurologic symptoms
  Meningoencephalitis or aseptic meningitis;
  peripheral neuropathy or radiculopathy;
  facial palsy; Guillain-Barré syndrome;
  brachial neuritis; or cognitive impairment or psychosis | 12 |
Risk factors for seroconversion

- Venepuncture or IM injection
- hollow bore needles
- injury is deeply penetrating
- blood is injected during injury
- exposure of broken skin
- volume of inoculum
- stage of infection and viral load of source
Occupational exposure

• **From July 1997-June 2000**
• In UK 293 health care workers exposed to HIV occupationally
• 138 out of 293 (47%) had post exposure prophylaxis (PEP) – a short but intense course of anti-viral medication
• Only 43 out of 138 (31%) completed 4 weeks of PEP
• 77 of 138 (56%) experienced side-effects
• 1 out of 293, developed HIV after the incident
US data on needle stick injuries

- Manipulating Needle in Patient: 27%
- Handling/Transferring Specimens: 5%
- Recapping: 5%
- Collision with HCW or Sharp: 8%
- IV Line-Related Causes: 8%
- Improper Disposal: 10%
- Cleanup: 11%
- Handling/Passing: 11%
- Disposal-Related Causes: 12%
- Other: 4%

(NIOSH, 1999)
Post exposure management

• Assess Risk of incident
• Assess Source Patient
  • If known to be HIV positive, then the patient’s viral load and treatment history affects PEP
  • If HIV status unknown, inform patient of incident and gain consent for testing with pre and post test discussion

• Document fully. Reassure and explain
HIV exposure risk assessment

• A risk assessment needs to be undertaken urgently by someone other than the exposed person
• It may not be possible to ascertain all the information required, especially if sexual exposure with anonymous partners
• An immediate initial assessment should be made with what information is available – ideally PEP should be started **within one hour of exposure**
• If there is a delay in presentation of the exposed person, it is usual practice to offer PEP up to 72hrs post-exposure
• In some circumstances, PEP can be offered up to 2 weeks post exposure – consultant based decision
Post incident risk assessment

CDC MMWR Vol 47/ No. RR-7
Figure 1. Determining the need for HIV postexposure prophylaxis (PEP) after an occupational exposure.

Step 1: Determine the Exposure Code (EC)

Is the source material blood, bloody fluid, other potentially infectious material (OPIM), or an instrument contaminated with one of those substances?

- Yes
  - OPIM
    - Blood or bloody fluid
      - Mucous membrane or skin, integrity compromised
      - Intact skin only
      - Percutaneous exposure

- No
  - No PEP needed

What type of exposure has occurred?

- Volume
  - Small (e.g., few drops, short duration)
  - Large (e.g., several drops, major blood splash and/or longer duration [i.e., several minutes or more])

- Severity
  - Less Severe (e.g., solid needle, superficial scratch)
  - More Severe (e.g., large-bore hollow needle, deep puncture, visible blood on device or needle used in source patient's artery or vein)

EC 1
EC 2
EC 2
EC 3

*This algorithm is intended to guide initial decisions about PEP and should be used in conjunction with other guidance provided in this report.

**Exposure to OPIM must be evaluated on a case-by-case basis. In general, these body substances are considered a low risk for transmission in health-care settings. Any unprotected contact to concentrated HIV in a research laboratory or production facility is considered an occupational exposure that requires clinical evaluation to determine the need for PEP.

**Skin integrity is considered compromised if there is evidence of chapped skin, dermatitis, abrasion, or open wound.

**Contact with intact skin is not normally considered a risk for HIV transmission. However, if the exposure was to blood, and the circumstance suggests a higher volume exposure (e.g., an extensive area of skin was exposed or there was prolonged contact with blood), the risk for HIV transmission should be considered.

**The combination of these severity factors (e.g., large-bore hollow needle and deep puncture) contribute to an elevated risk for transmission if the source person is HIV-positive.
What is the source patient’s HIV status?

**STEP 2: Determine the HIV Status Code (HIV SC)**

- **HIV negative**: No PEP needed
- **HIV positive**: Lower titer exposure (e.g., asymptomatic and high CD4 count***)
- **Status unknown**: Higher titer exposure (e.g., advanced AIDS, primary HIV infection, high or increasing viral load or low CD4 count***)
- **Source unknown**: HIV SC Unknown

---

**STEP 3: Determine the PEP Recommendation**

<table>
<thead>
<tr>
<th>EC</th>
<th>HIV SC</th>
<th>PEP recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>PEP may not be warranted. Exposure type does not pose a known risk for HIV transmission. Whether the risk for drug toxicity outweighs the benefit of PEP should be decided by the exposed HCW and treating clinician.</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Consider basic regimen. Exposure type poses a negligible risk for HIV transmission. A high HIV titer in the source may justify consideration of PEP. Whether the risk for drug toxicity outweighs the benefit of PEP should be decided by the exposed HCW and treating clinician.</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Recommended basic regimen. Most HIV exposures are in this category; no increased risk for HIV transmission has been observed but use of PEP is appropriate.</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Recommend expanded regimen. Exposure type represents an increased HIV transmission risk.</td>
</tr>
<tr>
<td>3</td>
<td>1 or 2</td>
<td>Recommended expanded regimen. Exposure type represents an increased HIV transmission risk.</td>
</tr>
</tbody>
</table>

---

**Notes:**

- HIV SC 1: A source is considered negative for HIV infection if there is laboratory documentation of a negative HIV antibody, HIV polymerase chain reaction (PCR), or HIV p24 antigen test result from a specimen collected at or near the time of exposure and there is no clinical evidence of recent retrovirus-like illness.
- HIV SC 2: A source is considered infected with HIV (HIV positive) if there has been a positive laboratory result for HIV antibody, HIV PCR, or HIV p24 antigen or physician-diagnosed AIDS.
- HIV SC Unknown: Examples are used as surrogates to estimate the HIV titer in an exposure source for purposes of considering PEP regimens and do not reflect all clinical situations that may be observed. Although a high HIV titer (HIV SC 2) in an exposure source has been associated with an increased risk for transmission, the possibility of transmission from a source with a low HIV titer also must be considered.

---

**Basic regimen:**

- Dapsone, 100 mg per day
- Azithromycin, 1 g per day
- Ritonavir, 400 mg per day

**Expanded regimen:**

- Dapsone, 100 mg per day
- Azithromycin, 1 g per day
- Ritonavir, 400 mg per day
- Nelfinavir, 750 mg three times a day
PEP?

- If the source patient involved in the needle stick incident is known to be HIV positive – initiate PEP protocols
- Consider PEP even if the source patient’s HIV status is unknown
Counselling the health care worker

• The health care worker needs to see a senior Dr specialising in HIV and then a health adviser
• The risks and benefits of PEP need to be fully understood
• Baseline HIV, HEP B and Hep C blood samples should be stored
• Time is of the essence!
Testing – an informed choice?

The health care worker needs to explore

• What a positive result would mean
• How might they cope
• Who could they tell for support
• Who have they told they are having the test
• Discuss benefits of knowing if positive:
  • Making life decisions
  • Treatment issues
  • Infection control
  • Reduction in anxiety / worry levels
## Regimens For Post Exposure Prophylaxis

<table>
<thead>
<tr>
<th>Type</th>
<th>Drugs</th>
<th>Regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic</strong></td>
<td>Zidovudine <em>(Zidovir)</em></td>
<td>600 mg/day</td>
</tr>
<tr>
<td><em>(28 days)</em></td>
<td>Plus Lamivudine <em>(Lamivir)</em></td>
<td>300 mg bid, 200 mg tid or 100 mg 4 hourly</td>
</tr>
<tr>
<td><strong>Expanded</strong></td>
<td>As above plus Indinavir <em>(Crixivan)</em> or Nelfinavir <em>(Viracept)</em></td>
<td>150 mg bid, 800 mg 8 hourly, 750 mg tid</td>
</tr>
<tr>
<td><em>(28 days)</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
If PEP is the chosen option?

- Commence post exposure prophylaxis
  - starter pack for 3 days with further PEP to be prescribed by HIV specialist
  - Combivir (AZT 300mg & Lamivudine 150g) 1 bd
  - Nelfinavir 1250mg bd

Note: - if previously vaccinated, then Hep B booster should be given, if not, then Hep B Immunoglobulin
Side Effects

• AZT (Zidovudine)
  • **Common**: nausea, headaches, muscle pain, tiredness and abdominal pain
  • **Uncommon**: anaemia, muscle weakness, liver abnormalities and insomnia

• 3TC (Lamivudine)
  • **Common**: nausea, headache, pruritis
  • **Uncommon**: pancreatitis, anaemia, neutropoenia, peripheral neuropathy

• Nelfinavir (Viracept)
  • **Common**: diarrhoea
  • **Uncommon**: diabetes, abdominal pain or distension, oedema, rash
Initial follow up

Day 0-7 At this first follow up visit the HIV Team will:
• review available information and decide whether PEP should continue
• discuss any deviations from standard PEP with an HIV consultant
• assess adherence and toxicity and make relevant interventions
• promote HIV-Ab testing in exposed person at first follow up
• encourage safer sex and use of condom/ femidom during follow up
• arrange confidential psychological support and counselling as necessary
• prescribe further PEP medicines if PEP is to continue
• reinforce symptoms of seroconversion
Follow up

Day 7-28

- The patient will be reviewed at the PEP clinic on (approximately) days 7, 14, 21 and 28 post exposure in order to:
  - assess adherence and toxicity
  - arrange confidential psychological support and counselling as necessary
  - perform the following blood tests: FBC, U&Es, LFTs, amylase, glucose and lipids
  - document and give HIV-Ab test result
Long term follow up

1 – 6 months after PEP

- The patient will be reviewed at the PEP clinic at 1, 3 and 6 months after stopping PEP for the following tests:
  - HIV-Ab test at 1, 3 and 6 months
  - HIV DNA PCR at 1 and 3 months for occupational exposures only
  - HCV-Ab at 6 months for occupational exposures only

At least 6 months should elapse after cessation of PEP before a negative antibody test is used to reassure the individual that infection has not occurred.
ZDV PEP Treatment Failures in HCWs

World-wide Cases
- 18 failures in health care providers
- 5 failures in other settings
- no delay in time to seroconversion
- no adverse effects on natural history

Potential Explanations
- delay in treatment
- dose too low / low drug levels
- resistant virus
- high inoculum exposure
- treatment duration too short
- zidovudine is not efficacious
PEPSI

• Anti-retrovirals can be given not just after occupational exposure, but after sexual exposure too.
• In such cases it is known as post exposure prophylaxis/sexual intercourse or PEPSI
• Some articles refer to post exposure prophylaxis/sexual exposure or PEPSE – it’s the same
<table>
<thead>
<tr>
<th>Exposure</th>
<th>Source HIV+</th>
<th>Source Prevalence high (&gt;10%)</th>
<th>Source Prevalence low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receptive anal sex</td>
<td>Yes</td>
<td>Yes</td>
<td>Consider</td>
</tr>
<tr>
<td>Insertive anal sex</td>
<td>Yes</td>
<td>Consider</td>
<td>No</td>
</tr>
<tr>
<td>Receptive vaginal sex</td>
<td>Yes</td>
<td>Consider</td>
<td>No</td>
</tr>
<tr>
<td>Insertive vaginal sex</td>
<td>Yes</td>
<td>Consider</td>
<td>No</td>
</tr>
<tr>
<td>Fellatio with ejaculation</td>
<td>Consider</td>
<td>Consider</td>
<td>No</td>
</tr>
<tr>
<td>Fellatio without ejaculation</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Splash semen into eye</td>
<td>Consider</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Cunnilingus</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Bibliography


Bibliography continued.....