HIV post-exposure prophylaxis following needle-stick injuries

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Human immunodeficiency virus (HIV) is one of the most serious global health challenges. In 2017, The Joint United Nations Programme on HIV/AIDS (UNAIDS) reported an alarming 36.9 million people living with HIV/AIDS.[1] The geographic distribution of this global health burden paints a dismal picture for Africa since eastern and southern Africa represent just over half of the cases worldwide.[2]

With an estimated 7.2 million people living with HIV, South Africa has the largest HIV epidemic in the world, accounting for 19% of the global HIV burden. Despite having one of the largest government-funded programmes, there were still 270 000 new cases and 110 000 AIDS-related deaths recorded in South Africa in 2017.[3,4] Risky sexual behaviour, changes in sexual orientation and declining boundaries between people are some of the main factors increasing the risk of exposure to HIV.[3,5]

An occupational hazard is defined as "any condition of a job that can produce a negative effect on an individual's health". Exposure to blood and body fluid as well as needle-stick injuries (NSI) are recognised as one of the most significant threats faced by healthcare workers (HCWs).[6] As such, every HCW around the world is at risk of blood-borne infections such as hepatitis B virus (HBV), hepatitis C virus (HCV) and HIV from accidental needle-stick and sharp object injuries.[6,7]

In spite of increasing awareness of infection control and prevention, an estimated three million HCWs continue to be at risk of accidental exposure to these infections daily.[6] Following percutaneous exposure, the risk of transmission of disease is high: 37% for HBV, 39% for HCV and a 4.4% chance of HIV.[7] Therefore, there is a need for HCWs to comply with safety precautions in order to avoid accidental exposure. Since the prevalence of HIV among the general population remains high (12.2%) in South Africa, the chance of HIV contagion remains a real threat in everyday life, particularly for HCWs due to their scope of practice.[3,5,7] Despite health education and precautions in place, the reality is that these precautions are not always adhered to in daily practice.[7] Therefore, effective post-exposure prophylaxis (PEP) management is an absolute necessity to prevent accidental HIV infections. The focus of this article aims to address HIV post-exposure prophylaxis following NSIs.

Needle-stick injuries in South Africa

NSIs can occur through needle recapping, withdrawal of needles, handling or disposal of used needles, needle disassembly, manipulating a needle in a patient, unexpected patient movement or accidental injury by a colleague.[8]

A study conducted in a South African hospital found that most NSIs affected doctors and nurses and occurred during surgical procedures, with improper disposal of needles responsible for one third of such injuries. Additionally, it was found that some HCWs are still recapping needles. In theory, neither of these practices should occur since sharp bins are provided in hospitals.[7] South African hospitals have also reported NSIs occurring after insertion of an intravenous catheter and with intravenous cannulation and venepuncture.[8]

Given the high prevalence of HIV in South Africa, HIV seroconversion (production of HIV antibodies) remains a concern. However, this seroconversion rate from occupational HIV exposure, including NSIs, is thought to be low, with a 0.33% risk of HIV from NSIs and a 0.09% risk from mucous membrane exposures. Despite the low risk of seroconversion, it was reported that 1000 HCWs worldwide since the year 2000 have contracted HIV through occupational exposures.[8]

Risk of HIV transmission following NSIs[8]

Box 1. Assessment of risk of NSIs

High-risk situations	Low risk-situations
- Injury involving a hollow-bore needle - Deep injuries - Injury with an instrument visibly contaminated with the patient's blood - Needle placement in a vein or artery - Terminal illness in the source patient	- Injuries occurring through a solid needle - A superficial wound - Injuries occurring from a low-risk source - A patient with an HIV viral load < 1500 copies/mL

Occupational post-exposure prophylaxis for HIV

The priority following a NSI with any infectious material is to thoroughly wash the wound with copious amounts of soap and water.[8,9] Box 2 below outlines what materials are considered to be infectious.[8]

Box 2. Assessment of risk of infectious materials
Infectious materials - risk of HIV [8]: Amniotic fluid, blood, body fluids contaminated with visible blood, breast milk, cerebrospinal fluid, penile pre-ejaculate, pericardial fluid, peritoneal fluid, pleural fluid, semen, synovial fluid and vaginal secretions

A thorough assessment of risk (Box 3) is necessary prior to initiating HIV post-exposure prophylaxis (PEP) because of the potential of adverse effects from antiretroviral (ARV) drugs.[9] The aim of ARV PEP is to prevent HIV infection. It takes at least 24 hours for the HIV virus to replicate in the dendritic cells of the skin and tissue before it spreads to the regional lymph nodes and the systemic system. This allows time for PEP to limit the replication of the virus in the initial target cells or lymph nodes and thus prevent systemic infection.[8]

Box 3. Assessment of risk of exposure to determine the need for HIV PEP (adapted from The Guidelines for Occupational PEP[9])

Type of exposure	HIV status of source patient	
	Negative	Unknown or positive
Exposure of intact skin to infectious or non-infectious material	No need for PEP	
Exposure of mucous membranes, including eye splashes or non-intact skin (cuts, open wounds) to blood or infectious materials	No need for PEP	PEP indicated
Percutaneous exposure (NSI) to blood or infectious materials	No need for PEP	PEP indicated

The following steps for HIV PEP following occupational exposure are adapted from the current guidelines[9]:

Step 1: Immediate management of HCW

- Assess the need for HIV PEP (Refer to box 3).
- Thorough pre-test HIV counselling in a confidential environment.
- Baseline HIV test results of HCW:
  - If Rapid test result is negative, initiate PEP and confirm with HIV antibody lab test (enzyme-linked immunosorbent assay = ELISA).
  - If Rapid test result is positive, repeat Rapid test for confirmation. If negative, initiate PEP and do ELISA. If confirmatory test is positive, refer for initiation of antiretroviral therapy (ART).
- Test results and post-test counselling should be conducted in strict confidence.
- If the HCW refuses HIV testing, offer PEP but no compensation granted if HCW becomes HIV positive.

Step 2: PEP

- If indicated, PEP should be initiated within one hour and not later than 72 hours after exposure. For higher risk exposures (Refer to Box 1), consider giving PEP up to seven days after exposure.
- PEP should not be delayed if waiting for ELISA results of HCW or source patient. PEP can be discontinued if the source is found to be HIV negative after ELISA test, unless the patient is displaying evidence of sero-conversion illness.
- Refer to Figure 1 for PEP regimens.
- HIV PEP must be taken for 28 days – therefore a full 28-day supply must be dispensed.

Step 3: Testing of source patient

- In addition to testing for HIV, the source patient must also be tested for HBV and HCV and the HCW managed accordingly.
- If source refuses to be tested or testing cannot be done, assume HIV positive.

Step 4: Follow up and monitoring

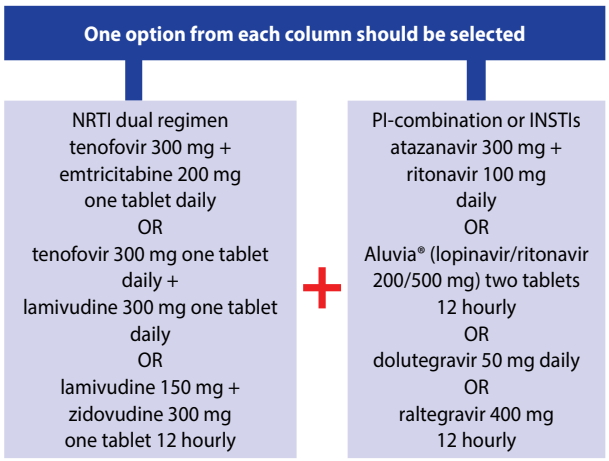
- Ongoing psychosocial support is necessary.
- HIV tests should be repeated at six weeks and three or four months post exposure using an ELISA test.
- The HCW should be counselled to practice safe sex until a negative result on the HIV test at three or four months is confirmed.
- HIV PEP should not be discontinued due to side-effects, as these should be appropriately managed.

HIV PEP Regimens

There are currently five classes of ART drugs available in South Africa:

- ***Nucleoside reverse transcriptase inhibitors (NRTIs)*** block the HIV enzyme, reverse transcriptase which converts its viral RNA into DNA (reverse transcription). By blocking this enzyme and preventing reverse transcription from occurring, this class of drug works to prevent HIV from replicating.[10]
- ***Protease inhibitors (PIs)*** block the HIV enzyme protease, and in doing so prevent new (immature) HIV from becoming a mature virus that can infect other CD4 cells.[10]
- ***Integrase strand transfer inhibitors (INSTIs)*** block the HIV enzyme integrase, which the virus uses to insert (integrate) its viral DNA into the DNA of the host CD4 cell, thus preventing HIV replication.[10]
- ***Non-nucleoside reverse transcriptase inhibitors (NNRTIs)*** also block HIV reverse transcriptase thereby preventing HIV from replicating.[10]
- ***Entry inhibitors*** block HIV from entering a host CD4 cell.[10]

The most commonly used drugs for PEP inhibit one of the three key HIV enzymes required by the virus to replicate.[8]



Despite evidence of efficacy, PEP is not 100% protective. There have been six cases of HIV in HCWs worldwide despite having initiated PEP within two hours of exposure. In light of this, it is essential to test the HIV status of the HCW with an ELISA test at baseline, at six weeks, three months and six months post exposure.[8] The following factors may contribute to the failure of PEP[8]:

- The presence of antiretroviral-resistant strains of HIV in the source patient
- Exposure to a large amount of body fluids
- Initiation of PEP more than 72 hours post-exposure
- Duration of PEP less than four weeks

Lack of compliance with HIV PEP among HCWs is a significant challenge for effective HIV PEP. The main reason for this is due to side-effects from the ARVs. The most common side-effects are gastrointestinal in nature, such as diarrhoea, nausea and vomiting. Other side-effects commonly reported include headache, lethargy and malaise. More serious side-effects include (but not limited to) hypersensitivity reactions, skin reactions (including Stevens-Johnson syndrome) and hepatitis.[8,9]

The foundation of avoiding exposure to HIV as a HCW is to ensure that preventative measures are in place and strictly followed. Despite awareness of occupational risks and the measures in place in the workplace, occupational exposures to HIV continue to be a health threat. Prompt management of HCWs in the case of HIV exposure is essential to reduce the risk of contracting HIV. Every HCW should be made aware that prompt wound management, initiation and compliance of HIV PEP with ARVs (where appropriate) and appropriate testing form the basis of effective occupational PEP for HIV.

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