Post-exposure prophylaxis following occupational exposure to HIV and hepatitis B: an analysis of a 12-year record in a Nigerian tertiary hospital

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Abstract

Background: Healthcare workers (HCWs) have an increased risk of occupational exposure to blood-borne pathogens.

Aims/objectives: We aim to examine the utilisation and outcome of post-exposure prophylaxis (PEP) for both HIV and hepatitis B (HBV) among HCWs.

Methods: This was a retrospective study conducted in a tertiary hospital in North-Western Nigeria. We reviewed data on HIV or HBV PEP given to HCWs between 2004 and 2016.

Results: A total of 115 HCWs presented for PEP during the study period. Intern doctors were the most exposed group (40/115; 34.8%). There were 86/115 (74.8%) needle stick exposures. While 53/115 (46.1%) of the sources of exposure were HIV-positive, 9/115 (7.83%) were HBV-positive. Zidovudine-based regimen (40/70) was the most commonly prescribed. No seroconversion occurred among those that completed PEP treatment and follow-up.

Discussion: No seroconversion occurred among those that received either or both HIV and HBV PEP and completed PEP treatment.

Keywords

Human immunodeficiency virus (HIV), infection control, vaccination

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Introduction

Healthcare workers (HCWs), in particular, are at risk of occupational exposure to blood-borne pathogens. According to the World Health Organization (WHO), 90% of the global reported healthcare-related percutaneous exposure occurs in resource-limited countries (Cardo et al., 1997; Mbaisi et al., 2013). As a consequence of occupational exposure, it is estimated that 1000 human immunodeficiency virus (HIV), 66,000 hepatitis B virus (HBV) and 16,000 hepatitis C virus (HCV) infections occur each year worldwide (Prüss-Üstün et al., 2005). Because of high prevalence of blood-borne pathogens, especially HIV, HBV and HCV in developing countries, HCWs in these regions are reported to be at serious risk of infection from these pathogens (Rossouw et al., 2014; Rudolph et al., 2001). It was also pointed out that, despite the high prevalence of

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blood-borne pathogens in many developing countries, documentation of infection caused by occupational exposure is inadequate (Ilhan et al., 2006; Rudolph et al., 2001).

HIV post-exposure prophylaxis (PEP) is defined as the services provided to prevent transmission of HIV infection when an individual sustains an exposure to an HIV-positive source (WHO, 2007). The PEP is essentially a five-step process which includes: first aid; counselling; assessment of risk; consent-based laboratory testing of both the source and the exposed personnel; and finally provision of appropriate treatment with follow-up (Mathewos et al., 2013). A previous study has demonstrated up to 81% protection from acquiring HIV following administration of antiretroviral medications for PEP (Cardo et al., 1997). The current guideline recommends administration of at least two antiretroviral medications for HIV PEP within 72 h of exposure for four weeks (Isah et al., 2016; Preboth, 2002). Adhering to the 28-day course of antiretroviral treatment (ART) is critical to the effectiveness of HIV PEP (WHO, 2014a). However, uptake of HIV PEP is reported to be inadequate (Ford et al., 2014). Less than 60% of those who began PEP treatment complete the full course (Ford et al., 2014). Higher completion rates were reported with a two-drug regimen compared to a three-drug regimen (Bassett et al., 2004; Ford et al., 2014). Adverse effects of drugs were reported as a reason for HIV PEP non-completion (Tokars et al., 1993; Wang et al., 2000). In this study, HIV PEP treatment default is defined as initiating PEP treatment following occupational exposure to HIV and failing to return to pick up the rest of the PEP at any point during the course of treatment.

If the exposure source has HBV infection, the current PEP guideline for HBV recommends the administration of hepatitis B immunoglobulin and commencement of HBV vaccination (Wolff, 1997).

There are few studies that reported on utilisation and outcome of PEP for both HIV and HBV in Africa (Ifeanyichukwu and Ofili, 2013; Okoh and Saheeb, 2017). The main objectives of this study were to examine the utilisation and outcome of PEP for both HIV and HBV in a tertiary hospital in North-Western Nigeria.

Methods

This was a retrospective study conducted at a major tertiary centre in North-Western Nigeria. The hospital is a 700-bed hospital, which serve as a referral centre for the north-western state. It also includes the largest ART centre in the region.

The hospital's PEP protocol was first developed in September 2004 by the Infection Control Unit (ICU) using Centers for Disease Control (CDC) recommendations (CDC, 2005). The Infection Control Team (ICT) members comprising trained nurses and physicians runs sensitisation workshops to HCWs on occupational exposure prevention

and prophylaxis on a quarterly basis. When there is exposure to HIV, the exposed HCW is counselled and the designated physician decides the need for PEP. Consent is taken from the source patient as well as the HCW for assessing his/her HIV status as well as for PEP therapy whenever indicated. Selection of basic (two drugs) or expanded (three drugs) PEP regimen for HIV is decided by a designated physician, which was based on guidelines given by the CDC (CDC, 2001b, 2005). Following the exposure to HIV, repeat testing for HIV of the exposed HCW was done at six weeks, three months and six months. In the case of exposure to HBV, the HCW's baseline HBsAg screening is done based on which decision to give HBV PEP, after appropriate counselling and consent. The hospital lacks facility for the measurement of anti-HBS antibody titre, and HBV vaccination is not routine. Therefore, all HCWs who reported exposure to HBV-positive sources are offered HBV vaccine. HBV immunoglobulin is not given because of cost and availability. HCWs who had exposure with blood or other body fluids from patients with unknown HIV or HBV status are also offered HIV and HVB PEP.

The study included details of all reported cases of occupational exposures to HIV-positive and HBV-positive sources that occurred within the hospital from October 2004 to December 2016. Cases of occupational exposures to unknown sources were also included.

A questionnaire was administered retrospectively to obtain information on the enrolees, such as their gender, the area of the hospital in which they work and the professional group to which they belong. Other information collected includes the nature of exposure, status of source of exposure, status of exposed staff, PEP given and outcome.

The information from the questionnaires was initially entered into an Excel spreadsheet and subsequently exported and analysed using STATA SE version 12.1 (Stata Corp., College Station, TX, USA). Descriptive statistics were used to present results as frequencies and percentages. Chi-square tests and relative risks were computed to describe associations. A P value < 0.05 was considered statistically significant.

Ethical approval to conduct the study was obtained from the hospital ethics committee.

Results

A total of 115 HCWs presented for PEP during the study period with men constituting 63/115 (55%) and their mean age was 35.13 ± 5.4 years. House officers (Intern Doctors) were the largest group of HCW exposed (40/115; 34.8%), followed by nurses (29/115, 25.2%), resident doctors (18/115; 15.7%) and laboratory scientists (14/115; 12.1%) (Table 1). The medical wards recorded the highest number of exposures in the hospital (33/115; 28.7%), followed by the laboratory (19/115; 16.5%), surgical ward (16/115; 13.9%) and the obstetrics and gynaecology ward (10/115;

Table 1. Baseline characteristics.

Variable	n (%)
Gender	
Male	63 (55)
Female	52 (45)
Area of hospital	
Medical wards	33 (28.70)
Surgical wards	16 (13.91)
Emergency Paediatric Unit	4 (3.58)
Laboratory	19 (16.52)
Accident and Emergency Unit	9 (7.83)
Obstetrics and Gynaecology Unit	10 (8.70)
Dialysis	1 (0.87)
SCBU	4 (3.48)
Theatre	4 (3.48)
ICU	2 (1.74)
Waste disposal site	2 (1.74)
Dental	2 (1.74)
GOPD	3 (2.61)
PMW	6 (5.22)
Professional group	
House officers	40 (34.78)
Resident doctors	18 (15.65)
Consultant	1 (0.87)
Nurses	29 (25.22)
Laboratory scientists	14 (12.12)
Attendants	8 (6.96)
Students	5 (4.35)

GOPD, General Outpatient Department; SCBU, Special Care Baby Unit; ICU, Intensive Care Unit; PMW, Paediatric Medical Ward.

8.7%) (Table 1). The most frequent route of exposure was needle stick 86/115 (74.8%). Fifty-three (46.1%) of the sources of exposure were HIV-positive, 9/115 (7.8%) were HBV-positive and 1/115 (0.9%) were both HIV- and HBV-positive, while in 19 (16.5%) of the exposures, the status of the source of the exposure was not known (Table 2). Of the 115 HCWs that presented for PEP during the study period, 66/115 (57%) received only antiretroviral medications (ARVs), 8/115 (7%) received only HBV vaccination, 4/115 (3%) received both ARVs and HBV vaccination, while 37/115 (32%) did not receive any PEP. Of the 37 of the 115 HCWs that did not receive PEP, 2/37 were exposed to HIV-positive sources but refused PEP while 1/37 was exposed to an HIV-positive source but was found to be HIV-positive and was referred for treatment. Another HCW exposed to HIV-negative sources was found to be HBV-positive and was referred for treatment, while the remaining 33/37 HCWs were exposed to HIV-/HBV-negative sources. Two of the staff that received HBV

Table 2. PEP characteristics of the enrolees.

Variables	n (%)
Nature of exposure (n = 115)	
Needle stick	86 (74.78)
Blood splash	26 (22.61)
Sharp injury	3 (2.61)
Status of source of exposure (n = 115)	
HIV-positive	53 (46.09)
HIV-/HBV-negative	33 (28.7)
HBV-positive	9 (7.83)
HIV + HBV	1 (0.87)
Unknown	19 (16.52)
Pre-PEP status of the HCW (n = 115)	
HIV-/HBV-negative	113 (98.26)
HIV-positive	1 (0.87)
HBV-positive	1 (0.87)
Distribution of HCW offered PEP (n = 115)	
Completed	59 (51.30)
Defaulted	19 (16.52)
Refused consent	2 (1.74)
No PEP given	35 (30.43)
Post-PEP status of the HCW (n = 78)	
Negative	59 (75.64)
Lost to follow-up	19 (24.36)

vaccination were exposed to sources with unknown HBV status (Table 3).

The most commonly prescribed medication for HIV PEP was AZT + 3TC (22/70) followed by TDF + FCT + EFZ (17/70) and AZT + 3TC + EFZ (14/70) (Table 3). Overall, Zidovudine-based regimen (40/70) was the most commonly prescribed, followed by TDF-based regimen (25/70). Three-drug regimens (40/70) were the most commonly prescribed HIV PEP, followed by two-drug regimens (30/70). Among those who received either or both HIV/HBV PEP, 59/78 (75.6%) completed the treatment and were seronegative for HIV and/or HBV at the end of follow-up (Table 2).

Discussion

This study found nurses and junior doctors were more at risk of occupational exposure, with needle stick and blood splash being the commonest route of exposure compared to sharp injury. Most of the reported cases were exposures to HIV-positive sources with very few cases of HBV exposures. The study also revealed that Zidovudine-based, as well as three-drug regimens, were the preferred practice, with zero seroconversion rate.

Table 3. PEP regimen given by PEP outcome.

PEP given	Completed	Defaulted	Total
AZT + 3TC	16	6	22
AZT + 3TC + EFV	10	4	14
D4T + 3TC	1	0	1
TDF + 3TC	1	0	1
3TC + D4T + NVP	2	2	4
TDF + FCT	0	3	3
TDF + FCT + EFV	15	2	17
TDF + FCT + ALUVIA	3	1	4
AZT + 3TC + HBV vaccine	2	1	3
AZT + 3TC + EFV + HBV vaccine	1	0	1
HBV vaccine	8	0	8
Total	59	19	78

It is not surprising that intern doctors and nurses were the most frequently exposed group of HCWs in this study, because they are the most likely category of staff to attend to hospitalised patients that require procedures that predispose to occupational exposure to body fluids (Ogoina et al., 2014). Moreover, house officers are beginning to perfect those skills that predispose HCWs to exposure to body fluids of patients (Ogoina et al., 2014). The higher number of needle stick and blood splash exposure is similar to results from previous studies in Nigeria, Egypt and Iran (Amoran, 2013; Erhabor et al., 2007; Ghannad et al., 2012; Olaleye et al., 2013; Talaat et al., 2003). Also similar to our findings, Erhabor et al. reported a high percentage of exposure to HIV-positive sources compared to HBV in Southern Nigeria (Erhabor et al., 2007). There have been reports on low-risk perception of HBV exposure and poor attitude towards HBV vaccination among HCWs (Hassan et al., 2016; Setia et al., 2013). Therefore, HCWs are more likely to report HIV exposure than HBV exposure, which may have explained the low number of HBV exposures reported in this study despite high prevalence of HBV in the population. Nevertheless, these findings should be taken seriously, as needle stick exposure to a HBV-positive source poses a 23–62% risk of infection (Walser et al., 2014).

The medical wards, laboratory and the surgical wards recorded the highest number of exposures compared to other wards in this study. This is similar to the findings in studies from Serbia and Turkey, where the majority of exposures occurred in clinical wards, surgical intensive care unit and the operating theatre (Markovic-Denic et al., 2015; Sencan et al., 2004). This is probably because of the

higher frequency of performing procedures that involve contact with body fluids in those locations.

Similar to our results, in South-Eastern Nigeria, all the affected HCWs received a Zidovudine-based regimen for PEP (Isah et al., 2016). Another study in western India reported a Zidovudine-based regimen as the most commonly prescribed but less well tolerated compared to a Tenofovir-based regimen (Sheth et al., 2016). The same study also reported the use of two-drug regimens being commoner than three-drug regimens. In contrast, Erhabor et al. reported that 100% of patients received Stavudine, lamivudine and Nevirapine for HIV PEP (Erhabor et al., 2007). The differences in the choice of ART and the number of drugs given for PEP among the various studies may reflect the changing national and international guidelines and availability of newer ARTs. For instance, in 2001, the CDC recommended prescribing two antiretroviral drugs for PEP in less severe exposures in which the source is HIV-positive class 1 defined as asymptomatic HIV infection or known low viral load (e.g. < 1500 RNA copies/mL). However, three antiretroviral drugs should be prescribed for all severe exposures irrespective of HIV-positive class of the source and less severe exposure in which the source is HIV-positive class 2 defined as asymptomatic HIV infection, AIDS, acute seroconversion or known high viral load (U.S. Public Health Service, 2001). The same guideline recommended the use of ZDV and 3TC, or 3TC and d4T, or d4T and ddI if the source virus is known to be susceptible to them, with or without a third drug based on the criteria mentioned previously. More recent guidelines recommend the administration of three drugs for HIV PEP irrespective of severity of exposure and

disease severity of the source of exposure (WHO, 2014b). The WHO recommends that the choice of antiretroviral medication for HIV PEP should be based on the country's first-line antiretroviral drug regimen for treatment of HIV (WHO, 2014b). In our study, four patients received Nevirapine for HIV PEP. It should be noted that Nevirapine is no longer recommended for HIV PEP due to its toxicity and possible widespread resistance following extensive use in prevention of mother-to-child transmission in developing countries (CDC, 2001a; Johnson and Baraboutis, 2000; Patel et al., 2004; Puro et al., 2003).

A previous study in Nigeria reported no seroconversion among those who received HIV PEP, which is similar to our findings (Erhabor et al., 2007). It is recommended to determine the antibody titre of the HCWs that are previously vaccinated against HBV following exposure to HBV-positive sources, to determine eligibility for administration of HBV immunoglobulin (U.S. Public Health Service, 2001). In our study, all the HCWs exposed to HBV-positive sources received only HBV vaccination for PEP. None of these healthcare staff had an assessment for HBV antibody titre or received HBV immunoglobulin because these services were not readily available.

This study is timely, given the impact of the HIV pandemic in sub-Saharan Africa and the need for policy-makers to have adequate information regarding occupational exposure to blood-borne pathogens among HCWs so that protective measures can be put in place to safeguard HCWs. The key strength of this study is the review of data over several years which provides a clearer picture of the problem compared to previous studies which are limited because of recruitment of fewer patients over short period of time. The major limitation of this study is its retrospective design. It is therefore impossible to obtain additional useful information that was not previously recorded. For instance, information on disease severity of the source patient that might have prompted the choice of antiretroviral medication was not recorded. Also, clinical and laboratory information on adverse effects of medications was not recorded. There was no record on the time interval between exposure and commencement of prophylaxis and the type of first aid given immediately after exposure.

Despite these limitations, the study highlights the need for further training of HCWs on avoidance of harmful practices that predisposes to needle stick injury such as the recapping of needles, in particular targeting nurses and lower cadre of doctors who were shown to be most at risk. Measures to compel implementation of these precautions should also be introduced. Furthermore, HCWs should be trained to always use personal protective equipment, safe disposal of sharps and use needles designed to sheath automatically after use when available. HBV immunoglobulin and facilities for HBV antibody titre determination should also be available and all HCWs should be aware of their HBV antibody titre status. There is also a need to study the

HBV immunisation coverage among HCWs in our facility so that any identified gap could be filled.

In conclusion, a Zidovudine-based regimen was used by the majority of those that require HIV PEP. No seroconversion occurred among those given PEP for HIV or HBV. HBV vaccination was the only targeted measure used for HBV PEP. Facilities for HBV antibody titre detection as well as HBV immunoglobulin should be provided as part of the HBV PEP package. Further studies should be conducted to determine the HBV vaccination coverage of HCWs at our facility.

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