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EPIDEMIOLOGY AND MANAGEMENT OF OCCUPATIONAL EXPOSURE TO BLOOD BORNE VIRAL INFECTIONS IN A RESOURCE POOR SETTING: THE CASE FOR AVAILABILITY OF POST EXPOSURE PROPHYLAXIS.

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ABSTRACT

Objectives: The aim of this study was to demonstrate the epidemiology and risk of occupational exposure to HIV, HBV and HCV among health care workers (HCWs) and highlight areas where greater training is required.

Methods: The study population included 13 health care workers; 5 males (38.5%) and 8 females (61.5%), mean age 34.15± 6.8 years including 3 doctors (23.1%), 2 laboratory scientist (15.4%), 1 laboratory technician (7.7%), 6 medical students (46.2%) and 1 trainee laboratory assistant (7.7%). The care and follow-up provided to the health care workers in the 500 -bed tertiary health hospital that had percutaneous exposure to patient's blood between June 2002 and June 2005 were analyzed. All exposed health care workers were evaluated and offered follow up counseling. Five milliliters of blood from each of the HCWs and the source patients were screened by immmuno-enzymatic testing for HIV, HBV, and HCV.

Results: Exposures were concentrated in few areas of the hOspital; pediatrics (46.2%); surgery (15.4%); obstetrics and gynecology (7.7%) and laboratory unit (30.8%) ($\div^2$ =7.72, p = 0.05). Risk of exposure was significantly higher among females (61.5%) compared to males (38.5%) ($\div^2$ = 29.96, p = 0.001). All exposed HCWs were seen and offered post exposure prophylaxis within 24 hours of exposure. All the exposed health care workers were sero-negative to HIV, HBsAg and anti-HCV at exposure. The source patients were known in all cases. Evidence of HIV was present in 5 (38.5%); 1 (7.7%) had HBV while none had HCV infection. Of all the HCWs who completed the follow-up, only 1(7.7%) confirmed case of HBV seroconversion occurred in a HCW who was not previously vaccinated against HBV but who received post exposure HBV vaccination. Exposure rate was significantly higher among house officers 7 (53.9%) followed by registrars 3 (23.1%) and laboratory scientist 3 (23.1) ($\div^2$ = 74.79, p = 0.0001).

Conclusions: There is need to address the issue of occupational exposure in Africa by providing training on universal precaution, phlebotomy, modifying procedures that have high risk, developing institutional policy for handling of sharps and post-exposure management of health care workers, provision of protective HBV vaccine for all HCWs coupled with the provision of post exposure prophylaxis for exposed HCWs.

Key words: Epidemiology, management, occupational exposure, viral infections, post exposure prophylaxis. *(Accepted 29 June 2006)*

INTRODUCTION

Blood pathogens acquired through occupational exposure are a major professional hazard among health workers. Over 20 pathogens have been transmitted to health care workers via needle stick injury [1]. The most important are HIV, HBV and HCV.

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According to the United Nations Programme on HIV/AIDS and the WHO, 40 million adults and 2.7 million children were living with HIV at the end of 2001 [2], and there are about 40 million people worldwide who are chronic carriers of HBV. The risk of HIV transmission after percutaneous and mucous membrane exposure to HIV-infected blood is 0.3% and 0.09% respectively [3]. The risk associated with a single parenteral exposure to blood from a source patient who has HBV infection ranges from 2- 40% [4]The average incidence of sero- conversion to HCV positive source ranges from 3-10%[5]. Health care

workers particularly in developing countries are at a serious risk of infection from blood-borne pathogens because of the high prevalence of these pathogens [6] and the increased risk of occupational injuries [7]. Unsafe practices like careless handling of contaminated needles, unnecessary injections on demand, re-use of inadequately sterilized needles and improper disposal of hazardous waste can potentially increase the risk of occupational exposure to blood-borne pathogens [8].

The risk of infection varies with the type of exposure, the prevalence of the infection in the specific population and the availability of post-exposure prophylaxis [9,10].

Post exposure use of zidovudine by HCWs appears to reduce the risk of HIV transmission by 79% [11,12]. However there have been at least 12 reported cases of zidovudine failing to prevent HIV infection in HCWs an indication that post exposure treatment will probably not prevent all cases of infection transmission [13].The available data from developing countries show that adherence to the standard precaution and adequate documentation of occupational exposure are sub-optimal and the knowledge about post exposure prophylaxis among health care workers is poor [14,15]. The objective of this study was to determine the epidemiology of occupational exposure to HIV, HBV and HCV infection in HCWs in tertiary health facility in a resource-limited setting in the Niger Delta of Nigeria.

MATERIALS AND METHODS

A survey of the University of Port Harcourt Teaching Hospital between June 2002 to January 2005 identified 13 health care workers who had percutaneous exposure to patient's blood. The hospital is a tertiary health facility in the cosmopolitan oil rich city of Port Harcourt in the heart of the oil and gas industry in the Niger Delta geopolitical zone of Nigeria. This study is based on retrospective reports of accidental work related exposure to blood borne pathogens among HCWs collected by the Hematology Department responsible for follow-up and provision of post exposure prophylaxis for exposed HCWs. The type, nature of exposure and safety precaution applied was evaluated in each case. All exposed HCWS were offered follow-up counseling. Epidemiological information and blood samples from the exposed HCWs and the source patients were screened by immuno-enzymatic methods of Immunocomb HIV 1 & 2 kits (Orgenics, Israel) and Genscreen HIV 1&2 kits (Bio Rad, France) and Clinotech HBV and HCV kits (Clinotech Diagnostics, Canada) immediately after exposure and serially after 3 and 6 months post exposure. The results are expressed as mean ± SD

Statistical Analysis

Date were entered and analyzed using a statistical package Epi-Info soft ware (version 6). Descriptive statistics were used to summarize data. Chi square analysis was used to access the significant differences between groups; A p-value of ≤ 0.05 was considered significant for statistical comparisons.

RESULTS

This study consisted of 13 HCWs made up of 5 males (38.5%) and 8 females (61.5%), mean age 34.15 ± 6.8 years including 3 doctors (23.1%), 2 laboratory scientist (15.4%), 1 laboratory technician (7.7%), 6 medical students (46.2%) and 1 trainee laboratory assistant (7.7%). The time in medical practice ranged from 1-16 years. Risk of exposure was significantly higher among females (61.5%) compared to males (38.5%) ($\chi^2 = 29.96$, p=0.001). The baseline demographic characteristics of the exposed HCWs are shown in Table 1.All the HCWs were exposed percutaneously to blood of patients; syringe needles, intravenous needles and suture needles caused the percutaneous injury. The most common mechanisms of injury were unexpected patient movement, needle resheating and withdrawal of needle. In more than half of the cases, protective equipment was worn. In all cases the HIV, HBV and HCV status of the exposed HCWs and the source patients were determined at baseline. All the HCWs were found HIV, HBV and HCV negative on exposure. Five (38.5%) of the source patients were positive for HIV, 1 (7.7%) for HBV and none for HCV. In all the cases informed consent was gotten.

Exposure was restricted to certain parts of the hospital. The pediatrics unit had the highest number of exposure 6 (46.2%) followed by the phlebotomy section of the laboratory unit 4 (30.8%) and surgery unit 2 (15.4%) ($\chi^2 = 7.72$, p= 0.005). Post exposure screening indicated that only one of the HCWs who were exposed to an HBV positive source patient and who had post exposure HBV vaccination sero-converted 6 months after exposure. Medical students constituted the highest number of exposed HCWs 6 (46.2%), followed by registrars 3 (23.1%) and laboratory scientists 2 (15.4%) ($\chi^2 = 74.79$, p = 0.0001).In all cases the exposed HCW were administered HAART chemoprophylaxis of stavudine (40mg), lamivudine (150mg) and nevirapine (200mg) orally twice daily for 1 month. Only 2 of the exposed HCWs who began post exposure prophylaxis reported side effects of Steven Johnson's syndrome (rash) and hyperbilirubinaemia. Post exposure prophylaxis against HBV was given to the HCW who was exposed to the HBV positive source patient and others without history of previous HBV vaccination.

Table 1: **Baseline characteristics of exposed Health Care Workers**

Baseline Characteristics	Mean	SD	Number Exposed N=13	% Exposed	*2	P-value
Age (years)	34.15	6.8				
Gender						
Males			5	38.5	29.96	0.001
Females			8	61.5		
Area of Hospital affected						
Pediatrics			6	46.2	7.72	0.05
Laboratory			4	30.8		
Surgery			2	15.4		
Obstetrics and Gynecology			1	7.7		
Professional group						
Physicians			3	23.1	13.62	0.001
Laboratory scientist			2	15.4		
Trainee laboratory assistant			1	7.7		
Laboratory technician			1	7.7		
Medical students			6	46.2		

DISCUSSION

Health care workers are exposed to blood borne pathogens mainly; HIV, HBV and HCV. Infection by these agents often leads to chronic and fatal illness, which are expensive and difficult to treat. Our finding of 13 cases of accidental exposure within a four-year period (2002-2005) although lower than 28 cases reported in a five-year period in a previous study [16], it does indicate the need to minimize the risk of blood-borne pathogen transmission from patients to HCWs. There is need for HCWs to adhere strictly to standard universal precaution; including the appropriate use of hand washing, wearing of protective barriers (gloves hand washing, wearing of protective barriers (gloves, mask, gown and goggles for eye protection and care in the use and disposal of needles and other sharps instruments. There is also the need to institute a system that includes written Protocol for prompt reporting, evaluation, counseling, treatment and follow-up of exposed HCWs that are at risk of infection by blood borne pathogens [17].

We observed that medical students constituted the highest number of exposed HCWs. This observation brings to bare the need for adequate training of HCWs particularly medical students and other trainee HCWs. There is the need for the implementation of behavior modification such as eliminating needle recapping and disposing of sharps into sharps container immediately after use, use of safer devices such as needles that sheath after use and the regular use of personal protective equipments aimed at reducing the risk of occupational exposure to blood-borne pathogens. Health care workers should be aware of the risk that exist in the work place, educated on the magnitude of such risk, trained in post exposure prophylaxis and in exposure risk

prophylaxis and in exposure risk minimizing strategies coupled with the provision of instruments and devices that reduces exposure risk through advanced manufacturing technologies. Previous studies indicate that that the knowledge about post exposure prophylaxis among HCWs particularly in developing countries is poor [14]. We observed that four out of the six source patients in pediatrics were sero-positive for HIV. This observation brings to light the risk associated with dealing with uncooperative pediatric patients particularly with the rising prevalence of HIV infection in Nigeria [18]. The risk associated with occupational exposure is likely to substantially increase in future unless drastic measures are taken to stem the rise.

No confirmed case of HIV seroconversion was observed among exposed HCWs who were offered post exposure chemoprophylaxis of HAART of stavudine, lamivudine and nevirapine. Our observation of a 100% protection provided by the post exposure HAART prophylaxis brings to bare the efficacy and possible superiority of HAART over monotherapy with zidovudine, which indicated a 79% protection [12]. However in HIV-infected patients, combination regimens have proved superior to immunotherapy in reducing viral load [17]. Thus theoretically, combination therapy can produce activity at different stages in the viral replication cycle and could offer an additive preventive effect in post exposure prophylaxis particularly in exposures that have a high risk for HIV transmission.

The risk of occupational exposure to HBV and HCV is more serious than HIV [5]. We observed that one HCW who was exposed to an HBV positive source patient and who was not previously vaccinated against HBV and who received post exposure prophylaxis of HBV vaccine seroconverted 6 months later. Although HBV vaccine is safe and effective in more than 90% of those immunized [19,20] and is currently mandatory for health care workers who handle blood and blood products in the developed world, this possibility is beyond the reach of a vast majority of HCWs in developing countries. There is need for post exposure prophylaxis to be present and for health care workers to be educated about post exposure prophylaxis particularly in resource-limited settings in sub Saharan Africa with a high prevalence of blood borne pathogens. There is also the need for effective counseling after occupational exposure and subsequent follow-up. Counseling should involve careful explanation of the risk of infection. Effective counseling can potentially alleviate the anxiety of the exposed HCW.

Our study has indicated a high risk of occupational exposure in our resource-limited setting. There is need to address the issue of occupational exposure inAfrica. There is the urgent need for the implementation of universal precautionary measures, training of health care workers on exposure minimizing strategies, development of institutional policy on management of sharps, post exposure management of exposed HCWs, provision of personal protective equipments, provision of free post exposure prophylaxis coupled with the provision of adequate counseling services for exposed HCWs.

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