Occupational Blood Exposures at a Dental Faculty: A three year review

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Abstract

Background: Dental healthcare workers and students are at risk of accidental exposure to blood-borne pathogens. It is thus crucial to provide education in universal precautions and blood-borne pathogen exposure to ensure continuous improvement of student, patient and healthcare worker's safety.

Purpose of the study: To determine the prevalence, risks and types of accidental blood exposure (ABE) among students and staff at the Tygerberg Oral Health Centre, Faculty of Dentistry, University of Western Cape over a 3-year period with a view to formulating appropriate risk reduction strategies.

Method: A retrospective analysis of data collected regarding ABE among students and staff between Jan 2004 and Dec 2006.

Results: During the analysis period there were 116 exposures. Most exposures occurred among undergraduate dental students (62.1%), followed by post-graduate trainees/registrars (14.7%) and nursing staff (14.7%). No HIV seroconversion occurred, which is consistent with results of other studies. An incidence of 50% under-reporting of ABE also came to light.

Discussion: Avoiding occupational blood exposure is the primary way to prevent transmission of blood-borne pathogens in healthcare settings. A reduction in the incidence of ABE can be effected through educational programs in the form of lectures and courses during the pre-clinical training of students. Hepatitis B vaccination should be mandatory for all students and staff.

Key words: Accidental blood exposure, blood-borne pathogens, occupationally acquired diseases, dental students, academic and nursing staff.

Introduction

Dental healthcare workers and dental students are frequently exposed to blood-borne pathogens. These include human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C (HCV), all of which can be contracted through needle stick and sharps injuries or mucosal splashes.

Approximately 24.9% of adults and children in South Africa are known to be living with HIV/AIDS, and many more may currently be undiagnosed.[1] As approximately one million people died of AIDS during 2003,[2] HIV poses a substantial risk to dental healthcare workers who are regularly in contact with the blood and body fluids of patients.

A report containing worldwide data up to September 1997 documented 94 healthcare workers with occupationally acquired HIV infection and refers to another 170 possible but unconfirmed cases.[3] Eighty-seven percent of the documented infections were associated with a percutaneous injury. Among these, 9 dental healthcare workers were possibly infected with HIV. It is interesting to note that even though 70% of the world's HIV-infected population lives in sub-Saharan Africa, to date only 4% of worldwide cases of occupational HIV infections have been reported from this region.[4]

The average risk of HIV infection after being exposed to HIV infected blood via a needle stick injury or cut is less than 0.3%.[5] The risk after exposure of the eye, nose, or mouth to HIV-infected blood is 0.09% (95% CI: 0.006-0.50%).[5,6] Prompt anti-HIV therapy reduces this risk by about 80%.[7]

In addition to the risk of HIV infection, dental healthcare workers and students also face substantial risk via exposure to HBV and HCV.

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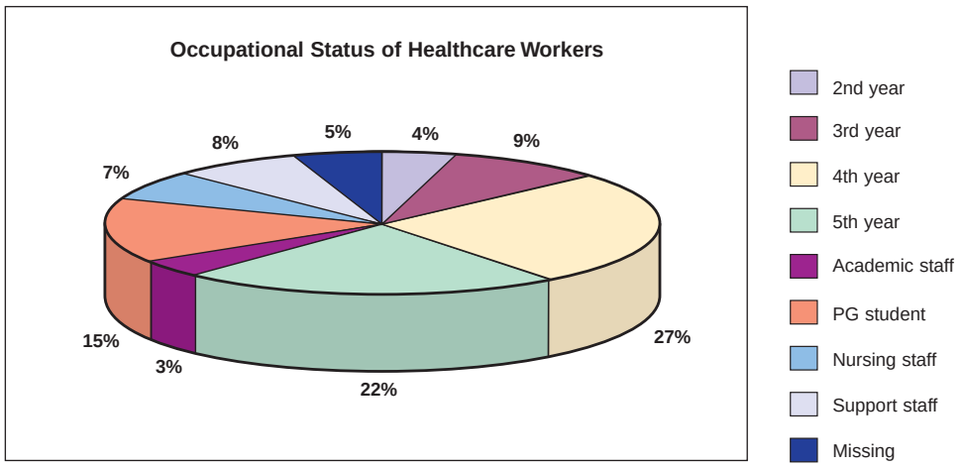

Figure 1: Occupational status of dental healthcare workers at UWC.

HBV is more readily transmitted in the oral healthcare setting than HIV. Blood is the body fluid which carries the highest level of HBV and it is the most important transmission vehicle in the healthcare setting.[8,9,10] The risk of contracting disease from a single percutaneous exposure to HBV-infected blood is very high and can range from 6% to more than 30% as indicated in various studies.[11,12] In an immune-compromised individual exposed to HBV, this risk may be even greater than 30% if the source is HbeAg-positive.[13,14] Dental students are considered to be the most vulnerable to HBV infection during training due to their lack of experience in patient care and surgical techniques.[15,16,17,18] It is therefore essential to train students in an environment where personal safety is stressed.

The most effective means of preventing HBV infection and its sequelae in dental healthcare workers is immunization. According to the Advisory Committee on Immunization Practices, any healthcare worker who performs procedures involving contact with blood, blood-contaminated body fluids, saliva or sharp instruments should be vaccinated against HBV.[14,19] Immunization of dental healthcare worker including dental students before they are placed at risk for exposure remains the most efficient and effective use of vaccination in healthcare settings.[9] Some educational institutions and infection control programs provide immunization schedules for students.[20,21]

The occupational risk of Hepatitis C infection in dentistry is low. The average incidence of HCV seroconversion after accidental percutaneous exposure to an HCV-positive source is 1.8% (range: 0%–7%).[6,12] There is no documented incidence of HCV transmission via intact or non-intact skin exposures to blood among healthcare workers.[22,23] Nonetheless, the high rate of chronic infection and lack of effective vaccine may be cause for concern for dental healthcare workers.[6,24]

The primary way of preventing transmission of blood-borne pathogens in healthcare settings, is to avoid occupational blood exposure. Percutaneous injuries can be reduced through personal protective garments such as gloves, masks, protective eyewear and gowns, and by modifying working practices. These include, among other means, not recapping needles by hand, disposing of used needles in appropriate sharps disposal containers, and using medical devices with safety features specially designed to prevent injuries.[7,9,25]

The purpose of this study was to evaluate the frequency of accidental blood exposures among staff members and students and to formulate risk-reduction strategies.

Materials and Methods

Information regarding incidences of accidental blood exposure between Jan 2004 and Dec 2006 at University of the Western Cape (UWC) Faculty of Dentistry was analysed and tabulated on data capture sheets.

The recorded information included the type of injury (eye splashes, needle stick, injury with elevators, bur, scaling instruments, blades, wires or probes); anatomical site of injury (hand, finger, eye, foot) and the occupational status and level of the health care worker (dental students of third, fourth or fifth year, dental faculty staff at UWC). The HIV and hepatitis status of the source patient was also noted. Consent regarding HIV/HBV testing of the source patients was also recorded on the data capture sheets.

In addition, students, academic and nursing staff were asked to complete a questionnaire anonymously which covered self-reporting of blood exposure incidences. This questionnaire included the type and site of the injury, whether the incidence was reported and the practice of post-exposure prophylaxis. Data recorded included type of exposure, anatomical site of exposure, procedure being performed at the time of exposure, whether the injury was reported or not, protective measures during the patient care and the knowledge of post-exposure prophylaxis and infection control. All results were tabulated in MS Excel® and analysed using Add in-Routines.

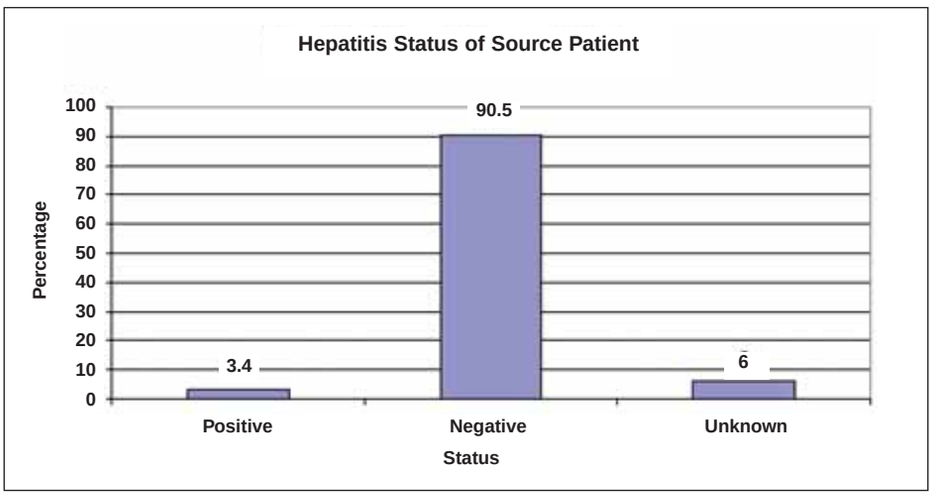

Figure 2: Hepatitis status of the source patients at injury.

Results

During the three-year period from Jan 2004 to Dec 2006, 116 dental healthcare workers reported accidental blood exposures at the UWC Faculty of Dentistry. There were no HIV seroconversions. This data is consistent with results obtained from other studies.

Of the 116 reported exposures, the incidence was highest among undergraduate dental students 71 (62.1%), followed by postgraduate students 17 (14.7%) and nursing/support staff 17 (14.7%). At UWC, dental students are exposed to limited clinical work in the first and second academic years. The full clinical programme commences in the third academic year and is completed at the end of the fifth year. Of the undergraduate incidents, the fourth-year students had the largest number of exposures, followed by fifth and third-year students respectively. Nursing staff were exposed mostly while collecting and cleaning instruments or cleaning the surgery after a surgical procedure (Figure-1).

Ten percent of source patients were found to be HIV positive (estimated HIV prevalence in the Western Cape is 15.4%26), and 3.4% were found HBV positive as shown in figure 2 and 3. One nursing staff member and one student tested positive for HBV.

Forty-eight percent of exposures were sustained through needle pricks, followed by 15% from blood mucosal splashes to the eyes. Fourteen percent of the students were injured while using Cryer/Coupland elevators during exodontia. Nine percent of injuries were caused by burs during restorative and crown/bridge procedures. Five percent of the students were pricked by the tip of an ultrasonic scaler (Figure-4).

Approximately 66% of exposures were to the fingers, followed by the eyes (13%) and hands (12%). Details of the exposures are shown in figure 5.

A self-completion questionnaire was also distributed among students and staff to document ABE. It was completed anonymously by 156 students and staff members of whom 100 were undergraduate students, 25 nursing staff, 23 postgraduate students and 8 academic staff. Distribution of self-reported exposures is depicted in Figure 6. Most exposures in this group were the result of needle prick injuries (30.4%), followed by eye splashes (29%) and explorer probes (14.4%). Fingers were most frequently the site of ABE (62%) followed by the eyes (30%). Sixty percent of the healthcare workers were aware of post exposure prophylaxis (PEP), while 93% showed awareness of infection control protocol. It is of concern that almost 50% of students did not officially report an ABE incident at the time of exposure as they considered the chances of acquiring a disease to be very low.

Discussion

The occurrence of blood exposures in the dental setting has always been of concern. The Faculty of Dentistry, University of the Western Cape has introduced a protocol for sharps injuries which is applicable to all students and faculty staff. In accordance with faculty policy, all blood exposures must be reported so it can be effectively managed.

The findings of the study are consistent with those of many studies on accidental exposures to blood-borne pathogens in healthcare settings. Forty-eight percent of the accidental exposures were due to needle pricks, mostly due to recapping and disposing of used needles. These findings are comparable with other studies describing high frequency of needle stick injuries among medical students in the UK[27,28,29] and USA.[30] Third-year students were less exposed to injuries than fourth-year students since they perform fewer clinical procedures. These results are similar to those of other studies conducted in the USA[30] and Germany (in a cross-sectional study carried out by Deisenhammer in 2006, 12% of medical students experienced injuries during the first year of training as opposed to 41% in the fourth year[31]).

Dental nursing staff sustained 14.7% of injuries by explorer

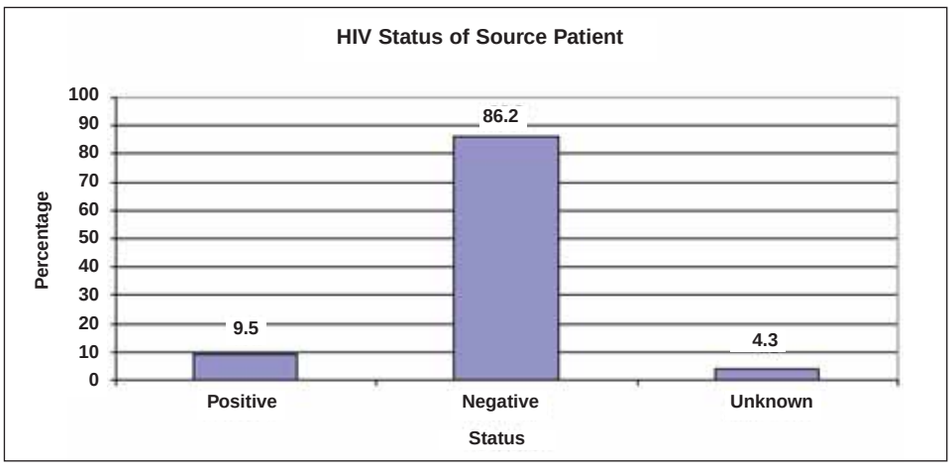

Figure 3: HIV status of the source patients at injury.

probes or needles. These injuries mostly occurred during surgery or while cleaning instruments. This is in contrast with studies among medical students and nursing staff, where the exposure incidence for these nurses was as high as 56% in Saudi Arabia[32], 44% in the National Surveillance System[33] and 37.6% in Egypt.[34] These higher incidences could be due to higher involvement of medical healthcare workers in blood sampling and direct contact with patients as compared to dental nursing staff.

The performance level of the use of protective garments showed by the students and staff in the survey represents good standard of care. In this survey 93% of students and staff showed adherence to universal precautions and knowledge of infection control. These results are in contrast to those reported by Rosenthal in his study[35]

Under-reporting is a universal problem. It is well-described by other researchers, who found actual reporting rates ranging from only 3% - 30%.[36,37,38] In separate studies, Askarian[39] documented under-reporting of 85% of incidences, Mangione[37] 80%, and Tarantola[40] 69%. In a review article, Heptonstall et al[25] discuss the issue of under-reporting and they caution that only 1%-10% of accidental blood exposures are actually reported. They suggest that the method of reporting should be well-publicized, not time-consuming, non-judgmental, confidential and should lead to appropriate outcomes.

Post-exposure prophylaxis is available in the event of exposure to HBV and HIV.[6,7,14] The immunoglobulins and vaccine against HBV can be administered up to 7 days after exposure since hepatitis B has a long incubation period. However PEP for HIV should be initiated as soon as possible after exposure, preferably within two hours. A basic regimen using two nucleoside analogs [(e.g., zidovudine (ZVD) and lamivudine(3TC), or 3TC and stavudine(d4T)] is recommended if the source is asymptomatic or has known low viral load i.e. ≤ 1,500 RNA copies/ml and the exposure was not considered high-risk (e.g., solid needle or a superficial injury).[12] An expanded PEP regimen, which includes a protease inhibitor such as Indinavir (MSD) or Nelfinavir (Pfizer)41 is recommended for more severe injuries (large bore hollow needle, deep

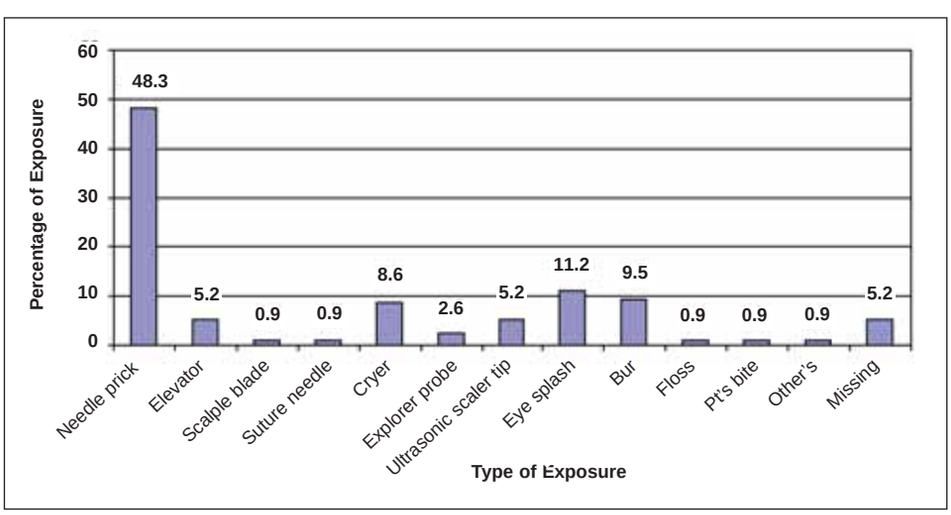

Figure 4: Type of accidental exposure sustained at UWC.

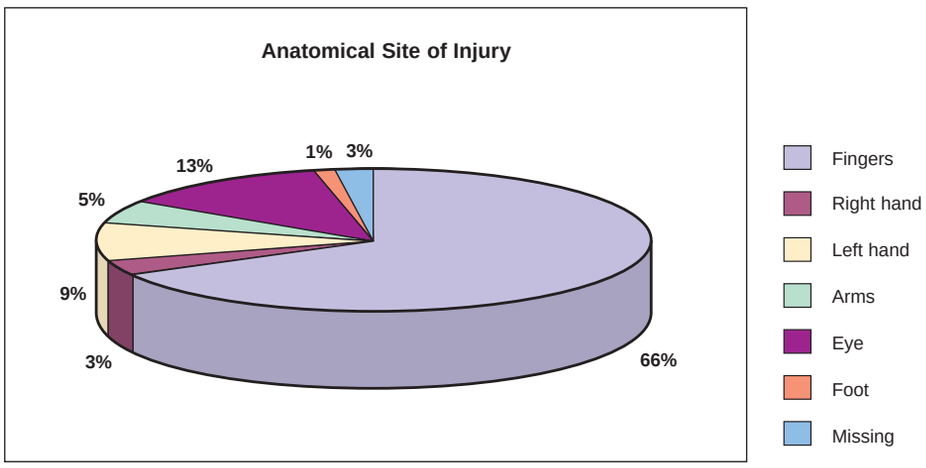

Figure 5: Anatomical site of injury sustained at UWC.

puncture, visible blood on device, or needle used in a patient's artery or vein) or if the source is HIV positive, has AIDS, or has a known high viral load ≥ 1,500 RNA copies/ml, regardless of the severity of the exposure.[6,12,14]

After initial treatment, an exposed healthcare worker should be tested for HIV-antibodies using an enzyme immunoassay at 6 and 12 weeks, and again at 6 months.[12,42] Although seroconversion may occasionally occur more than 6 months after exposure, routine testing beyond this time is not mandatory. Of the 156 dental students and staff members who responded in this study, 97 (62%) reported taking post-exposure prophylaxis, but only 7% completed the protocol. This low compliance of the protocol is of great concern and needs to be addressed.

Improved technique can minimise exposure injuries by controlled movements of instruments under force. For example, controlling movement while using an elevator or surgical bur, or using proper retractors while injecting instead of retracting using the fingers.

Current CDC guidelines state that used needles should never be recapped, purposely bent, or otherwise manipulated using both hands. One-handed recapping using a device or scoop technique is recommended for the prevention of such injuries.

Double gloving is a contentious recommendation. However, at least on the non-dominant hand, it will help minimize injury as the non-dominant hand is more often involved in exposures. Announcing passage of instruments can likewise reduce injuries to other workers during transfer over the surgical field.

Increased awareness and safe work practises are of prime importance for dental students, hospital staff and patients. To minimise the rate of accidental blood exposure, a structured teaching programme must form part of the clinical training of students. Senior staff must set an appropriate example by adopting universal precautions with every patient, and students must be advised to report all injuries so that appropriate therapy can be started.

All students and staff members must be vaccinated for HBV, and vaccination before the clinical training should be mandatory. Students should not perform any surgery on patients known to be positive for blood-borne pathogens unless they are experienced and proficient, and such patients should receive the full infection control protocol. A computerized system for data collection of ABE would be an effective tool for thorough exposure surveillance. This would enable institutions to identify high-risk activities and adjust treatment protocol accordingly.

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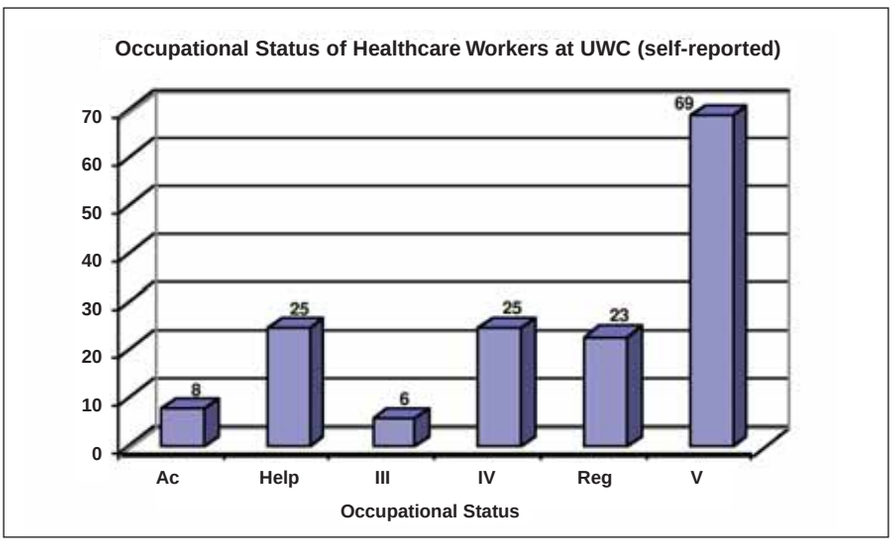

Figure 6: Dental healthcare workers at UWC completed the self-reported form.

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