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RESEARCH

A review of occupational exposure to blood and blood products in medical students in a South African university

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Background: There is a significant risk of a medical student acquiring a blood-borne pathogen following occupational exposure to blood and other bodily fluids from infected patients in the healthcare setting. Internationally and nationally, interventions have been implemented in medical schools to reduce students' risk of acquiring a blood-borne pathogen. Few studies in South Africa have evaluated such interventions.
Method: The aim of this study was to review the incidence and management of occupational exposure to blood and blood products in final-year medical students. The study was descriptive and cross-sectional. The study participants were final-year medical students. Data were collected using questionnaires and analysed with the SPSS® programme.
Results: A quarter of the participants reported occupational exposure. The risk appeared to be higher in certain medical departments and for female students. Some of the students did not receive a risk assessment which is part of university protocol. Over the study period, the number of students accessing post-exposure prophylaxis increased, and students received this within a shorter time after exposure.
Conclusion: The data reflect findings from other studies which show that medical students are at risk of occupational exposure. It is of concern in a setting of high human immunodeficiency virus (HIV) prevalence that some of the students who sustained occupational exposure did not report it to their supervisors. Although there has been an improvement in student access to post-exposure prophylaxis (PEP), ongoing training for students and their supervisors is required. Further important research, using quantitative and qualitative methods, is also needed.

Keywords: medical students, needle-stick injury, occupational post-exposure prophylaxis, South Africa

Introduction

The published literature on needle-stick injuries and exposure to blood-borne pathogens during the course of clinical duties in the South African healthcare environment has tended to focus on needle-stick injuries in graduate healthcare professionals.[1–5] Minimal research has been carried out in South Africa on the incidence of needle-stick injuries that have been acquired in another context, such as during undergraduate medical student training. Medical students are relatively inexperienced with respect to skills such as taking blood, erecting drips, performing a lumbar puncture and assisting in theatre, and are therefore vulnerable to sustaining needle-stick injuries. They are potentially at risk of acquiring blood-borne pathogens. A 2003 study on final-year medical students in the Western Cape[5] demonstrated that occupational exposure to blood and blood products was common, and the risk of acquiring an infectious disease was described as high.[6,7] It is important to ensure that adequate prevention and management programmes are in place to protect medical students against high human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS), both of which are prevalent in South Africa.[8]

The University of KwaZulu-Natal, where the study was conducted, is committed to providing a safe workplace environment for healthcare professionals and students. A preventative and occupational post-exposure prophylaxis (OPEP) programme was developed and implemented to meet this aim.[9] Studies elsewhere indicate that an OPEP can reduce the risk of HIV transmission by up to 80%.[4,6] The university has introduced several strategies to increase awareness of needle-stick injuries, which include increased undergraduate education and training in OPEP, as well as the establishment of a laboratory-based skills development programme. Additionally, protocols and drug treatments relating to needle-stick injuries are readily available at hospitals where students are based, as well as the campus occupational health clinic.

The aim of this study was to review the incidence and management of occupational exposure to blood and blood products, including needle-stick injuries, in final-year medical students at the Nelson R Mandela School of Medicine, University of KwaZulu-Natal.

Method

Study design

This was a descriptive, cross-sectional study carried out by the Department of Family Medicine at the University of KwaZulu-Natal.

Participants

Final-year medical students at the end of their studies in 2006 and 2008 were invited to participate.

Data collection method

Data were collected in November 2006 and 2008 using two self-administered questionnaires which were presented to the students at the end of the academic year. The questionnaire was developed around available international and national literature on occupational exposure to blood and blood products. It contained both open- and closed-ended questions aimed at

eliciting students' knowledge and experiences of needle-stick injuries and any occupational exposure to blood and blood products during their final year. The questionnaires were piloted on a small group of students to ensure that they could understand and respond to the questions.[10] Questionnaire A focused on knowledge of universal precautions and OPEP, and had to be completed by all of the students. Questionnaire B specifically targeted students who had sustained an occupational exposure to blood and or blood products, and captured details of the circumstances surrounding the incident.

Data analysis

Data were entered into a SPSS® programme and analysed using descriptive statistics.

Ethical issues

Permission to conduct the study was granted by the Research Ethics Committee of the University of KwaZulu-Natal (EXP 047/06, BE 136/08). Written permission to collect data was given by the appropriate authorities in the medical school. A study information sheet for students was available in English. Students were informed that they were under no obligation to complete the questionnaire. There would be no detrimental consequences if they chose not to partake. The questionnaire was anonymous and did not contain identifying data, such as names or student numbers.

Results

The majority of the students completed questionnaire A in 2006 and 2008 (Table 1).

A quarter of respondents reported having sustained occupational exposure to blood or blood products. Females reported more exposure than males (Table 2).

In 2006, all 43 respondents who had experienced exposure to blood or blood products completed questionnaire B, and thus details were available of the circumstances and procedures associated with the occupational exposure. However, in 2008, only 23 of 45 (51%) completed questionnaire B, and thus less data were available on needle-stick injuries. The results around the circumstances and procedures associated with the exposures summarised in Table 3 with table 4 giving a breakdown of departments where the exposure occurred.

In 2006, only 25 of 43 (55%) respondents reported the incident to their supervisor, and a formal assessment was carried out for only 20 of the 43 (47%) students after their exposure to blood or blood products.

Table 1: Results of completed Questionaire A

Year	Total number of students (*n*)	Response rate, *n* (%)
2006	*n* = 205	192 (94)
2008	*n* = 179	172 (96)

Table 2: Reported occupational exposure to blood or blood products

Year	Total number of students reporting exposure, *n* (%)	Females reporting exposure, *n* (%)
2006	43 (22)	31 (72)
2008	45 (26)	29 (64)

Table 3: Procedures associated with occupational exposure to blood or blood products

Procedure	2006, *n* (%) *n* = 43*	2008, *n* (%) *n* = 23*
Taking blood	17 (39)	11 (48)
Erecting an IV infusion	3 (7)	3 (13)
Assisting in theatre	8 (19)	1 (4)
Performing a lumbar puncture	1 (2)	2 (8)
Suturing a wound	5 (12)	1 (4)
Other	8 (19)	(16)

IV: intravenous
*: Data missing for one student in 2006 and 2008

In 2008, 14 of the 23 (61%) students reported the incident to their supervisor, and a formal assessment was carried out for 15 of the 23 (65%).

In 2006, 42 42% (18 of the 43) of the students considered their exposure to be high risk. This compares with 47% (11 of the 23) in 2008. Students considered the risk to be high for a variety of reasons, including the use of a hollow-bore needle, and exposure to a deep injury and an HIV-infected source patient. In 2006, 37% (16 of the 43) of the students were injured by a hollow-bore needle, compared to 70% (16 of the 23) in 2008.

In 2006, 27 of the 43 students (63%) students received post-exposure prophylaxis (PEP) after their occupational exposure, of whom 24 of the 27 (89%) students took PEP antiretroviral therapy (ART) within one hour of the exposure, and 20 of the 27 (74%) completed the 28-day course.

In 2008, 18 of the 23 students (78%) received PEP, of whom 17 of the 18 students (94%) received PEP ART within one hour, and 13 of the 18 students (72%) completed the course. The main reasons for not completing the course included side-effects (two in 2006 and three in 2008), the source patient being found to be negative (three in 2006 and one in 2008), and the injury not being considered to be high risk (one in 2008).

The majority of the students obtained their starting dose of ART from the teaching hospital, either directly from the pharmacy or from the occupational health clinic at the hospital. (Students are expected to report to the campus clinic the following day for further assessment and follow-up). Two students obtained ART from their private general practitioner in 2006, and one from the campus health clinic in 2006 and 2008.

In 2006, 17 of the 43 (40%) of the source patients were known to be HIV-positive (seven of the 43, status unknown for 16%), while in 2008, eight of the 23 (35%) of the source patients were known to be HIV-positive (four of the 23, status unknown for 17%).

Discussion

This study has shown that occupational exposure to blood and blood products is frequent in medical students. Up to a quarter of final-year medical students report an incident during the course of their final undergraduate year. This finding is consistent with other South African[5] and international studies.[11–13] A 2004 study in Germany[11] reported that 41% of fourth-year medical students had sustained at least one needle-stick injury during the course of their training, while a study from Canada in 2003 reported occupational exposure during undergraduate medical school

Table 4: Departments in which the occupational exposure occurred

Department	2006, *n* (%) *n* = 43	2008, *n* (%) *n* = 23*
Surgery	7 (16)	4 (17)
Medicine	9 (21)	5 (22)
Obstestrics and gynaecology	16 (37)	5 (22)
Family medicine	6 (14)	3 (13)
Paediatrics	3 (7)	5 (22)
Psychiatry	2 (5)	0

*: Data missing for one student in 2008

involving 11–50% of students.[14] Medical students are considered to be a high-risk group because of their inexperience, lack of skills, the expectation that they will be involved in taking blood and erecting drips, and their poor knowledge of precautionary measures and of PEP.[11–13] The majority of needle-stick injuries occurred while taking blood, which is consistent with the finding from Germany,[11] but is in contrast to the findings of other studies in which it was reported that the majority of needle-stick injuries occurred in theatre or while suturing.[12,14] A relatively high number of incidents occurred in certain disciplines, such as Obstetrics and Gynaecology. Reasons for this were not researched, and further exploration is advised. Possible reasons for this are the longer working hours, demanding working conditions and high stress associated with disciplines such as Obstetrics and Gynaecology.[5] Reasons why the female students appeared to be at higher risk also need to be explored further. It was encouraging to note that the proportion of students assessing PEP increased over the two-year study period, and that PEP was commenced within a short time of exposure.

Under-reporting of occupational exposure is a problem throughout the world.[11–15] Although 22% and 26% of students in 2006 and 2008, respectively, reported sustaining an occupational exposure this may represent under-reporting as data were collected at the end of the year, and not on an ongoing basis. In a study in Germany, 45% of students did not report their needle-stick injuries, and only 7% were aware of the university PEP policy.[11] At the University of Toronto, less than 46% of students who sustained a needle-stick injury reported the incident, and only 14% (six of the 41) of those who should have started PEP actually did so.[14] Similarly, 41% of needle-stick injuries sustained by medical students at Washington University School of Medicine were not reported.[12] Reasons given by healthcare professionals for not reporting a needle-stick injury or mucosal exposure are complex. Several reasons reported in the literature include the following:

- A perception that the injury was not a threat.
- A lack of time.
- Being too angry to report the exposure.
- Unfamiliarity with the reporting procedure.
- Being too depressed or embarrassed to report it.
- Being fearful of acquiring AIDS.
- Preferring not to know their own HIV status.
- Having concerns about confidentiality.
- Finding the process too time consuming or upsetting.
- A perception that the exposure was of a low risk.
- Avoidance of bureaucratic problems.[13]

The reasons why the medical students did not report their occupational exposure were not sought in this study, and this forms an important topic for further research. Under-reporting is of major concern as it prevents accurate monitoring and appropriate interventions by the university, adequate risk assessment, appropriate OPEP and the ongoing observation of students.[12]

Accidental exposure to blood and blood products is a documented mode of transmission for many blood-borne pathogens, including hepatitis B, hepatitis C and HIV.[6,7,16,17] Hepatitis B is more infectious than HIV and students should be assessed for immunity to hepatitis B (all students should have been immunised), as well as hepatitis C, following a needle-stick injury. Students must be followed-up for at least six months to ensure that they do not seroconvert. The availability of OPEP reduces the chances of acquiring HIV following exposure to blood or blood products by 80%,[4,6,18] and is the basis for current recommendations on PEP in South Africa.[19] Ideally, OPEP should be taken as soon as possible following exposure, ideally within an hour; and in this study, it was encouraging that the vast majority of those who accessed OPEP were able to obtain it within this period. However, not everyone who sustains an occupational exposure to blood or blood products requires OPEP, and a risk assessment is needed to evaluate the risk and to manage the healthcare worker or medical student appropriately. The status of the source patient, the type of injury sustained, the volume of blood inoculated into the healthcare worker and the infectiousness of the source patient should be taken into consideration during the risk assessment. It was noted in this study that a risk assessment was not performed for a significant number of students. It is likely that some students took ART unnecessarily, and some, who should have received ART, did not. The HIV status of the source patients in this study was only known in 40% of cases in 2006, and in 35% of cases in 2008. The HIV status, as well as the medical history and examination, of a patient, is important in assessing the level of risk.

Compliance with universal precautions in the handling of sharps and other material infected with blood and blood products is the primary way of preventing occupational exposure to blood-borne diseases.[6] To reduce the risk of accidental exposure to blood and blood products, students have to undergo training in a skills laboratory prior to clinical placement to ensure that they have acquired the necessary clinical skills before conducting procedures on patients. However, this is no substitute for clinical experience, and medical students are expected to be able to take blood, erect drips, suture wounds and assist in theatre. In the light of these findings, the relative lack of experience and skills of medical students should be taken into consideration when allocating hospital ward responsibilities. Appropriate supervision should also always be available.

Limitations of the study

This was a retrospective study and the students may not have accurately recalled all of the exposure that they sustained, nor all the details behind each incident. However, as these incidents are often distressing, it is possible that the students had vivid memories of them and could recall the relevant details. Some questionnaires were not fully completed and data were limited in the 2008 cohort. The study could have been strengthened by triangulation using a differing set of students and an alternative data collection method. Qualitative work may reveal the reasons around why the incidence of accidental occupational exposure was so high in certain departments and why some students did not report incident.

Conclusion and recommendations

A significant number of final-year medical students experienced occupational exposure to blood and blood products during the course of their final year. Under-reporting and inadequate risk

assessment is not uncommon in final-year medical students. There is a need for further research into important findings, i.e. Why did the students not report the accidental injury to a supervisor? Why was a risk assessment not carried out? Why are students at higher risk in some departments than in others? Why do female students appear to be at higher risk?

It is recommended that student training in the prevention of occupational exposure be strengthened, together with greater supervision in the clinical setting. Refresher training of healthcare staff in the teaching or placement hospital on the prevention and management of occupational exposure to blood and blood products is also necessary.

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