



## STUDENT PAPER

## Occupational exposure to blood in medical students

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*Objective.* To determine the extent of occupational exposure to blood in medical students, details of the circumstances surrounding the incidents and the subsequent experiences of the student.

*Design.* Prospective cohort study.

*Setting.* Tygerberg Hospital, the Health Sciences Faculty of the University of Stellenbosch during a 15-week period from 4 February to 19 May 2002.

*Subjects.* One hundred and thirty-six student interns (SIs), i.e. final-year medical students.

*Method.* All SIs received a questionnaire and a letter motivating them to participate in the study and explaining the procedure. Regular class meetings enabled continuous motivation and ongoing updates. In the case of an incident during the 15-week period, the SI filled in the form and placed it in a sealed drop-off box.

*Outcome measures.* Specific focus on the preceding events and

the situation in which the incidents occurred (department, time of day, procedure performed, and whether the student was on call), exposure to HIV (patient's retroviral status), use of post-exposure prophylaxis (PEP) (whether used, when initiated), and the consequences of the exposure (emotional, on sexual behaviour during the window period, and on career choice).

*Results.* During the 15-week period, 19 incidents were reported; the majority occurred while students were on call, almost half occurred after hours, and a disproportionate number occurred in three departments.

*Conclusions.* Occupational blood exposure is a very real problem and poses a significant risk. SI suggestions should be considered in improving the prevention and management of such incidents.

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Personal experience of occupational exposure to HIV, as well as that of fellow students, was the prime motivation for this study. Review of studies on occupational exposure to blood and HIV revealed little sub-Saharan research, especially on South African medical students. The prospective design provided better information and understanding of circumstances surrounding incidents, high-risk settings, and support given to students than existing retrospective studies.

The objectives of this study were: (i) to determine the incidence of student intern (SI) exposure to patients' blood (including sharp injuries and blood-in-the-eye incidents) and to HIV; (ii) to describe details of the setting in which incidents occurred (the procedure being performed, whether the student was on call, in which department it occurred and how long the student had been working there); (iii) to explore both practical and personal consequences to the SI involved (use of post-exposure prophylaxis (PEP) and difficulties associated with this, emotional consequences, changes in sexual behaviour during the risk period and effects on future career choices); and (iv) to obtain suggestions from involved SIs with regard to reducing exposure incidence, and personal impact of such incidents.

The population included all 136 final-year medical students

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at Tygerberg Hospital, the Health Sciences Faculty of the University of Stellenbosch. The period of the study was limited to 15 weeks from 4 February to 19 May 2002 to allow for planning and data analysis in time for the completion of student research projects.

Sharp object injuries were defined as any contact between a sharp object (which was previously in contact with blood) and the skin, during which the sharp object breaks the skin. Blood-in-the-eye incidents were defined as feeling blood (anything from a drop to a stream) enter the eye.

The current post-exposure procedure for students requires them to report to occupational health (or medical emergencies after hours), fill in several forms regarding the incident, obtain consent for HIV testing from the patient involved, and personally draw blood for HIV testing or ask a staff member to do so. The student's own blood is then drawn and s/he is given the starter pack of PEP. An appointment must be made at student health services the following day to receive the results of the blood tests and the full month of double-drug PEP if necessary. The cost of the drugs is covered by SI study fees, which are paid by all students.

## Method

The participation of all members of the SI class was obtained



by addressing the whole group, as well as through personal contact with the class and each of the 12 group representatives. Each class member was encouraged to participate by letter and posters were displayed on central notice boards. Regular class meetings enabled continuous motivation and ongoing updates on progress of the study. The class was enthusiastic about the study, as this is an important issue for all students, especially SIs.

Permission was obtained from the student council and all information was kept confidential. The study protocol was approved by the Ethics Committee for Research at the University of Stellenbosch Medical School.

Each student received a copy of the questionnaire as well as a letter explaining what to do in the event of an incident during the period of the study. Copies of these documents were given to group leaders (12 leaders who meet every second week, each representing 11 - 12 students), the occupational health office (where students are required to report incidents and fill in other forms) and the medical emergencies ward (where students report incidents after hours).

Staff involved in the management of these incidents were given letters explaining the study and the procedure of reporting incidents.

In the event of an incident during the 15-week period of the study the SI filled in the form and placed it in a sealed drop-off box. Boxes were placed at convenient central points, their safety was ensured, and they were emptied at regular intervals. Forms could also be given directly to group leaders if students were not concerned about anonymity.

## Results

During the 15-week period of the study there were 19 incidents among the 136 SIs, with 2 students reporting 2 incidents each and 6 students reporting incidents anonymously. The high number of incidents surprised the SIs as they did not anticipate more than 1 incident in the class per week.

The majority (16 of 19) of these incidents were sharp injuries, 14 of which were with hollow needles filled with blood. In 2 of the cases the students reported being injured by a surgeon while in theatre. Three of the students were exposed to HIV-infected blood (Table I). It is surprising that in 5 cases the HIV status of the patient was unknown, as the protocol for incident management requires HIV testing of the patient. In 1 of these cases the source of the contaminated needle was not known, but in the other 4 cases the protocol was not followed as students felt that it was too time consuming and upsetting and chose to deal with the uncertainty and to neglect prophylaxis.

The majority of the incidents (12 of 19) occurred while the student was on call, and almost half (8 of 19) occurred after hours (between 17h00 and 07h00). On average, a student works

6 days a week, 1 - 2 calls a week, and 1 - 2 evenings a week. Incidents therefore tended to occur on call or at night. More than half of the students (10 of 19) had slept 6 or fewer hours of the previous 24 hours, with 2 students having had no sleep.

Incidents also tended to occur in certain departments, with Obstetrics and Gynaecology having the highest number of incidents (7 incidents, 6-week rotation), followed by Internal Medicine (4 incidents, 8-week rotation), Vascular Surgery (3 incidents, 1-week rotation and Orthopaedic Surgery (2 incidents, 2-week rotation).

The numbers are small for statistical purposes, but it is interesting that most incidents occurred during the first week (8 incidents) and second week (4 incidents) of rotations in a new department.

Of the involved students, 6 used no prophylaxis (Table I). Students expressed feelings of ambiguity regarding indications for the use of antiretroviral drugs, for example for 'low-risk exposure' such as blood splashes in the eye, and to what extent the routine HIV antibody tests would identify a patient in the window period. Students also reported bureaucratic problems with accessing antiretrovirals and 4 students did not use them for this reason.

Six students felt that they needed more support during the ordeal while 3 were unsure about their feelings. Only 1 student reported adapting sexual behaviour during the 6-month period of uncertainty of HIV status. Three students felt that the incident would influence their career decisions; 2 of these students now question the viability of practising medicine in South Africa, and the other has decided not to pursue a career in any surgical field.

SIs who suffered incidents made valuable suggestions to improve prevention and management of incidents.

## Discussion

This study covered a short period of time and a small population, but similar rates have been found in other studies.

A study done at Baragwanath Hospital and Johannesburg General Hospital showed that 69% of interns reported 1 or more percutaneous exposures to blood, with the commonest mechanism being unexpected patient movement during phlebotomy. Karstaedt and Pantanowitz<sup>1</sup> estimated that 1 intern at these 2 hospitals would become infected every 7 years.

In an unpublished retrospective study done in 2001 in the Paediatric Department at Tygerberg Hospital by B Marais and M Cotton, 62% of nurses and doctors reported a needlestick injury during the preceding 2 years, with 91% of incidents occurring in house doctors and medical officers, and the majority happening while cleaning up after inserting an intravenous line or drawing blood.



Table I. Individual student experiences and suggestions

Student	Event during which exposure occurred	Patient's HIV status	Used PEP	Time (hours) before PEP?	Intend completing PEP?	Any problems experienced with PEP?	Student suggestions
1	Capping	Positive	Yes	1	Yes	No	Screen all pregnant patients
2	Capping	Negative	No	-	-	-	Starter packs more readily available
3	Capping	Negative	Yes	1	Undecided	No	Have own social support structures — church, family, friends
4	Theatre	Negative	Yes	4	No	No	Less time in hospital
5	Cleaning	Negative	No	-	-	-	Less working hours
6	Drawing	Unknown	No	-	-	-	More support for students
7	Drawing	Negative	Yes	4	No	No	Surgeons should work more carefully with assistants
8	Theatre	Negative	Yes	1	No	Yes	Revise method of drawing blood from neonates
9	Theatre	Negative	Yes	1	Undecided	No	Not requiring SIs who are post-call to draw blood
10	Cleaning	Negative	Yes	1	No	No	Nurses to monitor and replace drip fluids on time to reduce clogging and having to rinse line
11	Inserting	Negative	No	-	-	-	Students should not be required to take blood from HIV-positive patients
12	Cleaning	Unknown	Yes	4	Undecided	No	Careful in theatre with assistants
13	Flushing	Positive	Yes	1	Yes	No	Students should be given prophylaxis immediately
14	Capping	Positive	Yes	1	Yes	No	Specific doctors to be responsible for students
15	Cleaning	Negative	Yes	1	No	No	Training on handling of sharp objects
16	Theatre	Unknown	Yes	1	Yes	Yes	Safety goggles in theatre
17	Flushing	Negative	Yes	1	No	No	Less time-consuming reporting procedures
18	Theatre	Unknown	No	-	-	-	Less continuous hours — more time for breaks and sleep
19	Drawing	Unknown	No	-	-	Yes	Prophylaxis before filling out forms, regardless of forms Someone responsible for students

Capping = sharp object injury while recapping hollow-bore needle after venepuncture; theatre = injury or blood-in-eye incident while assisting in theatre; cleaning = injury while discarding items used for venepuncture; drawing = injury while performing venepuncture; flushing = injury or blood-in-eye incident while flushing blocked IN line; inserting = injury while inserting IV line.

At the University of Virginia, 77% of 4th-year students responded to a survey, of which 33% reported 1 or more sharp object injuries during an average of 17.5 weeks of clinical training, with most occurring in the operating room.<sup>2</sup>

At the University of Singapore, a study with a 97.5% response rate showed a 35% incidence rate of needlestick injuries during 12 months of clinical training, with most occurring during venepuncture.<sup>3</sup>

The study methodology, the definition of injuries and response rates differed greatly between the studies.

In this study more incidents occurred at the beginning of a rotation in a new department, in contrast to the study by Karstaedt and Pantanowitz<sup>1</sup> in which incidents tended to occur at the beginning of the year. Incidents at the beginning of the year could be due to inexperience, but not those at the beginning of the rotation in a new ward, as students would have had experience of drawing blood on previous rotations. It

is possible that students starting work in new wards do not know what is expected of them, where items are kept in the ward, etc., and thus may be rushed or flustered.

The departments where disproportionately more incidents occurred are notorious for longer hours, demanding and often chaotic conditions and high stress, resulting in students being tired, thus contributing to the high number of incidents. Gounden and Moodley<sup>4</sup> have cited high workload as a reason for the high rate of incidents in our country.

Students were worried about the uncertainty around the window period of the routine HIV antibody tests used at Tygerberg Hospital. One student paid R400 to have direct viral assays done at a private laboratory, despite recommendations that these tests should not be used in the occupational exposure setting as they have a high rate of false-positive results.<sup>5</sup>



In 6 cases the students chose not to start PEP. Four of the patients involved were not even tested (Table I).

In the USA by June 2000, 194 possible HIV occupational transmissions were reported to the Centers for Disease Control, 56 of these with documented seroconversion.<sup>5</sup> Prospective studies indicate an occupational exposure risk of 0.3% (95% CI: 0.2 - 0.5%),<sup>5</sup> which is low compared with sexual transmission rates. However, occupational blood exposure in health workers is still a significant cause of concern, with many indirect costs. A retrospective case control study showed that zidovudine used for occupational PEP was associated with a reduction in risk of HIV infection by approximately 81%.<sup>6</sup> It must also be remembered that the risk is not necessarily 1:300, as it is dependent on several risk factors, such as deep intramuscular penetration with a hollow needle containing blood from a patient with terminal AIDS.<sup>6</sup>

The short-term toxic effects of antiretroviral chemoprophylaxis are numerous and significant<sup>7,8</sup> and the long-term implications of repeated PEP in health workers are uncertain.<sup>7</sup> It is interesting that few students reported problems while taking PEP. Students pointed out that several procedures first have to be conducted before the prophylaxis starter pack is provided, contrary to United States Public Health Service Guidelines,<sup>5</sup> which recommend that prophylaxis should always be initiated as soon as possible.

## Conclusion and recommendations

Hazardous blood exposure in health care settings carries both physical and emotional risks.

In order to reduce the impact of injuries, clear guidelines and an enabling environment are needed. University and hospital authorities have a responsibility to facilitate healthier and safer decisions and to provide support to work through issues, especially when allowing students to perform risky procedures.

Many of the students involved stated that they would have liked more formal training in universal precaution guidelines, which is now part of the new undergraduate curriculum. The implementation of an education programme in India decreased the percentage of injuries attributed to disposal from 69.2% to 38.5%.<sup>9</sup> In a South African study,<sup>1</sup> it was reported that universal precaution guidelines would have prevented only the 22% needlestick injuries caused by recapping or unattended needles. However, recapping and unattended needles were the reason for the majority of the incidents during this study, and such training should make a significant difference. Helping students to identify high-risk settings and take precautions, obtain assistance, or in some cases delay the procedures, are also important in a training programme.

Another possibility to consider is a phlebotomy service, instead of students, for the drawing of blood or setting up of

intravenous (IV) lines during the high-risk periods identified, viz. at night, on call, and in high-risk departments.<sup>1</sup>

The current bureaucracy of incident management is a barrier. The starter pack of prophylaxis should be administered immediately and the full course of PEP provided after the time-consuming protocol has been completed.

The drugs used for PEP should also be reconsidered. In the case of more severe percutaneous exposure to HIV (e.g. large-bore hollow needle, visible blood on the device or needle used in the patient's artery or vein) or exposure to the blood of an HIV-positive class 2 patient (symptomatic patient or patient with high viral load), expanded three-drug prophylaxis is recommended.<sup>5</sup> In this study at least 15 of the 19 incidents fall into this category, yet the prophylaxis administered is according to one- and two-drug regimens. Students are an unpaid workforce in the hospital and should not bear the full cost of an injury on duty.

This initiative should continue to increase the data available for identifying high-risk settings and to evaluate the effect of changes made. Questionnaires should be kept short and the reporting system must be user-friendly, as students are already overwhelmed by paperwork following incidents.

This study has focused on the occupational risks associated with HIV transmission, but a number of important other diseases are transmitted through blood exposure. Helping young students to decrease their risk of HIV infection as a result of sexual activity should also not be neglected.

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