Field Study

Accidental Exposure to Blood in Medical Interns of Tehran University of Medical Sciences

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Abstract: Accidental Exposure to Blood in Medical Interns of Tehran University of Medical Sciences: Batoul Shariati, et al. Department of Community Medicine, Tehran University of Medical Sciences, Iran—Healthcare workers and medical students are at risk of exposure to blood-borne viruses such as HBV, HCV, HIV, etc. Here we report the results of a survey of the frequency and causes of cutaneous blood exposure accidents (CBEA) among medical students. Anonymous questionnaires were randomly distributed to 200 interns in their second year of internship in hospitals affiliated to Tehran University of Medical Sciences. A definite exposure was defined as injury by a sharp object causing obvious bleeding, whereas a possible exposure was defined as subtle or superficial injury due to contact with a contaminated instrument or needle but without bleeding, or contamination of an existing wound with blood or other body fluids. One hundred eighty-four subjects (92% of the original sample) responded to the questionnaire. We recorded 121 definite exposures and 259 possible exposures over a mean time interval of 14 months. Needles were the most common objects (41% of exposure episodes) causing CBEAs, while phlebotomy and suturing were the hospital procedures that accounted for the highest percentage of exposure episodes (30 and 28 percent, respectively). Only a minority of students regularly observed basic safety measures (wearing gloves, not recapping used needles and proper disposal of sharp objects). Considering the high incidence of blood exposure in medical interns at Tehran University of Medical Sciences and the ensuing risk of blood-borne infections, the subjects are likely to develop such infections during their internship period. (J Occup Health 2007; 49: 317–321)

Key words: Accidental exposure, Blood-borne infections, Cutaneous blood exposure, Medical interns

Blood-borne infections such as HBV, HCV, and HIV constitute a major occupational hazard for healthcare workers5). The greatest threat in this setting is accidental injury with contaminated needles or other sharp objects. While hepatitis B can be effectively prevented by vaccination, no vaccines are available for either HCV or HIV. There is a definite risk of HIV, HBV, and HCV transmission in environments where people regularly handle blood and other body fluids. Knowledge of exposure mechanisms, transmission risks, and prevention methods can assist hospital staff and managers in creating a safe working environment free of unnecessary fear or anxiety5). Current treatments for blood-borne infections are only marginally effective, so serious and potentially fatal complications are not rare. In 1987, the Centers for Disease Control (CDC) in the United States published a set of safety guidelines (entitled “Universal Precautions”), emphasizing the use of gloves, gowns, masks, and eyeglasses to avoid the risk of blood-borne disease transmission. These guidelines were based on the assumption that all patients are potentially infected5). In 1988, the CDC identified various objects and instruments capable of transmitting blood-borne infections and advised regular use of puncture-resistant containers for disposal of used needles and other sharp items. Hospital staff were strongly advised to avoid recapping contaminated needles5).

Accidental injuries of both percutaneous and mucocutaneous types are quite common, as shown by studies conducted in Denmark and the United States4, 5). According to the Center for Disease Control in Iran, by the end of December 2003 there were 6,337 documented cases of HIV infection in the country and more than 91% of these had been recorded over the preceding four years. The Center estimates that 3% of
the general population in Iran are HBV carriers and 3–5% are HCV carriers. Needle stick prevention devices could decrease the risk of infection with HCV and other blood-borne pathogens in healthcare workers.

It is thought that hospital procedures such as phlebotomy and suturing place the relatively inexperienced student community at high risk of acquiring blood-borne infections. The implementation of ESIPDs (i.e., Engineered Sharps Injury Prevention Devices) is a useful measure in a comprehensive program to reduce percutaneous injuries associated with phlebotomy procedures. The present investigation was conducted among the interns of Tehran University of Medical Sciences between 1999 and 2000. The aim was to determine the incidence of accidental blood exposures and the types of instruments and procedures that most commonly cause such accidents. We also looked at the extent to which our students observed basic safety recommendations in this setting, the ultimate goal being to protect future doctors from unnecessary risk of acquiring blood-borne viruses.

Subjects and Methods

The subjects of the study were medical interns, i.e., students in their last year of general medical training. These people had already received intensive training in basic medical and surgical procedures, enabling them to perform many routine hospital procedures such as phlebotomy, wound repair, débridement and suturing.

Data for this study were gathered through 200 self-administered questionnaires, of which 184 were filled out completely. Items covered by the questionnaire included history of definite and possible accidental exposures (see the definitions below), types of activities leading to exposure accidents, objects and instruments causing the accidents, use of gloves and needle disposal containers, the practice of recapping needles, and the subject’s status in terms of HBV vaccination (a copy of the study questionnaire accompanies this article). To limit the possibility of recall bias, we closely monitored all participants providing, where needed, detailed explanation of various questionnaire items.

All participants were informed of the nature and objectives of the survey and their consent was obtained before they filled the questionnaire.

Definite exposure was defined as a penetrating injury caused by a needle or another sharp object, and causing visible bleeding. Possible exposure was defined as i) a slight, superficial abrasion (caused by sharp object) without obvious bleeding or ii) an existing skin wound coming into direct contact with blood or other body fluids such as urine, peritoneal and pleural fluids, and mucosal secretions.

Using the exposure data, we calculated the incidence rates for both definite and possible exposure.

Results

Of the 184 questionnaires analyzed, 133 (72.3%) were filled by male interns and 51 (27.7%) by females. The subjects had been in their current training course for 5 to 18 months (mean=14.8 & SD=3.23). A total of 121 possible definite and 259 exposures were recorded with corresponding incidence rates of 0.56 and 1.2 exposures/person/year, respectively.

In this research, 117 out of the 184 subjects (63.6%) did not report any definite exposure, 38 interns (20.6%) had one definite CBEA and 29 (13.8%) had more than one definite exposure episode (see Table 1).

Table 1. Frequency of definite exposures among female and male interns

<table>
<thead>
<tr>
<th>Frequency</th>
<th>0 episode</th>
<th>1 episode</th>
<th>2–4 episodes</th>
<th>&gt;4 episodes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Females</td>
<td>33</td>
<td>64.7</td>
<td>13</td>
<td>25.5</td>
<td>4</td>
</tr>
<tr>
<td>Males</td>
<td>84</td>
<td>63.2</td>
<td>25</td>
<td>18.8</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>117</td>
<td>63.6</td>
<td>38</td>
<td>20.6</td>
<td>26</td>
</tr>
</tbody>
</table>

Table 2. Frequency of possible exposures among male and female interns

<table>
<thead>
<tr>
<th>Frequency</th>
<th>0 episode</th>
<th>1 episode</th>
<th>2–4 episodes</th>
<th>&gt;4 episodes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Females</td>
<td>20</td>
<td>39.2</td>
<td>8</td>
<td>15.7</td>
<td>15</td>
</tr>
<tr>
<td>Males</td>
<td>41</td>
<td>30.8</td>
<td>39</td>
<td>29.3</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>33.2</td>
<td>47</td>
<td>25.6</td>
<td>59</td>
</tr>
</tbody>
</table>
Only 61 subjects (33.2%) denied any possible exposure, while 47 respondents (25.6%) had one and 59 (32.1%) had experienced 2–4 possible CBEAs (see Table 2).

The highest exposure rates were associated with injection and suture needles, 36.8% and 25.3%, respectively (Table 3). Among different hospital procedures, most exposures were seen with phlebotomy and suturing; these procedures accounted for 29.7% and 27.9% of all exposures, respectively (Table 4).

As for safety precautions during phlebotomy or handling of blood samples, it was found that 48.9% of the interns wore protective gloves either rarely or not at all (Fig. 1).

Only 17.6% of the subjects used puncture-resistant containers for disposing of sharp instruments and a mere 4.3% regularly avoided recapping contaminated needles (Figs. 2 and 3).

In this survey, 161 interns (87.5%) had completed the HBV vaccination schedule, 15 (8.2%) had received two doses of anti-HBV vaccine, 7 subjects (3.8%) had received only one dose, and there was one subject (0.5%) who had not even begun anti-HBV vaccination.

**Discussion**

The present study showed that medical interns of Tehran University of Medical Sciences face a high risk of blood-borne infections through accidental blood exposures. Although vaccination coverage among the study subjects was at an acceptable level, its effectiveness is not clear yet. The incidence rate of definite CBEAs was 0.56 person/year, whereas in a study conducted in Denmark in 1998, an average of 3.0 PCE was reported among physicians annually. The higher rate among Danish physicians may be due to different study subjects, medical students and physicians, and hence longer working hours and greater probability of blood exposure for physicians than for medical students.

There is a wide and variable range of exposure rates among medical students. As shown in Table 1, the proportion of interns with at least one definite exposure
episode in our study was 36.4%. In 2005, a search was conducted among Australian medical undergraduates in which 35 students (13.8%) had suffered a total of 41 Needle stick and Sharps Injuries (NSI) incidents\(^9\). In a study on French students, one-quarter of the respondents had experienced a blood exposure accident by needle prick\(^{12}\). In 2003 a study was conducted among medical students in Missouri, USA, in which 43 out of 224 students (30%) reported needle stick injuries\(^{10}\). Similar research involving medical students in Lima, Peru, showed that 46.7% of them had been exposed to blood or body fluids at least once during the first nine months of 2002\(^{21}\). Needle stick injuries during internship were reported by 61.9% (438/708) of Taiwanese student nurses\(^{11}\). Although the above-cited studies were conducted at different times and on different subjects, a fact that might have influenced the results, it seems that in the more developed countries (e.g. USA), the number of blood-exposure accidents tends to be lower. Perhaps the overall socio-economic status and knowledge of necessary precautions has led to lower exposure rates and more strict observance of safety guidelines in Western societies. However, further research is needed to elucidate this point.

In the above-mentioned Australian study, 71.6% of the NSI reporters were female and 28.6% were male\(^9\), whereas in our study, blood exposure was found to be more frequent in men than women (73.1% vs 26.9%). More evidence is needed on the relation of sex and blood exposure among medical students to verify this difference.

There are several reports on the most common procedures and instruments by which blood exposures happen. In our study, phlebotomy and injection showed the highest CBEA rates (30%), followed by suturing (28%) and arterial puncture (15%). Together these procedures accounted for 73% of all exposure accidents. In the French study, drawing arterial blood was responsible for 44% of all exposure accidents\(^{10}\). A study conducted in Malaysia in 2003 showed that among various clinical procedures, venepuncture caused the highest incidence of needle stick injuries\(^{13}\). As for different instruments, we found injection needles to be the most common cause of CBEAs (36.8% of exposures) followed by suture needles (25.3%). In the Australian study, of the 41 NSI incidents, 29.2% were caused by a glass item and 24.4% by a hollow bore needle\(^9\). In view of our results and other studies on the procedures and instruments that may cause exposure accidents, it could be concluded that there is no single device or procedure that causes blood exposure accidents more frequently than others. The matter is related to the context in which the procedure is done. Norsayani and colleagues showed that medical students with needle stick injuries had a lower mean score of practice of Universal Precautions than students who did not have needle stick injury, although their knowledge about it was the same\(^{11}\) and research is needed for further clarification. However, it is of utmost importance for medical students to practice precautions with all procedures and instruments.

Compared to the studies cited in follow, vaccination coverage of the medical students of Tehran University was at an acceptable level. In our survey, 87.5% of the interns were properly vaccinated against HBV. These statistics are more than the figure for doctors in the Danish study with only 34.3%\(^{30}\) and 35.4% of students in the Peruvian study\(^{21}\). In the study conducted in Washington, all but one student had been vaccinated against hepatitis B\(^3\). In 2002, the Faculty of Medicine in Siriraj Hospital provided screening tests for HBV serology to all medical students for a vaccination campaign against the infection. 1,165 medical students were tested: 1,811 students (69.6%) had immunity by previous vaccination, but more importantly 212 (18.2%) had no immunity and required vaccination\(^4\). Among Taiwanese nursing students, vaccination against hepatitis B virus (HBV) was lacking in 47.6%\(^{11}\). However, the effectiveness of the vaccination is an important factor that needs to be tested on the medical students of Tehran University.

Only 6% of the interns wore protective gloves on a regular basis; almost half did so only rarely or not at all. Here our rates are similar to those of the French study\(^{10}\) but distinctly lower than those of a Danish survey in 1993, where glove use was observed by 70–100% of the medical staff\(^{15}\). In the French study, one out of two students applied elementary safety measures in a systematic fashion (gloves, not recapping the needle)\(^{10}\). In the study by Washington University, 86% of students reported always using double gloves in the operating room and 90% reported always wearing eye protection\(^5\). As wearing protective gloves is necessary for the prevention of blood-borne diseases, proper training for health staff and students regarding the use of gloves as well as providing access to disposable gloves is essential.

According to USA OSHA’s Blood-Born Pathogen Standards\(^{1996}\), recapping a needle is prohibited in order to reduce the risk of transmission of blood-born pathogens\(^{31}\). In our study, only 17.6% of the interns used safe containers for disposal of the sharp objects; 49.5% more or less neglected this measure, creating potential hazards for the workers involved in waste disposal. We found that 92.9% of our interns frequently recapped contaminated needles, a practice branded by some studies as the most risky practice leading to CBEAs. Indeed, some laboratories here refuse to process arterial blood samples if they are brought to the lab. in uncapped syringes. Therefore, it seems that a high proportion of interns actually neglect the precautionary measures designed to avoid CBEA and more education is required in this regard.
Conclusion
In light of the hazards associated with accidental blood exposures, our results point to a serious possibility of blood-borne infections among the medical student community at Tehran University of Medical Sciences. We conclude that interns practicing in hospitals run by Tehran University of Medical Sciences must receive comprehensive safety training in order to avoid unnecessary risk of blood-borne infections. Provision of required preventive devices is also essential for observing universal precautions.

Recommendations
1. The high rates of possible and definite CBEAs underline the importance of raising awareness of the risk of accidental exposure among our interns.
2. Widespread neglect of safety precautions emphasizes the need for relevant training courses targeted at hospital staff.
3. Hospital orderlies handling discarded objects must be warned of potential hazards and educated in preventive measures.
4. As recommended by the CDC, special hospital units must be set up with the task of implementing CDC’s Universal Precautions as well as gathering and updating information on recent exposure accidents and their follow up via appropriate laboratory tests.
5. Adequate facilities should be provided to extend Hepatitis B vaccination coverage among interns and other healthcare workers.
6. The regrettable common practice of bending and recapping of the needles must be combated by all means.
7. Similar studies are needed to assess the risk of CBEAs in different health-related professions and to establish appropriate prevention guidelines.

References