Occupational blood and body fluid exposure of university health care workers

Elisabetta Davanzo, MD, Clara Frasson, HA, Marta Morandin, HA, and Andrea Trevisan, MD
Padova, Italy

Background: Occupational exposure to bloodborne pathogens caused by percutaneous injuries or mucosal contamination is common in hospital settings.
Methods: Reports of exposures to human blood and body fluids from Padua university health care workers since 2004 to 2006 and compliance with follow-up after injury according to the patients' source were analyzed.
Results: The injury reports were 497. The residents in surgery and anesthesiology were significantly more injured than others, and the compliance with follow-up was low: from 26.3% (hepatitis B virus) to 40% (hepatitis C virus) with a positive source, less than 30% with a negative source, as far as 40% with an unknown source. No seroconversion was observed in subjects completing the follow-up.
Conclusion: We suspect underestimation of injury reports and low compliance with the follow-up requests that health care workers adhere to the protocols and follow the standard procedures to prevent exposures to bloodborne pathogens. (Am J Infect Control 2008;36:753-6.)

Health care workers are at risk of exposure to a variety of bloodborne pathogens by needlestick and sharp injuries or mucocutaneous contamination,[1] in particular hepatitis B (HBV), hepatitis C (HCV), and HIV. Needlestick injuries are the common method of transmission, but there are some differences if the wound is caused by a hollow-bore or a suture needle because 22-gauge hollow-bore needles can inoculate an average volume of 1 μL, a quantity sufficient to contain up to 100 infectious doses of HBV.[2] The probability of seroconversion depends on the volume of blood injected, the viral concentration, and the route of administration, but a 12-year Italian study found no seroconversion for HBV, 0.36% to 0.39% for HCV, and 0.14% to 0.43% for HIV.[3]

The aim of the present research was to analyze the bloodborne pathogen exposures in health care workers of Padua University Medical School obtained by injury reports since 2004 to 2006, according to the circumstance of the injury, the differences between staff and residents, the compliance with the postexposure prophylaxis (PEP), and the completion of follow-up.

From the Department of Environmental Medicine and Public Health, University of Padova, Padova, Italy.

Address correspondence to Andrea Trevisan, MD, Department of Environmental Medicine and Public Health, University of Padova, Via Giustiniani 2, I-35128 Padova, Italy. E-mail: andrea.trevisan@unipd.it.

The results have been presented partially to the 70th Congresso Nazionale della Società Italiana di Medicina del Lavoro e Igiene Industriale, Roma December 12-15, 2007.

Conflicts of interest: All authors report no conflicts of interest.

0196-6553/$34.00

doi:10.1016/j.ajic.2008.04.254

MATERIALS AND METHODS

Needlestick or sharp injuries and cutaneous or mucosal splashes were surveyed by reports of exposures occurred in Padua University Medical School health care workers since 2004 to 2006 and collected according to the form of the Italian Study for HIV Occupational Risk (SIROH).

University health care workers include staff workers (full, associate, and research professors); residents; students of medicine, dentistry, and health professions (comprised nurses) but not staff nurses, of hospital concern, who are not considered in the present study. Staff university surgeons (general and specialties) numbered 119; physicians (general and specialties), 195; anesthesiologists, 7; and laboratory personnel, 58. Residents in surgery numbered 452; in medicine, 821; in anesthesiology, 100; and in laboratory sciences, 188 per year. There are 405 nursing students per year.

The number of blood and body fluid exposures and gender, age, job description of the subjects, and the circumstance of the injuries (by hollow-bore or suture needles, sharp instruments, or splashes) were obtained from the injury reports. Finally, compliance to complete follow-up was evaluated if the subjects' source of injury was positive, negative, or unknown for HBV, HCV, or HIV. The protocol after bloodborne pathogen exposure consists in the control of the markers

immediately and 3 and 6 months after the exposure. The PEP is suggested for exposures to HBV- and HIV-positive subjects' source of injury.[4,5]

Statistical evaluation was by means of χ^2 analysis (2-tailed test) with Yeats correction, and significance was set from $P < .05$. All statistical analyses were performed by means of Statgraphic 4.0 version (Microsoft, Redmond, WA).

RESULTS

Since 2004 to 2006, 497 exposures were reported: 380 (76.5%) wounds and 117 (23.5%) mucocutaneous splashes. Yearly, approximately 7% of the university health care workers report at least 1 exposure, with most being by females (59.0%) and 30 years of age or less subjects (60.6%).

Among the wounds, 329 subjects (86.7%) specified whether injury was by needle, sharp instruments, or other. The needlesticks were far more numerous than sharp injuries (277 and 47, respectively): 142 with hollow-bore and 135 with suture needles. One bite, 2 scratches, and 2 wounds caused by pliers were also reported. Forty-eight university health care workers declared to have been wounded by a colleague, and 63 subjects reported 2 or more (up to 7) injuries. The splashes were less numerous, involving especially the eyes (71, 60.7%) but also the skin (46, 39.3%).

The rate of injuries per year (Table 1) reported by surgery (16.7%) and anesthesiology (17.7%) residents is significantly ($P < .05$) higher than that by staff surgeons (3.1%) or other specialties but not by the staff anesthesiologists (10.0%). The most injuries per year reported by residents in surgical specialties occurred in plastic (35.0%), orthopedic (23.3%), obstetric and gynecologic (22.2%), and general surgery (19.7%). On the contrary, less reports were from residents in cardiosurgery (10.8%), neurosurgery (7.0%), and thoracic surgery (1.2%).

HBV, HCV, and HIV markers are immediately checked after the exposure, and then subjects are started on follow-up. The compliance with follow-up was evaluated if the subjects' source of injury was positive, negative, or unknown. Nineteen HBV (hepatitis B surface antigen only)-, 65 HCV-, and 3 HIV-positive sources were found, but only 26.3%, 40.0%, and 33.3%, respectively, of exposed health care workers completed the follow-up; the compliance was lower (below 30%) if the subjects' source was negative, but increased as far as 40.0% if it was unknown (Table 2). The majority leaves the follow-up after the first control.

Sixteen HBV-negative subjects injured with instruments contaminated by hepatitis B surface antigen-positive or unknown blood were submitted to PEP, but only 10 completed the follow-up. Two subjects contaminated with a HIV-positive source adhered to PEP, but only 1 completed the follow-up; the subject who did not adhere to prophylaxis failed to complete the follow-up. None of the 73 subjects contaminated by an unknown source agreed with HIV prophylaxis, and only 29 (39.7%) completed the follow-up. No subject reporting an exposure was HCV or HIV positive, 2 were hepatitis B surface antigen carriers, and 85.0% had a good HBV immune coverage. No seroconversion was observed in university health care workers completing the follow-up.

Table 1. Injuries per year reported by residents (according to the specialty also) and nursing students compared with the staff members

Specialties	Residents per year	Injuries per year	Rate, %
Anesthesiology	100	17.7	17.7*
Surgery (all)	452	75.7	16.7*
Plastic	20	7.0	35.0
Orthopedic	40	9.3	23.3
Obstetric and Gynecologic	60	13.3	22.2
General	132	26.0	19.7
Otorhinolaryngologic	24	3.7	15.4
Vascular	25	3.3	13.2
Ophthalmologic	16	2.0	12.5
Maxillofacial	15	1.7	11.3
Cardiosurgery	25	2.7	10.8
Neurosurgery	10	0.7	7.0
Urologic	35	2.3	6.6
Pediatric	25	1.3	5.2
Thoracic	25	0.3	1.2
Medicine (all)	821	27.0	3.3
Laboratory (all)	188	4.7	2.5
Specialties	**Staff per year**	**Injuries per year**	**Rate**
Anesthesiologists	7	0.7	10.0
Surgeons (all)	119	3.7	3.1
Physicians (all)	195	3.7	1.9
Laboratory (all)	58	2.0	3.4
Nursing students	405	17.0	4.2

NOTE. The number per year of residents and nursing students is based on the number of yearly available seats for each specialty, whereas that of the staff is based on the number of full, associate, and research professors belonging to the School of Medicine.

*$P < .05$ residents in surgery or anesthesiology compared with residents in medicine or laboratory sciences, staff surgeons, staff physicians or laboratory staff, and nursing students.

DISCUSSION

Injuries with needlestick or sharp instruments are common in routine activity of health care workers,[6,7] but probably not all are reported. A recent study[8] established that only 51% of the health care workers of the English National Health Service had reported all needlestick injuries, and, in particular, doctors were less likely to report than nurses, despite a higher liability

Table 2. Rate of university health care workers reporting an injury and completing or not the 3 steps of the follow-up according to positive, negative, or unknown subjects' source of potential HBV, HCV, or HIV infection

	HBV			HCV			HIV		
	Positive	Negative	Unknown	Positive	Negative	Unknown	Positive	Negative	Unknown
Source, n	19	404	74	65	356	76	3	421	73
Time 0, n	10	230	35	23	213	38	0	238	36
Rate, %	52.6	56.9	47.3	35.4	59.8	50.0	0.0	56.5	49.3
Time 3 mo, n	4	60	9	16	52	9	2	63	8
Rate, %	21.1	14.9	12.2	24.6	14.6	12.2	66.7	15.0	11.0
Time 6 mo, n	5	114	30	26	91	29	1	120	29
Rate, %	26.3	28.2	40.5	40.0	25.6	38.2	33.3	28.5	39.7

Time 0, number and rate of subjects completing the first control only; *time 3 mo*, number and rate of subjects completing the first and second control; *time 6 mo*, number and rate of subjects completing the follow-up.

to injury; to explain the lack of reporting, the authors use the provocative sentence of ''culture of silence.'' Other reasons for underreporting could be not considering the exposure a ''significant risk''[9] but also the workload pressure and time constraints.[10] The reluctance is usual among surgeons and anesthesiologists, who have a heavy workload, but this is a poor justification because physicians omit other standard precautions such as wearing gloves during invasive procedures, avoiding recapping needles after use, and washing hands after patient care.[11]

The present research shows that the residents in surgery and anesthesiology are more injured than the others, comprised with the staff surgeons, but probably the staff surgeons report exposures less frequently than the residents for the reasons explained above. Differences in injury report exist also among surgical specialties. The higher rate of exposures was reported by residents in plastic surgery, a low invasive surgery but demanding a high number of sutures; in fact, most of injuries occurred during this duty. On the contrary, the few reports of residents in cardiosurgery, neurosurgery, and thoracic surgery, usually high invasive surgeries, are due surely to underreporting. The low rate of physician and laboratory worker exposures is probably related to the less number of invasive procedures. Interestingly, approximately 10% of injuries were caused by a colleague; this is not rare if the standard procedures are not correctly applied during exposure prone procedures such as surgical operations.

Finally, the poor compliance to the follow-up after exposures although the source was positive is of importance. This is difficult to explain, but the previous considerations could play a role. The control at the 6 months after the exposure is decisive because 95% of individuals develop HIV (the incubation time is longer than HBV and HCV) antibodies within this period of infection,[12] even though 6 months could be not enough; among health care workers with a documented seroconversion to HIV, 5% testing negative at 6 months after their occupational exposure was seropositive within 12 months.[13] This is relevant because a longer period of follow-up (1 year) could be necessary, but it could increase the reluctance.

In conclusion, the data on exposure to bloodborne pathogens show a higher rate of injuries in surgery and anesthesiology residents and a diffuse reluctance to complete the follow-up even though the source is positive or unknown. In our opinion, health care workers (staff, residents, and students) lack complete information on the standard procedures, on the necessity to report all biologic exposures, and on the importance of the follow-up for their own and public health. On the basis of the data, a campaign of sensitization has begun, beginning with all surgical specialties, with the aim to train university health care workers to follow proper behavior during medical practice. On the other hand, all suggestions to introduce safer sharps and needle-free devices are, until now, without success.

References

1. Collins CH, Kennedy DA. Microbiological hazards of occupational needlestick and sharps injuries. J Appl Bacteriol 1987;62:385-402.
2. Shikata T, Karasawa T, Abe K, Uzawa T, Suzuki M, Oda T, et al. Hepatitis B antigen and infectivity of hepatitis B virus. J Infect Dis 1977;136:571-6.
3. Ippolito G, Puro V, Petrosillo N. De Carli G, and the Studio Italiano Rischio Occupazionale da HIV (SIROH). Surveillance of occupational exposure to bloodborne pathogens in health care workers: the Italian national programme. Eur Surveill 1999;4:33-6.
4. Centers for Disease Control and Prevention. Update US public health service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. MMWR 2001;50(RR-11):1-52.
5. Panlillo AL, Cardo DM, Grohskopf LA, Heneine W, Ross CS. Updated US public health service guidelines for the management of occupational exposures to HIV and recommendations for postexposure prophylaxis. MMWR 2005;54(RR-09):1-17.
6. Dement JM, Epling C, Østbye T, Pompeii LA, Hunt DL. Blood and body fluid exposure risks among health care workers: results from the Duke health and safety surveillance system. Am J Ind Med 2004; 46:637-48.

7. Deisenhammer S, Radon K, Nowak D, Reichert J. Needlestick injuries during medical training. J Hosp Infect 2006;63:263-7.
8. Elmiyeh B, Whitaker IS, James MJ, Chahal CAA, Galea A, Alshafi K. Needle-stick injuries in the National Health Service: a culture of silence. J R Soc Med 2004;97:326-7.
9. Boal WL, Leiss JK, Sousa S, Lyden JT, Li J, Jagger J. The National Study to prevent blood exposure in paramedics: exposure reporting. Am J Ind Med 2008;51:213-22.
10. Clarke SP, Sloane DM, Aiken LH. Effects of hospital staffing and organizational climate on needle stick injuries to nurses. Am J Public Health 2002;92:1115-9.
11. Doebbeling BN, Vaughn TE, McCoy KD, Beekmann SE, Woolson RF, Ferguson KJ, et al. Percutaneous injury, blood exposure, and adherence to standard precautions: are hospital-based health care providers still at risk? Clin Infect Dis 2003;37:1006-13.
12. Busch MP, Satten GA. Time course of viremia and antibody seroconversion following human immunodeficiency virus exposure. Am J Med 1997;102(Suppl 5B):117-24.
13. Ciesielki C, Metler RP. Duration of time between exposure and seroconversion in health care workers with occupationally acquired infection with human immunodeficiency virus. Am J Med 1997; 102(Suppl 5B):115-6.