OCCUPATIONAL EXPOSURES IN HEALTHCARE WORKERS IN UNIVERSITY HOSPITAL DUBRAVA – 10 YEAR FOLLOW-UP STUDY

Tihana Serdar[1], Lovorka Đerek[1], Adriana Unić[1], Domagoj Marijančević[1], Durda Marković[2], Ana Primorac[3], Mladen Petrovečki[1, 4]

[1]Clinical Department for Laboratory Diagnostics, University Hospital Dubrava, Zagreb, Croatia
[2]Department for Clinical Microbiology and Hospital Infections, University Hospital Dubrava, Zagreb, Croatia
[3]Hospital Management, University Hospital Dubrava, Zagreb, Croatia
[4]Department of Medical Informatics, Rijeka University School of Medicine, Croatia

SUMMARY

Occupational hazardous exposure in healthcare workers is any contact with a material that carries the risk of acquiring an infection during their working activities. Among the most frequent viral occupational infections are those transmitted by blood such as hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV). Therefore, they represent a significant public health problem related to the majority of documented cases of professionally acquired infections. Reporting of occupational exposures in University Hospital Dubrava has been implemented in connection with the activity of the Committee for Hospital Infections since January 2002. During the period of occupational exposures' monitoring (from January 2002 to December 2011) 451 cases were reported. The majority of occupational exposures were reported by nurses and medical technicians (55.4%). The most common type of exposure was the needlestick injury (77.6%). 27.9% of the accidents occurred during the blood sampling and 23.5% during the surgical procedure. In 59.4% of the exposed workers aHBs-titer status was assessed as satisfactory. Positive serology with respect to HBV was confirmed in 1.6% of patients, HCV in 2.2% of patients and none for HIV. Cases of professionally acquired infections were not recorded in the registry. Consequences of the occupational exposure could include the development of professional infection, ban or inability to work further in health care services and last but not least a threat to healthcare workers life. It is therefore deemed necessary to prevent occupational exposure to blood-borne infections. The most important preventive action in respect to HBV, HCV and HIV infections is nonspecific pre-exposure prophylaxis.

Key words: healthcare worker, HBV, HCV, HIV, needlestick injury, occupational exposure

Address for correspondence: T. Serdar, Avenija Gojka Suska 6, 10000 Zagreb, Croatia. E-mail: tserdar@kbd.hr

INTRODUCTION

Occupational exposure in healthcare workers is considered any contact with a material that carries the risk of acquiring an infection, which occurs during the working activities, either in direct contact with patients or with body fluids or tissues (1, 2). Professional or nosocomial infections are infections acquired during the working hours in health institutions (3). They can be transmitted by any form of direct or indirect contact (4, 5). However, the main route of transmission is via blood, which implies contact with blood and other biological materials (tissue or fluid) that may contain blood and pathogens that are transmitted by blood (6). Viral infections are the main blood transmitted infections, and the most frequent among them are hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV). These viruses can be permanently present in the infected host blood. These infections are characterized by a potentially significant morbidity and mortality, and consequently, they represent a significant public health problem related to the majority of documented cases of professionally acquired infections (6).

According to the previously reported cases of professional infections in healthcare workers, the total risk for transmission of infection after occupational exposure is not high (7). The greatest risk for transmission of HCV, HBV or HIV occurs after a percutaneous injury, such as needlestick injury and cuts with sharp objects (scalpels, needles etc.) (7, 8). The possibility of an infection transmission after occupational exposure to blood-borne pathogens by percutaneous injury is 2–40% for HBV, 3–10% for HCV and 0.2–0.5% for HIV (7). Mucocutaneous incidents include exposure of mucosa and injured skin areas to potentially infectious body fluids (7, 8). The possibility of an infection transmission after occupational exposure to blood-borne pathogens by mucocutaneous injury is described as confirmed for HBV and HIV, and possible for HCV (7). Transmission of infections by a bite is also described and can result in infection of a bitten person and also a person who inflicted the bite (7). Because of the highest viral load, the exposure to contaminated blood represents the greatest risk for infection transmission (6).

In 1982, the first official recommendations for the prevention of occupational exposure to blood-borne infections were published by the Centers for Disease Control and Prevention (CDC), when specific imunoprophylaxis with HBV vaccination of healthcare workers in pre-exposure prophylaxis was introduced (9, 10). The awareness of the risk of occupational exposure and

infection has become greater with appearance of Human Immunodeficiency Virus infection/Acquired Immunodeficiency Syndrome (HIV/AIDS). Recommendations for prevention of HIV transmission in healthcare settings were published in 1987 (11). In 1989, assay for the detection of immunoglobulin G (IgG) antibodies to hepatitis C virus was developed and since then all programmes and recommendations for post-exposure prophylaxis incorporate HBV, HCV and HIV (11, 12).

CDC recommendations for prevention of occupational exposure to blood-borne infections in healthcare workers define specific and nonspecific pre-exposure and post-exposure prophylaxis. The implementation of standard precautions as nonspecific pre-exposure prophylaxis is the most important preventive measure for the prevention of occupational exposure to blood-borne infections in healthcare settings. Nowadays, specific pre-exposure prophylaxis is available only for HBV and includes specific immunoprophylaxis with HBV vaccination (13). Guidelines for the management of occupational exposures of healthcare workers to blood and blood-borne pathogens were developed for the purpose of post-exposure prophylaxis after occupational exposure (2, 14). These refer to the following steps in the procedure: decontamination of the exposure site, immediate report of occupational exposure, clinical and epidemiological evaluation of risk for HBV, HCV and HIV infection, serological testing of source patients and exposed healthcare worker, post-exposure procedure for HBV, HCV and HIV, and clinical follow-up care (2, 14).

Reporting of occupational exposures at University Hospital Dubrava has been implemented in accordance with the recommendation of the Reference Centre for Hospital Infections, the Ministry of Health of Croatia and in connection with the activity of the Committee for Hospital Infections of University Hospital Dubrava since January 2002. According to the latest official data for 2011, University Hospital Dubrava has 600 hospital beds (94.43% utilization) and 1,865 workers (1,342 medical workers, 123 cleaners and 400 others).

This article shows the way and frequency of occupational exposures reported at University Hospital Dubrava over the period from January 2002 to December 2011.

MATERIALS AND METHODS

Since January 2002, every reported occupational exposure of healthcare worker in University hospital Dubrava has been registered by the Committee for Hospital Infections of University Hospital Dubrava. Occupational exposure involves needlestick injuries, cutting and scratching with a sharp object, body fluids or secretion splashing in the eyes, mouth, on the damaged skin as well as patients' bites.

When reporting the occupational exposure, the exposed healthcare worker is educated about the treatment of the wound and completes a standard form prescribed by the Committee for Hospital Infections. The data concerning the occupational exposure are entered into the form: name, department and qualifications of the exposed worker, type of exposure, object that caused the exposure, the working process in which the exposure occurred, and the type of the body fluids that a healthcare worker was exposed to.

The form also requires information about the patient with whose body fluid exposed person has been in contact with (name and surname, identity number, ID number – if known). After recording occupational exposure, the Department for Blood Transfusion (2002–2007) and thereafter the Clinical Department for Laboratory Diagnostics (2008–2011), University Hospital Dubrava, urgently determined pre-existing immunity to HBV (aHBs-titer) and the initial serological status of exposed workers for HIV and HCV as well as the serological status of the patient for HBV, HCV and HIV (within 24 hours of reported occupational exposure). Serological status was determined using screening tests: hepatitis B surface antigen (HBsAg), and IgM and IgG antibodies to hepatitis B core antigen (aHBC) (IgM + IgG) for HBV, antibodies to HCV (aHCV) for HCV, antibodies to human immunodeficiency virus type 1 and/or 2 (aHIV) for HIV.

According to the estimates of the Committee for Hospital Infections, additional confirmation tests for HBV, HCV and HIV were carried out. The access to the occupational exposure database is strictly limited only to the authorized and qualified staff.

Spearman rank correlation was applied to assess the significance trend over time in number of reported occupational exposures. The level of $p<0.05$ was considered statistically significant. Statistical analyses were performed using MedCalc 9.2.0.0 statistical software (MedCalc, Mariakerke, Belgium).

RESULTS

From January 2002 to December 2011 (period of monitoring the occupational exposures), 451 cases were reported. Annual review is shown in Table 1 ($r=0.77$, $p=0.008$).

Table 1 shows the frequency of occupational exposures according to the qualifications and gender of healthcare workers at University Hospital Dubrava during the observed period. Employees of Surgery Clinic reported accidents most frequently (63.0%), followed by the Departments of the Clinic of Internal Medicine (22.6%) and other departments such as dialysis, different laboratories, neurology, psychiatry, incinerator, and radiology (14.4%).

The most common type of exposure is the needlestick injury (69.6%), followed by cuts with a sharp object (23.5%), splashing of body fluids or secretions in the eyes, mouth or damaged skin (4.7%), scratching with a sharp object (2.0%), and bite (0.2%). Table 2 shows the distribution of occupational exposures according to the operating procedures during which the exposure occurred. The needle is the object that caused the majority of accidents (69.6%), followed by scalpel (14.2%) and other sharp objects (16.2%). Other sharp objects include electrocauteries, endoscopic clippers, forceps, bone fragment, hip fragment, lancet, levers, rotary saws, glass, sternal wires, scissors, razor wire, and other unknown objects. The most common type of body fluid to which a healthcare worker was exposed during the incident was blood (84.7%), while the remaining cases (15.3%) were urine, saliva, stool, contents of the drain, and the unknown fluid.

59.4% of the exposed healthcare workers status had protective aHBs-titer (aHBs>100 IU/L) and in 19.5% the level of antibodies was not satisfactory (aHBs<100 IU/L). In 21.1% of the exposed workers the value of aHBs-titer was not measured. After examining the laboratory results of serological status of patients for HBV, HCV and HIV status as well as aHBs for healthcare worker, the Committee for Hospital Infections prescribed the intervention in 35.0% of the exposed workers in the form of additional booster

Table 1. *Distribution of occupational exposures according to the qualifications and gender of healthcare workers in University hospital Dubrava*

Qualifications of healthcare worker	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total	Male/ Female
Medical doctors specialist	2	2	2	4	6	2	4	6	6	2	36 (8.0%)	28/8
Medical doctor resident	1	2	6	3	9	4	8	8	8	8	57 (12.6%)	40/17
Medical doctor intern	0	0	1	0	1	3	0	3	0	0	8 (1.8%)	5/3
Nurse and medical technician (bacc.)	0	2	1	1	4	2	2	6	3	5	26 (5.8%)	3/23
Nurse and medical technician	19	12	21	21	30	28	32	37	32	18	250 (55.4%)	26/224
Laboratory technician	2	0	0	0	0	0	4	1	5	3	15 (3.3%)	2/13
Cleaner	0	2	1	3	5	2	3	4	8	3	31 (6.9%)	0/31
Assistant healthcare worker	0	1	1	2	2	2	3	1	1	1	14 (3.1%)	5/9
Technical stuff	0	0	0	0	1	0	0	0	0	0	1 (0.2%)	1/0
Nurse in training	1	0	0	0	0	2	1	1	1	2	8 (1.8%)	2/6
Radiology technician	0	0	0	0	0	0	1	2	1	1	5 (1.1%)	2/3
Total (N)	25	21	33	34	58	45	58	69	65	43	451	114/337

Table 2. *Distribution of occupational exposures according to the working procedures at which occupational exposure occurred*

Working procedure	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Injection/Infusion	0	0	6	4	13	7	9	9	10	7	65 (14.4%)
Blood sampling	7	7	10	13	11	13	10	23	21	11	126 (27.9%)
Surgical procedure	8	5	7	6	15	9	14	12	17	13	106 (23.5%)
Cleaning up	3	3	4	5	9	6	9	10	16	4	69 (15.3%)
Other activities	7	6	6	6	10	10	16	15	1	8	85 (18.9%)
Total (N)	25	21	33	34	58	45	58	69	65	43	451

doses of HBV vaccine or complete vaccination for HBV. Serological status of patients as regards HBV was reported negative in 71.4% of reported occupational exposures, and was confirmed positive in 1.6% of patients. 27.0% remained undetermined. In 71.0% of reported occupational exposures, the result of HCV testing was negative in patients, in 2.2% was confirmed positive, and in 26.8% it remained undetermined. The results of testing for HIV showed a negative result in 73.6% of reported incidents, and 26.4% remained undetermined.

DISCUSSION

The 10-year follow-up of occupational exposures in healthcare workers at University Hospital Dubrava has shown an increase in the number of reported events. The number of unreported accidents remains unknown. An increase in the number of reported occupational exposures may be due to continuous education and raising awareness of the exposure risk to potentially infectious biological material and the importance of reporting incidents. It can also be attributed to the increasing number of medical doctor residents, interns and also other healthcare workers who started their professional training during the last 5–7 years.

The number of reported incidents probably does not match the real state of occupational exposures in healthcare workers. As a reason for not reporting exposure, the healthcare workers state the assumption that transmission risk for infection in occupational exposure is very small, and the prevalence of infection among hospital patients is low (16). In addition, the stigmatization of the occupational exposures and conviction of the possible developed professional infections is still present. Most frequently, nurses and medical technicians have reported occupational exposures. This can be explained by the fact that this group of hospital workers is most frequently in contact with patients and uses objects during the medical treatment. Physicians reported less occupational exposures probably because they believe that they can estimate the transmission risk for infection themselves before they decide to report it (16). One of the reasons for not reporting is the insufficient education of healthcare workers about the procedure and management of occupational exposures to blood and blood-borne pathogens. Some studies report that even 16.7% of medical doctors and 14.2% of nurses did not know what to do and were not aware that they should proceed according to the protocol after occupational exposure (16).

A significant reduction in the incidence of HBV infection among healthcare workers in the developed countries occurred during the 1980s and 1990s. The reason for that was the implementation of preventive measures, such as universal precaution measures and HBV vaccination (17). The analysis of reported occupational exposures has shown that 59.4% of the healthcare

workers have satisfactory aHBs-titer status, so further intervention was not needed. In many countries, the number of healthcare workers that underwent HBV vaccination usually does not exceed 65%, indicating that HBV vaccination is not applied in a sufficient number of healthcare workers (1, 17, 18). In 1992, the World Health Organization (WHO) recommended the introduction of HBV vaccination in all national vaccination calendars (19). Among the reported occupational exposures with determined serological status, 7 patients (1.6%) were positive for HBV. The average prevalence of HBV infection in Croatia is about 2% and thus belongs to the countries with intermediate prevalence (20).

Immunization for HCV and HIV does not exist. Currently, there is no available specific prophylaxis for HCV so post-exposure procedures after occupational exposures to HCV positive blood include only serological monitoring of exposed healthcare worker (to determine or rule out seroconversion i.e. occupational HCV infection). Among reported occupational exposures with determined serological status, 5 patients (1.1%) were positive for HCV. In one occupational exposure, six healthcare workers were exposed to HCV-positive blood. Accurate data on the prevalence for chronic HCV infection in the general population of Croatia is not known. Based on the information that 1.6% of volunteer blood donors were positive for anti-HCV as well as other indirect indicators, HCV infection is certainly not less prevalent than HBV infection (20). Even though the number of patients with determined HCV infection is not insignificant, the consoling fact is that the infection average rate after occupational exposure to HCV is 1.8% (2). In addition, about 50% of acute HCV infections resolve spontaneously, so even the introduction of interferon in standard HCV post-exposure prophylaxis protocol is not currently justified (21–23). None of the reported occupational exposures with determined serological status of patients was positive for HIV. Fortunately, Croatia belongs to countries with low prevalence of HIV infection (24), with an annual rate of <10 new cases per million people (24). However, considering possible increase in the incidence of this infection, it is necessary to have in mind the possibility of a professional acquisition of HIV infection after occupational exposure (13).

Among the reported occupational exposures were those with undetermined serological status of patients for HBV (27.1%), HCV (26.8%) and HIV (26.4%), respectively, and the most common cause of this was the impossibility of determining the identity of patients since the occupational exposure occurred during cleaning, and there was only the contact with body fluids. There were also some failures in completing the protocol after occupational exposure had occured and subsequently reported. Information about the infection transmission from infected patients to exposed healthcare workers were not recorded in the registry. Besides the patient care, the purpose and aim of every national healthcare system should be safety and health protection of healthcare workers. Consequences of the occupational exposure could include the development of professional infection, the inability to continue in work and a threat to healthcare workers' life. Therefore it is necessary to prevent occupational exposure to blood-borne infection (6). The most important preventive action for HBV, HCV and HIV infections is nonspecific pre-exposure prophylaxis. Thus an education about universal precautions to blood-borne infections as well as applying education in daily work is of a great importance. One study reported that even 71% of healthcare workers did not use adequate protection (such as gloves, protection glasses or a mask) during their nursing and treating patients; this is also in correlation with results from other studies indicating that there was poor adherence to universal precautions (25).

In upcoming period in which the accreditation of the University Hospital Dubrava is expected, the implementation of standards for control of hospital infection, system of insurance and improving of quality in healthcare will be certainly set at a higher level. According to the Document of the Accreditation Standards for Healthcare Facilities, a programme for prevention and control of infections related to prevention of occupational exposures will be developed. The programme will comply with Standards for Control of Hospital Infection (26). Employees for infection control will implement a system for detecting, reporting, investigation and control of infections. Epidemiological studies similar to this one will help greatly in the analysis of quality indicators used for control of hospital infections.

REFERENCES

1. Jagger J, De Carli G, Perry J, Puro V, Ippolito G. Occupational exposure to bloodborne pathogens: epidemiology and prevention. In: Wenzel RP, editor. Prevention and control of nosocomial infections. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2003.
2. U.S. Public Health Service. Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Postexposure Prophylaxis. MMWR Recomm Rep. 2001 Jun 29;50(RR-11):1-52.
3. Act on the occupational diseases list. Narodne novine. 1998 Dec 22;(162). (In Croatian.)
4. La Grasta L, Božinović D. Supervision of healthcare workers infections in healthcare facilities. Infektol Glas. 1995;15(11):3-7. (In Croatian.)
5. La Grasta L, Božinović D. Supervision of healthcare workers infections in healthcare facilities. Infektol Glas. 1995;15(12):7-11. (In Croatian.)
6. Čivljak R, Begovac J. Occupational exposure to blood-borne infections in healthcare workers. Infectol Glas. 2003;23(4):183-8. (In Croatian.)
7. Gerberding JL. Management of occupational exposures to blood-borne viruses. N Engl J Med. 1995 Feb 16;332(7):444-51.
8. Beltrami EM, Williams IT, Shapiro CN, Chamberland ME. Risk and management of blood-borne infections in health care workers. Clin Microbiol Rev. 2000 Jul;13(3):385-407.
9. Centers for Disease Control (CDC). Recommendation of the Immunization Practices Advisory Committee (ACIP). Inactivated hepatitis B virus vaccine. MMWR Morb Mortal Wkly Rep. 1982 Jun 25;31(24):317-22, 327-8.
10. Centers for Disease Control (CDC). Current trends acquired immune deficiency syndrome (AIDS): precautions for clinical and laboratory staffs. MMWR Morb Mortal Wkly Rep. 1982 Nov 5;31(43):577-80.
11. Centers for Disease Control (CDC). Recommendations for prevention of HIV transmission in health-care settings. MMWR Morb Mortal Wkly Rep. 1987 Aug 21;36 Suppl 2:1S-18S.
12. Centers for Disease Control (CDC). Perspectives in disease prevention and health promotion update: universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis B virus, and other bloodborne pathogens in health-care settings. MMWR Morb Mortal Wkly Rep. 1988 Jun 24;37(24):377-88.
13. Čivljak R, Begovac J. Recommendations for prevention of ocupational exposure to blood-borne infections in health care workers. Sestrinski edukacijski magazin. 2004:1(4). (In Croatian.)
14. Gerberding JL. Postexposure prophylaxis for human immunodeficiency virus at San Francisco General Hospital. Am J Med. 1997 May 19;102(5B):85-9.
15. Frijstein G, Hortensius J, Zaaijer HL. Needlestick injuries and infectious patients in a major academic medical centre from 2003 to 2010. Neth J Med. 2011 Oct;69(10):465-8.
16. Elmiyeh B, Whitaker IS, James MJ, Chahal CA, Galea A, Alshafi K. Needle-stick injuries in the National Health Service: a culture of silence.

J R Soc Med. 2004 Jul;97(7):326-7. Erratum in: J R Soc Med. 2004 Sep;97(9):458.
17. Mahoney FJ, Stewart K, Hu H, Coleman P, Alter MJ. Progress toward the elimination of hepatitis B virus transmission among health care workers in the United States. Arch Intern Med. 1997 Dec 8-22;157(22):2601-5.
18. Stroffolini T, Petrosillo N, Ippolito G, Lopalco A, Sagliocca L, Adamo B, et al. Hepatitis B vaccination coverage among healthcare workers in Italy. Infect Control Hosp Epidemiol. 1998 Oct;19(10):789-91.
19. World Health Organization. Hepatitis B [Internet]. Geneva: WHO; 2002 [cited 2013 Jun 27]. Available from: http://www.who.int/csr/disease/hepatitis/HepatitisB_whocdscsrlyo2002_2.pdf.
20. Palmović D. Viral hepatitis. Zagreb: Školska knjiga; 1995. (In Croatian.)
21. Larghi A, Zuin M, Crosignani A, Ribero ML, Pipia C, Battezzati PM, et al. Outcome of an outbreak of acute hepatitis C among healthy volunteers participating in pharmacokinetics studies. Hepatology. 2002 Oct;36(4 Pt 1):993-1000.
22. Gerlach JT, Diepolder HM, Gruener NH, et al. Natural course of symptomatic acute hepatitis C. Proceedings of the 34th Annual Meeting of the European Association for the Study of the Liver. J Hepatol. 1999;30(suppl l):120.
23. Sata M, Hashimoto O, Noguchi S, Uchimura Y, Akiyoshi F, Matsukuma N, et al. Transmission routes and clinical courses in sporadic acute hepatitis C. J Viral Hepat. 1997 Jul;4(4):273-8.
24. European Centre for the Epidemiological Monitoring of AIDS. HIV/AIDS Surveillance in Europe. Mid-year report 2003 [Internet]. Saint-Maurice: Institut de veille sanitaire; 2003 [cited 2013 Jun 27]. Available from: http://ecdc.europa.eu/en/activities/surveillance/hiv/Documents/report_eurohiv_midyear_2003.pdf
25. Kocić B, Petrović B, Bogdanović D, Jovanović J, Nikić D, Nikolić M. Professional risk, knowledge, attitudes and practice of health care personnel in Serbia with regard to HIV and AIDS. Cent Eur J Public Health. 2008 Sep;16(3):134-7.
26. Document of the accreditation standards for healthcare facilities. Narodne novine. 2011 Mar 16;(31). (In Croatian.)

Received June 11, 2012
Accepted in revised form June 27, 2013