

Needlestick injuries and infectious patients in a major academic medical centre from 2003 to 2010

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ABSTRACT

To implement adequate preventive measures in a hospital, the number and nature of occupational exposures to blood must be known. In the Amsterdam Academic Medical Centre a standardised procedure was used to assess all reported occupational exposures to blood from 2003 to 2010.

1601 incidents were reported of which 66% were needlestick accidents. Thirty-five percent of the incidents concerned persons in training and 27% concerned experienced nurses. Twenty-nine percent of accidents occurred during cleaning up after a medical procedure, including the recapping of needles in 6%. In 8% of the accidents the patient was known or found to be infected with hepatitis B or C virus or HIV and in 86% of accidents the personnel were immune to HBV. One case of HCV transmission occurred.

The number and nature of the occupational exposures indicate that preventive measures must focus on the replacement of needles by safety devices and on awareness training of experienced nurses and of persons in training.

KEYWORDS

Needlestick injury, sharps injury, HBV, HCV, HIV

INTRODUCTION

To some degree it is inevitable that healthcare workers sustain injuries from sharp objects such as needles, scalpels and splintered bone. In addition, the employee's

mucosa may be exposed to droplets or splashes of blood, saliva and urine. Patients showing erratic behaviour may inflict bite and scratch wounds. These incidents, hereinafter referred to as 'occupational exposure', carry the risk of transmission of infectious agents of which hepatitis B and C virus (HBV, HCV) and human immunodeficiency virus (HIV) are the most relevant.

The number of occupational infections is determined by the prevalence of infectious agents among the patients, the transmissibility of the agents, the incidence of occupational exposures, and the efficacy of preventive measures after exposure. By definition, the prevalence of HBV, HCV or HIV infection approaches 100% in patients visiting specific outpatient clinics for the treatment of HBV, HCV or HIV infection. To estimate the prevalence of HBV, HCV and HIV infection in other patients, one often resorts to test results obtained by the local screening of pregnant woman or first-time blood donors, although patients often belong to high-risk groups. The reported incidence of needlestick injuries varies widely in different groups of medical workers. In a British study, senior surgeons reported 29 needlestick injuries in two years,¹ while 59% of 311 German medical students recalled at least one needlestick injury during their medical study.² To improve the prevention of occupational exposures, better information is needed on the incidence of sharps injuries.³ The Academic Medical Centre (AMC) in Amsterdam facilitates the training of more than 2000 medical students, medical specialists and nurses, who can be assumed to be a major source of occupational exposure to infectious agents. To monitor, manage and prevent occupational exposures to HBV, HCV and

HIV in the AMC, the Occupational Health and Safety Department devised a two-staged project. The first stage of the project aims at defining the problem by analysing the number and nature of occupational exposures. In the second stage preventive measures will be selected, based on the epidemiology of occupational exposures. Since 2003 a standardised procedure is in use at the AMC for the detailed registration and follow-up of each reported occupational exposure. Here we report on the number and nature of occupational exposures that occurred in the Academic Medical Centre in Amsterdam in the years 2003 to 2010 and on the infection status of the patients involved.

METHODS

Since 2003, each reported incident in the Academic Medical Centre in Amsterdam, involving exposure of personnel to blood or secretions of a patient, is managed and recorded according to a protocol by the Occupational Health and Safety Department of the hospital. Following a standardised questionnaire, the circumstances of each accident, including possible risk factors of the source, are investigated and stored in a database. Access to the database is strictly limited to the safety manager and to the occupational health physicians and nurses. Following the protocol, information on the HIV, HBV and HCV infection status of the source patient was categorised and managed as follows. If determined to be relevant by the occupational health physician in charge, the source patient was asked for permission to determine his or her infection status. If the patient could not be reached, or refused testing, or could not be identified (for example in accidents involving anonymous needles hidden in waste or laundry), the infection status was determined to be 'unknown, not available'. In other cases it was decided that the infection status of the source was not relevant. For example: the HBV infection status of the source is irrelevant if the exposed person is immune for hepatitis B. In such cases the infection status of the source was determined to be 'unknown, not relevant'.

RESULTS

During the study period (2003 to 2010) 1601 occupational exposures were reported, which amounts to an average of 0.55 reported exposures per day. The most common exposure involved needlestick injuries in 66% of cases, followed by cut wounds (17%) and splashes (12%), as reported in *table 1*. *Table 2* describes the professional background of the personnel involved. Most accidents occurred among experienced nurses (27%). *Table 3* provides an overview of the nature of the activities during which occupational exposures occurred. Cleaning up after a medical procedure was the most important cause of accidents (23%), followed by injuries during surgery and stitching (20%).

Regarding the infection status of the source patients, in 34% of the accidents the source patient tested negative for HBV, HCV and HIV. In 126 (8%) accidents the patient tested positive for one or more of the blood-borne viruses (60 HIV; 33 HBV and 53 HCV infections), including 19 patients with a double or triple infection. In 39% of cases the infection status of the patient was unknown and considered not relevant, while in 19% of accidents the infection status of the source patient was considered relevant but could not be obtained.

Regarding the immune status of the personnel, pre-existing immunity to HBV was documented in 86% of the healthcare workers involved; 4% were not vaccinated or had showed insufficient response to vaccination; and in 10% the HBV immune status was unknown, including persons with an undocumented, oral report of immunity.

DISCUSSION

During an eight-year observation period, the number of reported needlestick injuries and other exposures to potentially infectious material in the Academic Medical Centre in Amsterdam remained fairly constant at a rate of 0.5 reported incidents per day. The number of unreported accidents is unknown. Probably 'self-counselling'

Table 1. Number and nature of reported occupational exposures to potentially infectious material in the Academic Medical Centre in Amsterdam

	2003	2004	2005	2006	2007	2008	2009	2010	Total
Reported exposures	167	186	173	204	197	247	236	191	1601
Needlestick	108	140	125	130	139	158	143	110	1053 (66%)
Cut	26	24	21	39	35	40	48	36	269 (17%)
Splash	17	18	18	22	19	35	33	36	198 (12%)
Bite wound	5	0	4	5	1	5	6	3	29 (2%)
Other	11	4	5	8	3	9	6	6	52 (3%)

Table 2. Professional background of medical personnel involved in occupational exposure to potentially infectious material

	2003	2004	2005	2006	2007	2008	2009	2010	Total
Profession									
Nurse	54	50	47	46	50	64	69	47	427 (27%)
Medical student	20	25	21	*45	44	52	41	37	285 (18%)
Junior physician, in training	22	25	26	32	27	51	35	25	243 (15%)
Senior physician (specialist)	6	7	13	17	21	22	19	12	117 (7%)
Laboratory technician	15	8	6	14	21	11	21	9	105 (7%)
OR assistant	14	17	9	8	12	12	10	13	95 (6%)
Doctor's assistant	8	6	7	8	8	9	9	9	64 (4%)
Junior physician, not in training	10	13	4	3	2	2	4	7	45 (3%)
Nurse in training	2	7	5	5	3	5	2	4	33 (2%)
Radiology technician	0	5	3	2	2	3	1	2	18 (1%)
Cleaner	2	2	2	4	1	2	1	4	18 (1%)
Anaesthesiology assistant	0	3	1	7	1	0	4	2	18 (1%)
Sterilisation	0	3	3	0	2	1	5	2	16 (1%)
Other profession	14	15	26	13	3	13	15	18	117 (7%)
Total	167	186	173	204	197	247	236	191	1601

*In 2006 teachers in anatomy started the reporting of cutting accidents acquired by medical students during dissection lessons.

Table 3. Nature of 1601 occupational exposures in a large academic hospital

	2003	2004	2005	2006	2007	2008	2009	2010	Total
Activity									
Cleaning up after medical procedure	41	45	52	52	48	40	40	42	360 (23%)
Operation, stitching	31	42	35	36	41	47	51	35	318 (20%)
Blood sampling	17	24	18	29	31	29	32	24	204 (13%)
Handling of iv drip	19	18	10	16	20	21	24	10	138 (9%)
Laboratory activities	11	14	10	14	11	11	12	12	95 (6%)
Injection	16	11	12	7	12	13	15	14	100 (6%)
Recapping	11	13	8	10	8	21	13	8	92 (6%)
Patient care	5	6	11	5	5	17	13	13	75 (5%)
Assistance during operation	5	4	4	8	9	16	15	23	84 (5%)
Handling of catheter or drain	4	4	2	4	2	5	3	1	25 (2%)
Other activities	7	5	11	23	10	27	18	9	110 (7%)
Total	167	186	173	204	197	247	236	191	1601

frequently takes place, meaning that healthcare workers, with or without consulting their colleagues, decide not to report an accident because the risk involved is considered to be low. At first sight, nurses were most frequently involved in occupational exposures, namely in 27% of reported cases. However, if one takes all persons in training together (physicians in training, senior and junior medical students, and nurses in training), it appears that trainees account for 35% of the reported incidents. By far the most frequent type of accident was a needlestick injury. Surprisingly, accidents tend to occur during tidying-up after the 'real' work is done: cleaning-up after medical procedures and recapping of needles accounted

for 29% of incidents. Some of the injuries acquired during cleaning-up can be attributed to colleagues who leave the removal of contaminated sharp objects to others.

Apart from the nature of occupational exposures, the risk of transmission of HBV, HCV or HIV from patient to personnel also depends on the prevalence of these infections among the patients. Recently a representative number of random Amsterdam citizens, aged 18 years or older, were tested for HBV and HCV infection, revealing the presence of HBV infection in 0.41%, while HCV infection was found in 0.63% of the adult population in Amsterdam.⁴ The prevalence of HIV in the general population of Amsterdam is unknown; an indicator is

the 1.4% prevalence of HIV among pregnant women in Amsterdam.⁵ Not surprisingly, the prevalence of HBV, HCV and HIV infection among patients involved in occupational exposures was much higher: 8% of the source patients were infected with HBV, HCV or HIV. An unknown proportion of the 19% of relevant source patients with unknown infection status must be added to this figure.

Transmission of HBV can be prevented largely by pre- and post-exposure immunisation of personnel. Transmission of HIV can be prevented by post-exposure prophylaxis.⁶ Immunisation against HIV or HCV is not available, but fortunately the risk of transmission of HIV or HCV by hollow needlestick injuries is low, 0.3% and 1.8% respectively.⁷ Considering that in addition, the majority of source patients were not infected, the *a priori* chance of any transmission to personnel is low. Indeed in the study period no transmission of HBV or HIV was found. Only one transmission of HCV was observed, caused by a needlestick injury. In addition, in the year before the study period a case of HCV transmission occurred, also caused by needlestick injury.⁸ Therefore the main benefit of improved preventive measures is the reduction of the number of labour-intensive post-exposure procedures, which are costly for the hospital and a burden for the workers who experienced an accident.

The lack of vaccination and post-exposure measures against HCV infection, the higher transmissibility of HCV as compared with HIV, and the prevalence of HCV among patients explain why transmissions of HCV occurred. In the near future the registration of two orally available HCV protease inhibitors is expected (telaprevir and boceprevir). It may be possible to use these drugs as post-exposure prophylaxis after occupational exposure to HCV.

We conclude that in the Academic Medical Centre in Amsterdam, two-thirds of reported occupational exposures are needlestick injuries. In roughly two-thirds of the cases trainees and nurses are involved and one third of the cases

occur during cleaning-up and recapping after medical procedures. Several studies document a substantial reduction of the number of percutaneous injuries after the introduction of safety devices, although many studies do not account for confounding factors such as simultaneous implementation of other interventions.^{9,10} Nevertheless it seems appropriate to focus preventive measures on the replacement of needles by safety devices and on awareness training of experienced nurses and trainees.

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