Management of health care workers following occupational exposure to hepatitis B, hepatitis C, and human immunodeficiency virus
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CME / CNE / PEM point accreditation *(please refer to the attached test paper for the number of credit points awarded)*

Introduction

Needlestick injury or mucosal contact with blood or body fluids is well recognised in the health care setting. These incidents pose a small but definite risk for health care workers of acquiring blood-borne viruses, notably hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV). The estimated risk of contracting HBV infection through occupational exposure to known infected blood via needlestick injury varies from 18% to 30%, while that for HCV infection is 1.8% (range, 0%-7%).[(1)] The risk of HIV transmission following percutaneous or mucosal exposure to HIV-contaminated blood is 0.3% and 0.09%, respectively.[(1)] The risk is further affected by the type of exposure, body fluid involved, and infectivity of the source.

In Hong Kong, injured health care workers usually receive initial first aid and immediate management in the Accident and Emergency Department. They are then referred to designated clinics for specific post-exposure management. Currently, aside from staff of the Hospital Authority who are managed at two designated clinics post-exposure, all other health care workers from private hospitals, and government or private clinics and laboratories are referred to the Therapeutic Prevention Clinic (TPC) of the Integrated Treatment Centre, Department of Health. Since its launch in mid-1999, the TPC has provided comprehensive post-exposure management to people with documented percutaneous, mucosal, or breached skin exposure to blood or body fluids in accordance with the local guidelines set out by the Scientific Committee on AIDS and STI, and Infection Control Branch of Centre for Health Protection, Department of Health.[(2)] The present study describes the characteristics and outcome of health care workers who attended the TPC from mid-1999 to 2013 following occupational exposure to blood or body fluids.

Methods

The study included all health care workers seen in the TPC from July 1999 to December 2013 following occupational exposure to blood or body fluids, who attended following secondary referral by an accident and emergency department of a public hospital. Using two standard questionnaires (Appendices 1 and 2), data were collected by the attending nurse and doctor during a face-to-face interview with each health care worker on the following: demography and occupation of the exposed client, type and pattern of exposure, post-exposure management, and clinical outcome.

Details of the exposure, including type of exposure and the situation in which it occurred, were noted. The number of risk factors (see definitions below) for HIV transmission was counted for each exposure and further classified as high risk or low risk. Where known and reported by the injured party, hepatitis B surface antigen (HBsAg), HCV, and HIV status of the source were recorded.

The timing of the first medical consultation in the accident and emergency department, any prescription of HIV post-exposure prophylaxis (PEP), and the time since injury were noted. Exposed health care workers who received HIV PEP were reviewed at clinic visits every 2 weeks until completion of the 4-week course of treatment, and any treatment-related adverse effects were reported. Blood was obtained as appropriate at these visits for measurement of complete blood count, renal and liver function, and amylase, creatine kinase, fasting lipid, and glucose levels.

Apart from HIV PEP–related side-effects (reported and rated by patients as mild, moderate, or severe), the rate of completion of PEP, and number of HBV, HCV, and HIV seroconversions following the incident was also recorded. The HBsAg, anti-HBs, anti-HCV, and anti-HIV were checked at baseline and 6 months post-exposure to determine whether seroconversion had occurred. Those exposed to a known HCV-infected source or a source known to be an injecting drug user had additional blood tests 6 weeks post-exposure for liver function, anti-HCV, and HCV RNA. Additional HIV antibody testing at 3 and 12 months post-exposure was arranged for those who received HIV PEP. For those who contracted HCV infection from a source co-infected with HCV and HIV, further HIV testing was performed at 1 year post-exposure to detect delayed seroconversion.

Definitions

Health care workers included doctors and medical students, dentists and dental workers, nurses, midwives, inoculators, laboratory workers, phlebotomists, ward or clinic attendants, and workmen. Staff working in non–health care institutions (eg elderly home, hostels, and sheltered workshops) were excluded. Five factors were classified as high-risk exposure: (i) deep percutaneous injury, (ii) procedures involving a device placed in a blood vessel, (iii) use of a hollow-bore needle, (iv) device that was visibly contaminated with blood, and (iv) source person with acquired immunodeficiency syndrome (AIDS).[3] Another five factors were classified as low-risk exposure: (i) moderate percutaneous injury, (ii) mucosal contact, (iii) contact with deep body fluids other than blood, (iv) source person was HIV-infected but not or not sure about the stage of AIDS, and (v) any other reason contributing to increased risk according to clinical judgement.

Results

From July 1999 to December 2013, 1525 health care workers (75-168 per year) with occupational exposure to HBV, HCV, or HIV were referred to the TPC (Fig). Females constituted 77% of all attendees. The median age was 33 years (range, 17-73 years). The majority came from the dental profession (36.8%) and nursing profession (33.4%), followed by ward/clinic ancillary staff (11.6%) and the medical profession (4.7%).

Type and pattern of exposure

The majority of exposures occurred in a public clinic or laboratory (n=519, 34.0%), followed by public hospital (n=432, 28.3%), private clinic or laboratory (n=185, 12.1%), and private hospital (n=23, 1.5%). Most were a percutaneous injury (88.9%). Mucosal contact, breached skin contact, and human bite were infrequent (Table 1). Approximately 60% of the incidents occurred in one of the four situations: (a) cleaning/tidying up after procedures (the most common), (b) other bedside/treatment room procedures, (c) injection, including recapping of needles, or (d) blood taking/intravenous catheter insertion. The contact specimen was blood or blood products, blood-contaminated fluid, and saliva or urine in 30.6%, 5.8%, and 14.1% of the cases, respectively. The technical device involved was a hollow-bore needle in 48.1%, dental instrument in 20.7%, and lancet in 7.7%. More than 80% considered the injury superficial.

Figure 1. Referrals of healthcare workers with occupational exposures to TPC and the PEP prescriptions

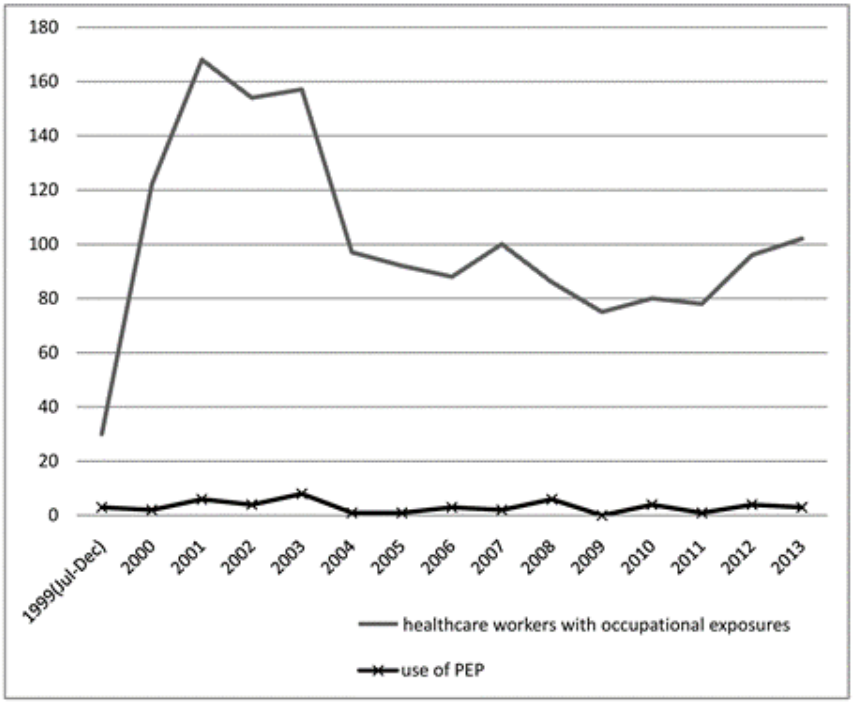

Table 1. Details of occupational exposures in healthcare workers

Nature of exposures (n=1525)		
Percutaneous	1356	(88.9%)
Mucosal	50	(3.3%)
Non-intact skin	30	(2.0%)
Human bite	59	(3.9%)
Others	30	(2.0%)
Severity		
Superficial	1263	(82.8%)
Moderate	196	(12.9%)
Deep	3	(0.2%)
Procedure involved		
Blood-taking/ intravenous catheter insertion	158	(10.4%)
Injection including recap	218	(14.3%)
Other bedside/treatment room procedures	252	(16.5%)
Cleansing/tidying up after procedures	298	(19.5%)
Others	534	(35.0%)
Contact specimen		
Blood/blood products	467	(30.6%)
Blood-contaminated fluid	89	(5.8%)
Saliva/urine	215	(14.1%)
Other/unknown	754	(49.4%)
Technical device		
Hollow-bore needle	733	(48.1%)
Lancet	118	(7.7%)
Dental instrument	315	(20.7%)
Others	195	(12.8%)
Nil	164	(10.8%)
Reported status of source (known in 1277)		% of known source
Known HBsAg positive	95	(7.4%)
Known HCV positive	21	(1.6%)
Known HIV positive	42	(3.3%)

High-risk and low-risk factors were noted in 869 (57%) and 166 (11%) exposures, respectively. Blood taking/intravenous catheter insertion carried the highest risk among all the procedures, with a mean risk factor of 1.29 (Table 2). Gloves were used in 956 (62.7%) exposures, goggles/mask in 50 (3.3%), and gown/apron in 55 (3.6%). Nonetheless, 101 (6.6%) health care workers indicated that they did not use any personal protective equipment during the exposure.

Table 2. Risk factors in health care workers with higher-risk occupational exposure during various activities/procedures from 1999 to 2013

	No. of workers	No. of risk factors		
		Range	Mean	(95% CI)
Blood-taking/intravenous catheter insertion	140	1-3	1.29	1.18-1.39
Injection including recap	196	1-2	1.02	1-1.04
Other bedside/treatment room procedures	95	1-2	1.03	0.99-1.07
Cleansing/tidying up after procedures	115	1-3	1.03	0.98-1.06
Surgery in operating theatre	46	1-1	1.00	--
Sharps disposal	174	1-3	1.09	1.03-1.14
Other	88	1-2	1.03	0.99-1.07

The source patient could be identified in 1277 (83.7%) cases but the infectious status was unknown in most. The baseline known positivity rate for HBV, HCV, and HIV of all identified sources was 7.4%, 1.6%, and 3.3%, respectively (Table 1).

Care and clinical outcome

Nearly half of the injured health care workers attended a medical consultation within 2 hours (n=720, 47.2%) and another 552 (36.2%) attended between 2 and 12 hours following exposure. The median time between exposure and medical consultation was 2.0 hours.

During the study period, 48 (3.1%) health care workers received HIV PEP for occupational exposure, ranging from zero to eight per year (Fig). One third received PEP within 2 hours of exposure, and the majority (89.6%) within 24 hours. The median time to PEP was 4.0 hours post-exposure (interquartile range, 2.0-8.1 hours). A three-drug regimen was prescribed in 85.7% of cases. The most common regimen was zidovudine/lamivudine/indinavir (39.6%), followed by zidovudine/lamivudine/ritonavir-boosted lopinavir (31.3%), and zidovudine/lamivudine (12.5%) (Table 3). Upon consultation and risk assessment at the TPC, 36 (75%) workers had treatment continued from the accident and emergency department. Among them, the source was confirmed to be HIV-positive in 14 (38.9%) cases. Of the 35 clients with known outcome, drug-related adverse events were seen in 31 (88.6%) health care workers; more than half (n=18, 58.1%) of which were considered to be moderate or severe. Treatment-related side-effects led to early termination of PEP in eight (22.9%) health care workers. Excluding nine clients in whom prophylaxis was stopped when the source was established to be HIV-negative, 19 (73.1%) clients were able to complete the 28-day course of PEP. Of the 14 clients who sustained injury from an HIV-infected source patient, all received PEP but two did not complete the course; the completion rate was 85.7%.

Table 3. Post-exposure prophylaxis regimens of human immunodeficiency virus

Regimen	No. of prescriptions	%
AZT/3TC	6	12.5
AZT/3TC/ATV	1	2.1
AZT/3TC/IDV	19	39.6
AZT/3TC/LPVr	15	31.3
AZT/3TC/NFV	5	10.4
AZT/DDI/LPVr	1	2.1
TDF/FTC/LPVr	1	2.1
Total	48	100

ATV= atazanavir; AZT= zidovudine; DDI = didanosine ; FTC= emtricitabine ; IDV= indinavir ; LPVr= ritonavir-boosted lopinavir ; NFV= nelfinavir ; TDF= tenofovir ; 3TC= lamivudine.

At baseline, none of the injured health care workers tested positive for HCV or HIV, while 49 (3.2% of all health care workers seen in TPC) tested HBsAg-positive. Almost half of the health care workers (n=732, 48.0%) were immune to HBV (anti-HBs positive). After follow-up of 6 months (1 year for those who took PEP), no case of HBV, HCV, or HIV seroconversion was detected in this cohort.

Discussion

Health care workers may be exposed to blood-borne viruses when they handle sharps and body fluids. Thus, adherence to standard precautions of infection control is an integral component of occupational health and safety for health care workers. In this cohort, percutaneous injury with sharps during cleaning or tidying up after procedures remained the most common mechanism of injury. Many of these incidents could have been prevented by safer practice, for instance, by not recapping needles or by disposing needles directly into a sharps box after use. The use of gloves as part of standard precautions was suboptimal and greater emphasis on the importance of wearing the appropriate personal protective equipment should be made during staff training at induction and on refresher courses. Technical devices with safety needleless features may reduce sharps injuries. Improvement in the system (eg by placing a sharps box near the work area) or the workflow to minimise distraction may also help compliance with infection control measures.

Once exposure occurs, PEP is the last defence against HBV and HIV. For HBV infection, PEP with hepatitis B immunoglobulin followed by hepatitis B vaccination has long been the standard practice in Hong Kong. For HIV infection, the efficacy of PEP in health care workers following occupational exposure was demonstrated by a historic landmark overseas case-control study.[3] Prescription of zidovudine achieved an 81% reduction in risk of HIV seroconversion following percutaneous exposure to HIV-infected blood.[3] Local and international guidelines now recommend a combination of three antiretroviral drugs for PEP.[2, 4, 5, 6] In this cohort, although more than half of the exposures had higher risk factors for HIV acquisition, it was uncommon for the source patients to have known HIV infection (2.8% of these exposures). Thus, in accordance with the local guideline, PEP

was not commonly prescribed. Nevertheless, PEP was prescribed in all 14 exposures to a known HIV-positive source and in other 34 exposures after risk assessment. Our experience is comparable with the health care service in the UK and US. In the UK, 78% of health care workers exposed to an HIV-infected source patient were prescribed PEP.[7] In a report from the US, only 68% of health care workers with such exposure took PEP.[8] For HCV, PEP with antiviral therapy is not recommended according to the latest guidelines from American Association for the Study of Liver Diseases/Infectious Diseases Society of America.[9] In case seroconversion occurs and early treatment is considered desirable, these patients with acute hepatitis C can be treated with direct-acting antivirals using the same regimen recommended for chronic hepatitis C.

If indicated, HIV PEP should be taken as early as possible after exposure to achieve maximal effect. Initiation of PEP after 72 hours of exposure was shown to be ineffective in animal studies.[10] The timing of PEP initiation in our cohort appeared to be less prompt (33.3% within 2 hours compared with more than 60% and 80% within 3 hours in the UK and US, respectively). Overall, however, 89.6% managed to start PEP within 24 hours, in line with experience in the UK or US. Health care workers should be reminded about post-exposure management and the need for timely medical assessment following occupational exposure. In the accident and emergency department, priority assessment should be given to health care workers exposed to blood-borne viruses. The median duration of PEP intake of 28 days was in line with the local guidelines. With the availability of newer drugs with fewer toxicities, the tolerance and compliance rate should improve.

Finally, using the estimated risk of HIV transmission with percutaneous injury of 0.3%, we would expect four HIV seroconversions in 1356 percutaneous exposures in TPC if all were exposed to HIV-infected blood. Because in most of these exposures the source HIV status was unknown and likely negative in this region of overall low HIV prevalence (approximately 0.1%[11]), the actual risk of HIV transmission was much lower in the health care setting of Hong Kong. This finding is confirmed by the fact that no HIV seroconversion occurred in this cohort. In addition, those with exposure of the highest risk received HIV PEP. In the UK, there were 4381 significant occupational exposures from 2002 to 2011, of which 1336 were exposures to HIV-infected blood or body fluid. No HIV seroconversions occurred among these exposures.[7] In the US, there has been one confirmed case of occupational transmission of HIV in health care workers since 1999.[12] Similarly, the local prevalence of HCV infection is low (<0.1% in new blood donors[13]), partly explaining the absence of HCV transmission in this cohort. In contrast, there were 20 cases of HCV seroconversion in health care workers reported between 1997 and 2011 in the UK.[7] Hepatitis B is considered to be endemic in Hong Kong, with HBsAg positivity of 1.1% in new blood donors and 6.5% in antenatal women in 2013.[13] Nonetheless, the HBV vaccination programme in health care workers coupled with HBV PEP has proven successful in preventing HBV transmission to health care workers. With concerted efforts in infection control and timely PEP, transmission of blood-borne viruses via sharps and mucosal injury in the health care setting is largely preventable.

There are several limitations to our study. First, data were collected from a single centre and based on secondary referral. We did not have data for other health care workers who had occupational exposure but who were not referred to the TPC for post-exposure management, or who were referred but did not attend. Thus, we were not able to draw any general conclusions on the true magnitude of the problem. Second, details of the exposure and the infection status of the source were self-reported by the exposed client and prone to bias and under-reporting.

Conclusions

Percutaneous injury with sharps during cleaning or tidying up after procedures was the most common cause of occupational exposure to blood or body fluids in this cohort of health care workers. The majority of source patients were not confirmed HIV-positive and HIV PEP was not generally

indicated. Prescriptions of HIV PEP were appropriate and timely in most cases. There were no HIV, HBV, and HCV seroconversions in health care workers who attended the TPC following sharps or mucosal injury from mid-1999 to 2013.

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Test paper

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Expiration Date: 11 December 2017

CME point [#] ***/ CNE point: 1 / PEM point: 1*** *(Healthcare related which contributes to the enhancement of professionalism of midwives/nurses)*

- Please indicate one answer to each question.
- Answer these on the answer sheet and make submission by fax to Special Preventive Programme, Department of Health.

[#] *Please contact respective authorities directly for CME/CPD accreditation if it is not on listed below.*

Accreditors	CME Point
Department of Health *(for practising doctors who are not taking CME programme for specialists)*	1
Anaesthesiologists	0
Community Medicine	1
Dental Surgeons	1
Emergency Medicine	1
Family Physicians	1
Obstetricians and Gynaecologists	0
Ophthalmologists	1
Orthopaedic Surgeons	1
Otorhinolaryngologists	pending
Paediatricians	pending
Pathologists	1
Physicians	0
Psychiatrists	1
Radiologists	1
Surgeons	1

1. Which of the following about occupational exposure to hepatitis B, hepatitis C and HIV is true?
   (a). Hepatitis B, hepatitis C and HIV, in descending order, are commonly transmitted by needlestick injury in the health care setting.
   (b). Injured health care workers in Hong Kong should call at one of the three designated clinics for immediate management.
   (c). Overseas guidelines are used for guidance in management as no local guidelines are available.
   (d). The Therapeutic Prevention Clinic (TPC) of the Department of Health caters only for exposed staff of the Department of Health.
   (e). None of the above

2. Which of the following alone does NOT constitute high risk exposure?
   (a). Use of solid bore needle
   (b). Deep percutaenous injury
   (c). Device that has been placed in a blood vessel
   (d). Source patient with AIDS
   (e). Device that is visibly contaminated with blood

3. Which of the following is NOT counted as health care workers among those referred to TPC?
   (a). Ward attendants
   (b). Phlebotomist
   (c). Inoculators
   (d). Workman of sheltered workshop
   (e). None of the above

4. Which of the following statement is true for HIV post-exposure prophylaxis (PEP)?
   (a). Used alone, zidovudine achieves only an 18% reduction in risk of HIV seroconversion after percuataneous exposure to HIV infected blood.
   (b). PEP is effective only if given within 24 hours of exposure.
   (c). Drug-related adverse events were uncommonly seen in recipients of PEP and most of them were considered mild.
   (d). The recommended PEP regimen comprises a combination of three drugs to be given for four weeks.
   (e). None of the above.

5. Which of the following is true of post-exposure prophylaxis against hepatitis B and hepatitis C?
   (a). Hepatitis B immunoglobulin (HBIG) should be given whenever the source is known to be HbeAg positive, regardless of the immune status of the exposed health care worker.
   (b). After HBIG is given, hepatitis B vaccination should be postponed for at least 6 months to avoid interference of response.
   (c). If available, direct acting antivirals should be given for post-exposure prophylaxis to hepatitis C.
   (d). Health care workers attending the A&E Department should be given priority assessment at triage.
   (e). None of the above.

6. In the cohort of injured health care workers followed by TPC, which of the following is NOT true?
   (a). The majority of exposures was classified as superficial.
   (b). Blood contaminated-fluid, not blood, was the most commonly implicated source of exposure.
   (c). The device most often implicated was a hollow-bore needle.
   (d). 6.6% of health care workers indicated that they had not used any personal protective equipment.
   (e). Infection status of the source was unknown in the majority of cases

7. Which of the following is among the common procedures involved in occupational exposure to blood-borne viruses?
   (a). Blood taking or intravenous catheter insertion
   (b). Injection, including recapping of needles
   (c). Cleaning or tidying up after procedures
   (d). Bedside or treatment room procedures
   (e). All of the above

8. Which of the following is NOT true regarding the care and clinical outcome of the cohort of health care workers followed by TPC?
   (a). About half of the injured health care workers received medical attention within 2 hours.
   (b). Drug related adverse effects were seen in 88.6% of PEP recipients and led to termination of PEP in some.
   (c). 89% managed to start PEP within 24 hours.
   (d). Two of the exposed health care workers tested positive for HIV at baseline.
   (e). None of the above.

9. Which of the following advice should be strengthened in the health care setting?
   (a). Avoidance of recapping needles
   (b). Wearing of gloves when performing blood taking
   (c). Disposing of used needles directly into sharps box
   (d). Employment of needleless device where possible
   (e). All of the above

10. Which of the following is not an explanation why there was no HIV seroconversion in this cohort?
   (a). The general prevalence of HIV in Hong Kong is low at 0.1%
   (b). All health care workers exposed to known HIV infected source were started on PEP
   (c). The risk of HIV seroconversion following percutaneous exposure to HIV infected blood is low at 3-10%.
   (d). All of the above