Surgery in Carriers of HIV and Hepatitis

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Surgeons who are in contact with patients and/or clinical material are at continuous risk of acquiring blood-borne viral infection, in particular, infection with hepatitis B or C and HIV. It is impossible to prevent all needlestick injuries and exposures to infected materials. In the UK, most needlestick injuries occur from poor handling of sharps. The prevention of occupational exposure to blood-borne viruses is dependent on education. The three strategies to combat occupational exposure include the use of universal precautions at all times to avoid exposure, immunization, and the availability of post-exposure advice and prophylaxis. The effectiveness of the hepatitis B vaccine make the prevention of occupationally acquired hepatitis B infection possible. Immunoprophylaxis for hepatitis C and HIV is unavailable, however, and avoidance of exposure is the only viable strategy for preventing the transmission of these pathogens to healthcare workers.

The clinical condition of patients who carry these viruses may also deteriorate if they are not managed appropriately. This article deals with the risk of infection to healthcare workers and strategies to manage exposure to potentially infected materials.

Hepatitis B virus

Risk of infection

Hepatitis B virus (HBV) is the most transmissible of all the blood-borne viruses, but it can be prevented by vaccination. The transmission risk relates to the titre of the virus present in the blood of the source patient and to the presence or absence of hepatitis B e antigen (HBeAg). A needlestick injury to a non-immune person from a patient who is e antigen positive (Hbeag present) carries a transmission risk of 30-40%. The absence of Hbeag lowers this risk considerably. Blood from patients who have titres of hepatitis B surface antigen (HBsAg) below the threshold of laboratory detection is seldom infectious. HBV is also transmissible through breaks in the skin and inoculation through mucous membranes. The virus is usually undetectable in faeces and urine, and mucosal contact with saliva appears to pose little, if any, risk; however, transmission through bites (ie, exposure of damaged mucosa) has been documented. HBV is not thought to be transmissible through inhalation of aerosolized blood.

Healthcare workers should be vaccinated against hepatitis B and should follow the guidelines for repeat antibody titre checks with subsequent booster injections if required. In the UK, it is recommended that healthcare workers have antibody levels measured every 5 years.

Post-exposure prophylaxis

Healthcare workers who are known to have adequate antibody levels do not require post-exposure prophylaxis. Unvaccinated personnel should receive HBV hyperimmune globulin within 24 hours, if possible, and recombinant HBV vaccine within the next 7 days. The former is assumed to provide passive immunity until the vaccine-induced antibodies (anti-Hbsag) appear. The use of hyperimmune globulin on its own without subsequent vaccination carries a failure rate of 5-25%. Healthcare workers who fail to mount an antibody response when initially vaccinated through occupational vaccination schemes should also receive HBV hyperimmune globulin with a second dose 1 month later. Exposed healthcare workers who follow the recommended prophylaxis regimen are unlikely to become infected. Testing of subsequent antibody levels should be delayed for 4-6 months after administration of immune globulin and vaccination. Such personnel should understand the importance of universal precautions and personal hygiene, and should be advised on ways to prevent minimal risk to their patients, household contacts and sexual partners. Referral for specialist medical care should be offered to all healthcare workers who are subsequently found to have seroconverted.

Hepatitis C virus

Risk of infection

Hepatitis C virus (HCV) is a major cause of liver disease worldwide and at least 85% of people with HCV infection become chronically infected. Of those infected with HCV, 70% develop persistently elevated liver enzymes and remain at risk for cirrhosis and primary hepatocellular carcinoma.

In the UK, the prevalence of HCV in the general population is 0.1-1.0%. HCV is therefore about 10 times less prevalent than HBV, but 10 times more prevalent than HIV, and less likely to be diagnosed than either. In the USA, the prevalence among healthcare workers, including orthopaedic, general and oral surgeons, is no greater than that in the general population, averaging 1-2%. In a single study that evaluated risk factors for infection, a history of unintentional needlestick injury was the only occupational risk factor independently associated with HCV infection. In healthcare workers who sustain a percutaneous exposure to blood from an anti-

HCV-positive patient the transmission rate is 1.8% (0-7%). One study reported that transmission occurred only with hollow-bore needles and not other sharps. Some studies have reported a higher transmission rate (6% in the USA and 10% in Japan) based on the detection of HCV RNA by polymerase chain reaction - PCR. In the UK, the Public Health Laboratory Service has 180 reported cases of occupational HCV exposure. There has been one seroconversion, making the transmission rate less than in the other reported studies.

No studies have documented transmission associated with exposure to either mucous membranes or broken skin. Transmission of HCV from blood splashes to the conjunctiva have been described. HCV RNA has not been detected in urine, faeces or saliva. Its presence in vaginal secretions or semen from patients with chronic HCV infection has been recorded, but the role of this in the sexual transmission of HCV is controversial.

Post exposure

There is no vaccine for the prevention of HCV infection. Post-exposure prophylaxis with immune globulin is no longer recommended because there is no evidence for its efficacy. Prevention of exposure is the only effective strategy.

Healthcare workers exposed to HCV should be tested immediately after exposure (serum saved) and 6-9 months later to detect antibodies and to look for evidence of hepatitis. Antibodies may appear several weeks after exposure and up to 90% of those who seroconvert will have antibodies detectable within 6 months. Infection can be detected earlier by measuring HCV RNA by PCR. The post-exposure follow-up protocol should address individual workers' concerns about their risk of HCV infection and possible disease outcomes, and should identify those who become infected with HCV. This information provides healthcare workers with the opportunity to be counselled about their risk for transmitting HCV to others (occupational, household and sexual contacts) and to be evaluated for development of chronic disease, and, if eligible, for antiviral therapy for chronic HCV infection.

HIV

The occupational acquisition of HIV is uncommon compared with acquisition by other routes. Worldwide there are less than 300 case reports of seroconversion following occupational exposure. Cases are classified as either definite (recorded negative HIV antibody test with subsequent positive result associated with a specific occupational exposure to a source of HIV) or possible (this definition varies between countries but usually centres around there being 'no other risk factor other than occupational exposure

identifiable'). The risk of occupational acquisition depends on the following:

- population prevalence
- nature of the work of the health provider
- method of transmission
- type of injury
- host and viral factors.

Population prevalence: surveillance systems for monitoring occupationally acquired HIV have been developed in many countries. Unfortunately, the most developed systems are found in countries in which the prevalence of HIV infection is low. Figure 1 summarizes all reported occupationally acquired HIV infection by country. Over 94% of all occupationally acquired infections were from countries with well-developed surveillance systems, in most of which the prevalence of HIV is low. Only 5% of definite cases were reported from African countries, and seven of the eight healthcare workers reported from the UK with possible occupationally acquired HIV had worked in African countries with a high HIV prevalence. The paucity of information from Africa, the Indian subcontinent and South East Asia makes it impossible to evaluate the risk of acquiring HIV infection occupationally in these areas.

Figure 1. Reported occupationally acquired HIV infections in healthcare workers and AIDS cases by country

Country	Estimated number living with HIV or AIDS	Definite	Possible acquisition	Total
- France	110.000	11	29	40
- Spain	120.000	5	-	5
- Italy	90.000	5	1	6
- Germany	35.000	3	22	25
- UK	25.000	4	8	12
- Belgium	8.000	2	1	3
- Switzerland	12.000	2	-	2
- Netherlands	14.000	-	2	2
- Denmark	3.000	-	1	1
- USA	820.000	52	114	166
- Canada	44.000	1	2	3
- South America	1.300.000	1	9	10
- Asia	6.220.000	-	1	1
- Africa	21.200.000	5	1	6
- Australia	12.000	4	-	4

Nature of the work of the health provider: surgeons and dental workers account for 1% of the definite and 12% of the possible occupationally acquired cases of HIV (Figure 2). Non-surgical

doctors and medical students account for 12% of the definite and 10% of the possible cases. Nurses and clinical laboratory staff account for 71% of the definite cases and 43% of the possible cases.

Method of transmission: HIV is not contagious and therefore transmission does not occur through casual or social contact. Percutaneous exposure to HIV-infected blood is the main route of occupational transmission. The average risk of transmission following such exposure is 0.32% (22 in 6955 exposures). Contact with broken skin and mucous membranes, including the eye, carries a lower estimated risk of 0.03% (91 in 2910). Biological materials that are considered to be high risk are indicated in Figure 3. At present there is no evidence to suggest that any other route of administration (eg, aerosol exposure) is a risk to healthcare workers.

Type of injury: HIV is of low infectivity compared with other blood-borne viruses. The severity of the injury, size of the inoculum and viral load in the source are considered to be factors that affect transmission. Deep injury, and injury with a needle used in a vessel, particularly where there is visible blood, increase the likelihood of a larger inoculum of blood entering the recipient.

Figure 2. Occupation of those with occupationally acquired HIV infection (1997)

Occupation	Definite acquisition	Possible	Total
- Nurse/midwife	50	62	112
- Non-surgical doctor/med student	11	20	31
- Surgeon	1	14	15
- Dentist/dental worker	-	9	9
- Clinical laboratory worker	17	21	38
- Ambulance/paramedic	-	10	10
- Non-clinical laboratory worker	3	3	6
- Embalmer/mortuary technician	-	3	3
- Surgical technician	2	3	5
- Dialysis technician	1	3	4
- Respiratory therapist	1	2	3
- Health aid/nurse aid/attendant	1	15	16
- Housekeeper/porter/maintenance	2	8	10
- Other/unspecified	6	18	24

Host and viral factors: with all modes of transmission, the donor stage of disease, the amount of viral RNA in the blood, the levels of circulating infected cells and anti-retroviral therapy are important factors. The higher the viral load in the source (uncontrolled HIV, AIDS at the time of seroconversion) the greater

the concentration of virus transferred and the greater the risk of transmission.

Post-HIV-exposure prophylaxis

If post-exposure chemoprophylaxis is to be considered, it should preferably be initiated within 1 hour of exposure. Healthcare workers should have immediate, 24-hour access to advice on prophylaxis and to appropriate support for the stress associated with the situation. Although local arrangements vary, once exposure has occurred the contacts are usually through casualty, occupational health, virology or microbiology departments. Experienced personnel can estimate the likelihood of transmission and rapid decisions on future management can be made. Such a systematic approach should also include early testing of the patient for HIV and hepatitis (consent is required) and regular testing of the employee for 6 months after exposure. The protocol used in the Oxford Radcliffe Hospitals Trust in the UK is shown as an example (Figure 4) and further information about the development of such protocols may be obtained from the author.

Management of occupational exposure

Prevention

The best way to prevent occupational exposure is to increase the perception of risk. Patients may be unaware of, or choose not to divulge, their HIV or hepatitis status. Seropositivity for these blood-borne viruses is not restricted to certain groups, nor is it necessarily identified by clinical assessment. Adopting a policy of universal precautions eliminates the danger of poor infection control practice in the case of individuals who are not perceived to be at risk of hepatitis and HIV infection. Despite universal precautions having been recommended in the UK for several years, most cases of occupational exposure occur as a result of injury from needles left lying around, passing needles to colleagues by hand or from not using needle holders.

Figure 3. Body substances presenting a risk of HIV infection

- Blood, including any blood-stained body fluid
- Semen
- Female genital tract secretions
- Amniotic fluid
- Breast milk
- Peritoneal fluid
- Synovial fluid
- Saliva in context of dental work
- CSF
- Unfixed tissues and organs.

Universal precautions include appropriate protective clothing (gloves, masks and eyewear) and rational procedures for handling sharp instruments, contaminated equipment and blood spillages. For surgical staff participating in exposure-prone procedures, additional strategies include:

- wearing two pairs of gloves and impervious gowns
- close supervision of inexperienced personnel
- no hand-to-hand passing and minimized use of sharp instruments
- no hand retraction of tissues
- where possible, only a single operator's hands within a wound.

Post exposure

All institutions should have local policies and protocols for the management of occupational exposure. Education of personnel is the key to the success of such strategies. All new staff should be made aware of the policies. It is recommended that protocols are clearly posted in each department and should include an immediate first aid protocol as well as a protocol dealing with the notification of employee representatives.

In the event of accidental exposure to body fluids or tissues, the incident should be recorded, and a risk assessment should be initiated as a matter of priority.

Figure 4. Needlestick injury and accidental exposure to high-risk body fluids chart.