

Siobhan Rankin



in harms' way: protecting ourselves against bloodborne pathogens

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This article is an edited and condensed version of the first Siobhan Rankin Memorial Lecture given by Professor Robert Pratt at the National Association of Theatre Nurses 38th Annual Congress in Harrogate in October 2002. Siobhan was Chairman of the NATN and died suddenly and unexpectedly on April 22, 2002 while fulfilling her international duties in California. She is greatly missed and affectionately remembered by all her colleagues in the Association.

Introduction

Exposure to blood and other body fluids during patient care activities puts nurses and midwives at significant risk of serious infection with bloodborne pathogens (BBP). Patients may also be at risk if exposed to blood from another patient or from a nurse or other healthcare provider (HCP). The consequences of infection can be dire and may result in severe chronic illness and death.

In this article, I'll briefly describe the range and prevalence of BBP that may be encountered in clinical nursing practice, identify factors that increase the probability of occupational exposure and define the risk of transmission and infection following an exposure. I'll then discuss how exposures and infections may be prevented and identify a range of current resources that nurses can easily access to keep informed of the latest research and recommendations in this field. Next, I'll describe the management of an exposure, including immediate first aid and any available chemoprophylaxis. Finally, I'll briefly outline the issues surrounding nurses and midwives who are infected with chronic BBP and how this may affect their own clinical practice.

Bloodborne Pathogens (BBP)

Various BBP may be encountered during clinical practice (Box 1), but in the United Kingdom (UK) the three most frequent are the human immunodeficiency virus (HIV) and two distinct hepatitis viruses – hepatitis B virus (HBV) and hepatitis C virus (HCV). HIV infection leads to progressive chronic illness and end-stage disease (acquired immunodeficiency syndrome 'AIDS') and both HBV and HCV acquisition can lead to persistent infection, chronic liver disease, cirrhosis and liver cancer. This article will focus on these three bloodborne viruses.

Other infectious microorganisms may be found in blood and other body fluids during both acute and chronic illness and in persons with asymptomatic or sub-clinical infections.

Prevalence of BBP in Clinical Practice

During the last 22 years the global pandemic of HIV infection and AIDS continues to accelerate with more than 40 million people worldwide now living with HIV disease.⁽¹⁾ At the end of June 2002 there had been

51,081 reports of individuals with diagnosed HIV infection in the UK. Of these, 29% had died and 36,259 persons are currently living with HIV disease.⁽²⁾ In addition, just under 1000 persons are diagnosed each year in the UK with HBV infection and a further 0.5% of the general population in England have been infected with HCV.⁽³⁾ By comparison with many other European Union member states, the prevalence of these infections is low in the general population in the UK but is often higher in patient populations in large

Box 1: Bloodborne Pathogens (BBP)

Pathogen

Hepatitis B Virus (HBV)
Hepatitis C Virus (HCV)
Human Immunodeficiency Virus (HIV)
Human T-cell leukaemia- lymphoma virus type I (HTLV-I)
Treponema pallidum

Potential Clinical Outcomes of Infection

Acute and chronic hepatitis, primary liver cancer
Chronic hepatitis, cirrhosis, primary liver cancer
Acquired Immunodeficiency Syndrome (AIDS)
Adult T-cell leukaemia/lymphoma (ATLL), HTLV-I-associated myelopathy (tropical spastic paraparesis) (HAM/TSP)
Syphilis

Box 2 – Factors Increasing the Risk for BBP Exposure in Nursing Practice

- frequency of contact with blood and body fluids in the workplace
- extent to which nurses adhere to infection prevention precautions
- prevalence of BBP in the general population and population subgroups who access care
- type of medical or surgical procedures performed
- circumstances under which these procedures are performed, e.g., emergency or elective
- type of medical or surgical device used and the likelihood that these devices could produce parenteral or mucous membrane exposure
- technical expertise of the nurse
- length of time a nurse has practised

metropolitan areas and in some sub-populations, such as injecting drug users.

The first important point to make is that it is never possible to reliably identify all those persons who are infected with BBP from their history, clinical and serological examination. Consequently, everyone working in healthcare needs to assume that the **blood and body fluids from all patients are potentially infectious and take appropriate precautions at all times with all patients to avoid exposure.**

Risk Factors for Exposure

Several factors can increase the likelihood that nurses and other HCP may become exposed to BBP during clinical practice (Box 2). However, the most important risks are the frequency of contact with blood and body fluids than those in the workplace and the degree to which individuals consistently adhere to infection prevention precautions designed to minimise the risk of exposure to these substances.⁽⁴⁻⁸⁾

Nurses working in certain specialities, e.g., haemodialysis, accident and emergency (A&E) departments, intensive care units, operating theatres, and midwives, are potentially more likely to come into contact with blood and body fluids than those in general wards or in community and primary care. Emergency procedures are more frequently associated with exposures than are carefully planned elective procedures carried out in a controlled environment. The longer a nurse or midwife has been in practice, the more time they have had to become exposed. Using invasive medical devices, e.g., vascular access devices, increases the potential for exposure. Finally, the technical expertise of the practitioner is important in avoiding exposure; the inexperienced being the most vulnerable (and requiring the most supervision).

Likelihood of transmission and infection following exposure

There are a variety of exposure-specific and biological factors that influence the likelihood of transmission following exposure (Box 3).

Type and characteristics of exposure

Two general types of exposure occur. **Percutaneous exposure** is where the skin is cut or penetrated by a needle or other sharp object, e.g., scalpel blade, trochar, bone spicule. **Mucocutaneous exposure** is where the eye(s), inside of the nose or mouth, or an area of non-intact skin is exposed, usually by splashing or spilling incidents.

Percutaneous exposures carry the greatest risk. In addition, percutaneous exposures which involve **fresh blood and hollow needles** are significantly associated with the greatest risk of viral transmission.

The characteristics of the exposure, e.g., type of wound, depth of injury, type of instrument, amount of blood contamination, may also be associated with the likelihood of infection. Deep injuries, visible blood on sharp devices, and injury from vascular access devices are all associated with a higher risk of viral transmission following percutaneous

injury.⁽⁹⁾ The type of body fluid is also important, **fresh blood being the single most important risk.**

Box 3 – Factors Increasing the Risk for BBP Transmission Following Exposure

- type of exposure: percutaneous or mucocutaneous
- characteristics of the exposure
- type of body fluid exposed to
- volume of the inoculum
- concentration of virus in inoculum
- virus specific factors

Box 4 Probability of infection following percutaneous exposure to BBP⁽¹¹⁻¹⁵⁾

Virus	Risk of Infection
Hepatitis B Virus (HbsAg-postive)	HbeAg-negative: 5% HbeAg-positive: 19%-30%
Hepatitis C Virus	1.8% - 3.3%
Human Immunodeficiency Virus	0.31%

Biological factors

Various biological factors are important and, in general, the greater the volume of the inoculum the greater the risk of viral transmission. The concentration of virus (viral load) in the inoculum is also important and the highest concentration is usually found in blood and bloody body fluids. Different patients have different and variable plasma viral loads at any moment in time and the higher the viral load in the source patient, the higher the risk of transmissions. Different strains of a particular virus may be more virulent and infectious, e.g., HBV associated with 'e' antigen. Some strains of HIV may also be drug-resistant, limiting the effectiveness of some antiretroviral drugs commonly used for post-exposure chemoprophylaxis (PEP).

Probability of infection following exposure

The estimated likelihood of becoming infected with a BBP following a single percutaneous exposure to blood or bloody body fluids from a patient known to be infected has been calculated (Box 4). Although the focus of this article is to alert practitioners to identify the potential for occupational transmission of BBP and develop effective strategies to reduce these events, the reality of the risk needs to be kept in perspective. For example, **most percutaneous exposures to HIV (99.7%) do not result in viral transmission.**⁽¹⁰⁾ Epidemiological studies have indicated that the average risk for HIV transmission after percutaneous exposure to HIV-infected blood in healthcare settings is about 1 per ever 319 exposures.^(9,11,12) However, the risk is likely to be greater if nurses and other HCP are exposed to large volumes of blood from a source patient who has a high HIV RNA viral load.

Percutaneous exposure to blood from a patient with active HBV disease and who is also 'e' antigen positive

and who has a high HBV DNA viral load is associated with a high risk of transmission and subsequent infection in susceptible persons. At the upper extreme of probability, 1 out of every 3 exposures may result in transmission.^(11,13,14) Percutaneous exposure to HCV is associated with a higher risk of infection than HIV exposure but significantly less than HBV exposure, with approximately 1 out of every 30 HCV exposures resulting in infection.^(11,14,15)

Although mucocutaneous exposures have been implicated in viral transmission in healthcare settings, the risk of this happening is less well-defined but it's certainly less than the risk following percutaneous exposure. There is no evidence to indicate that contact with blood or body fluids with intact skin presents a risk of BBP transmission. However most nurses, midwives and other HCP do not have intact skin on their hands, especially in the area of their fingernail beds.

Standard Principles for Preventing Exposure and Infection

Accepting that all blood and body fluids from all persons are always potentially infectious and then consistently adhering to current evidence-based guidelines for preventing healthcare-associated infections (HAI) offers the best protection against exposure and subsequent infection.^(4,5) Preventing needlestick and sharp injuries and other parenteral exposures, along with the judicious use of gloves for procedures where contact with blood, body fluids or mucous membranes is anticipated is at the very core of universal infection prevention precautions. As these recommendations have evolved, they are now referred to as 'Standard Principles for Preventing HAI'^(4,5) and some of the salient recommendations focused on preventing exposure to BBP including recommendations

THEATRE

Box 5 – Standard Principles for Preventing Exposure to BBP ^(4,5)

Hand Hygiene

- Hands must be decontaminated immediately before each and every episode of direct patient contact.
- Hands must be washed if they are visibly or potentially contaminated with dirt or organic material.
- Alcohol-based hand rub may be used to decontaminate hands between caring for different patients and different caring activities for the same patient.
- Effective technique ensures thorough hand decontamination and protects skin integrity.

Gloves

- Gloves must be worn for invasive procedures, contact with sterile sites, and non-intact skin, mucous membranes, and all activities that have been assessed as carrying a risk of exposure to blood, body fluids, secretions and excretions; sharp or contaminated instruments.
- Gloves must only be worn once, for one aspect of care and one patient.
- Dispose of gloves as clinical waste and decontaminate your hands following their removal.

Aprons and Gowns

- Disposable plastic aprons should be worn when there is a risk that clothing or uniform may become exposed to blood, body fluids, secretions and excretions, with the exception of sweat.
- Full body fluid-repellent gowns should be worn where there is a risk of extensive splashing of blood, body fluids, secretions and excretions, with the exception of sweat, onto the skin of HCP.

Face Mask and eye protection

- Face masks and eye protection should be worn where there is a risk of blood, body fluids, secretions and excretions splashing into the face and eyes.

Sharps and Needles

- Do not pass sharps from hand to hand and keep handling to a minimum.
- Do not bend or break needles, recap or disassemble needles and syringes by hand prior to disposal.
- Used sharps must be discarded at the point of use into a sharps' container (conforming to UN3291 and BS7320 Standards).

Box 6 Exposure Prone Procedures (EPP) ^(6,18)

EPP are those where there is a risk that injury to the HCP may result in the exposure of the patient's open tissues to the blood of the HCP. These include procedures where the HCP gloved hands may be in contact with sharp instruments, needle tips and sharp tissues (spicules of bone or teeth) inside a patient's open body cavity, wound or confined anatomical space where the hands or fingertips may not be completely visible at all times.

Nursing: General nursing procedures do not include EPP but the duties of operating theatre nurses, nurses practicing in A&E departments and haemodialysis units should be considered individually.

Midwifery: Simple vaginal delivery and the use of scissors to make an episiotomy cut are not exposure prone. Infiltration of local anaesthetic prior to episiotomy, suturing of an episiotomy and attaching sharp scalp electrodes to baby's head are considered exposure prone.

Operating Department Assistants/Technicians: General duties do not normally include EPP.

from the Health and Safety Commission,⁽¹⁶⁾ are listed in Box 5.

Additional, more specific recommendations pertaining to protection against BBP in a variety of clinical practice areas, e.g., operating theatres, haemodialysis units, have been published by the Department of Health and are downloadable from their website.^(7,8,17,18) Further guidance on standard principles for infection prevention and control are listed in the websites for references.^(5,6)

Management of Occupational Exposures to BBP Immediate first Aid

Immediately following any exposure incident, the site of the exposure should be washed liberally with soap and water but without scrubbing. There is no evidence that antiseptic/disinfectant skin preparations are more effective than soap and water in this situation and they're probably best avoided as their effect on local defences

is unknown. Free bleeding of the puncture wounds is 'gently' encouraged. Exposed mucous membranes, including conjunctivae, should be irrigated copiously with water, before and after removing any contact lenses.⁽⁹⁾

In addition to immediate first aid, medical advice should be immediately sought so that the need for any additional preventative measures can be assessed and serological testing of both the source patient and baseline serology of the nurse can be considered. In general, source patients can only be tested with their informed consent. Medical advice is usually accessed through the Occupational Health(OH) services or the A&E department. Every exposure incident needs to be reported to management, documented and thoroughly investigated.

Exposure incidents are psychologically traumatic for nurses and other HCP and counselling support needs to be available. This is frequently accessed from OH.

Active and/or passive immunisation or post-exposure chemoprophylaxis (PEP) helps reduce the risk of infection and is available following exposure to HBV and HIV but not for HCV.

Hepatitis B

All nurses, midwives and other HCP (including students) who work in NHS clinical areas where they may have direct contact with blood and other body fluids, perform exposure prone procedures (EPP) (Box 6) or who are at risk of injury from blood-stained sharp instruments, are required to be immunised against HBV infection.⁽¹⁷⁾ The vaccine is normally given intramuscularly in the deltoid region but not in the buttock as this may reduce vaccine efficacy.⁽¹⁹⁾ Antibody levels (titres) should be checked following vaccination and a booster is usually given every 5 years if antibody titres fall below 100 mIU/ml. Specific hepatitis B immunoglobulin (HBIG) may be used for passive protection in unvaccinated persons or those who did not respond to vaccination. Currently, there are no specific anti-Hepatitis B antiviral drugs that are recommended to be given following exposure (PEP) to abort infection.

Hepatitis C

Unfortunately, there currently is no vaccine or PEP available to prevent infection following exposure to HCV.

HIV Infection

Although there is no vaccine to prevent illness following exposure and infection with HIV, PEP with a combination of antiretroviral drugs is very effective in reducing the risk of HIV infection. Current guidelines recommend that if an initial assessment indicates that a significant exposure has occurred, the source patient should be tested and PEP recommended.^(20,21) A significant exposure usually means being exposed to blood or another high risk body fluid from a patient or other source either known to be HIV-infected, or considered to be at high risk of HIV infection, but where the result of an HIV test has not or cannot be obtained, for whatever reason.⁽²⁰⁾

For optimal efficacy, PEP should commence as soon as possible after the incident and ideally within the hour. There may be circumstances where it is appropriate that the exposed worker is offered the initial doses immediately pending fuller discussion and risk assessment as soon as practicable. Starter packs of PEP drugs need to be kept in a number of readily accessible and well advertised places, e.g., OH, Pharmacy, A&E, specified wards or departments.

A combination of antiretroviral drugs are prescribed for 4 weeks. Pregnancy does not preclude the use of HIV PEP. More detailed information about PEP regimens, antiretroviral drug side-effects, drug interactions and other issues associated with PEP can be found in the UK Departments of Health HIV PEP Guidance which is downloadable from the web.⁽²⁰⁾

Infected Nurses, Midwives and other HCP

Although the risk of occupational infection with BBP is low, it has occurred and nurses, midwives and other HCP have become infected as the result of an exposure incident. Additionally, all healthcare providers are as vulnerable to infection with bloodborne viruses as anyone else in the community as a result of their own social and sexual behaviour and other risk factors and are more commonly infected in their personal lives rather than during professional practice.

All professional ethical guidelines stress the primacy of the patient's interest which recognises that nothing should ever be done by HCP which could put their patients at risk, no matter how low that risk is. Consequently, all nurses and other HCP who believe that they may have been exposed to a BBP, regardless of the circumstances, need to seek competent medical advice and diagnostic serological testing, if appropriate. If found to be infected, they need to remain under the supervision of the OH service and specialist medical services as they will frequently require long-term follow-up.

Nurses and Midwives and all other HCP who are infected with a BBP may continue in professional practice. However, depending on their infection status, they may be restricted from performing EPP (Box 6). Specific restrictions for infected HCP are related to the particular infection.

HBV Infection

Nurses, midwives or other HCP who perform EPP and who test positive for HBV surface antigen (Hbs-Ag-positive) but are 'e' antigen negative (Hbe-Ag-negative) need to have their HBV DNA viral load tested every 12 months. If this doesn't exceed 10^3 (i.e., 1000) genome equivalents per ml, they need not be restricted from performing EPP. If it rises above 10^3 genome equivalents per ml, they must cease to perform EPP.

All nurses, midwives and other HCP who test positive for HBV 'e' antigen (Hbe-Ag-positive) must not perform EPP, regardless of their viral load.⁽²²⁾

HCV Infection

Nurses, midwives and other HCP who have been infected with HCV will test positive for HCV antibodies (HCV-ab-positive) but not all of them will

have ongoing active infection. This is determined by testing their plasma for HCV RNA. Those found to be HCV-RNA-positive are not allowed to perform EPP. However, if following antiviral therapy they revert to HCV-RNA-negative and remain so 6 months later, they may be allowed to return to performing EPP.⁽²³⁾

HIV Infection

HIV-infected nurses, midwives and other HCP must not perform EPP.⁽⁷⁾

Conclusion

Although the risk of becoming infected with a BBP during clinical nursing or midwifery practice is low, it's real. Consistently following the guidance described in this article and in the associated website references will reduce this risk even further. If an accident does happen, the recommendations for managing an occupational exposure will also reduce the risk of infection. Finally, if infection does occur, nurses need to be aware of potential restrictions on their clinical practice.

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