Exposure to Human Immunodeficiency Disease. What Precautions for the Healthcare Professional?

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Background: The Human Immunodeficiency Virus (HIV) epidemic is more pronounced in sub-Saharan Africa. The ever-increasing prevalence of HIV infection and the continued improvement in clinical management has increased the likelihood of these patients being managed by healthcare workers. The aim of the review was to assess current literature on the risks of transmission of HIV infection and protection of the healthcare worker.
Methods: A literature review was performed using MEDLINE articles addressing 'human immunodeficiency virus', 'HIV', 'Acquired immunodeficiency syndrome', 'AIDS', 'HIV and Surgery'. We also manually searched relevant surgical journals and completed the bibliographic compilation by collecting cross references from published papers.
Results: Transmission is by contamination with body fluids for example needle-stick injury and blood splashes. The risk of HIV transmission from patient to healthcare worker always exists. The risk of transmission is very small and depends on the type of discipline and type of procedure. Hollow needles are more dangerous than suture needles. Sero-conversion is, however, very minimal. Universal precautions are emphasised. In case of needle-stick injury or splash it is important that affected healthcare workers take post-exposure prophylaxis.
Conclusion: Occupational HIV transmission is lower than that for other infections. However, protection of all health care personnel should be the prime objective. Universal infection control guidelines must be accepted and strictly enforced. A prompt response to blood contact is crucial and post-exposure prophylaxis is essential.

Introduction

Infection with blood-borne pathogens such as human immunodeficiency virus (HIV), Hepatitis B virus (HBV) and Hepatitis C virus (HCV) and Coxsackie B has long been recognised as an occupational risk for healthcare workers, particularly surgeons [1-4]. Because of the ever-increasing prevalence of HIV infection, healthcare workers are becoming more involved in the care and management of a variety of disorders in this population [5,6] and the number of HIV-infected patients, both known and unknown, presenting for treatment is increasing [7].

This review addresses the prevalence of HIV infection, risk of transmission of HIV infection and ways of protecting healthcare workers from infection with HIV. As the operating room is the area most highly exposed to body fluids, more attention is paid to it in this review.

Prevalence of HIV Infection in the Population

In 2008 the World Health Organisation (WHO) estimated that there were approximately 33 million people in the world infected with HIV. It was estimated that 4.9 million new infections occurred and that there were 3 million deaths due to AIDS [8]. In South Africa the HIV prevalence rate in the population was 11% in 2004, with a slightly higher rate among women [9] and the infection rate among pregnant women attending antenatal services in 2006 was 29.1% [8]. The hospital prevalence for HIV in general surgical populations varies from 0.3% to 24% [6,10]. According to the 1993 report by the Centres for Disease Control and Prevention (CDC) [11] the proportion of "AIDS" among healthcare workers was similar to the proportion among the general population. The criticism of the CDC data is

that they did not differentiate between HIV infection and AIDS and both are categorised under the term "AIDS".

Risk of transmission

HIV transmission can be due to exposure to body fluids, the most important of which is blood [2,3]. The causes of exposure are puncture by sharp objects (such as needles, scalpels, and bone fragments), blood splash and body fluid contamination [2,3].

The risk of HIV transmission from patient to healthcare worker is far greater than the risk from healthcare worker to patient [12,13], with only two cases of transmission from healthcare worker to patient having been reported [11,13]. The risk for surgeons remains extremely small but greater than that of non-operating clinicians and other healthcare workers [4,11,14-20]. Patient-to-patient transmission of HIV has been described but it remains uncommon and is probably related to breaches in infection control [21-25].

The most common exposure to patient's blood is from blood contamination and needle-stick injuries [2,4,26]. Blood contamination may be due to blood splash or glove perforation, which may itself be caused by needle-stick injury or factory defects. As glove punctures are often minute, the surgeon is not always aware of the occurrence [16]. The risk of blood contamination by splashes is directly associated with various factors including type of surgical specialty, type of procedure, procedure duration, blood loss and emergent case status as well as the use of fingers rather than an instrument to hold the tissues [4,9,16,18,21,27-35]. Surgeons are particularly prone to blood splashes during certain procedures such as drilling [36] and in procedures associated with a lot of blood splashes [36].

Irrespective of specialty or procedure performed, suture needles are the leading cause of sharps injuries in operating rooms and delivery rooms and the second leading cause in hospitals overall [10,32,37,38]. Hollow needles transfer more blood compared to solid (suture) needles and, in both types of needles, increasing the needle size and the depth of injury leads to an increase in the inoculum [2].

There are various predisposing factors for s needle-stick injuries namely: inadequate assistance and excessive adipose tissue [30], major operations involving use of the mass closure technique [30,39,40], holding tissues while suturing or cutting [37], suturing deep in the pelvic areas where the surgeon cannot see what he is doing [36] and manipulation of instruments deep within the wound or during wound closure [30,41]. Most of the needle-stick injuries to the hand and leading to glove perforations are self-inflicted [30,41]; they occur mainly on the digits (84%) followed by digital inter-phalangeal crease (80%)[16,42] and most occur on the palmer surface of the index finger of the surgeon's non-dominant hand [15,16,33,40-45].

The average risk of sero-conversion after a needle-stick injury with infected blood is 0.3% - 0.5%[3,6,16,24,26,46]. While some authors have estimated the risk of sero-conversion following mucous membrane contact at 0.09% [47], more recent estimates suggest that the sero-conversion rate for mucous membrane is similar to that of percutaneous injury [48,49]. A surgeon's cumulative lifetime risk of sero-conversion is estimated to be as high as 1-10% [16,24].

Protection of the health-care professional

The only way to reduce the cumulative risk of occupational HIV infection is to reduce the number of injuries as the sero-prevalence of HIV in the surrounding population cannot be influenced by the healthcare professionals [7]. The principles of exposure prevention consists of (i) the use of personal protective equipment, and (ii) work practice and engineering controls [37]. The adoption of universal precautions by all healthcare workers is one way of achieving this [50,51].

These Universal Precautions can be achieved by (i) routine use of appropriate barrier precautions and techniques to reduce the likelihood of exposure to blood and other body fluids, (ii) washing hands and skin surfaces immediately after contamination, (iii) avoidance of recapping, bending or removal of needles, and (v) refraining of healthcare workers with exudative lesions or weeping dermatitis from direct patient care [51].

Protective equipment includes impervious garments, double gloving and eye protection. Impervious garments are preferable to pervious garments; disposable gowns and drapes are more secure barriers than woven cloth [7,18,52]. Whereas surgical gloves are impermeable to viruses, they do not prevent needle-stick injury [2,16,20,41,53,54], although they can significantly decrease the amount of blood conveyed by suture needles [2]. Double gloving has a proven record of reducing the incidence of glove perforation [2,6,10,16,34,44,54-57]. As there is a potential risk of virus transmission via conjunctiva, mucous membranes and minor facial lesions (e.g. after shaving), these must be covered as much as possible, using masks and eye protection by goggles or visors to prevent contact of blood stained body fluids with conjunctiva [1,7,33,58]; ordinary eye glasses are not protective [1,52].

Changes in surgical practice to reduce blood contamination or needle-stick injury can be achieved by adapting the operative technique. Surgeons should operate carefully and methodically and surgery should not be rushed [50]. The needle should be grasped with instruments, rather than by the finger; when resetting the needle in the needle-holder, the operator should avoid passing the suture needle toward the non-dominant hand or toward an assistant's hand; retracting tissues manually should be avoided and, when sewing in a bloody field, surgeons should not grope for a sharp needle to identify its location [37]. Dissection using the blunt end of sharp instruments such as scalpels is discouraged [7]. Blunt-tip needles have been shown to be effective in reducing the likelihood of suture-related injuries [4,16,37,38,40,59]; they are sharp enough to pierce internal tissues such as muscle and fascia, but generally not sharp enough to pierce skin. Scissors, diathermy and blunt retractors should be encouraged [33]. The adoption of the so-called neutral zone between surgeon and scrub nurse in which surgeon and nurse do not touch the same sharp instrument at the same time is recommended [16,50]. Other methods of replacing sharp instruments is the use of adherent drapes to avoid towel clips, blunt forceps instead of classic sharp surgical forceps vascular clips for vessel ligation, staplers for bowel surgery as well as electro-cautery and Argon beam coagulator [7,37,40,60]. Involvement of a second surgical team to relieve fatigued surgeons during long procedures is advised [4,59]. Glass ampoules should be avoided or replaced by removable covers that do not require breaking glass [61]; alternatively all glass items should be substituted by plastic [62]. Other more recently developed alternatives include use of safety engineered devices such as needle-less devices and shielded or retractable needles or blades [38].

Barriers to compliance

Barriers to compliance with universal precautions include familiarity with needle-stick and cutting injuries during operations to such an extent that they have more or less accepted them as unavoidable [7,50,63], the forgetting of safety protocols during crucial times such as resuscitation [7,63], variable acceptance of double gloving and eye protection by surgeons [9,64,65], discomfort and loss of sensitivity in the fingers [44] and the under-estimation of sero-conversion rates [64]. Furthermore healthcare workers rarely report needle-stick injuries even when they know that the patient is HIV-infected [64,66]. Resources for the protection of healthcare workers especially at government hospitals are severely lacking as demonstrated in many African countries [67].

Screening of patients

Screening of patients, although previously proposed, [7,20], is no longer regarded as an option, the reasons being that compulsory HIV testing (i) does not work in emergencies, (ii) it does not cater for false negative window period prior to antibody positivity and (iii) it may be regarded as social discrimination and may lead to breaches of confidentiality [7,28,36,50,68]. The decision to operate or not

should not take into account the HIV status of the patient [36,69,70]. Furthermore the adoption of universal precautions for all healthcare workers would resolve all these problems.

In the event of exposure

In the event of exposure the exposure site should be vigorously washed with soap and water [69,71]. Exposed mucous membranes (nose, mouth, and conjunctiva) should be flushed with copious quantities of clean water, 0.9% sodium chloride or sterile irrigants appropriate for these membranes [71]. Secondly the exposure should be reported to an infection control person as soon as possible, followed by screening for HIV status on both the healthcare werkers and the patient within 24 hours in order to document the infection for both medical and legal reasons [69]. Consideration should then be made to taking post-exposure prophylaxis (PEP).

The first dose should always be offered as soon as possible after exposure. Once commenced, the full PEP should be taken unless there are specific reasons to stop and the recommended duration is 28 days[72] . Post-exposure follow-up of the healthcare workers regarding possible HIV sero-conversion is paramount; the CDC recommends follow-up testing at 6 weeks, 12 weeks, and 6 months [71]. healthcare workers should be counselled about expected adverse events and the strategies for managing these; they should also be advised that PEP is not 100% effective in preventing HIV sero-conversion [73]. It should be recognised that patients who test negative for HIV may be in the window period and the healthcare worker needs to continue taking prophylaxis.

Conclusion

The HIV pandemic is likely to continue for sometime. Healthcare professionals will continue to treat HIV infected patients. Prevention of HIV transmission requires education of all H healthcare workers and health managers about adherence to Universal precautions.

The universal infection control guidelines must be accepted and strictly enforced from top leadership down. Better protection of all health care personnel should be the prime objective through modification of operational practices. A prompt response to blood contact when it does occur is crucial and post-exposure prophylaxis is essential.

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