Prevent the Occurrence of Bloodborne Disease Transmission Associated with Unsafe Injection Practices

ABSTRACT

Lapses in basic safe injection practices and infection control expose patients to needless risk of transmission of bloodborne pathogens. The Centers for Disease Control and Prevention and U.S. public health officials identified 51 reports of outbreaks of hepatitis B virus and hepatitis C virus infection primarily associated with unsafe injection practices in patients in the United States from 1998 through 2009. Of the 75,000 patients who were placed at risk, 620 became infected or died as a result of exposure. Events of unsafe syringe reuse reported to the Pennsylvania Patient Safety Authority from 2004 through 2010 were associated with delivery of injectable medications during surgery, vaccinations, and bedside care. This article describes approaches to integrate safe injection strategies into clinical practice and explains the key components of an infection prevention program, including dispelling the misperceptions associated with unsafe injection practices, increasing the awareness of safe injection practices, and oversight of compliance with safe injection practices. (Pa Patient Saf Advis 2011 Jun;8[2]:70-6.)

INTRODUCTION

Outbreaks of hepatitis B virus (HBV) and hepatitis C virus (HCV) infection in patients across the nation have been associated with unsafe injection practices. Lapses in basic infection control expose patients to needless risk of transmission of bloodborne pathogens.[1] The Centers for Disease Control and Prevention (CDC) and U.S. public health officials identified 51 outbreaks of HBV and HCV infection from July 1998 through June 2009. More than 75,000 patients were notified of potential exposure and at least 620 patients became infected or died with HBV or HCV as a result of exposure. The outbreaks were identified in a variety of healthcare settings, including hospitals, long-term care facilities, outpatient clinics and ambulatory surgical facilities, and hemodialysis facilities.[2,3]

These numbers may represent only a fraction of actual cases. Many outbreaks and sporadic transmissions go unrecognized.[4] Identifying epidemiological links to a common healthcare provider or facility is complicated by an incubation period of up to six months, during which a patient may have multiple healthcare encounters,[2] and by the high proportion of patients with new HBV or HCV infections who are asymptomatic or have mild nonspecific symptoms.[4]

Investigations of the healthcare-acquired outbreaks by CDC and state and local health departments have resulted in malpractice suits filed by patients, referral of providers to licensing boards for disciplinary actions, and the revocation of medical and nursing licenses.[4]

Strategies that can be applied to reverse the frequency and magnitude of the transmission of bloodborne pathogens caused by unsafe injection practices include (1) dispelling misperceptions surrounding unsafe injection practices, (2) increasing the awareness of safe injection practices, and (3) oversight of compliance with safe injection practices.[1]

Unsafe injection practices reported to the Pennsylvania Patient Safety Authority include the following:

> *IV propofol was injected into the IV tubing of two patients using the same syringe with the rationale that the probability of communicable disease is extremely low due to the IV port location high away from the IV site. No backflow of fluid was visible and the IV was free flowing.*
>
> *During a procedure, a patient received intravenous propofol from a syringe that had been used on the previous patient. Infectious disease [department] was consulted and recommended this patient and source patient be tested for HIV and hepatitis B and C.*
>
> *A staff person who was administering the vaccine accidentally stuck his own thumb. The patient was then administered the vaccine with the same needle.*
>
> *A patient reported that the nurse used the same syringe from another patient's IV line, drew fluid from his IV bag, and then reused the syringe to flush the other patient's IV.*
>
> *In a patient being intubated, the physician injected more fentanyl into the pulmonary artery catheter using the same syringe that had not been capped and without cleaning the infusion port.*
>
> *During administration of influenza vaccinations, the injection was given and the needle recapped. A second volunteer picked up the same syringe and vaccinated a second person.*

DISPELLING THE MISPERCEPTIONS SURROUNDING SAFE INJECTION PRACTICES

Misperceptions surrounding safe injection practices have been associated with a wide variety of procedures, including delivery of intravenous (IV), intramuscular (IM), and intradermal medications, and flushing IV lines or catheters. The delivery of anesthesia was a common factor in approximately half of the identified outbreaks. During outbreak investigation, the following breaches by healthcare personnel were identified in several categories of well-established fundamental principles of infection control:[1,2]

- Unsafe syringe reuse
- Contamination of shared medication by reused syringes
- Contamination of medical equipment, supplies, and the environment

Unsafe Syringe and Overt Needle Reuse

The dangerous practice of syringe reuse may be related to the misperception that contamination is limited to the needle device when a syringe and needle are reused. Contamination actually extends not just to the needle but also to the syringe when injections are administered by any route.[4] (See Figure.) Prevention of unsafe syringe reuse includes the following rationale:

Never use the same syringe on more than one patient, even if the needle is changed. A syringe may become contaminated because the negative pressure generated when the needle is removed may cause aspiration into the syringe of a small amount of blood remaining in the needle, even if blood is not visible.[5] Sterile injection devices, such as syringes, are single-use patient items.[6]

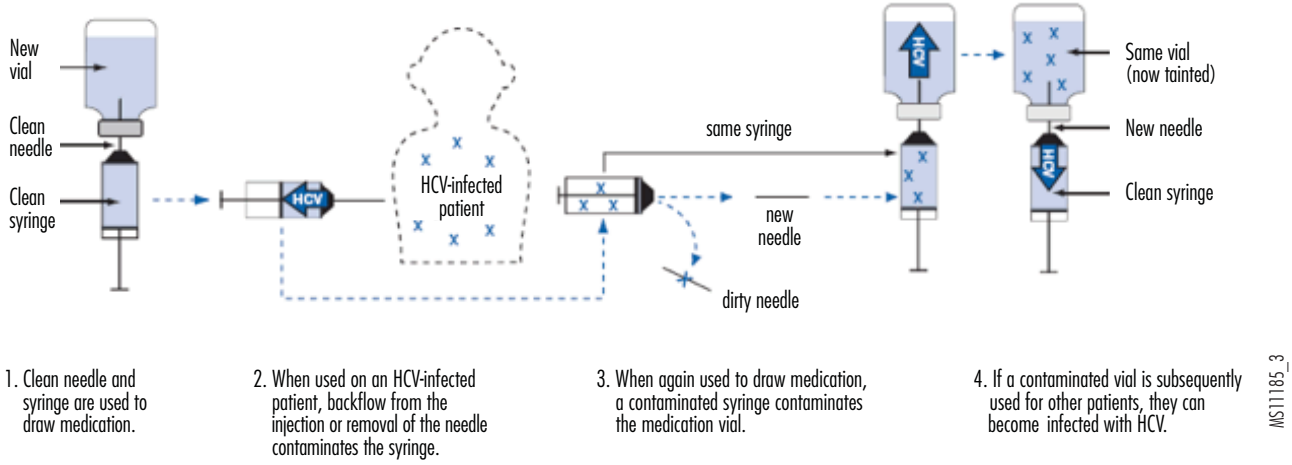
Never use the same syringe to inject more than one patient, even if the user only pushes the syringe plunger and does not draw back before injecting. A common misconception is that the syringe does not become contaminated if the plunger is only pushed to inject medications and not pulled to aspirate or withdraw.[1] Even when only positive pressure is applied, a microscopic amount of blood containing viral particles can flow back into the needle and syringe in sufficient quantities to infect subsequent patients, without visible evidence of contamination.[7]

Never use the same syringe used to draw blood or infuse meds into an IV port, including from the fluid path port that is several feet away from the IV site. The risk for syringe contamination is not eliminated by the intervening lengths of IV tubing or the presence of heparin locks or check valves.[5,7] Separation from the patient's IV by distance, gravity, or positive infusion pressure does not ensure that small amounts of blood are not present.[7]

The following steps can minimize the risk of reuse of contaminated injection equipment:[8,9]

- Remove packaging immediately before use, and prepare syringes as close to administration time as possible.
- Activate a sharps safety device as soon as a procedure is completed; this isolates the needle so that it never poses a hazard.
- Discard lancets, syringes, and needles into a designated sharps container immediately after use.

Figure. Unsafe Injection Practices and Disease Transmission



Source: Centers for Disease Control and Prevention. Acute hepatitis C virus infections attributed to unsafe injection practices at an endoscopy clinic—Nevada 2007. MMWR 2008 May 16 [cited 2011 Feb 28]. Available from Internet: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5719a2.htm.

— Use sharps safety devices whenever possible (e.g., single-use auto disabling lancets, syringes).

Contamination of Shared Medication by Reused Syringes

Restricting vials to single patient use provides an extra layer of safety to prevent patient-to-patient bloodborne pathogen transmission via contamination of medication vials. Residual content of the vial can be intentionally or unintentionally used on additional patients. The reuse of a needle or syringe to withdraw medication from a vial, IV flush, or medication diluent can transfer contaminants to the vial or fluid and has repeatedly been shown to result in transmission of HBV and HCV[4] (see Figure).

The practice of reusing a syringe for additional doses from a medication vial even for the same patient is considered unsafe as breaches in aseptic technique between doses can result in contamination of the vial. This can occur through unrecognized contact between the syringe and the patient's skin, syringe or needle contact with contaminated IV tubing or heparin lock, or putting the syringe down on a contaminated surface between doses.[1] The rationale for the adoption of practices to prevent contamination of shared medications includes the following precautions:

Never access a medication vial with a syringe or a needle that has already been used to administer medication to another patient. Even when the needle is changed and the vial is swabbed with alcohol, reusing a syringe to draw up additional medication can contaminate the vial or bag containing the medication or solution and expose subsequent patients if the bag or vial is reused.[7]

Never reuse medications packaged as a single dose vial on more than one patient. Reuse of a vial should be limited to single patients as an extra barrier against unrecognized contaminated syringe reuse or other means of vial contamination. For example, outbreaks linked to multipatient use of single-dose vials of propofol have been reported.[1]

Never use a common bag of IV solution as a source of a flush or medication diluent for more than one patient. Accessing an IV bag or medication diluent with a syringe that has already been used to flush a patient's IV or draw blood from a central line increases the number of patients who can be exposed from a single contaminant. Bloodborne pathogens can be present in sufficient quantities to produce infection in the absence of visible blood, without clouding or other visible evidence of contamination.[7]

Never pool leftover contents from multiple vials to obtain a sufficient dose. This practice increases the risk of serial contamination of additional vials.[4,6] Many single-dose vials do not have a bacteriostatic or preservative agent; once contaminated, the opportunities for bacterial growth increase relative to elapsed time between uses.[1] Bacteriostatic agents used in multidose vials are not effective against hepatitis and other viruses.

Never leave a needle, cannula, or spike device inserted into a medication vial rubber stopper (even if the stopper has a one-way valve). Vial contamination occurs when environmental microorganisms collect on the spiking device or needle. Sterile solutions are then contaminated when poured through or withdrawn from the spout or stopper.[8]

Strategies to reduce the risk of contamination of vials or diluents include the following:[1,8]

— Purchase single-dose medication and flush vials whenever possible. If multidose vials must be used, dedicate them to a single patient using a new, sterile needle and syringe for every access.

— Ensure ports and stoppers are disinfected using friction and a sterile 79% isopropyl alcohol. Alcohol must be allowed to dry before each access to ensure proper contact time.

— Never store or transport syringes or vials in a clinician's pocket.

Contamination of Medical Equipment, Supplies, and the Environment

Investigations of HBV infection outbreaks resulting in several deaths in long-term care facilities found lack of adherence to standard precautions, such as failure to implement long-standing recommendations against sharing finger stick devices and sub-optimal hand hygiene and glove use.[10] Outbreaks have occurred from contamination of multidose vials and because supplies used to prepare IV medications for multiple patients were stored in a contaminated workspace.[2] Preventing contamination of equipment, supplies, and the environment includes the following strategies:

Never use equipment designed for single-person use (e.g., reusable finger stick devices, insulin pens, lancets) on more than one patient. Microscopic amounts of blood in the cartridge may contain infectious viral particles that can inoculate bloodborne pathogens into a patient's finger stickwound.[11] HBV and HBC have been shown to remain infectious in the environment in dried blood for up to a week and 16 hours, respectively; either virus may be present in the absence of visible blood in sufficient quantities to cause infection.[12,13] In 2009, the U.S. Food and Drug Administration issued an alert to remind healthcare providers and patients that insulin pens are designed for single-patient use and should be identified with the name of the patient. Healthcare facilities should review their policies and educate their staff regarding safe use of insulin pens.[14] As with syringes, lancets must never be reused.

Never reuse blood glucose monitors for more than one patient without cleaning and disinfecting the device, washing hands, and changing gloves. There is evidence of risk of patient exposure via indirect transfer of virus from microscopic amounts of blood on a clinician's hands or gloves after contact with a contaminated monitoring device.[11] The practice of using blood sugar measuring devices

such as glucometers without cleaning and disinfecting between every use creates an immediate jeopardy to patient health by potentially exposing patients and nursing home residents to the spread of bloodborne infections.[15] Clean and disinfect glucose monitoring equipment between uses and routinely between patients. Cleaning must precede disinfection, as some disinfectants are ineffective in the presence of soil.[16] In the absence of manufacturer's recommendations, noncritical medical equipment is disinfected with an Environmental Protection Agency registered hospital solution with specific label claims for HBV and HBC. Follow the recommended solution contact time for maximum effectiveness against bloodborne and other pathogens.[17]

Never prepare injectable medications in a contaminated workspace (e.g., where needles and syringes are dismantled and discarded). Any item that could have come in contact with blood or body fluids should not be in the clean medication prep area.[4] Medication preparation should be restricted to a centralized medication area, a clear demarcation of clean and dirty areas in confined workspaces, and never in the patient treatment or procedure area, especially in hemodialysis centers.[2,4]

INCREASING THE AWARENESS OF SAFE INJECTION PRACTICES

A safe injection is one that does not harm the recipient, does not expose the provider to any avoidable risks, and does not result in waste that is dangerous for the community.[7] Improved education of healthcare professionals in nursing, medical, and vocational schools is urgently needed to ensure appropriate investment in basic infection requirements and to address incorrect beliefs about safe injection practices.[4] Outbreaks identified by CDC and U.S. public health services indicate a lack of awareness and understanding of injection safety and application of basic aseptic techniques.[2] Reinforcement of training includes periodic certification or competency requirements for all clinicians in healthcare facilities.[4] Perz et al. described the following learning objectives to support the development of an injection safety curriculum:[7]

- Recognize the basics of indirect contact transmission of infectious agents.
- Detect and correct unsafe practices.
- Describe safe injection and basic aseptic practices including hand hygiene, glove changing, and avoidance of cross contamination.
- Understand the need for monitoring practices related to injection safety and basic infection control.
- Recognize the potential consequences of syringe reuse and other unsafe practices.
- Identify CDC infection control guidelines and educational materials.

Educational materials, such as the CDC poster "Some Things Should Not Be Reused," can be placed in patient waiting areas and staff lounges to increase awareness of safe injection practices for patients and staff.[18] CDC through its "The One & Only Campaign" website and other organizations provide a variety of resources to assist in education, training, competency evaluations, and monitoring (see "Where Can Providers Go for More Information?").

OVERSIGHT OF COMPLIANCE WITH SAFE INJECTION PRACTICES

A comprehensive approach to management of unsafe injection practices should be aimed at assessment of the clinician, the team, the workplace, and the institution as a whole to make the process as safe as possible.[19]

Even when new knowledge is discovered and adequate research is available, there are many barriers to implementing research into practice.[1] Gurses et al. published a template that helps healthcare facilities identify barriers to implementation of safe practices, including methods for direct observation, staff interviews, short questionnaires, and practice simulations.[20] A prospective review of an organization's safe injection practices can be assessed with the World Health Organization Guide for Supervising Injections worksheet available at http://infocooperation.org/hss/documents/s15240e/s15240e.pdf. Senior management support for safety programs, frequent safety-related feedback, and removal of workplace barriers to safe work practices have been shown to be significantly related to compliance.[21] Administrative measures to assure compliance with safe injection practices may include the following:[7]

- Develop written infection control policies and measures tailored to the individual practice setting.
- Provide infection control training and at least an annual review of staff practices.
- Clearly designate responsibility for oversight and monitoring; include infection control personnel.
- Establish procedures and responsibilities for reporting and investigating breaches in infection control policy.
- Conduct quality assurance assessments.

Administrators can take the lead by sending a letter to clinicians that supports and describes the facility's safe injection policy and practice expectations[22] and by ensuring establishment of processes to address containing, transporting, and handling patient care equipment that may be contaminated with blood.[6]

Safe injection system design can be achieved by adopting a culture of safety and system reform to provide clinicians with both the reminders and the tools to address human variability factors.[19] This entails creating an environment in which every provider feels empowered to take responsibility to stop any colleague from engaging in unsafe practices.[1] While healthcare workers may witness

WHERE CAN PROVIDERS GO FOR MORE INFORMATION?

ASC Quality Collaboration
Safe Injection Practices Toolkit
http://www.ascquality.org/SafeInjectionPracticesToolkit.cfm

American Society of Consultant Pharmacists (ASCP)
ASCP Summary of New Surveyor Guidance on Infection Control at F-Tag 441
http://www.ascp.com/resources/nhsurvey/upload/FTag%20441%20summary.pdf

ASCP's Summary of Glucometer Cleaning Guidelines
http://www.ascp.com/sites/default/files/GlucometerInfectionControl-rev.pdf

Association for Professionals in Infection Control and Epidemiology (APIC)
APIC Position Paper: Safe Injection, Infusion and Medication Vial Practices in Healthcare
http://www.ascquality.org/Library/safeinjectionpracticestoolkit/Safe%20Injection%20Infusion%20and%20Medication%20Vial%20Practices%20in%20Healthcare%20(APIC).pdf

Centers for Disease Control and Prevention
2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings
http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/isolation2007.pdf

The One & Only Campaign
http://www.cdc.gov/injectionsafety/1anOnly.html

Georgia Association of Nurse Anesthetists
Safe Practices for Needle and Syringe Use [discussion of American Association of Nurse Anesthetists' position statement]
http://www.gana.org/documents/1241559948.pdf

World Health Organization (WHO)
WHO Best Practices for Injections and Related Procedures Toolkit
http://whqlibdoc.who.int/publications/2010/9789241599252_eng.pdf

unsafe actions, they often are not comfortable speaking up for patient safety. Examples of employee talking points for safe injection practices are described in a CDC video transcript available at http://www.oneandonlycampaign.org/Post/sections/36/Files/SIPC%20-%20FINAL%20VIDEO%20SCRIPT.pdf.

Adopting principles from human factors engineering includes redesigning devices, equipment, and processes to reduce or eliminate the risk of bloodborne pathogen transmission (e.g., using autodestruct syringes that make it easy for staff to comply with using a syringe and needle only once).[1]

CONCLUSION

CDC and U.S. public health officials have identified 51 outbreaks of HBV and HCV infection in the United States associated with unsafe injection practices, and 620 of 75,000 exposed patients became infected or died with HBV or HCV from 1998 through 2009. Preventing the spread of bloodborne pathogens represents a basic expectation anywhere healthcare is provided. Healthcare providers' awareness, understanding, and implementation of well-established safe injection practices remain suboptimal. The occurrence of outbreaks indicates an urgent need for a multifaceted approach focusing on improved education, surveillance, oversight, enforcement, and safely engineered technologies aimed at ensuring safe injection practices at all levels of healthcare delivery.[1]

NOTES

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LEARNING OBJECTIVES

— Distinguish between safe and unsafe injection practices.
— Recognize misperceptions associated with unsafe injection practices.
— Predict consequences of unsafe injection practices.
— Identify appropriate approaches to integrate safe injection strategies into clinical practice.

SELF-ASSESSMENT QUESTIONS

The following questions about this article may be useful for internal education and assessment. You may use the following examples or develop your own questions.

Case Scenario

While making rounds, the facility patient safety officer notices the following practices. Patient A was administered his daily dose of insulin using a reusable insulin pen. Then, the needle was changed and Patient B was administered his morning dose of insulin. Using a new syringe, intravenous (IV) flush solution was withdrawn from a common bag of IV solution to flush two patients' IV lines and administer IV medication. A second sterile syringe was used to draw a blood specimen on Patient C.

1. The following list includes infection control actions from the above scenario that are and are not associated with unsafe injection practices. Select the action that is not associated with unsafe injection practices.
   a. Changing the needle on a used syringe or device before injecting medication into more than one person
   b. Accessing a common bag of sterile intravenous solution to flush IV lines of multiple persons

SELF-ASSESSMENT QUESTIONS (CONTINUED)

c. Wiping the glucometer with a disinfectant between using it to test blood sugar levels on multiple patients
d. Preparing intravenous medication in the dialysis patient treatment area

2. Which statement *least accurately* describes the misperceptions associated with unsafe injection practices?
   a. The risk for syringe contamination in an IV line is eliminated by distance, gravity, and positive infusion pressure.
   b. Reusing a syringe for additional doses of medication for the same patient is safe.
   c. Secondary use of a syringe is safe because contamination is limited to the needle device.
   d. Preparation of injectable medications is appropriate in a confined workspace with a clear demarcation of clean and dirty areas.

Continued Scenario

In preparation for a surgical intervention on Patient A, the certified registered nurse anesthetist combined the contents of a used bottle of propofol from an earlier case with another partially used vial stored in his lab coat pocket, then administered propofol from that vial using a clean needle attached to the syringe from the previous case. The certified registered nurse anesthetist flushed the IV and used a new syringe and needle to draw a blood specimen. A new syringe and needle were inserted into the vial of propofol, and this was placed on the anesthesia table in preparation for the next case. During an investigation of an outbreak of hepatitis, both patients were subsequently diagnosed with new hepatitis C infections.

3. The following practices are evident in the above scenario. Select the process that will not contribute to contamination of injection equipment and medication vials.
   a. Administering propofol from the contents of a combined vial stored in a lab coat pocket
   b. Using a second syringe to draw a blood specimen after flushing an IV line
   c. Accessing a vial of medication with a clean needle using a syringe from a previous case
   d. Inserting a fresh needle and syringe into a medication vial and storing this on the anesthesia table for the next case

4. Which of the following system-level interventions would *not* be appropriate to prevent unsafe injection practices?
   a. Develop protocol to change needles on all syringes used for multiple patients.
   b. Unpackage syringes as close to administration time as possible.
   c. Purchase single dose medication and flush vials whenever possible.
   d. Label individual insulin pen devices for each patient using them.

5. Which of the following strategies is the *most appropriate* regarding awareness and oversight of safe injection practices?
   a. Empower patients to speak up about unsafe injection practice for patients.
   b. Write a policy outlining safe injection practice requirements.
   c. Require periodic injection practice education, competence assessment, and monitoring for all clinicians in healthcare facilities.
   d. Present a business plan to the chief executive officer supporting the facility's safe injection policy.

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An Independent Agency of the Commonwealth of Pennsylvania

The Pennsylvania Patient Safety Authority is an independent state agency created by Act 13 of 2002, the Medical Care Availability and Reduction of Error ("Mcare") Act. Consistent with Act 13, ECRI Institute, as contractor for the Authority, is issuing this publication to advise medical facilities of immediate changes that can be instituted to reduce Serious Events and Incidents. For more information about the Pennsylvania Patient Safety Authority, see the Authority's website at http://www.patientsafetyauthority.org.

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