Emergency Medicine Reports
The Practical Journal for Emergency Physicians

Volume 31, Number 13 / June 7, 2010 www.emreports.com

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Statement of Financial Disclosure

To reveal any potential bias in this publication, and in accordance with Accreditation Council for Continuing Medical Education guidelines, we disclose that Dr. Schneider (editor) serves on the editorial board for Logical Images. Dr. Farel (CME question reviewer) owns stock in Johnson & Johnson. Dr. Stapczynski (editor), Dr. Grossheim (author), Dr. Takenaka (author), Dr. Marco (peer reviewer), Mr. Underwood (associate publisher), and Ms. Mark (specialty editor) report no relationships with companies related to the field of study covered by this CME activity.

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Occupational HIV and Hepatitis Exposures

Getting stuck with a needle is frightening. Most health care workers are frightened and imagine they will become HIV positive. When prophylaxis is indicated, it needs to be started as soon as possible, so it falls to the ED provider to determine the risk and start the right medications to prevent the development of disease. This paper reviews the most recent risk stratification as well as the latest recommendations for prophylaxis.

— Sandra M. Schneider, MD, Editor

Injuries involving needles and other sharps in health care settings are associated with transmission of many pathogens, but the pathogens of most immediate concern during patient care activities are human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV).

Preventing HIV transmission from patients to health care providers has been the subject of extensive research throughout the course of the HIV epidemic. Although it is an uncommon event,[1,2] the consequences of occupational HIV transmission can be devastating. The overall risk of seroconversion after a percutaneous needlestick from a known HIV-positive source is widely reported to be 0.3% per exposure, as demonstrated by prospective data from almost 4000 health care workers.[3] Mucous membrane exposure to HIV-positive blood has a lower transmission rate of 0.09%. Seroconversion in at least five health care workers has been reported after this form of exposure.[4,5]

The Centers for Disease Control and Prevention (CDC) defines occupational HIV exposure as a "percutaneous injury (e.g., needlestick, cut from a sharp object) or contact of mucous membranes on nonintact skin (e.g., skin that is chapped, abraded, or affected by dermatitis) with blood, tissue, or other body fluids that are potentially infectious."[6] Potentially infectious fluids include cerebrospinal, synovial, pleural, peritoneal, pericardial, and amniotic fluids. Fluids not considered to be infectious unless visibly bloody include feces, nasal secretions, saliva, sputum, sweat, tears, urine, and vomitus.[7]

The incidence of occupationally transmitted hepatitis B infection has dramatically decreased since the widespread vaccination of health care providers and the general population.[8] The CDC estimates that approximately 400 new occupational HBV infections occurred in 1995 among U.S. health care workers, down from 17,000 in 1983.[8] The exact incidence of occupational HCV transmission is unknown. There were an estimated 19,000 new HCV infections in 2006 in the United States, with 1.5% of the cases having a reported occupational exposure to blood.[9] Although the risk of transmission of HIV and hepatitis to health care providers as a result of an occupational exposure is relatively low, the potential consequences of disease transmission are significant. This article will review current recommendations regarding evaluation and management of potential HIV and hepatitis B and C exposures.

Percutaneous injury, often inflicted with a hollow-bore needle, is the most common mechanism of occupational HIV transmission.[2,10] The handling of

Executive Summary

- The greatest risk for HIV and hepatitis B or C transmission for health care staff is a needlestick. Needles should never be recapped or broken.
- Risk of transmission from a positive-source needlestick is 0.3% for HIV, 23-62% for hepatitis B, and 1.8% for hepatitis C.
- Start prophylaxis for HIV as soon as possible. If the exact regimen is in doubt, start with the basic regimen and adjust later.
- Prophylaxis for hepatitis B consists of HBIG with or without hepatitis B vaccine. There is no prophylaxis for hepatitis C.

sharp instruments ("sharps") represents the greatest risk of HIV transmission to health care workers. Needlesticks are the most commonly reported occupational exposure route, accounting for approximately 80% of exposures.[10] Recapping needles is the single most common activity that results in needlestick injuries.[3] Needles should never be recapped, manipulated, bent, or broken. Other high-risk activities include improper disposal of used needles and transferring blood/body fluids between different containers.[11] Risk of transmission of HIV to health care workers is increased when the device causing the injury was visibly contaminated with blood, when the device had been used for insertion into a deep vein or artery, when the device caused a deep injury, or when the source patient died within 2 months of the exposure.[7,12-14] Latex gloves can be another source of exposure. Glove perforations are more likely when gloves are worn for longer periods, are used during critical care procedures, or are worn during more than one procedure.[15]

The CDC recommends that the best way to prevent transmission of bloodborne illness is to avoid exposure.[7] Standard precautions should be used with all procedures that carry a potential risk of exposure. However, "universal precautions" are not used routinely by many health care providers. As many as 40% of needlestick injuries are preventable.[3] Unfortunately, more than 50% of health care workers engage in inadequate infection control practices. Physician universal precaution compliance rates were highest for wearing gloves and disposing of sharps, but lowest for wearing protective clothing and not recapping needles.[16]

The emergency department management of precutaneous or mucus membrane exposure includes determining the type of exposure, evaluating the source of exposure, the health and immunization history of the exposed health care worker at the time of exposure, and providing appropriate follow-up of the health care worker after exposure. After sustaining an exposure, the health care worker should report the contact as outlined by institutional protocols.

Evaluation of a Potential Exposure

There is not a simple way to determine the likelihood that an unknown or untested source is infected with HIV or hepatitis. A step-wise approach considering each variable is a reasonable approach to management of occupational exposures.[17]

Evaluate the Exposure Incident. The first step is to consider the specific incident that led to concern over potential exposure. Did percutaneous, mucous membrane, or nonintact skin contact potentially infectious material? Percutaneous injuries should be assessed as either less severe (solid needle and superficial) or more severe (large-bore needle, deep puncture, visible blood on device, or needle in patient's artery or vein). Mucocutaneous exposures are deemed either small (few drops) or large (major blood splash) volumes.[7,18]

There is a risk of disease transmission if the health care worker is exposed to blood, body fluids containing visible blood, cerebrospinal, synovial, pleural, peritoneal, pericardial, and amniotic fluids.[19] If the exposure occurred to intact skin only, it is unlikely that a significant exposure occurred.

Determine the Status of the Source. The next step is to determine the HIV and hepatitis status of the source patient, if possible. The person whose blood or body fluid is the source of an occupational exposure should be evaluated for HIV, HBV, and HCV infection. Information available in the medical record at the time of exposure (e.g., laboratory test results or previous medical history) or questioning of the source might confirm HIV or hepatitis infection. If the source person is known to have HIV infection, obtain as much information as possible regarding the person's stage of infection (e.g., asymptomatic, symptomatic, or AIDS), CD4+ T-cell count, viral load, and current and previous antiretroviral therapy, as this is needed to assist in choosing an appropriate postexposure prophylaxis (PEP) regimen. An exposure to a high-risk source patient may warrant an expanded PEP regimen. High-risk sources are patients with symptomatic HIV infection, AIDS, acute seroconversion, or high viral load. Low-risk sources are patients with asymptomatic HIV infection or viral load of less than 1500 copies/mL.[19,20]

Testing to determine the HBV, HCV, and HIV infection status of an exposure source should be performed as soon as possible. If the HBV, HCV, and/or HIV infection status of the source is unknown, the source person should be informed of the incident, and his or her consent should be obtained for HIV

and hepatitis testing. If the patient refuses or cannot give consent for testing, that patient should be considered to be infected.[3] Some states allow testing the source patient without informed consent. Confidentiality should be protected while still ensuring that the appropriate information is provided to all exposed persons.[6,20] Any individual diagnosed with HBV, HCV, or HIV should be referred for appropriate counseling and treatment.

The use of rapid HIV ELISA testing can result in decreased use of PEP and spare the health care provider both undue anxiety and the potential adverse effects of antiretroviral PEP.[7] An FDA-approved rapid HIV-antibody test kit, if available, should be used to test the source. Confirmation of a reactive result with additional testing is not necessary to make initial decisions regarding post-exposure management, but should be done to complete the testing process and before informing the source person of a positive result on preliminary testing. A negative result on rapid testing is adequate for a decision to withhold or discontinue therapy if initiated.[6]

If the source person is HIV seronegative and has no clinical evidence of AIDS or symptoms of HIV infection, no further testing of the person for HIV infection is indicated. The likelihood of the source person being in the "window period" of HIV infection in the absence of symptoms of acute retroviral syndrome is extremely small.[6] No case of transmission involving an exposure source during the window period has been reported in the United States.[2]

Unknown sources pose a more complicated problem. An example of an unknown source is a needle in a sharps container or a suture needle left on a tray. Testing of needles or other sharp instruments implicated in an exposure, regardless of whether the source is known or unknown, is not recommended. The reliability and interpretation of findings in such circumstances are unknown.[6] If the exposure source is unknown or cannot be tested, information about where and under what circumstances the exposure occurred should be considered for the likelihood for transmission of HBV, HCV, or HIV. Expert consultation should be considered in this situation.

Table 1: Summary of Universal Precautions[3]

- Specimens, including blood, blood products, and body fluids, obtained from all patients should be considered hazardous and potentially infected with transmissible agents.
- Handwashing should be performed before and after patient contact, after removing gloves, and immediately if hands are grossly contaminated with blood; handwashing is the cornerstone of universal precautions.
- Gloves should be worn when hands are likely to come in contact with blood or body fluids.
- Gowns, protective eyewear, and masks should be worn when splashing, splattering, or aerosolizing of blood or body fluids is likely to occur.
- Sharp objects (sharps) should be handled with great care and disposed of in impervious receptacles.
- Needles should never be manipulated, bent, broken, or recapped.
- Blood spills should be handled by initial absorption of the spill with disposable towels, cleaning the area with soap and water, followed by disinfecting the area with a 1:10 solution of household bleach.
- Contaminated reusable equipment should be decontaminated by heat sterilization or, when heat is impractical, with a mycobacterial cleanser.
- Pocket masks or mechanical ventilation devices should be available in areas where cardiopulmonary resuscitation procedures are likely.
- Health care workers with open lesions or weeping dermatitis should avoid direct patient contact and should not handle contaminated equipment.

HIV Postexposure Prophylaxis. Because the majority of occupational HIV exposures do not result in transmission of HIV, the benefits of prescribing PEP should outweigh the risks of potential toxicity. The use of PEP is not justified for exposures that do not pose a credible risk for transmission of HIV. PEP should be provided following exposure of nonintact skin (through percutaneous sharps injury or skin abrasion) or mucous membranes (through splashes to the eyes, nose, or oral cavity) to a potentially infected body fluid from a source that is HIV-positive or has unknown HIV status.[17] Because of the complexity of selection of HIV PEP regimens, consultation with an infectious disease specialist is strongly recommended in complicated cases.[7]

Although preventing exposures to blood and body fluids is the primary way to prevent occupationally acquired HIV infection, when an exposure occurs, appropriate post-exposure management is necessary.[7] PEP is thought to prevent the establishment of HIV infection by blocking the replication of the viral inoculum.[12] Initial guidelines for PEP were developed from an early study that demonstrated that health care personnel who were treated with zidovudine after needlestick exposures were less likely to seroconvert to HIV.[21] Subsequently, the effectiveness of combination therapy for PEP was suggested from studies that showed multidrug therapy was superior to monotherapy in the treatment of HIV infection and in the prevention of perinatal transmission.[7]

Table 2: Recommended HIV Postexposure Prophylaxis for Percutaneous Injuries

Infection status of source					
Exposure type	**HIV-Positive Class 1***	**HIV-Positive Class 2***	**Source of unknown HIV status†**	**Unknown source §**	**HIV-Negative**
Less severe¶	**Recommend basic 2-drug PEP**	**Recommend expanded 3-drug PEP**	**Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors††	**Generally, no PEP warranted; however, consider basic 2-drug PEP** in settings where exposure to HIV-infected persons is likely	**No PEP warranted**
More severe§§	**Recommend expanded 3-drug PEP**	**Recommend expanded 3-drug PEP**	**Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors††	**Generally, no PEP warranted; however, consider basic 2-drug PEP** in settings where exposure to HIV-infected persons is likely	**No PEP warranted**

*** HIV-Positive, Class 1 — asymptomatic HIV infection or known viral load (e.g., <1,500 RNA copies/mL). HIV-Positive, Class 2 — symptomatic HIV infection, AIDS, acute seroconversion, or known high viral load. If drug resistance is a concern, obtain expert consultation. Initiation of postexposure prophylaxis (PEP) should not be delayed pending expert consultation, and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.**

† Source of unknown HIV status (e.g., deceased source person with no samples available for HIV testing).

§ Unknown source (e.g., a needle from a sharps disposal container).

¶ Less severe (e.g., solid needle and superficial injury).

** The designation "consider PEP" indicates that PEP is optional and should be based on an individualized decision between the exposed person and the treating clinician.

†† If PEP is offered and taken and the source is later determined to be HIV-negative, PEP should be discontinued.

§§ More severe (e.g., large-bore hollow needle, deep puncture, visible blood on device, or needle used in patient's artery or vein).

Source: Centers for Disease Control. Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Postexposure Prophylaxis. *MMWR* 2001;50(No. RR-11): 24.

Prospective, randomized studies to evaluate the efficacy of PEP in preventing HIV are unlikely to ever be conducted because the body of data that are generally supportive of its use create difficulty in withholding PEP for ethical reasons.[17] Failure of PEP may result from repeated exposures to HIV, delayed initiation or short duration of PEP, drug-resistant viral strains, a large inoculum, or host factors.[7,12]

The preferred PEP regimen depends on the type of exposure as well as the HIV status of the source patient.[6,7] There are no prospective data on the relative efficacy of two- and three-drug HIV PEP regimens. In most cases, when the source is unlikely to have HIV infection that is resistant to antiretroviral therapy, two-drug therapies are likely to be sufficient to prevent HIV transmission. The advantages of using two drugs as opposed to three include ease of administration, lower costs, and fewer side effects. In most cases, the addition of the third drug is considered to supply only a small increase in efficacy but adds significantly to the risk of side effects and reduced compliance.[17]

Current public health guidelines recommend a four-week regimen of two drugs for most HIV exposures that have occurred by percutaneous or mucous membrane routes.[7]

Antiretroviral agents from five classes of drugs are currently available to treat HIV infection. These include the nucleoside reverse transcriptase inhibitors (NRTIs), nucleotide reverse transcriptase inhibitors (NtRTIs), nonnucleoside reverse transcriptase inhibitors (NNRTIs),

Table 3: Recommended HIV Postexposure Prophylaxis for Mucous Membrane Exposures and Nonintact Skin* Exposures

Infection status of source					
Exposure type	**HIV-Positive Class 1†**	**HIV-Positive Class 2†**	**Source of unknown HIV status§**	**Unknown source¶**	**HIV-Negative**
Small volume**	**Consider basic 2-drug PEP††**	**Recommend basic 2-drug PEP**	**Generally, no PEP warranted; however, consider basic 2-drug PEP†† for source with HIV risk factors§§**	**Generally, no PEP warranted; however, consider basic 2-drug PEP†† in settings where exposure to HIV-infected persons is likely**	**No PEP warranted**
Large volume¶¶	**Recommend basic 2-drug PEP**	**Recommend expanded 3-drug PEP**	**Generally, no PEP warranted; however, consider basic 2-drug PEP†† for source with HIV risk factors§§**	**Generally, no PEP warranted; however, consider basic 2-drug PEP†† in settings where exposure to HIV-infected persons is likely**	**No PEP warranted**

*** For skin exposures, follow-up is indicated only if there is evidence of compromised skin integrity (e.g., dermatitis, abrasion, or open wound).**

† HIV-Positive, Class 1 — asymptomatic HIV infection or known low viral load (e.g., <1,500 RNA copies/mL). HIV-Positive, Class 2 — symptomatic HIV infection, AIDS, acute seroconversion, or known high viral load. If drug resistance is a concern, obtain expert consultation. Initiation of postexposure prophylaxis (PEP) should not be delayed pending expert consultation, and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.

§ Source of unknown HIV status (e.g., deceased source person with no samples available for HIV testing).

¶ Unknown source (e.g., splash from inappropriately disposed blood).

** Small volume (i.e., a few drops).

†† The designation, "consider PEP," indicates that PEP is optional and should be based on an individualized decision between the exposed person and the treating clinician.

§§ If PEP is offered and taken and the source is later determined to be HIV-negative, PEP should be discontinued.

¶¶ Large volume (i.e., major blood splash).

Source: Centers for Disease Control. Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Postexposure Prophylaxis. *MMWR* 2001;50(No. RR-11): 25.

and protease inhibitors (PIs). Various combinations of these agents comprise recommended PEP regimens.[7]

If the source patient is HIV-negative, no PEP is needed unless concern for occult seroconversion of the source exists (such as known or suspected recent high-risk behavior).[7,13] A basic two-drug regimen may be considered if the source patient's HIV status is unknown. A basic regimen is recommended for less severe exposures (e.g., superficial injury or solid needle) from source patients who are asymptomatic or have low viral loads (< 1,500 copies/mL).[7] Expanded three-drug regimens are recommended if a greater risk of HIV transmission exists (e.g., deep injury, visible contamination of needle with blood, needle placement directly into a blood vessel, source patient with high viral titers, high rate of viral resistance).[7,12-14]

Basic two-drug regimens include a combination of nucleoside, nucleotide analogue, and/or nonnucleoside reverse transcriptase inhibitors (NRTIs, NtRTIs, NNRTIs, respectively).[7] Two-drug therapy options include zidovudine plus lamivudine (available as Combivir), lamivudine plus stavudine, and didanosine plus stavduine. Other preferred two-drug regimens include zidovudine-emtricitabine and tenofovir-lamivudine.[7]

The choice of specific antiretroviral agents depends on the exposed

Table 4: Recommended PEP Regimens for Exposure to HIV[13,14,22]

Regimen	Dose	Advantages	Disadvantages
Tenofovir-emtricitabine (Truvada)	1 tablet (tenofovir 300 mg; emtricitabine 200 mg) once daily	Well tolerated; once-daily dosing	Potential nephrotoxicity; drug interactions
Zidovudiine-lamivudine (Combivir)	1 tablet (zidovudine 300 mg; lamivudine 150 mg) twice daily	Preferred in pregnancy	Less well tolerated than tenofovir-emtricitabine (nausea, asthenia, anemia, neutropenia, abnormal liver enzymes); twice-daily dosing
Ritonavir-lopinavir (Kaletra)	2 tablets (ritonavir 50 mg; lopinavir 200 mg) twice daily or 4 tablets once daily	Once- or twice-daily dosing; most experience in pregnancy; high genetic barrier to resistance; no refrigeration required	Gastrointestinal side effects (diarrhea); may cause increased liver enzymes or hepatitis
Ritonavir-atazanavir	Ritonavir 100 mg plus atazanavir 300 mg once daily	Once-daily dosing, well tolerated	Potential for jaundice, renal stones; may cause increased liver enzymes or hepatitis; ritonavir needs to be refrigerated
Ritonavir-darunavir	Ritonavir 100 mg plus 2 tablets of darunavir 100 mg each once daily	Once-daily dosing; high genetic barrier to resistance	Gastrointestinal side effects; may cause increased liver enzymes or hepatitis; ritonavir needs to be refrigerated

patient's comorbidities, potential drug interactions, pregnancy status, and allergies.[12] For example, tenofovir, lamivudine, and emtricitabine have activity against hepatitis B and may cause a flare of this disease when the PEP is discontinued.[13,22] Some medications, such as tenofovir-emtricitabine and zidovudine-lamivudine, should be used cautiously (if at all) in patients with severe renal disease.[13,22]

Although no one knows at what point the initiation of PEP becomes ineffective, it should be started as soon as possible after an exposure.[12,13] If a question exists concerning which antiretroviral drugs to use, or whether to use a basic or expanded regimen, the basic regimen should be started immediately rather than delay initiation of PEP. Changes in the PEP regimen can be made after PEP has been started, as needed. The length of delay in the initiation of therapy that reduces or eliminates PEP benefit is unclear. Animal studies demonstrate significant decreased efficacy when PEP therapy is initiated more than 24-36 hours after an exposure.[7] However, in practice, PEP therapy may be initiated even after prolonged intervals from the time of exposure if it is considered high risk for transmission. Therapy is continued for four weeks. The antiretrovirals may be discontinued earlier if the source patient is found to be HIV-negative or if the exposed patient experiences severe side effects.[22]

Re-evaluation of the exposed health care provider should be considered within 72 hours post-exposure, especially as additional information about the exposure or source person becomes available.[6] A first dose, or even better, a starter pack of PEP drugs should be made readily available to potentially exposed individuals and given according to national policy and local protocols.

Baseline testing of the exposed heath care worker includes, at the minimum, complete blood count, renal and hepatic function tests, and baseline testing for HIV and hepatitis. A pregnancy test should also be considered in women of child-bearing age. These studies are particularly important for those workers who will be taking PEP.

Expert consultation may be helpful when choosing a PEP regimen for patients with exposures from an unknown source patient, a delayed presentation to the emergency department, or severe adverse effects to PEP as well as those who are pregnant or lactating.[7] The 24-hour-a-day National Clinicians' Postexposure Prophylaxis hotline (PEPline, 1-888-448-4911) may be helpful in these circumstances.[13,22]

Adverse Effects of PEP

The potential side effects and toxicities of PEP medications should be considered prior to starting therapy, especially in those exposures with very low risk of disease transmission. Almost half of all health care workers taking PEP experience side effects, and about one-third

discontinue PEP prior to the recommended four weeks of therapy due to side effects.[7] Constitutional and gastrointestinal side effects such as nausea and fatigue may be significant and often lead to early termination of treatment.[7] In addition, severe toxicities such as liver failure requiring transplantation, Stevens-Johnson syndrome, and rhabdomyolysis have been reported in individuals taking PEP.[23] Zidovudine also may be associated with anemia and neutropenia. PIs may cause gastrointestinal symptoms, increased cholesterol and triglycerides, exacerbations of diabetes, nephrolithiasis, and increased liver enzymes.[7,12]

Pregnancy

The pregnant health care worker should make an informed decision about PEP based on information about what is known and not known about the risks and benefits of PEP and the potential risks to the fetus. Unfortunately, data regarding the potential effects of antiretroviral drugs on the developing fetus or neonate are limited.[6] Carcinogenicity and mutagenicity have been demonstrated in certain in vitro screening tests for ZDV and all other FDA-licensed NRTIs. The relevance of animal data to humans is unknown; however, because teratogenic effects were reported among primates at drug exposures similar to those representing human therapeutic exposure of efavirenz (EFV), for example, pregnant women should not use this drug.[6,7] Indinavir (IDV) also should be avoided, as it is associated with infrequent side effects in adults such as hyperbilirubinemia and renal stones that could be problematic for a newborn. Other concerns regarding PEP during pregnancy are related to reports of neurologic disease and death among uninfected children whose mothers had taken antiretroviral drugs to prevent prenatal HIV transmission and of fatal and nonfatal lactic acidosis in pregnant women treated with a combination of stavudine and didanosine.[6]

Treatment of an Exposure Site

Wounds and skin sites that have been exposed to blood or body fluids should be washed with soap and water; mucous membranes should be flushed with water. Attempting to express fluid by squeezing the wound has not been shown to reduce the risk of HIV or hepatitis transmission. The application of caustic agents such as bleach or the injection of antiseptics or disenfectants into the wound is not recommended.[6]

If the skin is broken following an injury with a contaminated needle or sharp instrument, the following steps are recommended:[17]

- do not squeeze or rub the injury site;
- wash the site immediately using soap or mild disinfectant solution that will not irritate the skin, such as chlorhexidine gluconate solution;
- clean the site with hand-cleaning solution and water;
- do not use strong solutions, such as bleach or iodine, to clean the site as these may irritate the wound.

After a splash of blood or body fluids, the following steps are recommended:

- after a splash contacts unbroken skin, wash the area and clean with hand-cleaning solution;
- after a splash to the eye, irrigate the eye with water or normal saline; if contact lenses are worn, leave these in place while irrigating the eye, as they form a barrier over the eye and will help protect it; once the eye has been cleaned, remove the contact lenses and clean them in the normal manner; this will make them safe to wear again.

After a splash contacts the mouth, do the following:

- spit the fluid out immediately;
- rinse the mouth thoroughly using water or saline, and spit again. Repeat this process several times; do not use soap or disinfectant in the mouth.

Follow Up

If PEP is used, the health care provider should be monitored for drug toxicity by testing at baseline and again at 2 weeks after starting the medications. Minimally, lab testing should include a complete blood count and renal and hepatic function tests. Re-evaluation of the exposed health care provider should occur within 72 hours post-exposure, especially as additional information about the exposure or source person becomes available.[7] If PEP is offered and taken and the source is later confirmed to be HIV-negative, PEP can be stopped. Although concerns have been expressed regarding HIV-negative sources being in the window period for seroconversion, no case of transmission involving an exposure source during the window period has been reported in the United States.[2]

Psychological Issues

The emotional impact of a known or suspected HIV exposure is usually significant, especially in the first hours to days after the episode.[24,25] Objective information about exposure risk and the pros and cons of post-exposure prophylaxis must be explained to an individual who is often emotionally upset.[26,27] Health care workers who are too confused or upset to make a decision about PEP can sometimes be helped by suggesting that treatment be started immediately, with the option to stop it later. Health care workers who sustain exposure to HIV should be counseled to avoid potential transmission to others during the follow-up period, especially during the first 6-12 weeks after exposure, when seroconversion is most likely to occur.[7] Sexual abstinence or condom use should be encouraged in high-risk exposures, as well as avoiding breast feeding.

Hepatitis B

While much of the current literature on occupational exposures to bloodborne illnesses in health care workers focuses on HIV, hepatitis B and C still pose risk of transmission. Widespread use of the HBV vaccine has lowered the level of the concern for HBV transmission, thus making

Table 5: Recommended PEP for Exposure to Hepatitis B[6]

Vaccination and antibody response status of exposed patient	Treatment		
	Source patient HBsAg positive	Source patient HBsAg negative	Source patient status unknown
Unvaccinated	HBIG* x 1 and start HB vaccine series	Start HB vaccine series	Start HB vaccine series
Previously vaccinated			
Known responder**	No treatment	No treatment	No treatment
Unknown antibody response	Test exposed patient for anti-HBs 1. If adequate antibody response, no treatment 2. If inadequate antibody response, HBIG x 1 and HB vaccine booster	No treatment	Test exposed patient for anti-HBs 1. If adequate antibody response, no treatment 2. If inadequate antibody response, HB vaccine booster and recheck titer in 1-2 months
Known nonresponder***	HBIG x 1 and start revaccination or HBIG x 2****	No treatment	If known high-risk source patient, treat as if source patient is HBsAg positive

HBsAg = hepatitis B surface antigen; HBIG = hepatitis B immune globulin; HB vaccine = hepatitis B vaccine; anti-HBs = antibody to HBsAg
* 0.06 mL/kg intramuscularly
** Responder: adequate antibody response to vaccination (anti-HBs ≥ 10 mIU/mL
*** Nonresponder: inadequate response to vaccination (anti-HBs < 10 mIU/mL
**** For nonresponders who have not completed a second vaccine series, the preferred regimen is one dose of HBIG and starting revaccination. Two doses of HBIG are preferred for those who have failed to respond to a second 3-dose vaccine series.
Source: Centers for Disease Control. Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Postexposure Prophylaxis. *MMWR* 2001;50(No. RR-11): 22.

it less of an important clinical issue than HIV, but there still is concern regarding the non-vaccinated or non-responders to the vaccine.

The probability of acute HBV or HCV infection after the exposure to a susceptible person generally depends on the route of exposure, the concentration of virus particles in body fluids, the volume of infectious material transferred, and the immune status of the recipient.[28] HBV is primarily transmitted by percutaneous and mucosal exposure to blood and body fluids, with the highest titers of HBV being found in the blood. Other body fluids are not as conducive to the transmission of HBV.[6] The risk of HBV seroconversion after a percutaneous injury ranges from 23% to 62% in unvaccinated individuals.[25] Risk of contracting HBV depends on the degree of exposure to infectious fluids and the presence of hepatitis B surface antigen, anti-hepatitis B core antibody or hepatitis B e antigen, as the latter is a marker of increased viral replication and infectivity.[6] HBV can persist in the environment for prolonged periods and can remain infective in dried blood at room temperature for more than a week.[28,29] Infective concentrations of HBV also have been detected on environmental surfaces in the absence of visible blood.[30]

Hepatitis B Postexposure Prophylaxis. The preferred PEP regimen for hepatitis B depends on the vaccination and antibody response status of the exposed patient as well as whether the source patient is positive for hepatitis B surface antigen (HBsAg).[6,31] Options range from no treatment to the use of hepatitis B (HB) vaccine alone to a combination of hepatitis B immune globulin (HBIG) and vaccination. (*See Table 5.*) When indicated, HBIG and/or HB vaccine should be administered as soon as possible (ideally within 24 hours of exposure).[6]

The effectiveness of hepatitis B immune globulin (HBIG) and/or hepatitis B vaccine in various postexposure settings has been studied prospectively. In the occupational

setting, multiple doses of HBIG initiated within one week following percutaneous exposure to HBsAG-positive blood provided an estimated 75% protection from HBV infection.[6,8,32,33] The increased efficacy of the combination of HBIG and hepatitis B vaccine observed in the perinatal setting, compared with HBIG alone, is thought to apply to the occupational setting as well.[6]

The hepatitis vaccine consists of three intramuscular doses of hepatitis B vaccine, which induces a protective antibody response in more than 90% of healthy recipients.[34] Adults who develop a protective antibody response are protected from clinical disease and chronic infection. Nearly all vaccinated persons who respond have lifelong immunity against HBV infection.[34] Health care personnel who do not respond to the primary vaccine series should receive a second three-dose series. Booster doses of hepatitis B vaccine are not necessary, and periodic serologic testing to monitor antibody concentrations after completion of the vaccine series is not recommended.[6]

When hepatitis B vaccine is indicated, it should also be administered as soon as possible (preferably within 24 hours) and can be administered simultaneously with HBIG at a separate site.

When HBIG is indicated, it should be administered as soon as possible after exposure (preferably within 24 hours). The effectiveness of HBIG when administered more than 7 days after exposure is unknown. For exposed persons who are in the process of being vaccinated but have not completed the vaccination series, vaccination should be completed as scheduled, and HBIG should be added as indicated. Persons exposed to HBsAg-positive blood or body fluids who are known not to have responded to a primary vaccine series should receive a single dose of HBIG and re-initiate the hepatitis B vaccine series with the first dose of the hepatitis B vaccine as soon as possible after exposure. Alternatively, they should receive two doses of HBIG. Re-initiating the vaccine series is preferred for non-responders who did not complete a second three-dose vaccine series. For persons who have previously completed a second vaccine series but failed to respond, two doses of HBIG are preferred.[6] If the health care provider does not know his or her response to the vaccine, a vaccine booster should be given along with an HBIG dose. No apparent risks exist for adverse effects to developing fetuses when hepatitis B vaccine is administered to pregnant or lactating women.[6]

A summary of prophylaxis recommendations for percutaneous or mucosal exposure to blood according to the HBsAg status of the exposure source and the vaccination and vaccine-response status of the exposed person is included in Table 5.

Table 6: Resources

- **The National Clinician's Postexposure Prophylaxis Hotline (PEPline)** at 1-888-448-4911 (24 hrs/7 days a week) for assistance in assessing risk and advice on managing occupational exposures to HIV, hepatitis, and other blood-borne pathogens. Additional information about PEPline can be found on the National HIV/AIDS Clinicians' Consultation Center web site at www.ucsf.edu/hivctr/Hotlines/PEPline.html
- **HIV Antiretroviral Pregnancy Registry** at htto://www.apregistry.com/index.htm
- **Food and Drug Administration** (for reporting unusual or severe toxicity to antiretroviral agents) at http://www.fda.gov/medwatch; phone 800-332-1088
- **Centers for Disease Control and Prevention** (for reporting HIV infections in HCP and failures of PEP) at 800-893-0485

Hepatitis C

Hepatitis C is the most common bloodborne infection in the United States, with an estimated 3.2 million chronically infected persons.[9] There is no vaccine for HCV and no effective postexposure prophylaxis. HCV is not transmitted efficiently through occupational exposures to blood. Approximately 50 to 150 cases of HCV transmission in health care workers are estimated to occur every year in the United States.[35] HCV transmission is most efficient after percutanous injury, with deep punctures or extensive blood exposures enhancing the likelihood of transmission.[36-38] The average incidence of anti-HCV seroconversion after accidental percutaneous exposure from an HCV-positive source is 1.8% (range 0-7%), with one study indicating that transmission occurred only from hollow-bore needles compared with other sharps.[39] Transmission rarely occurs from mucous membrane exposures to blood, and no transmission in HCP has been documented from intact or nonintact skin exposures to blood.[6,40-42] However, data are limited on the survival of HCV in the environment, although it is suggested that environmental contamination with blood containing HCV is not a significant risk for transmission in the health care setting.[36,43]

Hepatitis C Postexposure Prophylaxis. Currently, no effective PEP exists for the prevention of hepatitis C.[14,31] Although the use of immune globulin has been investigated, it has been found to be ineffective in preventing the transmission of hepatitis C.[6,14] Antivirals such as interferon α-2b have been found to be useful in the treatment of acute hepatitis C, being associated with a high rate of long-term viral clearance.[14] However, they do not have a role in routine PEP due to the low rate of disease transmission after occupational exposures, the high spontaneous cure rates for acute infection, and the potential adverse effects of the drugs themselves.[14,44]

Exposed patients who become seropositive for hepatitis C should be referred to an appropriate specialist to identify treatment options.[6,14]

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Physician CME Questions

121. Which of the following body fluids is *not* considered to be infectious unless visibly bloody?
    A. cerebrospinal
    B. saliva
    C. synovial fluid
    D. amniotic fluid
    E. peritoneal fluid

122. Which of the following is the most common route of occupational exposure to HIV and hepatitis?
    A. mucous membrane contact
    B. fluid splash in the eye
    C. percutaneous injury
    D. blood contact to intact skin

123. Which of the following is considered to be the highest risk for HIV and hepatitis transmission?
    A. contaminated hollow-needle deep puncture causing visible bleeding
    B. nonbloody sputum splash in the eye
    C. suture needle puncture through a glove without causing visible injury
    D. bloody amniotic fluid splash on intact skin
    E. nonbloody diarrhea contact with the arm of a health care provider with a healing abrasion on that arm

124. Which PEP regimen is preferred in pregnancy?
    A. ritonavir-darunavir
    B. ritonavir-atazanvir
    C. tenofovir-emtricitabine
    D. zidovudine-lamivudine

125. Which of the following is recommended as part of treatment of an exposure site?
    A. squeeze the injury site in an attempt to cause bleeding and extrude the innoculum
    B. clean the wound with iodine
    C. irrigate the eye with disinfectant solution
    D. clean the exposure site with a mild disinfectant such as chlorhexidine solution
    E. scrub the wound vigorously

126. Which of the following statements regarding hepatitis B prophylaxis is *false*?
    A. Nearly all vaccinated persons who have an antibody response to the hepatitis B vaccine have lifelong immunity to hepatitis B infection.
    B. Periodic serologic testing to monitor hepatitis B antibody concentrations after completion of the vaccine series is recommended.
    C. The presence of hepatitis B e antigen reflects increased viral replication and infectivity.
    D. HBV can remain infective in dried blood at room temperature for more than a week.

127. Regarding PEP for hepatitis B, which statement is *incorrect*?
    A. Vaccinated hepatitis B known responders need an HBIG dose after an exposure to a hepatitis B patient.
    B. Unvaccinated individuals need HBIG one dose and should be started on the hepatitis B vaccine series after an exposure to a hepatitis B patient.
    C. Vaccinated providers with an unknown antibody response to the vaccine and source patient unable to be tested should receive the hepatitis B booster vaccine. Recheck titers in 1-2 months.
    D. Hepatitis B vaccine is safe in pregnant women.

128. Hepatitis C is the most common bloodborne infection in the United States. Which of the following statements about hepatitis C is true?
    A. HCV is not transmitted efficiently through occupational exposures to blood.
    B. Currently no effective PEP exists for the prevention of hepatitis C.
    C. There is no vaccine against hepatitis C.
    D. Immune globulin is not effective in preventing the transmission of hepatitis C.
    E. All of the above are true.

129. Factors that increase the likelihood of HIV transmission from occupational exposures include all of the following *except*:
    A. hollow-needle with visible blood contamination
    B. source patient with advanced disease
    C. deep puncture injury
    D. needle in the source patient's artery or vein
    E. solid needle causing injury

130. Which of the following drugs is *not* recommended for use during pregnancy?
    A. idinavir
    B. stavudine
    C. didanosine
    D. efavirenz
    E. None of the drugs is recommended for use during pregnancy.

CME Answer Key

121. B; 122. C; 123. A; 124. D; 125. D; 126. B; 127. A; 128. E; 129. E; 130. E

Correction

In the May 10, 2010 issue of *Emergency Medicine Reports*, question 102 should read: "Which of the following statements concerning suicide in the elderly is true?"

Emergency Medicine Reports™ (ISSN 0746-2506) is published biweekly by AHC Media LLC, 3525 Piedmont Road, N.E., Six Piedmont Center, Suite 400, Atlanta, GA 30305. Telephone: (800) 688-2421 or (404) 262-7436.

Executive Editor: Russ Underwood

Specialty Editor: Shelly Morrow Mark

Director of Marketing: Schandale Kornegay

GST Registration No.: R128870672

Periodicals Postage Paid at Atlanta, GA 30304 and at additional mailing offices.

POSTMASTER: Send address changes to Emergency Medicine Reports, P.O. Box 740059, Atlanta, GA 30374.

Back issues: $31. Missing issues will be fulfilled by customer service free of charge when contacted within one month of the missing issue's date.

Multiple copy prices: One to nine additional copies, $359 each; 10 to 20 additional copies, $319 each.

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Occupational HIV and Hepatitis Exposures

Recommended HIV Postexposure Prophylaxis for Percutaneous Injuries

Infection status of source					
Exposure type	**HIV-Positive Class 1***	**HIV-Positive Class 2***	**Source of unknown HIV status†**	**Unknown source §**	**HIV-Negative**
Less severe¶	**Recommend basic 2-drug PEP**	**Recommend expanded 3-drug PEP**	**Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors††	**Generally, no PEP warranted; however, consider basic 2-drug PEP** in settings where exposure to HIV-infected persons is likely**	**No PEP warranted**
More severe§§	**Recommend expanded 3-drug PEP**	**Recommend expanded 3-drug PEP**	**Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors††	**Generally, no PEP warranted; however, consider basic 2-drug PEP** in settings where exposure to HIV-infected persons is likely**	**No PEP warranted**

*** HIV-Positive, Class 1 — asymptomatic HIV infection or known viral load (e.g., <1,500 RNA copies/mL). HIV-Positive, Class 2 — symptomatic HIV infection, AIDS, acute seroconversion, or known high viral load. If drug resistance is a concern, obtain expert consultation. Initiation of postexposure prophylaxis (PEP) should not be delayed pending expert consultation, and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.**

† Source of unknown HIV status (e.g., deceased source person with no samples available for HIV testing).

§ Unknown source (e.g., a needle from a sharps disposal container).

¶ Less severe (e.g., solid needle and superficial injury).

** The designation "consider PEP" indicates that PEP is optional and should be based on an individualized decision between the exposed person and the treating clinician.

†† If PEP is offered and taken and the source is later determined to be HIV-negative, PEP should be discontinued.

§§ More severe (e.g., large-bore hollow needle, deep puncture, visible blood on device, or needle used in patient's artery or vein).

Source: Centers for Disease Control. Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Postexposure Prophylaxis. *MMWR* 2001;50(No. RR-11): 24.

Recommended HIV Postexposure Prophylaxis for Mucous Membrane Exposures and Nonintact* Skin Exposures

Infection status of source					
Exposure type	**HIV-Positive Class 1†**	**HIV-Positive Class 2†**	**Source of unknown HIV status§**	**Unknown source¶**	**HIV-Negative**
Small volume**	**Consider basic 2-drug PEP††**	**Recommend basic 2-drug PEP**	**Generally, no PEP warranted; however, consider basic 2-drug PEP†† for source with HIV risk factors§§**	**Generally, no PEP warranted; however, consider basic 2-drug PEP†† in settings where exposure to HIV-infected persons is likely**	**No PEP warranted**
Large volume¶¶	**Recommend basic 2-drug PEP**	**Recommend expanded 3-drug PEP**	**Generally, no PEP warranted; however, consider basic 2-drug PEP†† for source with HIV risk factors§§**	**Generally, no PEP warranted; however, consider basic 2-drug PEP†† in settings where exposure to HIV-infected persons is likely**	**No PEP warranted**

*** For skin exposures, follow-up is indicated only if there is evidence of compromised skin integrity (e.g., dermatitis, abrasion, or open wound).**

† HIV-Positive, Class 1 — asymptomatic HIV infection or known low viral load (e.g., <1,500 RNA copies/mL). HIV-Positive, Class 2 — symptomatic HIV infection, AIDS, acute seroconversion, or known high viral load. If drug resistance is a concern, obtain expert consultation. Initiation of postexposure prophylaxis (PEP) should not be delayed pending expert consultation, and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.

§ Source of unknown HIV status (e.g., deceased source person with no samples available for HIV testing).

¶ Unknown source (e.g., splash from inappropriately disposed blood).

** Small volume (i.e., a few drops).

†† The designation, "consider PEP," indicates that PEP is optional and should be based on an individualized decision between the exposed person and the treating clinician.

§§ If PEP is offered and taken and the source is later determined to be HIV-negative, PEP should be discontinued.

¶¶ Large volume (i.e., major blood splash).

Source: Centers for Disease Control. Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Postexposure Prophylaxis. *MMWR* 2001;50(No. RR-11): 25.

Recommended PEP Regimens for Exposure to HIV

Regimen	Dose	Advantages	Disadvantages
Tenofovir-emtricitabine (Truvada)	1 tablet (tenofovir 300 mg; emtricitabine 200 mg) once daily	Well tolerated; once-daily dosing	Potential nephrotoxicity; drug interactions
Zidovudiine-lamivudine (Combivir)	1 tablet (zidovudine 300 mg; lamivudine 150 mg) twice daily	Preferred in pregnancy	Less well tolerated than tenofovir-emtricitabine (nausea, asthenia, anemia, neutropenia, abnormal liver enzymes); twice-daily dosing
Ritonavir-lopinavir (Kaletra)	2 tablets (ritonavir 50 mg; lopinavir 200 mg) twice daily or 4 tablets once daily	Once- or twice-daily dosing; most experience in pregnancy; high genetic barrier to resistance; no refrigeration required	Gastrointestinal side effects (diarrhea); may cause increased liver enzymes or hepatitis
Ritonavir-atazanavir	Ritonavir 100 mg plus atazanavir 300 mg once daily	Once-daily dosing, well tolerated	Potential for jaundice, renal stones; may cause increased liver enzymes or hepatitis; ritonavir needs to be refrigerated
Ritonavir-darunavir	Ritonavir 100 mg plus 2 tablets of darunavir 100 mg each once daily	Once-daily dosing; high genetic barrier to resistance	Gastrointestinal side effects; may cause increased liver enzymes or hepatitis; ritonavir needs to be refrigerated

Recommended PEP for Exposure to Hepatitis B

Vaccination and antibody response status of exposed patient	Treatment		
	Source patient HBsAg positive	Source patient HBsAg negative	Source patient status unknown
Unvaccinated	HBIG* x 1 and start HB vaccine series	Start HB vaccine series	Start HB vaccine series
Previously vaccinated			
Known responder**	No treatment	No treatment	No treatment
Unknown antibody response	Test exposed patient for anti-HBs 1. If adequate antibody response, no treatment 2. If inadequate antibody response, HBIG x 1 and HB vaccine booster	No treatment	Test exposed patient for anti-HBs 1. If adequate antibody response, no treatment 2. If inadequate antibody response, HB vaccine booster and recheck titer in 1-2 months
Known nonresponder***	HBIG x 1 and start revaccination or HBIG x 2****	No treatment	If known high-risk source patient, treat as if source patient is HBsAg positive

HBsAg = hepatitis B surface antigen; HBIG = hepatitis B immune globulin; HB vaccine = hepatitis B vaccine; anti-HBs = antibody to HBsAg
* 0.06 mL/kg intramuscularly
** Responder: adequate antibody response to vaccination (anti-HBs ≥ 10 mIU/mL
*** Nonresponder: inadequate response to vaccination (anti-HBs < 10 mIU/mL
**** For nonresponders who have not completed a second vaccine series, the preferred regimen is one dose of HBIG and starting revaccination. Two doses of HBIG are preferred for those who have failed to respond to a second 3-dose vaccine series.
Source: Centers for Disease Control. Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Postexposure Prophylaxis. *MMWR* 2001;50(No. RR-11): 22.

Summary of Universal Precautions

- Specimens, including blood, blood products, and body fluids, obtained from all patients should be considered hazardous and potentially infected with transmissible agents.
- Handwashing should be performed before and after patient contact, after removing gloves, and immediately if hands are grossly contaminated with blood; handwashing is the cornerstone of universal precautions.
- Gloves should be worn when hands are likely to come in contact with blood or body fluids.
- Gowns, protective eyewear, and masks should be worn when splashing, splattering, or aerosolizing of blood or body fluids is likely to occur.
- Sharp objects (sharps) should be handled with great care and disposed of in impervious receptacles.
- Needles should never be manipulated, bent, broken, or recapped.
- Blood spills should be handled by initial absorption of the spill with disposable towels, cleaning the area with soap and water, followed by disinfecting the area with a 1:10 solution of household bleach.
- Contaminated reusable equipment should be decontaminated by heat sterilization or, when heat is impractical, with a mycobacterial cleanser.
- Pocket masks or mechanical ventilation devices should be available in areas where cardiopulmonary resuscitation procedures are likely.
- Health care workers with open lesions or weeping dermatitis should avoid direct patient contact and should not handle contaminated equipment.

Supplement to *Emergency Medicine Reports*, June 7, 2010: "Occupational HIV and Hepatitis Exposures." *Authors:* **Lisa Freeman Grossheim, MD, FACEP,** Assistant Professor of Emergency Medicine, Department of Emergency Medicine, University of Texas Medical School at Houston; and **Katrin Takenaka, MD, FACEP**, Assistant Professor of Emergency Medicine, Department of Emergency Medicine, University of Texas Medical School at Houston.

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12. Would you prefer to test with each issue or by semester?_____ by issue_____by semester (check one)
13. Do you have any general comments about the effectiveness of this CME program?

_____

I have completed the requirements for this activity.

Name (printed) _____ **Signature**_____

NOVEL H1N1 INFLUENZA

1. A B C D 2. A B C D 3. A B C D 4. A B C D 5. A B C D 6. A B C D 7. A B C D
8. A B C D 9. A B C D 10. A B C D

EVALUATION AND TREATMENT OF THE HOT JOINT

11. A B C D 12. A B C D 13. A B C D 14. A B C D 15. A B C D 16. A B C D 17. A B C D
18. A B C D 19. A B C D 20. A B C D

CARDIAC BIOMARKERS: HOW TO USE THEM WISELY

21. A B C D E 22. A B C D E 23. A B C D E 24. A B C D E 25. A B C D E 26. A B C D E 27. A B C D E
28. A B C D E 29. A B C D E 30. A B C D E

COMPLICATIONS OF PROSTHETIC HEART VALVES IN THE EMERGENCY DEPARTMENT

31. A B C D 32. A B C D 33. A B C D 34. A B C D 35. A B C D 36. A B C D 37. A B C
38. A B C D 39. A B C D 40. A B C D E

DENTAL EMERGENCIES

41. A B C D 42. A B C D 43. A B C D 44. A B C D 45. A B C D 46. A B C D E 47. A B C D
48. A B C D 49. A B C D 50. A B C D E

DRUG- AND TOXIN-INDUCED SEIZURES

51. A B C D 52. A B C D 53. A B C D E 54. A B C D E 55. A B C D 56. A B C D 57. A B C D E
58. A B C D 59. A B C D 60. A B C D E

CONTROVERSIES IN EMERGENCY MEDICAL SERVICES

61. A B C D 62. A B 63. A B C D 64. A B C D 65. A B 66. A B C D 67. A B C D
68. A B C D 69. A B C D 70. A B C D

SELF-HARM IN THE EMERGENCY DEPARTMENT: A CRY FOR HELP, A CALL TO ARMS

71. A B C D 72. A B C D 73. A B C D 74. A B C D 75. A B C D 76. A B C D 77. A B C D
78. A B C D 79. A B C D 80. A B C D

COMMON DIAGNOSES BECOME DIFFICULT DIAGNOSES WHEN GERIATRIC PATIENTS VISIT THE EMERGENCY DEPARTMENT: PART I

81. A B C D 82. A B 83. A B C 84. A B C D 85. A B C D 86. A B C D 87. A B C D
88. A B C D 89. A B C D 90. A B C D

COMMON DIAGNOSES BECOME DIFFICULT DIAGNOSES WHEN GERIATRIC PATIENTS VISIT THE EMERGENCY DEPARTMENT: PART II

91. A B C D 92. A B C D 93. A B C D 94. A B C D 95. A B C D 96. A B C D 97. A B C D
98. A B C D 99. A B C D 100. A B C D

GERIATRIC PSYCHOSOCIAL ISSUES IN THE EMERGENCY DEPARTMENT

101. A B C D 102. A B C D E 103. A B C D 104. A B C D 105. A B C D E 106. A B C D 107. A B C D E
108. A B C D 109. A B C D 110. A B C D

NEW OVERDOSES

111. A B C D 112. A B C D 113. A B C D 114. A B C D 115. A B C D 116. A B C D 117. A B C D
118. A B C D 119. A B C D 120. A B C D

OCCUPATIONAL HIV AND HEPATITIS EXPOSURES

121. A B C D E 122. A B C D 123. A B C D E 124. A B C D 125. A B C D E 126. A B C D 127. A B C D
128. A B C D E 129. A B C D E 130. A B C D E