

Recommendations

Pre-Exposure Management Education and Infrastructure

At the time of hire or matriculation, health-care providers and health-care institutions should provide training to HCP to improve recognition and encourage timely reporting of blood and body fluid exposures. The possibility that the postexposure evaluation will cause the HCP to have time lost from work should not be a barrier to reporting. Institutions should ensure that HCP have rapid access to postexposure testing and prophylaxis, including HBIG and HepB vaccine.

Serologic Testing for HBV Infection

Testing unvaccinated HCP for HBV infection is not generally indicated for persons being evaluated for hepatitis B protection because of occupational risk. Prevacination serologic testing is indicated for all persons born in geographic regions with HBsAg prevalence of $\geq 2\%$ (e.g., much of Eastern Europe, Asia, Africa, the Middle East, and the Pacific Islands) and certain indigenous populations from countries with overall low HBV endemicity ($< 2\%$); persons with behavioral exposures to HBV (e.g., men who have sex with men and past or current injection drug users); persons receiving cytotoxic or immunosuppressive therapy; and persons with liver disease of unknown etiology.

HBV endemicity (HBsAg prevalence) can be described as low ($< 2\%$), moderate ($2\% - < 8\%$), and high ($\geq 8\%$). Because certain persons might have been infected with HBV before they received HepB vaccination, HBsAg testing is recommended regardless of vaccination history for persons born in geographic regions with HBsAg prevalence of $\geq 2\%$, U.S.-born persons not vaccinated as infants whose parents were born in regions with high HBV endemicity (HBsAg prevalence) ($\geq 8\%$), persons who received HepB vaccination as adolescents or adults after the initiation of risk behaviors (12), and persons who are HIV-positive or who receive hemodialysis (11).

Testing HCP at risk for HBV infection should consist of a serologic assay for HBsAg, in addition to either anti-HBc or anti-HBs (11,12). For unvaccinated HCP at risk for previous HBV infection, blood should be drawn for testing before the first dose of vaccine is administered.

Vaccination

All HCP whose work-, training-, and volunteer-related activities involve reasonably anticipated risk for exposure to blood or body fluids should be vaccinated with a complete, ≥ 3 -dose HepB vaccine series. OSHA mandates that vaccination be available for employees within 10 days of initial assignment (27). HCP trainees should complete the series before the potential for exposure with blood or body fluids, when possible, as higher risk has been reported during professional training (e.g., residency training).

Incompletely vaccinated HCP should receive additional dose(s) to complete the vaccine series (15). The vaccine series does not need to be restarted for HCP with an incomplete series; however, minimum dosing intervals should be heeded (15). Minimum dosing intervals are 4 weeks between the first and second dose, 8 weeks between the second and third dose, and 16 weeks between the first and third dose (15).

HCP lacking documentation of HepB vaccination should be considered unvaccinated (when documentation for HepB vaccine doses is lacking) or incompletely vaccinated (when documentation for some HepB vaccine doses is lacking) and should receive additional doses to complete a documented HepB series. Health-care institutions are encouraged to seek documentation of "missing" HepB doses in IIS, when feasible, to avoid unnecessary vaccination.

OSHA mandates that HCP who refuse HepB vaccination sign a declination statement (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10052&p_table=STANDARDS). HCP refusing HepB vaccination can obtain vaccination at a later date at no expense if the HCP is still covered under OSHA's Bloodborne Pathogens Standard. Health-care institutions should encourage HepB vaccination among HCP to improve HBV protection and to achieve the *Healthy People 2020* target of 90% vaccination (66).

Postvaccination Serologic Testing

HCP who have written documentation of a complete, ≥ 3 -dose HepB vaccine series and subsequent postvaccination anti-HBs ≥ 10 mIU/mL are considered hepatitis B immune. Immunocompetent persons have long-term protection against HBV and do not need further periodic testing to assess anti-HBs levels (Figure 6).

All HCP recently vaccinated or recently completing HepB vaccination who are at risk for occupational blood or body fluid exposure should undergo anti-HBs testing. Anti-HBs testing should be performed 1–2 months after administration

of the last dose of the vaccine series when possible. HCP with documentation of a complete ≥ 3 -dose HepB vaccine series but no documentation of anti-HBs ≥ 10 mIU/mL who are at risk for occupational blood or body fluid exposure might undergo anti-HBs testing upon hire or matriculation. Testing should use a quantitative method that allows detection of the protective concentration of anti-HBs (≥ 10 mIU/mL) (e.g., enzyme-linked immunosorbent assay [ELISA]).

- Completely vaccinated HCP with anti-HBs ≥ 10 mIU/mL are considered hepatitis B immune. Immunocompetent persons have long-term protection and do not need further periodic testing to assess anti-HBs levels.
- Completely vaccinated HCP with anti-HBs < 10 mIU/mL should receive an additional dose of HepB vaccine, followed by anti-HBs testing 1–2 months later. HCP whose anti-HBs remains < 10 mIU/mL should receive 2 additional vaccine doses (usually 6 doses total), followed by repeat anti-HBs testing 1–2 months after the last dose. Alternatively, it might be more practical for very recently vaccinated HCP with anti-HBs < 10 mIU/mL to receive 3 consecutive additional doses of HepB vaccine (usually 6 doses total), followed by anti-HBs testing 1–2 months after the last dose.

Standard Precautions and Advising HCP to Report Exposures

All HCP should adhere to infection-control guidelines and follow Standard Precautions (90), including the use of engineering and work-practice controls, to reduce the risk for blood or body fluid exposure. All HCP, including those who have demonstrated protection against HBV, should be advised to immediately report blood or body fluid exposures to occupational health for evaluation of the appropriate measures to prevent transmission of bloodborne pathogens (including HIV, hepatitis C, and hepatitis B).

Postexposure Management

Initial Postexposure Management

Wounds and skin sites that have been in contact with blood or body fluids should be washed with soap and water; mucous membranes should be flushed with water. Using antiseptics (e.g., 2%–4% chlorhexidine) for wound care or expressing fluid by squeezing the wound further have not been shown to reduce the risk for HBV transmission; however, the use of antiseptics is not contraindicated. The application of caustic agents (e.g., bleach) or the injection of antiseptics or disinfectants into the wound is not recommended.

Procedures should be followed for testing known source persons, including obtaining informed consent, in accordance with applicable laws. Source patients determined to be HBsAg-positive should be referred for appropriate management and should be reported to the state or local health department. When a source patient is unknown (e.g., as occurs from a puncture with a needle in the trash), the exposed HCP should be managed as if the source patient were HBsAg-positive. Testing needles and other sharp instruments implicated in an exposure is not recommended, regardless of whether the source patient is known or unknown. The reliability and interpretation of findings in such circumstances are unknown, and testing could be hazardous to persons handling the sharp instrument. Exposures involving human bites should be managed with the knowledge that both the person being bitten and the person who engaged in biting were potentially exposed.

Institutions should ensure that HCP have timely access to postexposure management and prophylaxis, including HBIG and HepB vaccine. For exposed HCP thought to be susceptible to HBV infection, HBIG and HepB vaccine should be administered as soon as possible after an exposure when indicated. The effectiveness of HBIG when administered > 7 days after percutaneous, mucosal, or nonintact skin exposures is unknown. HBIG and HepB vaccine can be administered simultaneously at separate injection sites.

Anti-HBs testing of HCP who received HBIG should be performed after anti-HBs from HBIG is no longer detectable (6 months after administration) (11). Anti-HBs testing should be performed using a method that allows detection of the protective concentration of anti-HBs (≥ 10 mIU/mL) (Table 2).

Managing Vaccinated HCP

For vaccinated HCP (who have written documentation of a complete, ≥ 3 -dose HepB vaccine series) with subsequent documented anti-HBs ≥ 10 mIU/mL, testing the source patient for HBsAg is unnecessary. No postexposure management for HBV is necessary, regardless of the source patient's HBsAg status.

For vaccinated HCP (who have written documentation of HepB vaccination) with anti-HBs < 10 mIU/mL after two complete, ≥ 3 -dose HepB vaccine series, the source patient should be tested for HBsAg as soon as possible after the exposure. If the source patient is HBsAg-positive or has unknown HBsAg status, the HCP should receive 2 doses of HBIG (1, 11). The first dose should be administered as soon as possible after the exposure, and the second dose should be administered 1 month later. If the source patient is HBsAg-negative, neither HBIG nor HepB vaccine is necessary.

For vaccinated HCP (who have written documentation of a complete, ≥ 3 -dose HepB vaccine series) without previous anti-HBs testing, the HCP should be tested for anti-HBs and the source patient (if known) should be tested for HBsAg as soon as possible after the exposure. Testing the source patient and the HCP should occur simultaneously; testing the source patient should not be delayed while waiting for the HCP anti-HBs test results, and likewise, testing the HCP should not be delayed while waiting for the source patient HBsAg results.

- If the HCP has anti-HBs < 10 mIU/mL and the source patient is HBsAg-positive or has unknown HBsAg status, the HCP should receive 1 dose of HBIG and be revaccinated as soon as possible after the exposure. The HCP should then receive the second 2 doses to complete the second HepB vaccine series (6 doses total when accounting for the original 3-dose series) according to the vaccination schedule. To document the HCP's vaccine response status for future exposures, anti-HBs testing should be performed 1–2 months after the last dose of vaccine.
- If the HCP has anti-HBs < 10 mIU/mL and the source patient is HBsAg-negative, the HCP should receive an additional HepB vaccine dose, followed by repeat anti-HBs testing 1–2 months later. HCP whose anti-HBs remains < 10 mIU/mL should undergo revaccination with 2 more doses (6 doses total when accounting for the original 3-dose series). To document the HCP's vaccine response status for future exposures, anti-HBs testing should be performed 1–2 months after the last dose of vaccine.
- If the HCP has anti-HBs ≥ 10 mIU/mL at the time of the exposure, no postexposure HBV management is necessary, regardless of the source patient's HBsAg status.

Managing HCP Who Lack Documentation of Vaccination, are Unvaccinated or Incompletely Vaccinated

For unvaccinated or incompletely vaccinated HCP (including those who refused vaccination), the source patient should be tested for HBsAg as soon as possible after the exposure. Testing unvaccinated or incompletely vaccinated HCP for anti-HBs is not necessary and is potentially misleading, because anti-HBs ≥ 10 mIU/mL as a correlate of vaccine-induced protection has only been determined for persons who have completed an approved vaccination series (15,42).

- If the source patient is HBsAg-positive or has unknown HBsAg status, the HCP should receive 1 dose of HBIG and 1 dose of HepB vaccine administered as soon as possible after the exposure. The HCP should complete the HepB vaccine series according to the vaccination schedule. To document the HCP's vaccine response status for future exposures, anti-HBs testing should be performed approximately 1–2 months after the last dose of vaccine. Because anti-HBs testing of HCP who received HBIG should be performed after anti-HBs from HBIG is no longer detectable (6 months after administration), it will likely be necessary to defer anti-HBs testing for a period longer than 1–2 months after the last vaccine dose.
 - HCP with anti-HBs ≥ 10 mIU/mL after receipt of the primary vaccine series are considered immune. Immunocompetent persons have long-term protection and do not need further periodic testing to assess anti-HBs levels.
 - HCP with anti-HBs < 10 mIU/mL after receipt of the primary series should be revaccinated. For these HCP, administration of a second complete 3-dose series on an appropriate schedule, followed by anti-HBs testing 1–2 months after the third dose, usually is more practical than conducting serologic testing after each additional dose of vaccine. To document the HCP's vaccine response status for future exposures, anti-HBs testing should be performed 1–2 months after the last dose of vaccine.
- If the source patient is HBsAg-negative, the HCP should complete the HepB vaccine series according to the vaccination schedule. To document the HCP's vaccine response status for future exposures, anti-HBs testing should be performed approximately 1–2 months after the last dose of vaccine.
 - HCP with anti-HBs ≥ 10 mIU/mL after receipt of the primary vaccine series are considered immune. Immunocompetent persons have long-term protection and do not need further periodic testing to assess anti-HBs levels.
 - HCP with anti-HBs < 10 mIU/mL after receipt of the primary series should be revaccinated. For these HCP, administration of a second complete 3-dose series on an appropriate schedule, followed by anti-HBs testing 1–2 months after the third dose, usually is more practical than conducting serologic testing after each additional dose of vaccine. To document the HCP's vaccine response status for future exposures, anti-HBs testing should be performed 1–2 months after the last dose of vaccine.

Testing of HCP Exposed to an HBsAg-Positive or Unknown Source

HCP who have anti-HBs < 10 mIU/mL, or who are unvaccinated or incompletely vaccinated, and who sustain a percutaneous, mucosal, or nonintact skin exposure to a source patient who is HBsAg-positive or has unknown HBsAg status should undergo baseline testing for HBV infection as soon as possible after the exposure, and follow-up testing approximately 6 months later. Testing immediately after the exposure should consist of total anti-HBc, and follow-up testing approximately 6 months later should consist of HBsAg and total anti-HBc.

HCP exposed to a source patient who is HBsAg-positive or has unknown HBsAg status do not need to take special precautions to prevent secondary transmission during the follow-up period; however, they should refrain from donating blood, plasma, organs, tissue, or semen (1). The exposed HCP does not need to modify sexual practices or refrain from becoming pregnant (1). If an exposed HCP is breast feeding, she does not need to discontinue (1). No modifications to

an exposed HCP's patient-care responsibilities are necessary to prevent transmission to patients based solely on exposure to a source patient who is HBsAg-positive or has unknown HBsAg status.

Vaccine Nonresponders

Vaccinated HCP whose anti-HBs remains <10 mIU/mL after revaccination (i.e., after receiving a total of 6 doses) should be tested for HBsAg and anti-HBc to determine infection status. Those determined not to be HBV infected (vaccine nonresponders) should be considered susceptible to HBV infection. No specific work restrictions are recommended for vaccine nonresponders (91).

Documentation

Health-care institutions should maintain records, ideally electronic records that are easily retrievable following exposures, of documented vaccination histories and serologic test results for reference in managing occupational exposures, and to provide to other health-care institutions if requested by the HCP. The vaccination information should be entered into an IIS accepting records from adult vaccination, if available. HCP should be provided a copy of HepB vaccination and anti-HBs testing results and encouraged to keep them with their personal health records so they can readily be made available to future employers.

HCP with HBV Infection

HCP who are positive for HBsAg should be counseled how to prevent HBV transmission to others and referred for further evaluation (92). Those who perform exposure-prone procedures should be advised regarding the procedures they can perform safely as per updated CDC recommendations for the management of HBsAg-positive health-care providers and students (11,13). Chronic hepatitis B infection in itself should not preclude the practice or study of medicine, surgery, dentistry, or allied health professions (13).