Hepatitis is inflammation of the liver caused by viruses and other factors including medications, trauma and alcohol. Included are hepatitis A, B, C, D and E.

The five primary hepatitis viruses vary greatly. Each has a unique genetic composition and particle structure. They are grouped together only because they can infect, inflame and damage liver tissue. Fortunately, the liver is one of the few human internal organs capable of natural regeneration of lost cells.

**Hepatitis A**

Hepatitis A virus (HAV) generally is a mild disease that does not lead to chronic infection. Deaths are very uncommon. Infection results in lifelong protection against subsequent infection. HAV is environmentally stable and spreads primarily by fecal-oral routes through soiled hands/objects and by consumption of contaminated food, beverages and water. Both isolated cases of disease and widespread epidemics occur. Approximately one-third of Americans have serological evidence of a previous HAV infection.

The average incubation for HAV is 30 days (range 15-45 days). Disease severity increases with age. Symptoms if present last about two months. About 15% of infected individuals have prolonged or relapsing symptoms which last six to nine months. In 1975, more than 50,000 reported cases occurred. Greater awareness, improved hygiene and the introduction of an HAV vaccine in 1995 has resulted in an 85% decrease in the number of cases.

HAV is not an occupational hazard for dental healthcare workers.

**Hepatitis B**

Hepatitis B (HBV) is a highly infectious virus that causes serious acute and chronic infections. HBV is a bloodborne pathogen and a proven occupational hazard to dental healthcare workers. HBV transmission occurs percutaneously or permucosally by contact with infected body fluids, primarily blood. Sexual transmission and perinatal spread also occurs.

About 30% of acute cases have no signs or symptoms. Incubation varies between 45 and 160 days (average is 90 days). Acute disease eventually leads to viral clearance or to chronic infection.

About 5% to 10% of acute cases become chronic. Chronically infected persons are the prime reservoir for HBV. There are an estimated 1.5 million chronic carriers in the United States. The younger a person is when infected, the more likely they will become chronic carriers.

The best way to avoid HBV infection is through immunization. Vaccines became commercially available in the United States in 1982. The two vaccines used today employ recombinant techniques that generate HBV surface antigen protein (HBsAg) from modified yeast cells.

Widespread HBV vaccination of infants in the United States began in 1991. In that same year, the Occupational Safety and Health Administration (OSHA) began requiring employers to inform at-risk em-

**Learning Objectives**

After reading this article, the reader should be able to:

- identify the routes of transmission for the five human hepatitis viruses.
- describe levels of infectivity and modes of pathology for the five human hepatitis viruses.
- list hepatitis viruses that are occupational hazards for dental personnel.

*continued on page 2*
The ABCs of Hepatitis continued from front cover

employees of the vaccine and to offer it at no cost. Vaccine programs have proved successful - from 1990-2005, the U.S. incidence of HBV declined 78%.

Hepatitis C
Hepatitis C virus (HCV) is the most common chronic bloodborne infection. It is the leading indication for liver transplantation. In the U.S., there are an estimated 4.1 million persons infected with HCV with 3.2 million having chronic infections. The majority of infected persons (up to 80%) experience no signs or symptoms. Depending upon age at the time of infection, 50% to 80% of acute cases become chronic. More than 70% of chronically infected persons experience some form of liver disease with death occurring in 1%-5% of cases. No effective vaccine currently exists.

Serologic screening began in 1981 and new infections have fallen every year to a low of 51,000 in 2005. Today, one HCV infection develops in every two million blood transfusions. The greatest number of cases (39%) occurs among injectable drug abusers. Only 14% of cases involve sexual contact, but the risk doubles if there are multiple partners. About 10% of cases involve virus transmission within the household (e.g., sharing personal grooming items, including toothbrushes). Occupational exposures and mother-to-child transmission each comprise 4% of cases. Almost 40% of HCV infections have no known cause.

Because no vaccine currently exists, behavior modification is essential. Healthcare workers must properly use personal protective devices and handle contaminated sharps as safely as possible.

Hepatitis D
Hepatitis D virus (HDV) is a defective virus that requires the help of HBV to replicate. In fact, HDV takes up residence within a HBV particle. Parts of the HDV particle are actually HBV surface antigens. Modes of HDV transmission and risk groups are similar to those of HBV. HDV and HBV can infect simultaneously or HDV can cause a superinfection in persons already having chronic HBV. A combined HDV-HBV infection can increase the severity of the acute disease and can multiply tenfold the rate of liver failure. Successful HBV vaccination prevents HDV infection.

Hepatitis E
Hepatitis E virus (HEV) is common outside the United States. Domestic cases involve travelers returning from endemic areas. Transmission routes and symptoms are similar to HAV. Highest attack rates occur among young adults. HEV infections are more severe among pregnant women.

No vaccine exists for HEV. Hygiene and avoidance of contaminated foods and drinks (including ice) are essential preventive mechanisms.

— OSAP

Photos on pages 1 and 2 are courtesy of the Centers for Disease Control & Prevention (CDC)
Centers for Disease Control and Prevention

HBV vaccination began in the U.S. in 1982. The initial emphasis was to immunize at-risk adults, especially injectable drug users, men who have sex with men and healthcare workers. Attention soon moved to pregnant women and in 1988, the recommendation was made that all pregnant women be screened and vaccinated. Infected mothers could be identified and their newborn children vaccinated and given immune globulin while in the birth hospital. By 1996, comprehensive programs began to vaccinate all infants and to establish catch-up schemes for older children and adolescents. In 2000, HBV vaccine manufacturers removed the mercury-containing preservative in their products. Since the federal government started to fund perinatal HBV prevention programs, the CDC estimates that more than 50 million infants and children received immunization. An estimated 30 million adults have completed the HBV vaccine series.

Cutting Edge

Hepatitis C (HCV) is a major cause of acute and chronic liver disease. According to the World Health Organization (WHO), globally, an estimated 170 million persons (3.1% of the world’s population) have chronic infections with three to four million new cases each year.

HCV spreads primarily through contact with blood. Screening of blood transfusions does not occur worldwide. Inadequately sterilized needles, syringes and other pieces of medical equipment are common modes of transmission. Social practices using percutaneous procedures and non-sterile equipment, such as ear and body piercing, circumcision, tattooing and ornamental scarring can lead to infection. In developed countries, injectable drug users comprise 90% of cases.

There is no vaccine available for HCV and treatment for chronic infections is too costly for most of the world’s population. From a global perspective, the greatest impact on HCV disease would most likely come from reducing exposure to contaminated blood. This would include: 1) screening and testing of blood and organ donors; 2) viral inactivation of plasma-derived products; 3) establishing and maintaining high levels of infection control practices in healthcare settings; 4) behavior modification by the general public as well as by healthcare professionals.

Occupational Safety and Health Administration

HBV vaccination is a key element of OSHA’s Bloodborne Pathogens Standard. The immunization series must be free to all at-risk employees and given at a reasonable time by a licensed physician or another licensed healthcare professional within ten days of employment. Training concerning occupational risks and the value of the vaccine is required. Serological screening for the presence of protective antibodies should occur one to two months after completion of the series. Additional injections may be required for non-responders. Employees that decline vaccination must read and sign a specific vaccination refusal form. Currently, there is no indication for booster injections.
Strategies to reduce hepatitis infection

The hepatitis viruses are important human pathogens both worldwide and in the United States. One or more of the hepatitis viruses will infect a significant portion of the world’s population. The socioeconomic effect of viral hepatitis is tremendous and the impact on human health and longevity is profound. We must protect ourselves in the workplace, at home and outside the home. Successful avoidance of infection will include a combination of factors - immunization, when available, hand hygiene, sanitation, modifying sexual practices and prudent selection of food and beverages, especially when in large groups or when traveling.

The major hepatitis viruses fall into two basic groups: enterically transmitted hepatitis (HAV and HEV) and parenterally transmitted hepatitis (HBV, HCV and HDV). Many of the factors that place us at increased risk for hepatitis also increase our chances of acquiring HIV/AIDS. Following are suggestions to help prevent infection with hepatitis viruses.

Enterically transmitted hepatitis - HAV and HEV
Spread of contaminated fecal material is the prime mode of viral transmission. Consider the following:
- especially when traveling, follow the adage - “boil it, peel it or forget it”
- carry alcohol-based hand rubs for hand hygiene
- know the times of year that certain foods, such as shellfish, can be safely ingested
- consider being vaccinated for HAV
- wash all unprepared foodstuffs in the household and carefully clean cutting boards, knives and forks
- be vigilant when eating outside the home, especially at restaurants, group functions, traveling (e.g., cruise ships and foreign destinations) and even at church or family gatherings
- wear condoms if engaging in anal intercourse

Parenterally transmitted hepatitis - HBV, HCV and HDV
Blood is the prime mode of transmission for these viruses. Incredibly small amounts of blood can cause infection. Other body fluids can contain blood or carry parenteral hepatitis viruses. Immunization and minimizing exposure are essential. Consider:
- vaccination if successful will prevent HBV and HDV infections
- can you prove that you have been successfully immunized against HBV?
  - Did you receive the correct amount/type of vaccine?
  - Was the vaccine schedule correct (e.g., 0, 1 and 6 months)?
  - Did post-screening for seroconversion occur within a few months of completing the series?
  - If you have not been post screened or if screening was delayed more than a few months after completion of the series and a negative result occurred, consider the following -
    - receive a single HBV injection
    - wait 60 days and be post-screened
    - if the proper amounts of antibodies are detected, you are protected
    - if proper amounts of antibodies are not detected, consult your healthcare provider and consider repeating the series of three injections followed by another post-screening
- multiple sex partners and anal intercourse increase the chances of a HBV or HDV infection
- sharing injectable drug paraphernalia increases dramatically the chances of infection
- occupationally, proper use of personal protective devices and safer use and disposal of contaminated sharps is imperative

continued on page 6

Ask OSAP

Q: I am having trouble keeping all these hepatitis viruses straight. Can OSAP help me?

A: Yes, we can. To help learn about the various “alphabet soup” strains of hepatitis, try these memory tricks:
- To differentiate between routes of transmission, remember that consonants refer to bloodborne strains: B, C and D and vowels refer to oral-fecal transmitted strains: A & E. To remember the virulence of the strains, learn two phrases: “Hepatitis can be bad, chronic and deadly” and “Arts and Entertainment.” As for the first, Bad, hepatitis B infection results in a 5 - 10% chance of developing a chronic carrier state. Chronic: hepatitis C has a much higher chronic carrier rate. Deadly: hepatitis D is typically a co-infection piggybacking with B that results in the highest rates of death.). “Arts & Entertainment,” hepatitis A & E are much less virulent. You’ll be more likely to survive and have fun throughout your life, i.e., “enjoy Arts & Entertainment,” if you contract one of these two strains. Hepatitis A & E tend to develop protective antibodies in the host.

Resource: Dental Infection Control Educators and Trainers Toolkit (www.OSAP.org) Credit: Kathy Eklund RDH MHP

Do you have an inquiry about infection control, occupational health, or practice safety? Ask OSAP. Send your questions to office@OSAP.org
According to the CDC, an estimated 600,000 - 800,000 needlestick injuries and other percutaneous injuries occur annually among healthcare workers. Many go unreported. Additional exposure incidents include splashes and other contact with mucous membranes or non-intact skin. Post-exposure management is an integral part of a complete program for preventing infection following exposure incidents.

If you experience a needlestick or get blood or other, potentially infectious materials in your eyes, nose, mouth, or on broken skin, there some three basic actions to perform. These responses are to: 1) immediately flood the exposed area with water and clean any wound with soap and water or a skin disinfectant if available, 2) report this immediately to your employer and 3) seek immediate medical attention.

Immediate medical attention comprises post-exposure medical evaluation and follow-up. According to OSHA, the process must involve a confidential medical evaluation and follow-up at no cost to the employee. Such activities are to occur at a reasonable time and place and performed by a licensed physician or other licensed healthcare professional. Using a prepared incident reporting form helps document exposures and associated circumstances. The form can describe the incident as well as the employee’s job description and salient health data, such as HBV vaccination. Each of the three involved parties - employer, employee and qualified healthcare professional have specific responsibilities.

**Employer Tasks**

1. Send employee with consent to a qualified healthcare professional for evaluation.
2. Send source individual to healthcare professional or arrange or other testing (with consent).
3. Inform healthcare professional if source patient has HBV, HCV or HIV or if consent is not given.
4. Convey the following to the healthcare professional:
   - copy of the OSHA Bloodborne Pathogens Standard
   - incident report
   - employee’s job description as it relates to the exposure incident
   - written evidence of employee’s HBV vaccination and other previous exposure incidents
5. Assure that the healthcare professional informs the employee of these results stressing confidentiality.
6. Receive a written opinion of the employee from the healthcare professional.

**Employee Tasks**

1. Report to the healthcare professional for evaluation.
2. Give or withhold consent for testing.
3. Receive their test results as well as those of the source individual from the healthcare professional.
4. Receive information from the healthcare professional of any conditions resulting from exposure that require additional evaluation and/or treatment.

**Qualified Healthcare Professional Tasks**

1. Receive the following from the employer:
   - copy of the OSHA Standard
   - copy of the incident report
   - employee’s job description
   - information concerning the employee’s HBV vaccination history and past exposure incidents
2. Arrange for testing of source individual with consent OR receive test results from employer-arranged testing OR receive other information about source individual’s HBV, HCV and HIV status or that consent for testing was not given.
3. Evaluate exposed employee for testing with consent and arranges for testing when indicated (if blood is drawn but consent for testing is not given, arrangements can be made to store blood samples for 90 days should the employee change their mind).
4. Inform exposed employee of:
   - source individual's test results, stressing confidentiality
   - results of the evaluation
   - any condition that requires further evaluation or treatment
5. Generate a written opinion for the employer that the employee was informed of results and of any further evaluation or treatment needed.
Glossary

**Antigen:** Substances or cells that the body identifies as foreign and toward which it mounts an immune response.

**Bloodborne Pathogens:** Pathogenic microorganisms that are present in human blood and can cause disease in humans, including, but are not limited to, HBV, HCV and HIV.

**Enteric/Enterically:** A general term for the intestines/as coming from the intestines.

**HBV Vaccination:** Immunization against hepatitis B virus infections, which usually requires a series of three injections followed by a serologic evaluation for antibodies.

**Immunization:** Process of inoculating the body with specific antigens with the intention of producing immunity to those antigens.

**Parenteral:** Piercing mucous membranes or the skin barrier through such events as needlesticks, human bites, cuts, and abrasions.

**Recombinant DNA Technology:** Also known as genetic engineering, transfer of genes (including human) into easily cultured cells, such as bacteria and yeasts with the result being large-scale production of useful gene products (usually proteins). The HBV vaccine, insulin and certain hormones are examples.

**Seroconversion:** Formation of detectable antibodies after exposure to an antigen.

**Source Patient:** Any individual, living or dead, whose blood or other potentially infectious materials may be a source of occupational exposure to the employee.

**Standard Precautions:** Melds the features of universal precautions (blood and body fluid precautions designed to reduce the risk of transmission of bloodborne pathogens) with body substance isolation precautions (designed to reduce the risk of transmission of pathogens from moist body substances) and applies them to all patients receiving care, regardless of their diagnosis or presumed infection status.

**Superinfection:** A process by which a cell that has previously been infected by one virus is co-infected with another virus at a later point in time.

**Universal Precautions:** An approach to infection control in which all human blood and certain human body fluids are treated as if known to be infectious for HIV, HCV, HBV, and other bloodborne pathogens.

**Vaccine:** A substance that contains an antigen to which the immune system responds.

**Viral Hepatitis:** Inflammation of the liver caused by a virus.

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**Best Practices**


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**Strategies to reduce hepatitis infection**

*knowing one’s HBV/HCV/HDV status is an essential element of a successful pregnancy*
*
be prepared to share HBV, HCV and HDV information with your patients, families and friends*
*
while HCV vaccine is a major area of research, currently none exists*
*
sharing injectable drug paraphernalia is the #1 cause of HCV infection*
*
multiple sex partners and anal intercourse increases the risk of infection*
*
occupationally, proper use of personal protective devices and safer use and disposal of contaminated sharps is imperative*
*
ensure proper infection control is observed if considering a tattoo or body piercing*
*
because 40% of HCV cases have no known cause and many people today live with HCV infected persons, consider the following household advice:*
*
> there is little evidence for sexual transmission when a monogamous relationship exists*
*
> avoid sharing personal grooming items, such razors, scissors, toothbrushes, nail files or clippers or any items that may contain blood*
*
> use a mechanical dishwasher to clean flatware and cutlery— OSAP
If you wish to obtain one (1) hour of continuing-education (CE) credit, complete the following test by selecting the best answer and fax or mail it to the OSAP Central Office for grading. Please include a check or credit card to cover handling charges. Pending satisfactory results (at least seven out of ten), you will be issued a letter for one (1) CE credit hour. OSAP is recognized by the American Dental Association as a CERP Provider. For more information, call OSAP at 800-298-6727 (410-571-0003).

For each question, pick the best answer.

1. Which of the following spreads primarily by contact with fecally-soiled items, food and beverages?
   a. hepatitis A  
   b. hepatitis B  
   c. hepatitis C  
   d. hepatitis D

2. Which is the most common chronic bloodborne infection in the United States?
   a. hepatitis A  
   b. hepatitis B  
   c. hepatitis C  
   d. hepatitis D

3. Who is responsible for paying post-exposure medical evaluation and follow-up costs?
   a. employee  
   b. employer  
   c. healthcare professional  
   d. a shared responsibility of the employee and employer

4. Through which of the following pathways do dental healthcare workers most commonly acquire an HCV infection?
   a. inhalation  
   b. ingestion  
   c. needlestick

5. What percent of HCV infections involve occupational exposure?
   a. 1%  
   b. 4%  
   c. 15%  
   d. 28%

6. Ideally, when should post-screening occur after completion the HBV vaccination series?
   a. the same day  
   b. one to two months  
   c. after one year  
   d. anytime

7. Must employers provide booster HBV injections to vaccinated employees?
   a. yes  
   b. no

8. After an occupational exposure, can the injured employee refuse testing for antibodies to HBV, HCV or HIV?
   a. yes  
   b. no

9. Which federal agency requires employers to inform employees of their occupational risk for HBV and to offer free-of-charge the HBV vaccine?
   a. FDA  
   b. EPA  
   c. OSHA  
   d. CDC

10. Can at-risk employees refuse the HBV vaccine?
    a. yes  
    b. no
One important infection control function performed by the Environmental Protection Agency (EPA) is to better assure the safety and effectiveness of disinfectants used on surfaces. Product manufacturers submit to the EPA information concerning safety and antimicrobial claims. If the product claims meet the required criteria, the EPA will issue a registration number that must appear on the product's label.

However, the code system the EPA uses can be confusing. The manufacturer receives an EPA registration number and an establishment number. The registration number most often appears as “EPA Reg. No. XXXX-YY” or “EPA Registration No. XXXX-YY.” The “XXXX” identifies the company holding the registration, while the “YY” represents a specific product.

A common practice is to market the same disinfectant under a variety of brand names. If a distributor then offers the product under its own name, the EPA registration number changes. For example, the number is now “EPA Reg. No. XXXX-YY-ZZZ.” The “ZZZ” denotes the distributor.

Establishment numbers are not always present on the product label. If present, the establishment number appears as “EPA Est. No. XXXX-SS-C.” In this case, the “XXXX” is the company number, the “SS” is the abbreviation of the state in which the product was manufactured and “C” the actual facility from which the product came.

The registration number has no required location on the label, but usually appears on the front or back panel of the product label, and near the registrant's name and address. The registration number must be set in type and style similar to and running parallel to other print on the section of the label where the registration number is located.

The presence of the EPA registration numbers helps to assure that the product used is safe, appropriate and effective. By deciphering the numbers, office staff can reassure themselves that a product is exactly what they require.


Chris H. Miller PhD
Dr. Miller earned his PhD in microbiology and has been on the faculty at Indiana University School of Dentistry since 1970. He currently serves as Executive Associate Dean, Associate Dean for Academic Affairs and for Graduate Education. He is also Director of Infection Control Research, and Professor of Oral Microbiology. Dr. Miller was a Founding Member of OSAP.