HEPATITIS C

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About the Author

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Purpose & Goals

The goal of this course is designed to give nurses and other healthcare professionals an overview of the hepatitis C virus (HCV) as a major public health problem in the U.S. today. Topics covered include the assessment, treatment, and prevention and patient teaching strategies related to Hepatitis C.

Instructional Objectives

Upon completion of this course, the learner will be able to:
1. Outline the prevalence of HCV infection in the United States
2. Name the primary ways that HCV is transmitted.
3. Recognize current methods for screening and diagnosis of HCV.
4. List clinical indicators of both acute and chronic HCV infection.
5. Name and define primary approaches to management and treatment of HCV.
6. Outline specific prevention strategies for various populations at risk for HCV infection.
7. Enumerate key components of the education process for patients with HCV.
8. Document selected CAM therapies available to treat Hepatitis C & reasons for their use.

Introduction

Hepatitis C virus (HCV) is a single-stranded RNA virus that is transmitted primarily through blood exposure. More than 4 Million Americans have been infected with HCV, and 3.2 million of those are chronically infected. For every one person that is infected with the AIDS virus, there are more than four infected with HCV. The CDC (Center For Disease Control) estimates that there are up to 26,000 new HCV infections in the U.S. every year and that Hepatitis C causes 10,000 to 12,000 deaths each year.

Many might not be aware of their infection, however, because they are not clinically ill. Infected persons serve as a source of transmission to others and are at risk for chronic liver disease or other HCV-related chronic diseases during the first two or more decades following initial infection. The Public Effects Are Going To Get Worse, Fast. Over the next 10-20 years chronic HCV is predicted to become a major burden on the health care system as patients who are currently asymptomatic with relatively mild disease progress to end-stage liver disease and develop hepatocellular carcinoma.
Chronic liver disease is the tenth leading cause of death among adults in the United States and 40% of cases are HCV-related. Most HCV-infected persons are between 40 and 49 years of age, the majority of whom likely became infected during the 1970s and 1980s when rates were highest. The number of deaths attributable to HCV-related chronic liver disease could increase substantially during the next 10-20 years. As this group reaches ages at which complications from chronic liver disease typically occur. Surveillance for acute hepatitis C remains critical as the best means to assess the effects of primary prevention strategies, determine where transmission continues to occur, and identify and control outbreaks.

HCV infection occurs among persons of all ages. However, since 1992, the greatest declines in incidence of acute hepatitis C have occurred among persons aged 25--39 years, the age group that has had the highest rates. In 2005, cases among children continued to be rare. Progress has been made in reducing disparities in race/ethnicity-specific rates; in 2005, the incidence of acute hepatitis C was similar across all racial/ethnic populations.

HCV is transmitted primarily through large or repeated direct percutaneous exposures to blood. In the United States, the most common exposure associated with transmission of HCV is injecting-drug use. Interestingly, the dramatic decline in incidence of acute hepatitis C since 1989 correlates with a decrease in cases among injecting-drug users. This decline is primarily related to risk-reduction practices in this population, including declines in needle-sharing behaviors. However, in 2005, injection-drug use continued to be the most commonly identified risk factor for infection. Approximately 40% of persons who reported multiple sex partners, which was the next most frequently reported risk factor, also reported injection-drug use. Other risk factors for transmission of HCV include employment in patient care or clinical laboratory work, exposure to a sex partner or household member who has had a history of hepatitis, exposure to multiple sex partners, and low socioeconomic level.

Screening & Diagnostic Tests

Acute HCV infection is usually not recognized. In most cases, patients are asymptomatic or have nonspecific symptoms such as fatigue and, occasionally, jaundice and scleral icterus. Elevated blood levels of the enzyme alanine aminotransferase (ALT) are a diagnostic indication of liver disease but are not specific to HCV. The only tests currently approved by the U.S. Food and Drug Administration (FDA) for diagnosis of HCV infection are those that measure anti-HCV antibodies. These tests detect anti-HCV in more than 97% of infected patients, but do not distinguish between acute, chronic, or resolved infection. The diagnosis of HCV infection also can be made by qualitatively detecting HCV RNA using gene amplification techniques such as RT-PCR. HCV RNA can be detected in serum or plasma within one to two weeks after exposure to the virus and weeks before the onset of ALT elevations or the appearance of anti-HCV. Rarely, detection of HCV RNA might be the only evidence of HCV infection.

At least six different genotypes and more than 90 subtypes of HCV exist. Approximately 70% of HCV-infected persons in the United States are infected with genotype 1. Differences do exist in responses to antiviral therapy according to HCV genotype. Rates of response in patients infected with genotype 1 are substantially lower than in patients with other genotypes, and treatment regimens might differ on the basis of genotype 1, with frequency of subtype 1a predominating over subtype 1b. Different nucleic acid detection methods are available commercially to group isolates of HCV, based on genotypes and subtypes. Evidence is limited regarding differences in clinical features, disease outcome, or progression to cirrhosis or hepatocellular carcinoma (HCC) among persons with different genotypes. However, differences do exist in responses to antiviral therapy according to HCV genotype. Rates of response in patients infected with genotype 1 are substantially lower than in patients with other genotypes, and treatment regimens might differ on the basis of genotype. Thus, genotyping might be warranted among persons with chronic hepatitis C who are being considered for antiviral therapy.

OraSure Technologies is teaming up with Schering-Plough to develop and market the first Oral test to detect hepatitis C virus (HCV) antibodies. Ease of testing for HCV will be a major step forward in efforts to identify infected individuals. Hopefully, the development will be accelerated by this collaboration between these two companies. Encouraging individuals to assess their past risk behaviors that may have exposed them to hepatitis C and to seek testing has been a challenge. Making testing easier will enhance public health initiatives to identify those who are HCV infected. Estimates of the number of unidentified hepatitis C infected individuals is in the tens of thousands and probably many more. Call the Hepatitis Foundation International at 800-891-0707 to obtain more information and referral to liver specialists.

Clinical Presentation

Hepatitis symptoms vary widely because the liver is an extremely robust organ, able to function even if large portions are destroyed. Persons with acute HCV infection typically are either asymptomatic or have a mild clinical illness; 60%-70% have no discernible symptoms; 20%-30% might have jaundice; and 10%-20% might have nonspecific symptoms such as anorexia, malaise, or abdominal pain. Clinical illness in patients with acute hepatitis C who seek medical care is similar to that of other types of viral hepatitis, and serologic testing is necessary to determine the etiology of hepatitis in an individual patient. The course of acute hepatitis C is variable, although elevations in serum ALT levels, often in a fluctuating pattern, are its most characteristic feature. Normalization of ALT levels might occur and suggests full recovery, but this is frequently followed by ALT elevations that indicate progression to chronic disease. Fulminant hepatic failure following acute hepatitis C is rare.

After acute infection, 15%-25% of persons appear to resolve their infection without sequelae. Chronic HCV infection develops in most persons, however, with active liver disease in 60-70% of those who are chronically infected. In chronic hepatitis, nutrients ordinarily distributed by the liver become unavailable. Low blood sugar and fatigue result. It also keeps the liver from breaking down the toxins it normally removes from the body. This build-up of toxins in the bloodstream can result in depression, delirium, or loss of short-term memory. The course of chronic liver disease is usually insidious, progressing at a slow rate without symptoms or physical signs in the majority of patients during the first two or more decades after infection. Frequently, chronic hepatitis C is not recognized until asymptomatic persons are identified as HCV-positive during blood-donor screening, or elevated ALT levels are detected during routine physical examinations. Most studies have reported that cirrhosis develops in 10%-20% of persons with chronic hepatitis C over a period of 20-30 years, and hepatocellular carcinoma (HCC) in 1-4%.

“The only tests currently approved by the U.S. Food and Drug Administration (FDA) for diagnosis of HCV infection are those that measure anti-HCV antibodies.”
Although factors predicting severity of liver disease have not been well defined, recent data indicate that increased alcohol intake, being over 40 years of age at infection, and being male are associated with more severe liver disease. In particular, among persons with alcoholic liver disease and HCV infection, liver disease progresses more rapidly; and among those with cirrhosis, a higher risk for development of HCC exists. Furthermore, even intake of moderate amounts of alcohol in patients with chronic hepatitis C might enhance disease progression. More severe liver injury observed in persons with alcoholic liver disease and HCV infection possibly is attributable to alcohol-induced enhancement of viral replication or increased susceptibility of cells to viral injury. In addition, persons who have chronic liver disease are at increased risk for fulminant hepatitis A.

Extrahepatic manifestations of chronic HCV infection are considered to be of immunologic origin and include cryoglobulinemia, membranoproliferative glomerulonephritis, and porphyria cutanea tarda. Other extrahepatic conditions have been reported, but definitive associations of these conditions with HCV infection have not been established. These include seronegative arthritis, Sjögren syndrome, autoimmune thyroiditis, lichen planus, Mooren corneal ulcers, idiopathic pulmonary fibrosis (Hamman-Rich syndrome), polyanteritis nodosa, aplastic anemia, and B-cell lymphomas.

Management & Treatment

HCV-positive patients should be evaluated for presence and severity of chronic liver disease. Initial evaluation for presence of disease should include multiple measurements of ALT at regular intervals, because ALT activity fluctuates in persons with chronic hepatitis C. Patients with chronic hepatitis C should be evaluated for severity of their liver disease and for possible treatment.

Antiviral therapy is recommended for patients with chronic hepatitis C who are at greatest risk for progression to cirrhosis. These persons include anti-HCV-positive patients with persistently elevated ALT levels, detectable HCV RNA, and a liver biopsy that indicates either portal or bridging fibrosis or at least moderate degrees of inflammation and necrosis.

In patients with less severe histologic changes, indications for treatment are less clear, and careful clinical follow-up might be an acceptable alternative to treatment with antiviral therapy (e.g., interferon) because progression to cirrhosis is likely to be slow, if it occurs at all. Similarly, patients with compensated cirrhosis (without jaundice, ascites, variceal hemorrhage, or encephalopathy) might not benefit from interferon therapy. Careful assessment should be made, and the risks and benefits of therapy should be thoroughly discussed with the patient.

Patients with persistently normal ALT values should not be treated with interferon outside of clinical trials because treatment might actually induce liver enzyme abnormalities. Patients with advanced cirrhosis who might be at risk for decompensation with therapy and pregnant women also should not be treated. Interferon treatment is not FDA-approved for patients aged less than 18 years, and more data are needed regarding treatment of persons aged less than 18 years or greater than 60 years. Treatment of patients who are drinking excessive amounts of alcohol or who are injecting illegal drugs should be delayed until these behaviors have been discontinued for at least 6 months. Other contraindications to treatment with interferon include major depressive illness, cytopenias, hyperthyroidism, renal transplantation, and evidence of autoimmune disease.

Treatment for hepatitis C is a rapidly changing area of clinical practice. Combination therapy with interferon and ribavirin, a nucleoside analogue, is now now the primary FDA-approved for treatment of chronic hepatitis C in patients who have relapsed following interferon treatment and is also an option for patients who have not been treated previously. Studies of patients treated for one year with a combination of ribavirin and interferon have demonstrated a substantial increase in sustained response rates, reaching 45%-55%, compared with response rates of 15%-25% with interferon alone. However, as with interferon alone, combination therapy in patients with genotype 1 is not as successful, and sustained response rates among these patients are still less than 30%.

Most patients receiving interferon experience flu-like symptoms early in treatment, but these
symptoms diminish with continued treatment. Later side effects include fatigue, bone marrow suppression, and neuropsychiatric effects (e.g., apathy, cognitive changes, irritability, and depression).

Interferon dosage must be reduced in 10%-40% of patients and discontinued in 5%-15% because of severe side effects. Ribavirin can induce hemolytic anemia and can be problematic for patients with preexisting anemia, bone marrow suppression, or renal failure. In these patients, combination therapy should be avoided or attempts should be made to correct the anemia. Hemolytic anemia caused by ribavirin also can be life threatening for patients with ischemic heart disease or cerebrovascular disease. Ribavirin is teratogenic, and female patients should avoid becoming pregnant during therapy.

Other treatments, including corticosteroids, ursodiol, and thymosin, have not been effective. High iron levels in the liver might reduce the efficacy of interferon. Use of iron-reduction therapy (phlebotomy or chelation) in combination with interferon has been studied, but results have been inconclusive. Because patients are becoming more interested in complementary/alternative therapies (e.g., traditional Chinese medicine, antioxidants, naturopathy, and homeopathy), nurses and other healthcare professionals should be prepared to address questions regarding these topics.

Complementary Therapies

There are various reasons why people use complementary/alternative medicine (CAM) for hepatitis C, including:

- They have not had a response to initial treatment or to retreatment with drugs.
- They are not willing to have drug treatment or continue it--for example, because of the side effects or length of treatment.
- They would like to support their body’s fight against damage by hepatitis C, & benefits can include “strengthening the immune system” or “cleansing or rejuvenating the liver” (or other organs).
- They are experiencing problems from other diseases and conditions that can be caused by or worsened by hepatitis C.
- They are not satisfied with their conventional medical treatment.

There is a wide range of CAM therapies available to treat hepatitis C and it’s associated conditions. Therefore, it is beyond the scope of this course to discuss all possible CAM therapies used. Selected therapies include:

Milk Thistle (Silybum Marianum)

Powerful natural liver protection starts with milk thistle. The first scientifically-proven alternative liver protecting herb treatment is milk thistle. Silymarin, the purified extract of the fruits of Silybum marianum, and its main constituent, silybin, are used to maintain liver health and for the treatment of diseases of the liver. Worldwide milk thistle is, deservedly, one of the most commonly prescribed medicinal plants.

S. marianum is a medicinal plant which has been widely used in traditional European medicine for centuries. It is commonly known as milk thistle, St. Mary’s thistle and lady’s thistle. It is native to southern Europe, southern Russia, Asia Minor and North Africa. It has been naturalized to North and South America. Milk Thistle has a long therapeutic history.

This plant has been known since ancient times; it is a biblical plant. It was mentioned by Theophrastus (4th century B.C.) with the name of Pternix and by Pliny the Elder (1st century A.D.) with the name of Sillybum. Von Haller (1744) in its “Medizinischen Lexicon” documented the specific use of the plant for liver disorders. In the 19th and 20th centuries many authors such as Rademacher, Schulz and Henry Leclerc mentioned the fruits of S. marianum for the treatment of liver diseases, disorders of the bile duct and spleen.

Ancient use and modern studies verify its safety and effectiveness.

For over 2,000 years Europeans have used Milk Thistle seeds as an herbal treatment for liver disorders. The plant has been grown both as an ornamental and a vegetable. Virtually all parts of the plant have been used as food with no reports of toxicity. Animal experiments have shown that seed extracts are safe, even in large doses, with practically no side effects, as well as no embryo-toxic effect.
Adverse effects in human studies with the seed extract (silymarin) are also generally absent. There are no contradictions nor known side effects of concern. It can be safely used by a wide range of persons, including pregnant and lactating women, although it may have a mild, transient laxative effect for some people.

Double blind studies on the effect of silymarin on toxic liver damage (mostly induced by alcohol), chronic liver disease and disease caused by certain drugs have been reviewed by medical experts. They concluded that basic lab and clinical data suggests silymarin is a therapeutically useful medicinal plant product that stabilizes the cell membrane and stimulates protein synthesis, while accelerating the process of regeneration in damaged liver tissue, and that these effects are important in the therapeutic efficacy of silymarin. Silymarin, derived from the seeds of the plant (and most specifically, its main constituent, silybin) has shown both protective and restorative effects in liver disease. The plant is a primary example of the usefulness of using historical efficacy as a starting point for the development of modern applications for medicinal plants.

**Licorice Root (Glycyrrhiza glabra)**

Licorice root has been in use in China since the second and third century B.C. and in the West since Egyptian, Greek, and Roman times. Next to ginger, licorice is the world’s most widely used herbal remedy. The plant bears clusters of creamy white flowers similar to lupine. But it is the root, harvested in Autumn, that is used for medicinal purposes. Licorice root is the peeled or unpeeled dried root of the licorice plant (Glycyrrhiza glabra). The primary active component of licorice root is a substance called glycyrrhizin.

Summary of the research findings
- Laboratory studies of glycyrrhizin in cell cultures suggest that it may have antiviral properties.
- In a review of several randomized controlled trials, researchers reported that glycyrrhizin has potential for reducing long-term complications in chronic hepatitis C in those patients who may not respond to interferon. Several of the trials reviewed indicated improvements in liver tissue damaged by hepatitis. Some also showed improvements in how well the liver did its job after treatment.
- Studies suggest that long-term administration of glycyrrhizin might prevent liver cancer in patients with chronic hepatitis C.

**Schisandra (Schisandra chinensis)**

Schisandra is a plant that has been used (through extracts from its fruit) in traditional Chinese medicine and in Kampo, traditional Japanese medicine. Schisandra is now a recognized adaptogen—a substance capable of increasing the body’s resistance to disease and stress. As such, it is said to balance body functions, improve mental function, improve function of the adrenal glands, and energize RNA and DNA molecules to rebuild cells. It is considered one of the most useful Asian herbal treatments for liver ailments.

Lab studies have shown the extracts to increase the liver’s ability to make the enzyme glutathione peroxidase, which deactivates several kinds of toxic free radicals that attack the outer membranes of the liver cells. Glutathione peroxidase also helps offset damage done by chronic viral hepatitis and HIV/AIDS.

Schisandra increases the flow of bile. Therefore people with gallstones or blockages of the bile ducts should not use this herb. People with peptic ulcers, epilepsy, or hypertension also should avoid this herb.

**Postexposure Prophylaxis & Follow-Up**

Available data regarding the prevention of HCV infection with IG indicate that IG is not effective for postexposure prophylaxis of hepatitis C. Research does not support postexposure use of antiviral agents (e.g., interferon) to prevent HCV infection, and such use is not currently recommended. Mechanisms of the effect of interferon in treating patients with hepatitis C are poorly understood, and an established infection might need to be present for interferon to be an effective treatment.

The immediate postexposure setting provides opportunity to identify persons early in the course of their HCV infection. Studies indicate that interferon treatment begun early in the course of HCV infection is associated with a higher rate of resolved infection. However, no data exist indicating that treatment begun during the acute phase of infection is more effective than treatment
begun early during the course of chronic infection. In addition, interferon is not FDA-approved for this indication. Determination of whether treatment of HCV infection is more beneficial in the acute phase than in the early chronic phase will require further evaluation with well-designed research protocols.

Prevention & Control of HCV

Further reducing the burden of HCV infection and HCV-related disease in the United States requires implementation of primary prevention activities that reduce the risks for contracting HCV infection, and secondary prevention activities that reduce risks for liver and other chronic diseases in HCV-infected persons. In addition, surveillance and evaluation activities are required to determine the effectiveness of prevention programs in reducing incidence of disease, identifying persons infected with HCV, providing appropriate medical follow-up, and promoting healthy lifestyles and behaviors.

Primary prevention activities can reduce or eliminate potential risk for HCV transmission from a) blood, blood components, and plasma derivatives; b) such high-risk activities as injecting-drug use and sex with multiple partners; and c) percutaneous exposures to blood in healthcare and other (i.e., tattooing and body piercing) settings. Immunization against HCV is not available; therefore, identifying persons at risk but not infected with HCV provides opportunity for counseling on how to reduce their risk for becoming infected.

Current practices that exclude blood, plasma, organ, tissue, or semen donors determined to be at increased risk for HCV by history or who have serologic markers for HCV infection must be maintained to prevent HCV transmission from transfusions and transplants. Viral inactivation of clotting factor concentrates and other products derived from human plasma, including IG products, also must be continued, and all plasma-derived products that do not undergo viral inactivation should be HCV RNA negative by RT-PCR before release.

Healthcare professionals in all patient care settings routinely should obtain a history that inquires about use of illegal drugs (injecting and others) and evidence of high-risk sexual practices, such as multiple sex partners or a history of sexually transmitted diseases (STDs). Primary prevention of illegal drug injecting will eliminate the greatest risk factor for HCV infection in the United States. Although consistent data are lacking regarding the extent to which sexual activity contributes to HCV transmission, persons having multiple sex partners are at risk for STDs (e.g., HIV, HBV, syphilis, gonorrhea, and chlamydia). Counseling and education to prevent initiation of drug-injecting or high-risk sexual practices is important, especially for adolescents. Persons who inject drugs or who are at risk for STDs should be counseled regarding what they can do to minimize their risk for becoming infected or of transmitting infectious agents to others, including the need for vaccination against hepatitis B. Injecting and non-injecting illegal drug users and sexually active men who have sex with men also should be vaccinated against hepatitis A.

Healthcare, emergency medical, and public safety workers should be educated regarding risk for and prevention of bloodborne infections, including the need to be vaccinated against hepatitis B. Standard barrier precautions and engineering controls should be implemented to prevent exposure to blood. Protocols should be in place for reporting and follow-up of percutaneous or permucosal exposures to blood or body fluids that contain blood.

Currently, no recommendations exist to restrict professional activities of healthcare workers with HCV infection. As recommended for all healthcare workers, those who are HCV-positive should follow strict aseptic technique and standard precautions, including appropriate use of hand washing, protective barriers, and care in the use and disposal of needles and other sharp instruments.

Healthcare professionals responsible for overseeing patients receiving home infusion therapy should ensure that patients and their families (or caregivers) are informed of potential risk for infection with bloodborne pathogens, and should assess their ability to use adequate infection control practices consistently. Patients and families should receive training with a standardized curriculum that includes appropriate infection control procedures, and these procedures should be evaluated regularly through home visits.
Prevalence of anti-HCV positivity among chronic hemodialysis patients averages 10%, with some centers reporting rates greater than 60%, and studies indicate that HCV transmission might occur among patients in a hemodialysis center because of incorrect implementation of infection control practices, particularly sharing of medication vials and supplies. In chronic hemodialysis settings, therefore, intensive efforts must be made to educate new staff and reeducate existing staff regarding hemodialysis-specific infection control practices that prevent transmission of HCV and other bloodborne pathogens. Hemodialysis center precautions are more stringent than standard precautions. Standard precautions require use of gloves only when touching blood, body fluids, secretions, excretions, or contaminated items. In contrast, hemodialysis center precautions require glove use whenever patients or hemodialysis equipment is touched. Standard precautions do not restrict use of supplies, instruments, and medications to a single patient; hemodialysis center precautions specify that none of these items be shared among any patients. Thus, appropriate use of hemodialysis center precautions should prevent transmission of HCV among chronic hemodialysis patients, and isolation of HCV-positive patients is not necessary or recommended.

Persons who are considering tattooing or body piercing should be informed of potential risks of acquiring infection with bloodborne and other pathogens through these procedures. These procedures might be a source of infection if equipment is not sterile or if the artist or piercer does not follow other proper infection control procedures (e.g., washing hands, using latex gloves, and cleaning and disinfecting surfaces).

Persons who should be tested routinely for hepatitis C virus (HCV) infection based on their risk for infection include those who:
- have ever injected illegal drugs, including those who injected once or a few times many years ago and do not consider themselves as drug users.
- have been diagnosed with selected medical conditions, including those who:
  - received clotting factor concentrate produced before 1987;
  - were ever on chronic (long-term) hemodialysis; and have persistently abnormal ALT levels.
- are recipients of transfusions or organ transplants, including those who:
  - were notified that they received blood from a donor who later tested positive for HCV infection;
  - received a transfusion of blood or components before July 1992; or
  - received an organ transplant before July 1992.

Persons who should be tested routinely for HCV infection based on a recognized exposure include healthcare, emergency medical, and public safety workers after needle sticks, sharps, or mucosal exposures to HCV-positive blood; and children born to HCV-positive women.

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Persons who should be tested routinely for HCV infection based on a recognized exposure include healthcare, emergency medical, and public safety workers after needle sticks, sharps, or mucosal exposures to HCV-positive blood; and children born to HCV-positive women.

Routine testing for HCV infection is not recommended for healthcare, emergency medical, and public safety workers; pregnant women; household (non-sexual) contacts of HCV-positive persons; or the general population, unless they have specific risk factors for infection.

**Education for Patients with Positive HCV**

Persons who test positive for HCV should be provided with information regarding the need for preventing further harm to their liver; reducing risks for transmitting HCV to others; and medical evaluation for chronic liver disease and possible treatment.

**To reduce the risk for transmission to others, HCV-positive persons should be advised not to:**
- donate blood, body organs, other tissue, or semen; or
- share toothbrushes, dental appliances, razors, or other personal-care articles that might have blood on them; and
- cover cuts and sores on the skin to keep from spreading infectious blood or secretions.

**HCV-positive persons with one long-term steady sex partner do not need to change their sexual practices. They should:**
- discuss the risk, which is low but not absent, with their partner; and
- discuss with their partner the need for counseling and testing. If they want to lower the limited chance of spreading HCV to their partner, they might decide to use barrier precautions such as latex condoms.
HCV-positive women do not need to avoid pregnancy or breast feeding. Potential, expectant, and new parents should be advised that:

- approximately 5 out of every 100 infants born to HCV-infected women become infected (this occurs at the time of birth, and no treatment exists that can prevent this from happening).
- infants infected with HCV at the time of birth seem to do very well in the first years of life. More studies are needed to determine if these infants will be affected by the infection as they grow older.
- no evidence exists that mode of delivery is related to transmission; therefore, determining the need for cesarean delivery versus vaginal delivery should not be made on the basis of HCV infection status.
- limited data regarding breast feeding indicate that it does not transmit HCV, although HCV-positive mothers should consider abstaining from breast feeding if their nipples are cracked or bleeding.
- infants born to HCV-positive women should be tested for HCV infection and if positive, evaluated for the presence or development of chronic liver disease.
- if an HCV-positive woman has given birth to any children after the woman became infected with HCV, she should consider having the children tested.

HCV-positive persons should be evaluated (by referral or consultation, if appropriate) for presence or development of chronic liver disease including:

- assessment for biochemical evidence of chronic liver disease;
- assessment for severity of disease and possible treatment according to current practice guidelines in consultation with, or by referral to, a specialist knowledgeable in this area; and
- determination of need for hepatitis A vaccination.

Other counseling messages:

- HCV is not spread by sneezing, hugging, coughing, food or water, sharing eating utensils or drinking glasses, or casual contact.
- Persons should not be excluded from work, school, play, child care or other settings on the basis of their HCV infection status.
- Involvement with a support group might help patients cope with hepatitis C.

On The Horizon

HCV’s Gene Inraveling Secret Revealed

Revealing new potential for future vaccine possibilities, University of Illinois professors have unlocked one of Hepatitis C’s propagation mysteries. By using biochemical dye technology, their research demonstrates how the virus gathers enough energy to dismantle RNA and DNA to create new genetic material.

When your body, or a nasty virus invading it, cooks up a batch of genes, helicases are often involved in the cellular process. Helicases are a class of enzymes vital to all living organisms. They are motor proteins that move directionally along a nucleic acid backbone, separating two nucleic acid strands (i.e. DNA, RNA, or RNA-DNA hybrid) using energy. Their actions appear to be bigger than Betty Crocker in the kitchen.

The tasks performed by the proteins apparently include the unwinding of the tightly coiled ribbon-like DNA and RNA molecules containing the instructions for gene making. Those chains of nucleic acids – the “N” and “A” in DNA and RNA and the basic building blocks of life – are then read by another type of protein molecule, called a polymerase. But the genetic cookbook has to be cracked open by helicases first, and scientists have been of two minds on how that happens.

Biochemical studies indicated that helicases sometimes work over three base pairs at once. University of Illinois Professors Sua Myong and Taekjip state their theory, which is backed by research using a technique developed by Ha, is to capture the movement of single molecules.

Helicases have three domains, or legs, as Myong described it recently. Two of those legs step along the acid chains, a base pair at a time during the unwinding process. The third leg remains anchored behind and gets stretched out until enough tension builds that it snaps loose and ahead three pairs. Ha, a UI physics professor, likened its movement to a spring.

The helicase and its unwinding job are necessary for the virus to replicate, which makes the protein a potential target for new hepatitis C treatments.

It appears that many helicases, including those of benefit in the human body, might function in a similar manner. A treatment
would need to target the hepatitis C helicase while leaving others alone.

In their study of the hepatitis C helicase, the researchers found that the protein is powered by a lot of energy – and plenty of a cellular fuel called ATP, to generate it. Ha said that makes a helicase more like a gas guzzling SUV than an economy car.

But gas guzzling could be a good thing here, Ha and Myong said. The nucleic acid chain road is a rough one, full of bumps and twists and turns and possibly obstacles to be cleared, such as other proteins interacting with the DNA or RNA molecules. The helicas might need an SUV's power and off-road capability, to get their job done. This study was funded by the National Institute of General Medical Sciences at the National Institutes of Health.

For more information, see entire article on www.hepatitis-central.com

**HCV Vaccine Phase I Clinical Trials**

Chiron Corporation, a leader in hepatitis C research and now owned by Novartis, is collaborating with Saint Louis University School of Medicine to study the safety and effectiveness of Chiron's investigational hepatitis C vaccine. This Phase I clinical trial will be testing the vaccine in humans for the first time.

A majority of this course was adapted from the Centers for Disease Control and Prevention material entitled Surveillance for Acute Viral Hepatitis ... United States, MMWR 2005; 56(SS03), March 16, 2007 & Recommendations for prevention and control of hepatitis C virus (HCV) infection and HCV-related chronic disease. MMWR 1998; 47 (No. RR-19).

**Additional Sources**


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**NOTES**