Hepatitis C Virus

By Elizabeth Tipps

Etiology, Transmission, and Reservoirs:

Hepatitis C is a viral disease caused by the Hepadnaviridae hepatitis C virus, a Flaviviridae virus which leads to inflammation of the liver. It is identified as a nationally notifiable infectious disease. Individuals who are at risk for this illness include: those who have frequent, consistent contact working with blood, those having unprotected intercourse with one or more individuals who have hepatitis C, those injecting street drugs and sharing needles with one or more individuals with hepatitis C, those on long-term kidney dialysis. Additionally, the list includes: those who received a blood transfusion before July 1992, (when sensitive tests for HCV were introduced), received a tattoo or acupuncture with contaminated needles, received blood or blood products or organs from an individual with hepatitis C, those who share personal items such as nail clippers, toothbrushes or razors with someone who has hepatitis C, and infants born to mothers who have hepatitis C. According to most resources including The New York State Department of Health, the risk of contracting HCV through means of sexual contact is very low and that the disease cannot be contracted from breastmilk(5). According to a study done by Reuters Health, New York, a screening of infants born to mothers infected by HCV, showed the rate of transmission by this means to be very low (9). The most common mode of transmission is through shared needles that are contaminated with the virus. Humans are the primary reservoir for HCV, as transmission occurs from contact with infected human blood. The worldwide reservoir of chronically infected persons is estimated at 170 million, or 3% of the global population (2).

Signs and Symptoms:

Hepatitis C has been described as a silent epidemic. Symptoms may occur from two weeks to six months after exposure but usually within six to nine weeks (5). Individuals with a chronic hepatitis C infection can remain asymptomatic for up to 20 years. It is very seldom clinically apparent. About 1 in 10 individuals who become infected will develop a yellowing of the skin and eyes known as jaundice that eventually clears up. Persons with acute hepatitis C virus infection are generally contagious from one or more weeks before the onset of symptoms. The contagious period is indefinite in chronically infected persons. All persons who
test positive should be considered to be potentially contagious. Individuals who become chronically infected will experience abdominal pain, abdominal swelling (ascites), clay-colored/pale stools, dark urine, fatigue, fever, itching, jaundice, loss of appetite, nausea, and vomiting. Approximately 70% of those chronically infected will develop liver disease (5). Chronic hepatitis c infection leads to cirrhosis of the liver in about 10% to 15% of individuals. Many patients remain unaware of infection until cirrhosis begins to develop. There is also strong evidence demonstrating the association of chronic HCV infection to hepatocellular carcinoma (2).

“Persistent infection appears to rely on rapid production of the virus and continuous cell-to-cell spread, along with a lack of vigorous T-cell immune response to HCV antigens.” (2)

Key tests for identification:

Three types of enzyme and enzyme-linked immunoassay tests approved by the FDA are an ELISA, EIA, and an Anti-HCV assay. Serological tests were developed to detect HCV antibodies, however, there is a period of about 70-80 days between infection and the appearance of detectable HCV antibodies. A PCR test (a molecular assay), can detect viral RNA within 1 to weeks after infection(13). These qualitative tests only detect the presence of HCV RNA, and not the quantity or viral load(10).

Both serological and molecular assays have been used to adequately identify acute or chronic HCV infections. After an acute HCV infection, HCV RNA could be detectable in serum within 2 weeks following exposure. On the other hand, anti-HCV could take about 8-12 weeks before results are positive.

Characteristics of the microorganism:

Hepatitis C Virus is in the Flaviviridae viral family is also characterized as a Hepadnaviridae virus because it causes hepatitis (inflammation of the liver) and because it contains DNA. This class of viruses differs from other DNA containing viruses in that they use viral reverse transcriptase to synthesize DNA by copying RNA. It has a single strand of RNA and is enveloped. HCV replicates in the cytoplasm of hepatocytes. Rather than killing the infected cell, the virus causes illness by triggering an immune response that will either clear the infection or slowly destroy the liver (13). The virus is capable of rapid genetic variation to
evade the immune system. The rapid viral replication and lack of error proofreading by the viral RNA polymerase are reasons why the HCV RNA genome mutates frequently (2).

Prevention:

Currently, prevention methods for hepatitis C virus are limited to minimizing exposure. An effective vaccine has not been created, largely in part to its ability for rapid genetic variation. However, individuals who have hepatitis C are encouraged to get the vaccines that are available for both hepatitis A and hepatitis B, in order to avoid the risk of contracting etiological agents that would further damage the liver.

Treatment:

The most common treatment of choice is a drug treatment combination of peginterferon and ribavirin. The treatment must be administered for a long period of time (several months). This is a disadvantage, as the drugs are very costly. However, patients have seen complete eradication of the virus in their bodies. An alternative treatment is a combination of a protease inhibitor, a nucleoside analogue, and a non-nucleoside polymerase inhibitor. According to the World Health Organization, over 95% of people with hepatitis C can be completely cured within 2-3 months. This is, of course, contingent upon whether or not treatment is accessible(11).

History:

In the 1960s, a previously unsuspected form of transfusion-transmitted hepatitis appeared. However, it wasn’t until 1989 that the virus was isolated and identified as non-A hepatitis and non-B hepatitis from the serum of a person infected with this pathogen. Shortly after it was isolated, it was discovered to be the cause of approximately 90% of non-A and non-B hepatitis in the U.S. (2). According to the CDC government website, there were an estimated 29,500 acute cases of Hepatitis C in 1982, compared to only 2,800 estimated acute cases in 2010. However, there was a huge spike in estimated cases of acute hepatitis C in the late 1980s, peaking at 47,800 estimated cases in 1989(3). The incidence of acute hepatitis C infection in the U.S. declined sharply in 1990. It is speculated that this decline is due to greater awareness of high risk sexual behavior and clean needle exchange programs that were put into place (2).
3 in 4 people with hepatitis C were born between 1945-1965. Due to the timing of the isolation of the virus, and the relatively late introduction of sensitive HCV tests in 1992, it is speculated that the majority of individuals from the Baby Boomer generation who have hepatitis C contracted the disease from blood transfusions, or during medical treatment before universal precautions and infection control procedures were adopted (8).

Virulence Factors:

HCV has the ability to change rapidly during replication, attributing to its virulence. Changes in the proteins of the envelope allow the virus to evade the human immune system (13). “Persistent infection appears to rely on rapid production of the virus and continuous cell-to-cell spread, along with a lack of vigorous T-cell immune response to HCV antigens.” (2)

Hepatitis C Incidence (Global, U.S., Texas):

The incidence of Hepatitis C virus is challenging to estimate due to the fact that most cases of acute HCV are not diagnosed because the majority of individuals are asymptomatic. Once the disease is considered chronic hepatitis C, it is often challenging to pinpoint the exact time of infection. Approximately 75-85% of infected patients do not clear the virus from the body within 6 months, at which point it is considered chronic hepatitis C.

According to the World Health Organization, there are an estimated 1.5 million people living with hepatitis C worldwide(11). There are multiple genotypes of the HCV virus and their distribution varies by region. The most affected regions are the Eastern Mediterranean and European Regions, with a prevalence of 2.3% and 1.5% respectively. Prevalence in other regions varies from 0.5% to 1.0%. (12)

The incidence of acute hepatitis C in the U.S. was estimated to be 180,000 cases per year in the mid-1980s, but declined to 30,000 new cases per year in 1995. In 2014, the total of new reported cases of acute hepatitis C in the U.S. was 2,194. For any given year, the estimated total cases of acute hepatitis C is 13.9 times the reported incidence. In the U.S., the estimated prevalence of chronic HCV is between 0.87 and 1.3 cases per 100,000 population. The estimated number of chronic cases in the US is between 2.7 and 3.9 million. In Texas, this represents 217,500 – 325,000 cases (4).
According to the Texas Department of State Health Service, the number of new reported cases of acute hepatitis C in Texas in 2016 was 40. The individuals were equally distributed among gender. However, 63% of these individuals were white, 25% hispanic, 10% black, and 3% unknown ethnicity(1).

References:

1. Texas Department of State Health Services. “Hepatitis C Data.” Texas Department of State Health Services, www.dshs.texas.gov/hivstd/info/hcv/data.shtm Date visited: 05/07/18


