HEPATITIS B AND C IN ADOLESCENTS

BY

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Abstract

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An estimated 1 million to 1.25 million people in the United States are chronically infected with hepatitis B virus. Approximately 100,000 to 150,000 new infections occur each year (CDC, 2000). Of every 100 young adults who contract hepatitis B, 6 to 10 become chronic carriers. The younger the infected person, the more likely the person will become a carrier.

According to CDC (2000), among the cases of acute viral hepatitis, hepatitis B accounts for 34%, and hepatitis C accounts for 16%. Possibly, 150,000 adolescents in the United States are currently infected. In addition, both types of hepatitis may become chronic with high risk of morbidity and mortality due to cirrhosis and primary hepatocellular carcinoma. The CDC estimates that approximately 16,000 adolescents die each year from cirrhosis and liver cancer secondary to viral hepatitis (CDC, 2000).

The purpose of this paper is to review the available research data applicable to diagnosis, treatment, modes of transmission, and prevalence of hepatitis B and C in adolescents. The paper explores the causal relationships between drug use, tattooing, psychiatric disorders, sexual practices and the incidence of hepatitis B and C in adolescents. Consequently, the information provided by this paper may help nurse practitioners achieve greatest proficiency in the prevention of hepatitis and assessment, diagnosis and treatment of this condition in adolescents.
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Introduction

Adolescence is the interval in physical, cognitive, emotional and psychosocial development that occurs in a person between the ages of 10 and 21 years. Adolescence is also a time when individuals may engage in intentional or unintentional risk behaviors that can lead to significant consequences, complicating their future health. High-risk behaviors such as injection drug use, cocaine snuffing, unprotected sexual practices, tattooing, and body piercing are common among adolescents. These practices place adolescents at an increased risk of contracting hepatitis (CDC, 1998).

Acute and chronic consequences of hepatitis B and C in adolescents continue to create a major public health problem in the United States. While the overall incidence of the disease appears to be declining, the incidence among specific groups, including young adults, continues to rise. About 300,000 children and young adults in the U. S. become infected with chronic forms of hepatitis each year. Approximately 70% of new cases of chronic hepatitis occur among young adults between the ages of 15 and 39, of which 75% occur in individuals between 15 and 19 years of age. More than 10,000 of these adolescents need hospitalization and approximately 250 die annually (CDC, 1999).

The purpose of this paper is to review the available research data applicable to diagnosis and treatment, modes of transmission, prevalence and prevention of hepatitis B and C in adolescents. The paper explores causal relationships between drug use, tattooing, psychiatric illness, sexual practices and other factors and the incidence of hepatitis B and C in adolescents. Health providers need to have current knowledge about hepatitis B and C to be able to prevent, diagnose and effectively treat those diseases. Consequently, the information provided by this paper may help health care professionals achieve the highest standards of assessment of hepatitis in their practice, acquire skills in the prevention of it, and thus assure quality care for adolescents infected with hepatitis B and C.
Hepatitis 3

Conception of hepatitis.

The liver, the second largest organ in the body, normally weighs about 3 pounds. The liver is located in the right upper quadrant of the abdomen, beneath the diaphragm, commonly divides into 3 sections, called lobes. The liver performs several vital functions for the body, including detoxification and neutralization of substances such as chemicals, drugs and alcohol, regulation of blood clotting, control of production and excretion of cholesterol, storage of sugars, vitamins and minerals, and the manufacturing of proteins (Alexander, 1998).

The word *hepatitis* (Gk hepar, or liver and itis, inflammation) is defined as an inflammatory condition of the liver, characterized by jaundice, hepatomegaly, anorexia, abdominal and gastric discomfort, abnormal liver function, clay-colored stools, and dark urine. The condition may be caused by bacterial or viral infection, parasitic infestation, alcohol, drugs, toxins, or transfusion of incompatible blood. Common viral causes include hepatitis B and C, which are the focus of the paper. Symptoms may be mild and brief or severe and life-threatening. The liver usually regenerates tissue, but hepatitis B, and especially C viruses, can produce irreversible and chronic conditions such as cirrhosis and hepatocellular carcinoma that can cause permanent liver dysfunction (Copstead & Banasik, 2000).

As defined by Copstead and Banasik (2000), cirrhosis is a chronic degenerative disease of the liver in which the lobes are covered with fibrous tissue, the parenchyma degenerates, and the lobules are infiltrated with fat. No effective treatment exists for cirrhosis. Hepatocellular carcinoma is a malignant tumor of the liver that impairs normal liver functions. The only effective treatment is a surgical extraction of the tumor. However, surgery is often not feasible, because the tumor grows rapidly and often spreads through the lobes and to other organs. Both chronic conditions, cause deterioration of the important liver functions, such as gluconeogenesis, detoxification of drugs and alcohol, bilirubin metabolism, vitamin absorption, and hormonal metabolism, that can result in a complete liver failure.

Hepatitis B virus.

Hepatitis B virus, a significant cause of hepatic inflammation, has long been known as a
serious cause of the chronic damage to the liver. However, with current sophisticated technologies, especially in genetic medicine, the disease has become more detectable (Rezents, Foster, & Goldstein, 1998). These researchers found that hepatitis B virus (HBV) is a 42nm hepadnavirus with a partially double-stranded DNA genome, inner core protein (hepatitis B core antigen, HBsAg) and outer surface coat (hepatitis B surface antigen, HBsAg). HBV can be found in blood, saliva, vaginal secretions, and seminal fluid.

The pathology of acute hepatitis B involves isolated hepatocyte injury with focal necrosis and immune-complex mediated tissue damage. Hepatitis B core antigen presents on the hepatocyte cell membrane and acts as a target for host antibody responses. Lymphocytes invade the hepatic tissue, particularly around the bile ducts. This produces degeneration of hepatic cells. Circulating immune complexes activate the complement system consisting of I1complex, enzymatic proteins that combines with an antibody and create immunologic reaction that can cause rash, fever, angioedema and other forms of immune complex diseases such as glomerulonephritis and polyarteritis nodosa (Rezents, Foster, & Goldstein, 1998).

Hepatitis C virus.

The existence of hepatitis C virus was suspected just two decades ago. In 1975, researchers identified a varied number of hepatitis strain associated with blood transfusions not caused by the previously identified hepatitis A virus (HAV) or hepatitis B virus (HBV). Researchers referred to the new strain as hepatitis non-A, non-B. In 1989 when the viral genome of the new entity was cloned and sequestered, the new strain of hepatitis was renamed as hepatitis C virus, or HCV. HCV is a spherical, enveloped virus that belongs to the Flaviviridae family. The genome is a highly heterogenous, single-stranded linear RNA. Due to a high rate of transcription errors of the RNA polymerase, researchers estimate the rate of spontaneous mutations in humans and chimpanzees as 103 base substitutions per site per year. Six genotypes of the virus have been identified, with wide variations in their geographic distribution. Due to this high rate of mutation, individuals may be simultaneously infected with multiple
genotypes of HCV. (Rezents, Foster, & Goldstein, 1998).

Similar to HBV, hepatitis C core antigen adheres to hepatocyte cell membranes. As a result, mononuclear infiltration with degenerative changes of the hepatic tissue occurs. After degeneration, the cytoplasm of the hepatic cell shrinks and condenses to an acidophil body. These pathological processes occur over several months in a severe acute infection but are more commonly seen in chronic infections lasting more than five years. The necrotic changes described above may cause collapse and condensation of the liver stroma which prevents complete regeneration and recovery of the hepatic cells. Over time, these severe processes may result in liver failure and death (Rezents, Foster, & Goldstein, 1998).

**Epidemiology of Adolescent Hepatitis.**

An estimated 1 million to 1.25 million people in the United States are chronically infected with hepatitis B and C viruses. Approximately 100,000 to 150,000 new infections occur each year. Of every 100 young adults who contract hepatitis B, 6 to 10 become chronic carriers. The younger the infected person, the more likely the person will become a carrier (CDC, 1999).

According to CDC (1999), among the cases of acute viral hepatitis, hepatitis B accounts for 34%, and hepatitis C accounts for 16%. Possibly 150,000 adolescents in the United States are currently infected. In addition, the illness often tends to become chronic with high risk of morbidity and mortality due to cirrhosis and primary hepatocellular carcinoma. The CDC estimates that approximately 16,000 adolescents die each year from cirrhosis and liver cancer secondary to hepatitis B and C. (CDC, 1999).

**Modes of transmission.**

Before 1992, when routine screening of blood donors and blood products was instituted in the United States, most HBV and HCV infections were transmitted through transfusion of contaminated blood, factor products, intravenous immunoglobulins, and the transplantation of infected organs. Since then, better routine screening has reduced the risk of HBV and HCV transmission through transfusion of infected blood to an estimated 0.01% to 0.001% per unit of blood. Currently, all intravenous and intramuscular immunoglobulin products in the US are documented as HBV and HCV RNA-negative before the products are released for use. (Diaz et al., 2001).
The similar modes of transmission for HBV and HCV differ in some regards. Percutaneous transmission is the major route for HCV, whereas adolescent HBV is transmitted mainly via a sexual route. According to the research, HBV and HCV infections occur among adolescents and young adults 15 to 39 years of age mainly through unprotected sexual contact and drug injection (McQuillan et al., 1999). McQuillan et al. (1999) investigated the prevalence of hepatitis B and C in the United States among groups of different ages and ethnicities. Investigators used a series of cross-sectional national surveys, called National Health and Nutrition Examination Surveys (HNANES). The sample included individuals from all age group starting from 5 years of age to persons aged 60 and older. As reported by the researchers, the prevalence of hepatitis B virus begins to dramatically increase with puberty and is higher among Hispanic, Black, and foreign born adolescents, individuals who reported multiple number of sexual partners, early age of first intercourse, male-to-male sexual contact. Prevalence of HCV among adolescent participants of the study was strongly correlated with illicit drug. The authors concluded that sexual transmission is the primary mode of transmission of hepatitis B in adolescents and hepatitis C is primarily contracted through injectable drug use in the United States.

Percutaneous transmission of HCV occurs mainly among those adolescents who have shared needles and been tattooed. In contrast to HBV, sexual route of transmission is less common in HCV. Cocaine sniffing poses a significant risk factor for viral transmission of both types of hepatitis since intranasal bleeding may occur and contaminate shared equipment. Body piercing is also a risk factor for both hepatitis B and C. (Diaz et. al., 2001).

**Risks factors.**

Screening for HBV and HCV in asymptomatic adolescents should be based on known risk factors for those infections. These risk factors include adolescents who are gay, lesbian, intravenous drug users, HIV-positive persons, sexual assault victims, adolescents who were born outside of western Europe, north America and Australia, needle-stick victims, sexual partners of high-risk patients, persons with multiple sexual partners, and mentally retarded adolescents due to their high risk-behaviors. Adolescents with the highest rate of infections are those with hemophilia (90%), transfusion dependent thalassemia (23 to
36%), cancer survivors who received blood or blood products before 1990 (up to 43%), sickle cell patients (18%), renal dialysis patients (18.5%) and adolescents who have a biological mother with known risk for hepatitis. High risk behaviors such as injecting drugs, having a tattoo, body piercing or using crack cocaine were found to be significant to the transmission of HBV and HCV in adolescents (Diaz et al., 2001).

Diaz et. al. (2001) examined the prevalence of chronic hepatitis in young people 15-19 years of age. Participants were street recruited from the Lower East Side and Harlem. The researchers interviewed participants about drug use and sex practices, risk behaviors including tattoos, and body piercing. Each participant provided researchers with a blood sample via venipuncture. Blood specimens of the participants were analyzed for HBV and HCV infections. This study indicates that testing positive for hepatitis C was generally associated with intravenous drug use by adolescents for more than 3 years. Also, participants who shared needles and other equipment including cotton with an individual who have had hepatitis were found to have hepatitis C. Ninety five percent of respondents who tested positively for hepatitis B reported that they had engaged in sexual intercourse at least once.

The lifestyle of homeless adolescents places them at high risk for contracting serious illnesses including HBV and HCV (Beech et al. (2002); Roy, Haley, Lecerc, Boivin, Cedras & Vincellette, 2001, Noel et al, 2001). The homeless population of adolescents is substantial in the United States. According to statistics, 1.3 to 2 million adolescents are homeless (CDC, 2000). Beech et al. (2002) designed a study to determine the hepatitis status and predictors of hepatitis infection among 150 homeless adolescents (70% male). Each participant provided a venous blood sample and underwent a psychosocial survey. Participants were classified as positive for hepatitis if they were seroprevalent for either HBV or HCV. Results of the study showed that a significant link exists between drug and alcohol use and hepatitis. Researchers found strong univariate relationship between early sexual intercourse, sexual preference (male adolescents who have sex with men), number of sexual partners and positive HCV and HBV status.

Based on findings of Mincovitz et al., (2001) young males who have sex with men (MSM) are at high risk for HBV infection. The investigators conducted a cross-sectional and anonymous survey in the following metropolitan areas: Baltimore, Dallas, Los Angeles, Miami, New York, San Francisco Bay area and Seattle. The 23,881 participants were randomly chosen and administered a standardized questionnaire. The questionnaire collected information on sociodemographic characteristics, including source of health care, use of STD treatment, HIV testing and HBV vaccination services, sexual prevalence, drug use and needle-sharing practices. Blood samples were obtained for HBV testing. Participants concluded as having HBV if they tested positively for hepatitis B surface antigen (HBsAg), for antibodies to hepatitis B surface (anti-HBs) and for core (anti-HBc) antigens.

The results of the study showed that sexual behavior among MSM serves as a primary mode of transmission of HBV infection. In addition, despite the availability for nearly 2 decades of effective HBV vaccine, few adolescents and young adults who are MSM were vaccinated against hepatitis B. As a consequence, nearly 1 in 5 MSM in the sample acquired HBV by age 22. The prevalence of infection increased significantly with other risk behavior and corroborating findings such as multiple male sex partners, anal sex, anal fisting, prostitution, diagnosis of STDs, and sharing needles or equipment to inject drugs. For most respondents, sexual and drug-using behavior risks began in their early teens and were associated with leaving school prematurely. The researchers suggested the development of targeted programs to immunize the MSM population since, due to lifestyle and a high rate of dropping out of school, high-risk adolescents are often missed at school-based immunizations.

According to the research of Rosenberg et al., (2001), adolescents with psychiatric impairment and mental illness are at increased risk for comorbid conditions such as hepatitis B and C. Rosenberg et al. (2001) studied the prevalence of HIV, hepatitis B and hepatitis C in a sample of young people with severe mental illness. All participants were recruited through the public mental health system of Connecticut, Maryland, New Hampshire and North Carolina. All participants completed questionnaires
and interviews with post-test counseling. Blood samples were collected following informed consent and interview. Serologic tests were collected from the participants and included testing for HIV and hepatitis B and C antibodies. A structured interview was done to assess risk behaviors. The results of the study show that adolescents with mental illness exhibit elevations in the prevalence of HIV, HBV, and HCV. The prevalence for HBV was 5 times higher and HCV 11 times higher when contrasted with a general population. In this study elevated rates of HBV and HCV among the participants with psychiatric problems are correlated with several categories of high-risk behaviors, such as intravenous drug use, unprotected sex, increased number of sexual partners, poverty (e.g. annual income <10,000), and lack of access to medical care (Rosenberg et al, 2001).

**Diagnostic tests and laboratory findings with HBV.**

Certain diagnostic tests and procedures indicate suspicion of hepatitis B. Hepatitis B virus can be diagnosed by evaluating hepatitis B surface antigen (HBsAg), the core antibody (HBcAb) or B core antibody IgM (IgM anti-HBc), and presence of DNA of hepatitis B virus (HBV DNA). By measuring those hepatitis B markers, the viral agent causing the symptoms of acute viral hepatitis B can be determined.

Immunoglobulin M (IgM) is one of the five classes of humoral antibodies produced by the body as a response to an antigen. It is a specialized protein found in serum between 4 to 6 weeks after inoculation and indicates an acute stage of hepatitis B. It is a first immunoglobulin that body produces in response to a viral agent. IgM triggers the increased production of immunoglobulin G and the complement system activation for an effective immune response (refer to Table 2). Hepatitis B surface antigen (HBsAg) is another earliest indicator of the presence of acute infection (4-12 weeks). Hepatitis B surface antigen (HBsAg) is found in many patients with chronic active hepatitis because the presence of it longer than 6 months indicates chronic infection. HBV DNA is also routinely used to diagnose HBV because its presence during acute and chronic HBV infections indicates ongoing viral replication and high infectivity. With all types of hepatitis, liver enzymes, AST and ALT can be elevated dramatically and remain elevated for several weeks after the initial infection. Another enzyme, alkaline phosphatase
Hepatitis usually rises slightly in the beginning of the illness, but in icteric patients may continue to rise even after AST and ALT levels fall (Gregorek et al., 2000).

Recovery and protection against HBV are determined by evaluating IGG anti-HBc, HBV e-antibody (anti-HBe), and anti-HBs. Anti-HBs develops during convalescence after HBsAg has disappeared. Anti-HBs also develops after a vaccination against HBV and transiently after inoculation with HBV immunoglobulin. Levels of anti-HBs can decrease over time. Unlike anti-HBs, IgG anti-HBc levels develop during or after infection and persist for life (Alexander, 1998). As noted by Alexandr (1998), the white blood cell count in acute HBV usually remains normal to low, especially in preicteric phase. Mild proteinuria is a common finding with hepatitis B. Markedly prolonged prothrombin time correlates with severe hepatitis and increased mortality (Gregorek et al., 2000).

(Table 2)

**Diagnostic tests and laboratory findings with HCV.**

Diagnosing hepatitis C infection requires not only detecting the virus but also assessing the severity of liver disease. The presence of HCV antibody usually means that the infection is active, because antibodies do not neutralize the infection. Enzyme immunoassay (EIA)-2 is the main screening assay for detecting anti-HCV antibodies. This fairly inexpensive assay has low variability and is used most frequently due its high accuracy in high-prevalence populations. The test becomes positive about one month after exposure. The sensitivity of the test is 92% to 99% (Degott, Guettier, Chevret & Degos, 2000).

Recombinant immunoblot assays (RIBA) also monitor the presence of antibodies and should be used as supplemental tests in asymptomatic low-risk patients who are anti-HCV positive on EIA-2. The FDA-approved, second-generation assay (RIBA-2) detects the same HCV antigents as EIA-2 but has greater sensitivity. RIBA-2 may be positive (two antigens are positive), indeterminate (one antigen positive), or negative. In the case with indeterminate finding, another screening test for HCV such as reverse transcription polymerase chain reaction, may be used. Reverse transcription polymerase chain reaction (RT-PCR), detects HCV-RNA and provides an important method for confirming an HCV
infection after EIA-2 positive. HCV-RNA is also used to monitor response to interferon therapy and detecting viral load, and should be used as supplemental tests in asymptomatic low-risk patients who are anti-HCV positive on EIA (Degott, Guettier, Chevret & Degos, 2000).

Clinical findings in Hepatitis B.

Many cases of hepatitis B go unrecognized due to the presentation of vague symptoms during the incubation period that usually lasts 45 to 180 days (Douglas & Post, 2001). Symptoms are similar to flu and may include nausea, vomiting, anorexia, abdominal discomfort, possible arthralgia and rash that generally develops 1 to 2 weeks before the onset of jaundice. Distaste for smoking may occur early in acute stage of HBV. Dark-colored urine and clay-colored stools precede jaundice by 1 to 5 days. The onset of jaundice or the icteric phase can be observed when the serum bilirubin is greater than 2.5 mg/dl and is most easily observed in the sclera or under the tongue. With the onset of jaundice, the constitutional symptoms usually diminish. On physical examination, patients with HBV often have hepatomegaly and splenomegally (Douglas & Post, 2001). Hepatomegaly occurs in 50% of cases. Splenomegaly presents in 15% of patients. Soft, enlarged lymph nodes, especially in the cervical or epitrochlear areas, may occur. Signs of toxemia may vary from minimal to severe and include fluid and electrolyte imbalance, pervasive tenderness of the skin, pulmonary edema, sepsis, shock, renal and cardiac failure.

Because the clinical presentation of hepatitis B is often nonspecific, certain laboratory tests can be extremely helpful in diagnosing acute stage. The most helpful markers are the serum aminotransferase (AST/SGOT) and alanine aminotransferase (ALT/SGPT). These enzymes increase proportionally during the prodromal phase of hepatitis and may reach twenty times of normal. The diagnosis of HBV is dependant upon the presence of HBsAg and IgM antibodies to hepatitis B core antigen (IgM anti-HBc). IgM anti-HBc appears approximately at the same time as the first symptoms. The antibody to HBsAg (anti-Hbs) develops after infection (approximately 4 to 5 months after exposure) and serves as indicator to immunity (Douglas & Post, 2001) (Table 2).

The course of chronic hepatitis B is variable and unpredictable due to the development of a
chronic complications such as cirrhosis, hepatocellular carcinoma and liver failure. These conditions that develop in 6 to 10% of adolescents infected with HBV. The severity of complications associated with chronic hepatitis B virus is determined by the extent and rate of progression to fibrosis. Liver biopsy, with connective tissue staining, is the only means for determining the extent of liver damage. Nevertheless, mortality rates clearly rise once cirrhosis and hepatocellular carcinoma develops. Up to 40-50% of adolescents with chronic hepatitis B who develop cirrhosis and hepatocellular carcinoma die within 5 years after the onset of symptoms (Chang et al., 2000).

Clinical findings in Hepatitis C

Infection with hepatitis C is a two-stage process: the initial stage (cirrhosis) and outcome stage (either Hepatitis C carrier or death) (Douglas & Post, 2001; Hoshiyama et al., 2000). The mean incubation period is seven weeks, but infection can occur from 3 to 20 weeks after exposure. The infectious state develops 4 to 6 weeks before symptoms. Symptomatic acute hepatitis C is difficult to miss, but half of the patients with acute HCV have flu-like symptoms. Infected patients report nonspecific symptoms of fatigue, vague abdominal pain, nausea, anorexia, weight loss, and arthralgias. Physical examination usually is unremarkable but may depend on the degree of liver involvement. In most cases the disease is subclinical; acute HCV infection rarely results in hepatic failure (refer to Table 3).

Serum alanine aminotransferase (ALT), an enzyme that is released in the serum because of the liver tissue injury, begins to rise several weeks after the exposure to the virus. HCV-RNA becomes detectable in serum within 1 to 3 weeks of exposure and peaks at six weeks. In 80 to 85% when acute clinical symptoms disappear, the serum ALT remains elevated and the HCV-RNA remains detectable. Serum anti-HCV is detectable in most adolescents with the onset of symptoms (Douglas & Post, 2001, Nishiguchi et al., 2001). Researchers Marcelini et al. (1997) performed a clinical study of 21 adolescent patients with hepatitis C. The results showed that after six years of the illness, only 10% had achieved remission with normal ALT, and 40% of the sample showed evidence of chronic active hepatitis.

Extrahepatic manifestations may complicate chronic HCV infection. Manifestations include keratoconjunctivitis, essential mixed cryoglobulinemia and porphyria cutanea tarda. Keratoconjunctivitis
sicca is an inflammation of the cornea and conjuctiva manifested by itching, burning and decreased visual acuity. Essential mixed cryoglobulinemia (EMC) is a syndrome of fatigue, muscle and joint pain, arthritis, skin rash, neuropathy and glomerulonephritis. Cryoglobulins are detected in one third of patients with HCV. Sometimes the clinical symptoms of EMC, seen only in 1 to 2% of adolescents, are fatal. Porphyria cutanea (PTC) usually is seen in adolescents with severe liver disease associated with iron overload and manifested as photosensitivity, abdominal pain, and neuropathy. This symptom is treated with phlebotomy (Badizegan et al., 1998).

Unfortunately, infection with HCV is not limited to the acute process, and in most cases tends to become chronic with the development of cirrhosis due to high level of virus mutation that enables the host’s immune defense (Hoshiyama et al., 2000). This serious complication of HCV occurs in adolescents due to continual exposure of HCV producing toxemia, inflammation, ischemia and necrosis of hepatic tissue. The persistence of inflammation and necrosis stimulates hepatocellular regeneration, causing the development of fibrous tissue (scar) such as collagen distorting normal hepatic functions. As cirrhosis progresses, portal hypertension develops and collateral circulation becomes prone to the development of varicosities. Almost half of all deaths occurring in adolescents from cirrhosis are caused by the rupture of the collateral varicose veins and a subsequent hemorrhage (Hoshiyama et al., 2000).

### Treatment of hepatitis B and C.

The patients diagnosed with either HBV or HCV need general supportive care that promotes a rest, fluid balance, prevention of injury, prevention of spread of disease, adequate nutrition, comfort and education. Bed rest is recommended only an as-needed basis during the acute initial phase of the disease, when symptoms are most severe. During the acute phase of illness, the patient needs of 3000 ml/day of fluid to avoid dehydration. The fluid is usually given orally. Dietary management of both types of hepatitis consists of giving meals as tolerated, without overfeeding. No special dietary restrictions are required in most patients. The diet should be well balanced and provide adequate nutrients and calories based on patient’s size and age. Intake, output and weight should be monitored daily. Frequent small meals are recommended. Restrictions of fat should be recommended by the provider if intolerance to fatty
foods occurs. If nausea and vomiting are pronounced or if oral intake is substantially decreased, intravenous administration of 10% glucose solution is indicated. Patients with hepatitis B and C need to be educated to quit smoking and stay away from the alcoholic beverages and other toxic substances that are metabolized through the liver (Hay, Hayward, Levin & Sondheimer, 2000).

Adolescents with HCV and HBV should be educated to avoid strenuous exercise and physical exertion. The level of physical activity allowed should be individually determined on the basis of fatigue and severity of disease, and rest periods should be interspersed through the day so patient would be able to alternate activity with rest periods. The health care provider should also educate patient with hepatitis to avoid unprotected sexual intercourse and sharing needles, and immunize to prevent reoccurrence of hepatitis (Hay, Hayward, Levin & Sondheimer, 2000).

**Pharmacologic treatment of HBV.**

Early in the course, HbeAg and HBV DNA present in the serum indicate active viral replications. Such adolescents are at risk for the development of cirrhosis can may be treated with recombinant human interferon (IFN), which is the drug of choice to treat HBV in adolescents. Currently only two recombinant forms of IFN-a are FDA approved for adolescents: alfa-interferon 2a (IFN-a 2a) and alfa-interferon 2b (IFN-a 2b). Research of Douglas & Post (2001) demonstrated the effectiveness of alpha-interferon in treatment of 837 adolescent patients who were treated for 3 to 6 months with alpha-interferon and then followed for 6 to 12 months. Studies have shown that alpha interferon is successful in ceasing viral replication in 40% of individuals treated. Patients were given 5-20 M. U. of Alpha interferon by injection, twice a week for twelve to thirty two weeks. Treatment was defined as effective if the participant lost hepatitis B antigen (HBeAg) after treatment. The side effects of the treatment reported in this study were dose-related and included fatigue, nausea, anorexia, and myalgias. Symptoms sometimes were improved spontaneously after 6 weeks of the therapy (Douglas & Post, 2001).

Kosak, Saltik, Ozen, Gurakan & Yuce (2001) investigated long-term alpha-interferon treatment in a total of 107 adolescent patients with chronic HBV. The participants received IFN alpha for three to six months in two clinical trials and were checked for 69 months. In the second trial 34 participants
received 5MU/m² for 12 weeks. Thirty cases received IFN-alpha at the same dosage after four weeks of prednisolone. A control group of 59 patients was monitored for a mean period of 46 months without any therapy. Response to the treatment was defined as loss of hepatitis B antigen (HBeAg) within 12 months after stopping treatment. The results of the study showed that the majority of patients (65%) tested clear of HBV DNA and HBeAg after 12 months of therapy. The side effects of the treatment reported by adolescents included flu-like symptoms (fever, headache, malaise, irritability, myalgias); neuropsychiatric effects (depression, suicidal ideation, seizures); autoimmune diseases (either hypothyroidism or hyperthyroidism); and myelosupression (thrombocytopenia, leukopenia, anemia). The relapse rate with IFN-a due to discontinuation of the treatment and side effects was high, ranging from 30 to 70%. Sustained normalization of ALT following treatment with IFN-a observed in 10 to 20% of the patients (Bortolotti et al., 2000).

Researchers recommended that adolescents who receive interferon treatment should be monitored carefully by a health provider for leukopenia and thrombocytopenia. A complete blood count (CBC) should be ordered before the initiation of the treatment, on the fifteenth day of the treatment, and monthly thereafter to monitor for leukopenia and thrombocytopenia. The clinician needs to assess adolescents for signs of depression and suicidal ideations on a continual basis during the course of treatment with interferon.

**Treatment of HCV.**

Liver biopsy is considered a standard procedure in adolescents with HCV to determine the severity of liver disease. Findings of liver biopsy in adolescents with chronic infection, even those with normal ALT, may range from minimal hepatitis to cirrhosis. The degree of pathology in the liver influences which treatment modalities are indicated for HCV. Additionally, management approaches in HCV infection are directly affected by which of the six specific genotypes of HCV the adolescent has contracted (Lackner et al., 2000). Determining genotype is also useful in counseling patient regarding antiviral therapy since certain genotypes are more responsive to the treatment than others. Approximately
70% of infected patients carry genotype 1, which is most resistant to antiviral therapy. Factors that predict an increased chance of responding to therapy include the absence of cirrhosis on liver biopsy, low serum HCV RNA levels, and possibly infection by genotypes of HCV other than 1a and 1b (Badizadegan, Jonas, Ott, Nelson & Perez-Atayde, 1998).

Interferon, either alone or with ribavirin (a nucleoside analogue) is the only treatment now available for chronic hepatitis C in adolescents. The aim of the pilot study of Lackner et al., (2000) was to evaluate the efficacy and safety of a combined virostatic treatment with alpha-interferone (IFN-alpha) and ribavirin (RBV). Twelve adolescents (median age: 13.5) with chronic HCV were treated with a recombinant IFN-alpha-2a (6 megaunits/m2 body surface area) combined with RBV (15mg/kg body weight/day, orally) for 12 months. Combining alpha- interferone and ribavirin (RBV) has been showed to significantly improve the response in adolescents with chronic hepatitis C. This combination therapy involves the oral administration of ribavirin in two divided doses of either 1, 2000 or 1,000 mg/d, depending on patient's weight, and IFN administered at 3 million IU subcutaneously three times per week. The duration of the combination therapy is from 6 to 12 months. At the end of the treatment hepatitis C virus cleared in 8 of 12 patients. The researchers concluded that in adolescent patients with chronic hepatitis C combination therapy of IFN-alpha and ribavirin is a safe and an effective therapeutic option (Kondili, Spada, Sartorelli, Palumbo & Rapicetta, 1997).

Nishiguchi et al., (2001) also investigated a treatment for chronic hepatitis C in forty adolescent patients who were prone to cirrhosis. Such patients have persistently elevated ALT levels, detectable HCV RNA, and liver biopsy results showing either partial and bridging fibrosis or at least moderate degrees of inflammation and necrosis (Nishiguchi et al., 2001). According to this study, the goal of the treatment of adolescents with HCV is reduction viral levels of hepatitis C virus to zero. The recommended therapeutic regime is 3 million IU three times a week, subcutaneously for 6 months. The relapse rate seen with the treatment is approximately 10-15% and more likely to occur within 6 months after termination of the treatment. Nevertheless, of those patients who have a sustained response, more than 90% continued in remission for at least 5 years with a normal ALT level, undetectable serum HCV
RNA, and often undetectable virus in the liver.

**Contraindications to treatment.**

Specific contraindications to IFN treatment in patients with HBV and HCV include decompensated liver disease, neutropenia or thrombocytopenia, known hypersensitivity to IFN, active alcohol or illicit drug use, and autoimmune disorders. Patients with severe depression and a history of attempted suicide should not receive IFN therapy. IFN is also not recommended when ALT levels are persistently normal. Patients receiving antiviral therapy for HBV and HCV must be monitored for neutropenia and thrombocytopenia, which most likely will occur during the first 4 to 6 weeks of treatment. Therapy should be discontinued if the white blood cell (WBC) account has dropped below 750/mm3, or the platelet count has dropped to 50,000/mm3, or WBC drops to < 1,000/mm3 (Nishiguchi et al., 2001).

**Prevention of Hepatitis B**

Hepatitis B can be easily prevented by administration of hepatitis B vaccine. Prophylaxis against hepatitis B could be obtained either through hepatitis B vaccination or temporarily hepatitis B immune globulin (HBIG) (CDC, 1999). The CDC (1998) recommends a comprehensive hepatitis B vaccination as a strategy to eliminate HBV transmission in the United States. Hepatitis B is now started at birth and only given in adolescence as catch-up for those who did not get it at birth. This strategy emphasizes the importance of a routine office visit at 11 to 12 years of age, at which time vaccination of adolescents with Recombivax HB is recommended as a primary protection against hepatitis B (CDC, 1998).

The Advisory Committee on Immunization Practices (ACIP) recommends vaccination of all children in age 0-18 years of age (CDC, 1998). Infants should be immunized with 3 doses of hepatitis B vaccine by 18 months of age. They should get their first dose at birth or at 1-2 months of age. The second dose should be given 1 or 3 months later, and the third dose between 6 and 18 months of age. This immunization schedule will protect them from the virus when they become teenagers and adults. All infants born to women who are infected with HBV or to women who are chronic carriers of HBV should be immunized within 12 hours of birth; if not, infants will likely be infected with HBV and become chronic carriers themselves (Yusuf et al., 1999). At risk infants also should get their second vaccine at 1
to 6 months of age. Infants who are born to healthy women (non-carriers of HBV) should also get HBV vaccine to prevent HBV infection and chronic HBV carriage (CDC, 1998).

The ACIP recommends that all adolescents who lack 3 doses of hepatitis B vaccine should be immunized with Recombivax vaccine due to the high risk of getting HBV through sexual contact or using injectable drugs. Vaccination should be offered to non-immune adolescents born in countries of high endemicity who have been screened to detect chronic carriage. Studies have shown that hepatitis B vaccine prevents HBV infection in 85-95% of people who receive all three shots, and this protection lasts at least 10 years (Yusuf et al., 1999). Booster doses of vaccine are not required in immunocompetent adolescents who have responded to an initial vaccine course. HIV-positive and immuno-compromised adolescents will still need to be monitored and given boosters when anti-HBs levels fall below 10iu/l (CDC, 1998) (See Algorithm for HBV).

The research study of Cassidy (2001) shows that Recombivax HBV vaccine given adolescents at two doses can protect them from HBV. This study was designed to investigate the administration of hepatitis B vaccine to more than 1,000 adolescents. The vaccine, Recombivax HB, was given at two adult dose at six-month intervals. Over 95% of adolescents demonstrated desired antibody responses after the vaccination. The investigators concluded that furthermore, two doses instead of three may also be effective for achieving better vaccine compliance with a little loss (5%) in vaccine protection.

**Education/ Screening and Primary prevention**

Prevention of hepatitis in adolescents by the health care provider demands an incorporation of proven and effective methods, including immunizations, education, and tracking systems. Schaffer, Humiston, Shone, Averno & Szilagyi (2001) performed a national survey of US physicians regarding immunization practices. The survey was designed to describe physician’s adolescent immunization practices and barriers to successful adolescent immunization. A twenty-four-item survey was mailed to a national sample of 1480 pediatricians and family physicians living in the United States. The results of the study showed that adolescent immunization rates remain at 84% for HBV. According to the authors, these comparative low immunization rates were directly related to the factors stated below: only 42% of
physicians reported that they review the immunization status of adolescent patients at acute illness visits, 24% of physicians immunized eligible adolescents during such visits; and only 21% of physicians used immunization tracking and recall systems. Other factors preventing adolescent immunization included financial barriers, record scattering, lack of tracking and recall, and missed appointments. The researchers recommended that to avoid missing the immunization of adolescents the health care providers should ensure vaccination of all adolescents during the routine medical visits.

Lachman, Pastore, Steed & Maresca (2000) also investigated strategies to increase vaccination with hepatitis B vaccine among the adolescents. In this study a random sample consisted of 205 teenagers (ages 13 to 19) recruited a local school-based center in New York. The researchers performed a chart review as well as examination of vaccination records. Investigators defined completion of Vaccination B as successful if the subject’s medical record indicated 3 dosages of hepatitis B vaccine. The highest completion of immunization was accomplished using a system to recall patients for missed appointments and a system to advertise specific days to complete the vaccination series. Other outreach strategies proven effective in reaching adolescents included reminder-recall letters and telephone calls. The researchers concluded that school-based programs offer a unique opportunity to obtain a required immunization status of hepatitis B with adolescents (Lachman, Pastore, Steed & Maresca, 2000).

Skinner, Imberger, Nolan, Glover, & Bowes (1999) investigated educational strategies to increase hepatitis B vaccination among adolescents in metropolitan secondary schools. A randomized sample was used to evaluate the effect of the intervention on the uptake of vaccine at the school level (7,588 students). A Hepatitis B education/promotion kit was implemented in the study and incorporated in the school curriculum. Results of the study showed that immunization rates increased by only 4 -10%. The researchers concluded that implementation of an educational package about hepatitis B in the school curriculum alone was not able to successfully increase knowledge or awareness of hepatitis B. As recommended by the authors, additional strategies such as education of parents, the cooperative role of schools, and pro-active health providers are needed to maximize vaccination in this age group.
**Exposure to HBV/HCV.**

All unvaccinated adolescents who report having shared needles or having unprotected intercourse with a partner who tested positively for HBV/HCV virus should be evaluated for the potential to contract HBV and HCV based on the type of body substance involved and the route and severity of the exposure (Roy, Haley, Lecrerc, Boivin, Cedras & Vincellette, 2001). Blood, fluid containing visible blood, semen, vaginal secretions, cerebrospinal, synovial, peritoneal, pericardial, amniotic fluids or tissues are considered infectious for bloodborne pathogens. Testing of needles or other sharp instruments for the HBV/HCV implicated in an exposure, regardless of whether the source is known or unknown, is not recommended due to the fact that the reliability and interpretation of findings are unknown. Any blood or body fluid exposure to an unvaccinated persons should lead to initiation of the hepatitis B vaccine series.

The hepatitis B vaccine provides long-term protection against hepatitis B infection and is recommended for pre-exposure in unvaccinated adolescents, whereas HBIG provides short-term protection and is indicated in post-exposure states. Hepatitis B immunoglobulin (HBIG) should be administered as soon as possible after the exposure (preferable within 24 hours). Hepatitis B vaccine also should be administered within 24 hours with HBIG at a separate site. Vaccines always should be administered at the deltoid site. For exposed persons who are in the process of vaccination but in whom the series have not been completed, vaccination should be completed as scheduled and HBIG should be administered. Persons exposed to HBsAg-positive blood or body fluids who have not responded to primary immunization should receive a dose of HBIG and reinitiate the hepatitis B vaccine series (Roy, Haley, Lecrerc, Boivin, Cedras & Vincellette, 2001).

**Discussion.**

Adolescence is a time when individuals may engage in intentional or unintentional risk behaviors that can lead to significant consequences, complicating their future health. Physical changes and psychological challenges that adolescents face such as a growth spurt, physical maturation, emerging sexuality, and anticipated separation from the nurturing of parents predispose them to experimentation
with high-risk behaviors such as injection drug use, unprotected sexual practices, tattooing, and body piercing. These high-risk behaviors may ultimately result in the contracting of hepatitis B or C.

Acute and chronic consequences of chronic hepatitis in adolescents continue to create a major public health problem in the United States. Annually, 16,000 adolescents die from the complications related to chronic hepatitis. CDC (1998) recommends a comprehensive hepatitis B vaccination as a strategy to eliminate HBV transmission in the United States. While the overall incidence of the viral hepatitis appears to be declining, the incidence of this disease among specific groups, including young adults, continues to rise (Diaz et al., 2001, Beech et al., 2002; and Mackellar, Valleroy, Secura & Jansen 2001).

Unfortunately, no HCV vaccine is available at the current time. But an early screening for hepatitis in adolescents is essential for the better treatment outcomes (Douglas & Post, 2001; Kosak, Saltik, Ozen, Gurakan & Yuce, 2001; Lackner et al., 2000; Chang et al., 2000). Acute hepatitis B and C are difficult to miss because of specific diagnostic tests but half of the adolescent patients with acute HBV and HCV also present with nonspecific symptoms of fatigue, vague abdominal pain, nausea, anorexia, weight loss, arthralgias (Douglas & Post, 2001, Nishiguchi et al., 2001). Detecting HBV and HCV in at risk adolescents should be based on known risk factors for those infections. According to the research of Diaz et al., (2001), Beech et al., (2002) and Minkovits, et al., (2001), adolescents who are gay, lesbian, intravenous drug users, HIV-positive adolescents, sexual assault victims, or adolescents born outside of western Europe, north America and Australia, needle-stick victims, sexual partners of high-risk patients, those with multiple partners have an increased risk for contracting hepatitis B and C. Mentally retarded adolescents also need to be followed by a health care provider for detecting hepatitis due to possible high risk-behaviors such as self-mutilation, biting, scratching, drooling and unprotected sexual practices (Diaz et al., 2001, Beech et al., 2002 and Minkovits, et al., 2001).

Knowledge regarding the pathophysiology and management of HBV and HCV infections, along with management of those viral infections continues to expand. The generally slow progression of chronic hepatitis, especially hepatitis C, along with an overall absence of acute symptoms in adolescents,
makes it difficult to diagnose the disease in the early stages. Over the next two decades a significant increase in morbidity and mortality rates related to the serious medical complications of hepatitis B and C is expected (Hoshiyama, et al., 2000). Generally, the research indicates that early detection and appropriate treatment of HBV and HCV results in better outcomes. However, interferon, either alone or with ribavirin (a nucleoside analogue) is the only treatment now available for the treatment of chronic hepatitis in adolescents (Lackner et al., 2000). Therapy with interferon and ribavirin is a successful therapeutic approach resulting in ceasing viral replication of HBV and HCV in infected adolescents (Douglas & Post, 2001; Kosak, Saltik, Ozen, Gurakan & Yuce, 2001). (See Table 2 for a concise description of treatment protocol).

According to the research, educating adolescents about chronic forms of hepatitis, modes of transmission, and prevention of hepatitis B through vaccination results in decreased rates of HBV and HCV among adolescents (Cassidy, 2001). Prevention of hepatitis in adolescents by the health care provider demands an incorporation of proven and effective methods. Reduction of risks of HBV and HCV transmission demands creation of prevention programs, including educating youth about safe sexual practices, dispensing condoms, creating drug treatment centers and syringe exchange centers, initiating programs that will reach transient youth, and supply information on HBV and HCV infections (Diaz et al., 2001). While an effective vaccine for HCV has not yet been developed, health care providers should maintain an updated knowledge base on diagnosing hepatitis in order to evaluate current options, risks, benefits, and costs of the treatment. Health care providers have unique opportunities to identify adolescents at highest risk for HBV and HCV through screening for early detection, interventions to prevent infections, and planning treatment to significantly improve the outcomes.
TABLE 1.

**Risks of contracting chronic hepatitis in adolescents**

<table>
<thead>
<tr>
<th>Letter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>homosexual, homeless population, HIV-positive youth</td>
</tr>
<tr>
<td>E</td>
<td>exposure to infected blood and blood products</td>
</tr>
<tr>
<td>P</td>
<td>prostitution, psychiatric problems</td>
</tr>
<tr>
<td>A</td>
<td>assault victims</td>
</tr>
<tr>
<td>T</td>
<td>tattooing, transfusion of blood before 1992</td>
</tr>
<tr>
<td>I</td>
<td>intravenous drug users, trading sex for money, food</td>
</tr>
<tr>
<td>S</td>
<td>sharing cotton and other equipment to inject drugs, sexual practices without protection, sexual intercourse with multiple partners, self-mutilation, scratching, snuffing cocaine.</td>
</tr>
</tbody>
</table>
TABLE 3.

Algorithm for Hepatitis C.

Risk factors: illicit drug use, exchange equipment for drug use, sharing cotton, needles, unprotected sex, body piercing, tattooing.

Sub: Anorexia, nausea, vomiting, malaise, symptoms of URI or flu-like symptoms, aversion to smoking, abdominal pain/discomfort, fatigue

Ob: Fever, enlarged liver, jaundice, abdominal pain in RUQ/epigastric area, hepatomegaly, splenomegaly, spider angiomas.

Laboratory/Diagnostic tests:

- CBC - WBC: Normal to Low
- Infectious mononucleosis: Large atypical lymphocytes
- Mononucleosis: High AST, ALT, PT (severe hepatitis)
- Hepatitis Panel: EIA2(+) or RIBA(+) for Anti-HCV Confirm with (RT-PCR) HCV RNA

**NO HISTORY OF HEPB/C**

- Hx blood transfusions
- Hx illicit drug use
- Sexual exposure

**Alpha Interferon 2b**

- 6mU/m² body surface
- 2x week for 6-12 m

**Or/and**

- Oral ribavirin Ribavirin
- 15 mg/kg/day for 6-12 m

**Assess for S/E and Tx response**

**If Anti-HCV (+) and HCV RNA(-) recovery from previous infectious**

**EDUCATION ON PREVENTION OF HEP C**
Algorithm for Hepatitis B.
Risk factors: early age first intercourse, homosexual, multiple sexual partners, HIV status, prostitution, body piercing, tattooing.

- **Sub:** Anorexia, nausea, vomiting, malaise, symptoms of URI or flu-like symptoms, aversion to smoking, abdominal pain/discomfort, fatigue
- **Ob:** Fever, enlarged liver, jaundice, abdominal pain in RUQ/epigastric area, hepatomegaly, splenomegaly, spider angiomas.

**Laboratory/Diagnostic tests:**
- CBC: WBC - normal to low
- Large atypical lymphocytes
- Mononucleosis
- AST! ALT! PT! (severe hepatitis)
- Hepatitis Panel: (-) HBsAg (-) Anti-HBc (-) IgM (-) IgG (+) Anti-HBs-vaccination
- (+) HBsAg + Anti-HBc IgM for both (+) HBV DNA
- (+) HBsAg + Anti-HBc IgG → chronic hepatitis B

**Treatment (symptomatic):**
- rest, nutrition & fluid balance.
- NO HISTORY OF HEP B
- Sexual exposure or to cont body fluid
- Refer for Gastroenterologist
- Liver biopsy if (+)
- Tx: Alpha Interferon 2b
- 5-20mU 2x week for 12-6m
- Lamivudine 100mg PO QD
- Monitor for S/E, liver function and Tx response

**Hx of Hep B vaccination**
- Known nonresponder
- Unknown
- No history of Hep B vaccine

- Check HbsAb titer
- > 10 =No risk
- < 10 SRU HepB vac booster
- HB IG 0.6ml/kg + Ongoing exposure
- < 10SRU Hep-B vaccination
- Check Hbs Ab
- < 10SRU Hep-B vaccination
- Check HBc Ab
- if negative
- HB IG 0.6ml/kg + Ongoing exposure
- No ongoing exposure
- Hep-B vaccination

**EDUCATION ON PREVENTION OF HEP B**
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