

# Epidemiology of Hepatitis C in Dialysis Units

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**Background:** Chronic hemodialysis patients are at high risk for infection because the process of hemodialysis requires vascular access for prolonged periods. In an environment where multiple patients receive dialysis concurrently, repeated opportunities exist for person-to-person transmission of infectious agents, directly or indirectly via contaminated devices, equipment and supplies, environmental surfaces, or hands of personnel. Furthermore, hemodialysis patients require frequent hospitalizations and surgery, which increases their opportunities for exposure to nosocomial infections.

Recommendations for the control of hepatitis B in hemodialysis centers were first published in 1977, and by 1980, their widespread implementation was associated with a sharp reduction in incidence of hepatitis B virus (HBV) infection among both patients and staff members. In 1982, hepatitis B vaccination was recommended for all susceptible patients and staff members. However, outbreaks of both HBV and hepatitis C virus (HCV) infections continue to occur among chronic hemodialysis patients. Epidemiologic investigations have indicated substantial deficiencies in recommended infection control practices, as well as a failure to vaccinate hemodialysis patients against hepatitis B. These practices apparently are not being fully implemented because staff members a) are not aware of the practices and their importance, b) are confused regarding the differences between standard (i.e., universal) precautions recommended for all health-care settings and the additional precautions necessary in the hemodialysis setting, and c) believe that hepatitis B vaccine is ineffective for preventing HBV infection in chronic hemodialysis patients.

**Epidemiology:** Since 1990, limited data from U.S. studies using testing for antibody to HCV (anti-HCV) to evaluate the incidence of HCV infection have reported annual rates of 0.73%-3% among hemodialysis patients. None of the patients who seroconverted had received transfusions in the interim or were injecting-drug users. During 1992-1999, national surveillance data indicated that the proportion of centers that tested patients for anti-HCV increased from 22% to 56% (CDC, unpublished data, 2001). In 1999, nationwide prevalence of anti-HCV was 8.9%, with some centers reporting prevalences >40% (CDC unpublished data, 2001). Other studies of hemodialysis patients in the United States have reported anti-HCV prevalences of 10%-36% among adults and 18.5% among children.

HCV is most efficiently transmitted by direct percutaneous exposure to infectious blood, and like HBV, the chronically infectious person is central to the epidemiology of HCV transmission. Risk factors associated with HCV infection among hemodialysis patients include history of blood transfusions, the volume of blood transfused, and years on dialysis. The number of years on dialysis is the major risk factor independently associated with higher rates of HCV infection. As the time patients spent on dialysis increased, their prevalence of HCV infection increased from an average of 12% for patients receiving dialysis < 5 years to an average of 37% for patients receiving dialysis >5 years. These studies, as well as investigations of dialysis-associated outbreaks of hepatitis C, indicate that HCV transmission most likely occurs because of inadequate infection control practices. During 1999-2000, CDC investigated three outbreaks of HCV infection among patients in chronic hemodialysis centers (CDC, unpublished data, 1999 and 2000). In two of the outbreaks, multiple transmissions of HCV occurred during periods of 16-24 months (attack rates: 6.6%-17.5%) and in the third, multiple new infections clustered at one point in time (attack rate: 27%). Seroconversions were associated with receiving dialysis immediately after a chronically infected patient. Multiple opportunities for cross-contamination among patients were observed, including a) equipment and supplies that were not disinfected between patient use; b) use common medication carts to prepare and distribute medications at patients' stations; c) sharing of multiple dose medication vials, which were placed at patients' stations on top of hemodialysis machines; d) use of common supply carts moved from one station to another, which contained both clean supplies and blood-contaminated items, including small biohazard containers, sharps disposal boxes, and used vacutainers containing patients' blood; e) contaminated priming buckets that were not routinely changed or cleaned and disinfected between patients; f) machine surfaces that were not routinely cleaned and disinfected between patients; and g) blood spills that were not cleaned up promptly.

**Recommendations for Preventing Transmission:** Preventing transmission long chronic hemodialysis patients of HCV

and other bloodborne viruses from both recognized and unrecognized sources of infection requires implementation of a comprehensive infection control program. The components of such a program include infection control practices specifically designed for the hemodialysis setting (Table), including routine serologic testing and immunization, surveillance, and training and education.

HCV transmission within the dialysis environment can be prevented by strict adherence to infection control precautions recommended for all hemodialysis patients (Table). Although isolation of HCV-infected patients is not recommended, routine testing for alanine aminotransferase (ALT) and anti-HCV is important for monitoring transmission within centers and ensuring that appropriate precautions are being properly and consistently used. Routine HCV testing should include use of both an EIA to test for anti-HCV and supplemental or confirmatory testing with an additional, more specific assay. Use of nucleic acid testing for HCV RNA as the primary test for routine screening is not recommended because few HCV infections will be identified in anti-HCV negative patients. However, if ALT levels are persistently abnormal in anti-HCV negative patients in the absence of another etiology, testing for HCV RNA should be considered. Blood samples collected for RT-PCR should not contain heparin, which interferes with the accurate performance of this assay.

For HCV-negative patients, monthly ALT testing will facilitate timely detection of new infections and provide a pattern from which to determine when exposure or infection might have occurred. In the absence of unexplained ALT elevations, testing for anti-HCV every 6 months should be sufficient to monitor the occurrence of new HCV infections. If unexplained ALT elevations are observed in patients who are anti-HCV negative, repeat anti-HCV testing is warranted. If unexplained ALT elevations persist in patients who repeatedly test anti-HCV negative, testing for HCV RNA should be considered.

Persons who seroconvert to anti-HCV-positive should be reported to the local health department as required by law or regulation. When a seroconversion occurs, review all other patients' routine laboratory test results to identify additional cases, perform additional testing as indicated, and investigate potential sources for infection to determine if transmission might have occurred within the dialysis unit. If  $\geq 1$  patient seroconverts from anti-HCV negative to positive during a 6-month period, more frequent (e.g., every 1-3 months) anti-HCV testing of HCV-negative patients could be warranted for a limited time (e.g., 3-6 months) to detect additional infections. If no additional newly infected patients are identified, resume semiannual testing. If ongoing HCV transmission among patients is identified, implement control measures based on results of investigation of potential sources for transmission and monitor their effectiveness (e.g., perform more frequent anti-HCV testing of HCV-negative patients for 6-12 months before resuming semiannual testing).

Patients who are anti-HCV positive (or HCV RNA positive) do not have to be isolated from other patients or dialyzed separately on dedicated machines. Furthermore, they can participate in dialyzer reuse programs. Unlike HBV, HCV is not transmitted efficiently through occupational exposures. Thus, reprocessing dialyzers from HCV-positive patients should not place staff members at increased risk for infection. HCV-positive persons should be evaluated (by consultation or referral, if appropriate) for the presence or development of chronic liver disease according to current medical practice guidelines. They also should receive information concerning how they can prevent further harm to their liver and prevent transmitting HCV to others. Persons with chronic liver disease should be vaccinated against hepatitis A, if susceptible.

## **TABLE: RECOMMENDED INFECTION CONTROL PRACTICES FOR HEMODIALYSIS UNITS AT A GLANCE**

### **Infection Control Precautions for All Patients**

- ◆ Wear disposable gloves when caring for the patient or touching the patient's equipment at the dialysis station; remove gloves and wash hands between each patient or station.
- ◆ Items taken into the dialysis station should either be disposed of, dedicated for use only on a single patient, or cleaned and disinfected before taken to a common clean area or used on another patient.
- ◆ Nondisposable items that cannot be cleaned and disinfected (e.g., adhesive tape, cloth-covered blood pressure cuffs) should be dedicated for use only on a single patient.
- ◆ Unused medications (including multiple dose vials containing diluents) or supplies (syringes, alcohol swabs, etc.) taken to the patient's station should be used only for that patient and should not be returned to a common clean area or used on other patients.

- ◆ When multiple dose medication vials are used (including vials containing diluents), prepare individual patient doses in a clean (centralized) area away from dialysis stations and deliver separately to each patient. Do not carry multiple dose medication vials from station to station.
- ◆ Do not use common medication carts to deliver medications to patients. Do not carry medication vials, syringes, alcohol swabs or supplies in pockets. If trays are used to deliver medications to individual patients, they must be cleaned between patients.
- ◆ Clean areas should be clearly designated for the preparation, handling and storage of medications and unused supplies and equipment. Clean areas should be clearly separated from contaminated areas where used supplies and equipment are handled. Do not handle and store medications or clean supplies in the same or an adjacent area to that where used equipment or blood samples are handled.
- ◆ Use external venous and arterial pressure transducer filters/protectors for each patient treatment to prevent blood contamination of the dialysis machines' pressure monitors. Change filters/protectors between each patient treatment, and do not reuse them. Internal transducer filters do not need to be changed routinely between patients.
- ◆ Clean and disinfect the dialysis station (chairs, beds, tables, machines, etc.) between patients.
- ◆ Give special attention to cleaning control panels on the dialysis machines and other surfaces that are frequently touched and potentially contaminated with patients' blood.
- ◆ Discard all fluid and clean and disinfect all surfaces and containers associated with the prime waste (including buckets attached to the machines).
- ◆ For dialyzers and blood tubing that will be reprocessed, cap dialyzer ports and clamp tubing. Place all used dialyzers and tubing in leak-proof containers for transport from station to reprocessing or disposal area.

### Schedule of Routine Testing for Hepatitis B Virus (HBV) and Hepatitis C (HCV) Infection

<i>Patient's Status</i>	<i>On Admission</i>	<i>Monthly</i>	<i>Semi-Annual</i>	
<i>All patients</i>	HBsAg*, Anti-HBc (total)* Anti-HBs* Anti-HCV, ALT			A
<i>HBV susceptible, including non-responders to vaccine</i>		HBsAg		
<i>Anti-HBs positive (&gt;10mIU/ml), and HBc negative</i>				A
<i>Anti-HBs and Anti HBc positive</i>		No additional testing needed	No additional testing needed	B r
<i>Anti-HCV negative</i>		ALT	Anti-HCV	

\*Results of HBV testing should be known before the patient begins dialysis ; HBsAg=hepatitis B surface antigen, Anti-HBc=antibody to hepatitis B core antigen; Anti-HBs=antibody to hepatitis B surface antigen; Anti-HCV=antibody to hepatitis C virus; ALT – alanine aminotransferase

### Hepatitis B Vaccination

- ◆ Vaccinate all susceptible patients against hepatitis B.
- ◆ Test for anti-HBs 1-2 months after last dose
  - If anti-HBs is < 10 mIU/mL, consider patient susceptible, revaccinate with an additional three doses, and retest for anti-HBs.
  - If anti-HBs is > 10 mIU/mL, consider immune, and retest annually.
  - Give booster dose of vaccine if anti-HBs declines to <10 mIU/mL and continue to retest annually

### Management of HBsAg-Positive Patients

- ◆ Follow infection control practices for hemodialysis units for all patients.
- ◆ Dialyze HBsAg-positive patients in a separate room using separate machines, equipment, instruments, and supplies.
- ◆ Staff members caring for HBsAg-positive patients should not care for HBV susceptible patients at the same time (e.g., during the same shift or during patient change-over).

## **References**

1. Centers for Disease Control and Prevention. *Recommendations for preventing transmission of infections among chronic hemodialysis patients. MMWR 2001;50(No. RR-5):1-43.*
2. Centers for Disease Control and Prevention. *Recommendations for prevention and control of hepatitis C virus (HCV) infection and HCV-related chronic disease. MMWR 1998;47(No. RR-19):1-39.*