COMMENTARY

Hepatitis C Virus Outbreaks in Hemodialysis Centers: A Continuing Problem

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(See the articles by Nguyen et al, on pp. 125–133, and by Aho et al, on pp. 134–139.)

The Centers for Disease Control and Prevention (CDC) estimates that ~370,000 people in the United States rely on hemodialysis care.[1] Despite the publication of multiple guidelines over the years, acquisition of hepatitis C virus (HCV) continues to occur in dialysis centers. In this commentary, we review recent outbreaks of hepatitis C in hemodialysis centers and describe the breach of infection control policies and procedures that were incriminated in these outbreaks.

The reasons for continued outbreaks of HCV in dialysis centers may be examined by reviewing the following factors: (1) characteristics of HCV including prevalence, transmissibility, and environmental stability; (2) the physical layout of dialysis centers; (3) patient risk factors; and (4) failure of healthcare personnel (HCP) to adhere to standards of infection control.

FEATURES OF HCV THAT FAVOR TRANSMISSION IN DIALYSIS CENTERS

Several features of HCV enhance the risk of transmission in hemodialysis centers: (1) HCV infection is common in the United States. (2) HCV is transmissible via needle sticks and other parenteral exposures. (3) HCV is stable in the environment for days to weeks. (4) Most patients with HCV are asymptomatic. The CDC estimates that there are 2.7 million persons with chronic HCV infection in the United States.[2] Transmission routes for HCV include infection drug use, needle-stick injuries in healthcare, sharing personal items contaminated with infectious blood (eg, razors), and other healthcare procedures that involve invasive procedures such as injections. The risk of transmission via a parenteral exposure such as a needle stick is between 1% and 2%.[3] A meta-analysis reported the rate or transmission by needle sticks as 1.9%.[4] Various studies have reported that HCV inoculated onto surfaces survived at room temperature for up to 16 hours,[5] up to 5 days,[6] and up to 6 weeks.[7] HCV survived in tuberculin syringes for up to 63 days.[8] Importantly, ~70%–80% of patients with HCV are asymptomatic.[2,3] Thus, infection can only be detected via diagnostic tests. Failure to obtain HCV testing to identify infected persons may lead to decreased attention to infection control in infected persons.

CHARACTERISTICS OF DIALYSIS CENTERS THAT ENHANCE THE POSSIBILITY OF HCV TRANSMISSION

A number of characteristics of hemodialysis centers and the process of dialysis enhance the possibility of HCV transmission. (1) Patients are generally placed in bays separated from other patients by a short distance. (2) Sinks may not be available in each bay. (3) HCP have frequent contact with blood-containing devices. (4) Facilities may lack separate clean and dirty utility rooms or a separate medication preparation area. (5) Dialysis centers are usually free standing and do not have immediate access to trained infection control preventionists. (6) Dialysis machines and equipment are heavily blood contaminated and must be disinfected with strict adherence to manufacturer's recommendations and sterilization/disinfection guidelines.

PATIENT CHARACTERISTICS THAT PROMOTE TRANSMISSION OF HCV

Several patient characteristics promote transmission of HCV: (1) Dialysis is prolonged and patients require venous access. (2) Patients frequently receive medications via injection or infusion. (3) Patients may be unable to fully participate in their care.

INFECTION CONTROL IN HEMODIALYSIS CENTERS

Multiple studies have demonstrated that HCP in dialysis centers are often poorly compliant with infection guidelines to prevent HCV transmission in these settings.[9,10] Shimokura et al[9] used a cluster random survey design to study HCP in

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TABLE 1. Selected Recent Clusters of Hepatitis C Virus in Hemodialysis Centers, 2005–2015

Author, Year	Country	No. of Cases[a]	Molecular Analysis	Potential Breaches Identified
Savey, 2005[11]	France	22	Yes	Lack of adequate space between bays; lack of space for preparing infusions and injections; low nurse-to-patient ratio; inadequate training of staff; noncompliance with HH and proper glove use; sharing of equipment among patients (eg, scissors); lack of routine surface decontamination
Kondili, 2006[12]	Italy	4	Yes	Use of multidose vials of heparin
Spada, 2008[13]	Italy	4	Yes	Mechanism of transmission unclear
CDC, 2009[14]	United States	9	Yes	Failure to test patients for HCV; inadequate cleaning and disinfection practices (visible blood remained on surfaces); poor compliance with HH; failure to change gloves between patients; lack of separate clean area for medication storage
Lanini, 2010[15]	Italy	13	Yes	Source likely contamination of a multidose heparin via use of multidose vials of saline; poor compliance with HH; failure to change gloves between patients
Roy, 2012[16]	Spain	2	Yes	Poor compliance with HH and glove use; multidose heparin vials; lack of adequate space between dialysis bays; source likely an infected HCP
Szucs, 2014[17]	Hungary	17	Yes	Multidose vials of heparin and saline
Rao, 2014[18]	United States	8	Yes	Multidose vials of heparin, poor compliance with HH (73%) and glove use (72%); failure to disinfect venous ports and medication vial prior to accessing; multidose vials stored throughout the facility; waste handling port used to obtain blood and not disinfected between patients
Nguyen, 2015[19]	United States	18	Yes	Poor compliance with HH (82%); failure to change gloves between machines; clinic did not clearly label clean and dirty sinks; failure to disinfect hubs and vial tops; medication preparation next to a sink; failure to maintain asepsis when accessing vascular devices; ineffective surface disinfection; failure to disinfect priming buckets
Aho, 2015[20]	France	1	Yes	Transmission felt due to failure to perform HH and/or transmission by instruments (eg, scissors, clamps, etc.)

NOTE. HCP, healthcare provider; HCV, hepatitis C virus; HH, hand hygiene.
[a]Cases may have been distributed among multiple clusters as identified by molecular analysis; not all patients identified may have been linked to the outbreak(s).

53 hemodialysis facilities in the United States in 2000. Only 57% of these facilities reported that HCP always performed hand hygiene (HH) and changed gloves before putting patients on dialysis; 47% reported that HCP performed HH between patient care stations; and 55% reported that HCP performed HH between patients when administering intravenous medications,[9] In a more detailed analysis, Shimokura et al[10] reported that the patient care practices independently associated with a higher center prevalence of HCV included reusing priming receptacles without disinfection (odds ratio [OR], 2.3), handling blood specimens adjacent to medications and clean supplies (OR, 2.2), and using mobile carts to deliver injectable medications (OR, 1.7). Independently related facility covariates were ≥10% patient HCV prevalence (OR, 3.0), patient-to-staff ratio >7 to 1 (OR, 2.4), and treatment duration ≥2 years (OR, 2.4).

LESSONS FROM OUTBREAKS OF HCV IN HEMODIALYSIS CENTERS

Outbreaks of HCV in hemodialysis centers continue to be reported (Table 1).[11–20] The papers in this issue by Nguyen et al[19] and Aho et al[20] add to the growing body of knowledge regarding the breaches in infection control practices that lead to HCV outbreaks. Most clusters of HCV were associated with multiple breaches in infection control practices. The potential breaches described in these outbreaks demonstrate the following common themes: (1) use of multidose vials generally for heparin or saline administration; (2) poor compliance with hand hygiene before and after each patient contact or after touching a possibly contaminated surface; (3) failure to change gloves when moving between patients or between patients and potentially contaminated surfaces; (4) failure to adequately disinfect environmental surfaces; (5) unsafe injection practices; (6) failure to disinfect shared equipment between patient uses; (6) lack of a separate area for medication preparation; and (7) failure to have clearly separated clean and dirty utility rooms. Reviews of outbreak investigations between 1998 and 2008 revealed similar deficiencies in infection control practices.[21]

These outbreaks also demonstrate the importance of using molecular methods in outbreak investigations of HCV outbreaks related to dialysis. In many cases, multiple small clusters were demonstrated rather than a single large clonal cluster.

PREVENTING HCV TRANSMISSION DURING DIALYSIS

Detailed recommendations are available from the CDC for preventing the transmission of infections among chronic

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hemodialysis patients;[22] they have been updated by the CDC to clarify guidance on parenteral medical vial.[23] Strict adherence to these guidelines should prevent person-to-person transmission of HCV in hemodialysis centers. Furthermore, recent advances in therapy for hepatitis C have demonstrated that direct acting antiviral regimens are safe and highly effective for treating HCV-infected patients on hemodialysis.[24] Thus, screening and identification of HCV in hemodialysis patients with consideration for treatment could further decrease the risk of transmission within dialysis units.

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