Environmental Aspects of Infection Control in the Dialysis Clinic

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CMS CFC for ESRD Facilities

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- 16 Conditions
  - Water Treatment
  - Care at Home
  - Quality Assessment and Process Improvement
  - Infection Control
    - Subpart B: Patient Safety Condition 494.30
    - 1 tag to 29 V tags

V112 Comprehensive Infection Control Program

- Infection control practices for hemodialysis units
  - Infection control precautions specifically designed to prevent transmission of bloodborne viruses and pathogenic bacteria among patients.
  - Routine serologic testing for hepatitis B virus infections
  - Vaccination of susceptible patients against hepatitis B
  - Isolation of patients who test positive for hepatitis B surface antigen.

Comprehensive Infection Control Program Continued

- Surveillance for infections and other adverse events.
- Infection control training and education

Dialysis Patient

- Infection second-leading cause of death among dialysis patients.
- Each stick offers an ingress
- Vascular access equipment provides a point of entry
- Weakened and immunocompromised state.
V115

• Staff members should wear gowns, face shields, eye wear, or masks to protect themselves and prevent soiling of clothing when performing procedures during which spurting or spattering of blood might occur. Staff members should not eat, drink, or smoke in the dialysis treatment area or in the laboratory.
  – The protective garment should fully cover the arms and torso from the neck area to the thigh/knee area.
  – Aprons without sleeves are not sufficient PPE for procedures which may result in spurting or spattering of blood.

V116

• Items taken into the dialysis station should either be disposed of, dedicated for use only on a single patient, or cleaned and disinfected before being 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 BP 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. Do not carry multiple dose medication vials from station to station.

V113 Hand Hygiene

• After every contact with a patient and between patient contacts, even if the contact is casual.
• Before entering and on exiting the patient treatment areas.
• Imperative after contact with the chair-side computer and before contact with the patient, regardless of whether contact with the computer occurred through gloved or ungloved hands.

V113 Hand Hygiene

• 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.
• Gloves must be provided to patients and visitors if these individuals assist with procedures which risk exposure to blood or body fluids...
• In addition, a new pair of clean gloves must be used each time of access site care, vascular access cannulation, administration of parenteral medication or to perform invasive procedure.

Infection Control Precautions for All Patients

Sources for Bloodborne Virus Infections in Hemodialysis Patients

• Internal to the dialysis unit
  – Patient-equipment-patient (HBV contamination on devices, tubing, supplies, surfaces)
  – Patient-equipment-staff-patient (HBV contaminated surfaces touched by staff and transmitted with contaminated gloves or hands)
  – Patient-staff-patient (direct contamination of staff members’ hands/gloves with blood)

Environmental Reservoirs in the Hemodialysis Setting

• Water
• Dialysate
• Surfaces (high touched surfaces, medical devices or instruments)
• Intrinsically contaminated products (eg, antimicrobial soaps, mouth wash, saline, povidone iodine, antiseptic wipes, etc)
• Extrinsically contaminated products (Saline, brushes, refillable soap containers, Erythropoietin, etc)
• Do not use common medication carts to deliver medications to patients.
• If trays are used to deliver medications to individual patients, they must be cleaned between patients.

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If a common supply cart is used to store clean supplies in the patient treatment area, this cart should remain in a designated area at a sufficient distance from patient stations to avoid contamination with blood. Such carts should not be moved between stations to distribute supplies.

Blood Contaminating a Pressure Transducer Filter

Cleaning and disinfection
• Without visible blood – low level disinfection
  – Low level: disinfection that kills most bacteria with general purpose disinfectants.
• For visible blood – intermediate-level disinfection
  – Intermediate-level: disinfection that kills bacteria and most viruses with tuberculocidal “hospital disinfectant” or a 1:100 dilution of bleach (300-600 mg/L free chlorine).
<table>
<thead>
<tr>
<th>Item or Surface</th>
<th>Low-level Disinfection</th>
<th>Intermediate-level Disinfection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross blood spills or items contaminated with visible blood</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Hemodialyzer port caps</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Interior pathways of dialysis machine</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Water treatment and distribution systems</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Scissors, hemostats, clamps, blood pressure cuffs, stethoscopes</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Environmental surfaces, including exterior surfaces of dialysis machines</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

*Careful mechanical cleaning to remove visible organic material must occur before disinfection.
†Water treatment and distribution systems of dialysis fluid concentrates require more extensive disinfection if significant biofilm is present within the system.
§If item is visibly contaminated with blood, use a tuberculocidal disinfectant.

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**V128 Isolation of HBV+ Patients**

- **Separate isolation room**
  - February 9, 2009 all new facilities must have a separate isolation room (waiver)...
  - Separate isolation area
  - If there are current HBV+ patients on census, the isolation area/room can not be used for HBV+ patients on other shifts or days due to the risk of cross-contamination.

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**V130**

- Separate dedicated supplies and equipment, including blood glucose monitors.
  - Labeled “isolation”
  - Concentrate containers

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**Hep B PPE V115**

- Separate PPE (gown, face shields, etc) in the isolation room/area
- Family member or visitor PPE.

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**V131**

- Staff members caring for HBsAg positive patients should not care for HBV susceptible patients at the same time, including during the period when dialysis is terminated on one patient and initiated on another (e.g., during the same shift or during patient change-over).
  - If a staff member assigned to care for an HBV+ patient must concurrently care for someone other than another HBV+ patient, the additional patient must be HBV immune
Intensive efforts must be made to educate new staff members and reeducate existing staff members regarding these practices.
- OSHA mandates dialysis staff receive bloodborne pathogen training annually and CDC recommends infection control training initially on employment and annually...
- Personnel records must reflect staff having received appropriate infection control training.

Patients Who Might Be At Increased Risk For Transmitting Pathogenic Bacteria
- Uncontained wound drainage, fecal incontinence or diarrhea uncontrolled with personal hygiene measures.
  - a) staff members treating the patient should wear a separate gown over their usual clothing and remove the gown when finished caring for the patient and
  - b) dialyze the patient at a station with as few adjacent stations as possible (e.g., at the end or corner of the unit).

CDC Infection Control Guidelines and Recommendations
- Guideline for Environmental Infection Control in Health-Care Facilities, 2003
  http://www.cdc.gov/ncidod/hip/enviro/guide.htm
- Hand Hygiene in Healthcare Settings
  http://www.cdc.gov/handhygiene/
- Preventing Transmission of Infections Among Chronic Hemodialysis Patients
- Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2002
  http://www.cdc.gov/ncidod/hip/IV/Iv.htm
- Guidelines for Vaccinating Kidney Dialysis Patients and Patients with Chronic Kidney Disease, 2006

Published Recommendations
- CDC. Recommendations for preventing transmission of infections among chronic hemodialysis patients. *MMWR* 2001; 50(RR05):1-43
  - http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5005a1.htm

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Bacteria (CFU/ml)</th>
<th>Endotoxin (EU/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water used for dialysate, reprocessing of hemodialyzers, germicide production</td>
<td>200 / 50 action level</td>
<td>2 / 1 action level</td>
</tr>
<tr>
<td>Dialysate</td>
<td>200 / 50 action level</td>
<td>2 / 1 action level</td>
</tr>
<tr>
<td>Minimum Frequency</td>
<td>Monthly</td>
<td>Monthly</td>
</tr>
</tbody>
</table>
Bacteria Commonly Found in Water for Dialysis

- Primarily gram negative bacilli:
  - Pseudomonas aeruginosa, Burkholderia cepacia complex, Ralstonia pickettii, Stenotrophomonas maltophilia, Methyllobacterium mesophilicum, M. extorquens, Caprividae consamona
  - Enterobacter cloacae, Klebsiella pneumoniae
- Occasionally mycobacteria:
  - Mycobacterium abscessus, M. chelonae, M. fortuitum, M. mucogenicum
- Other organisms: Corynebacterium aquaticum, Oeskovia spp, Bacillus spp.

Bacteriology of water

- V178 IG: the final decision of whether to discontinue dialysis rests with the medical director of a facility.
- V179 IG: “Promptly” would be met if action is taken within 48 hours of receiving the results of testing.

Findings from Common Source Exposure Outbreak

- Machine surfaces that were not routinely cleaned and disinfected between patients
- Blood spills that were not cleaned up promptly
- Multiple opportunities for cross-contamination
- Supply carts were moved from one station to another and contained both clean supplies and blood-contaminated items, including small biohazard containers, sharps disposal boxes, and used vacutainers containing patients’ blood

Areas of Dialysis Where Biofilms Develop

- Water Treatment Systems
  - RO Membranes
  - Distribution System
  - Dialysis machines
  - Storage tanks
- Patients
  - Indwelling Catheters
  - PD - IV Catheters

Disinfection Frequency

- Distribution/Loop System
  - Central systems at least once a month
  - Disinfect water inlet line to hemodialysis machines
- Dialysis Machines
  - daily
- Bicarbonate mixing systems
  - daily rinse
  - Weekly disinfect
- Individual bicarbonate concentrate containers
  - should rinsed and inverted to drain at end of each day
  - disinfected weekly
HCV Transmission at an Outpatient Hemodialysis Unit

Inadequate cleaning and disinfection practices were observed during site visits in July and August 2008. A single bleach-soaked gauze pad was used to clean a patient's entire dialysis station, including dialysis machine surfaces and ancillary patient equipment (e.g., blood pressure cuff and shared computer monitor and keyboard). The bleach solution was prepared and stored improperly, and staff members did not allow sufficient contact time between surfaces and bleach. Visible blood remained on dialysis chairs, dialysis machine surfaces, and the surrounding floor between patient treatments. Moreover, direct care staff members failed to don gloves with every patient encounter, change gloves between patients, or perform hand hygiene after contact with patients and soiled surfaces. Supervisory staff members failed to address these breaches. Many of the direct care staff members were unaware of the hemodialysis unit's written infection control policies, including those pertaining to cleaning and disinfection. Investigators also noted the lack of a separate clean area for medication storage and preparation and short turnover periods between patient treatments.

Most Common Route of Spread

- **Bacteria**
- **Worker's Hands**
- **Infected or colonized Patients**
- **Becomes colonized**