Prevention of Infections in Hemodialysis Facilities

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I have no relevant financial relationships to disclose

Objectives

1. Review the problem – CLABSI in HD Facilities
2. Review key strategies to optimize infection prevention and control in hemodialysis settings including:
   - A success story from New Jersey 2012
   - Environmental Cleaning and Disinfection
   - Equipment Cleaning and Disinfection
   - Hand Hygiene
   - Patient Immunizations and TB Screening
   - Medication Safety and Injection Practices
   - Standard Precautions and Isolation
   - Vascular Access
   - Water Treatment and Testing
   - Unresolved issues
Disclosure

Thanks to Danilo B. Concepcion CCHT, CHT Operations Manager, Renal Services St Joseph Hospital Orange Country CA for slide content used in this presentation

The Problem: CLABSI In HD Facilities

37,000 in 2008

One Success Story


- A New Jersey HD facility reduced bloodstream infection rate from 2.04 to 0.75/100 patient months

- Improvements made:
  1. Joined CDC Hemodialysis BSI Prevention Collaborative and positive deviance training Observation of catheter/access care
  2. Use of CHG for skin antisepsis
  3. Auditing HH compliance
  4. Pt education/engagement
  5. Catheter reduction program
  6. Staff education/competency testing
Sources of Published HBV Outbreaks in HD Facilities

- Cross-contamination of environmental surfaces, supplies, medications, or equipment.
- Simultaneous provision of care to both HBV (Hepatitis B) infected and susceptible patients by the same staff members.
- Multiple dose medication vials.
Prevention of Infection Transmission via Equipment

Environmental Cleaning and Disinfection

Outpatient HD Environment
Prevention of Infection Transmission via Environment

Fluorescing solution – cleanliness assessment

From Dr. Philip Carling and Ecolab

ATP – pathogen assessment
TABLE 1: Doses and schedule of licensed hepatitis B vaccines for hemodialysis patients and staff members

<table>
<thead>
<tr>
<th>Group</th>
<th>Vaccine Dose</th>
<th>Volume</th>
<th>Schedule</th>
<th>Vaccine Dose</th>
<th>Volume</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients aged ≥18 yrs</td>
<td>Prevnar®</td>
<td>10 µg</td>
<td>0.5 mL</td>
<td>10 µg</td>
<td>0.5 mL</td>
<td>0.5 mL</td>
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<tr>
<td></td>
<td>1.0 mL</td>
<td>0.5 mL</td>
<td>0.5 mL</td>
<td>1.0 mL</td>
<td>0.5 mL</td>
<td>0.5 mL</td>
</tr>
<tr>
<td>Diabetic or insulin-re</td>
<td>5 µg</td>
<td>1.0 mL</td>
<td>0.5 mL</td>
<td>5 µg</td>
<td>1.0 mL</td>
<td>0.5 mL</td>
</tr>
<tr>
<td>dependent</td>
<td></td>
<td>1.0 mL</td>
<td>0.5 mL</td>
<td></td>
<td>1.0 mL</td>
<td>0.5 mL</td>
</tr>
<tr>
<td>HCV-infected patients</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff members</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Medication Safety and Injection Practices

The Risk: Injectable Medications

- > 35 outbreaks have occurred in the last 10 years involving transmission of HBV or HCV in > 500 patients
- Causes include: syringe reuse b/w patients during medication administration, contamination of medication vials or IV bags, gaps in basic injection practices including scrub the hub.
Key Concepts: Medication Safety

- Scrub the hub before access of IV lines
- Don’t re-use syringes, tubing, IV bags
- 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.**

Standard Precautions and Isolation

"Let me guess...it's contagious!"

Key Concepts: Standard precautions

- Standard Precaution PLUS disposable gloves when touching a patient or touching the patient’s equipment in HD facilities.
- Remove gloves and clean 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 being taken to a common clean area or used on another patient.
- No shared med or supply carts.
HBV Isolation for HD Facilities

- 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).

Additional considerations

- Increased risk with uncontained wound drainage, fecal incontinence or diarrhea uncontrolled with personal hygiene measures.
- Staff should wear a separate gown over their usual clothing and remove the gown when finished caring for the patient.
- These patients should be dialyzed at a station with as few adjacent stations as possible (e.g. at the end or corner of the unit).
- If treating patients with active TB separate isolation area should be used or patient sent to hospital for treatment.

Vascular Access
The Problem: CLABSI
- Second leading cause of death (after cardiovascular disease)
- CLABSI can result in:
  - Septic shock
  - Endocarditis
  - Septic arthritis
  - Osteomyelitis
  - Epidural abscess
- Exposes patients to multiple antibiotics and at risk for antibiotic resistance

The Risk: HD Catheters
- Indwelling catheters are the single most important factor contributing to bloodstream infection in hemodialysis patients.
- Use catheters only when essential
- Remove catheters when they are no longer essential
- Maximize use of fistulas and grafts

Key Concepts: Vascular Access
- Change the catheter exit-site dressing at each HD treatment, using either a transparent dressing or gauze and tape.
- Chloraprep preferred
- Using aseptic technique to prevent contamination of the catheter or port catheter system, including the use of a surgical mask for staff and patient and clean gloves for all catheter or port catheter system connect, disconnect, and dressing procedures.
**Buttonhole (a.k.a. Constant Site)**

Infection can occur if:
- Improper skin cleansing
- Improper scab removal
- Contaminated needle
- Improper cannulation of the track

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**Water Treatment and Testing**

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**Bacteria In Water and Dialysate**

<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 dialyzer, 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 of testing</td>
<td>Monthly</td>
<td>monthly</td>
</tr>
</tbody>
</table>

**Bacteria Testing and Reporting**

- Should be performed at minimum once a month for established systems, and after any modification
- Collect samples as part of patient work up for bacteremia or pyrogenic reaction
- Do not accept “positive” or “negative” as a result – request a full count of every viable colony
- Watch for results that consistently have zeroes (e.g. 200 cfu, etc.) – this may indicate the lab is using a calibrated loop
- Be suspicious of many “no growth” results
- Trend results over time to identify issues

**Pyrogenic (Endotoxin) Reaction**

- Endotoxin is a by-product of water-borne gram negative bacteria
- Reaction occurs 1 hour to half-way into the treatment
- Severity of reaction is directly proportional to amount of endotoxin exposure
- Symptoms: uncontrollable shaking, chills, temperature, nausea and vomiting, myalgia, hypotension
Root Cause Analysis – Bacteria in Water/Dialysate

- Improper water treatment system design
  - Loop
  - Holding tanks
  - UV/Ultrafilters
- Improper maintenance of water treatment system and delivery system (dialysis machine)
  - Disinfection schedule
  - Improper disinfectant
  - Stagnation or non-use of equipment

Unresolved Issues

- Improper disinfectant significantly greater, with more than 20%

Unresolved Issues: MRSA AST/Decolonization

- *S. aureus* bacteremia in the HD patient has severe consequences, with an in-hospital mortality rate of 13.5%, compared to 3.8% for bacteremia due to other organisms. 3
- Hospital stay and therefore cost is also significantly greater, with more than 20% of patients developing major complications such as endocarditis and osteomyelitis.
Unresolved Issues: Antibiotic locks

- There are 2 major routes of infection reaching the bloodstream: extraluminal via the catheter tunnel and intraluminal resulting from hub contamination during the HD process.
- 3 recent meta-analyses have examined the efficacy of antimicrobial locks in preventing bacteremia in patients utilizing CVCs for HD. All come to similar conclusions: antimicrobial locks are very effective in reducing the rate of CRBSI, but longer studies are needed to determine whether antimicrobial resistance will result.

Unresolved Issues: HeRO Graft/Catheter

- In 2009, a new type of VAD was introduced to the dialysis community, termed HeRO. It was developed to provide an alternative for patients who have exhausted the usual permanent access sites in the extremities, and do not want to have an external catheter. This device consists of two main sections, and is part catheter and part AVG.
- Only time will tell if there are lower infection rates for this device when compared to catheters, AVGs, and AVFs.

Unresolved Issues: Skin antisepsis with bleach

- In 2002, bleach–based skin antiseptic solution in a 1100 ppm 10% electrolytic chloroxidizing formulation was brought to market. Bleach is well known for its antibacterial properties and is used extensively as an environmental disinfectant.
- The lack of evidence supporting product efficacy in addition to reports of respiratory irritation associated with bleach use argues against the use of bleach for skin antisepsis in HD settings at this time.
Key Resources


- 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](http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5005a1.htm)