ONLINE HEMODIALYSIS TRAINING

SESSION 3
Infection Control

Hemodialysis Infection Control Precautions

The U.S. Centers for Disease Control (CDC) recommended ways to prevent bloodborne infections in hemodialysis patients in 2001. These guidelines are more strict than the Standard Precautions often used in hospitals. They include hand washing between patient contact, before and after invasive procedures (like cannulation), before touching a wound (including needle site) or any body substance or mucous membrane, after taking off gloves, between tasks and procedures on the same patient, and when entering or leaving the center. Hand washing should be done for at least 15 seconds, covering all surfaces of the hands and fingers. Protective equipment is to be used for staff protection and to keep clothes clean. Precautions must also be taken to avoid needle stick injuries.

Universal Precautions," as defined by CDC, are a set of precautions designed to prevent transmission of human immunodeficiency virus (HIV), hepatitis B virus (HBV), and other bloodborne pathogens when providing first aid or health care. Under universal precautions, blood and certain body fluids of all patients are considered potentially infectious for HIV, HBV and other bloodborne pathogens.

Universal Precautions is necessary for ALL patients.
If there is a risk of being splashed, sprayed, or splattered with blood or other body fluids you should wear …

Pre- personal protective equipment
1. Gloves
2. Face shield/mask/protective eyewear
3. Gowns

The single most important procedure for preventing the spread of disease and antimicrobial resistant organisms (MRSA & VRE) is HAND WASHING (15 seconds).

Contact Transmission plays a major role in transmission of pathogens
- Prompt Hand Washing
- Designate clean and dirty area
- Eliminate medication carts
- Cleaning and disinfecting multi-use items when taken into a dialysis station
- Disinfect reusable items
- - No eating or drinking in dialysis areas by staff
- - Clean up blood spills promptly (according to written policy/procedure)

CLEANING AND DISINFECTION should be followed according to written policy/procedure
Water Treatment

As you have learned earlier in this course
we use dialysate to help remove wastes from patient’s blood.

NOTE: Dialysate consists of:

- **Acid** – An acid is a substance with a PH below 7.0 that is capable of donating a hydrogen ion (H+). In the human body, acids are created when protein and other substances are broken down by cell metabolism.

- **Bicarbonate** – Bicarbonate is a buffer used by the body to neutralize acids that form when the body breaks down protein and other foods. It is absorbed by healthy kidneys. Dialysis patients often have low levels of bicarbonate because their kidneys do not absorb enough. Thus, they can’t neutralize acids well. Bicarbonate is used in dialysate to help restore levels of bicarbonate in the body. Bicarbonate dialysate has two main disadvantages. It supports bacterial growth and it requires two concentrates (acid and bicarbonate) to prevent formation of scale (calcium carbonate or magnesium) that can interfere with the equipment operation.

- **Purified water** – Treated water


**Water Treatment**

Water has contaminants (harmful substances) which may enter the blood through the dialyzer and cause disease, injury, or even death to a patient.

Tap water is treated with chloramines, a mix of chlorine and ammonia, is often used to kill bacteria. Fluoride is used to prevent tooth decay and Alum, an aluminum, which removes solid particles from the water. All these substances added are to help prevent disease. Unfortunately, tap water has too many contaminants to be used for dialysis. Many of the substances used to make water safe to drink are harmful to people on dialysis.

**The purpose of water treatment is to prevent harm to the patient and to water equipment.**

The water treatment systems has a series of components in which water is purified. Water for dialysis has to meet standards set by Association for the Advancement of Medical Instrumentation (AAMI). AAMI has standards for bacteria, endotoxins (toxins on the membranes of certain bacteria), metals, salts, trace elements, and other substances.
Water Treatment (RO)

1. **Blending Valve**
   Stabilizes R.O. product water flow rate by mixing Hot & Cold water to a constant water temperature

2. **Depth Filter, Also Known As, Sediment Filter**
   Protects downstream components from plugging/fouling by filtering out particles that may be in the tap water supply.

3. **Water Softener**
   Protects R.O. membrane by removing Calcium & Magnesium “Hardness” Ions adding Sodium Ions in their place.

4. **Primary Carbon Filter**
   Protects patients and R.O. membrane by removing Chlorine & Chloramine (Prevents Hemolysis)

5. **Secondary Carbon Filter**
   Backup to primary carbon filter to protect patients and R.O. membrane by removing Chlorine & Chloramine

6. **Reverse Osmosis (R.O.) Pre-Filter**
   Protects R.O. from plugging/fouling by filtering out particles that may be in the R.O feed water

7. **Reverse Osmosis (R.O.)**
   Primary water purification device used to remove organic & inorganic contaminants

8. **Purified Water Storage Tank**
   Used in water treatment systems to store purified water for distribution to the machines in the unit

9. **Ultrafilter**
   Sub-micron device used to filter Endotoxins and Bacteria in the purified water
Testing Water For Patient Safety In Hemodialysis

Chlorine and Chloramines testing must be done BEFORE each shift or every 4 hours.

Total Chlorine – Free Chlorine = Chloramines
Total Chlorine: Maximum level allowed in dialysis is ≤0.1mg/L.
Free Chlorine refers to bleach and is commonly added to water systems for disinfection and bacterial control. The maximum allowable level is 0.5mg/L.
Total Chlorine Testing

Test directly after 1\textsuperscript{st} CARBON TANK.

If the result is negative $< 0.1 \text{mg/L}$ document results O.K. TO DIALYZE

If the result is positive $\geq 0.1 \text{mg/L}$ test it again

If the result is positive $\geq 0.1 \text{mg/L}$ immediately test after the 2\textsuperscript{nd} CARBON TANK (back up tank)

If the result is negative $\leq 0.1 \text{mg/L}$ document results in the Total Chlorine Log and continue testing every 30 minutes. OK TO DIALYZE. CONTACT MEDICAL DIRECTOR, FACILITY ADMINISTRATOR AND BIOMEDICAL.

If the result is positive $\geq 0.1 \text{mg/L}$ DISCONTINUE DIALYSIS IMMEDIATELY! CONTACT MEDICAL DIRECTOR, FACILITY ADMINISTRATOR AND BIOMEDICAL.

Chlorine can cause HEMOLYSIS (breakdown of red blood cells)
What to look for: BRIGHT RED COLORED BLOOD
Testing Water For Patient Safety In Hemodialysis

AAMI recommends testing components of water treatment system for bacteria and endotoxin at least **once a month**. Contamination of water by microorganisms is a serious health concern for patients on dialysis.

**Microorganism**
A very small organism usually visible only with a microscope.
Example: Bacteria, Viruses, Fungi, Endotoxin

**Bacteria**
Bacteria are microscopic, single-celled organism that can cause disease. Bacteria are classified as Gram-positive or Gram-negative by the color they turn on a standard laboratory test called a Gram’s stain.

**Endotoxins**
Is a toxic part of the cell walls of some bacteria. Living bacteria can shed endotoxins and released when bacteria die. Endotoxin is not alive; disinfectants can’t kill it. If endotoxin enters a patient’s body, it can cause a pyrogenic (fever) reaction. Endotoxin is a concern in water treatment and dialyzer reprocessing. It is controlled by reducing the number of bacteria in the water or removing it with an ultrafilter.

**Pyrogen**
A pyrogen is a fever producing substance, such as endotoxin.
Presence of Endotoxin causes a Pyrogenic reaction

Signs and Symptoms
- Fever and Chills
- Hypotension
- Vomiting
- Muscle Pain

Presence of Bacteria causes Septicemia

Signs and Symptoms
- Fever and Chills
- Nausea
- Diarrhea
- Headache
- Decreased Consciousness

NOTE: Multiple patients experiencing fever and chills is an indication of a microorganism contamination.
Microbiological Testing

**Bacteria**

- Water used for Dialysate = <200 CFU (Colony Forming Units)/ml
- Dialysate = <200 CFU (Colony Forming Units)/ml
- Bicarbonate = <200 CFU (Colony Forming Units)/ml

**Endotoxin**

- Water used for Dialysate = <2 EU (Endotoxin Units)/ml
- Dialysate = <2 EU (Endotoxin Units)/ml
- Bicarbonate = <2 EU (Endotoxin Units)/ml