Infection Prevention in Dialysis Centers

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Outline:

- Risk of Infection in hemodialysis unit (HD).
- Water treatment system.
- Blood-borne viruses & its control.
- General infection control measures in HD unit.

Introduction

- 3 major forms of renal replacement therapy: -
  - Hemodialysis (HD).
  - Peritoneal dialysis (PD).
  - kidney transplantation .
- Maintenance hemodialysis patients comprise the majority of this population.

Why HD patient is at risk of infection?

- Compromised immune system (cellular, neutrophil function, complement activation) .
- Comorbidities that lead to frequent hospitalization & surgeries.
- Chronic HD patients have enhanced cytokine response compared to non-hemodialysis patients, which may account for the high rate of fatal sepsis in uremic patients.

Why HD patient is at risk of infection?

In HD unit environment:

Multiple patients typically receive dialysis concurrently, and there are repeated opportunities for person-to person transmission of infectious agents, directly or indirectly via contaminated devices, equipment and supplies (including medications), environmental surfaces, or the hands of healthcare personnel when recommended infection control practices are not followed.

Why HD patient is at risk of infection?

- The high potential for blood contamination & the need for routine aseptic access of the patient's vascular system makes the HD unit unique & more similar to a surgical suite than to a standard hospital room.

Microbial Contaminants in HD Systems

- Gram-negative water bacteria are capable of multiplying rapidly in all types of waters, even those containing relatively small amounts of organic matter, such as water treated by distillation, softening, deionization, or reverse osmosis.
- These organisms can attain levels ranging from 10^5 to 10^7 colony forming units (CFU) mL^{-1} of water without turbidity, which can directly or indirectly cause septicemia or endotoxemia .

Microbial Contaminants in HD Systems

- Nontuberculous or environment mycobacteria also can multiply in water.
- Although they do not contain bacterial endotoxin, they are comparatively resistant to chemical germicides and, have been responsible for patient infections due to inadequate disinfection.

Microbial Contaminants in HD Systems

- ***Gram negative Bacteria:***

- Serratia Spp.
- Stenotrophomonas Spp.
- Sphingomonas Spp.
- Ralastonia Spp.
- Burkholderia Spp.
- Flavobacterium Spp.
- **Environmental Mycobacteria**

Microbial Contaminants in HD Systems

- There is increasing evidence that the microbial quality of HD fluids plays a role in the chronic inflammatory response syndrome impacting anemia management, serum albumin level, and rate of loss of residual renal function.

Microbial Contaminants in HD Systems

- Hemodialysis systems :

- Water supply.
- Water treatment system.
- Water / dialysate distribution system.
- Dialysis Machines.
- Method of disinfection.

Water Supply

- Surface, ground, or blends of surface and ground waters. The source of the water may be important in terms of chemical, bacterial, and endotoxin content.
- Surface waters frequently contain endotoxin from gram-negative water bacteria and from certain types of blue-green algae(Cyanobacteria).
- Endotoxin levels are not substantially reduced by conventional municipal water treatment processes and can be high enough to cause pyrogenic reactions in patients undergoing dialysis

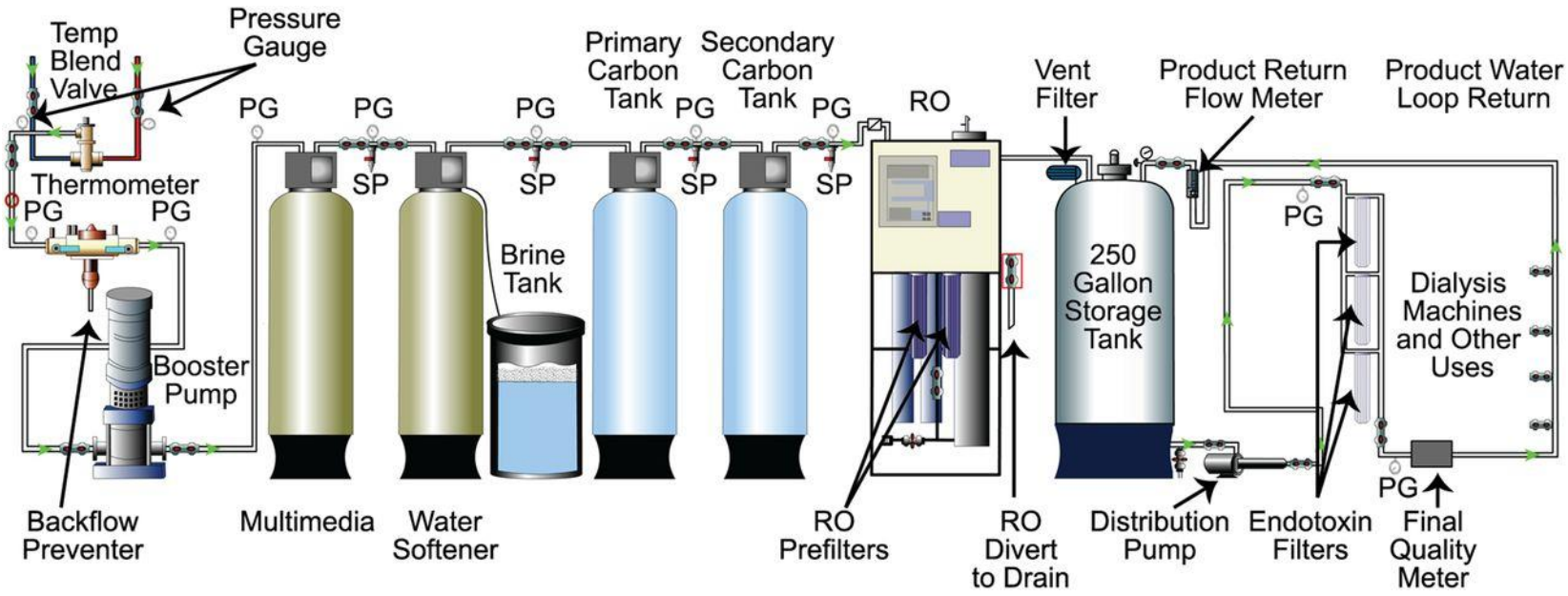
Water Treatment System

- Water systems are divided into three types of components based on function: pretreatment, treatment, and polishing.
- Some pretreatment components may vary based on the area and local water quality.
- Pretreatment serves several purposes, the most important is protecting the downstream treatment components.

Water Treatment System

- Water treatment systems consists of water softener, carbon filters, particulate filters, reverse osmosis and/or deionizer and filters and ultrafilters, with or without ultraviolet (UV) light.

The water treatment system.



Ted Kasparek, and Oscar E. Rodriguez CJASN 2015;10:1061-1071


GAMBRO


WATER TREATMENT SYSTEM AND RO DISINFECTION
RO DISINFECTION
OPERATION MODE
BAMBINI WATER TREATMENT SYSTEM - CHRYSI
MODE
VALVE
REJECT RECIRC
REJECT TO DRAIN
PURE WATER TO LOOP
PURE WATER TO DRAIN
OPERATION
CLOSE
OPEN
OPEN
CLOSE
DISINFECTION
OPEN
CLOSE
CLOSE
CLOSE
RINSE
CLOSE
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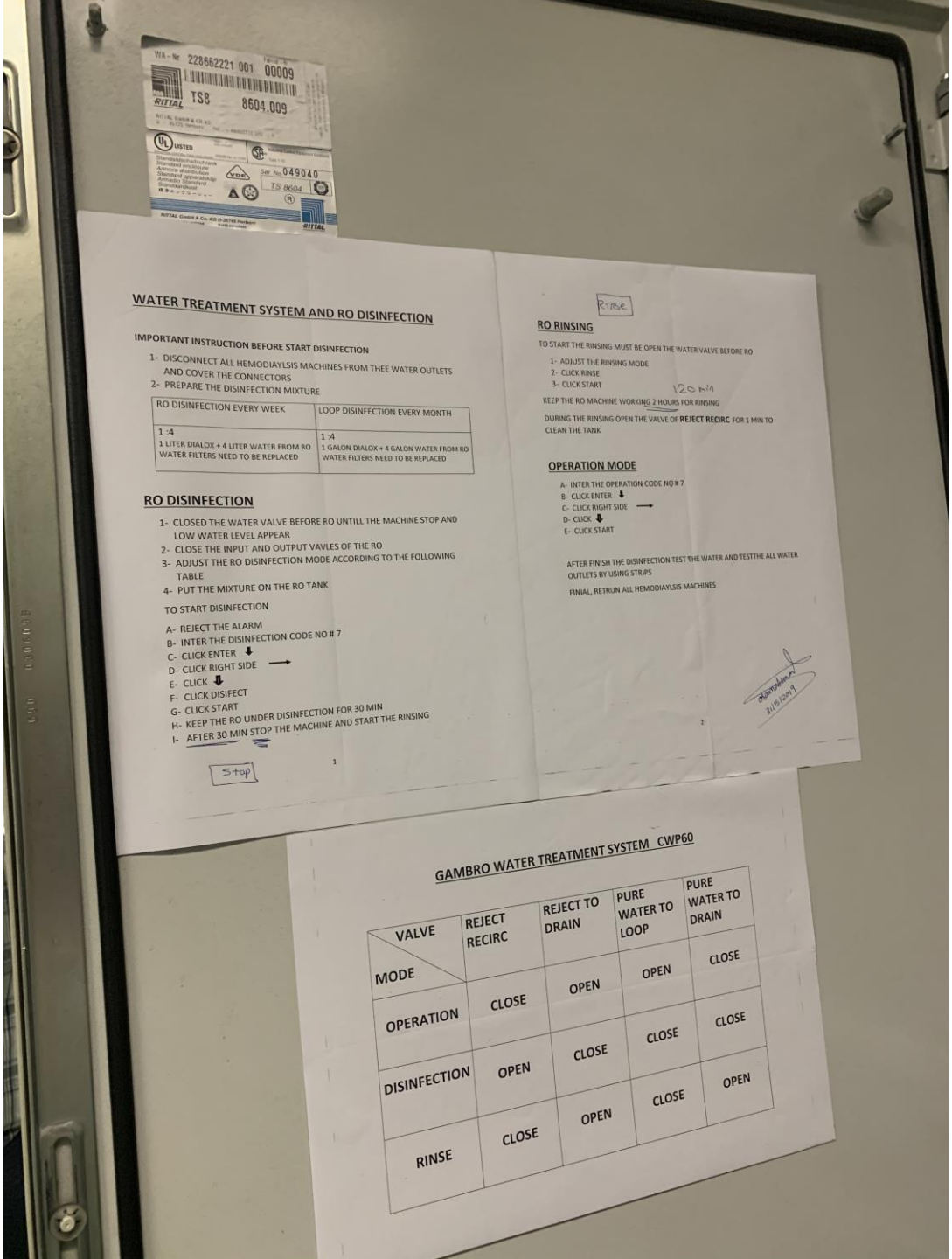
CLOSE
OPEN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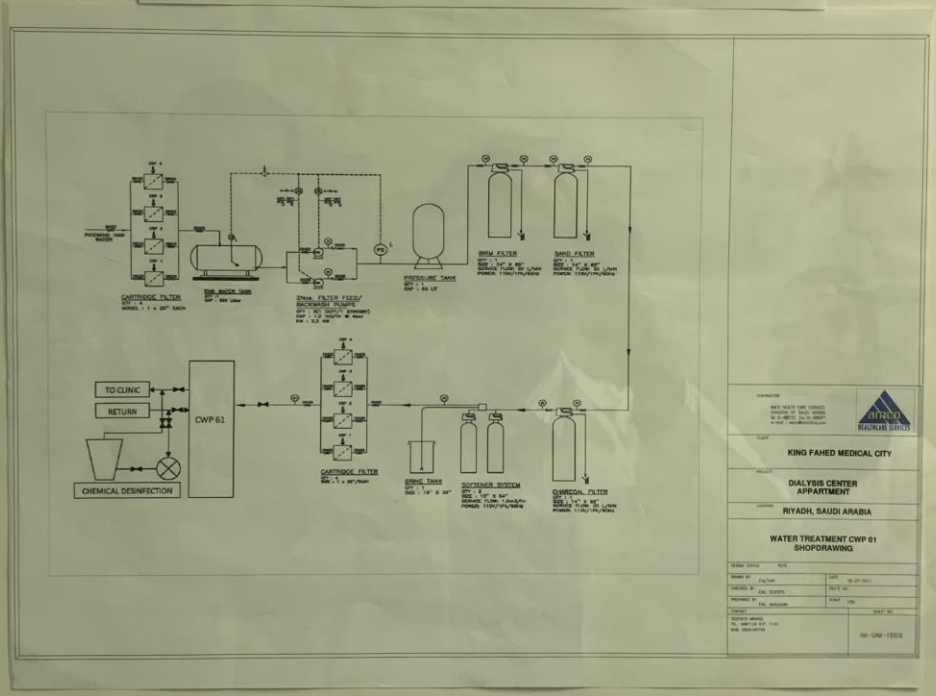
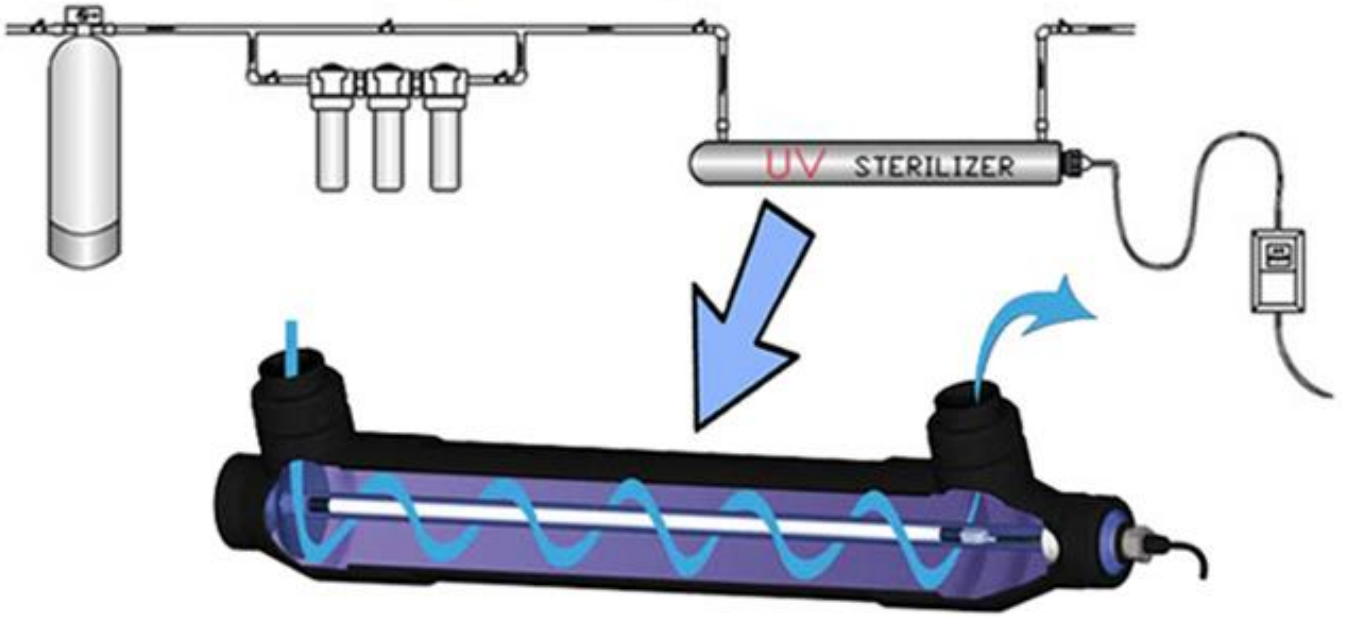
WATER TREATMENT SYSTEM AND RO DISINFECTION
IMPORTANT INSTRUCTION BEFORE START DISINFECTION
1- DISCONNECT ALL HEMODIAYLSIS MACHINES FROM THEE WATER OUTLETS AND COVER THE CONNECTORS
2- PREPARE THE DISINFECTION MIXTURE
RO DISINFECTION EVERY WEEK
LOOP DISINFECTION EVERY MONTH
1 :4
1 LITER DIALOX + 4 LITER WATER FROM RO WATER FILTERS NEED TO BE REPLACED
1 :4
1 GALON DIALOX + 4 GALON WATER FROM RO WATER FILTERS NEED TO BE REPLACED
RO DISINFECTION
1- CLOSED THE WATER VALVE BEFORE RO UNTILL THE MACHINE STOP AND LOW WATER LEVEL APPEAR
2- CLOSE THE INPUT AND OUTPUT VAVLES OF THE RO
3- ADJUST THE RO DISINFECTION MODE ACCORDING TO THE FOLLOWING TABLE
4- PUT THE MIXTURE ON THE RO TANK
TO START DISINFECTION
A- REJECT THE ALARM
B- INTER THE DISINFECTION CODE NO # 7
C- CLICK ENTER
D- CLICK RIGHT SIDE
E- CLICK
F- CLICK DISIFECT
G- CLICK START
H- KEEP THE RO UNDER DISINFECTION FOR 30 MIN
I- AFTER 30 MIN STOP THE MACHINE AND START THE RINSING
Stop
1
Rinse
RO RINSING
TO START THE RINSING MUST BE OPEN THE WATER VALVE BEFORE RO
1- ADJUST THE RINSING MODE
2- CLICK RINSE
3- CLICK START
120 min
KEEP THE RO MACHINE WORKING 2 HOURS FOR RINSING
DURING THE RINSING OPEN THE VALVE OF REJECT RECIRC FOR 1 MIN TO CLEAN THE TANK
OPERATION MODE
A- INTER THE OPERATION CODE NO # 7
B- CLICK ENTER
C- CLICK RIGHT SIDE
D- CLICK
E- CLICK START
AFTER FINISH THE DISINFECTION TEST THE WATER AND TESTTHE ALL WATER OUTLETS BY USING STRIPS
FINIAL, RETRUN ALL HEMODIAYLSIS MACHINES
2
31/5/2019
GAMBRO WATER TREATMENT SYSTEM CWP60
VALVE / MODE
REJECT RECIRC
REJECT TO DRAIN
PURE WATER TO LOOP
PURE WATER TO DRAIN
OPERATION
CLOSE
OPEN
OPEN
CLOSE
DISINFECTION
OPEN
CLOSE
CLOSE
CLOSE
RINSE
CLOSE
OPEN
CLOSE
OPEN

HAEMO – DIALYSIS SYSTEM





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Distribution Systems

- **Can contribute to microbial contamination:**
- They sometimes use pipes that are larger in diameter and longer than necessary to handle the required fluid flow.
- This slows the fluid velocity and increases both the total fluid volume and the wetted surface area of the system.
- Bacteria in fluids remaining in pipes may multiply rapidly and colonize these wetted surfaces of the pipes.

Distribution Systems

- Usually constructed of plastic pipes because the use of metal pipes could contaminate the treated water with element such as copper, lead or zinc.
- The system should be configured as a continuous loop, with no dead ends or unused branches to the piping system, because these **stagnant areas** may serve as a source of bacterial contamination for the rest of the water system.
- The minimum numbers of elbows & T-joints should be used.

Distribution Systems

- Disinfection schedules should be designed to prevent bacterial growth rather than eliminate it when bacterial contamination over the limit is detected.

Distribution Systems

- Samples should be obtained from the first and last outlets of the water distribution loop.
- At least monthly & more frequently if problems are identified.
- Weekly testing for one month should be done when water distribution system is new or changes has been made in the existing system.
- Samples should always be taken before disinfection or sanitization of the processed water system or dialysis machines.

Hemodialysis Machines

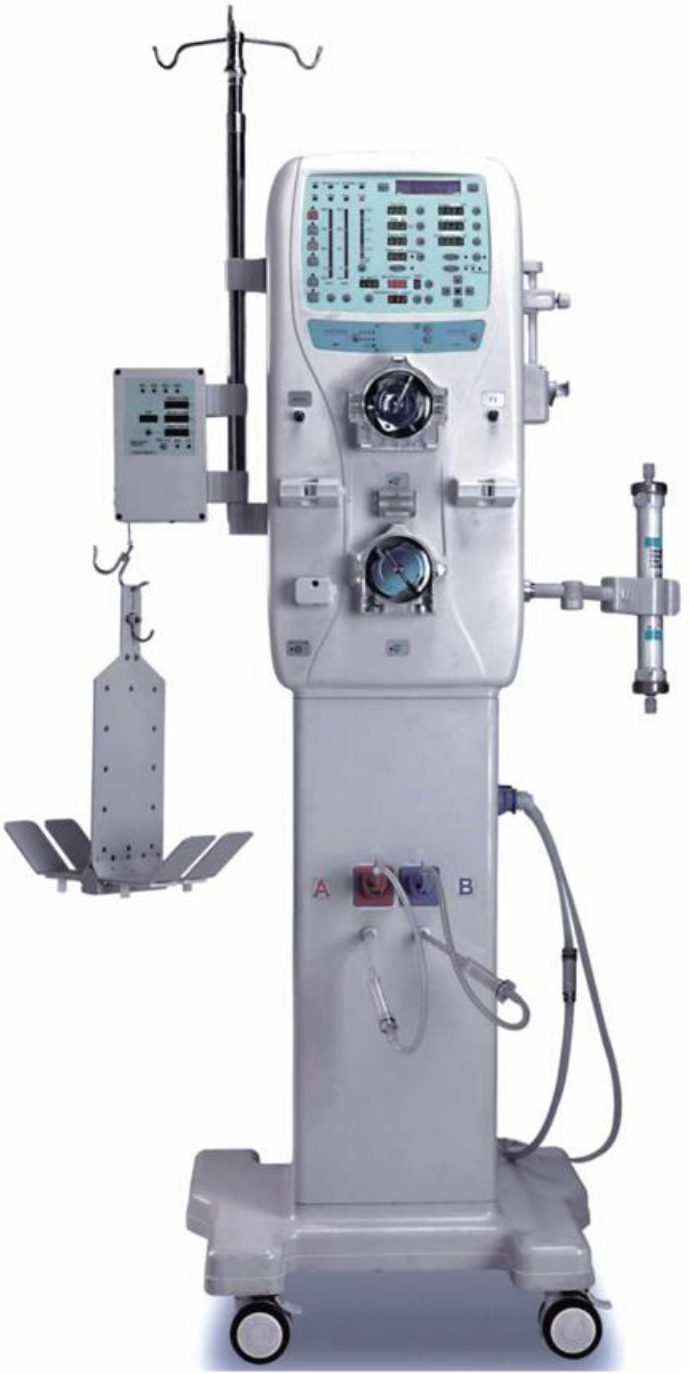
- Levels of contamination in single-pass machines depend primarily on the bacteriologic quality of the incoming water and on the method of machine disinfection .

Hemodialysis Machines

- Patient should be observed during each dialysis treatment.
- Temp. should be checked & recorded at least before and after each dialysis treatment.
- Any fever or unexplained symptoms occurring after onset of HD should be evaluated for relationship to water treatment, dialysis equipment, and dialysis and reprocessing procedures.

Dialyzers

- The hollow-fiber dialyzer (artificial kidney) usually does not contribute significantly to bacterial contamination of the dialysate.
- Improper reprocessing techniques have been associated with outbreaks of bacteremia and pyrogenic reactions in dialysis patients .


A
B

Types of Disinfectants

- hypochlorite-chlorine solutions.
- Hydrogen peroxide, ozone, heat and citric acid, and peracetic acid are not as corrosive as hypochlorite solutions and can be allowed to remain in the dialysis system for long periods when it is not operational, thereby preventing the growth of bacteria in the system.

Monitoring Water and Dialysis Fluid

- Bacteriologic assays of water and dialysis fluids should be performed at least once a month.
- Chemical analysis of water used for dialysis should be done before the system is designed and then at least seasonally (since feed water quality is not static and may change).

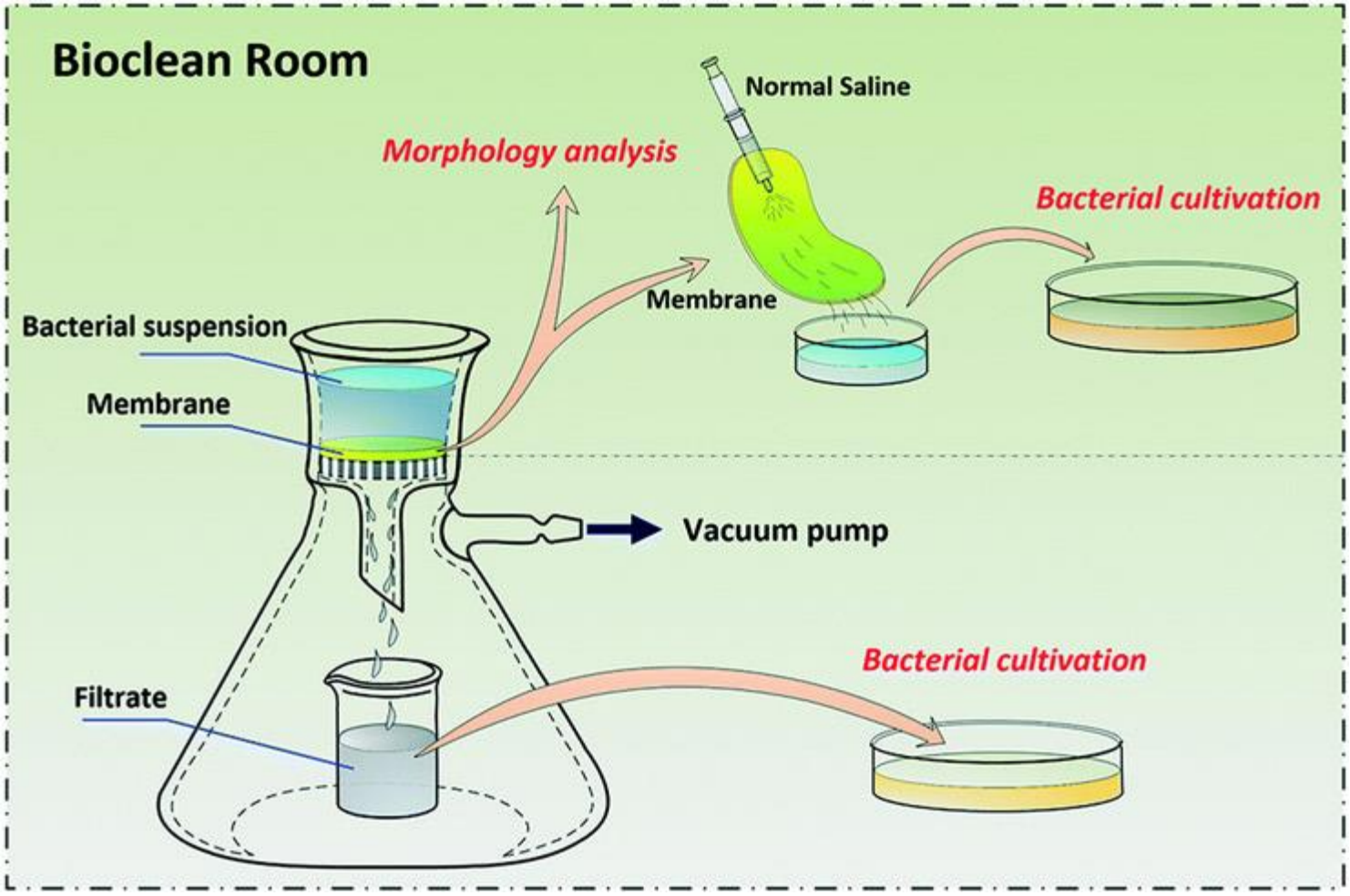
Microbial Quality of Standards for Dialysis Fluids

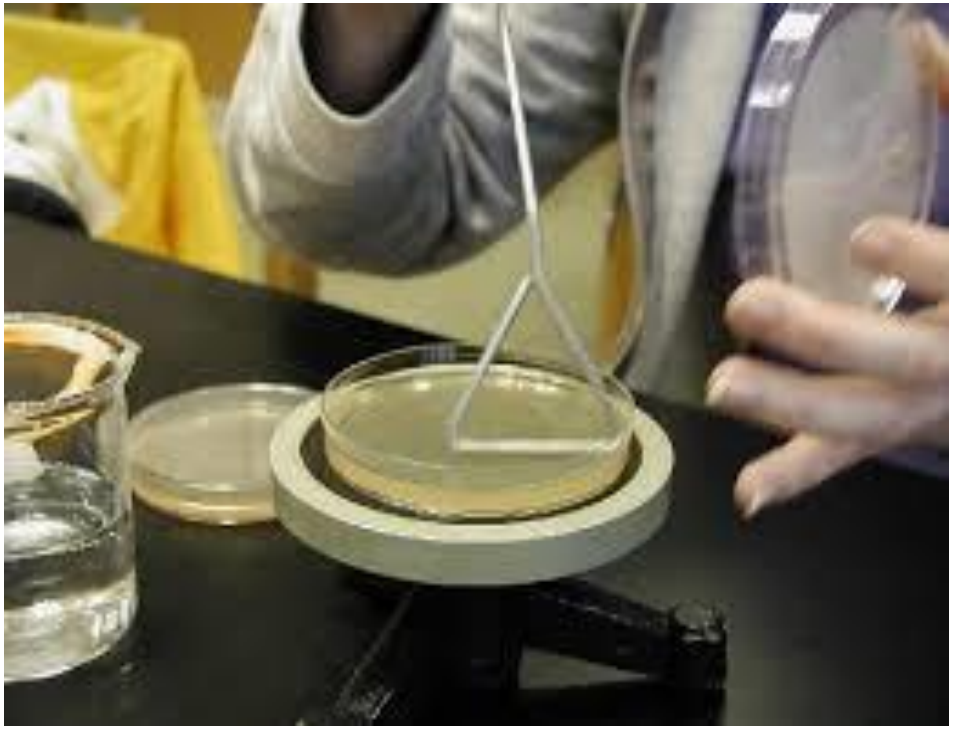
Fluid Type	Microbial Bioburden (CFU mL^{-1})		Endotoxin (EU mL^{-1})	
	Maximum Limit	*Action limit*	*Maximum limit*	*Action Level*
AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)/AAMI (48,50,51)				
Water for all purposes	200	50	2	1
Conventional dialysate	200	50	2	1
Ultrapure dialysate	0.1	—[b]	0.03	0.03
Dialysate for infusion	10^{-6}[a]	—[b]	0.03	0.03
ANSI/AAMI/ISO (47,49)				
Water for hemodialysis	100	50	0.25	0.125
Conventional dialysate	100	50	0.5	—[b]
Ultrapure dialysate	0.1	—[b]	0.03	—[b]

[a]Compliance is not demonstrated by culture but by engineering process developed by the equipment manufacturer, (e.g., serial ultrafiltration).
[b]None specified.

Microbial Quality of Standards for Dialysis Fluids

- Results should be logged so that trends and the need for corrective action can be identified.
- Total viable counts should be obtained using membrane filter technique (known volume of sample is filtered through a 0.45-µm membrane filter and then transferred to an agar plate) or spread plate.
- Samples should be plated on tryptone glucose extract agar at 17 - 23C for 7 days.
- Dialysis center should obtain preliminary results if the colony count is near or greater than 50 cfu/ml at any time during incubation period.
- Identification of organisms may be necessary to link high counts to cases of bacterimia or pyrogenic reactions but is not routinly performed unless count are repeatedly above the action limit or linked to cases.


Bioclean Room
Normal Saline
Morphology analysis
Bacterial cultivation
Membrane
Bacterial suspension
Membrane
Vacuum pump
Bacterial cultivation
Filtrate



Microbial Quality of Standards for Dialysis Fluids

- At least 2 machines should be tested each month and from enough machines that each machine is tested at least once per year.
- For units with large number of dialysis machines, a representative number of machines be sampled on a monthly basis & more frequent or extensive testing be performed if a problem is suspected because of routine sampling results or a cluster of patient infections

Microbiological assay

- In the event of an outbreak, the assay may need to be both qualitative and quantitative, and samples may have to be cultured using additional microbiologic culture media and methods as is the case with nontuberculous mycobacteria and fungi.
- In such instances, plates should be incubated up to 14 days or longer based on the organism of interest.

Microbiological assay

- If centers reprocess dialyzers for reuse on the same patient, water used to rinse dialyzers and prepare dialyzer disinfectants also should be assayed at least monthly in the manner described previously.

PYROGENIC REACTIONS AND SEPTICEMIA/FUNGEMIA

- The most common complications associated with high levels of gram-negative bacterial contamination of dialysis fluid.

Pyrogenic reactions can result from either:

1. passage of bacterial endotoxin (lipopolysaccharide) in the dialysis fluid across the dialyzer membrane.

2- The transmembrane stimulation of cytokine production in the patient's blood by endotoxins in the dialysis fluid.

3. Direct contamination of the dialyzer blood compartment during reuse .

SURVEILLANCE OF PYROGENIC REACTIONS AND INFECTIONS

- Pyrogenic reactions in patients undergoing dialysis are associated with shaking chills, fever, and hypotension.
- Depending on the type of dialysis system and the level of initial contamination, the onset of an elevated temperature and chills can occur 1 to 5 hours after the initiation of dialysis and usually are associated with a decrease in systolic blood pressure of at least 30 millimeters of mercury (mm Hg).
- Other less frequent but characteristic symptoms may include headache, myalgia, nausea, and vomiting.
- **Definition**: as the onset of objective chills (visible rigors), fever (oral temperature 37.8°C), or both in a patient who was afebrile (oral temperature ≤37.0°C) and who had no signs or symptoms of infection before the dialysis treatment .

SURVEILLANCE OF PYROGENIC REACTIONS AND INFECTIONS

- Differentiating gram-negative bacterial sepsis from a pyrogenic reaction can be difficult because the initial signs and symptoms of the two conditions are identical.
- The most reliable means of detecting sepsis is by culturing blood taken at the time of the reaction.
- Collection of dialysis fluid from the dialyzer (downstream side) for quantitative and qualitative bacteriologic assays; and recording the incident in a log or other permanent record.

BLOODBORNE VIRUSES: VIRAL HEPATITIS AND ACQUIRED IMMUNODEFICIENCY SYNDROME

- HBV is the most efficiently transmitted bloodborne virus in the dialysis setting,
- Considered as a model for the prevention of transmission of other blood borne viruses.
- Infection control practices that effectively control HBV transmission also are effective for other bloodborne viruses, such as HCV and HIV, because their efficiency of transmission is much less than that of HBV.

VIRAL HEPATITIS: Hepatitis B Virus

Transmission:

- HBV is transmitted by percutaneous or permucosal exposure to infectious blood or body fluids.
- Hepatitis B surface antigen (HBsAg)-positive persons who also are positive for e antigen (HBeAg) have an extraordinary level of HBV circulating in their blood, approximately 10^8 virions mL^{-1}.
- HBV can be present on environmental surfaces in the absence of any visible blood and still contain 10^2 to 10^3 infectious virions mL^{-1}

- HBV is relatively stable in the environment, and has been shown to remain viable for at least seven days on environmental surfaces at room temperature .

- **HBV transmission:**
- Dialysis patients, once infected, frequently become chronically infected but remain asymptomatic and are sources of HBV contamination of many environmental surfaces.
- Dialysis staff members may physically carry HBV from infected patients to susceptible patients by means of contaminated hands, gloves, or other objects.

Hepatitis B

- Routine serologic surveillance facilitates the rapid identification of patients who become HBsAg-positive, which allows for the rapid implementation of isolation procedures before cross-infection can occur.
- HBV vaccine has been shown to reduce the costs of serologic screening.

Hepatitis C

- **Risk factors:**
- The number of years on dialysis is the major risk factor that is independently associated with higher HCV infection rates.
- As the time patients spent on dialysis increased, their prevalence of HCV infection increased from an average of 12% for patients receiving dialysis less than 5 years to an average of 37% for patients receiving dialysis more than 5 years .

ROUTINE TESTING

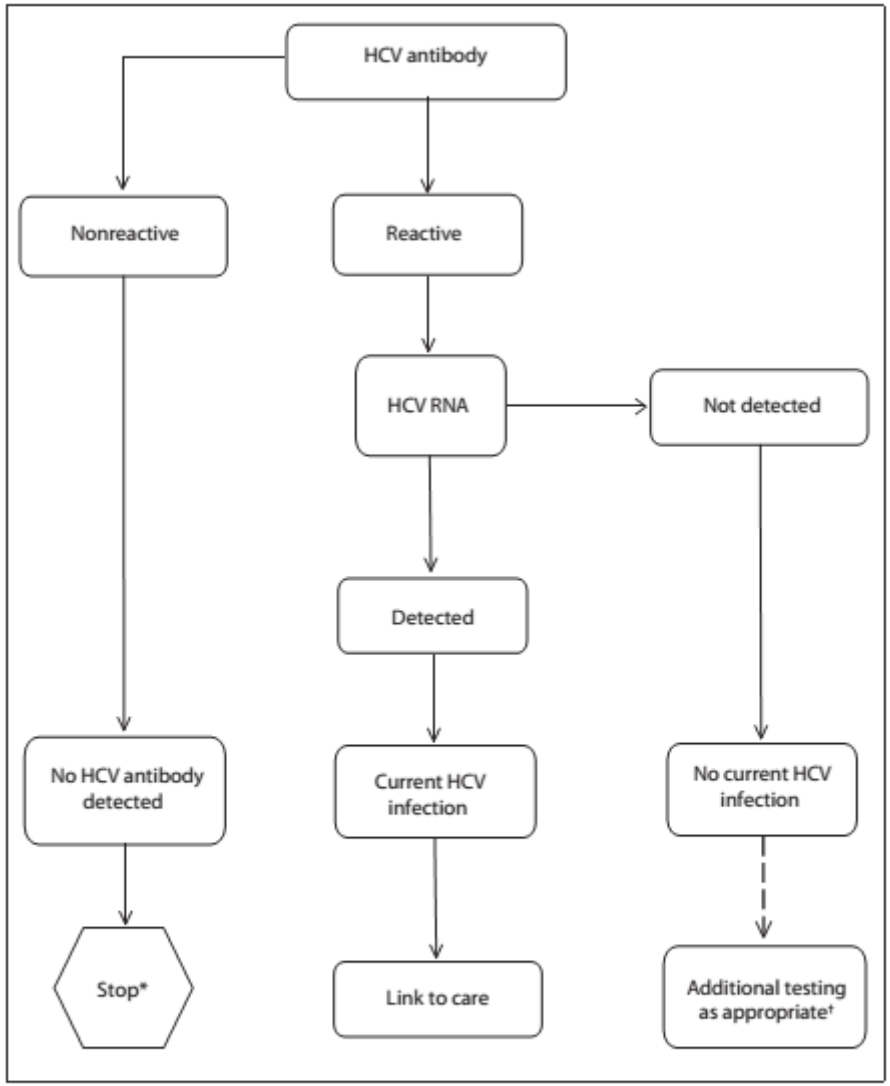
- All chronic hemodialysis patients should be routinely tested for HBV and HCV infection and the results promptly reviewed to ensure that patients are managed appropriately based on their testing results.
- Test results (positive and negative) should be communicated to other units or hospitals when patients are transferred for care.
- Routine testing for HIV is recommended.

TABLE 23.7 Recommended Schedule for Routine Testing for Hepatitis B and Hepatitis C Virus Infections

Patient Status	On Admission	Monthly	Semiannual	Annual
All patients	HBsAg,[a] Anti-HBc[a] (total), Anti-HBs,[a] Anti-HCV, ALT[b]	—	—	—
HBV susceptible, including nonresponders to vaccine	—	HBsAg	—	—
Anti-HBs positive (≥10 mIU mL^{-1}), anti-HBc negative	—	—	—	Anti-HBs
Anti-HBs and anti-HBc positive	—	No additional HBV testing needed		
Anti-HCV negative	—	ALT	Anti-HCV	—

[a]Results of HBV testing should be known before the patient begins dialysis.
[b]HBsAg, hepatitis B surface antigen; anti-HBc (total), total antibody to hepatitis B core antigen; anti-HBs, antibody to hepatitis B surface antigen; anti-HCV, antibody to hepatitis C virus; ALT, alanine aminotransferase.

FIGURE. Recommended testing sequence for identifying current hepatitis C virus (HCV) infection



* For persons who might have been exposed to HCV within the past 6 months, testing for HCV RNA or follow-up testing for HCV antibody is recommended. For persons who are immunocompromised, testing for HCV RNA can be considered.

† To differentiate past, resolved HCV infection from biologic false positivity for HCV antibody, testing with another HCV antibody assay can be considered. Repeat HCV RNA testing if the person tested is suspected to have had HCV exposure within the past 6 months or has clinical evidence of HCV disease, or if there is concern regarding the handling or storage of the test specimen.

- HBV chronically infected patients do not require any routine follow-up testing for purposes of infection control.
- However, annual testing for HBsAg is reasonable to detect the small percentage of HBV-infected patients who might lose their HBsAg.
- Persons with chronic liver disease should be vaccinated against HAV if susceptible.

- HCV:
- HCV-positive patients do not have to be isolated from other patients or dialyzed separately on dedicated machines.
- The purpose of routine testing is to facilitate early detection and intervention to stop transmission within centers and ensure that appropriate practices are being properly and consistently used.
- Persons with chronic liver disease should be vaccinated against HAV if susceptible.

- HIV:
- Infection control precautions recommended for all hemodialysis patients are sufficient to prevent HIV transmission between patients.
- HIV-infected patients do not have to be isolated from other patients or dialyzed separately on dedicated machines.
- In addition, they can participate in dialyzer reuse programs.

HBV Vaccination

- Recombinant vaccines available in are :
  - **Recombivax HB™**(Merck & Company, Inc., West Point, Pennsylvania)
  - **Engerix-B®** (SmithKline Beecham Biologicals, Philadelphia, Pennsylvania).
- Recombivax HB™ contains 10–40 µg of HBsAg protein per mL, whereas Engerix-B® contains 20 µg/mL.
- Primary vaccination comprises three intramuscular doses of vaccine, with the second and third doses given 1 and 6 months, respectively, after the first.
- An alternative schedule of four doses given at 0, 1, 2, and 12 months to persons with normal immune status or at 0, 1, 2, and 6 months to hemodialysis patients has been approved for Engerix-B.

TABLE 3. Doses and schedules of licensed hepatitis B vaccines for hemodialysis patients and staff members

Group	Recombivax HB™* Dose	Volume	Schedule	Engerix-B®† Dose	Volume	Schedule
Patients aged ≥20 years						
Predialysis§	10 µg	1.0 mL	0, 1, and 6 months	20 µg	1.0 mL	0, 1, and 6 months
Dialysis-dependent	40 µg	1.0 mL¶	0, 1, and 6 months	40 µg	2–1.0 mL doses at one site	0, 1, 2, and 6 months
Patients aged <20 years**	5 µg	0.5 mL	0, 1, and 6 months	10 µg	0.5 mL	0, 1, and 6 months
Staff members aged ≥20 years	10 µg	1.0 mL	0, 1, and 6 months	20 µg	1.0 mL	0, 1, and 6 months

* Merck & Company, Inc., West Point, Pennsylvania.
† SmithKline Beecham Biologicals, Philadelphia, Pennsylvania.
§ Immunogenicity might depend on degree of renal insufficiency.
¶ Special formulation.
** Doses for all persons aged <20 years approved by the U.S. Food and Drug Administration; for hemodialysis patients, higher doses might be more immunogenic.

Note: All doses should be administered in the deltoid by the intramuscular route.

HBV Vaccination

- **Immunogenicity.** The recommended primary series of hepatitis B vaccine induces a protective anti-HBs response (defined as >10 milli-International Units [mIU]/mL) in **90%–95%** of adults with normal immune status.
- Compared with adults with normal immune status, the proportion of hemodialysis patients who develop a protective antibody response after vaccination (with higher dosages) is lower.
- For those who receive the three-dose schedule, the median is 64% (range: 34%–88%), and for those who receive the four dose schedule, the median is 86% (range: 40%–98%) .

HBV Vaccination

- Limited data indicate that concurrent infection with HCV does not interfere with development of protective levels of antibody after vaccination, although lower titers of anti-HBs have been reported after vaccination of HCV-positive patients compared with HCV-negative patients.

HBV Vaccination

- Some studies have demonstrated that higher antibody response rates could be achieved by vaccinating patients with chronic renal failure before they become dialysis dependent, particularly patients with mild or moderate renal failure.

HBV Vaccination

- After vaccination with four 20 µg doses of recombinant vaccine, a protective antibody response developed in 86% of predialysis adult patients with serum creatinine levels <4.0 mg/dl (mean:2.0 mg/dl) compared with 37% of those with serum creatinine levels >4.0 mg/dl (mean: 9.5 mg/dl), only 12% of whom were predialysis patients.

HBV Vaccination

- **Revaccination of Nonresponders.** Among persons who do not respond to the primary three-dose series of hepatitis B vaccine, 25%–50% of those with normal immune status respond to one additional vaccine dose, and 50%–75% respond to three additional doses.
- For persons found to be nonresponders after six doses of vaccine, no data exist to indicate that additional doses would induce an antibody response.
- Few studies have been conducted of the effect of revaccination among hemodialysis patients who do not respond to the primary vaccine series. Response rates to revaccination varied from 40%–50% after two or three additional 40 µg intramuscular doses to 64% after four additional 10 µg intramuscular doses.

HBV Vaccination

- **Antibody Persistence.** Among adults with normal immune status who responded to a primary vaccine series with a protective antibody level, antibody remained above protective levels in 40%–87% of persons after 9–15 years .

HBV Vaccination

- **Duration of Vaccine-Induced Immunity.** Among persons with normal immune status who respond to the primary series of hepatitis B vaccine, protection against hepatitis B persists even when antibody titers become undetectable .
- However, among hemodialysis patients who respond to the vaccine, protection against hepatitis B is not maintained when antibody titers fall below protective levels.

HBV Vaccination

- If an adult patient begins the vaccine series with a standard dose before beginning hemodialysis treatment, then moves to hemodialysis treatment before completing the series, complete the series using the higher dose recommended for hemodialysis patients.
- No specific recommendations have been made for higher doses for pediatric hemodialysis patients. If a lower than recommended vaccine dose is administered to either adults or children, the dose should be repeated.

HBV Vaccination

- If the vaccination series is interrupted after the first dose, the second dose should be administered as soon as possible.
- For the three-dose primary vaccine series, the second and third doses should be separated by an interval of at least 2 months; if only the third dose is delayed, that dose should be administered when convenient.
- When hepatitis B vaccine has been administered at the same time as other vaccines, no interference with the antibody response of the other vaccines has been demonstrated.

HBV Vaccination

- **Follow-Up of Vaccine Responders.** Retest patients who respond to the vaccine annually for anti-HBs.
- If anti-HBs declines to <10 mIU/mL, administer a booster dose of hepatitis B vaccine and continue to retest annually. Retesting immediately after the booster dose is not necessary.
- For staff members who respond to the vaccine, booster doses of vaccine are not necessary, and periodic serologic testing to monitor antibody concentrations is not recommended .

HBV Vaccination

- **Patients with a History of Vaccination.** (Routine childhood vaccination and routine adolescent vaccination).
- Patients who develop end-stage renal failure will have a history of vaccination against hepatitis B.
- These persons should have responded to the vaccine when their immune status was normal, but if their anti-HBs levels are <10 mIU/mL when they begin dialysis, they should be revaccinated with a complete primary series.

MANAGEMENT OF INFECTED PATIENTS

- **HBsAg Seroconversions.** When a seroconversion occurs, review all patients' routine laboratory test results to identify additional cases.
- Investigate potential sources for infection to determine if transmission might have occurred within the dialysis unit, including review of newly infected patients' recent medical history (e.g., blood transfusion, hospitalization), history of high-risk behavior (e.g., injecting-drug use, sexual activity), and unit practices and procedures.

Specific measures for HBV:

1. Isolation of HBsAg-positive patients in a separate room.

2. Assignment of staff members to HBsAg-positive patients and not to HBV susceptible patients during the same shift.

3. Assignment of dialysis equipment to HBsAg-positive patients that is not shared by HBV-susceptible patients.

4. assignment of a supply tray to each patient (regardless of serologic status).

Specific measures for HBV:

- The segregation of HBsAg-positive patients and their equipment from HBV susceptible patients resulted in 70%–80% reductions in incidence of HBV infection among hemodialysis patients.

- HBV-immune patients can undergo dialysis in the same area as HBsAg-positive patients, or they can serve as a geographic buffer between HBsAg-positive and HBVsusceptible patients. Staff members can be assigned to care for both infected and immune patients on the same shift.

- Newly opened units should have isolation rooms for the dialysis of HBsAg-positive patients.
- For existing units in which a separate room is not possible, HBsAg-positive patients should be separated from HBV-susceptible patients in an area removed from the mainstream of activity and should undergo dialysis on dedicated machines.
- If a machine that has been used on an HBsAg-positive patient is needed for an HBV susceptible patient, internal pathways of the machine can be disinfected using conventional protocols and external surfaces cleaned using soap and water or a detergent germicide.

- **Anti-HCV Seroconversions.**
- If >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).

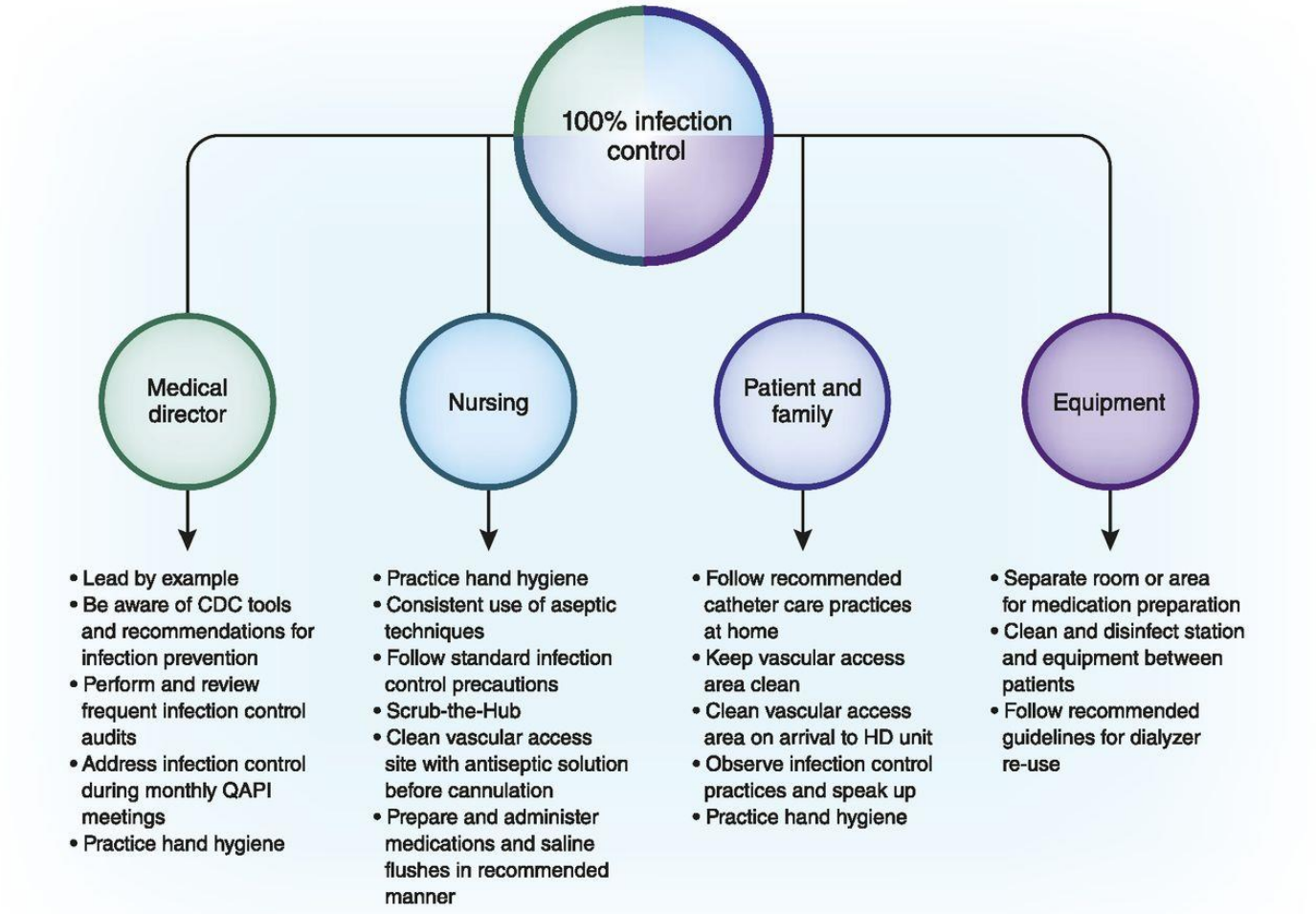
General Infection Control Practices for Hemodialysis Units

- Policies and practices should be reviewed and updated to ensure that infection control practice recommended for HD units are implemented and rigorously followed.

- Intensive efforts must be made to educate new staff members and reeducate existing staff members regarding these practices.

- Surveillance for infections and other adverse events are needed to monitor the effectiveness of infection control practices.

Infection prevention requires a collaborative effort between the medical director, dialysis staff, and the patient and family.



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General Infection Control Practices for Hemodialysis Units

- Careful use of single-dose and multi-dose medication vials is also essential in prevention of infection transmission.
- Single use should only be accessed once.
- Multi-dose vials should be dedicated to one patient.
- Medications and saline syringes should be prepared in a dedicated, clean, separate area in the dialysis unit and taken to specific individual stations by hand.
- A medication cart should not be used to take medications from station to station, because this has been associated with transmission of infections, especially HCV.

General Infection Control Practices for Hemodialysis Units

- Crowding patients and overtaxing staff members may increase the likelihood of microbial transmission.
- There should be enough space to move completely around each patient's dialysis station without interfering with the neighboring stations.

General Infection Control Practices for Hemodialysis Units

- During hemodialysis, gloves are required whenever caring for a patient or touching the patient's equipment.
- Supply of clean nonsterile gloves and a glove discard container should be placed near each dialysis station.
- Hands always should be washed after gloves are removed and between patient contacts, as well as after touching blood, body fluids, secretions, excretions, and contaminated items.
- A sufficient number of sinks with warm water and soap should be

  available to facilitate hand washing.
- If hands are not visibly soiled, use of a waterless antiseptic hand rub can be substituted for hand washing.

General Infection Control Practices for Hemodialysis Units

- 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.
- Clean and disinfect the dialysis station (e.g., chairs, beds, tables, machines) between patients. If trays are used to distribute medications, clean them before using for a different patient.

Equipment, Supplies, and Environmental Surfaces

- There is specific recommendations and checklists for dialysis station disinfection, which should be performed only after the patient has left the HD unit.
- Antiseptics, such as formulations with povidone iodine, hexachlorophene, or chlorhexidine, should not be used because they are formulated for use on skin (i.e., antisepsis) and are not designed for use on hard surfaces (i.e., disinfection).

Equipment, Supplies, and Environmental Surfaces

- After each patient treatment, frequently touched environmental surfaces, including external surfaces of the dialysis machine, should be cleaned (with a good detergent) or disinfected (with a detergent germicide).
- In the absence of visible soil a one-step disinfection process may be used.
- If visible organic soil is present, then a separate cleaning step is necessary and important for interrupting the cross-contamination transmission routes.

Equipment, Supplies, and Environmental Surfaces

- The floors in a dialysis center are routinely contaminated with blood, but the protocol for floor cleaning is the same as for floors in other healthcare settings.
- Usually, this involves the use of a good detergent germicide; the formulation can contain a low or intermediate-level disinfectant.

Equipment, Supplies, and Environmental Surfaces

- High-level disinfectants are designed to be used on medical devices, not environmental surfaces.
- Intermediate and low-level disinfectants are designed to be used on environmental surfaces; they also can be used on noncritical medical devices, depending on the design and labeling claim.

TABLE 2. Disinfection procedures recommended for commonly used items or surfaces in hemodialysis units

Item or Surface	Low-Level Disinfection*	Intermediate-Level Disinfection*
Gross blood spills or items contaminated with visible blood		X
Hemodialyzer port caps		X
Interior pathways of dialysis machine		X
Water treatment and distribution system	X	X†
Scissors, hemostats, clamps, blood pressure cuffs, stethoscopes	X	X§
Environmental surfaces, including exterior surfaces of hemodialysis machines	X	

* Careful mechanical cleaning to remove debris should always be done 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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- Thank you