State of Kuwait
Ministry of Health
Infection Control Directorate

Infection Control Guidelines For Prevention of Transmission of Infection Among Chronic dialysis Patients

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INTRODUCTION:

Haemodialysis was introduced first in 1940 up to early 1960's it was used exclusively for the treatment of acute renal failure. Subsequently with the development of the advanced technology in dialysis equipment, the use of both haemodialysis and peritoneal dialysis had increased. Dialysis is a hazardous process, adverse reaction may occur due to the chemical or microbial contamination during the process of dialysis.

Patients with end stage renal failure necessitating the use of dialysis are more susceptible to infections due to their immune dysfunction and the use of artificial organs of foreign materials many of these patients renal condition is the consequence of an original disease which affects the immunity system e.g., diabetes mellitus and systemic lupus erythematosus.

1. Types and definition:

Dialysis is a process replaces the function of the kidney, by which toxins and excess fluids are removed from the blood stream.
There are two types of dialysis: haemodialysis and peritoneal dialysis.

Haemodialysis:
It is a process, which involves circulating the patient's blood outside of the body through an extra corporeal circuit (ECG), where it is separated form dialysis fluid by artificial semi-permeable membrane.

Peritoneal dialysis:
In this type of dialysis, the patient's peritoneum or lining of the abdomen is used to dialysis waste products from the patient's blood.

2. Infectious complications:

Peritoneal dialysis (PD):
It is associated with several infectious complications involving catheter exit site (exit site infection), infection of the subcutaneous catheter (tunnel infection), and peritonitis. Peritonitis is considered the most serious complications and may end by destruction of the peritoneal membrane and shifting to haemodialysis treatment. Studies suggested that (PD) patients who use automated cycles are less prone to infections.

The most common diagnosed pathogens involved with peritoneal dialysis infections are:

- Gram positive bacteria:

Gram-positive bacteria as a group (Staphylococcus epidermedis and staph.aureus) are the most common etiologic agent causing peritonitis complicating conventional peritoneal dialysis. Patient who are nasal carriers of staph. aureus are at a high risk for exit site infection and peritonitis.

- Gram negative positive:

They can be derived from skin, gastrointestinal tract, urinary tract, contaminated water, and disinfectant solutions. Automated peritoneal dialysis machines may act as a reservoir for pathogens. E.g., pseudomonas spp. and non-tuberculous bacteria.

♦ Fungal peritonitis :

The fungal infection is usually difficult to eradicate and require early removal of the catheter. One of the predisposing factors of fungal infection is prior use of antibiotic therapy.

Haemodialysis system:

In general, haemodialysis system consists of a water supply, a system for mixing water and concentrated dialysis fluid and a machine to pump the dialysis fluid through the artificial kidney. This aqueous environment provides a good growth medium that can result in the production of massive accumulation of gram negative bacterial which has direct and indirect infectious complications on patients such a septicemia and pyrogenic reaction due to bacterial endotoxemia.

Non-tuberculous mycobacteria, which have the capability of multiplying in acquous environment, found to be the cause of some infectious complication for dialyzed patients.

The process of haemodialysis requires vascular access for prolonged periods, hence these patients are at high risk for infection. This infection usually is caused by s.aureus, coagulase-negative staphylococci, gram-negative bacilli, non-staphylococcal gram-positive cocci (including enterococci) and fungi.

Bacterial infections especially those involving vascular access are considered the most frequent infectious complications of haemodialysis and the most common cause of morbidity and mortality among these patients.

The reuse of disposal haemodialyzers for the same patient is practiced in some centers as a cost saving effort. However, this practice should not be considered risk free. Inadequate reprocessing procedures are usually associated with infectious hazards.

Viral Infections:

In dialysis unit, both patients and staff are at high risk of acquiring blood-borne viral infections. Viral hepatitis is a major complication of haemodialysis, several agents are involved such as hepatitis B, C, D and non-A, non-B.

Risk of HIV infection was a major concern among dialysis patients as the virus was considered epidemiologically similar to hepatitis B virus. However, recent studies proved that HIV is significantly less efficiently transmitted than hepatitis B virus.

Other viruses are encountered in viral infections in the dialysis units, such as Epstein-Bar Virus, Coxsackie B, herpes simplex and varicella-zoster virus.

Mode of Transmission of hepatitis B:

Dialysis patients once infected with HBV, are likely to become chronic asymptomatic HBsAg carriers who, in-turn, become sources of contamination for many environmental surfaces. HBV is considered to be a resistant virus, is relatively stable in the environment, and remains viable for at least seven days on environmental surfaces at room temperature.

Dialysis staff members may acquire the infection by:

1. Accidental needle puncture through intact skin.
2. Infected plasma, serum or contaminated environmental surfaces through breaks in the skin such as abrasions, cuts, or scratches.
3. Introduction of infected serum or plasma onto mucosal membranes e.g., splash of blood onto the mouth or eye.

Dialysis patients may become infected in various ways:

1. Through internally contaminated dialysis equipment e.g., venous pressure gauges, isolators or filters.
2. Through externally contaminated dialysis machines such as surfaces, control knobs or intravenous poles.
3. Through contaminated injection site.
4. Through breaks in skin or mucous membranes.
5. Through contaminated items and surfaces such as clamps, scissors, telephones or walls.
6. Used multiple dose medication vials and intravenous solutions.

The dialysis staff may contribute to infection transmission via contaminated hands, gloves and other objects.

3. <u>Water Supply:</u>

Display centers use water from public supply, which inspite of being chlorinated is usually contaminated with water bacteria e.g., gram-negative bacteria, non tuberculous bacteria and certain types of blue-green algae. Endotoxins produced by gram-negative bacteria may be high enough to produce pyrogenic reaction in patients undergoing dialysis.

Water treatment system:

Water used for the production of dialysis fluid must be treated adequately to remove chemical contaminants. It should be also filtered to prevent bacterial contamination. Used filters should be frequently and regularly changed and/or disinfected according to manufacturer's instructions.

Distribution system:

Which is used for delivering dialysis fluids to each dialysis machine, consists of plastic pipes and appurtenances. This distribution system plays a role in microbial contamination since they frequently use larger diameter and longer pipes than are needed to control the required fluid flow. This increases both the total volume and the wetted surfaces area of the system and decreases the fluid velocity, which allows the gram-negative bacteria to multiply rapidly and colonize the wetted surfaces of the pipes. Such colonization leads to formation of bio-films, which is usually difficult to remove or disinfect.

To ensure adequate disinfection of the distribution system, it should be routinely disinfected at least weekly. Further more, the design of the system should be in a way that facilitate adequate disinfection and prevents fluids form being trapped and serves as a reservoir of bacteria. It is recommended to use ultra-filter at the outlet of the storage thank of the distribution system, the tank should be frequently drained and

adequately disinfected including scrubbing of its base and sides to remove the bacterial bio-film.

Regular monitoring of the system using standard microbial assay methods for water borne microorganisms should be performed at least monthly and should be repeated if counts are elevated [more than 200 colony forming units per milliliter (CFU/ml)] or after maintenance work.

There should be written procedures on water monitoring and a plan of action if excessive contamination is found.

4. Infection Control Strategies in Dialysis Unit:

Surveillance:

4.1.1. All patients and staff members in dialysis unit should be screened for hepatitis B surface antigen (HBsAg) and antibody to HbsAg (anti-HBs) when they join the unit, to determine their serologic status, then periodically according to the following table.

Table: C.D.C Recommendations for serologic surveillance in chronic hemodialysis centers

Vaccination and serologic status	*Frequency of HBsAg screening*		*Frequency of anti-HBs screening*	
	Patients	*Staff*	*Patients*	*Staff*
Unvaccinated	Monthly	2-3 months	3months	2-3 months
Susceptible	3months	3 months	None	None
HBsAg carrier	None	None	Annually	None
Anti –HBs-positive *				
Vaccines	None	None	Annually	None
Anti-HBs-positive	Monthly	3 months	3months	2-3 months
Low level or no anti-HBs				

* At least 10 ml U/ ml

The serologic status can be defined as:
HBsAg-positive (source of infection), anti- HBs-positive (immune).
HBsAg-negative and anti-HBs-negative (seronegative i.e. susceptible).

4.1.2. HBsAg-positive employee can continue to work in dialysis unit where he/ she may be assigned to care for HBsAg-positive patients.

4.1.3. Hepatitis B vaccination is recommended for all susceptible patients and staff in haemodialysis unit. For patients, higher vaccine closes or increased number of doses may be required.

4.1.4. The most sensitive test methods available for HBsAg and anti-HBs should be used such as radioimmunoassay (RIA) and enzyme-immunoassay which are used for HBsAg detection and reverse passive hemoaggltination (RPHA) which is used for anti-HBs detection.

4.1.5. Screening of patients for HCV should be done on admission to determine the prevalence of the virus in the haemodialysis unit.

4.1.6. Screening of patients for HIV should be done on admission to determine the prevalence of the virus in the haemodialysis unit.

Record Keeping:

A properly kept recording system is essential in dialysis unit for better surveillance and follow-up purposes.

4.2.1. The patient record in dialysis unit should include the following:

- Lot number of all blood and blood products used.
- Name or number and location of the machine used for each dialysis session.
- Names of staff members assigned for the patient on each dialysis session.
- Any mishaps including dialysis machine malfunction, blood leaks etc.

4.2.2. A log for all incidents sustained by patients and staff such as needle puncture (use the incident report prepared by the infection control department).

4.2.3. A log for all hepatitis serologic results for patients and staff.

Patient monitoring:

Patient temperature should be monitored before and after dialysis to detect early sign of pyrogenic reaction. Any fever ($T>37.8^0C$) or rigors should be investigated by:

1. Clinical assessment of the patient to rule out other causes of fever e.g., pneumonia.
2. Cultures of blood samples.
3. Cultures of other body fluids or secretion if suspected to be the source of infection.
4. Cultures of dialysate (downstream side) for bacteriologic quantitative and qualitative assays.

5. Infection control recommendations:

5.1. Standard precautions for all patients should be followed by all staff members.

5.2. Staff should wash hands wear a new pair of gloves between patients to prevent cross infection. The staff should wear gloves when handling patients , dialysis equipment and accessories e.g., taking blood pressure, adjusting flow rate by touching dialysis machine knobs and handling blood specimens.

5.3 Staff should change gowns between patients and the gowns should be discarded at the end of the day.

5.4. It is advisable for the staff to wear protective eyeglasses and surgical masks during procedures where splashing of blood is anticipated.

5.5.The staff should not drink or eat or smoke in dialysis treatment area.

5.6. Crowding of patients and staff should be avoided to give enough space for easy movement of staff, placement of equipment and cleaning of environment.

5.7. Staff should not attend both HBsAg-positve and HBV susceptible patients during the shift.

5.8. Patients who are HBsAg –positive should be dialyzed in a separate room, using separate machines, equipment, instruments and supplies.

5.9. A specific dialysis machine, bed, chair, and supply tray (including tourniquet, antiseptics and blood pressure cuff) should be assigned for each patient.

5.10. Disposable external venous and external pressure transducer filters/protectors, should be used once for each patient, these items should not reprocessed and reused.

5.11. Linen should be used on chairs and beds and should be changed after each patient. Chairs and beds should be cleaned after each use.

5.12. Non disposable items such as clamps and scissors should not be used for more than one patient unless appropriately cleaned and disinfected or sterilized. Non-disposable items that cannot be cleaned and disinfected such as adhesive tape, blood pressure cuffs, should be assigned for a single patient.

5.13. When multiple dose medication vials are used, doses should be prepared in a clean area away from dialysis stations and should be delivered separately to each patient.

5.14. Unused medications or supplies taken to the patient's site (e.g., syringes, alcohol swabs) should not be returned to a common clean area and should not be used for other patients.

5.15. Do not use common medication carts to deliver medications to patients. Trays should be used to deliver medications to individual patients. These trays must be cleaned and disinfected between patients.

5.16. Patients should not share food or its utensils with other patients or staff.

5.17. Medial records and laboratory specimens from HBsAg – positive individuals should be clearly labeled as Hepatitis B.

5.18. The same precaution mentioned in 5.7, 5.8, and 5.9 should be applied for patients infected with delta hepatitis, hepatitis C and human immunodeficiency virus.

5.19. Patients who are considered to be at high risk for transmitting infections such as patients with infected skin, wound with drainage that is not contained by dressing (regardless to the culture results) or patients with uncontrolled diarrhea or fecal incontinence, these patients should be dealt with additional precautions.

A. Attending staff should wear a separate gown, which should be removed when finished caring for the patient.

B. These patients should be dialyzed at a station away from adjacent stations. (e.g., at the end or corner of the unit).

6. <u>Disinfection of Dialysis system:</u>

The purpose of the disinfection procedures for the dialysis system is not only to prevent the multiplication of water bacteria to a significant level, but also to eliminate blood borne viruses.

The routine disinfection of isolated components of a dialysis system usually is inadequate and consequently, the total dialysis system (water treatment system, distribution system and dialysis machine) should be considered in the disinfection procedures. For single pass machines disinfection process should be performed the beginning and end of the shift. Disinfection process should be performed at the beginning and end of the shift. Disinfection process performed after each use for batch recirculating machines.

The rinse water which usually contains some gram-negative water bacteria, should not be permitted to stand overnight, otherwise, the water will contain significant microbial contamination and nullify the disinfection procedures. Different types of disinfectants are used for the purpose of disinfecting dialysis system. The manufacturer's instructions should be followed for both the machines and the disinfectants.

1. Chlorine base disinfectants: It is one of the effective disinfectants and can be used for machines and water system as well. It is used at the beginning of the shift and between patients.
   Due to its corrosive nature it should be rinsed after a short time of exposure which is 20-30 minutes.

2. Aqueous formaldehyde peroxyacetic acid or gluteraldehyde solutions are good disinfectants and can be used in the machines for longer period because they are less corrosive than chlorine-based disinfectants. Formaldehyde is considered an environmental hazardous chemical and potentially carcinogenic which render it less favorable as a disinfectants.

3. Hot water: Some type of dialysis systems use hot water >90% as a disinfectant and is considered as an excellent method for controlling bacterial growth.

7. <u>House keeping:</u>

Dialysis units are considered high risk areas due to the nature of the procedures done and the immune status of the patients, thus house keeping should serve two tasks; removal of soil and waste to prevent accumulation of infectious material and maintaining clean environment for better patient care.

7.1. Special training should be given to house keeping personnel working in dialysis unit.

7.2. Two space surrounding the patient should be utilized efficiently by orderly arranging the required items, discarding the unneeded ones and removing excess tubes and wires on the floor.

7.3. The personnel should wear gloves and gowns during work and when handling contaminated items.

7.4. Chairs and beds should be cleaned and disinfected between patients.

7.5. Separate cleaning tools should be used for cleaning area designated for patients with blood borne diseases.

7.6. Disposable items should be placed in strong-leak proof bags, double bagging is necessary when contamination of outer surface occur.

7.7. Disposable used needle sharp items should be discarded in puncture –proof containers.

7.8. All used disposable items should be discarded according to the waste management policy.

7.9. Contaminated linens and other laundry items should be placed in heat soluble bags before sending to the laundry.

8. <u>Infection control precautions for multi-drug resistant bacteria in the dialysis centers:</u>

8.1. Infection control recommendations mentioned previously (item-5) should be followed for all patients with multi-drug resistant bacteria.

8.2. Private isolation room is recommended for vancomycin resistant enterococci (VRE) positive patient with uncontained wound drainage, diarrhea, colostomy, faecal incontinence and for patient with poor hygienic habits. If a private room is not feasible, separation of patients and staff, strict adherence to standard precautions and meticulous environmental cleaning might be sufficient.

8.3. Infection control precautions for patients with methicillin-resistant staphylococcus aureus (MRSA) should be followed according to MRSA protocol prepared by the ministry of health.

8.4. Rational use of vancomycin should not be practiced, other than for certain surgical procedures.

9. <u>Education:</u>

Continuous educational program on infection control should be instituted in dialysis units for patients and staff. The program should highlight the following points:

1. The most common pathogens causing infection in dialysis units and their way of transmission especially viral hepatitis.
2. Principles of infection control practice to prevent transmission of infection both at dialysis units and at home.

<u>Infection control recommendations for peritoneal dialysis at home:</u>

Continuous Ambulatory Peritoneal dialysis (CAPD); Continuous Cyclic Peritoneal Dialysis (CCPD); Night Intermitted Peritoneal Dialysis (NIPD), all are self administered treatment done at home settings. Care to prevent infection during the process of dialysis is of high importance.

When replacing the solution or removing it, this process should be done under the following precautions:

1. The room should not be crowded, not more than two attendants should be in the room.
2. The room should be clean.
3. The bed sheets should be clean.
4. The patient is kept away from air draft.
5. The patient should be hygienically clean and wearing clean clothes.
6. Care provider should:
    a. Not be complaining of fever , upper respiratory tract infection, skin infection, eye discharge or diarrhea.
    b. Wear clean clothes.
    c. Cut nails short.
    d. Wash hands thoroughly with soap and water then dry hands using clean towel.
    e. Avoid touching surfaces and items not related to the procedures to avoid contamination of his hands.
7. During the process smoking and unnecessarily talking is not permitted.
8. Sterile supply should be used (clamps, gauze… etc).
9. The site of the peritoneal catheter should be cleaned using a proper antiseptic solution.
10. The used disposable items should be discarded directly in a separate bag and the area should be kept clean.
11. Finally the hands of the care providers and the helpers should be washed using soap and water.
12. The treating physician should be informed about any complaint for example redness at site of infection, fever, change in the color of the fluid drained…etc.
13. Continuous care of the site of insertion between dialysis runs:
    - Should be kept covered using sterile gauze.
    - When taking a bath the site should be covered using a plastic bag to avoid wetting of the gauze and preventing water entering through the catheter to the peritoneal cavity.
14. Vaccination against hepatitis B is preferable for both patient and care provider.

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