INFECTION PREVENTION AND CONTROL IN DIALYSIS UNIT

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INTRODUCTION

• Haemodialysis (HD) and peritoneal dialysis is a lifeline for patients with end stage renal disease (ESRD) or renal failure and are awaiting kidney transplant.

• Dialysis patients are at high risk of infection because of underlying illness and numerous environmental and procedural illnesses.

• Establishing a comprehensive infection prevention and control (IPC) program for dialysis settings will reduce the infection risks for both patients and healthcare workers (HCWs).
OBJECTIVE

• To overview the multiple infections transmitted/induced in dialysis patients.
• To stress on the essential elements of IPC program in dialysis units.
DEFINITIONS

Central Venous Catheter (CVC):
- **CVC** is only intended for short-term access use for HD in an emergency, while awaiting a fistula to heal or in preparation for a graft.
- It carries the highest risk of infection.
- Standard care procedures must be followed to reduce the risk of infection.

Fistula:
- A connection surgically created between an artery and vein (usually in the arm).
- It is accessed via a needle for HD.
- It has the lowest risk of infection.

Vascular graft:
- An artificial tube surgically placed between an artery and vein (usually in the arm).
- This graft is accessed via a needle for HD.
- It carries an intermediate risk of infection.
Dialysate:
- A balanced electrolyte solution which is introduced on one side of the semi-permeable dialyser membrane (opposite to the patient’s blood) to exchange solutes with blood during HD.

Dialysis water:
- Purified water that is used to mix the dialysate or to disinfect, rinse, or reprocess the dialyser.

Dialyser:
- A part of the HD machine; it has two sections separated by a membrane.
- The patient’s blood flows through one side and the dialysate flows through the other side.
Reverse osmosis (RO):

- A process used to purify dialysis water by removing dissolved inorganic solutes as well as bacteria and their endotoxins.

Peritoneal dialysis (PD):

- PD involves dialysis fluid instilled via a surgically inserted PD catheter into the peritoneal space of the abdomen.
- Most catheters are made from silicone.
- The fluid is removed, taking with it any toxins.
- Most common types of PD include chronic ambulatory, continuous cyclical and chronic intermittent PD.
How Dialysis Works

In-center hemodialysis is the most common blood-cleansing therapy used by Americans with kidney failure. Patients typically are treated three times a week for three-to-four-hour sessions. Blood lines can be attached to either a catheter or fistula.

**Connection Types**

**A** Catheter
A tube inserted into a vein in the neck, chest or leg

**B** Fistula
A surgically created connection of an artery to a vein

1. Blood is pumped out of a patient’s catheter or fistula into the blood line.
2. Heparin, a blood thinner, is added to prevent clotting.
3. Blood flows into the dialyzer, where impurities, salt, and excess fluid are drawn into the dialysis solution.
4. Cleansed blood is returned.

Graphic by Al Granberg
UNDERLYING DISEASES OR CONDITIONS PRECIPITATING TO INFECTIONS IN DIALYSIS PATIENTS

- Diabetes
- Hypertension
- Cardiovascular disease
- Immunosuppressive therapy
- Other critical diseases
- Direct access into normally sterile areas.
- Contamination:
  at various steps in the dialysis procedure (extrinsic) or of any of the components of the dialysis system (intrinsic).
THE MOST COMMON TYPES OF DIALYSIS-ASSOCIATED INFECTIONS

- Access site infections
- Bacteremias
- Peritonitis
- Pyrogenic reactions
- Infections with blood-borne pathogens
INFECTION-ASSOCIATED RISKS

- Hepatitis B
- Hepatitis C
- Acquired immune deficiency syndrome (AIDS)
- Bacterial disease
- Fungi
- Mycobacteria
HEPATITIS B

• Hepatitis B virus (HBV) is transmitted through percutaneous or permucosal exposure to the blood of infected patients (HBsAg-positive or HBeAg-positive).

• HBV remains viable at room temperature for at least 7 days.

• HBV has been detected on: clamps, scissors, and external surfaces and parts of dialysis machines.

• HBV can be transmitted to patients or staff on gloves or unwashed hands.
HEPATITIS C

- HCV is transmitted by percutaneous exposure to infected blood.

- Factors that increase HCV infection in HD patients
  1. history of blood transfusions,
  2. volume of blood transfused, and
  3. years on HD.
  4. inadequate IPC practices.

- Transmission of HCV through:
  1. shared equipment and supplies not disinfected between patients,
  2. use of common medication carts,
  3. shared multi-dose medication vials,
  4. contaminated HD machines, related equipment & blood spills.
ACQUIRED IMMUNE DEFICIENCY SYNDROME (AIDS)

- Human immunodeficiency virus (HIV) is transmitted by blood or blood-containing body fluids.

- There have been very few reports of HIV transmission in dialysis and these resulted from inadequate disinfection of equipment, including access.
BACTERIAL DISEASE

- Increased risk of infection and colonisation with multi-drug resistant organisms (MDRO), such as Staphylococcus aureus (MRSA) and vancomycin-resistant enterococci (VRE).

- Vancomycin use is high in dialysis populations.

- Outbreaks of MRSA in some dialysis units from colonised\infected patients.

- MDR Gram-negative infections as Pseudomonas aeruginosa, Stenotrophomonas maltophilia, and Acinetobacter spp
MYCOBACTERIA

• Reports of mycobacterial infections in dialysis patients from contaminated water.

• High-risk for progression from latent tuberculosis to active TB disease.

• Frequent hospitalisation of dialysis patients increases the risk of transmission of TB to other patients or to HCWs.
Fungi

• Dialysis patients are susceptible to fungal infections such as Aspergillus spp.

• In addition, there is a risk of Candida bacteraemia and peritonitis with the patient’s skin as a source.
Basic Principles of IPC in Dialysis Unit
1-SURVEILLANCE

Routine testing / or documentation for:

- HBV, HCV & HIV as soon as, it is anticipated that dialysis is required & every 3 months, for: HBsAg, HCV & HIV antibody
- Patient’s vaccination (e.g. HBV).
- Bacteraemia, access site infections, and peritonitis.
- Treatment station used and machine number, as well as names of staff connecting and disconnecting the patient.

This information will be useful in any outbreak investigation.
2-STANDARD AND TRANSMISSION-BASED PRECAUTIONS

- Segregation of HBsAg-positive patients and their equipment and supplies from those used for non-HBV-infected patients.

- Patients with either HCV or HIV infection also require a dedicated machine.

- Contact Precautions for MDR microorganisms, such as MRSA and VRE, and Gram negative microbes.
2-STANDARD AND TRANSMISSION-BASED PRECAUTIONS (CONT’)

• Proper hand hygiene (HH) (as WHO’s 5 moments).

• Staff must wear a mask and gloves and the patient must wear a mask while the site is being accessed.

• Wash the access site using an antibacterial soap/scrub and water.

• Cleanse the skin by 2% chlorhexidine gluconate/70% isopropyl alcohol, 70% alcohol, or 10% povidone iodine.

• Access lines used for HD must not be used for other purposes.
3-ENVIRONMENTAL CLEANING AND DISINFECTION

• Hospital grade disinfectant is used for all patient areas.

• Special attention to high-touch items or surfaces likely to be contaminated with blood or body fluids.

• Prompt containment and cleaning of spills of blood or body fluids.

• Prevention of mould contamination resulting from water damage or wetting of permeable walls, furniture, etc.

• Strict adherence to IPC precautions for construction and renovation activities.

• Used supplies and dialysers should be disposed of to prevent contamination of patients and environmental surfaces.
4-EQUIPMENT CLEANING AND DISINFECTION

- Policies and procedures for correct care and maintenance of, dialysis systems, including the water treatment system, distribution system, and dialysis machines.

- Reusable dialysers must be cleaned, receive high-level disinfection, and be thoroughly rinsed and dried prior to reuse.

- Adequate cleaning and disinfection of dialysis machines and equipment and reusable supplies between all patient uses.
5-SAFE MEDICATION AND INJECTION PRACTICES

• Avoid contamination of multi-dose vials.
• The stopper should be disinfected with alcohol before accessing the vial.
• A single use sterile needle and syringe for each access.
• Single-use vials are preferable.
• Needles should not be recapped.
• Used sharps should be discarded sharps containers.
• Safety engineered medical devices (e.g., self-retracting or self sheathing needles) when possible.
6-PATIENT IMMUNISATION, POST-VACCINATION TESTING, AND SCREENING

- Screen for HBV prior to start of HD treatment.
- Immunise for HBV.
- Testing for HBV one to two months after the primary vaccinations.
- Annual testing for antibody to HBsAg. A booster dose should be administered when anti-HBs levels decline to <10 mIU/ml.
- Dialysis patients younger than 65 years receive a dose of pneumococcal vaccine followed by a dose every 5 years. If over 65 years, only one dose of vaccine is required.
- Screening of patients for MRSA or VRE is only necessary in outbreak or suspected transmission.
7-PATIENT AND HCWs EDUCATION

- The **staff** should receive initial and on-going education on the basic principles and practices of dialysis, infectious risks and potential adverse events, and IPC practices.

- The **patient** should receive education on access site and dressing care, signs and symptoms of infection, and the importance of reporting potential infections.
8-OCCUPATIONAL SAFETY CONSIDERATIONS

- Standard Precautions and, as necessary, transmission-based precautions, PPE and HH to protect from blood or body fluids.
- Gloves, masks, and gowns must be used when connecting and disconnecting dialysis patients during the dialysis process.
- Routine testing of staff for HCV, HBV, or MDRO is not recommended.
- Staff should receive hepatitis B vaccination.
9-WATER TREATMENT AND TESTING

• Testing of dialysis water and dialysate at least monthly as per the US Association for the Advancement of Medical Instrumentation (AAMI) guidelines.

• Water quality; both microbial and chemical components should also be monitored.

• Water used to prepare dialysate or to process dialysers and dialysate should contain a total viable microbial count of no more than 200 CFU/ml and an endotoxin concentration lower than 2 EU/ml.

• If the total viable microbial count reaches 50 CFU/ml or the endotoxin concentration reaches 1 EU/ml, corrective measures should be taken promptly.
A study done by Abdel-Aal et al. (2003) on water and dialysate fluids of four Egyptian hospitals.

Samples taken at four seasons.

A higher contamination with fecal bacterial was found in spring and summer whereas fungal contamination as Aspergillus spp. was more detected in autumn and summer.
SUMMARY

• Dialysis (HD or PD) is a lifeline for patients with ESRD or renal failure and/or awaiting kidney transplant.
• Patients receiving dialysis treatments are at increased risk of infection.
  IPC programs includes:
• Hand hygiene,
• Appropriate PPE to provide a barrier to contact with blood, body fluids, Non-intact skin or mucous membranes,
• Immunisation of patients & HCW’s,
• Aseptic technique----------------------to reduce patient/client exposure to microorganisms,
• Management of sharps, blood spills, linen, and
• Waste management to maintain a safe environment,
• Routine environmental cleaning.
CONCLUSION

• Infection control is a responsibility of everyone involved with the dialysis treatment process.

• Implementation of IPC procedures and a safe environment including water, all are critical in eliminating or mitigating infection risk for both patients and HCW.

• Patients’ education is also an essential to prevent infections associated with dialysis.
REFERENCES

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Thank You for Attendance