

# 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**.

# DEFINITIONS (CONT')

## 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.

# DEFINITIONS (CONT')

## 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**.

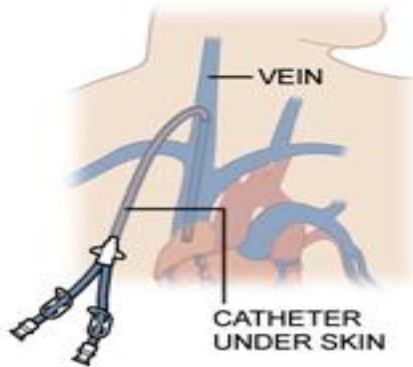
# How Dialysis Works

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. Bloodlines can be attached to either a catheter or fistula.

## CONNECTION TYPES

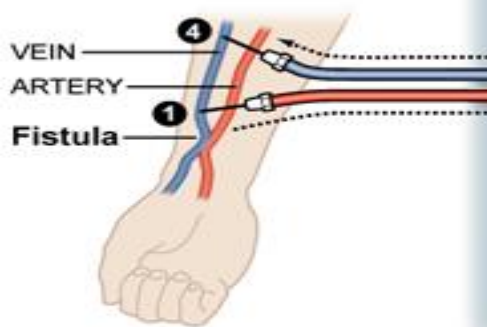
### A Catheter

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

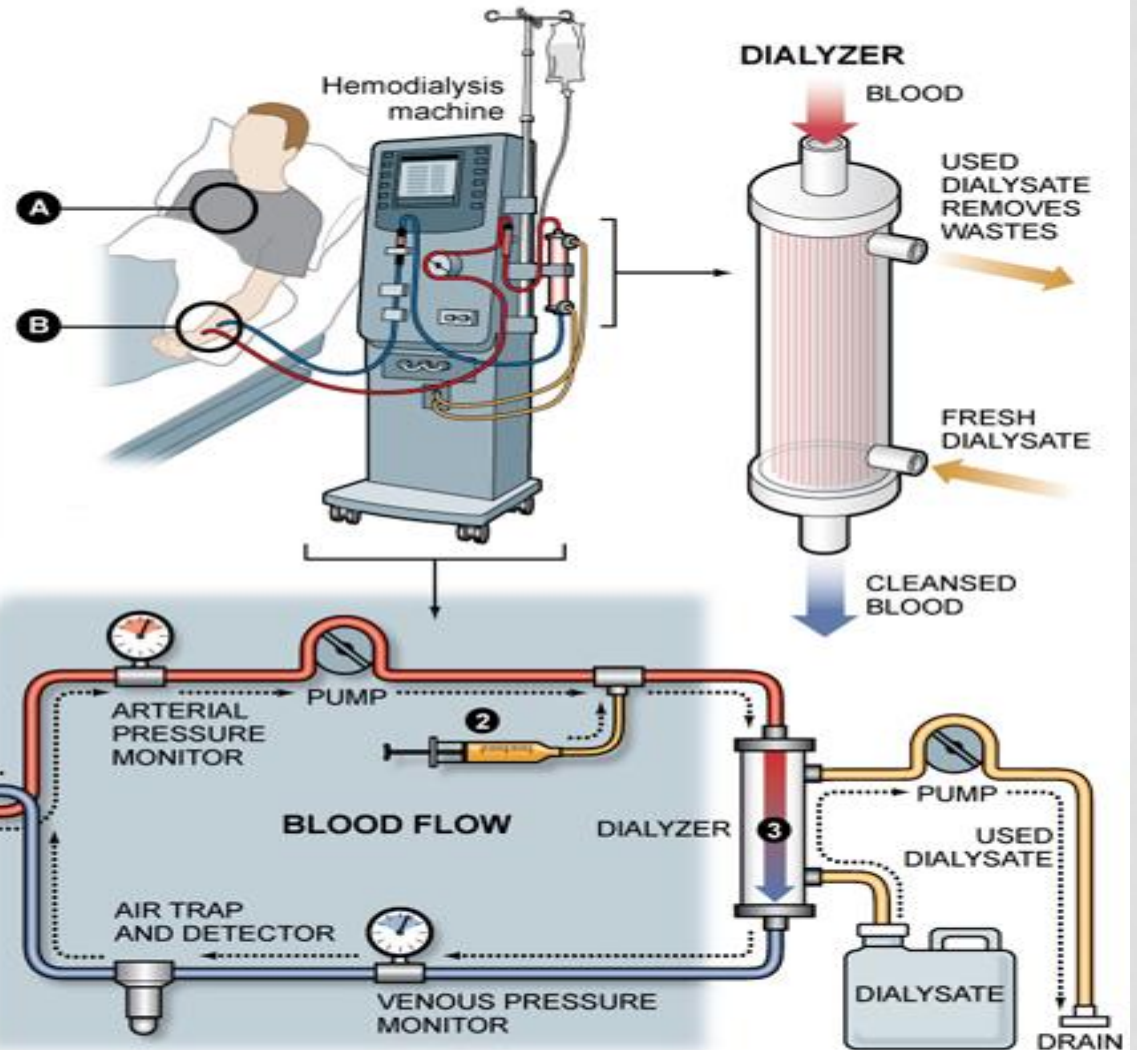


### B Fistula

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.



# UNDERLYING DISEASES OR CONDITIONS PRECIPITATING TO INFECTIONS IN DIALYSIS PATIENTS

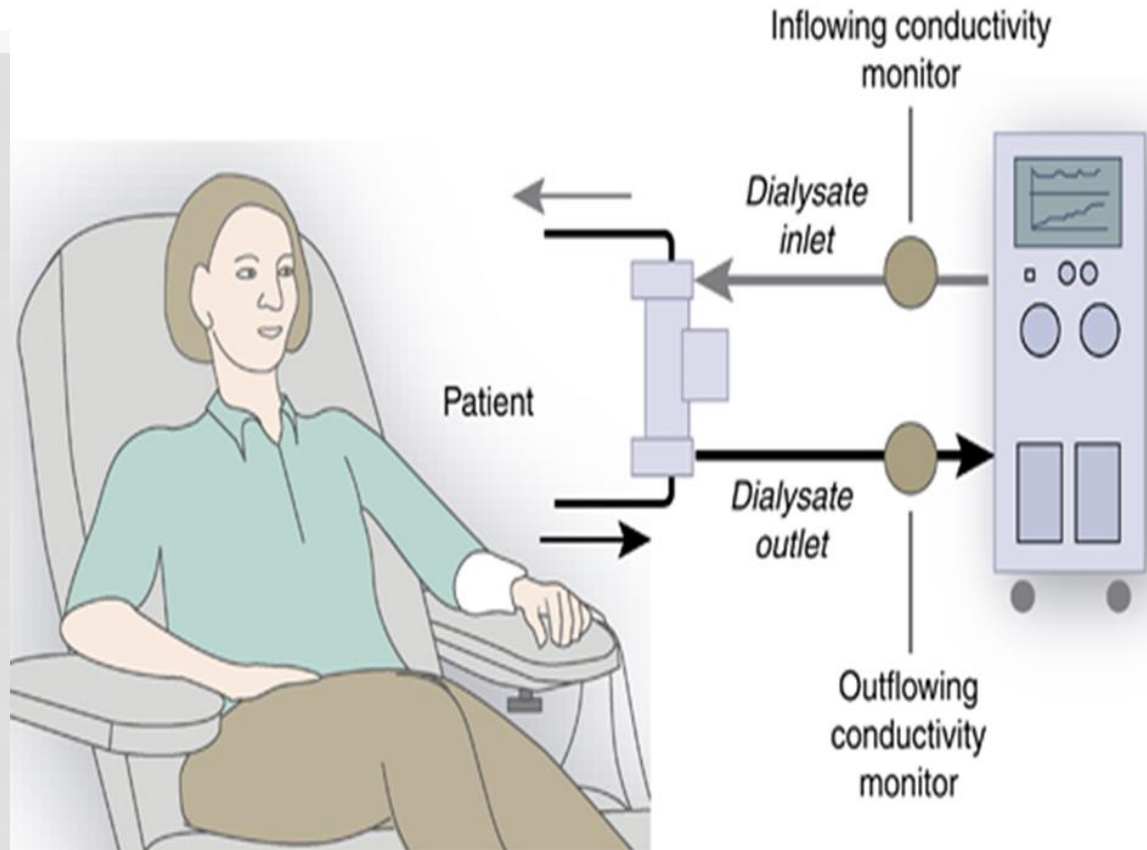
- Diabetes
- Hypertension
- Cardiovascular disease
- Immunosuppressive therapy
- Other critical diseases
- Direct access into normally sterile areas.
- Contamination:

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 **7days**
- 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 to 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 -----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.

## 9-WATER TREATMENT AND TESTING (CONT')

- A study done by Abdel-Aal et al.(2003)on water an the 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.

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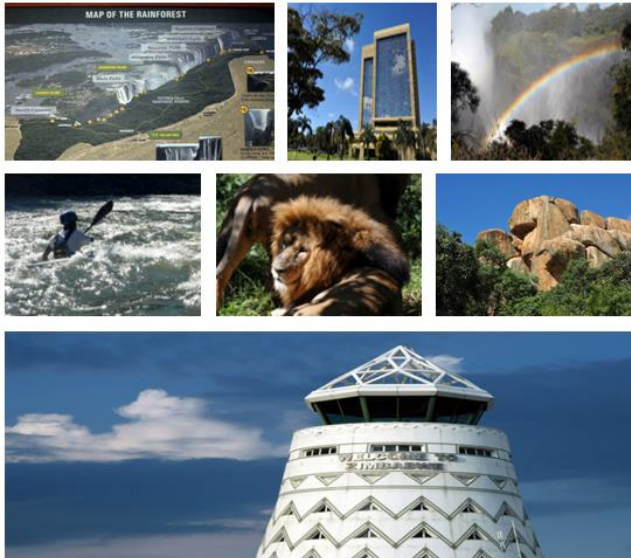
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