Dialysis Hygiene

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Abstract

Dialysis hygiene represents a comprehensive and evolving framework that goes beyond traditional infection-control practice to cover patient-centred, personnel-centred, machine-centred, environmental, metabolic, financial, and social dimensions of safety in kidney replacement therapy (KRT). With the increasing number of patients living on haemodialysis (HD) and peritoneal dialysis (PD), the need and complexities of maintaining an aseptic and functionally optimal dialysis environment have grown considerably. This article reviews the concept of dialysis hygiene, integrating universal precautions, vascular access care, dialysate and water-treatment hygiene, personal and caregiver hygiene, metabolic hygiene relating to glycaemia and electrolytes, and emerging domains such as "monetary hygiene" and "social hygiene."

Keywords: Dialysis, Haemodialysis safety, Infection control, Peritoneal dialysis, RO water, Ultrapure dialysate, Universal precautions, Vascular access care

DOI: https://doi.org/10.47391/JPMA.26-21

Introduction

Maintaining hygiene in dialysis unit has long been associated with infection control, viz. hand hygiene, use of personal protective equipment (PPE), surface decontamination, and safe aseptic handling of the bloodlines.[1,2] However, with expanding patient volumes and increasing comorbidities, the scope of "dialysis hygiene" has broadened significantly. Dialysis hygiene should include cross-disciplinary domains taking care of universal precautions, infrastructure safety, human-factor optimization, personal hygiene behaviours, metabolic stability, environmental sanitation, and socio-behavioural practices that influence patient outcomes. It encompasses not only the prevention of bloodstream infections (BSI), peritonitis, and hepatitis B and C transmission but also aims to ensure safety in vascular access handling, dialysate purity, water-treatment systems, reuse practices, skin integrity, nutritional considerations, and responsible economic and operational hygiene within dialysis units.[3-7] (Table 1) In this expanded conceptualization, dialysis hygiene becomes a holistic philosophy of safe and sustainable dialysis- balancing equipment/ laboratory standards with human responsibility, institutional systems with personal behaviour, and technical procedures with psychosocial determinants of health. It is a continuous, dynamic process involving patients, dialysate pathways, machines, technicians, caregivers, and the larger community ecosystem.

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At the core of "Dialysis hygiene" lies three interrelated pillars- biological hygiene (preventing transmission of pathogens, and ensuring environmental safety), technical hygiene (ensuring safe machinery, dialysate, and RO water), and behavioural hygiene (sustaining safe and protective habits among patients, caregivers, and staff). This multilayered model extends these pillars into several specific domains as described in Table 1. Maintaining hygiene among patients includes regular bathing, meticulous hand hygiene, nail care, clothing cleanliness, skin care, catheter exit-site cleanliness, and awareness of early warning signs of infection.[1,2,8] For patients on chronic ambulatory peritoneal dialysis (CAPD), CAPD peritonitis prevention depends on consistent hand hygiene, mask use, clean technique, and environmental cleanliness.[9] Both AV fistulae (AVF) and central venous catheters (CVC) require proper hygiene.[8] AVF care involves cleaning, avoiding trauma, and monitoring for infection.[10] Catheters demand sterile dressing changes, strict exit-site handling, and prompt evaluation for any signs of infection.[8-10] Moreover, patients must maintain metabolic hygiene through regular exercise, and dietary regulation for careful glycaemic control, appropriate protein intake, and electrolyte balance (Potassium, calcium, phosphate) to reduce metabolic derangements.[10-12] Psychological hygiene is essential to prevent dialysis distress and needs proper counselling of

Table -1: Dialysis hygiene- Conceptual domains and best practices.

Domain	Best Practices	
Patient Centred	Personal Patient Hygiene	-Regular bathing, clean clothing, hand hygiene, trimmed nails, skin care, access-site hygiene, avoid scratching access site
	Skin Hygiene	-Moisturization, prevention of xerosis, fungal infection control
	VA Hygiene	-AVF cleaning, catheter dressing care, use chlorhexidine preparation, avoiding trauma to fistula arm
	Psychological Hygiene	-Stress management, adherence motivation, alertness during dialysis, reducing dialysis distress
	Metabolic Hygiene	-Glycaemic control, weight control, electrolyte regulation, dietary hygiene, medication adherence, regular exercise
	PD Hygiene	-Mask & hand hygiene, clean separate room for exchange, exit-site care, early peritonitis warning recognition
HD Unit Centred	Machine Hygiene	-Heat/chemical disinfection, external wipe-down, leak checks, biofilm prevention, safe reuse station practices
	Dialysate Hygiene	-Ultrapure dialysate, endotoxin testing, bacterial culture, disinfecting mixing tanks, conductivity and temperature verification
	RO Water Hygiene	-Backwash & sanitization, cartridge prefilters, storage tank cleaning, conductivity & hardness checks, monthly bacterial/ endotoxin checks
	Dialysis Personnel Hygiene	-Hand disinfection, PPE use, needle safety, mental vigilance, strict protocol adherence, proper waste disposal
Socio-environmental	Caregiver Hygiene	-Handwashing, clean home environment, mask use during wound care, avoiding contamination during PD exchanges
	Social Hygiene	-Patient segregation during outbreaks, respiratory etiquette, reducing chair/ bed crowding, social acceptance
	Environmental Hygiene	-Waste management, airflow quality, green dialysis (responsible water use and minimise carbon footprint)
	Monetary Hygiene	-Ethical consumable use, timely budgeting, avoiding cost-cutting that compromises safety, health insurance coverage for PD and HDF

the patients with CKD for stress management and adherence motivation.[13]

Dialysis personnel must adhere to strict universal precautions, including proper hand disinfection, appropriate PPE, safe needle handling, access-specific protocols, and strict adherence to cleaning and equipment disinfection guidelines.[1,2,14] Personnel hygiene also encompasses mental hygiene- stress management, attentiveness to burnout, and maintaining vigilance in safety practices.[15] Dialysis staff must undergo periodic training in infection control, emergency protocols, and new hygiene practices as updated by Kidney Disease: Improving Global Outcomes (KDIGO) and national regulatory authorities.[1,2]

Dialysis machines are potential vectors for transmission if improperly disinfected. Routine chemical disinfection, heat disinfection cycles, internal pathway integrity checks, and external cleaning after each session are essential.[1,2] Reprocessing stations, where applicable, also require rigorous monitoring to ensure no cross-contamination. Dialysate purity has evolved into the concept of ultrapure dialysate, which is critical for reducing inflammation, preventing endotoxin exposure, and improving long-term outcomes.[4] The HD unit must be designed to minimize microbial spread. Floor drainage, high-quality ventilation, dedicated areas for reprocessing, and well-separated high-risk areas for HBV-positive patients are essential. Regular environmental audits ensure sustained compliance. Safe administration of heparin, erythropoiesis-stimulating agents, intravenous iron, and antibiotics requires sterile technique. Multi-dose vials should be avoided when possible.[16,17]

Family members and attendants must practice proper hand hygiene, maintain hygiene at home, and support environmental cleanliness for CAPD exchanges or post-dialysis wound care.[18] Social hygiene includes social acceptance of patients with CKD. It also includes patient segregation during outbreaks, respiratory etiquette, and minimizing crowding. Environmental hygiene is an extension to the concept of green dialysis, which promotes responsible water use through RO reject-water recycling for non-clinical purposes and optimization of machine energy consumption. It encourages biodegradable waste segregation, rational use of plastics, and environmentally safe disposal pathways for dialyzers, tubing, and chemical disinfectants, all contributing to an environmentally sustainable dialysis ecosystem.[19] An important dimension often ignored is monetary hygiene,

by ensuring ethical financial practices, appropriate resource utilization, timely procurement of consumables, and prevention of cost-driven compromise in safety.[20]

Conclusion

Dialysis hygiene is no longer a narrow operational concept- it is an expansive, multifaceted safety strategy that integrates personal behaviours, system processes, environmental safeguards, metabolic stability, and ethical operational practices. By adopting a holistic framework of dialysis hygiene, dialysis units can substantially reduce infections, improve vascular access survival, and enhance patient well-being and dignity. The long-term survival and quality of life of patients with ESKD depend significantly on consistent, comprehensive hygiene practices.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

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