National Institute of Longevity Elderly Sciences
NILES Journal for Geriatric and Gerontology
Abdel Rahman LAAR, Hand Hygiene
Volume 8, Issue 2
Review Article

Hand Hygiene as part of Infection Control at Hemodialysis Unit

Lamiaa Ahmed Abdel Rahim Abdel Rahman[1], Fouad Metry Atia Yousef [2], Eman Roshdy Mohamed [3]

1 Department of public health, Faculty of medicine, Sohag University
2 Department of Public Health and Community Medicine, Sohag university, Egypt
3 Public health and community medicine
Tel: +20 100 702 0275

Abstract:

Healthcare-associated infections represent a major risk to patient safety. Among haemodialysis (HD) patients, the first cause of hospitalization is infection. Similar to dialysis staff, HD patients are vulnerable to healthcare-associated infections owing to their prolonged and frequent exposures to many possible contaminants in the dialysis environment. The most important predisposing factors in this case include the extracorporeal nature of the therapy, the associated common environmental conditions, and the immune compromised status of HD patients. HD patients are exposed to different types of infections including bloodstream infections and blood-borne infections with hepatitis B virus, hepatitis C virus, and/or human immunodeficiency virus, localized infections of the vascular access, and airborne infections. Sources of infections include infected patients in addition to contaminated environmental surfaces, equipment, and water. Out of the proven increased potential for transmission of infections in HD settings, specific and stricter infection prevention and control measures were created and implemented and this was in addition to the usual standard precautions. One of the most common modes of transmission of healthcare-associated infections is the contaminated hands of healthcare workers. Hand hygiene is identified as the most important infection prevention intervention. Interventions to improve compliance with hand hygiene include providing enough sinks with soap dispensers, paper towels, hand lotions and alcohol-based hand rub placed at each patient station, continuous education and monitoring, along with regular feedback of surveillance results. Education and training and full awareness of infection control policies and procedures should be provided to all healthcare workers and should be repeated regularly.

Keywords: Hemodialysis; Hand hygiene; Infection control.

Receive Date : 16/9/2024	Accept Date: 12 /10/2024	Publish Date :1/3/2025

Introduction

Healthcare-associated infections comprise a major risk to patient safety. Among haemodialysis (HD) patients, the first cause for hospitalization is infection. As the case with dialysis staff, HD patients are vulnerable to healthcare-associated infections owing to their prolonged and frequent exposures to many possible contaminants in the dialysis environment. The increased risk in this case is mainly

Print ISSN 2636-3224
Online ISSN 2636-3232

due to 1) the immune-compromised status of this group of patients, 2) close proximity of these patients to other patients during receiving treatment in the HD facility, 3) prolonged and frequent blood exposure during HD treatments through vascular access (mainly catheters) and extracorporeal circuit (with many ports and connections), 4) frequent contact with healthcare workers (HCWs), who frequently move between machines and patients, 5) frequent exposure to hospitalization and surgery, and, the most important of these risk factors is 6) non-adherence to the recommended infection control practices **(1)**.

Infection is identified as the first cause of hospitalization in addition to being the second most common cause of mortality among HD patients. The most important means to achieve a healthy environment in dialysis units is infection control. Infection control acts mainly to prevent and avoid dissemination of infection among this group of immunocompromised patients. HD patients are exposed to different types of infections including blood-borne infections with hepatitis B virus, hepatitis C virus, and/or human immunodeficiency virus; localized infections of vascular access and bloodstream infections as well as airborne infections. Environmental surfaces, contaminated water, equipment, as well as infected patients are the sources of infections in this case **(2)**. And as outlined by Waheed and Philipneri in 2020, in case the recommended infection control practices are not followed in HD settings, the potential harm is high **(3).**

The most common mode of transmission of healthcare-associated infections is the contaminated hands of HCWs **(2)**. In fact, hand hygiene has been proven to be the most important intervention that can prevent infections **(1)**. Keeping in mind that a detailed discussion of all recommended infection control practices in HD units cannot be covered in a single article, we will focus on hand hygiene in this article.

Standard and transmission-based precautions

A two-level approach precautions to prevent the transmission of infectious agents in healthcare settings was recommended by Healthcare Infection Control Practices Advisory Committee (HICPAC) and Centers for Disease Control and Prevention (CDC), namely 1) Standard Precautions and 2) Transmission-Based Precautions. The basic level of infection control practices that should be applied in healthcare settings and with all patients, regardless of the suspected or confirmed infection status is Standard Precautions. The basis behind Standard Precautions was the principle that all mucous membranes, body fluids, blood, secretions, excretions (except sweat), and non-intact skin may contain transmissible infectious agents. The

Print ISSN 2636-3224
Online ISSN 2636-3232

elements of Standard Precautions include: 1) hand hygiene, 2) use of personal protective equipment (PPE) such as gown, gloves, mask, eye protection (face shield or eye goggles), and 3) handling of items including surfaces or equipment in the patient environment in a way which prevents transmission of infectious agents. New elements were added by the CDC to be considered as a standard of care which include a) respiratory hygiene/cough etiquette; b) use of masks for insertion of catheters; and c) safe injection practices **(2)**.

Transmission-Based Precautions are to be applied for patients known or suspected to be infected or colonized with infectious agents, including certain epidemiologically important pathogens which require additional control measures for effective prevention of transmission. Transmission-Based Precautions are categorized into: 1) contact precautions, 2) droplet precautions, and 3) airborne precautions **(2)**.

In addition to Standard Precautions and Transmission-Based Precautions, CDC recommended more strict measures to be applied in HD settings, including non-sharing of instruments, supplies, medications, and medication trays between patients, as well as prohibiting the use of a common medication cart **(4)**. Owing to the previously discussed risk factors for increased risk of infection among this group of patient, strict implementation of Standard Precautions and mainly hand hygiene represents an essential measure of infection prevention and control **(5)**.

Hand hygiene as part of standard precautions

The CDC recommends implementation of standard precautions in all patient care settings. Important components in prevention of spread of infection from patient to another and protection of health care providers include hand hygiene and use of PPE **(3)**.

The contaminated hands of HCW is the most common mode of transmission of healthcare-associated infections. A five-step sequence resulting in microbial transmission through contaminated hands during healthcare delivery was described by Pittet and colleagues **(6)**. These steps are “1) pathogens shed by infected patients contaminate surrounding environments, 2) following contact with patient skin or surrounding environment, HCW’s hands become contaminated, 3) pathogen remains viable on the HCW’s hands for some minutes 4) HCW may neglect hand decontamination or use inappropriate procedure or product for decontamination, and 5) pathogen can be transferred through HCW’s contaminated hands either directly to another patient or indirectly on objects or a medical device within the patient’s

Print ISSN 2636-3224
Online ISSN 2636-3232

immediate vicinity". A number of previous studies have declared the main route of transmission of healthcare-associated infections to be the transiently contaminated hands of the HCW. This explains why hand hygiene is identified as the most important intervention for infection prevention **(4)**.

The term "hand hygiene" involves both handwashing using either plain (ie, non-antimicrobial) soap and water or antiseptic-containing soap and water in addition to the use of alcohol-based hand rubs (ABHRs). ABHRs are readily accessible and easier to use, in addition to being effective in reducing microorganisms on the hands of HCW. ABHRs have also been found to result in less skin irritation when compared to handwashing with soap and water **(3)**.

Indications of hand hygiene at HD facilities

There are multiple important opportunities for hand hygiene at HD facilities. The World Health Organization (WHO) recommends 5 opportunities for hand hygiene as follows: before touching a patient, before clean/aseptic procedure, after body fluid exposure, after touching a patient and after touching patient surroundings **(3)**.

Table (1): Recommended situations for hand hygiene at HD units (3)

Prior to touching a patient	• Before entering patient station • Before touching vascular access site
Prior to aseptic procedures	• Before accessing dialysis catheter • Before preparing parenteral medication
After body fluid exposure	• After handling used dialyzers • After performaning dressing changes
After touching a patient	• When leaving dialysis station • After removing gloves
After touching patient surroundings	• After touching dialysis machine • After using chairside computers for charting

Print ISSN 2636-3224
Online ISSN 2636-3232

Table (2): Hand hygiene indications as recommended by Association for Professionals in Infection Control and Epidemiology (APIC), CDC and WHO (4)

APIC	CDC	WHO
1. Just before touching a patient	- Before touching a patient, even if gloves will be worn - Prior to performing an aseptic task (e.g., placing an IV, preparing an injection)	- Before touching a patient - Before clean/aseptic procedure
2. After touching blood, body fluids, secretions, excretions and contaminated items (including front of the HD machine)	- After contact with blood, body fluids, excretions, or wound dressings	- After body fluid exposure risk
3. Before leaving a patient station	- Before exiting the patient's care area after touching the patient or the patient's immediate environment	- After touching a patient - After touching patient surroundings
4. Before accessing or restocking supplies	- If hands will be moving from a contaminated-body site to a clean-body site during patient care	
5. After gloves are removed	- After glove removal	

Hand hygiene methods

The preferred hand hygiene method, according to the CDC and WHO recommendations, is the use of ABHRs. However, there are some situations when handwashing with soap and water is required: (1) when there is visible dirt or soiling of hands with blood or other body fluids, and (2) if there is strong suspicion or proof of potential exposure to spore-forming pathogens (eg, C difficile, which is highly resistant to ABHRs). At any dialysis facility, hand hygiene should be performed multiple times during an HD session. It is important that each HD facility is equipped with enough number of easily accessible ABHR dispensers in addition to clearly identified hand washing sinks with soap, water, and appropriate drying methods **(3)**.

Print ISSN 2636-3224
Online ISSN 2636-3232

Monitoring of hand hygiene

As a main component of infection control measures, regular monitoring of hand hygiene practices is essential to ensure successful outcomes at any HD facility. Regular observation of all staff at the HD facility, including physicians, should be performed. Moreover, regular and constructive feedback regarding compliance should be delivered to staff. Education of patients in HD facilities on proper hand hygiene practices is of great concern. This can help patient engagement in observation of hand hygiene practices among staff in addition to creation of a culture in which everyone, including patients, is encouraged to contribute to the maintenance of dialysis safety **(3)**.

Inevitable causes possibly standing behind the break in implementation of recommended infection prevention and control practices include: 1) understaffing with low nurse to patient ratio **(**7**)** , 2) frequent turn-over of nursing staff **(8)** , 3) inadequate or missing training resulting in incompetency of HD staff **(9)**, 4) inadequate or missing patient/family education, 5) lack of adequate necessary supplies/equipment, including adequate clean sinks and/or ABHRs, soap and towels, 6) poorly designed HD unit lay-out (congested and inadequate segregation/isolation) **(10)**, and 7) the urgent status associated with dialysis complications (sometimes life-threatening situation) which may sacrifice adherence to standard precautions **(9)**.

An important note here is that the compliance rate of HCWs with hand hygiene practices is very poor, with an overall average of 40% or less. The estimated number of times a single dialysis staff is required to perform hand hygiene per HD session per patient, as per hand hygiene indications per recommendations from APIC, CDC and WHO, is approximately 30 times. This number can reach a minimum of 60 to 100 times when multiplied by the number of patients assigned per staff (e.g., 2 - 3 patients). The large number of times an HD staff is required to perform hand hygiene might be the reason for lack of compliance **(4)**. However, continuous education, supervision and monitoring of hand hygiene behaviors can improve compliance, keeping in mind that monitoring of hand hygiene behaviors represents the most effective method in improving performance **(11)**.

Print ISSN 2636-3224
Online ISSN 2636-3232

Table (3): Estimated minimum number of times where hand hygiene is required per dialysis session per patient (regardless of gloves use) (5)

Activity	Before	After	Total
Accessing supplies from common clean storage area	1	-	1
Preparing/setting-up the HD machine	*	1	1
Preparing/administering medications (including for anticoagulation)	1	1	2
Pre-dialysis: measuring vital signs/weighing	*	1	1
Preparing trolley/tray for cannulation	*	1	1
Palpating clean cannulation sites	*	1	1
Skin preparation & cannulation of arteriovenous access (AVF, AVG)	*	1	1
Preparing trolley for catheter dressing**	*	1	1
Removing old dressing over catheter site**	-	1	1
Catheter exit site dressing**	*	1	1
Connection for HD	1	1	2
Handling blood samples and other specimens	-	1	Minimum 1
Checking blood pressure (every 1/2 - 1 hour for 4 hours)	1	1	Minimum 8
Catheter/blood lines manipulation	1	1	Minimum 2
Adjusting machine parameters and/or attending machine alarms	-	1	Minimum 1
Attending to patient's incidents/assisting patient	1	1	Minimum 2
Prepare trolley for dialysis disconnection	1	-	1
Disconnection of HD	1	1	2
Post-dialysis: measuring vital signs/weighing	*	1	1
Cleaning/disinfection of dialysis equipment	*	1	1
Leaving the dialysis unit	1	-	1
Total estimated minimum number of times hand hygiene is required per dialysis per patient			~30

*Most of the time, the activity is recently preceded by a hand hygiene performed at the end of one procedure/activity (between two different activities). Therefore, repetition of hand hygiene prior to an activity (wherein performance of hand hygiene is indicated per recommendation) is unnecessary **(5)**

Print ISSN 2636-3224
Online ISSN 2636-3232

Monitoring hand hygiene compliance is essential and direct observation is its present gold standard method. However, several limitations might hinder direct observation. These include the small sample size (may cover only 1% of total hand hygiene activity), being labor intensive, in addition to being non-standardized. The Computational Epidemiology Research Group at the University of Iowa has developed a new model device application (the "iScrub Lite", which is available for free download on the Apple iTunes store for Apple® iPhone or iPod). This application can facilitate the work of the Infection Preventionist (IP) through recording the observations, which can be loaded to an excel spreadsheet for further analysis. The number of hand hygiene activities (10 to 50 thousand per month) in each department, floor or unit can be monitored using advanced technologies, with automated electronic devices and software (Real Time Location System). Furthermore, these technologies can monitor and identify the HCW performing the hand hygiene through wristband or badge detection, with identification of the time of day and day of the week hand hygiene activity is performed. Feedback/cueing is also provided to encourage proper hand hygiene **(12)**.

Compliance can also be improved by providing enough number of sinks with soap dispensers, hand lotions (e.g., one for every 2 - 4 dialysis stations), paper towels, and ABHR placed at each patient's station. And all these aforementioned requirements should be placed in convenient locations. ABHR is recommended to be used in all clinical situations if hands are not visibly soiled wing to the ease of use, proven superior efficacy in decontamination, and better skin tolerability. In case of suspected or proven exposure to bacterial spores (i.e., bacillus anthracis and/or clostridium difficile), hand washing with soap and water is recommended, as spores requires physical removal by washing then rinsing and are resistant to most antiseptic agents **(4)**. Other preventive measures include avoiding long nails and placing of artificial fingernails or extenders by HCW who provide direct patient care, as artificial nails could be the harbor of yeasts and gram negative bacilli **(13)**.

List of abbreviations

ABHRs	Alcohol-Based Hand Rubs
APIC	Association for Professionals in Infection Control and Epidemiology
CDC	Centers for Disease Control and Prevention
HCW	Healthcare Worker
HD	Hemodialysis
HICPAC	Healthcare Infection Control Practices Advisory Committee
PPE	Personal Protective Equipment
WHO	World Health Organization

Print ISSN 2636-3224
Online ISSN 2636-3232

References:

1. **Karkar A (2018).** Infection control guidelines in hemodialysis facilities. Kidney Research and Clinical Practice ;37(1):1–3.
2. **Pittet D, Dharan S, Touveneau S, Sauvan V, Perneger TV (1999).** Bacterial contamination of the hands of hospital staff during routine patient care. Archives of Internal Medicine ;159:821–826.
3. **Waheed S, Philipneri M (2020).** Targeting zero infections in the outpatient dialysis unit: Core curriculum. American Journal of Kidney Diseases ;76(1):130-140.
4. **Karkar A (2016).** Hand hygiene in hemodialysis units. Open Access Library Journal; 3(8):1-15.
5. **Karkar A, Bouhaha MB, Dammang ML (2014).** Infection control in hemodialysis units: A quick access to essential elements. Saudi Journal of Kidney Diseases and Transplantation; 25:496-519
6. **Pittet D, Allegranzi B, Sax H, Dharan S, Lúcia Pessoa-Silva C, Donaldson L, Boyce JM (2006).** Evidence-based model for hand transmission during patient care and role of improved practices. On behalf of the WHO global patient safety challenge and world alliance for patient safety. The Lancet Infectious Diseases; 6:641-652.
7. **Harbarth S, Sudre P, Dharan S, Cadenas M, Pittet D (1999).** Outbreak of Enterobacter cloacae related to understaffing, overcrowding, and poor hygiene practices. Infection Control and Hospital Epidemiology; 20:598-603.
8. **Cimiotti JP, Aiken LH, Sloane DM, Wu ES (2012).** Nurse staffing, burnout, and healthcare-associated infection. American journal of Infection Control; 40: 486-490.
9. **Efstathiou G, Papastavrou E, Raftopoulos V, Merkouris A (2011).** Factors influencing nurses' compliance with standard precautions in order to avoid occupational exposure to microorganisms: A focus group study. BioMed Central Nursing; 10:1.
10. **Oliveira AC, Cardoso CS, Mascarenhas D (2010).** Contact Precautions in intensive care units: Facilitating and inhibiting factors for professionals' adherence. Revista da Escola de Enfermagem da USP; 44:161-165.
11. **Allegranzi B, Gayet-Ageron A, Damani N, Bengaly L, McLaws ML, Moro ML, Memish Z, Urroz O, Richet H, Storr J, Donaldson L, Pittet D (2013)**. Global implementation of WHO's multimodal strategy for improvement of hand hygiene: A quasi-experimental study. The Lancet Infectious Diseases; 13:843-851.
12. **Hedderwick SA, McNeil SA, Lyons MJ, Kauffman CA (2000).** Pathogenic organisms associated with artificial fingernails worn by healthcare workers. Infection Control and Hospital Epidemiology; 21:505-509.
13. **Boyce JM, Pittet D (2002).** Guideline for hand hygiene in health-care settings: Recommendations of the healthcare infection control practices advisory committee and the HICPAC/SHEA/APIC/IDSA hand hygiene task force. Morbidity and Mortality Weekly Report; 51:1-44.

Print ISSN 2636-3224
Online ISSN 2636-3232