PERSONAL PROTECTIVE EQUIPMENT IN THE HAEMODIALYSIS UNIT

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GUIDELINES

a. We recommend that personal protective equipment should be used as part of a comprehensive approach that addresses the promotion of hand hygiene, environmental hygiene, reduction of opportunities for cross-contamination through modification of the environment and care practices, reduction of burden of disease in the patient population and reduction of susceptibility of patients to become colonised or infected if exposed to the infectious agent and reduction. (1D)
b. We recommend that haemodialysis units must have an adequate supply of personal protective equipment (variety of medical gloves accommodating allergies and size variations, aprons, gowns, protective eyewear and masks/face shields) available at the point of use. (1D)
c. We recommend that gloves, gown, protective eyewear and face mask/shield should be used when assisting patients to commence and finish haemodialysis treatments and at other times when the risk of exposure to blood or other potentially contaminated body fluids is high. (1D)
d. We recommend that personal protective equipment should be removed and hand hygiene performed between each new patient contact in line with the “5 moments of hand hygiene.” (2D)
e. We recommend that sterile gloves, apron/gown, face masks and goggles or face shield should be worn when inserting or manipulating central venous dialysis catheters using aseptic technique. (1D)
f. We suggest that at times when the risk of spread of significant organisms (e.g. multdrug resistant organisms, influenza or norovirus) from colonised or infected patients is high and clinically relevant consequences of transmission have been demonstrated, it may be appropriate to mandate that staff wear additional personal protective equipment targeted to the mode of transmission during all contacts with colonised or infected patients. (2D)

UNGRADED SUGGESTIONS FOR CLINICAL CARE

We suggest that all dialysis units have a protocol/guideline for the management of patients outlining:
- Standard transmission based precautions
- Clinical situations requiring the use of personal protective equipment
- System for training staff in the correct use of personal protective equipment (including selection, donning and doffing)
- Process for auditing compliance with personal protective equipment protocols
- Delegation of responsibility for personal protective equipment selection, storage and ordering.

IMPLEMENTATION AND AUDIT

The use of standard precautions is the primary strategy used for minimising the risk of transmission of disease. The risk of transmission is minimised by the implementation of effective work practices, including appropriate use of both standard and transmission based precautions [1]. Selection of personal protective equipment (PPE) is based on the type of patient interaction, known or possible infectious agents, and/or the likely mode of transmission.

Protocols/guidelines for the use of PPE should be developed and adopted when there is an agreement between nephrology, infection control, infectious diseases and/or microbiology staff. The
protocol/guideline should be based on facility demographics, with a detailed understanding of the prevalence, transmission patterns, clinical relevance of infectious agents, and human and physical resources (staffing, workload, workflow patterns and the environment) in each individual dialysis unit. International and national guidelines are available to guide clinical decision making. Regular review of prevalence data (local and national) and available literature is necessary to ensure practices are consistent with evidence-based standards.

BACKGROUND

Healthcare associated infections can occur in any environment that provides healthcare to patients. Haemodialysis centres provide high-level care to a compromised patient population, given the environment and type of clinical care delivered there is a risk of disease transmission. Standard precautions are the system of infection control practices that apply to all patients regardless of their known or suspected infection (or colonisation) status [1]. They are designed to minimise the risk of transmission and protect both patients and healthcare workers [2].

- The environment of the haemodialysis unit promotes repeated, prolonged and unavoidable contact within a confined space both between members of the patient cohort and between patients and staff.
- The prevalence rate of colonisation of patients with multidrug resistant organisms (MROs) in dialysis units has been often high as a consequence of the high burden of comorbidities, high rates of hospitalisation and high rates of antibiotic exposure amongst its clients [3].
- MROs that are commonly found in dialysis populations are transmitted by direct and indirect contact [1].
- Cannulation, connection and disconnection of high flow and high-pressure dialysis circuits is a risk for accidental body fluid exposure [3].
- Colonisation or infection with certain significant organisms and infectious agents (e.g. Hepatitis B, C, HIV and Staphylococcus aureus) have been associated with significant morbidity, mortality and cost to the community [4, 5].

SEARCH STRATEGY

Databases searched: MeSH terms and text words for haemodialysis were combined with MeSh terms and text words for chronic kidney disease, housekeeping (hospital), sterilisation, disinfection, decontamination, disinfectants, cleaning, PPE and then combined with text words for meta-analysis, randomised controlled trial, case control, cross sectional and cohort studies. The search was carried out in Medline (1946 – November Week 3, 2014).

Date of search/es: 22 December 2014.

WHAT IS THE EVIDENCE?

Infection prevention and control aims to reduce the development of healthcare associated infection, including organisms of significance and to minimise their risk of transmission through the application of safe work practices including standard and transmission based precautions and isolation [1, 6]. It is recognised by the broader infection prevention and control community that just as there is no single cause of infection, there is no single solution.

Effective Use of PPE:

The effective use of PPE is based on the well-established principle that placing a clean physical barrier between a potential source of infection and a person’s skin/mucous membranes/clothes/accessories will decrease the likelihood that infectious agents will be transferred onto these surfaces if they come into direct contact with patients’ skin, clothes or body fluids during the delivery of care. Although, there is no randomised controlled trial evidence to support this, there is a relatively large bank of prospective cohort studies to support the use of PPE. These studies demonstrate a reduction in levels of a variety
of infectious agents grown from swabs taken off the skin and clothes of staff members when the swabbed area has been covered with an item of PPE compared to when no appropriate PPE barrier had been in place [7-9].

There is no data available showing reduction in clinically relevant end points such as rates of infection or mortality specifically attributable to PPE use. The role of PPE in preventing transmission of infection or controlling outbreaks of infection in haemodialysis units has always been investigated as part of a multifaceted approach. Involving other strategies that include: promotion of hand washing before and after contact with each patient, thorough cleaning of the general environment, including the dialysis station between each sessions, avoiding the reuse of items designed for single use, sterilising and maintaining dialysis machines, associated water treatment units and circuits according to manufacturers’ instructions, screening programmes to identify colonised/infected patients, isolation in a dedicated environment with dedicated staff caring for colonised/infected patients with similar organisms, isolating dialysis machines used for patients with blood borne infections, decolonisation programmes (e.g. nasal mupirocin for S. aureus nasal carriers), vaccination programmes (e.g. Hepatitis B), treatment of infected patients and antibiotic stewardship programmes where relevant [10-20].

In order to be effective, PPE items need to be used in accordance with the well-established principles of infection control [21]:

- Attend hand hygiene
- Selection of PPE is based on contact anticipated and risk of contact.
- Don PPE before entering the patient’s room/dialysis station in the following order: apron/gown, mask and goggles/face shield then gloves.
- Don PPE in such a way as to create an intact and if necessary waterproof barrier, which is durable and well fitting. Remove and replace PPE if the barrier is breached e.g. torn/punctured at any time.
- Removal (doff) of PPE in a manner to avoid contamination of uniform before leaving the patient’s room or dialysis station in the following order: Gloves, apron/gown, attend hand hygiene prior to removal of face shield/goggles and mask.
- Attend hand hygiene
- Change PPE after each individual patient contact and/or if severely soiled.

Risks Associated with PPE Use:

Mandating use of PPE comes at a cost which needs to be weighed against potential benefits. PPE items incur monetary costs for their acquisition and disposal, require space for storage and disposal, increase the time required to deliver care as PPE items are repeatedly donned and removed, may interfere with care provision, may negatively affect the clinician-patient relationship [22] and have negative impacts on the general environment. However, the use of PPE aims to reduce the development of healthcare-associated infection, including organisms of significance and to minimise their risk of transmission through the application of safe work practices [1].

WHAT DO THE OTHER GUIDELINES SAY?

All international and local guidelines recommend the use of PPE equipment in line with standard and transmission based precautions in providing healthcare. Given the complexities of haemodialysis, all patients should be managed in line with standard precautions. It is acknowledged that PPE is of assistance in a range of circumstances, if the risk of transmission of an agent is particularly high and the consequences of becoming infected or colonised are particularly severe.

Kidney Disease Outcomes Quality Initiative: No recommendations.

UK Renal Association:
Blood borne virus infection guideline [23]
Guideline 1.1 – BBV Infection: Prevention of spread to patients and staff in the renal unit (Universal precautions)
We recommend that infection-control procedures should include hygienic precautions that effectively prevent the transfer of blood or fluids contaminated with blood between patients either directly or via contaminated equipment or surfaces (often referred to as “universal precautions”). (1A)

**Canadian Society of Nephrology:**

**The prevention of transmission of blood-borne pathogens in hemodialysis patients (2005) [24]**

3.3 Recommendations to prevent the transmission of hepatitis C virus in hemodialysis patients.

3.3.1 Strict adherence to good infection control practice is required to prevent nosocomial transmission of HCV in hemodialysis units.

**European Best Practice Guidelines:** No recommendations.

**KDIGO:**

**Guideline for the prevention, diagnosis, evaluation and treatment of hepatitis C in chronic kidney disease [25]**

3.1 Hemodialysis units should ensure implementation of, and adherence to, strict infection-control procedures designed to prevent transmission of blood-borne pathogens, including HCV. (Strong)

3.2 Infection-control procedures should include hygienic precautions (Tables 18 and 19) that effectively prevent the transfer of blood—or fluids contaminated with blood—between patients, either directly or via contaminated equipment or surfaces. (Strong)

**CDC**

**Recommendations for preventing transmission of infections among chronic hemodialysis patients (2001) [21]**

ii) Infection control

- Glove use whenever any patient or hemodialysis equipment is touched and glove changes between each patient (and station).

**Local guidelines**

**Queensland Health recommended practices – Guideline for the prevention and control of infections in dialysis settings (2003) [26]**

**Hand Hygiene**

- All staff should cover cuts and abrasions with waterproof dressings. Staff who come into direct contact with patients or dialysis machines, who have extensive untreated cuts or chronic skin disease, such as eczema, should not work in dialysis units when their skin lesions are active, or if there is extensive breaks in the skin surface.
- Staff who provide direct hands-on care to patients should not wear artificial fingernails or extenders.
- Hand hygiene facilities should be located as close as possible to the point of contact with patients and dialysis equipment:
  - one Type A clinical hand wash basin should be provided for every three dialysis stations in the main dialysis area and a minimum of one Type A clinical hand wash basin in an isolation room.
- Appropriate hand hygiene supplies (including dispensers and brackets) should be available at all hand wash basins, including:
  - non-antimicrobial soap solution
  - antimicrobial soap solution:
    - an antimicrobial soap is recommended (1) prior to clinical and surgical procedures where it is important to reduce bacterial counts as low as possible, and/or (2) to reduce cross transmission of multi resistant organisms.
    - hand moisturising agent (lotion or cream) to minimise irritant contact dermatitis
    - paper towel (preferably interleaved) for hand drying.
- The soap solution should be provided in dispensers with disposable cartridges or single-use bottles, to prevent bacterial contamination of the product.
- Hand moisturising agents should be compatible with other hand hygiene products e.g. Chlorhexidine gluconate, and gloves being used in the facility.
- Alcohol-based hand hygiene products should be placed at the point of patient contact (unless contraindicated), for example:
next to each patient’s bed or dialysis chair
attached to the frame of patient’s beds
near the door to each patient room/bay
staff stations or chart and medication trolleys.

- To avoid any confusion between soap and alcohol-based hand hygiene products, alcohol dispensers should not be placed adjacent to sinks.
- It is important to reinforce that hands should be rubbed together after application of the alcohol-based hand hygiene product until all the alcohol has evaporated before engaging in other activities.

### Personal Protective Equipment (PPE)
- There should be adequate supplies of PPE available at the point of use.

#### Gloves
Non-sterile, disposable gloves made of a variety of materials (e.g. latex, vinyl, nitrile, neoprene) are available for routine patient care.
- Gloves should be stocked in several sizes and located in dispensers at the point of patient contact.
- Heavier, reusable utility gloves can be used for handling and cleaning contaminated equipment or surfaces.
- Clean, single use non-sterile gloves are required when contact with blood or body fluids is anticipated; this includes contact with patients and dialysis equipment.
  - gloves should be changed and hand hygiene performed between patients and/or stations
  - gloves must also be changed and hand hygiene performed between different activities on the same patient (e.g. moving from a contaminated to a clean body site)
  - gloves should not be washed or alcohol based hand hygiene product applied for subsequent reuse
  - gloves should be worn for any cleaning activities.

#### Eye/Face Protection
- Face protection (eyewear/goggles, masks, face shields) is required when performing procedures that may generate splashes or sprays of blood or body fluids. Personal eyeglasses and contact lenses are not considered adequate eye protection.
- Appropriate face protection should be selected based on the anticipated level of exposure.
- Masks come in various shapes, sizes, filtration efficiency, and method of attachment (e.g. ties, elastic, ear loops). Different types of masks may need to be supplied based on individual HCW needs.
- Eye protection (goggles) should allow for sufficient peripheral vision, be adjustable to ensure a secure fit, and incorporate indirect air flow properties to reduce fogging.
  - disposable or non-disposable face shields may be used as an alternative to goggles.

#### Aprons/Gowns
- Plastic aprons are indicated to prevent contamination of the HCW’s clothing with blood, body fluids, MRO’s and other potentially infectious material.
- Aprons and/or gowns should be provided in several sizes and at the point of patient contact.
- A long-sleeved, fluid-barrier (impervious) gown should be worn if exposed areas of the body e.g. arms, body front, are likely to be contaminated by blood, body fluids or MRO’s.
- All PPE (with the exception of eyewear/goggles unless soiled) should be changed and hand hygiene performed between attending different patients.
- PPE should be changed at the earliest opportunity if it becomes contaminated with blood or body fluids.
- PPE should be removed immediately on leaving the work area in a manner that prevents contamination of the wearer’s clothing or skin.

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**South Australia Statewide Renal Clinical Network – Blood borne virus working group**

**Management of haemodialysis patients with a blood born virus [27]**

**General Principles**

These principles apply to ALL patients attending haemodialysis centres
Hand Hygiene
Alcohol based hand gels or rubs (with 60-80% v/v ethyl alcohol or equivalent isopropanol) are the most effective method for decontaminating the hands. They should be used for hand hygiene when hands are not visibly soiled. Visibly soiled hands should be washed with soap and water.
Staff must perform hand hygiene in accordance with the principles of the ‘5 moments’ for hand hygiene and SA Health Hand Hygiene Policy Directive and Guidelines.
The 5 moments include:
- Before touching a patient
- Before a procedure
- After a procedure or blood / body fluid exposure risk
- After touching a patient
- After touching a patient’s surroundings

Hand hygiene should also be performed after removal of gloves and / or personal protective equipment.

Personal Protective Equipment
There should be adequate supplies of personal protective equipment (PPE) available at the point of use. This should include:
- Clean, non-sterile gloves are required when contact with blood and body fluids is anticipated and includes contact with patients and dialysis equipment.
- Gloves should be worn for any cleaning activities.
- Face protection (face shield) is required when initiating and terminating a patient from dialysis and where there is any risk of splashing or spray of blood. Prescription glasses do not provide adequate protection.
- Plastic aprons are indicated to prevent contamination of the health care worker’s (HCW’s) clothing with blood, body fluids and other potentially infectious material.
- All PPE (face wear excluded) should be changed between patients/stations and removed immediately prior to leaving the work area.

South Australia Statewide Renal Clinical Network – Vancomycin Resistant Enterococci (VRE) and Methicillin-resistant Staphylococcus aureus (MRSA) Screening and Management in the Adult Renal Patient Population Clinical Guideline [28] All patients regardless of their infectious status will require the use of standard precautions.
Standard precautions include the following practices:
  - Alcohol based hand gels or rubs (with 70% v/v ethyl alcohol) are the most effective method for decontaminating the hands. They should be used for hand hygiene when hands are not visibly soiled.
  - Visibly soiled hands should be washed with soap and water.
  - Staff must perform hand hygiene as per Hand Hygiene Australia 5 moments of hand hygiene.
  - A clinical hand basin should be provided within close proximity to the patient.
  - Alcohol based hand gels should be made available for staff and patients in each clinical area and each dialysis station.
  - All patients and visitors should be strongly encouraged to perform hand hygiene on entry and exit to the clinical area.
- Use of aseptic technique where required
- Use of personal protective equipment (PPE) according to risk of body fluid exposure
- Environmental controls including cleaning and spills management.
- Appropriate reprocessing of re-useable instruments and equipment
- Safe handling and disposal of sharps and potentially infectious material
- Safe handling of waste and linen
- Personal hygiene (including respiratory hygiene and cough etiquette)
Transmission Based Precautions - Contact Precautions
Contact precautions should be used when there is a risk of direct or indirect contact transmission of VRE and MRSA and may include the following elements:

Whilst a ward inpatient in a hospital:
- Appropriate use of PPE for contact precautions (i.e. gown or apron, and gloves)

Management of VRE positive patients according to renal service settings - Satellite Haemodialysis Units and Country Haemodialysis Units
Personal Protective Equipment (PPE) is only required to be worn where there is known or potential risk of exposure to blood and body fluids (i.e. cannulation / connection / disconnection).

Management of the MRSA patients in different renal service settings.
Personal Protective Equipment (PPE)
- Staff caring for the patient or touching the patient’s equipment at the dialysis station must wear non-sterile disposable gloves and a long sleeved gown or apron. The choice of sleeve length depends on the procedure being undertaken and the extent of risk of exposure of the healthcare worker’s arms. If an apron is used, it is important to ensure that wrists and forearms are included in the hand hygiene procedure. All wrist jewellery and long sleeved clothing must be removed prior to the procedure to ensure hand hygiene can be performed adequately.
- All PPE must be removed and discarded prior to leaving the station.
- If MRSA patients have been cohorted, staff must change PPE and perform hand hygiene between caring for the individual patients.
- Other PPE (e.g. mask, waterproof apron) should be used as required by standard precautions.
- Hand hygiene should be performed before donning and after doffing PPE.

SUGGESTIONS FOR FUTURE RESEARCH
There is a clear need for prospective studies, with meaningful clinical level outcomes that investigate the effectiveness of PPE in the prevention and control of nosocomial transmission of infection in haemodialysis units. These studies should examine the use of PPE in isolation rather than in a bundle of infection control measures, where appropriate.

CONFLICT OF INTEREST
Carolyn van Eps and Belinda Henderson have no relevant financial affiliations that would cause a conflict of interest according to the conflict of interest statement set down by KHA-CARI.
REFERENCES


