Nursing care of central venous catheters

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Author: Pamela Lopez-Vargas, Kevan Polkinghorne

GUIDELINES

a. Highly permeable transparent, transparent polyurethane or gauze dressings are all appropriate for use on exit sites of central venous lines used in haemodialysis. (Level I evidence)

b. Long term central venous line dressings should be changed weekly or sooner if soiled or no longer intact. (Level II evidence)

SUGGESTIONS FOR CLINICAL CARE
(Suggestions are based on Level III and IV evidence)

- Chlorhexidine impregnated dressings should be used to reduce catheter related bacteraemia compared to standard dressings.
- Preferably a transparent dressing should be used to protect the exit site as it allows for clear visibility and assessment of the site.
- If there is bleeding or oozing, it is suggested a dry dressing is used until this is resolved.
- It is suggested the dressing be changed on a weekly basis to reduce irritation of the skin and minimize the introduction of foreign agents. The dressing should be changed sooner if it becomes soiled or loose.
- It is suggested adequate hand hygiene is maintained with the use of alcohol based hand rub or other agent if contraindicated.
- Aseptic technique should be maintained at all times when accessing or dressing the central venous site.
- It is suggested that this guideline is used in conjunction with the KHA-CARI guideline on prevention of dialysis catheter infection.

IMPLEMENTATION AND AUDIT

1. Comparison between transparent, gauze and no dressing and catheter-related bacteraemia, exit-site infection and tunnel infection.
2. Comparison between frequency of dressing changes (3 times a week or weekly) to see incidence of catheter-related infections and skin irritation.
3. Monitor hand hygiene and catheter-related infections.
4. Monitoring catheter-related bacteraemia.

BACKGROUND

Patients who are eligible for haemodialysis need to have some type of venous access for dialysis to take place. The preferred access type is the arteriovenous fistula, followed by the arteriovenous graft.[1-3] However when these access types are not possible a central venous catheter (CVC) is used instead. The main issue with patients dialyzing with central venous catheters is that they are more prone to catheter-related infections which are in turn associated with higher morbidity, mortality and cost [4-7].
In Australia (57%) and in New Zealand (69%) of patients commence haemodialysis through a central venous catheter (tunneled and non-tunnelled)[8]. The mortality rate for patients commencing haemodialysis with a CVC, is higher than for patients commencing with an AVF or AVG, for all age groups [9]. Similar trends have been identified in the US, where over the past decade, the rate of hospitalizations due to bacteraemia/sepsis have increased. The increased use of cuffed-catheters as the most common access at the first dialysis, reached 64.8% in 2008 [10].

The majority of organisms responsible for catheter-related bacteraemia (CRB) are Gram-positive (52-84%), where Staphylococcus aureus accounts for 21 to 43% and methicillin-resistant S. aureus is reported in 12 to 38% of cases [11-15] S. aureus is associated with more than three times greater rate of infectious complications, and a four times greater risk of recurrent bacteremia or septic death in 3 months, compared to other microbiologic isolates.[16]. Methicillin resistant staphylococcus aureus has been associated with greater cost and up to five times higher mortality compared with methicillin sensitive strains.[17]

Serious infectious complications occur in 3-44% of cases and include: endocarditis (3-17%)[11, 12, 15, 16, 18] osteomyelitis (1.5-15%)[15, 16, 18]; septic arthritis (2-5%)[11, 15]; large atrial thrombi and spinal epidural abscess have occurred in rare occasions [19-25]; and death (6-34%). [14, 16, 26-29] Risk factors identified for CRB include: poor patient hygiene, previous CRB, S. aureus nasal carriage, immunocompromised status, diabetes mellitus, recent hospitalization, longer duration of catheter use, inadequate dialysis, hypoalbuminemia, atherosclerosis and hypertension[15, 30-33]

Prophylactic measures are essential to minimize catheter-related bacteremia (CRB). These interventions include: 1. the use of topical antimicrobial ointments at the catheter exit-site 2) the use of prophylactic catheter locking solutions 3) strategies for management of the catheter in CRB and 4) the use of vascular access managers and quality initiative programs [4, 10] Patients and haemodialysis staff should follow universal precautions and hygienic measures [10].

The objective of this guideline is to identify the best type of dressing to be used at the catheter exit site of adult haemodialysis patients, the frequency in which dressings should be replaced and the appropriateness of cleansing solutions to maintain good hand hygiene.

**SEARCH STRATEGY**

**Databases searched:** MeSH terms and text words for central venous catheters were combined with MeSH terms and text words for dressings, transparent dressings, and gauze and tape, and combined with MeSH terms and text words for wound infection, bacterial infection and catheter infection and then combined with Cochrane highly sensitive search strategy for randomised controlled trials. MeSH terms and text words for renal dialysis, hemofiltration, dialysis and end-stage renal disease were also added to the search to identify haemodialysis specific publications. The search was carried out in Medline (1948 to July 2011). The Cochrane Renal Group Register was also searched for trials not indexed in Medline. An update search was conducted in Medline (2011 to March 2013) using the same MeSH terms and text words.

**Date of initial search:** July 2011
**Date of update search:** March 2013

**WHAT IS THE EVIDENCE?**

**Dressings**

McCann and Moore [34] conducted a Cochrane systematic review relating to interventions for preventing infectious complications in haemodialysis patients with central venous catheters. A total of ten studies were included (n=788) however only one study with a small sample size (n=58) related to central venous catheter dressings. From this study, there was a non-significant reduction in central
venous catheter infection, exit-site infection and catheter-related bacteraemia with transparent polyurethane dressing compared to dry gauze dressing. Central venous catheter infection Risk Ratio (RR) 0.33 (95% CI: 0.004-3.02, P = NS); exit-site infection RR 0.33 (95 %CI: 0.001-7.86, P = NS); catheter-related bacteraemia RR 0.50 (95% CI: 0.05-5.21, P = NS). No conclusion could be made on the frequency of dressing changes. The authors conclude that CVC sites need to be dressed, however the type of dressing used should be based on the appearance of the exit site, the patient’s preference or the cost.

Rickard and Ray-Barruel performed a systematic review (11 studies) of infection control practices relating to Intravascular Devices [35] in which four of the assessed studies were in ESRD patients. Within this review, information was analysed regarding the frequency of central venous line dressing changes and the types of dressings used. The use of chlorhexidine-impregnated dressing was associated with a significant reduction in intravenous device (IVD) related or associated bloodstream infection (BSI), odds ratio (OR) 0.52 (95% CI: 0.34-0.7, P = 0.003) when compared with other dressings. Chlorhexidine-impregnated dressings were also associated with a significant reduction in device colonisation OR 0.40 (95% CI: 0.31-0.51, P < 0.00001) when compared with other dressings.

One study of haemodialysis patients with long term central venous lines showed no significant difference in IVD related BSI rates between sterile gauze and transparent dressing (0.23 vs 0 per 1000 IVD days, P = 0.43)[36]. While another study in long term central venous devices in oncology patients, showed a significant reduction in IVD-related sepsis with no dressing (23%) compared to sterile gauze dressing (34%, P = 0.02) [37]. In their analysis of frequency of dressing changes one study showed less skin toxicity with less changes (14% toxicity in 15-day group vs 43% toxicity in 4-day group, P = 0.001) however there was no difference in IVD- related BSI rates[38]. In a study with semipermeable transparent dressings, there was also no difference in either device colonisation and IVD-related BSI between 3-day and 7-day scheduled dressing changes [39].

Gilles and colleagues performed a Cochrane systematic review relating to central venous line dressings that was first published in 2003, updated and republished in 2010.[40] A meta-analysis of the data was undertaken and six studies (n=331) were assessed, providing four central venous line dressing comparisons. In the analysis for the highly permeable transparent polyurethane (HPTP) dressings compared with gauze and tape, results showed that there were no significant differences in the primary outcomes of catheter related bloodstream infection (CRBSI) (OR 1.72, 95% CI: 0.43-6.85, P = 0.44), exit site infection (OR 2.32, 95% CI: 0.41-13.27, P = 0.34) or tunnel infection (OR 0.64, 95% CI: 0.14-2.83, P = 0.56). There were a few more events (CRBSI and exit site infections) with the HPTP dressings but more tunnel infections with the gauze and tape dressing. The analysis between the HPTP dressing and the transparent polyurethane dressings also showed no significant differences for CRBSI (OR 0.31, 95% CI: 0.003-3.12, P = 0.32). HPTP performed slightly better than the transparent polyurethane dressing. The third analysis relating to the comparison of transparent polyurethane to gauze and tape dressings showed that there was also no significant difference in rates of CRBSI (OR 2.82, 95% CI: 0.11-70.98, P = 0.53) or exit site infection (OR 1.88, 95% CI: 0.16-21.41, P = 0.61). Lastly the analysis of the comparison of Opsite and Tegaderm showed no significant difference in exit site infection (OR 0.75, 95% CI: 0.12-4.66, P = 0.76).

Other studies

In a non-blinded crossover trial by Camins et al [41] patients in two centres were randomized to chlorhexidine impregnated dressing or usual care (transparent dressing). During the intervention phase, there were 37 catheter-related bloodstream infections (CRBSI) (6.3 CRBSIs / 1,000 dialysis sessions) compared to 30 CRBSIs during the control phase (5.2 CRBSIs/1,000 dialysis sessions); relative risk 1.22 (95% CI: 0.75-1.97, P = 0.46). Dialysis at one dialysis centre was an independent risk factor for development of CRBSI, adjusted odds ratio 4.9 (95% CI: 1.77-13.65, P = 0.002). Obesity also increased the risk for CRBSI development however age above 60 years was associated with a lower risk of CRBSI. From these results, chlorhexidine impregnated foam dressings did not reduce the incidence of CRBSI in patients undergoing haemodialysis via tunneled central venous catheters. No other randomized studies have been performed in the ESRD population using chlorhexidine impregnated dressings. Two recent large randomized controlled trials have demonstrated significant
reductions in catheter related bacteremia using chlorhexidine impregnated dressings in the intensive care unit setting [39, 42]. The chlorhexidine gluconate-impregnated sponge dressings reduced the catheter-related bloodstream infection rate to 0.3% (6/1953), compared with 0.9% (17/1825) for the standard dressing hazard ratio (HR) = 0.24 (95%CI: 0.09-0.65, P=0.005)[39]. The second study by Timsit showed similar results.0.5/1000 catheter-days for the chlorhexidine dressing versus 1.3/1000 catheter-days for non-chlorhexidine dressings. HR = 0.40 (95%CI: 0.186-0.868, P=0.02)[42]

In a retrospective review by Altman et al [43] 209 patients were interviewed about the effectiveness of the CD-1000 surgical dressing and about the participants’ prior and current history of catheter-related infections. Prior to using the CD-1000 dressing, there were 169 recorded infections in 61 patients (1.83 infections per 1,000 catheter days) while using the CD-1000 dressing there were nine infections in nine patients (0.47 infections per 1,000 catheter days). That is a 75% reduction in catheter-related infections. Of note is the conflict of interest of the primary author who is a share-holder in SDA Product Inc and Courier Med Inc (supplier of CD-1000 dressing).

In a small observational study by Harwood et al [44] a number of patient characteristics which were associated with positive exit-site culture results were identified. Patients who used dry gauze-type dressings were more likely to have a positive exit-site culture (69%) vs semi-permeable transparent dressing (31%) (P = 0.007). Patients who used 2% Chlorhexidine Gluconate cleansing solution were more likely to have a negative exit-site culture (78%) compared to 22% for patients using 10% Povidine-Iodine solution, P = 0.007. It was also apparent that weekly dressing changes were associated with negative exit-site culture results (70%) compared to dressing replacement at every dialysis session (24%), P = 0.03.

**Hand Hygiene**

In a systematic review by Larmer et al [45] out of a total of 35 comparisons made, 24 showed that alcohol-based hand rub had greater antimicrobial efficacy than medicated and/or plain soap whilst the remaining 11 comparisons showed no significant difference. With regard with hand drying there were two studies available which showed conflicting results. One study showed no significant difference between paper towel and air drying, whilst another study showed warm air dryer was more effective than paper towels in reducing the number of bacteria on the hand.

In a review by Beckman et al [46] eight studies looked at hand hygiene and health care associated infections, three of these studies showed that alcohol based hand rub produced a significant reduction in MRSA infections. The main problem with this review was that the majority of the studies had significant flaws in design and were considered weak studies.

**Skin Asepsis**

Maintaining adequate skin asepsis during dressing changes and line connections/disconnections is paramount. No trials specifically addressing haemodialysis patients have been performed. CDC guidelines recommend skin preparation with >0.5% chlorhexidine preparation with alcohol before central venous catheter and peripheral arterial catheter insertion and during dressing changes[47].

**SUMMARY OF THE EVIDENCE**

Results from the systematic reviews show that no one type of dressing is better than another. One review looked at CVC use in haemodialysis patients but only one study looked at dressings. The other two systematic reviews included studies which involved inpatients in settings other than haemodialysis such as: oncology, post-transplant, intensive care and elective surgery. These patients will have very different needs to haemodialysis patients where the length of hospital stay and use of CVC would differ. Studies were of small sample size and short term. As a result there were mixed findings with one review suggesting that there was no difference between transparent gauze dressing compared to dry gauze dressing; while another identified gauze and tape dressing better than highly permeable transparent polyurethane dressing for preventing catheter-related sepsis and exit site infection but not for preventing tunnel infection. Gauze and tape also performed better when compared to transparent polyurethane dressing in reducing catheter-related sepsis and exit-site infection however these
differences were not significant. It was identified from the reviews that chlorhexidine-impregnated dressing was associated with a reduction in intravascular device associated blood stream infection.

One review identified significant reduction in skin toxicity with less frequent dressing changes, and also no difference in device colonisation between 3-day and 7-day dressing changes. The study by Harwood et al [44] also supports that weekly dressing changes are better than changes at every dialysis sessions.

With regard to hand hygiene there is some evidence to support alcohol based hand rub as the product of choice as it has shown greater antimicrobial efficacy compared to medicated or plain soap. The review by Larmer et al [45] included two studies on hand drying, but the results were conflicting.

WHAT DO THE OTHER GUIDELINES SAY?

Kidney Disease Outcomes Quality Initiative: [1]

3.1 Aseptic techniques:

3.1.1 For all vascular accesses, aseptic technique should be used for all cannulation and catheter accession procedures. (A)

3.4 Infection-control measures that should be used for all HD catheters and port catheter systems include:

3.4.1 The catheter exit site or port cannulation site should be examined for proper position of the catheter/port catheter system and absence of infection by experienced personnel at each HD session before opening and accessing the catheter/port catheter system. (B)

3.4.2 Changing the catheter exit-site dressing at each HD treatment, using either a transparent dressing or gauze and tape. (A)

3.4.3 Using aseptic technique to prevent contamination of the catheter or port catheter system, including the use of a surgical mask for staff and patient and clean gloves for all catheter or port catheter system connect, disconnect, and dressing procedures. (A)

UK Renal Association: [48]

5. Prevention of catheter related infections

Guideline 5.2 – Minimising the risk of catheter related infection
We recommend that aseptic technique should be mandatory at every manipulation of central venous dialysis catheters. (2C)

Guideline 5.3 – Minimising the risk of catheter related infection
We recommend that the catheter exit site should be cleaned with Chlorhexidine 2%. (1B)

Canadian Society of Nephrology: [49]

IV. Infection Prevention in the Vascular Access

1. Instruct all staff and patients on infection control measures. (Grade D, opinion)

2. Change catheter exit site dressings at each haemodialysis treatment (Grade D, opinion). Use dry gauze dressings and povidone iodine (Grade C), mupirocin (Grade C), or polysporin triple ointment (Grade A) at the catheter exit site.

European Renal Best Practice:
(Position Statement) [50]

Nursing care

B.2.1 Universal precautions, a sterile environment and aseptic technique should be applied at any occasion when a venous catheter is manipulated, connected or disconnected.

Preventive antimicrobial catheter locks and catheter surface treatment

B.3.3 Antimicrobial lock solutions should not replace hygienic standards with regard to catheter care and handling.

Exit-site dressings

B.4.1 The catheter exit site should be covered by a dressing as long as the catheter remains in place. The exit site should be inspected at every haemodialysis session, and the exit-site dressing should be replaced on a routine basis if it is no longer clean or intact.

B.4.2 The patient should be instructed to maintain the hygiene and integrity of the dressing.
**International Guidelines:**


**Education, Training and Staffing – Recommendations**

1. Educate healthcare personnel regarding the indications for intravascular catheter use, proper procedures for the insertion and maintenance of intravascular catheters, and appropriate infection control measures to prevent intravascular catheter-related infections. **Category IA**

2. Periodically assess knowledge of and adherence to guidelines for all personnel involved in the insertion and maintenance of intravascular catheters. **Category IA**

3. Designate only trained personnel who demonstrate competence for the insertion and maintenance of peripheral and central intravascular catheters. **Category IA**

**Hand Hygiene and Aseptic Technique – Recommendations**

1. Perform hand hygiene procedures, either by washing hands with conventional soap and water or with alcohol-based hand rubs (ABHR). Hand hygiene should be performed before and after palpat ing catheter insertion sites as well as before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter. Palpation of the insertion site should not be performed after the application of antiseptic, unless aseptic technique is maintained. **Category IB**

2. Maintain aseptic technique for the insertion and care of intravascular catheters. **Category IB**

6. Wear either clean or sterile gloves when changing the dressing on intravascular catheters. **Category IC**

**Skin Preparation – Recommendations**

2. Prepare clean skin with a 0.5% chlorhexidine preparation with alcohol before central venous catheter and peripheral arterial catheter insertion and during dressing changes. If there is a contraindication to chlorhexidine, tincture of iodine, an iodophor, or 70% alcohol can be used as alternatives. **Category IA**

**Catheter Site Dressing Regimens – Recommendations**

2. If the patient is diaphoretic or if the site is bleeding or oozing, use gauze dressing until this is resolved. **Category II**

3. Replace the catheter-site dressing when it becomes damp, loosened, or soiled. **Category IB**

4. Do not use topical antibiotic ointment or creams on insertion sites, except for dialysis catheters, because of their potential to promote fungal infections and antimicrobial resistance. **Category IB**

5. Do not submerge the catheter or catheter site in water. Showering should be permitted if precautions can be taken to reduce the likelihood of introducing organisms into the catheter (e.g., if the catheter and connecting device are protected with an impermeable cover during the shower). **Category IB**

6. Replace dressings used on short-term CVC sites every 2 days for gauze dressings. **Category II**

8. Replace transparent dressings used on tunneled or implanted CVC sites no more than once per week (unless the dressing is soiled or loose), until the insertion site has healed. **Category II**

9. No recommendation can be made regarding the necessity for any dressing on well-healed exit sites of long-term cuffed and tunneled CVCs. **Unresolved issue**

14. Monitor the catheter sites visually when changing the dressing or by palpation through an intact dressing on a regular basis, depending on the clinical situation of the individual patient. If patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local or bloodstream infection, the dressing should be removed to allow thorough examination of the site. **Category IB**

15. Encourage patients to report any changes in their catheter site or any new discomfort to their provider. **Category II**

**Australian Guidelines for the Prevention and Control of Infection in Healthcare (NHMRC 2010): [51]**

1. **Routine hand hygiene**

   Hand hygiene must be performed before and after every episode of patient contact. This includes: before touching a patient; before a procedure; after a procedure or body substance exposure risk;
after touching a patient; after touching a patient’s surroundings. Hand hygiene must also be performed after the removal of gloves. **Grade B**

2. **Choice of product for routine hand hygiene practices**
   For all routine hand hygiene practices in healthcare settings, use alcohol-based hand rubs that
   • contain between 60% and 80% v/v ethanol or equivalent **Grade B**; and
   • meet the requirements of EN1500. **Grade GPP**

3. **Choice of hand hygiene product when hands are visibly soiled**
   If hands are visibly soiled, hand hygiene should be performed using soap and water. **Grade B**

4. **Hand hygiene for *Clostridium difficile* and non-enveloped viruses**
   Hand hygiene should be performed using soap and water when *Clostridium difficile* or non-enveloped viruses such as noro virus are known or suspected to be present and gloves have not been worn. After washing, hands should be dried thoroughly with single-use towels. **Grade GPP**

6. **Use of face and protective eyewear for procedures**
   A surgical mask and protective eyewear must be worn during procedures that generate splashes or sprays of blood, body substances, secretions or excretions into the face and eyes. **Grade C**

7. **Wearing of gloves**
   Gloves must be worn as a single-use item for:
   • each invasive procedure;
   • contact with sterile sites and non-intact skin or mucous membranes; and
   • activity that has been assessed as carrying a risk of exposure to blood, body substances, secretions and excretions.
   Gloves must be changed between patients and after every episode of individual patient care. **Grade GPP**

8. **Sterile gloves**
   Sterile gloves must be used for aseptic procedures and contact with sterile sites. **Grade GPP**

**Intravascular Devices**

*Dressings*
- Use chlorhexidine-impregnated (CHG) sponge dressings for peripheral arterial devices, short-term and long-term central venous devices **Grade B**
- Use sterile gauze or sterile, transparent, semi-permeable dressings to cover the catheter site
- If the patient is diaphoretic, or if the site is bleeding or oozing, use a gauze dressing
- For long-term tunnelled central venous devices used for haemodialysis, use an antimicrobial or antibiotic ointment (calcium mupirocin, or Polysporin) at the exit site after catheter insertion and at the end of each dialysis session unless the ointment interacts with the material of the catheter **Grade B**

*Changing dressings*
- Examine short-term vascular catheter dressings daily and change if soiled or loosened **Grade C**
- Examine dressings for short-term central venous and peripheral arterial devices daily and replace: when soiled or loose; if the patient’s clinical presentation indicates a BSI; and after seven days for paediatric patients
- Monitor dressings for tunnelled central venous devices and replace when soiled or loose, or after 8 days

**WHO Guidelines on Hand Hygiene in Health Care – Part II: Consensus Recommendations** [52]

A. Wash hands with soap and water when visibly dirty or visibly soiled with blood or other body fluids (IB) or after using the toilet (II).

B. If exposure to potential spore-forming pathogens is strongly suspected or proven, including outbreaks of *Clostridium difficile*, hand washing with soap and water is the preferred means (IB).

C. Use an alcohol-based hand rub as the preferred means for routine hand antisepsis in all other clinical situations described in items D(a) to D(f) listed below, if hands are not visibly soiled (IA). If alcohol-based hand rub is not obtainable, wash hands with soap and water (IB).

D. Perform hand hygiene:
   a. before and after touching the patient (IB);
   b. before handling an invasive device for patient care, regardless of whether or not gloves are used (IB);
c. after contact with body fluids or excretions, mucous membranes, non-intact skin, or wound dressings (IA);

d. if moving from a contaminated body site to another body site during care of the same patient (IB);

e. after contact with inanimate surfaces and objects (including medical equipment) in the immediate vicinity of the patient (IB);

f. after removing sterile (II) or non-sterile gloves (IB).

E. Before handling medication or preparing food perform hand hygiene using an alcohol-based hand rub or wash hands with either plain or antimicrobial soap and water (IB).

F. Soap and alcohol-based hand rub should not be used concomitantly (II).

6. Use of gloves

A. The use of gloves does not replace the need for hand hygiene by either handrubbing or handwashing (IB).

B. Wear gloves when it can be reasonably anticipated that contact with blood or other potentially infectious materials, mucous membranes, or non-intact skin will occur (IC).

SUGGESTIONS FOR FUTURE RESEARCH

1. Conduct a study which compares the types of dressings used and frequency of dressing replacement and their association with catheter-related bacteraemia, exit-site and tunnel infections.

2. Conduct a study that compares nursing care of CVC following a standardised protocol versus usual care (no protocol provided)

3. Conduct a randomised controlled trial of chlorhexidine impregnated dressings versus mupirocin exit site application in reducing catheter related bacteraemia.

CONFLICT OF INTEREST

Pamela Lopez-Vargas and Kevan Polkinghorne 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


18. Engemann JJ, Friedman JY, Reed SD et al. Clinical outcomes and costs due to Staphylococcus aureus bacteremia among patients receiving long-term hemodialysis. *Infection Control & Hospital Epidemiology.* 2005; **26:** 534-9.


## APPENDICES

### Table 1. Characteristics of included studies

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<thead>
<tr>
<th>Study ID</th>
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| McCann and Moore (2010) [34]    | 10 studies (n=786) | Cochrane Systematic Review | Adults and children with end-stage kidney disease who were either on short-term or maintenance haemodialysis using tunnelled or non-tunnelled central venous catheters as vascular access | NA        | - The risk of catheter-related bacteria was significantly reduced by: Mupirocin ointment relative risk (RR) 0.17 (95%CI: 0.07 to 0.42, P= 0.00017); Polysporin RR 0.40 (95%CI: 0.19 to 0.86, P=0.19); and povidone-iodine ointment RR 0.10 (95%CI: 0.01 to 0.72, P=0.022) when each was compared to no ointment/placebo.  
- Mortality related to infection was not reduced with any ointment.  
- Topical honey did not reduce the risk of exit-site infection RR 0.45 (95%CI: 0.10 to 2.11, P=0.31) or catheter-related bacteraemia RR 0.80 (95%CI: 0.37 to 1.73, P=0.57) when compared with topical antimicrobial ointments.  
- There was only one study used to determine the effect of dressings on cvc or exit-site infection, or catheter related bacteraemia, with a small sample size (n=58).  
- Transparent polyurethane dressing did not significantly reduce the risk of: central venous catheter infection Risk Ratio (RR) 0.33 (95%CI: 0.004 – 3.02, P=NS); exit-site infection RR 0.33 (95%CI: 0.001 – 7.86, P=NS); or catheter-related bacteraemia RR 0.50 (95%CI: 0.05 – 5.21, P=NS) when compared to dry gauze dressing. |
| Rickard and Ray-Barruel (2009)[35] | 11 studies (n=3188) | Systematic review | There were three paediatric and eight adult studies. Four studies in oncology patients, four in end-stage renal failure patients, two in intensive care and one in general ward patients. | NA        | - One study showed significant reduced skin toxicity with the use of less frequent dressings (43% toxicity, 4-day group versus 14% toxicity 15-day group, P=0.001). There was no difference in intravascular device (IVD) related bloodstream infection (BSI) rates.  
- Another study showed no difference in either device colonisation (10.4 vs 11.0 per 1000 IVD days, P=0.95) and IV-related BSI (0.7 vs 0.9 per 1000 IVD days, P=0.65) with the semipermeable transparent dressings scheduled for 3-day replacement compared with 7-day scheduled replacement.  
- The use of chlorhexidine-impregnated dressing when compared with other dressings was associated with a significant reduction in IVD-related or associated BSI, odds ratio (OR) 0.52 (95%CI:0.34-0.7, P=0.003)  
- Chlorhexidine-impregnated dressings were also associated with a significant reduction in device colonisation OR 0.40 (95%CI: 0.31 – 0.51, P<0.00001) when compared with other dressings.  
- When transparent dressing was compared with sterile gauze dressing, no significant difference in IVD-related BSI was detected (0 vs 0.23 per 1000 IVD days, P=0.43)  
- Another study compared no dressing versus gauze dressing, a significant difference in IVD-related sepsis was detected (23% vs 34%, P=0.02) |
<p>| Gillies et al (2003) [40]        | 6 studies (n=331) | Cochrane Systematic | Only 14 participants were dialysis patients, others were | NA        | - Review was last updated 2008. Updated search was conducted with no new relevant articles. |</p>
<table>
<thead>
<tr>
<th>Study ID</th>
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| Timsit et al (2009)[39] | 1636 (3,778 catheters; 28,931 catheter-days) | RCT          | Adult patients in intensive care units requiring an arterial catheter, or a central-vein catheter or both for 48 hours or longer. Patients were randomised into four groups. Group 1 – standard dressing, changed every 3 days (control) Group 2 – chlorhexidine gluconate-impregnated sponge (CHGIS) dressing, changed every 3 days. Group 3 – standard dressing, every 7 days Group 4 – CHGIS dressing, every 7 days Multiple sites, France. | Median 6 days (48 hours post discharge) | - CHGIS dressings decreased the rates of major catheter-related infections (CRIs) 10/1953 catheters (0.5%) versus 19/1825 catheters (1.1%), hazard ratio (HR) = 0.39 (95%CI: 0.17-0.93, P=0.03).  
- CHGIS also decreased catheter-related bloodstream infections 6/1953 catheters (0.3%) versus 17/1825 catheters (0.9%) with the standard dressing, HR = 0.24 (95%CI: 0.09-0.65, P=0.005)  
- Sever CHGIS-associated contact dermatitis occurred in 8 patients (5.3/1000 catheters)  
- Catheter colonisation rates were 142/1815catheters 97.8% in the 3-day group and 168/1693 catheters (8.6%) in the 7-day group; HR 0.99 (95%CI: 0.77-1.28, P=0.95).  
- CRIs in the 3-day group 12 compared with 17 in the 7-day group (HR =1.16: 95%CI: 0.49-2.69, P=0.74)  
- The median number of dressing changes per catheter was 4 (IQR 3-6) in the 3-day group and 3 (IQR 2-5) in the 7-day group, P<0.001. |
<p>| Timsit et al (2012)[42] | 1,879 (4,163 catheters; | RCT          | Adult patients in intensive care units requiring intravascular catheterisation for 48 hours. | N/A | - Major catheter-related infection rate decreased to 0.7/1000 catheter-days for chlorhexidine dressings compared with 2.1/1000 catheter-days for non-chlorhexidine dressings. Hazard ratio (HR) = 0.328 (95%CI: 0.174-0.619, P =... |</p>
<table>
<thead>
<tr>
<th>Study ID</th>
<th>N</th>
<th>Study design</th>
<th>Participants</th>
<th>Follow up</th>
<th>Comments and results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34,339 catheter-days)</td>
<td></td>
<td>Patients were randomised into three groups:</td>
<td>0.0006</td>
<td>• Catheter-related bloodstream infection rate also decreased with the chlorhexidine dressing 0.5/1000 catheter-days compared with 1.3/1000 catheter-days for non-chlorhexidine dressings. HR = 0.402 (95%CI: 0.186-0.868, P=0.02)</td>
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<td>Group 1 – Chlorhexidine-gel impregnated dressing</td>
<td></td>
<td>• Highly adhesive dressing increased skin colonization (P&lt;0.0001) and catheter colonization HR = 1.65 (95%CI: 1.21-2.26, P=0.0016).</td>
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<td>Group 2 – highly adhesive non-chlorhexidine dressing</td>
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<td>• Dressing detachment decreased to 64.3% with the highly adhesive dressing compared with 71.9% with the standard dressing (P&lt;0.0001)</td>
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<td>Group 3 – standard dressing</td>
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<tr>
<td>Camins (2010) [41]</td>
<td>121</td>
<td>Crossover trial</td>
<td>Patients having haemodialysis through a tunnelled central venous catheter. Intervention - chlorhexidine impregnated foam dressing; control – usual care, transparent dressing.</td>
<td>6months (each group i.e. total 1 year)</td>
<td>37 catheter-related bloodstream infections (CRBSI) occurred during the intervention period (29 in the chlorhexidine-impregnated foam dressing group, unit A; and 8 in the control group, unit B), incidence of 6.3 CRBSI/1,000 dialysis sessions</td>
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<td>• After cross over: total of 30 CRBSI occurred during the control period, incidence of 5.2 CRBSI/1,000 dialysis sessions (20 in the control group unit A, and 10 in the intervention group, unit B) (relative risk 1.22 [95%CI: 0.75 to 1.97], P=0.46)</td>
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<td>2 patients experienced dermatitis with the chlorhexidine-impregnated foam dressing, which led to its discontinuation</td>
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<td>Dialysis treatment at one dialysis centre was identified as an independent risk factor for CRBSI, adjusted odds ratio 4.4 (95%CI: 1.77 to 13.65, P=0.002)</td>
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<td>Age of ≥60 years was associated with lower risk of CRBSI, adj odds ratio 0.28, (95%CI: 0.09 to 0.82, P=0.02)</td>
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<td></td>
<td>Chlorhexidine-impregnated foam dressing did not decrease the incidence of CRBSI</td>
</tr>
<tr>
<td>Altman (2008) [43]</td>
<td>209</td>
<td>Retrospective review</td>
<td>All patients on haemodialysis through a catheter, who were prescribed CD-1000 composite dressing</td>
<td>6 months</td>
<td>There were 169 infections in 61 of the 209 patients prior to using the CD-1000 (1.83 infections per 1000 catheter days)</td>
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<td>• While using the CD-1000, there were nine infections in nine of the 209 patients (0.47 infections per 1000 catheter days)</td>
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<td>75% reduction in catheter associated infections</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>Conflict of interest</td>
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<tr>
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<td></td>
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<td></td>
<td>Patient selection bias</td>
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<td></td>
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<td>Data collection by telephone interview (209 patients)</td>
</tr>
<tr>
<td>Harwood et al (2008) [44]</td>
<td>52</td>
<td>Observational</td>
<td>Patients on haemodialysis through central venous catheter. Participants were &gt;18 years old.</td>
<td>18 months</td>
<td>Patients with a positive exit-site culture results were more likely to use dry gauze type (69%) versus semi-permeable transparent (31%) dressing (P=0.007)</td>
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<td></td>
<td>• Patient characteristics associated with negative exit-site culture results include: use of 2% Chlorhexidine Gluconate (78%) vs 10% Povidone-Iodine cleansing solution (22%) (P=0.007); weekly dressing changes (70%) versus at every dialysis treatment (24%) (P=0.03)</td>
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<td></td>
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<td>• Study: small sample size; results depended on nurses’ clinical observations</td>
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<tr>
<td>ii) Hand Hygiene</td>
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<tr>
<td>Larmer et al (2008) [45]</td>
<td>12 studies n=480</td>
<td>Systematic review</td>
<td>Studies related to hand hygiene including: hand hygiene product; skin condition</td>
<td>NA</td>
<td>There were 35 comparisons of the antimicrobial efficacy of alcohol-based hand rub (ABHR) to plain and/or medicated soap.</td>
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<td>• 24 comparisons showed statistically significant positive results and the remaining</td>
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</tbody>
</table>

Vascular Access

July 2012
<table>
<thead>
<tr>
<th>Study ID</th>
<th>N</th>
<th>Study design</th>
<th>Participants</th>
<th>Follow up</th>
<th>Comments and results</th>
</tr>
</thead>
</table>
| Backman et al    | 35 | Review       | Studies looking at the relationship between hand hygiene interventions and the incidence of health care-associated infections were included | NA                                           | There were 11 studies looking at hand hygiene products, however there were a number of different interventions.  
Eight studies compared alcohol-based hand rub against hand washing or antiseptic hand wash. Three of these studies had no comparator, two of these studies showed significant reduction in MRSA rates. Of the remaining five other studies, four showed no significant difference in health care-associated infections (HCAIs). One showed significant reduction in infection rates with the hand sanitizer.  
Six of these studies had scored a value of one or two, indicating they were weak studies with flaws such as inadequate sample size, inadequate statistical analysis, uncontrolled bias and/or confounding.                                                                 |

11 comparisons demonstrated no significant differences between ABHRs and medicated and/or plain soap.  
- Thus greater than 2/3 of moderate quality studies provided moderate evidence that ABHRs have greater antimicrobial efficacy than medicated and/or plain soap  
- Greater efficacy was shown by ABHRs that contained 70% alcohol and 70% alcohol with chlorhexidine gluconate (CHG)  
- Moderate level evidence that ABHR are less irritating than medicated and/or plain soap (five trials)  
- There was conflicting evidence between two studies whether any particular method of hand drying is more effective than another.
Table 2. Methodological quality of randomised trials

<table>
<thead>
<tr>
<th>Study ID (author, year)</th>
<th>Method of allocation concealment *</th>
<th>Method of allocation concealment *</th>
<th>Blinding (participants)</th>
<th>Blinding (investigators)</th>
<th>Blinding (outcome assessors)</th>
<th>Intention-to-treat analysis †</th>
<th>Loss to follow up (%)</th>
<th>Comments ‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timsit et al (2009)[39]</td>
<td>Web-based random number generator, permuted blocks of 8 patients each</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>0%</td>
<td>-</td>
</tr>
<tr>
<td>Timsit et al (2012)[42]</td>
<td>Web-based random number generator, permuted blocks of 8 patients each</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>0%</td>
<td>-</td>
</tr>
</tbody>
</table>

* Choose between: central; third party (e.g. pharmacy); sequentially labelled opaque sealed envelopes; alternation; not specified.
† Choose between: yes; no; unclear.
‡ Quality score – “How successfully do you think the study minimised bias?” Choose between: very well (+); okay (Ø); poorly (−).

Table 3. Results for dichotomous outcomes

<table>
<thead>
<tr>
<th>Study ID (author, year)</th>
<th>Outcomes</th>
<th>Intervention group (number of events/ number of catheters)</th>
<th>Control group (number of events/ number of catheters)</th>
<th>Relative risk (RR) [95% CI]</th>
<th>Risk difference (RD) [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timsit et al (2009)[39]</td>
<td>Catheter related infections</td>
<td>10/1953 (Chlorhexidine dressing)</td>
<td>19/1825 (standard dressing)</td>
<td>0.49 [0.23, 1.05]</td>
<td>-0.01 [-0.01, 0.00]</td>
</tr>
<tr>
<td>Timsit et al (2012)[42]</td>
<td>Catheter related infections</td>
<td>12/2108 (Chlorhexidine dressing)</td>
<td>36/2055 (non-chlorhexidine dressing)</td>
<td>0.32 [0.17, 0.62]</td>
<td>-0.01 [-0.02, -0.01]</td>
</tr>
<tr>
<td>Timsit et al (2009)[39]</td>
<td>Catheter related infections</td>
<td>17/1963 (7-day group)</td>
<td>12/1815 (3-day group)</td>
<td>1.31 [0.63, 2.74]</td>
<td>0.00 [-0.00, 0.01]</td>
</tr>
<tr>
<td>Timsit et al (2012)[42]</td>
<td>Catheter related infections</td>
<td>15/988 (highly adhesive dressing)</td>
<td>21/1067 (standard dressing)</td>
<td>0.77 [0.40, 1.49]</td>
<td>-0.00 [-0.02, 0.01]</td>
</tr>
<tr>
<td>Timsit et al (2009)[39]</td>
<td>Catheter-related bloodstream infections</td>
<td>6/1553 (Chlorhexidine dressing)</td>
<td>17/1825 (standard dressing)</td>
<td>0.33 [0.13, 0.83]</td>
<td>-0.01 [-0.01, -0.00]</td>
</tr>
<tr>
<td>Timsit et al (2012)[42]</td>
<td>Catheter-related bloodstream infections</td>
<td>9/2108 (Chlorhexidine dressing)</td>
<td>22/2055 (non-chlorhexidine dressing)</td>
<td>0.40 [0.18, 0.86]</td>
<td>-0.01 [-0.01, -0.00]</td>
</tr>
<tr>
<td>Timsit et al (2012)[42]</td>
<td>Catheter-related bloodstream infections</td>
<td>10/988 (highly adhesive dressing)</td>
<td>12/1067 (standard dressing)</td>
<td>0.90 [0.39, 2.07]</td>
<td>-0.00 [-0.01, 0.01]</td>
</tr>
<tr>
<td>Timsit et al (2009)[39]</td>
<td>Catheter colonization</td>
<td>168/1963 (7-day group)</td>
<td>142/1815 (3-day group)</td>
<td>1.09 [0.88, 1.36]</td>
<td>0.01 [-0.01, 0.02]</td>
</tr>
<tr>
<td>Timsit et al (2012)[42]</td>
<td>Catheter colonization</td>
<td>75/2108 (Chlorhexidine dressing)</td>
<td>186/2055 (non-chlorhexidine dressing)</td>
<td>0.39 [0.30, 0.51]</td>
<td>-0.05 [-0.07, -0.04]</td>
</tr>
<tr>
<td>Timsit et al (2012)[42]</td>
<td>Catheter colonization</td>
<td>97/988 (highly adhesive dressing)</td>
<td>89/1067 (standard dressing)</td>
<td>1.18 [0.89, 1.55]</td>
<td>0.01 [-0.01, 0.04]</td>
</tr>
</tbody>
</table>