

## Executive Summary

**Citation** Yap, G., Joseph, C. & Melder, A. 2016. Central venous access devices: An Evidence Snapshot of antiseptic dressings, catheter valves, heparin locking practices and hub disinfection. Centre for Clinical Effectiveness, Monash Health, Melbourne, Australia.

### Main points listed according to question:

#### 1. Are topical antiseptics required for central lines?

- Practice recommendations (12) are to use chlorhexidine-containing dressings for central venous catheters (CVCs) in patients over 2 months of age to reduce central line-associated blood stream infections. **High quality evidence.**
- Dressing impregnated with a medication (i.e. chlorhexidine gluconate - CHG) reduces catheter-related blood stream infection (1,2,3,4) and catheter colonisation (1) compared with a dressing without medication. **Evidence Class B or unclear.\***
- 3M Tegaderm CHG IV securement dressing for central venous and arterial catheter insertion sites to reduce CRBSI and local infection is supported by the evidence (3,4). **Quality of evidence unclear.**

Although there has been no direct comparison of Tegaderm CHG with other CHG impregnated dressings (e.g. Biopatch) on the effect of catheter-related bloodstream infection (CRBSI), the rates of CRBSI and surrogate measures of infection, such as catheter colonisation, are likely to be similar with CHG sponges and Tegaderm CHG (3,4). **Quality of evidence unclear.**

- According to 2013 prices, the estimated cost saving from using a 3M Tegaderm CHG IV securement dressing instead of a standard transparent semipermeable dressing is £73 (approx. AUD\$123) per patient (4).
- Evidence suggests to consider the use of a chlorhexidine impregnated sponge dressing in adult patients with a central venous catheter as a strategy to reduce catheter related bloodstream infection (1). **Class B evidence.\***  
*NOTE: four of the five of these studies were sponsored by the manufacturer of the product.*

\* Class B = Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate. Evidence based on one high-quality study, or several studies with some limitations.

#### 2. What is the effectiveness of neutral pressure valves as compared to positive pressure valves in reducing central blood line infections?

- Using a broad and general set of search terms, no evidence was able to be identified for this question. This may indicate that there is a gap in the evidence base however, it may also mean that an alternate approach is required. As a result, it is suggested that consideration should be given to another approach other than a Snapshot in identifying evidence for this question. For example, systematically identifying specific device names and product lines may allow comparisons to be made regarding infection rates.
- An alternate approach was briefly trialed to gather some evidence in order to meet the question. It must be noted that this was not a systematic search, extremely random, unorganised, and done so in a short period of time. A summary of limited recent evidence found in a non-systematic manner has suggested:
  - Overall, the clinical effectiveness of needleless positive fluid displacement mechanical valve connectors versus negative displacement connectors is inconclusive based on the current evidence.
  - The Society for Healthcare Epidemiologists of America and Infectious Disease Society of America have recommended against using positive displacement needleless connectors with mechanical valves without a thorough assessment of risks and benefits.

- The United States Food and Drug Administration (14) is not recommending changes in use of positive displacement needleless connectors. Their main concern is related to three reports of deaths from blood stream infections and positive displacement connectors.
- A systematic review of MaxPlus™ positive-displacement connectors has shown lower central line associated bloodstream infection than other negative- or neutral-displacement needleless catheters on the market (1.5 events per 1,000 days vs 0.5 events per 1,000 days) (11).
- A single prospective study indicated that the use of a positive-displacement needleless intravenous access device was associated with lower microbial contamination rates compared with a neutral-displacement device (10). Rates of central line-associated bloodstream infection did not differ between devices (10).
- A single observational study (9) showed that a positive fluid displacement mechanical valve device was associated with more catheter-related bloodstream infections than a negative fluid displacement mechanical valve device.

### 3. What is the evidence for the use of Heparin to “lock” catheters in central lines?

- The evidence base for Heparin flushing to maintain patency of central venous catheters is limited (2 RCTs and 1 SR), and of **low quality** (1). NHS guidelines recommend to use sterile normal saline for injection to flush and lock catheter lumens that are accessed frequently. **Class A evidence.\*** (1)
- Heparin lock is not superior to a saline lock for the prevention of lumen occlusion and/or catheter colonisation, and/or catheter-related blood stream infection. (5) **Poor quality evidence.**
- NHS guidelines do not recommend to use systemic anticoagulants routinely to prevent catheter-related bloodstream infection. **Class D evidence.\*** (1)
- The role of an anti-coagulant lock, such as Heparin, is only marginally important in the management of non-dialysis central venous access (NDCVA), in terms of prevention of lumen occlusion. Saline lock is as appropriate as anticoagulant lock in prevention of occlusion of NDCVA (5).
- The Society for Healthcare Epidemiology of America and the Infectious Diseases Society of America recommend the use antimicrobial locks for CVCs to prevent central line-associated blood stream infections. **High quality evidence^.** (12)

*\*Class A = Further research is very unlikely to change our confidence in the estimate of effect. There are several high-quality studies with consistent results In special cases: one large, high-quality multi-centre trial.*

*Class D = Any estimate of effect is very uncertain and evidence based on expert opinion, no direct research evidence, or one or more studies with very severe limitations.*

*^ High = Highly confident that the true effect lies close to that of the estimated size and direction of the effect. Evidence is rated as high quality when there is a wide range of studies with no major limitations, there is little variation between studies, and the summary estimate has a narrow confidence interval.*

### 4. What is the effectiveness of antiseptic-coated injection caps for passive decontamination as compared to or in addition to active decontamination (scrub the hub)?

- NHS guidelines recommend a 15 second cleansing with alcoholic chlorhexidine prior to, and after, each access is recommended (1). A single-use application of 2% chlorhexidine gluconate in 70% isopropyl alcohol (or povidone iodine in alcohol for patients with sensitivity to chlorhexidine) should be used to decontaminate the access port or catheter hub (1). The hub should be cleaned for a minimum of 15 s and allowed to dry before accessing the system (1). **Class D evidence^**
- Evidence suggests the use of disinfection on surfaces of needleless connectors, stopcocks and other intravascular access ports immediately prior to any connection, infusion or aspiration with appropriate antiseptic agent to prevent catheter-related infections (6). **Level B evidence\***
- Antimicrobial caps/port protectors may be effectively used for passive continuous hub disinfection on needleless connections in conjunction with frictional antiseptic wiping between applications and access (6). **Level B/C evidence\***

*\*Level B = the body of evidence can be trusted to guide practice in most situations, RCT or high quality observational study.*

*Level C = the body of evidence provides some support for recommendation but care should be taken in its application, observational studies.*

*^Class D = Any estimate of effect is very uncertain and evidence based on expert opinion, no direct research evidence, or one or more studies with very severe limitations*

### Full Report

**Citation** Yap, G., Joseph, C. & Melder, A. 2016. Central venous access devices: An Evidence Snapshot of antiseptic dressings, catheter valves, heparin locking practices and hub disinfection. Centre for Clinical Effectiveness, Monash Innovation and Quality, Monash Health, Melbourne, Australia.

### Question(s)

The objective of this report was to answer the following questions in relation to their impact on infection rates:

1. Are topical antiseptics (i.e., antiseptic dressing) required for central lines (i.e. Tegaderm vs Biopatch)
2. What is the effectiveness of neutral pressure valves as compared to positive pressure valves in reducing central blood line infections?
3. What is the evidence for the use of heparin to “lock” catheters in central lines?
4. What is the effectiveness of antiseptic-coated injection caps for passive decontamination as compared to or in addition to active decontamination (i.e. scrub the hub)?

### Search methods

Databases searched can be seen in Table 1. Evidence was included based on the information in Table 2. The following terms were used to search for evidence regarding the 4 questions of interest in this report:

Q1- “central venous device dressing” AND tegaderm OR biopatch OR “antiseptic dressing”

Q2 - positive OR neutral AND Needlefree OR "needle free" AND Catheter AND infection

Q4 - "central venous catheter" AND infection

**Table 1.** Databases searched

<b>Systematic Reviews/HTAs</b>
<a href="#">Medical Services Advisory Committee (MSAC)</a>
<a href="#">The Cochrane Library</a>
<a href="#">PubMed Clinical Queries</a>
<a href="#">Adelaide Health Technology Assessment (AHTA)</a>
<a href="#">Royal Australasian College of Surgeons (ASERNIP-S)</a>
<a href="#">Scottish Health Technologies Group</a>
<a href="#">Health Systems Evidence</a>
<a href="#">ECRI</a>
<b>Guideline websites</b>
<a href="#">National Health and Medical Research Council (NHMRC)</a>
<a href="#">National Institute for Health and Clinical Excellence UK (NICE)</a>
<a href="#">Scottish Intercollegiate Guidelines Network (SIGN)</a>
<a href="#">National Guideline Clearinghouse US (NGC)</a>
<a href="#">TRIP Database</a>

**Table 2.** Inclusion/exclusion criteria

Item	Description
Population/Setting	Include: Not limited to any specialty or clinical setting Exclude: Community care, nursing homes
Intervention	Medication-impregnated dressings (CGH)
Comparator	Standard polyurethane (SPU)
Outcomes	Catheter-related blood stream infection (CRBSI) AND/OR colonisation
Publication details	Include: Reviews published in English. Exclude: Editorials, Commentaries, Opinion papers
Publication date	2010 – current (Dec 2016)

## Definitions

Medication-impregnated dressings include only CGI dressings either as patch or whole dressing. The terms CHG, chlorhexidine gluconate, chlorhexidine and CGI were used interchangeably in literature, and referred to as CHG for the purpose of this snapshot.

## Results

The evidence for each question is summarised and presented below.

### Q1. Are topical antiseptics required for central lines?

The search for evidence identified four papers of relevance. These include the EPIC 3 guidelines (1), a high quality NICE medical technology guidance (MTG) (4), a high quality, Cochrane Review (2), and a high quality literature review (3). Relevant data was extracted and summarised in Table 3. One other document was also found via non-systematic searching (X)

**Table 3.** Topical antiseptic dressings for central venous access lines

Source	Results
NICE, 2014. (4)  ***NICE HTA	<ul style="list-style-type: none"> <li>The case for adopting the 3M Tegaderm CHG IV securement dressing for central venous and arterial catheter insertion sites is supported by the evidence.</li> <li>This technology allows observation, and provides antiseptic coverage, of the catheter insertion site. It reduces catheter-related bloodstream infections and local site infections compared with semipermeable transparent (standard) dressings (Tegaderm IV 1635). It can be used with existing care bundles.</li> <li>According to 2013 prices, the estimated cost saving from using a 3M Tegaderm CHG IV securement dressing instead of a standard transparent semipermeable dressing is £73 (approx. AUD\$123) per patient. This estimate is based on a baseline catheter-related bloodstream infection rate of 1.48 per 1000 catheter days. Tegaderm CHG is estimated to be cost neutral when the baseline catheter-related bloodstream infection rate is 0.24 per 1000 catheter days, and cost incurring when the baseline rate falls below that figure.</li> <li>Estimates of the population for Tegaderm CHG based on adult intensive care episodes needing a central venous or arterial catheter vary from around 88,000 to 226,000 depending on whether episodes longer than 48 hours, or all episodes, are used. Based on these estimates, if the use of Tegaderm CHG became standard practice, it has the potential to save the NHS in England between £4.2 million and £10.8 million each year (approx. AUD\$7-18 million), assuming the baseline catheter-related bloodstream infection rate is 1.48 per 1000 catheter days.</li> <li>Recommendations based on paper by Jenks et al., 2016. (3) This paper suggests the quality is missed. Three of four studies included in this review were able to be quality</li> </ul>

	<p>assessed. One study was a conference abstract and bias was not able to be assessed due to limited information. Two of the three RCTs were reported to have a low risk of bias. The other RCT did not provide sufficient information to rule out bias.</p>
Jenks et al., 2016. (3)	<ul style="list-style-type: none"> <li>Both types of CHG-impregnated dressings (Tegaderm CHG or CHG-impregnated sponge) lead to lower rates of CRBSI and catheter colonisation than standard dressings.</li> <li>There is a higher risk of dermatitis with both Tegaderm CHG and CHG sponges than with standard dressings (Tegaderm Transparent Film Dressing, 3M), although this risk has declined with the modified Tegaderm CHG product.</li> <li>Users of the dressings reported that Tegaderm CHG is at least as easy to use as standard dressings (Opsite IV 3000; Tegaderm HP Transparent Film Dressing, 3M) and easier to use than the CHG sponge due to its transparency and all-in-one component.</li> <li>A comparison of Tegaderm CHG with other CHG impregnated dressings (e.g. Biopatch) was not performed because no direct comparative evidence was found in the literature review.</li> <li>Three of four studies included in this review were able to be assessed for quality. One study was a conference abstract and bias was not able to be assessed due to limited information. Two of the three RCTs were reported to have a low risk of bias. The other RCT did not provide sufficient information to rule out bias.</li> </ul>
Ullman et al., 2015. (2)	<ul style="list-style-type: none"> <li>High quality evidence that medication-impregnated dressings reduce the incidence of catheter-related BSI relative to all other dressing types (RR 0.60, 95% CI 0.39 to 0.93).</li> <li>Moderate quality evidence that CHG dressings reduce the frequency of catheter-related BSI per 1000 patient days compared with SPU dressings (RR 0.51, 95% CI 0.33 to 0.78) or that catheter tip colonisation is reduced with CHG dressings compared with SPU dressings (RR 0.58, 95% CI 0.47 to 0.73)</li> <li>Overall, there quality of the evidence is unclear as the majority of studies were reported to have unclear risk of bias. This review showed the included studies had no evidence of publication bias.</li> <li>The quality of the evidence is unclear due to unclear risk of bias.</li> </ul>
Loveday et al., 2014. (1)	<ul style="list-style-type: none"> <li>CHG-impregnated sponge dressings are effective in the prevention of CRBSI (OR 0.43, 95% CI 0.29-0.64) and catheter colonisation (OR 0.43, 95% CI 0.36-0.51). <i>NOTE: four of the five of these studies were sponsored by the manufacturer of the product.</i></li> <li>Economic evaluation of the use of CHG sponge dressings and the non-inferiority of dressing changes at 3 and 7 days was performed .It was concluded that the major cost avoided by the use of CHG sponge dressings and 7-day dressing changes rather than 3-day dressing changes was the increased length of stay of 11 days associated with CR-BSI. Chlorhexidine impregnated sponge dressings remained cost saving for any value where the cost per CR-BSI was &gt;USD\$4400 and the baseline rate of CR-BSI was &gt;0.35%.</li> <li>A single RCT showed major catheter-related infection rate was 67% lower (0.7 vs 2.1 per 1000 catheter-days, HR 0.328, 95% CI 0.174–0.619, p=0.0006) and the CR-BSI rate was 60% lower (0.5 vs 1.3 per 1000 catheter days, HR 0.402, 95% CI 0.186–0.868, p=0.02) in the CHG group as compared with non-CHG dressings (Tegaderm Transparent Film Dressing, 3M).</li> <li>Consider the use of a chlorhexidine-impregnated sponge dressing in adult patients with a central venous catheter as a strategy to reduce catheter-related bloodstream infection. <b>(New recommendation. Class B)*</b></li> </ul> <p>*Levels of evidence (based on GRADE): Class B = Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate. Evidence based on one high-quality study, or several studies with some limitations.</p>
Marschall et al., 2014. (12)	<ul style="list-style-type: none"> <li>Use chlorhexidine-containing dressings for central venous catheters (CVCs) in patients over 2 months of age (<b>High quality</b>)*. It is unclear whether there is additional benefit to</li> </ul>

	<p>using a chlorhexidine-containing dressing if daily chlorhexidine bathing is already established and vice versa.</p> <ul style="list-style-type: none"> <li>• There is low and unclear evidence on the association between CLABSI risk and standard, non-antimicrobial transparent dressing use.</li> <li>• The evidence is unclear on the widespread use of chlorhexidine-based products (e.g. use of chlorhexidine bathing, antiseptics, and dressings) for the promotion of reduced chlorhexidine susceptibility bacterial strains. Testing for chlorhexidine susceptibility is not standardized. The clinical impact of reduced chlorhexidine susceptibility in gram-negative bacteria is unknown.</li> </ul> <p>*Based on GRADE and the Canadian Task Force on Preventive Health Care: High. Highly confident that the true effect lies close to that of the estimated size and direction of the effect.</p>
--	---


## Q2. What is the effectiveness of neutral pressure valves as compared to positive pressure valves in reducing central blood line infections?

Using a broad and general set of search terms, no evidence was able to be identified for this question. This may indicate that there is a gap in the evidence base however, it may also mean that an alternate approach is required. As a result, it is suggested that consideration should be given to another approach other than a Snapshot in identifying evidence for this question. For example, systematically identifying specific device names and product lines may allow comparisons to be made regarding infection rates.

An alternate approach was briefly trialed to gather some evidence in order to meet the question. It must be noted that this was not a systematic search, extremely random, unorganised, and done so in a short period of time. The following results are seen in Table 4.

Additionally, infection prevention experts (8) have identified design features that must be present in catheters in order to reduce infection. These features include: a solid, smooth external septum surface; a tight septum housing seal; a clear fluid pathway; minimal internal complexity; reduction or elimination of interstitial or dead space; elimination of a specific disinfection-clamping sequence; a straight fluid pathway; no blood reflux; and the ability to flush with saline alone.

**Table 4.** The effectiveness of neutral pressure valves compared to positive pressure valves in reducing central blood line infections.

Source	Results
Tabak et al., 2014. (11) <i>Meta-analysis</i>	<p>MaxPlus positive-displacement connector (below) has lower central line associated bloodstream infection than other negative- or neutral-displacement needleless catheters on the market (1.5 events per 1,000 days vs 0.5 events per 1,000 days).</p>  <p><a href="https://goo.gl/images/5rfhA4">https://goo.gl/images/5rfhA4</a></p>
Casey et al., 2016. (10) <i>Single study</i>	<p>The use of a positive-displacement needleless intravenous access device was associated with lower microbial contamination rates compared with a neutral-displacement device when used on central venous catheters in hemato-oncology patients.</p> <p>In addition, rates of central line-associated bloodstream infection did not differ when either device was used.</p>
Canadian Agency for Drugs and Technologies in Health, 2010. (13) <i>Review</i>	<p>A single observational study (9) showed that "...a positive fluid displacement mechanical valve device (PFD) was associated with more catheter-related bloodstream infections than a negative fluid displacement mechanical valve device (NFD) used for central venous catheters. Taken together, the clinical effectiveness of PFD needleless connectors versus NFD needleless connectors for adult patients receiving central venous lines or peripheral venous lines is inconclusive based on the current evidence. There were no guidelines to indicate which type of mechanical devices (NFD or PFD) should be used for venous access devices (central or peripheral)."</p>

### Q3. What is the evidence for the use of heparin to “lock” catheters in central lines?

Searches revealed 3 sources of evidence regarding the use of heparin for central line catheter infection. These were the EPIC 3 guidelines (1), a consensus statement from the Italian Group of Long Term Venous Access Devices (5), and a high quality systematic review that makes a clear recommendation for abandoning the use of systemic anticoagulants stating they should not be used routinely to prevent catheter-related blood stream infections (3). The findings are summarised in Table 4 below.

**Table 4.** Evidence for the use of heparin to “lock” catheters in central lines

Source	Results
Loveday et al., 2014. (1)	<ul style="list-style-type: none"> <li>• Use sterile normal saline for injection to flush and lock catheter lumens that are accessed frequently. <b>Class A.*</b></li> <li>• Do not use systemic anticoagulants routinely to prevent catheter-related bloodstream infection. <b>Class D.*</b></li> <li>• The SR states that the evidence base for heparin flushing to maintain patency of central venous catheters is limited (2 RCTs and 1 SR), and of low quality.</li> </ul> <p>*Levels of evidence (based on GRADE):            Class A = Further research is very unlikely to change our confidence in the estimate of effect. There are several high-quality studies with consistent results In special cases: one large, high-quality multi-centre trial.            Class D = Any estimate of effect is very uncertain and evidence based on expert opinion, no direct research evidence, or one or more studies with very severe limitations.</p>
Pittiruti et al., 2016. (5)	<ul style="list-style-type: none"> <li>• Heparin lock is not superior to a saline lock for the prevention of lumen occlusion and/or catheter colonisation, and/or catheter-related blood stream infection.</li> <li>• The role of an anti-coagulant lock is only marginally important in the management of non-dialysis central venous access (NDCVA), in terms of prevention of lumen occlusion. Saline lock is as appropriate as anticoagulant lock in prevention of occlusion of NDCVA.</li> <li>• The large majority of evidence is poor-quality, and there are only a few randomized clinical trials available.</li> </ul>
Jenks et al., 2016. (3)	<ul style="list-style-type: none"> <li>• Systemic anticoagulants should not be used routinely to prevent catheter-related blood stream infections.</li> <li>• Three of four studies included in this review were able to be assessed for quality. One study was a conference abstract and bias was not able to be assessed due to limited information. Two of the three RCTs were reported to have a low risk of bias. The other RCT did not provide sufficient information to rule out bias.</li> </ul>
Marschall et al., 2014 (12)	<p><u>Excerpt from Practice Recommendations.</u></p> <p>5. Use antimicrobial locks for CVCs (<b>High quality*</b>).</p> <p>a. Antibiotic locks are created by filling the lumen of the catheter with a supratherapeutic concentration of an antimicrobial solution and leaving the solution in place until the catheter hub is re-accessed. Such an approach can reduce the risk of central-line–associated bloodstream infection (CLABSI). Because of concerns regarding the potential for the emergence of resistance in exposed organisms, use antimicrobial locks as a preventative strategy for the following:</p> <ol style="list-style-type: none"> <li>i. Patients with long-term hemodialysis catheters.</li> <li>ii. Patients with limited venous access and a history of recurrent CLABSI.</li> <li>iii. Patients who are at heightened risk of severe sequelae from a CLABSI (eg, patients with recently implanted intravascular devices, such as a prosthetic heart valve or aortic graft).</li> </ol> <p>b. To minimize systemic toxicity, aspirate rather than flush the antimicrobial lock solution after the dwell time has elapsed. For additional guidance, see the IDSA’s “Clinical Practice Guidelines for the Diagnosis and Management of Intravascular Catheter- Related Infection.”</p> <p>*Based on GRADE and the Canadian Task Force on Preventive Health Care:            cvc</p>

#### Q4. What is the effectiveness of antiseptic-coated injection caps for passive decontamination as compared to or in addition to active decontamination (scrub the hub)?

The search identified two (6, 7). One was a high quality Cochrane Review however, comparisons were only made between impregnated catheters versus non-impregnated catheters, and not active decontamination (7). The other was a systematic review (6). The findings are summarised in Table 5 below.

**Table 5.** Antiseptic-coated injection caps for passive decontamination as compared, to or in addition to, active decontamination

Source	Results
Moureau et al., 2015. (6)	<p>Top 4 of 8 recommendations for disinfection practices:</p> <ol style="list-style-type: none"> <li>1) Use disinfection on surfaces of needleless connectors, stopcocks and other intravascular access ports immediately prior to any connection, infusion or aspiration with appropriate antiseptic agent (e.g., alcoholic chlorhexidine, povidone iodine, an iodophor, or 70% alcohol). Access catheter connections with sterile devices only. <b>Level B.*</b></li> <li>2) Antimicrobial caps/port protectors may be effectively used for passive continuous hub disinfection on needleless connections in accordance with manufacturer instructions, in conjunction with frictional antiseptic wiping between applications and access. <b>Level B-C.*</b></li> <li>3) Ensure compliance with hand hygiene, gloving and aseptic practices prior to any contact with intravenous devices and add-on equipment. <b>Level B.*</b></li> <li>4) Establish and educate all clinical staff on a standard protocol to disinfect catheter hubs, needleless connectors and ports prior to and after each access. <b>Level B-C.*</b></li> </ol> <ul style="list-style-type: none"> <li>• Aseptic technique is the foundation for safe delivery of intravenous medications and solutions. An increasing number of studies reveal lack of compliance with disinfection of access ports prior to and after access, despite educational initiatives, and better disinfection agents.</li> <li>• Passive disinfection caps reduce guess work, provide clinicians with a point of use solution, and reduce contamination. It is critical for healthcare facilities and clinicians to take responsibility for compliance with aseptic technique for needleless cap disinfection, to monitor compliance regularly, to involve frontline staff in solutions, and to facilitate education that promotes understanding of the consequences of failure to comply with the standard of care for access site disinfection.</li> </ul> <p>*Grade of recommendation was modified from the NHMRC definitions. To achieve a grade of A the research is required to be a high quality randomized control trial (RCT) or a systematic review of high quality RCTs. Laboratory (in vitro) research was classified as level V evidence (7).  A: body of evidence can be trusted to guide practice, systematic review or RCT.  B: body of evidence can be trusted to guide practice in most situations, RCT or high quality observational study.  C: body of evidence provides some support for recommendation but care should be taken in its application, observational studies.  D: Level V evidence or evidence that is weak and recommendation must be applied with caution, expert opinion, animal, or laboratory studies.</p>
Loveday et al., 2014. (1)	<ul style="list-style-type: none"> <li>• Evidence-based guidelines recommend a 15 second cleansing with alcoholic chlorhexidine prior to and after each access (<b>Class D*</b>).</li> </ul> <p>*Levels of evidence (based on GRADE):  Class D. Very low quality, Any evidence of effect is very uncertain. Based on expert opinion, no direct research evidence, or one or more studies with very severe limitations.</p>
Lai et al., 2016. (7)	<ul style="list-style-type: none"> <li>• Compared to those participants given non-impregnated catheters, participants with impregnated catheters had 2% lower rates of bloodstream infections that were definitely catheter-related (CRBSI) (average absolute reduction in CRBSI: 2%). <b>High quality*</b>.</li> </ul>

	<ul style="list-style-type: none"> <li>• There was also a 9% lower chance of finding bacteria on these impregnated catheters (catheter colonization) (average absolute reduction in catheter colonization: 9%). <b>Moderate quality*</b>.</li> <li>• The benefits of these catheters in reducing catheter colonization varied according to study setting, with significant benefits observed only in studies conducted in Intensive Care Units. <b>Moderate quality*</b></li> <li>• There were no clinically significant differences in the overall rates of bloodstream infections (clinically-diagnosed sepsis) (<b>Moderate quality*</b>), or in death (<b>High quality*</b>) between impregnated and non-impregnated catheters. There is also a <b>high quality*</b>, but smaller body of evidence that shows no significant benefit of impregnated catheters in reducing mortality, and <b>moderate quality evidence*</b> shows no difference in clinically diagnosed sepsis. Subsequently, there remains uncertainty about the value of these modified catheters in improving overall patient mortality and morbidity. Therefore, impregnated catheters appeared no more likely than non-impregnated catheters to cause adverse effects such as bleeding, clots, pain or redness at the insertion site.</li> </ul> <p>*GRADE Working Group grades of evidence High quality: Further research is very unlikely to change our confidence in the estimate of effect. Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.</p>
Marschall et al., 2014 (12)	<p><u>Excerpt from Practice Recommendations.</u></p> <p>1. Use antiseptic- or antimicrobial-impregnated CVCs in adult patients (<b>High quality*</b>).</p> <p>a. The risk of CLABSI is reduced with some currently marketed antiseptic-impregnated (e.g., chlorhexidine– silver sulfadiazine) catheters and antimicrobial impregnated (e.g., minocycline-rifampin) catheters.</p> <p><u>IV. Unresolved issues.</u></p> <p>1. Routine use of needleless connectors as a CLABSI prevention strategy before an assessment of risks, benefits, and education regarding proper use.</p> <p>a. Multiple devices are currently available, but the optimal design for preventing infections is unresolved.</p> <p>The original purpose of needleless connectors was to prevent needlestick injuries during intermittent use. No data regarding their use with continuous infusions are available.</p> <p>*Based on GRADE and the Canadian Task Force on Preventive Health Care: High. Highly confident that the true effect lies close to that of the estimated size and direction of the effect. Evidence is rated as high quality when there is a wide range of studies with no major limitations, there is little variation between studies, and the summary estimate has a narrow confidence interval.</p>

## Conclusion

**Q1.** Practice recommendations are to use chlorhexidine-containing dressings for central venous catheters (CVCs) in patients over 2 months of age to reduce central line-associated blood stream infections. Dressings impregnated with a medication reduce catheter-related blood stream infection and catheter colonisation. CGH-impregnated sponge dressings are also recommended in adult patients with a central venous catheter to reduce bloodstream infection.

The use of 3M Tegaderm CHG IV securement dressings for central venous and arterial catheter insertion sites to reduce catheter-related bloodstream infection (CRBSI) and local infection is supported by the evidence.

**Q2.** At this point in time, no conclusion can be made comparing the needleless catheter connector type and infection rates given the paucity of evidence and the evidence search strategy used in this report. The Society for Healthcare Epidemiologists of America and Infectious Disease Society of America recommend against using positive displacement needleless connectors with mechanical valves without a thorough assessment of risks and benefits. The United States Food and Drug Administration also do not recommend changes in use of positive displacement needleless connectors.

In 2010 the US Food and Drug Administration (FDA) required 9 companies that make positive-displacement needleless connectors for intravenous (IV) therapy to assess whether these devices pose a higher risk for bloodstream infections than other types of needleless connectors.

In order to satisfy an FDA post-market surveillance request, CareFusion undertook a large analysis for needleless connectors. Using 2013 Center for Medicare and Medicaid Services Hospital to compare data. The analysis reported from 3,074 hospitals, accounting for nearly 11,000 CLABSIs associated with nearly 10 million catheter days that hospitals using CareFusion MaxPlus needleless connector had lower unadjusted CLABSI rates, as well as lower

standardized infection ratios, compared to hospitals not using MaxPlus needleless connector (15). In August 6, 2014 letter to CareFusion, the FDA confirmed that CareFusion fulfilled the post-market surveillance request. (15)

**Q3.** Heparin locking is not superior to saline locking for the prevention of lumen occlusion and/or catheter colonisation and/or catheter-related blood stream infection.

**Q4.** A 15 second cleansing with alcoholic chlorhexidine prior to and after each access. Aseptic technique is the foundation for safe delivery of intravenous medications and solutions. A lack of compliance exists with disinfection of access ports prior to and after access, despite educational initiatives, and better disinfection agents.

While impregnated catheters are effective in reducing CRBSI and catheter colonization, particularly in Intensive Care Units, they may not be effective across all settings. Furthermore, impregnated catheters do not appear to reduce all bloodstream infections and numbers of deaths.

## References

---

1. Loveday, H. P., Wilson, J., Pratt, R. J., Golsorkhi, M., Tingle, A., Bak, A., ... & Wilcox, M. (2014). Epic3: national evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. *Journal of Hospital Infection*, 86, S1-S70. <http://www.sciencedirect.com/science/article/pii/S0195670113600122>
2. Ullman, A. J., Cooke, M. L., Mitchell, M., Lin, F., New, K., Long, D. A., ... & Rickard, C. M. (2015). Dressings and securement devices for central venous catheters (CVC). *The Cochrane Library*. <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010367.pub2/pdf>
3. Jenks, M., Craig, J., Green, W., Hewitt, N., Arber, M., & Sims, A. (2016). Tegaderm CHG IV Securement Dressing for Central Venous and Arterial Catheter Insertion Sites: A NICE Medical Technology Guidance. *Applied Health Economics and Health Policy*, 14(2), 135-149. <http://link.springer.com/article/10.1007/s40258-015-0202-5>
4. National Institute for Health Care and Excellence. (2015). The 3M Tegaderm CHG IV securement dressing for central venous and arterial catheter insertion sites. Medical technologies guidance. Published: 22 July 2015. [www.nice.org.uk/guidance/mtg25](http://www.nice.org.uk/guidance/mtg25)
5. Pittiruti, M. (2015). A GAVeCeLT Project: The Development of a Consensus on the Most Appropriate Lock Solution for Central Venous Catheters. *The Journal of the Association for Vascular Access*, 20(4), 240-241. [http://www.avajournal.com/article/S1552-8855\(15\)00176-2/abstract](http://www.avajournal.com/article/S1552-8855(15)00176-2/abstract)
6. Moureau, N. L., & Flynn, J. (2015). Disinfection of needleless connector hubs: clinical evidence systematic review. *Nursing Research and Practice*, 2015. <https://www.hindawi.com/journals/nrp/2015/796762/abs/>
7. Lai, N. M., Chaiyakunapruk, N., Lai, N. A., O'Riordan, E., Pau, W. S. C., & Saint, S. (2013). Catheter impregnation, coating or bonding for reducing central venous catheter-related infections in adults. *The Cochrane Library*. <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007878.pub3/full>
8. Jarvis W.R. (2010). Choosing the best design for intravenous needleless connectors to prevent bloodstream infections. *Infection Control Today*.
9. Maragakis LL, Bradley KL, Song X, Beers C, Miller MR, Cosgrove SE, et al. (2006) Increased catheter-related bloodstream infection rates after the introduction of a new mechanical valve intravenous access port. *Infection Control and Hospital Epidemiology*, 27(1):67-70.
10. Casey, A. L., Karpanen, T. J., Nightingale, P., Chaganti, S., & Elliott, T. S. J. (2016). Microbiologic contamination of a positive-and a neutral-displacement needleless intravenous access device in clinical use. *American Journal of Infection Control*.
11. Tabak, Y. P., Jarvis, W. R., Sun, X., Crosby, C. T., & Johannes, R. S. (2014). Meta-analysis on central line-associated bloodstream infections associated with a needleless intravenous connector with a new engineering design. *American Journal of Infection Control*, 42(12), 1278-1284.
12. Marschall, J., Mermel, L. A., Fakih, M., Hadaway, L., Kallen, A., O'Grady, N. P., . & Yokoe, D. S. (2014). Strategies to prevent central line-associated bloodstream infections in acute care hospitals: 2014 update. *Infection Control & Hospital Epidemiology*, 35(S2), S89-S107.
13. Canadian Agency for Drugs and Technologies in Health. (2010). Positive versus Negative Needleless Connectors for Central Venous Lines and Peripheral Lines: A Review of the Clinical Effectiveness and Guidelines. *Ottawa: Canadian Agency for Drugs and Technologies in Health (CADTH)*.
14. United States Food and Drug Administration. (2015). Letter to Infection Control Practitioners Regarding Positive Displacement Needleless Connectors. <http://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm220459.htm>
15. [http://www.wyohospitals.com/pdf/2016/InfectionPrevention/Jarvis%20Understanding%20the%20Realtive%20Risk%20of%20NCs\\_A%20Call%20to%20Action%20BCCR%20Approved%20May%2020%202015.pdf](http://www.wyohospitals.com/pdf/2016/InfectionPrevention/Jarvis%20Understanding%20the%20Realtive%20Risk%20of%20NCs_A%20Call%20to%20Action%20BCCR%20Approved%20May%2020%202015.pdf)