Guideline for Infection Prevention in NICU Patients: Workgroup Update

Kristina Bryant, MD
HICPAC Member
Workgroup Chair

Health Care Infection Control Practices Advisory Committee Meeting
May, 2019
Overview

• Preliminary Draft Recommendations
  • CLABSI

• Updates
  • Respiratory Illness
  • NICU Core Practices
  • *S. aureus*

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
Methods: GRADE

Confidence in the Evidence
- RCTs start high
- Non-randomized studies start low

- Factors lower the quality of evidence
  - Risk of Bias, Inconsistency, Indirectness, Imprecision, and Publication bias
- Factors can increase the quality of evidence
  - Large magnitude of effect, Dose-Response, and Confounding
Methods: Updated Recommendation Categories

Recommendation
• Benefits clearly exceed the harms (or vice versa)
• Confidence in supporting evidence:
  • High to moderate
  • Low, very low, or expert opinion if high-quality evidence is impossible to obtain
• Federal regulation

Conditional Recommendation
• Benefits likely to exceed the harms (or vice versa)
• Confidence in supporting evidence is low, moderate, or high when:
  • High quality evidence exists, but benefit/harm balance is not clearly in one direction
  • Weak evidence and the recommendation may not consistently lead to benefit
  • Indirect high quality evidence (e.g. benefit is seen in other populations & settings)
  • Evidence of benefit (or harm) is in the context of simultaneously implemented interventions
  • The evidence base is likely to change
  • Benefit is most likely if intervention is implemented as a supplemental measure

No Recommendation
• Lack of evidence
• Unclear balance of benefits and harms

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy
Draft Recommendations

1. Statement (Recommendation; Conditional Recommendation; No Recommendation)

   Supporting Evidence:
   Level of confidence in evidence:
   Benefits:
   Harms:
   Resource use:
   Balance of benefits and harms:
   Value judgments
   Intentional vagueness:
   Exceptions:
CLABS I: What are effective strategies to prevent CLABS I in neonatal intensive care unit patients?

Literature Search

• 168 studies selected for inclusion
  • 72 studies included from 2012
  • 96 studies included from 2012-2018
CLABSI Topics

• Updated 2012 Topics
  • Central Line Antimicrobial Locks
  • Optimal UVC Duration
  • Optimal Central Line Type
  • Optimal Central Line Insertion Site

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy
CLABSI: Central Line Antimicrobial Locks

In NICU patients with central line catheters, does the use of central line antimicrobial locks, compared to standard of care, prevent CLABSI?

Evidence: 3 RCTs

- Seliem 2010, n=83
  - Amikacin-heparin saline locks 2x/day for 20 minutes
- Filippi 2007, n=103
  - Fucidic acid-heparin locks 1x/day for 30-60 minutes
- Garland 2006, n=84
  - Vancomycin-heparin saline locks 2x/day. 20 minutes for neonates fed by parenteral hyperalimentation, and 60 minutes when feeding exceeded 20ml/kg/day
CLABSI: *Central Line Antimicrobial Locks*

**Evidence: CRBSI - Benefit**

- **Seliem 2010, n=83**
  - Amikacin Lock 3/41 (7.3%) vs. No Lock: 11/42 (26.2%);
  - OR: 0.27 (95% CI: 0.16 – 0.87); p<0.001

- **Filippi 2007, n=103**
  - Fusidic acid lock: 1/50 (2%) vs. Heparin saline: 11/53 (20.8%)
  - RR: 0.09 (95% CI: 0.01 – 0.72); p<0.01

- **Garland 2006, n=84**
  - Vancomycin lock: 0/42 vs. Heparin saline: 8/43 (18.6%)
  - RR: 0.05 (95% CI: 0.003 – 0.95); p=0.05
CLABSI: *Central Line Antimicrobial Locks*

**Evidence:** CRBSI - Benefit

- **Seliem 2010**, n=83
  - Amikacin Lock 3/41 (7.3%) vs. No Lock: 11/42 (26.2%)
  - OR: 0.27 (95% CI: 0.16 – 0.87); p<0.001

- **Filippi 2007**, n=103
  - Fusidic acid lock: 1/50 (2%) vs. Heparin saline: 11/53 (20.8%)
  - RR: 0.09 (95% CI: 0.01 – 0.72); p<0.01

- **Garland 2006**, n=84
  - Vancomycin lock: 0/42 vs. Heparin saline: 8/43 (18.6%)
  - RR: 0.05 (95% CI: 0.003 – 0.95); p=0.05

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy
## CLABSI: Central Line Antimicrobial Locks

<table>
<thead>
<tr>
<th>Study, year</th>
<th>Suspected /Probable BSI</th>
<th>Hypoglycemia</th>
<th>Antimicrobial Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lock (%)</td>
<td>Control (%)</td>
<td>Lock (%)</td>
</tr>
<tr>
<td>Seliem, 2010</td>
<td>2.4</td>
<td>2.3</td>
<td>12.2</td>
</tr>
<tr>
<td></td>
<td>RR: 1.01 (95% CI: 0.8 – 1.1); P=0.9</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Filippi, 2007</td>
<td>4</td>
<td>3.8</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>1.06 (95% CI: 0.16 – 7.24); P= NS</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Garland, 2006</td>
<td>4.8</td>
<td>11.6</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>0.41 (95% CI: 0.08 – 2.00); p=0.43</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
Consider central line antimicrobial locks for neonatal intensive care unit patients in addition to core infection prevention and control strategies when a unit is experiencing ongoing CLABSIs. Conditional Recommendation

- **Supporting Evidence**: Three randomized controlled trials. (Seliem, Garland, Filipi)
- **Level of confidence in evidence**: The level of confidence in this evidence is high because randomized controlled trials are considered at low risk of bias. This evidence could be rated down for indirectness as the studies were not conducted in the current standard of care.
- **Benefits**: A reduction in definite CR-BSI, was seen in all three studies. No benefit was seen in the outcomes of suspected/probable CR-BSI, or BSI without a source.
- **Harms**: Harms that could result from this recommendation include hypoglycemia, adverse product related events, and the development of antimicrobial resistance to the agent used. The presence of a lock results in the interruption of fluid to the neonate, and asymptomatic hypoglycemia occurred in greater than 10% of infants during use of the locks whether the lock contained antibiotics-heparin or saline-heparin. Antibiotic levels in infants’ blood were not detected in the vast majority; and when antibiotic levels were detected, they were at very low levels that should not result in harm.
- **Resource use**: The use of antimicrobial lock prophylaxis will result in increased human and material cost, however, in the context of high baseline rates these costs are likely to be lower than the costs of the infections.
Consider central line antimicrobial locks for neonatal intensive care unit patients in addition to core infection prevention and control strategies when a unit is experiencing ongoing CLABSI.  Conditional Recommendation

- **Balance of benefits and harms**: The benefits of CR-BSI reduction are balanced with the possible harms of hypoglycemia and the development of antimicrobial resistance. However, all three studies reported high baseline CR-BSI rates, which may confound the benefit seen in these studies, since evidence-based insertion and maintenance practices have resulted in baseline CR-BSI rates that are currently much lower than the baseline rates at the time of the studies. In the context of high baseline rates, these benefits may outweigh the harms.

- **Value judgments**: Patient safety, facility rates, economic and human resource use, and the development of antimicrobial resistance.

- **Intentional vagueness**: The antimicrobial agent is not specified in this recommendation. This is because each study used a different antibiotic. Each facility can review the hospital antibiogram and the causal bacteria for the high CLABSI rates in the unit and determine the optimal antibiotic agent. Not all catheters may be compatible with all antimicrobial agents.

- **Exceptions**: Infants who require continuous infusions that cannot be interrupted.

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
CLABSI: Catheter Dwell Time: UVCs


1. Remove and do not replace umbilical artery catheters if any signs of CRBSI, vascular insufficiency in the lower extremities, or thrombosis are present [145]. *Category II*

2. Remove and do not replace umbilical venous catheters if any signs of CRBSI or thrombosis are present [145]. *Category II*

7. Remove umbilical catheters as soon as possible when no longer needed or when any sign of vascular insufficiency to the lower extremities is observed. Optimally, umbilical artery catheters should not be left in place >5 days [145, 154]. *Category II*

8. Umbilical venous catheters should be removed as soon as possible when no longer needed, but can be used up to 14 days if managed aseptically [155, 156]. *Category II*

9. An umbilical catheter may be replaced if it is malfunctioning, and there is no other indication for catheter removal, and the total duration of catheterization has not exceeded 5 days for an umbilical artery catheter or 14 days for an umbilical vein catheter. *Category II*
CLABSI: Catheter Dwell Time: UVCs

BSI Guideline 2011 Umbilical Catheter Recommendations:

Not reassessed

1. Remove and do not replace umbilical artery catheters if any signs of CRBSI, vascular insufficiency in the lower extremities, or thrombosis are present [145]. *Category II*

2. Remove and do not replace umbilical venous catheters if any signs of CRBSI or thrombosis are present [145]. *Category II*

7. Remove umbilical catheters as soon as possible when no longer needed or when any sign of vascular insufficiency to the lower extremities is observed. Optimally, umbilical artery catheters should not be left in place >5 days [145, 154]. *Category II*

8. Umbilical venous catheters should be removed as soon as possible when no longer needed, but can be used up to 14 days if managed aseptically [155, 156]. *Category II*

9. An umbilical catheter may be replaced if it is malfunctioning, and there is no other indication for catheter removal, and the total duration of catheterization has not exceeded 5 days for an umbilical artery catheter or 14 days for an umbilical vein catheter. *Category II*
CLABSI: *Catheter Dwell Time: UVCs*

BSI Guideline 2011 Umbilical Catheter Recommendations: Assessed for Draft Updates to Optimal Dwell Time

1. Remove and do not replace umbilical artery catheters if any signs of CRBSI, vascular insufficiency in the lower extremities, or thrombosis are present [145]. *Category II*

2. Remove and do not replace umbilical venous catheters if any signs of CRBSI or thrombosis are present [145]. *Category II*

7. Remove umbilical catheters as soon as possible when no longer needed or when any sign of vascular insufficiency to the lower extremities is observed. Optimally, umbilical artery catheters should not be left in place >5 days [145, 154]. *Category II*

8. Umbilical venous catheters should be removed as soon as possible when no longer needed, but can be used up to 14 days if managed aseptically [155, 156]. *Category II*

9. An umbilical catheter may be replaced if it is malfunctioning, and there is no other indication for catheter removal, and the total duration of catheterization has not exceeded 5 days for an umbilical artery catheter or 14 days for an umbilical vein catheter. *Category II*

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
In NICU patients, what is the optimal duration of umbilical catheters to prevent CLABSI?

**Evidence:** 1 RCT and 4 non-randomized studies

- **Sanderson 2017**, n = 3,985 infants
  - UVC vs PICC vs UVC followed by PICC

- **Vachharajani 2017**, n = 201 infants >1000g and <1500g
  - QI initiative to reduce the number of PICCs inserted by updating feeding guidelines and increasing dwell time of UVCs from 5 to 7 days prior to changing to PICC

- **Butler O’Hara 2012**, n = 986 infants
  - Cohort comparing UVC in place for 7 days, followed by PICC when needed vs UVC in place for >7 days, followed by PICC when needed

- **Butler O’Hara 2006**, n = 210 infants <1250g (RCT)
  - Umbilical vein catheter in place up to 28 days (long-term) vs. umbilical vein catheter for 7–10 days followed by percutaneous central venous catheter (short-term)

- **Bhandari 1997**, n = 2,091 infants
  - Risk factor analysis for vascular catheter types (UA: Umbilical Artery; UV: Umbilical Venous; CV: Central Venous Tunneled; PC: Percutaneous; PA: Peripheral Artery)
CLABSI: Catheter Dwell Time: UVCs

Evidence: infectious outcomes
• CLABSI
  • 2 studies: longer use of umbilical catheter was associated with increased risk of CLABSI
    • Butler O’Hara 2012: CLABSI rate in UVC rose rapidly for catheters in place >7 days, with a more than 20-fold increase in CLABSI risk in UVC in place for 11-14 days
    • Sanderson 2017: Risk of CLABSI increased beyond 3-4 days of dwell time, and that risk doubled every 2 days thereafter if the UVC was followed by PICC insertion
  • Vachharajani 2017: Increasing UVC dwell time from 5 to 7 days before inserting PICC was associated with no increase in CLABSI (Vachharajani)
CLABSI: Catheter Dwell Time: UVCs

Evidence: infectious outcomes

- CRBSI
  - Dwell times up to 28 days for UVC only had a higher rate of infection compared with UVC dwell times of 7-10 days followed by a PICC but this was not significant (Butler O’Hara 2006)

- Sepsis
  - Sepsis incidence associated with UAC increased with increasing duration, however this did not reach significance until aggregating ≥ 8 days compared with ≤7 days (P<0.0001). (Bhandari)
CLABSI: Catheter Dwell Time: UVCs

Evidence: Adverse events
• No difference in thrombosis, mortality, arrhythmia, embolus, hemorrhage, and pleural effusion between UVCs left in place up to 28 days and UVCs left in place 7-10 days (Butler O’Hara 2006)
CLABSI: UVC Dwell Time Draft Recommendation

Remove umbilical venous and umbilical arterial catheters as soon as possible and when no longer needed due to the concern for increasing risk of CLABSI associated with increasing dwell time. Recommendation

• **Supporting Evidence:** One randomized controlled trial (Butler O’Hara, 2006 (3028), and four observational studies. (Bhandari, Butler O’Hara 2012, Sanderson, Vachharajani)

• **Level of confidence in evidence:** The level of confidence in this evidence is very low because observational studies are considered at higher risk of bias than randomized controlled trials and there was a loss of confidence due to imprecision. Only one study was conducted in the current standard of care.

• **Benefits:** The evidence reported increasing risk of infection with increasing UVC dwell time, suggesting a benefit to removing UVCs at the earliest opportunity.

• **Harms:** The evidence suggested that increasing dwell time for UVCs resulted in no difference in adverse events.

• **Resource use:** The literature search did not retrieve evidence on resource use. Theoretically, reducing UVC dwell time could reduce material and human resource costs.

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
CLABSI: UVC Dwell Time Draft Recommendation

Remove umbilical venous and umbilical arterial catheters as soon as possible and when no longer needed due to the concern for increasing risk of CLABSI associated with increasing dwell time. Recommendation

• **Balance of benefits and harms:** While the evidence did not indicate an optimal day by which to remove a UVC to prevent CLABSI, the benefits to removal of UVCs at the earliest opportunity outweigh the harms. It is important to note that UVC dwell time and the risk of CLABSI is only one consideration to balance in the clinical needs of a patient.

• **Value judgments:** The values considered in the formulation of this recommendation include patient safety and economic and human resource costs.

• **Intentional vagueness:** There is no intentional vagueness in this recommendation.

• **Exceptions:** There are no exceptions to this recommendation.
CLABSI: *Insertion Site – Femoral* vs. non-femoral

In NICU patients requiring a central venous catheter, does the use of one insertion site compared to another, prevent CLABSI?

**Evidence:** 2 non-randomized studies for percutaneously inserted central catheters in overlapping populations at the same facility

- **Tsai 2009,**
  - n=518 lines in 334 VLBW infants
  - Femoral = 240 lines vs. Non-femoral = 278 lines
- **Tsai 2011 = Tsai 2009 plus 290 lines in 200 infants.**
  - n=808 lines in 534 VLBW infants
  - Femoral = 410 lines vs. Non-femoral = 398 lines
- Both studies
  - Femoral vs. non-femoral (greater & lesser saphenous veins of lower extremities, basilica veins or cephalic veins of the upper extremities)
  - *Femoral insertion performed when all other peripheral vascular access failed*
CLABSI: Insertion Site - Femoral vs. non-femoral

In NICU patients requiring a central venous catheter, does the use of one insertion site compared to another, prevent CLABSI?

**Evidence:** Catheter-related Sepsis – benefit to using non-femoral site

- Tsai 2009
  - Femoral 54/240 (22.5%) vs non-femoral 34/278 (12.2%); p = 0.002
- Tsai 2011
  - Femoral: 83/410 (20.2%) vs. Non-femoral: 51/398 (21.8%)
  - Adjusted OR for Femoral Placement: 1.53 (1.07 – 2.25); p = 0.044
CLABSI: *Insertion Site - Femoral vs. non-femoral:*

In NICU patients requiring a central venous catheter, does the use of one insertion site compared to another, prevent CLABSI?

**Evidence:** Adverse events – inconsistent results across studies.

- Tsai 2009
  - Non-femoral insertion was associated with phlebitis, catheter site inflammation, or early removal of line, but no difference in thrombosis, occlusion, rupture, leakage

- Tsai 2011
  - No difference in non-infectious complications including phlebitis, thrombosis, cholestasis, rupture, leakage, etc.
CLABSI: Insertion Site – Upper vs. Lower Extremity

In NICU patients requiring a central venous catheter, does the use of one insertion site compared to another, prevent CLABSI?

Evidence: 3 non-randomized studies on PICCs

- Bashir 2016, 827 PICC lines in 827 preterm infants
  - Upper extremity = 593 lines vs. Lower extremity = 234 lines
  - Insertion site selected at discretion of inserter based on accessibility of veins
- Wrightson 2013, n=626 PICCs in 559 infants
  - Upper extremity = 374 lines vs. Lower extremity = 252 lines
  - Insertion location based on vein quality, infant’s condition, and inserter’s skill and preference (Cephalic was most common at 49.7%)
- Hoang 2008, 477 PICCs in 396 infants
  - Upper extremity = 370 lines vs. Lower extremity = 183 lines
  - Lower extremity PICCs inserted b/c of failure to insert in upper extremity or as primary selection site.
CLABSI: Insertion Site – Upper vs. Lower Extremity

In NICU patients requiring a central venous catheter, does the use of one insertion site compared to another, prevent CLABSI?

Evidence: for infectious outcome measures all = no difference

- CLABSI: Bashir 2016
  - No difference in incidence or rates (baseline of 5.9%)
- CRBSI: Hoang 2008
  - No difference in incidence (baseline 11%)
- Presumed Sepsis: Wrightson 2013
  - No difference in incidence (baseline 7-8%)
CLABSI: Insertion Site – Upper vs. Lower Extremity

In NICU patients requiring a central venous catheter, does the use of one insertion site compared to another, prevent CLABSI?

Evidence: Adverse Events – inconsistent results

• Bashir 2016
  • Upper extremity = greater risk of infiltration
  • no difference in phlebitis or occlusion

• Wrightson 2013
  • No difference in phlebitis, clotting, and edema

• Hoang 2008
  • Upper extremity = greater risk of cholestasis, shorter time to first complication
  • No difference in phlebitis
CLABSI: Insertion Site - Femoral vs. Jugular vs. Subclavian:

In NICU patients requiring a central venous catheter, does the use of one insertion site compared to another, prevent CLABSI?

Evidence: 2 non-randomized studies for tunneled catheters

- Breschan 2007, n=236
  - Internal jugular n=129 lines vs. subclavian, n=107
- Venguta 2005, n=137
  - Neck, n=88 (Left and right subclavian and internal jugular veins, and right internal and external jugular vein) vs. Groin, n=49 (left and right long saphenous vein)
CLABSI: Insertion Site - Femoral vs. Jugular vs. Subclavian

In NICU patients with central line catheters, does the use of central line antimicrobial locks, compared to standard of care, prevent CLABSI?

Evidence:

- Breschan 2007, CABS: benefit to using subclavian vs. internal jugular
  - Internal jugular 20/129 (15/5%) vs. subclavian 5/107 (4.7%) p<0.01
- Venguta 2005, Catheter infection – benefit to using groin
  - Neck: 11/88 (12.5%) vs. Groin: 1/49 (2%); p=0.032
CLABSI: Insertion Site - Femoral vs. Jugular vs. Subclavian

In NICU patients with central line catheters, does the use of central line antimicrobial locks, compared to standard of care, prevent CLABSI?

Evidence: Adverse events

- Breschan 2007
  - Reduction in clinical obstruction associated with the subclavian site
  - No difference in clinical thrombosis, pneumothorax, hemothorax
- Venguta 2005
  - Reduction in dislodgement was associated with groin
  - No difference in clinical thrombosis, leaks, and pleural/ pericardial complications
CLABSI: Catheter Insertion Site Draft Recommendation

Choose the insertion site appropriate to the central line type to be inserted in a NICU patient (e.g., UVC, PICC, etc.) based on the clinical needs of the patient. The choice of central line insertion site for a NICU patient should not be based solely on CLABSI prevention. Recommendation

- **Supporting Evidence:** Seven observational studies (Bashir, Hoang, Wrightson, Breshan, Venguta, Bashir, Tsai 2011, Tsai 2009)
- **Level of confidence in evidence:** The level of confidence in this evidence was very low because observational studies are at higher risk of bias compared to randomized controlled trials, and studies reported heterogeneous outcome measures for infection, resulting in a loss of confidence due to imprecision. The two studies evaluating femoral lines vs. non-femoral lines were conducted in the same NICU with overlapping study periods (Tsai 2011, Tsai 2009). All studies were conducted prior to the implementation of insertion and maintenance bundles.
- **Benefits:** The evidence was either limited (percutaneous and tunneled catheters) or did not suggest a benefit to use of one insertion site over another (PICCs).
- **Harms:** Association between adverse events and an insertion site was limited and inconsistent, but suggested adverse events were associated with upper extremities, and non-femoral sites.

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
CLABSI: Catheter Insertion Site Draft Recommendation

Choose the insertion site appropriate to the central line type to be inserted in a NICU patient (e.g., UVC, PICC, etc.) based on the clinical needs of the patient. The choice of central line insertion site for a NICU patient should not be based solely on CLABSI prevention. Recommendation

- **Resource use**: The literature search did not retrieve studies comparing resource utilization associated with different insertion sites for tunneled catheters or PICCs. Theoretically, there would be no difference in human or materials costs to place a catheter in one site over another but in two studies, the femoral insertion site was chosen only if insertion in other sites failed. If placement in the first insertion site chosen is technically more challenging and results in multiple attempts, this could increase both human and material costs.

- **Balance of benefits and harms**: There was unclear benefit associated with different insertion sites. There is limited data to suggest an increase in adverse events associated with upper extremity site and non-femoral sites with PICCs. The choice of catheter insertion site is often limited by the availability of access in the neonate.

- **Value judgments**: Value judgements considered in the formulation of this recommendation include patient safety and economic and human resource costs, as well as practical considerations. There may be logistical challenges to maintaining femoral catheters in diapered children.

- **Intentional vagueness**: There is no intentional vagueness in this recommendation

- **Exceptions**: There are no exceptions to this recommendation

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy
CLABSI: Catheter Type: UVC vs. PICC

In NICU patients requiring a central venous catheter, does the use of one catheter type compared to another, prevent CLABSI?

Evidence: 3 non-randomized studies comparing UVCs and PICC
  • Sanderson 2017, n = 3985 lines (data collected from 2007 – 2009)
    • UVC = 2668 lines vs. PICC = 3332 lines
  • Shalabi 2015, n= 540 lines – (data collected from 2010 – 2013: utilized bundle)
    • UVC = 180 lines vs. PICC= 180 lines
  • Arnts 2014, n = 203 lines – data collected from 2005 - 2006
    • UVC = 140 lines vs. PICC= 63 lines
CLABSI: Catheter Type: UVC vs. PICC

In NICU patients requiring a central venous catheter, does the use of one catheter type compared to another, prevent CLABSI?

**Evidence:** Infectious outcomes – largely no difference

- **CLABSI**
  - Sanderson 2017: CLABSI risk 2 times as high for UVCs (aHR 1.00 vs. 0.51 (95%CI: 0.40 – 0.66)
  - Arnts: no difference in incidence of removal for CLABSI

- **CRBSI**
  - Shalabi 2015: no difference in risk of CABS (Adj IRR: 1.18 (95%CI: 0.59 – 2.34); p=0.64

- **Late onset sepsis**
  - Shalabi 2015: no difference in risk (Adj IRR: 1.06 (95%CI: 0.64 – 1.75); p=0.82
CLABSI: Catheter Type: UVC vs. PICC

In NICU patients requiring a central venous catheter, does the use of one catheter type compared to another, prevent CLABSI?

**Evidence:** Adverse events
- Arnts 2014
  - No difference in obstruction, extravasation, dislocation, and leakage
CLABSIs: Catheter Type: UVC vs. PICC vs. Tunneled

In NICU patients requiring a central venous catheter, does the use of one catheter type compared to another, prevent CLABSIs?

Evidence: 6 non-randomized studies comparing UVCs, PICCs, and tunneled

- Geldenhuys 2017, n=95 neonates
  - UVC = 55 lines vs. PICC = 23 lines vs. CVC = 14 lines

- Soares 2017, n = 400 lines (240 neonates)
  - UVC = 84 lines vs. UAC = 55 lines vs. PICC = 182 lines vs. short duration = 57 lines vs. tunneled = 22 lines

- **Greenberg 2015, n = 15,567 lines
  - Tunneled = 1,116 lines vs. PICC= 14,451 lines

- de Brito 2010, n= 461
  - UVC = 33 lines vs. PICC= 20 lines vs. phlebotomy = 24 lines vs. intracath = 7 lines

- Chien 2002, n=19,507 infants
  - Lines NR, data provided as rate

- Bhandari 1997, n=3,107 lines
  - UAC = 1,699 lines vs. UVC = 617 lines vs. percutaneous= 308 lines vs. CVC: 294 vs. Peripheral Artery =189 lines

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
CLABSI: Catheter Type: UVC vs. PICC vs. Tunneled

In NICU patients requiring a central venous catheter, does the use of one catheter type compared to another, prevent CLABSI?

Evidence: infectious outcomes

• CLABSI: tunneled catheters = higher incidence
  • Geldenhuys found higher incidence for tunneled catheters, PICCs, and CVCs compared with UVCs (insertion in operating theater = significant risk factor)
  • Greenberg: Tunneled catheters incidence 2.4 times PICC
  • Soares: no difference

• Catheter-associated BSI
  • De Brito: higher rate for PICCs than UVC, intracath, and phlebotomy

• Nosocomial BSI
  • Chien: higher rate associated with PICC and tunneled than UVC

• Nosocomial Sepsis
  • Bhandahari: higher incidence with tunneled and PICC than UVC
CLABSI: Catheter Type: UVC vs. PICC vs. Tunneled

In NICU patients requiring a central venous catheter, does the use of one catheter type compared to another, prevent CLABSI?

**Evidence:** adverse events

- Infiltration
  - Soares: reported higher rates of infiltration and no elective removal associated with PICCs compared with UAC, UVC, short duration venous catheters and tunneled catheters.
CLABSI: Catheter Type Draft Recommendation

Choose the central line type to be inserted (e.g., umbilical venous catheter (UVC), percutaneously inserted central catheter (PICC), tunneled catheter, etc.) based on the clinical needs of the NICU patient. The choice of central line type to insert in a NICU patient should not be based solely on CLABSI prevention. Recommendation

- **Supporting Evidence**: Nine observational studies. (Arnts, Sanderson, Shalabi, Bhandari, Chien, de Brito, Geldenhuys, Greenberg, Soares).

- **Level of confidence in evidence**: The level of confidence in this evidence is very low because observational studies are considered at higher risk of bias than randomized controlled trials, and each study compared different interventions and reported different infectious outcome measures, resulting in a loss of confidence due to imprecision. Three studies compared umbilical venous catheters to with percutaneously inserted central venous catheters (Arnts, Sanderson, Shala). Six studies compared various catheter types that included umbilical arterial catheters, umbilical venous catheters, percutaneous arterial catheters, percutaneous venous catheters, peripherally inserted central catheters, intracath, phlebotomy catheters, and tunneled catheters. Only two studies were conducted in the era of insertion and maintenance bundles.

- **Benefits**: The evidence did not suggest a clear benefit of one catheter type over another, however studies evaluated different patient populations with varying clinical indications for central venous access and this was likely reflected in the evidence. The variations in dwell time according to catheter type was a confounding factor in interpreting the results seen in the evidence.
CLABSI: Catheter Type Draft Recommendation
Choose the central line type to be inserted (e.g., umbilical venous catheter (UVC), percutaneously inserted central catheter (PICC), tunneled catheter, etc.) based on the clinical needs of the NICU patient. The choice of central line type to insert in a NICU patient should not be based solely on CLABSI prevention. Recommendation

- **Harms:** One study suggested the risk of infiltration was higher with PICCs than with other catheters.

- **Balance of benefits and harms:** The balance of benefits vs harms was unclear in the evidence. Factors that influence catheter type selection include but are not limited to the chronologic and gestational age of the patient, patient size, the presence or absence of congenital abnormalities, prior device utilization and the projected duration of central venous catheterization. *CLABSI prevention is not the primary consideration when choosing the which catheter type to insert in a NICU patient.*

- **Resource use:** The literature search did not retrieve data on the comparative material costs of different catheter types. It is likely that material and human resource costs for insertion and maintenance of each catheter type will vary from facility to facility. Insertion of some catheter types (i.e. tunneled catheters) requires technical expertise that may not be available in all centers.

- **Value judgments:** Value judgements considered in the formulation of this recommendation include patient safety and economic and human resource costs.

- **Intentional vagueness:** There is no intentional vagueness in this recommendation

- **Exceptions:** There are no exceptions to this recommendation

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
Questions?

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
CLABSI: What are effective strategies to prevent CLABSI in neonatal intensive care unit patients?

Remaining 2012 Intervention categories with no new evidence:

• Systemic Prophylaxis
  • Antimicrobial
  • Anticoagulant

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
CLABSIs: What are effective strategies to prevent CLABSIs in neonatal intensive care unit patients?

Remaining 2012 Interventions with newer evidence:

- Multi-intervention strategies, bundles, and checklists: 25
- PICC dwell time: 5
- Catheter manipulation (including Closed Medication Systems): 3
- Skin antisepsis: 3
  - Chlorhexidine adverse events: 34
- Line maintenance: 2 (e.g., catheter hub antisepsis)
- Other: 4 (e.g., compliance measures; probiotic use)

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
CLABSI: What are effective strategies to prevent CLABSI in neonatal intensive care unit patients?

Next Steps

• Review and update remaining interventions
• GRADE
• Draft Recommendations & Narrative

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy
Respiratory Illness: What are effective strategies to prevent respiratory illness in NICU patients?

Progress

• 2012 extraction tables updated
  • 23 studies included

• Literature search update:
  • 557 studies retrieved for title and abstract screening
  • 112 studies selected for full text review
  • 18 studies included
Respiratory Illness: What are effective strategies to prevent respiratory illness in NICU patients?

Next Steps

• Review Relevant Questions
• Review & Aggregate Applicable Evidence

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
NICU Core Practices

NICU-specific practices
- Specific family & visitor education
- Specific environmental recommendations (laundry, phenolics, isolette cleaning)
- Visitor screening

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
Questions

• Other NICU-specific core practices?
• NICU Best Practices Document format?

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
S. aureus

Next Steps

• Finalize CDC Clearance
• Public Comment
• Present Public Comments to HICPAC
• Finalize

Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy
Workgroup members and support

**Workgroup members**
- Kristina Bryant (WG Chair, HICPAC, lead – *C. difficile*)
- Michael Brady
- Alexis Elward
- Loretta Fauerbach (HICPAC)
- Charles Huskins (HICPAC)
- Aaron Milstone

**CDC Technical Advisors and Support**
- Kendra Cox
- Cal Ham
- Jamesa Hogges
- Devon Okasako Schmucker
- Shannon Novosad
- Kristin Roberts
- Srila Sen
- Nalini Singh
- Workgroup DFO: Erin Stone
References

Central Line Antimicrobial Locks


References

**UVC Dwell Time**


Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
References

Optimal Catheter Insertion Site


Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
References

Optimal Catheter Type


Disclaimer: This document is a draft. The findings and conclusions in this draft report have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy