ASK THE QUESTION

**Question 1**: For Pediatric Cardiac Intensive Care Unit (PCICU) patients, does the use of a closed arterial line lab sampling system reduce the risk of infection compared to the stopcock method?

**Objective**: To evaluate evidence on the use of a closed system in PCICU patients requiring arterial lines for hemodynamic monitoring and lab sampling.

**Background**: A three-way stopcock is the primary means of obtaining blood from arterial catheters. These stopcocks have been associated with Catheter Related Blood Stream Infections (CR BSI).

SEARCH FOR EVIDENCE

**Search strategies** Review of literature that includes comparison of intraluminal and catheter tip colonization between three-way stopcocks and closed sampling systems, included research-based articles published in English.

**Databases** Google Scholar, PubMed, INS Standards, Rapid Response Report

**Key words/terms** Arterial lines, CR BSI, VAMP, three-way stopcock, infection, blood conservation device
CRITICALLY ANALYZE THE EVIDENCE

Question 1: For PCICU patients, does the use of a closed arterial line lab sampling system reduce the risk of infection compared to the stopcock method?

Practice Recommendation: The use of a closed arterial line lab drawing system should be considered for PCICU patients. Strong Recommendation, Moderate Quality Evidence

Three studies were found comparing the incidence of contamination between open and closed arterial line lab drawing methods. One RCT of 216 patients found that intraluminal fluid contamination was statistically significantly lower in the closed system group than the stopcock group \((p=0.03)\). There was lack of double blinding. The patients were randomized, but the practitioner could identify the system used. The study was limited to adult ICU patients. The qualitative method used for this microbial analysis characterizes colonization less well than semi-quantitative methods. A second RCT of 130 patients found that use of a closed sampling system resulted in significantly fewer episodes of internal bacterial contamination of the arterial monitoring line \((7\%)\) than did the use of a stopcock system \((61\%)\). It also found that use of a closed sampling system resulted in significantly fewer episodes of external bacterial contamination of the arterial monitoring line \((8\%)\) than did the use of a stopcock system \((37\%)\). There was lack of double blinding. The study was limited to adult ICU patients. This study was not designed to evaluate the relationship of contamination to bacteremia and surveillance for this was not performed. Also, the patients were randomized, but the practitioner could identify the system used.

The last RCT of 352 patients found the closed (CLAVE) system showed significant reduction in hub colonization and catheter tip colonization; both \(p<0.0001\). It did not reach statistical significance for CR BSI due to insufficient sample size. \((850\text{ patients required to achieve an } \alpha \text{ error of } 0.05 \text{ and power of } 85\%)\). The CLAVE system was found to be an independent protective factor for catheter tip colonization \((\text{OR } 0.63; 95\% \text{ CI } 0.46-0.85)\) probably because it reduces hub colonization.

<table>
<thead>
<tr>
<th>PICO Question # 1 For PCICU patients, does the use of a closed arterial line lab sampling system reduce the risk of infection compared to the stopcock method?</th>
<th>Lower Quality Rating if:</th>
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</thead>
<tbody>
<tr>
<td>Author/Date/Journal</td>
<td>Purpose of Study</td>
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<tr>
<td>Oto, J et al., 2012 American Journal of Infection Control</td>
<td>To compare microbial contamination resulting from use of blood conservation [BCS] systems and three-way</td>
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<td>Authors</td>
<td>Year</td>
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<td>Crow, S. et al.</td>
<td>1989</td>
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<td>Bouza, E. et al.</td>
<td>2003</td>
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</table>

**Test group 9/107 vs. comparator group 9/107; p=0.03**

There was statistically significant correlation between catheter tip colonization and duration of arterial line utilization.

No relationship between intraluminal fluid contaminiztion and catheter tip contamination.

Less microbial contamination of intraluminal fluid when BCS was used for arterial catheterization.

No relationship between intraluminal fluid contaminiztion and catheter tip contamination.
| [COS] | multiple surgeries and received the same catheter type each time admitted | CLAVE=7.56  
COS=24.66  
P=0.0017  
Skin Colonization  
CLAVE=41.5  
COS=58.9  
P=0.038  
CRBSI  
CLAVE=3.78  
COS=5.89  
P=0.4  
CLAVE was an independent protective factor for catheter tip colonization (OR 0.63; 95% CI 0.46-0.85) |
|---|---|---|

**APPLY THE EVIDENCE**

- A closed system for atrial line lab sampling may be considered in PCICU patients.
- The results comparing the incidence of contamination between open and closed arterial line lab sampling methods were consistent.

**EVALUATE THE EVIDENCE**

**Outcome & Process Measures:**
- A closed system will be in place on patients in PCICU that require and arterial line for lab sampling
- CLABSI will continue to be monitored in PCICU
- A survey will be done to determine RN/MD satisfaction with product as part of IMPROVE project

**Implementation Plan:**
- Educate staff on IMPROVE project
- Explore changes in order set to include: “Closed arterial line system in place”
REFERENCES

