L’accesso venoso nel bambino e nel neonato: nuove metodologie e nuove tecnologie

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Disruptive Innovations

• Vision (first)

• Companies working towards new technologies
Our goal is...

• **Targeting Zero CLABSI and CRBSI**
  – The philosophy that every healthcare institution should be working toward a goal of zero healthcare-associated infections

• **Targeting Zero early and late catheter-related complications**
Central Line Associated Bloodstream Infections (CLABSI) and Catheter Related Bloodstream Infections (CRBSI) are still associated with significant mortality and morbidity in critically ill children with attributable costs exceeding 40,000 dollars.

CLABSI and CRBSI are multifactorial events with a reported incidence varying between 0.46 and 26.5 infections/1,000 catheter-days.
VAD SELECTION
AND HEALTHCARE WORKERS
EDUCATION AND TRAINING

INSERTION

CRBSI Prevention

CARE OF EXITE SITE

DISINFECTION OF CATHETER HUBS,
CONNECTORS AND INJECTION PORTS
Bacteria can colonize a catheter by different mechanisms:
- contamination of the catheter during insertion
- contamination of the catheter hub during maintenance
- spread of skin organisms along the external catheter surface
- hematogenous spread from infection at another site
- infusion of a contaminated fluid (rarely)
Insertion and Maintenance Bundle

Consistent adoption of a specific 'bundle' for CVCs insertion, aiming to minimize CRBSI: **targeting zero**!

1. Hand washing and maximal barrier precautions;
2. Skin antisepsis with 2% chlorhexidine in 70% alcohol;
3. Ultrasound guided venipuncture;
4. Tunneling of the catheter so to obtain an exit site in the infraclavicular area;
5. Sealing of the exit site with glue;
6. Securement with sutureless device or subcutaneously anchored securement devices;
7. Coverage with transparent semipermeable dressing and CHG impregnated sponges;
8. Use of neutral NFC and Port Protectors
✓ Our PICU is a 8 beds tertiary referral center admitting 85 to 100 pediatric critically ill trauma patients per year
✓ We retrospectively reviewed all CVCs inserted in our PICU before and after the adoption and implementation of the insertion, education and maintenance bundle
✓ PICCs and emergency CVCs were excluded.
• **183** CVC in 165 pts: **15** < 1 mo, **70** 1-12 mo, **80** 1-6 yr

• Average dwelling time: **16 ±9** days
Results: Infections

- Before bundle adoption = 16.7 CRBSI per 1000 caths days

- After adoption and implementation of our PICU Bundle, CRBSI dropped to 1.56 per 1000 catheter days!

- Diagnosis by delayed time to positivity after paired blood cultures from the CVC and from a peripheral vein
Late complications: dislodgement

• No episodes of dislodgement

• Why?
  – Consistent use of ‘sutureless’ securement and transparent dressing
  – Appropriately trained nurses
  – Limited spontaneous movements (ICU patients)
  – Glue at the time of insertion
  – Tunneling the catheter
Late complications: thrombosis

• No episodes of **symptomatic venous thrombosis**.

Why?

• Careful US scan of all veins before insertion
• Careful match between vein diameter and cath diameter
• Ultrasound venipuncture
• Optimal micro-introducer kits
• Central tip position verified by I-EKG
• Securement with ‘sutureless’ devices
Most recommendations of our bundle are already known to be effective in reducing infection risk.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Category of Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand hygiene prior to catheter insertion</td>
<td>Category IB</td>
</tr>
<tr>
<td>All inclusive catheter carts or kits</td>
<td>Category IB</td>
</tr>
<tr>
<td>Maximal sterile barrier precautions</td>
<td>Category IB</td>
</tr>
<tr>
<td>Chlorhexidine for skin anti-sepsis</td>
<td>Category IA</td>
</tr>
<tr>
<td>Disinfect hubs and needle-less connectors</td>
<td>Category IA</td>
</tr>
<tr>
<td>Remove non-essential CVCs</td>
<td>Category IA</td>
</tr>
<tr>
<td>Chlorhexidine cleansing</td>
<td>Category II</td>
</tr>
<tr>
<td>CVC dressing</td>
<td>Category IA</td>
</tr>
<tr>
<td>Chlorhexidine sponge dressing</td>
<td>Category 1B</td>
</tr>
</tbody>
</table>
Insertion and Maintenance Bundle

- Four aspects makes this bundle new and original
  - (1) **ultrasound guidance**, which minimizes contamination, by reducing the number of attempts and possible break-down of aseptic technique;
  - (2) **Tunneling the catheter** so to obtain exit site in the infra-clavicular area with reduced bacterial colonization when a long indwelling catheter is expected (> 7 days)
  - (3) **glue, suturless devices and subcutaneously anchored securement devices**, which may act synergistically in reducing all the potential complications of the exit site;
  - (4) **education and assessment** of procedural competence of the staff
Ultrasound Guidance
Critical Care, 2006

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>Ultrasound group (n = 450)</th>
<th>Landmark group (n = 450)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access time (seconds)</td>
<td>$17.1 \pm 16.5,\text{(11.5 to 41.4)}$</td>
<td>$44 \pm 95.4,\text{(33.2 to 77.5)}$</td>
</tr>
<tr>
<td>Average number of attempts</td>
<td>$1.1 \pm 0.6,\text{(1.1 to 1.9)}$</td>
<td>$2.6 \pm 2.9,\text{(1.5 to 6.3)}$</td>
</tr>
<tr>
<td>CVC-BSI</td>
<td>$47,(10.4%)$</td>
<td>$72,(16%)$</td>
</tr>
</tbody>
</table>
By reducing the number of attempts and the risk of hematoma formation, ultrasound guidance may indirectly reduce the incidence of CRBSI (Category IB, CDC Guidelines 2011)
Facilitating Central Venous Catheter placement, ultrasound guidance may indirectly reduce the incidence of CRBSI

(EPIC Guidelines 2014)
Strategies to Prevent Central Line–Associated Bloodstream Infections in Acute Care Hospitals:
2014 Update

5. Use ultrasound guidance for internal jugular catheter insertion (quality of evidence: II).99
   a. Ultrasound-guided internal jugular vein catheterization reduces the risk of CLABSI and of non-infectious complications of CVC placement.100
International evidence-based recommendations on ultrasound-guided vascular access
Table 6 Recommendations regarding sterility using ultrasound guidance and prevention of infectious and mechanical complications using ultrasound-guided cannulation

<table>
<thead>
<tr>
<th>Domain code</th>
<th>Suggested definition</th>
<th>Level of evidence</th>
<th>Degree of consensus</th>
<th>Strength of recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>D8.S1</td>
<td>Sterile techniques should always be used during the placement of a vascular access device, including hand washing; sterile full body drapes; wearing of sterile gowns, gloves, caps and masks covering both the mouth and nose. Probe and cable sterility have to be maintained using sterile gel and appropriate probe and cable shields</td>
<td>A</td>
<td>Very good</td>
<td>Strong</td>
</tr>
<tr>
<td>D8.S2</td>
<td>Ultrasound guidance should be used in order to decrease the rate of CRBSI in adults and children</td>
<td>C</td>
<td>Very good</td>
<td>Strong</td>
</tr>
<tr>
<td>D8.S3–4</td>
<td>A multi-faceted strategy, including the use of ultrasound guidance with specific preventive and educational measures and the promotion of good practices applied by both medical and nursing staff, is suggested in order to reduce the incidence of CRBSI</td>
<td>B</td>
<td>Good</td>
<td>Strong</td>
</tr>
<tr>
<td>D8.S5</td>
<td>Ultrasound guidance should be used to avoid cannulation of thrombotic sites</td>
<td>A</td>
<td>Very good</td>
<td>Strong</td>
</tr>
<tr>
<td>D8.S6</td>
<td>Ultrasound guidance, by reducing puncture attempts, technical failure rates and mechanical complications, has to be preferred because of a reduced incidence of catheter-related thrombosis</td>
<td>A</td>
<td>Very good</td>
<td>Strong</td>
</tr>
</tbody>
</table>
Tunnelling the Catheter

• Reduce risk of dislodgement
• Reduce CRBSI

• *Is the problem the vein or the exit site location?*
• Disregarding the puncture site, tunnelling the catheter allows to move catheter’s exit site on the chest, a dry, flat and stable area with lower colonization where dressing is optimal and the risk of infection is low!

• We use Power Injectable PICC as a multipurpose CICC which can be easily tunnelled in children
• Use Sutureless Devices!

**Catheter Securement Devices**

Use a sutureless securement device to reduce the risk of infection for intravascular catheters [105]. **Category II**
Cyanoacrylate Glue

• Sealing the exit site of catheters with cyanoacrylate glue reduces the risk of extraluminal contamination, presumably by reducing bacterial entrance through the skin breech.
• The glue reduces bleeding at the exit site and at the puncture site.
• Stabilizing the catheter and reducing “in and out” movement, the glue may decrease local damage to the endothelium and the risk of thrombosis.
• Synergistic effect?
  – Tunneling the catheter + Sutureless devices or SAS + Glue → reduce the risk of bacterial contamination, the risk of dislodgement and the risk of thrombosis
Conclusion

• Vision First
  ✔ Ultrasound guidance: old technology → disruptive innovations
  ✔ Tunnelling the Catheter

• Technologies
  ✔ Use of suturless devices or SAS + Sealing the exit site with cyanoacrylate glue

• High-quality and simulation-based training program is essential and institutional efforts should be focused on promoting and implementing such education protocol
Conclusion

I Believe in Targeting Zero