



IX
Congresso
GAVeCeLT

La Scienza
dell'Accesso Venoso



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

Daniele G. Biasucci

Fondazione Policlinico Universitario "A. Gemelli"

Università Cattolica del Sacro Cuore - Roma



Gemelli



Fondazione Policlinico Universitario A. Gemelli
Università Cattolica del Sacro Cuore

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**



CRBSI & CLABSI: The Problem

- ✓ 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**

Minimizing Complications Associated With Percutaneous Central Venous Catheter Placement in Children: Recent Advances

John M. Costello, MD, MPH¹; Timothy C. Clapper, PhD²; David Wypij, PhD³

Pediatric Critical Care Medicine

Janum et al. *Critical Care* 2013, 17:238
<http://ccforum.com/content/17/4/238>



REVIEW

Bench-to-bedside review: Challenges of diagnosis, care and prevention of central catheter-related bloodstream infections in children

Susanne Janum¹, Walter Zingg², Volker Classen³ and Arash Afshari^{*1,4}

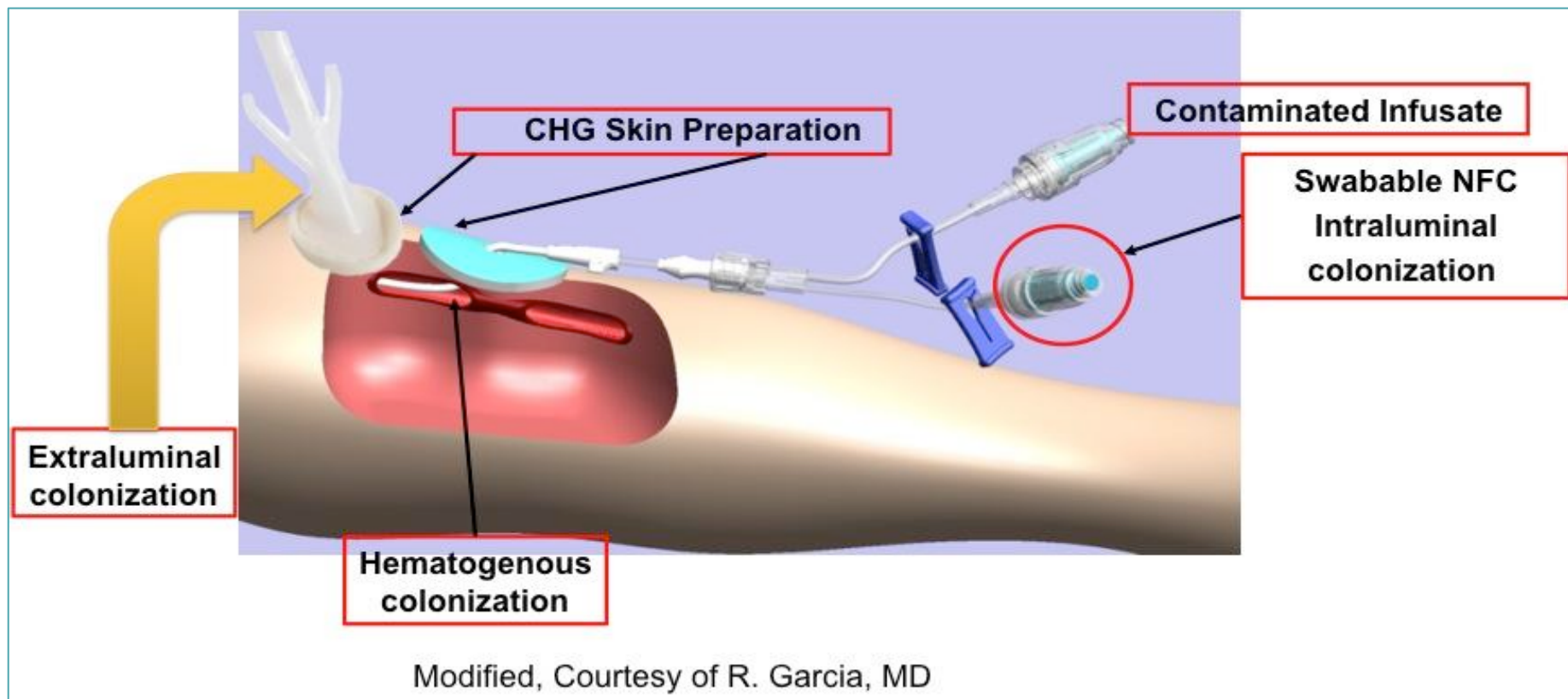
**VAD SELECTION
AND HEALTHCARE WORKERS
EDUCATION AND TRAINING**

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.

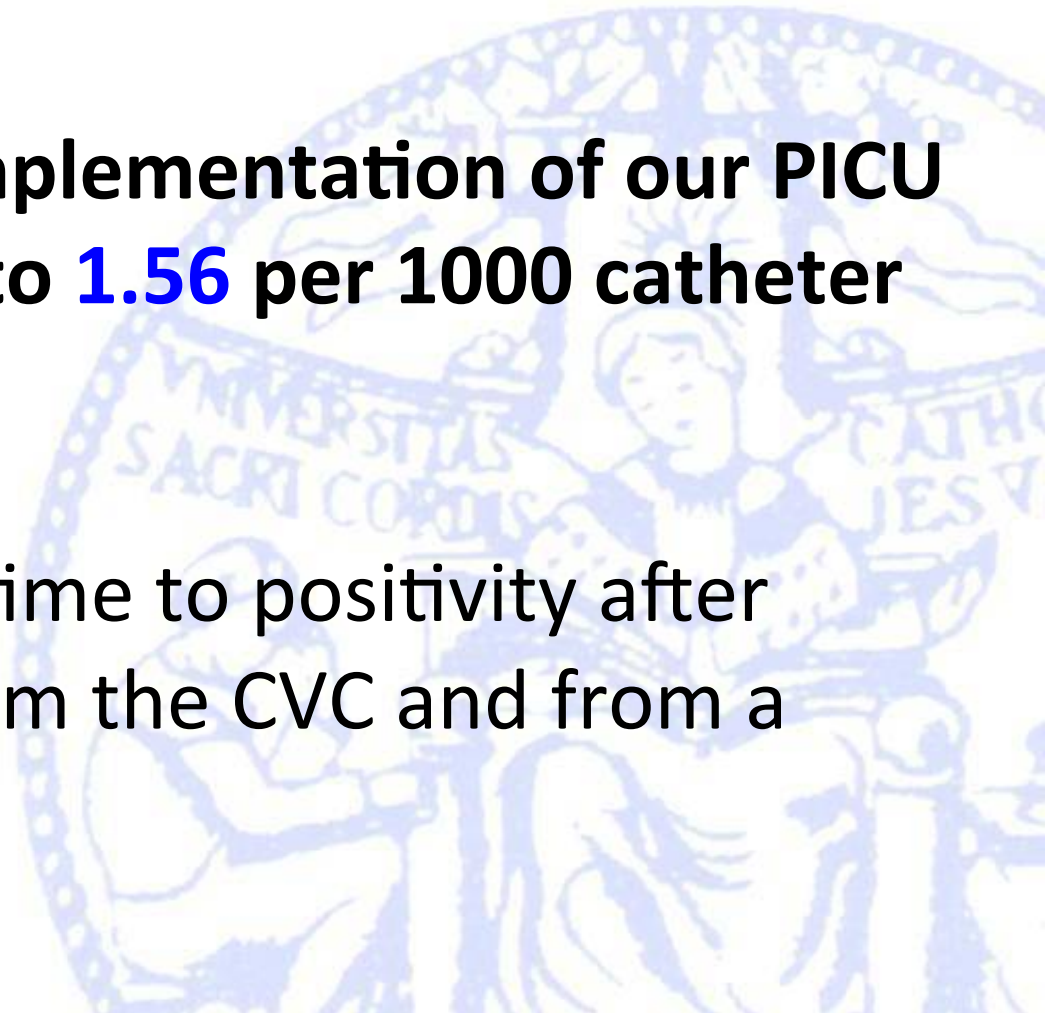


- **183 CVC in 165 pts: 15 < 1 mo, 70 1-12 mo, 80 1-6 yr**
- **Average dwelling time: 16 $\pm$ 9 days**



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

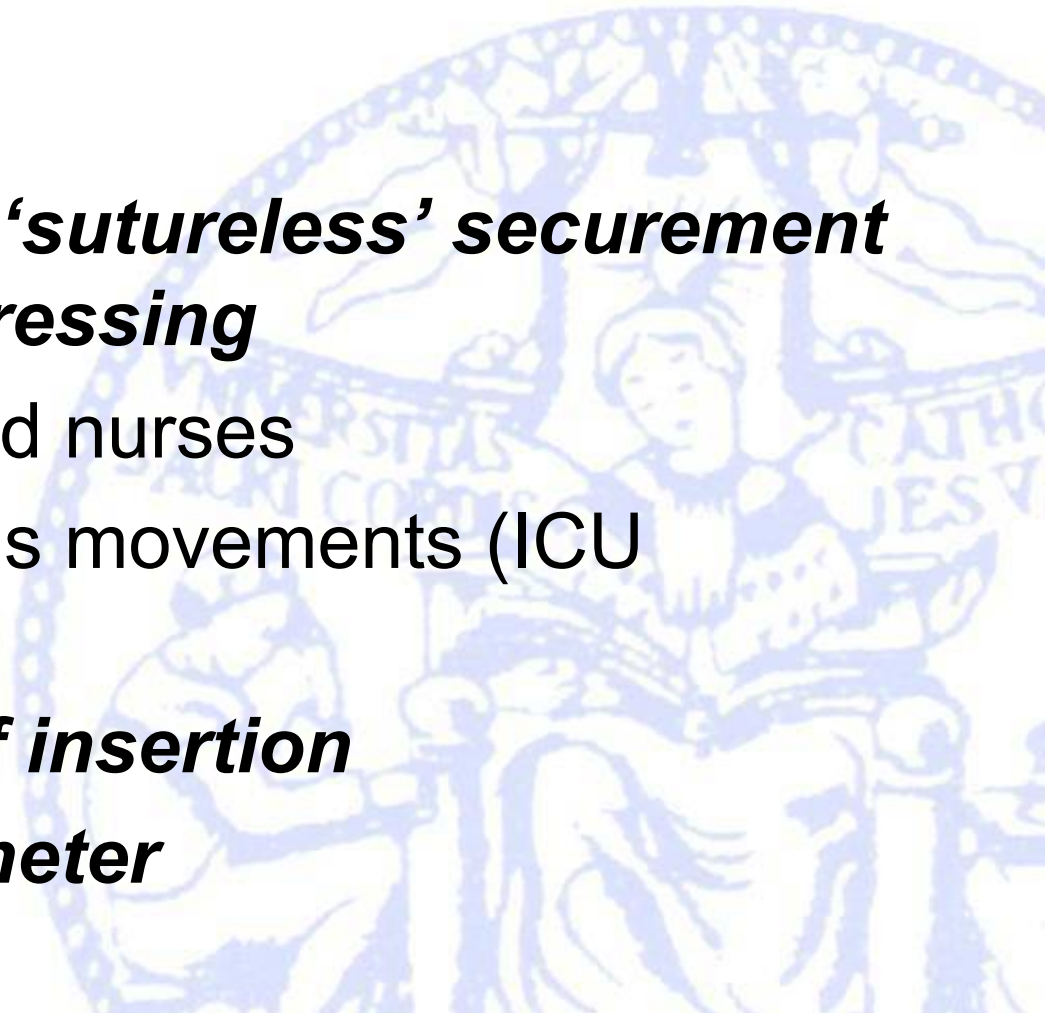


Late complications: dislodgement

- 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***

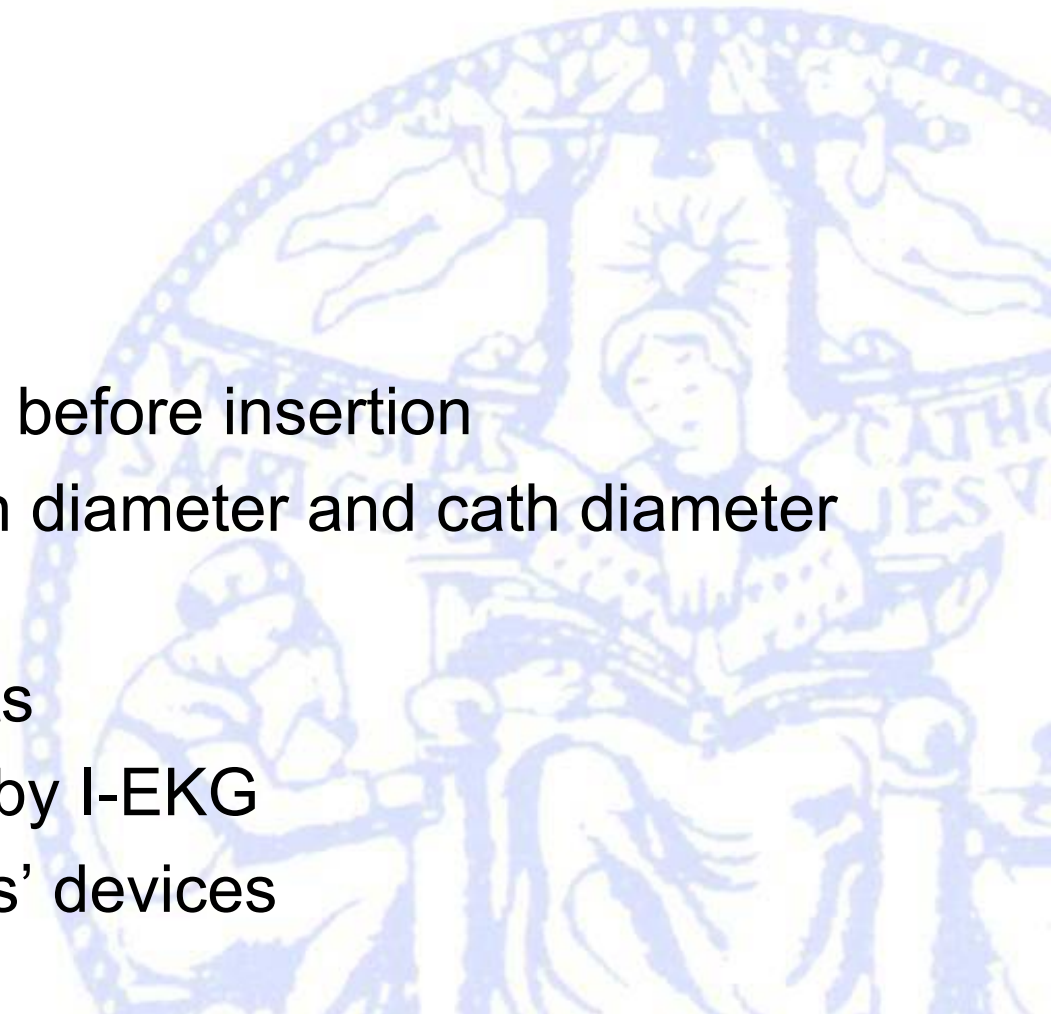


Late complications: thrombosis

- 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



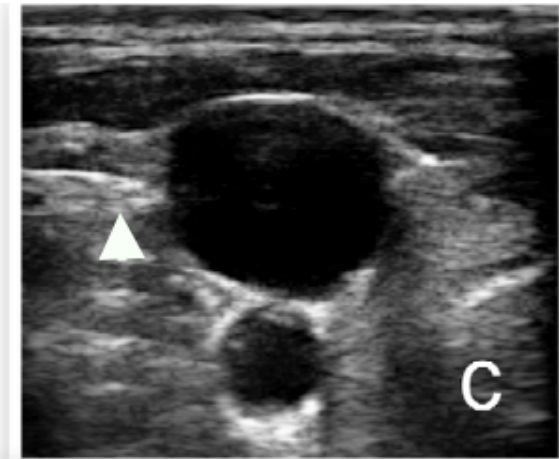
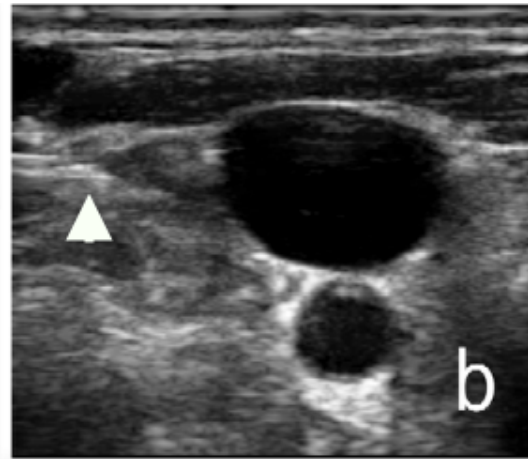
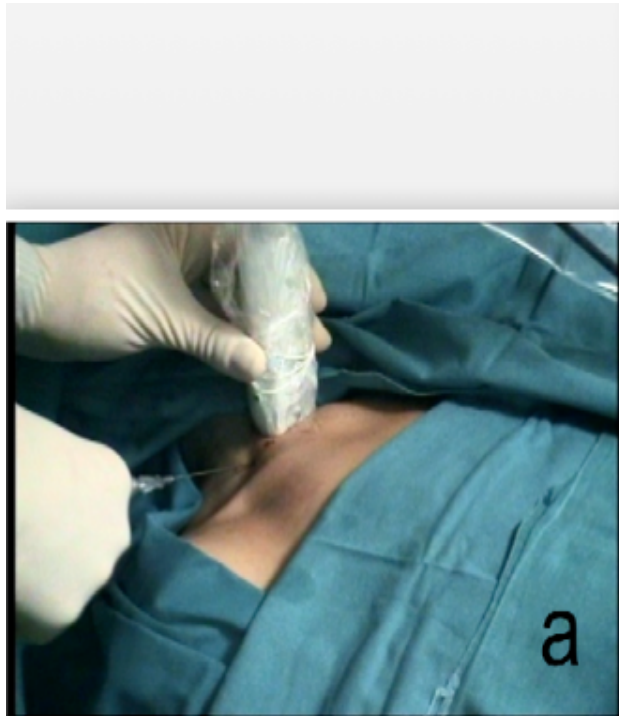
- Most recommendations of our bundle are already known to be effective in reducing infection risk.

Recommendation	Category of Recommendation
Hand hygiene prior to catheter insertion	Category IB
All inclusive catheter carts or kits	Category IB
Maximal sterile barrier precautions	Category IB
Chlorhexidine for skin anti-sepsis	Category IA
Disinfect hubs and needle-less connectors	Category IA
Remove non-essential CVCs	Category IA
Chlorhexidine cleansing	Category II
CVC dressing	Category IA
Chlorhexidine sponge dressing	Category 1B

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



Research

Open Access

Real-time ultrasound-guided catheterisation of the internal jugular vein: a prospective comparison with the landmark technique in critical care patients

Dimitrios Karakitsos¹, Nicolaos Labropoulos², Eric De Groot³, Alexandros P Patrianakos⁴, Gregorios Kouraklis⁵, John Poularas¹, George Samonis⁶, Dimosthenis A Tsoutsos⁷, Manousos M Konstadoulakis⁸ and Andreas Karabinis¹

Critical Care, 2006

Outcome measures in the ultrasound group versus the landmark group of patients

Outcome measures	Ultrasound group (n = 450)	Landmark group (n = 450)
Access time (seconds)	17.1 ± 16.5 (11.5 to 41.4) ^a	44 ± 95.4 (33.2 to 77.5)
Average number of attempts	1.1 ± 0.6 (1.1 to 1.9) ^a	2.6 ± 2.9 (1.5 to 6.3)
CVC-BSI	47 (10.4%) ^a	72 (16%)

Guidelines for the prevention of intravascular catheter-related infections

American Journal of Infection Control
May 2011

Naomi P. O'Grady,^a Mary Alexander,^b Lillian A. Burns,^c E. Patchen Dellinger,^d Jeffrey Garland,^e Stephen O. Heard,^f Pamela A. Lipsett,^g Henry Masur,^a Leonard A. Mermel,^h Michele L. Pearson,ⁱ Issam I. Raad,^j Adrienne G. Randolph,^k Mark E. Rupp,^l Sanjay Saint,^m and the Healthcare Infection Control Practices Advisory Committee (HICPAC) (Appendix 1)
Bethesda, Maryland; Norwood, Worcester, Boston, Massachusetts; Staten Island, New York, Seattle, Washington; Milwaukee, Wisconsin; Baltimore, Maryland; Rhode Island; Atlanta, Georgia; Houston, Texas, Omaha, Nebraska; and Ann Arbor, Michigan

TABLE 2. Summary of Selected, Key Recommendations for the Prevention of Catheter-Associated Bloodstream Infections

Recommendations	Category
CVC insertion	
Avoid using femoral vein for central venous access in adults	1A
Use a CVC with the minimum number of ports essential for patient management	1B
Use ultrasound guidance to place CVCs (if this technology is available and the operator has been trained) to reduce the number of cannulation attempts and mechanical complications	1B

By reducing the number of attempts and the risk of hematoma formation, ultrasound guidance may indirectly reduce the incidence of CRBSI

(Category 1B, *CDC Guidelines 2011*)





Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin



epic3: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England

H.P. Loveday^{a*}, J.A. Wilson^a, R.J. Pratt^a, M. Golsorkhi^a, A. Tingle^a, A. Bak^a, J. Browne^a, J. Prieto^b, M. Wilcox^c

Facilitating Central Venous Catheter placement, ultrasound guidance may indirectly reduce the incidence of CRBSI
(*EPIC Guidelines 2014*)

SHEA/IDSA PRACTICE RECOMMENDATION

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

Jonas Marschall, MD;^{1,2,a} Leonard A. Mermel, DO, ScM;^{3,a} Mohamad Fakih, MD, MPH;⁴
Lynn Hadaway, MEd, RN, BC, CRNI;⁵ Alexander Kallen, MD, MPH;⁶ Naomi P. O'Grady, MD;⁷
Ann Marie Pettis, RN, BSN, CIC;⁸ Mark E. Rupp, MD;⁹ Thomas Sandora, MD, MPH;¹⁰
Lisa L. Maragakis, MD, MPH;¹¹ Deborah S. Yokoe, MD, MPH¹²

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

**Massimo Lamperti
Andrew R. Bodenham
Mauro Pittiruti
Michael Blaivas
John G. Augoustides
Mahmoud Elbarbary
Thierry Pirotte
Dimitrios Karakitsos
Jack LeDonne
Stephanie Doniger
Giancarlo Scoppettuolo
David Feller-Kopman
Wolfram Schummer
Roberto Biffi
Eric Desruennes
Lawrence A. Melniker
Susan T. Verghese**

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

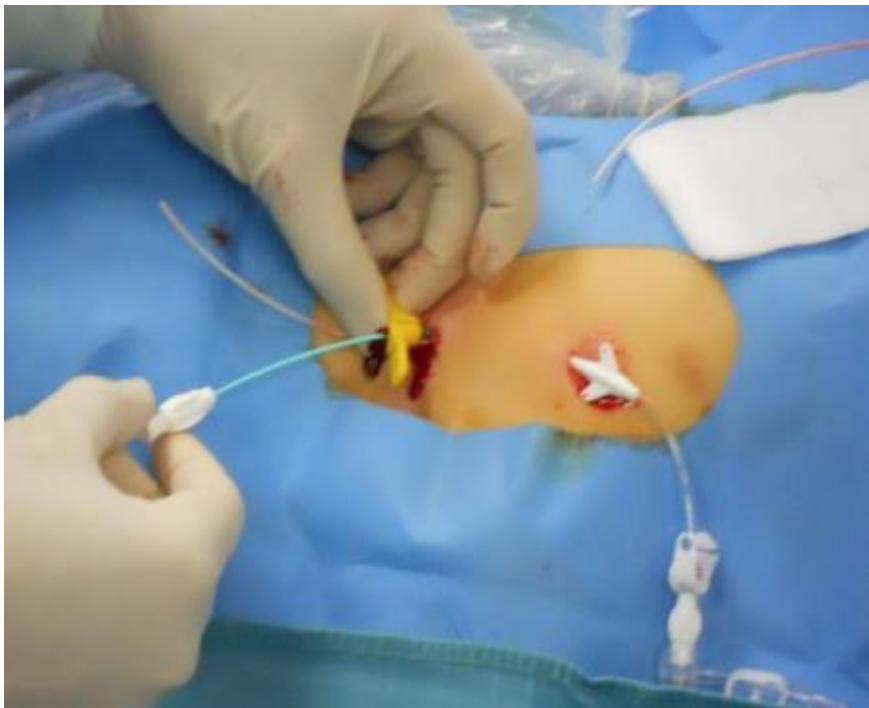
Sterility during ultrasound vascular procedures				
Domain code	Suggested definition	Level of evidence	Degree of consensus	Strength of recommendation
D8.S1	Sterile techniques should always be used during the placement of a vascular access device, including hand washing; sterile full body drapes; wearing 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	A	Very good	Strong
Prevention of infectious and mechanical complications with ultrasound-guided cannulation				
D8.S2	Ultrasound guidance should be used in order to decrease the rate of CRBSI in adults and children	C	Very good	Strong
D8.S3–4	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	B	Good	Strong
D8.S5	Ultrasound guidance should be used to avoid cannulation of thrombotic sites	A	Very good	Strong
D8.S6	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	A	Very good	Strong



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 the risk of extraluminal contamination**, presumably by reducing bacterial entrance through the skin breach



Further benefits of cyanoacrylate glue for central venous catheterisation

Scoppettuolo et al., 2015



- 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

