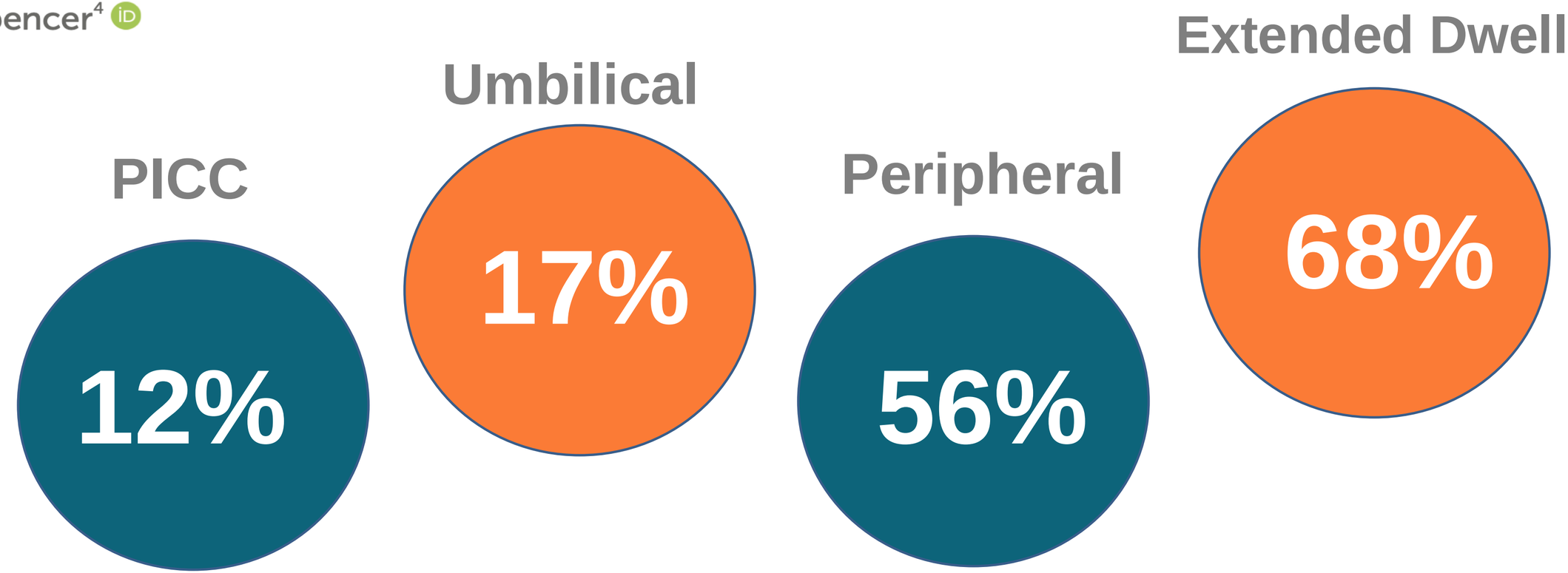
How to prevent infections

Fiammetta Piersigilli

Neonatal European Vascular Access Team

The ABBA project (Assess Better Before Access): A retrospective cohort study of neonatal intravascular device outcomes

Matheus F. P. T. van Rens[1*†], Mohammad A. A. Bayoumi[1†], Agnes van de Hoogen[2], Airene L. V. Francia[1], Irian J. Cabanillas[1], Fredericus H. J. van Loon[3] and Timothy R. Spencer[4]



23.878 catheters

CENTRAL IV ACCESS

1. Occlusion
2. Infection
3. Tip malposition

Definition

CLABSI – Central Line Associated Blood Stream Infection

Positive blood culture in a patient with a CVC

Catheter in place > 48 hours

Catheter in place at the moment of infection or 24 hours prior

Not related to an infection at another site

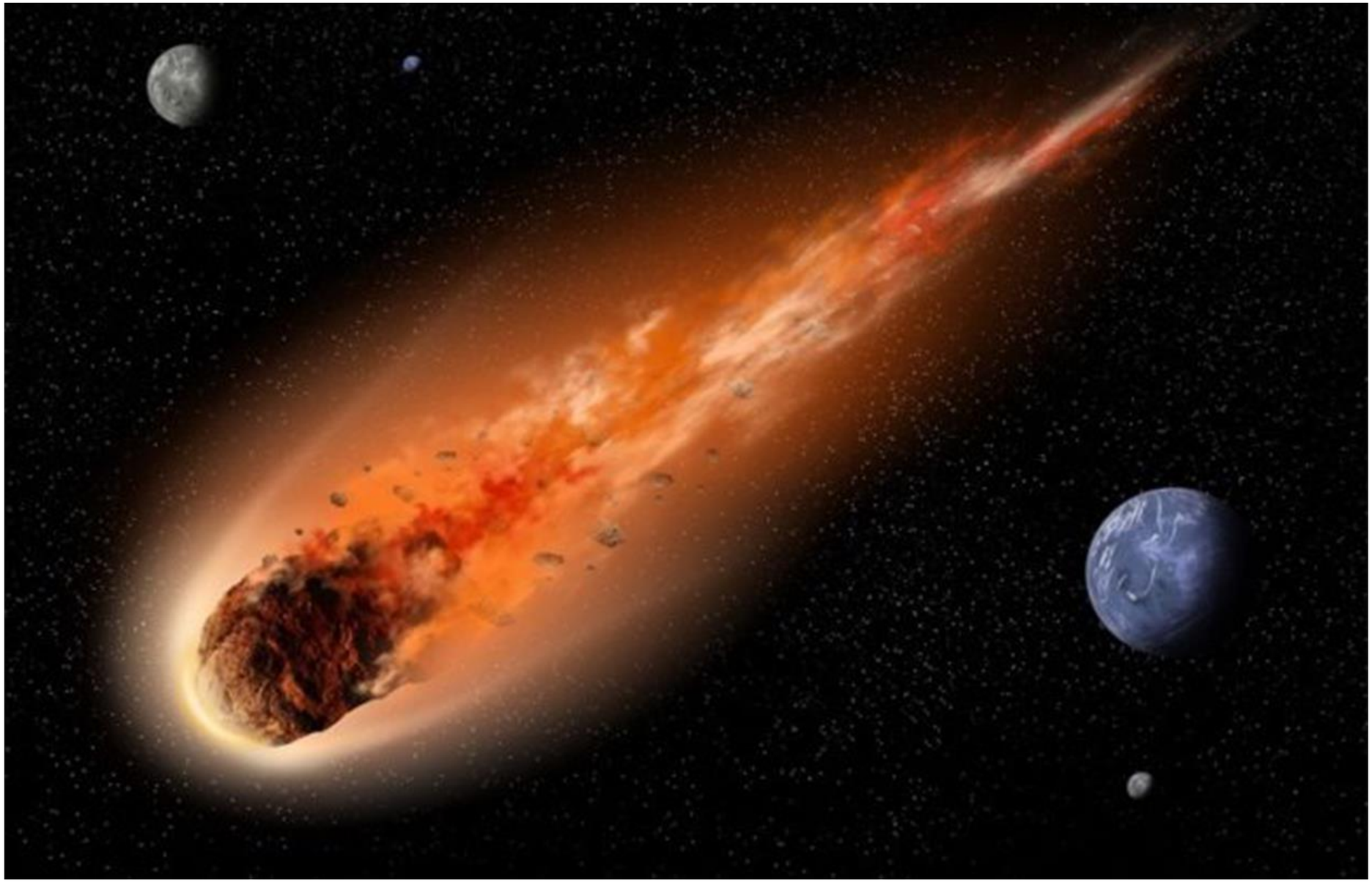
CRBSI - Catheter Related Blood Stream infection

Positive culture of blood from a peripheral vein and the catheter (same germ)

Blood culture from CVC must be positive at least 2/4h h before the peripheral culture

Blood culture from CVC bacterial load $>10^3$ CFU compared to peripheral one

Infection



Insertion Bundles

THE LANCET
Infectious Diseases

Effectiveness of insertion and maintenance bundles to prevent central-line-associated bloodstream infections in critically ill patients of all ages: a systematic review and meta-analysis

Dr Erwin Ista, PhD • Ben van der Hoven, MD • René F Kornelisse, PhD • Cynthia van der Starre, PhD •

The bundles are a set of rules that have to be followed **always** and **all together**

The use of insertion bundles has **reduced** the rate of Central Line Associated Blood Stream Infections (CLABSI)

Hand washing

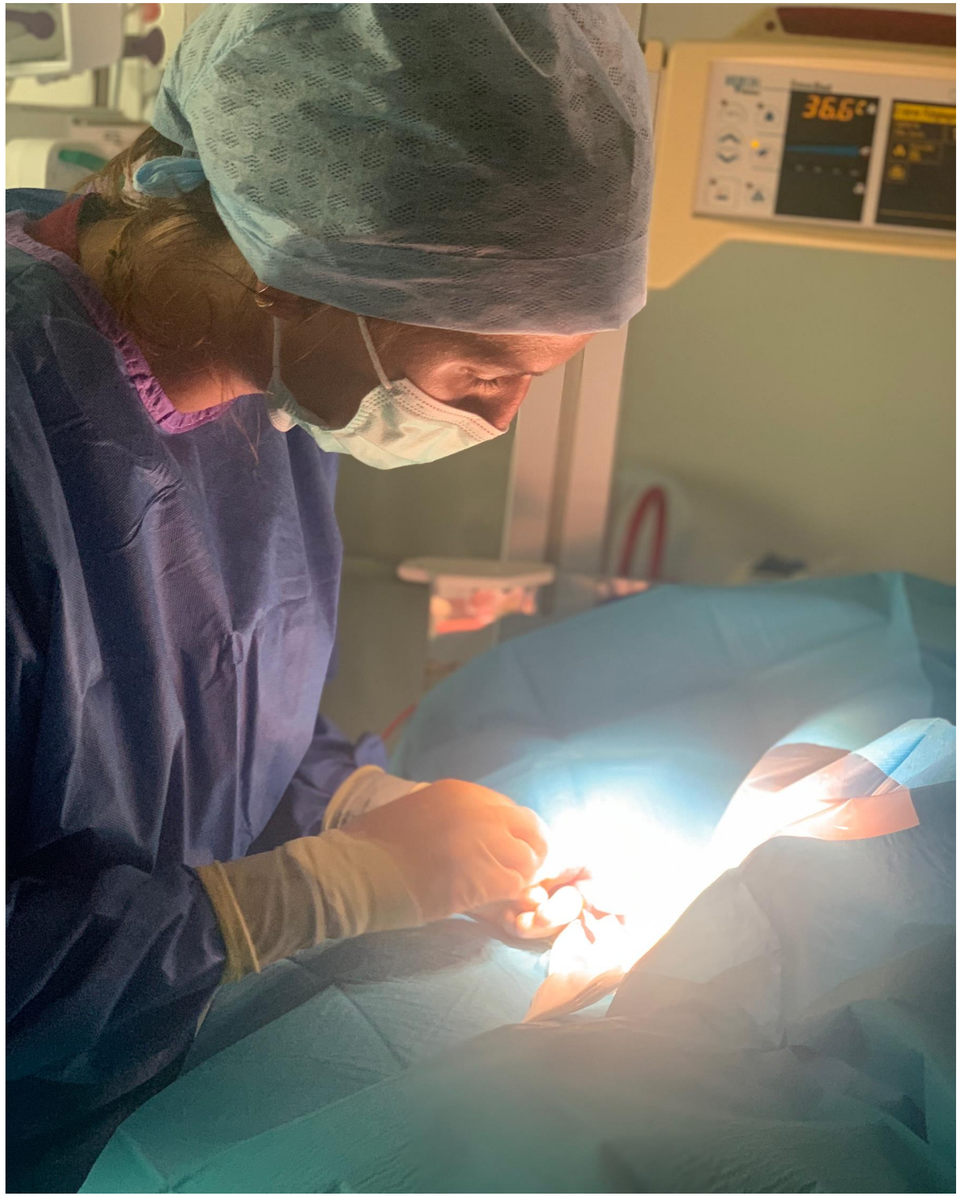
Always perform a surgical hand washing

before wearing gloves and gown

After soap hand washing

also wash with hydroalcoholic gel

Maximal barrier precautions



Always wear hat, mask, sterile gloves and gown

Maximal barrier precautions

Cover the baby completely

Prevention of central venous catheter-related infections by using maximal sterile barrier precautions during insertion

I I Raad [1], D C Hohn, B J Gilbreath, N Suleiman, L A Hill, P A Bruso, K Marts, P F Mansfield, G P Bodey

6 times higher incidence of CLABSI if the patient is not fully covered and if operator is not wearing a sterile gown

Skin desinfection

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, MPH[12]

Chlorhexidine 2% in 70% alcohol solution

The use of chlorhexidine reduces the risk of CLABSI compared to povidone iodine

7. Use an alcoholic chlorhexidine antiseptic for skin preparation (quality of evidence: I).[108-111]
   a. Before catheter insertion, apply an alcoholic chlorhexidine solution containing more than 0.5% CHG to the insertion site.[112]
      i. The antiseptic solution must be allowed to dry before making the skin puncture.

Chlorhexidine

In neonates with GA < 26 weeks

Chlorhexidine in
aqueous solution

Chlorhexidine alcohol solution
Just at the point of insertion, dab and not rub, rinse with saline solution after disinfection

Maintenance Bundles

Standard-Aseptic Non Touch Technique when accessing the catheter

Wear masks and sterile gloves in case of:

- Change of infusion sets
- Multiple therapies

Remove the catheter as soon as it is not necessary anymore

→ Reduction of CLABSI when CVC is removed at 100ml/Kg enteral nutrition

Erdei C, McAvoy LL, Gupta M, Pereira S, McGowan EC (2015) Is zero central line-associated bloodstream infection rate sustainable? A 5-year perspective. Pediatrics 135:e1485-1493

EDITORIAL

Catheter-associated bloodstream infection rates: how low can you go?

Stijn Blot[1,2*], Garyphallia Poulakou[3] and Jean-Francois Timsit[4,5]

What else can we do
to achieve
zero infections?

Bundles

Materials

Assessment of the veins

Maintenance

Infection

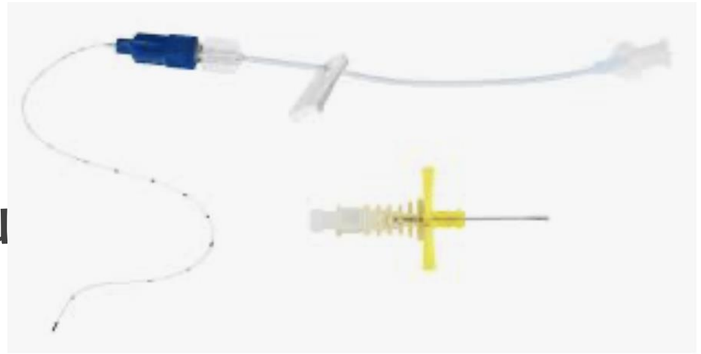
Stabilization

Insertion techniques

Materials

Discard older generation catheters

- Silicone
- Two pieces that are likely to log ou



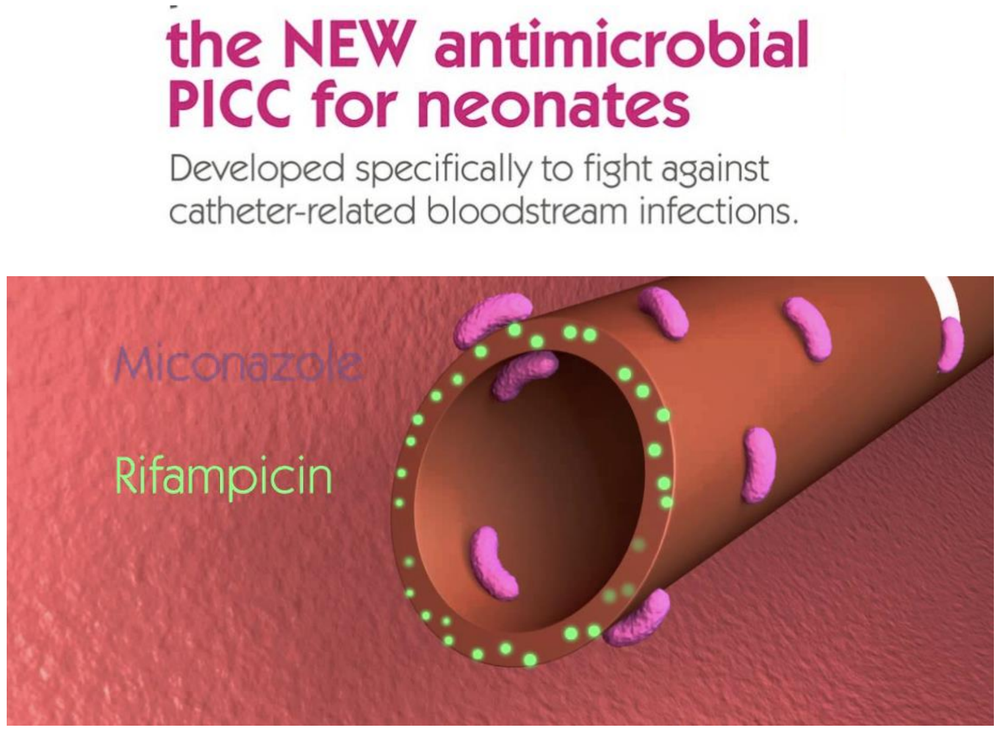
Give preferenze to new generation catheters

- Polyurethane
- Single unit

Reduce the number of lumen

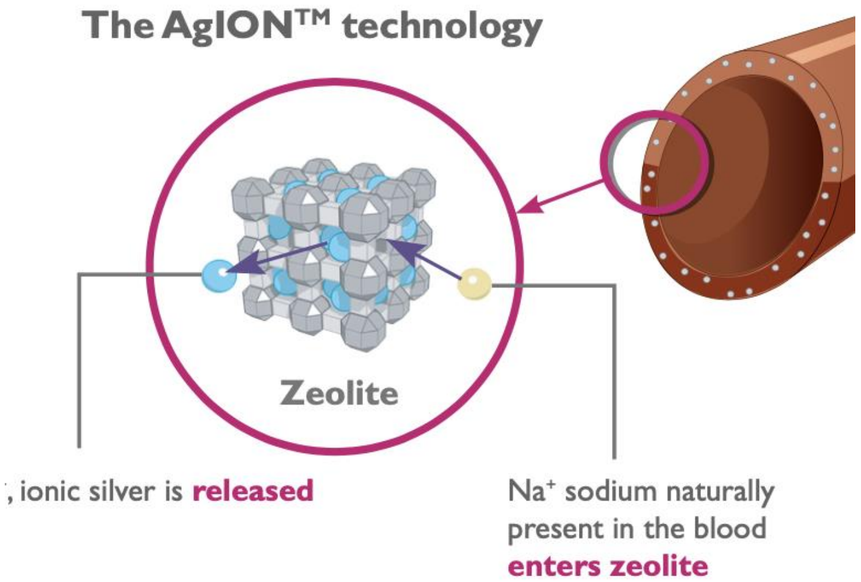
Materials

Antibiotic / silver coated catheters



Epicutaneo cava 1 Fr

Silver coated umbilical catheters



Reduction of infections, but only for long term use

Materials

Pre prepared packs

Prepackaged central line kits reduce procedural mistakes during central line insertion: a randomized controlled prospective trial

Yelena Fenik [1], Nora Celebi, Robert Wagner, Christoph Nikendei, Frederike Lund, Stephan Zipfel, Reimer Riessen, Peter Weyrich

Affiliations + expand

PMID: 23631396 PMCID: PMC3645964 DOI: 10.1186/1472-6920-13-60

Results: The prepackaged kit group outperformed the standard kit group in four of the five quality indicators: procedure duration (26:26 ± 3:50 min vs. 31:27 ± 5:57 min, p = .01); major technical mistakes (3.1 ± 1.4 vs. 4.8 ± 2.6, p = .03); minor technical mistakes (5.2 ± 1.7 vs. 8.0 ± 3.2, p = .01); and correct steps (83 ± 5% vs. 75 ± 11%, p = .02). The difference for breaches of aseptic techniqu (1.2 ± 0.8 vs. 3.0 ± 3.6, p = .06) was not statistically significant.

Conclusions: Prepackaged all-inclusive kits for novices improved the procedure quality and savec staff time resources in a controlled simulation environment. Future studies are needed to address whether central line kits also improve patient safety in hospital settings.

Journal of Hospital Infection 86S1 (2014) S1-S70

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]

[a] Richard Wells Research Centre, College of Nursing, Midwifery and Healthcare, University of West London (London).
[b] Faculty of Health Sciences, University of Southampton (Southampton).
[c] Microbiology and Infection Control, Leeds Teaching Hospitals and University of Leeds (Leeds).

Single use applicators

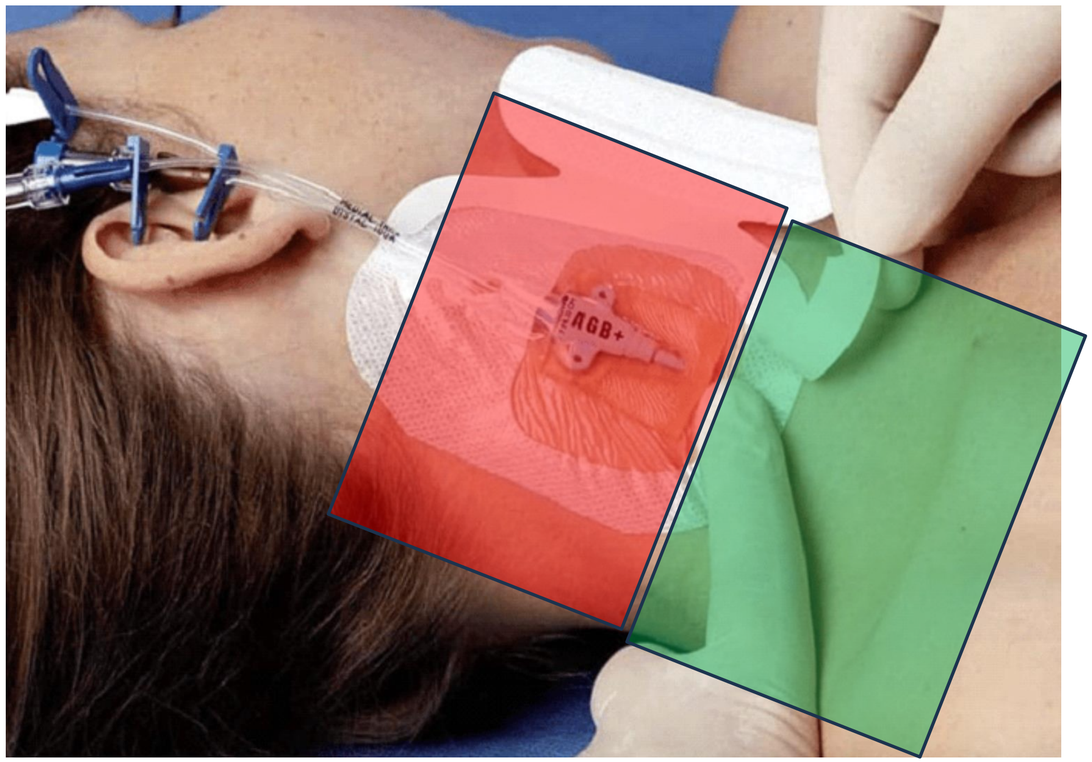
IVAD14 Decontaminate the skin at the insertion site with a single-use application of 2% chlorhexidine gluconate in 70% isopropyl alcohol (or povidone iodine in alcohol for patients with sensitivity to chlorhexidine) and allow to dry prior to the insertion of a central venous access device.

Class A

Insertion site

CICC – centrally inserted central catheter

Avoid the neck and the area near the ear



Selection of catheter insertion site

IVAD11 In selecting an appropriate intravascular insertion site, assess the risks for infection against the risks of mechanical complications and patient comfort.

Class D/ GPP

IVAD12 Use the upper extremity for non-tunnelled catheter placement unless medically contraindicated.

Class C

Insertion site

Peripherally Inserted Central Catheter Complications in Neonates With Upper Versus Lower Extremity Insertion Sites

Wrightson, Della Daugherty MSN, RNC-NIC

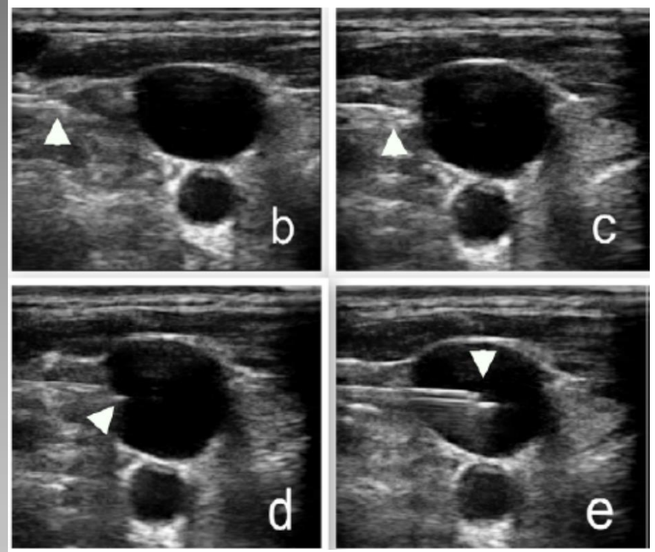
Advances in Neonatal Care: June 2013 - Volume 13 - Issue 3 - p 198-204
doi: 10.1097/ANC.0b013e31827e1d01

Epicutaneo Cava Catheters

Always choose the **best available vein**,

regardless of the insertion site

Ultrasound



Ultrasound-Guided Percutaneous Central Venous Access in Low Birth Weight Infants: Feasibility in the Smallest of Patients

Seth D. Goldstein, MD, MPhil[1] Howard Pryor, MD[1] Jose H. Salazar, MD[1] Nicholas Dalesio, MD[2]
F. Dylan Stewart, MD[1] Fizan Abdullah, MD, PhD[1] Paul Colombani, MD, MBA[1]
and Jeffrey R. Lukish, MD, FACS[1]

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]

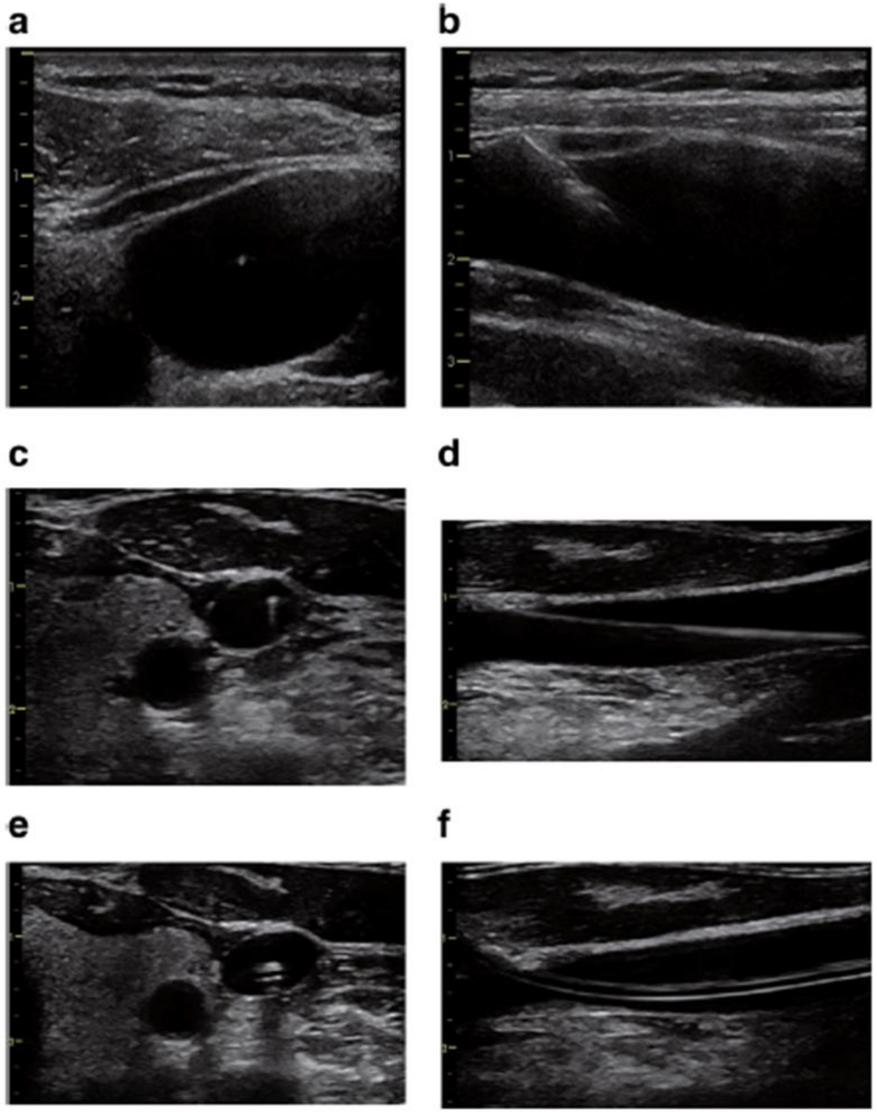
Ultrasound

Why does it reduce infections

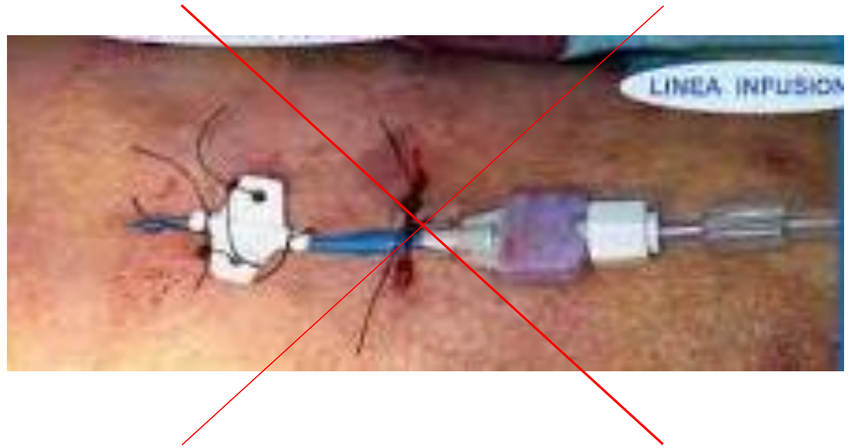
Direct visualization of the vein

Decreased number of attempts

The more the number of attempts, the bigger the infectious risk



Stabilization



Sutureless device

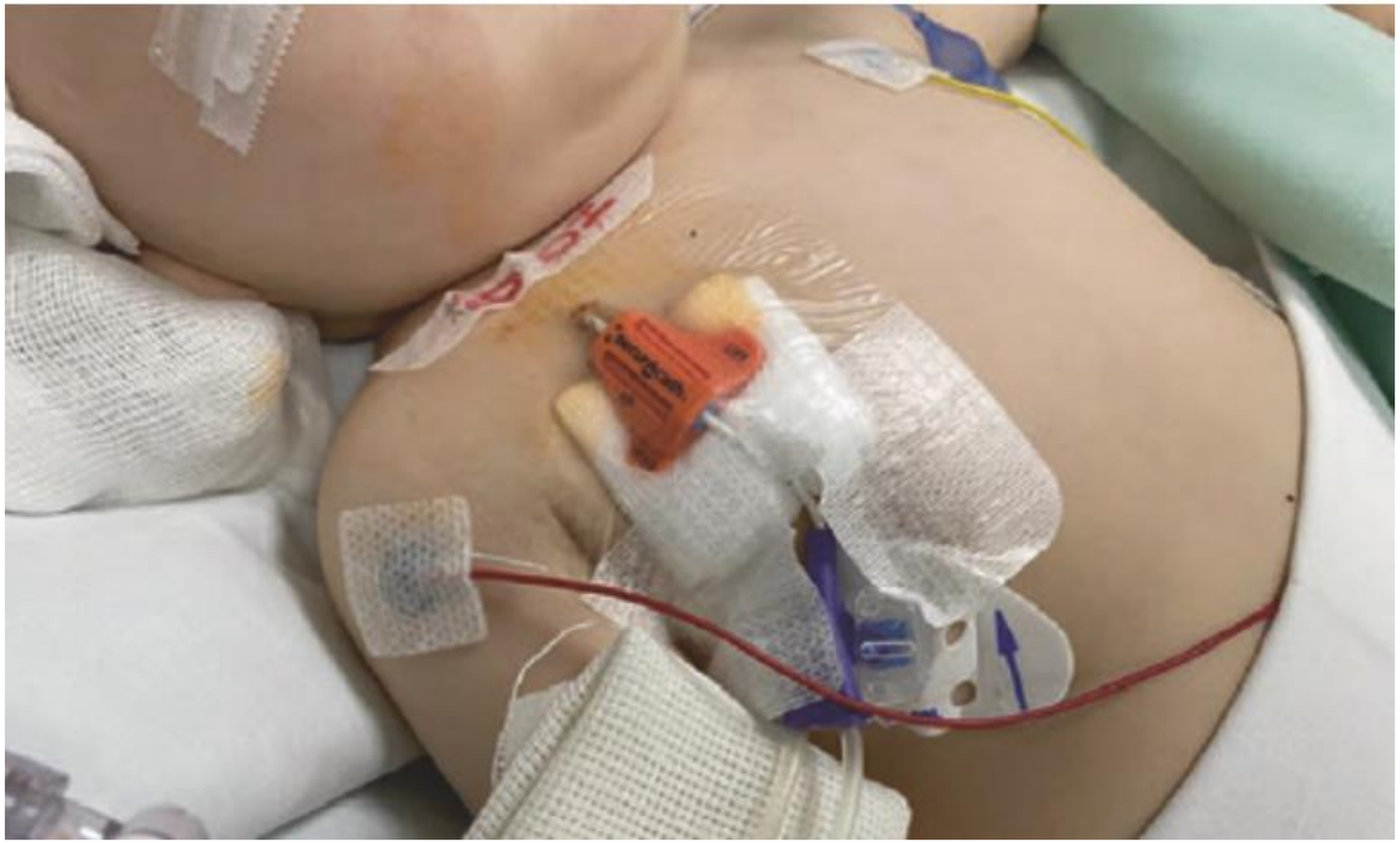
Increased stabilization of the device

Avoids the in/out movement of the catheter

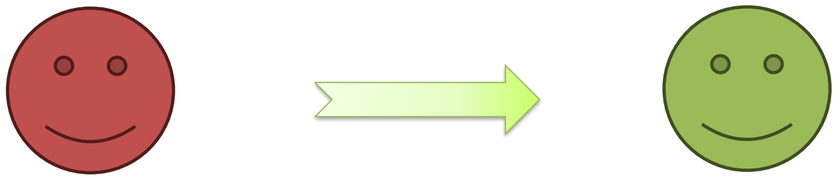
Easier to clean

Stabilization

Tunnelization



The exit site is different from the insertion site



Stabilization

Epicutaneo cava catheters

Trasparent dressing

Insertion point must remain always visible

Check the insertion site to assess presence of redness, swelling or discharge

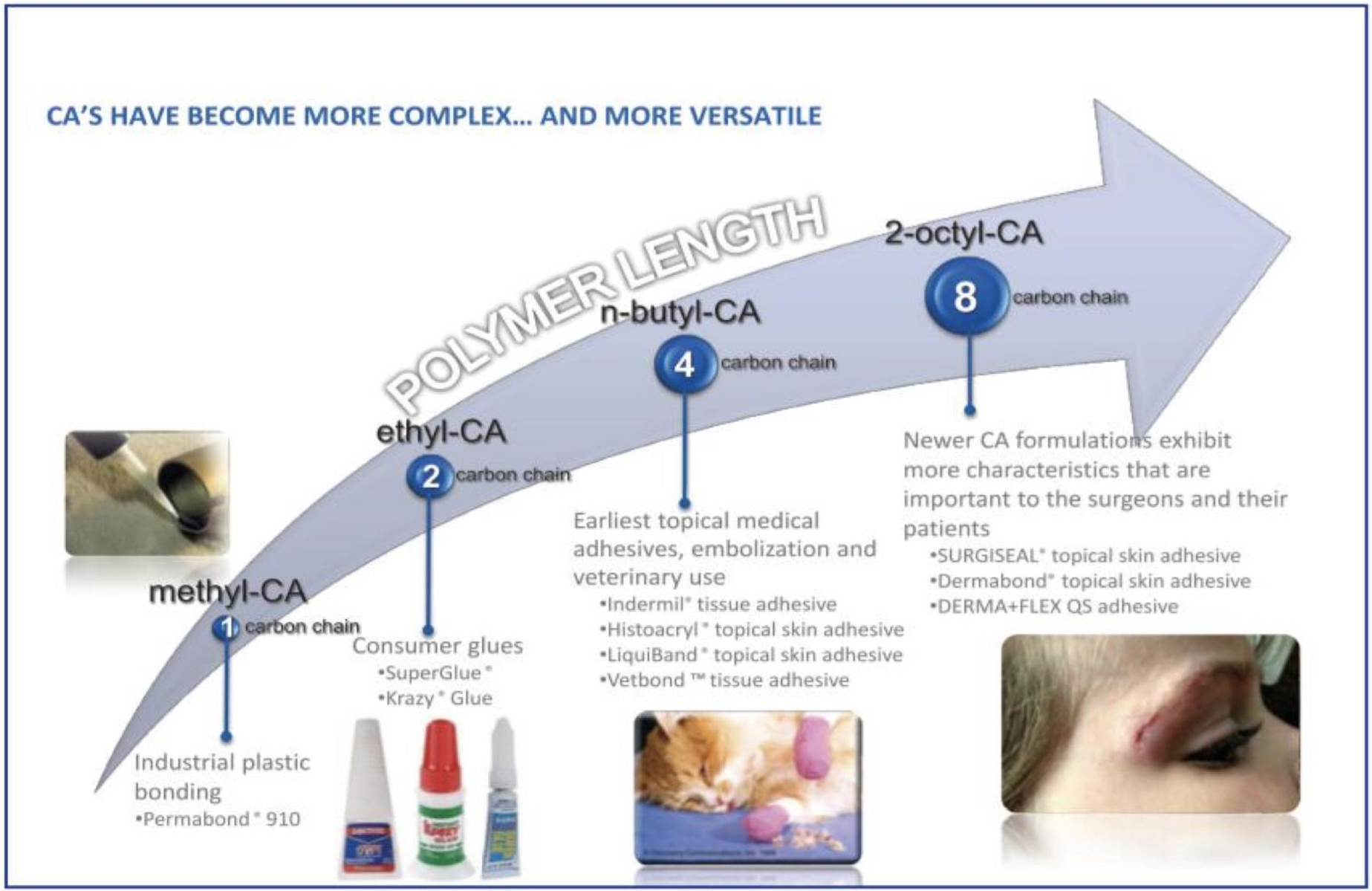
Cyanoacrylate glue

Stabilizes

Hemostatic

Anti infective

Histoacryl glue



Published in Journal of infection prevention 2014

The antibacterial effect of 2-octyl cyanoacrylate (Dermabond®) skin adhesive

J. Rushbrook, Grace White, Lizi Kidger, P. Marsh, T. Taggart

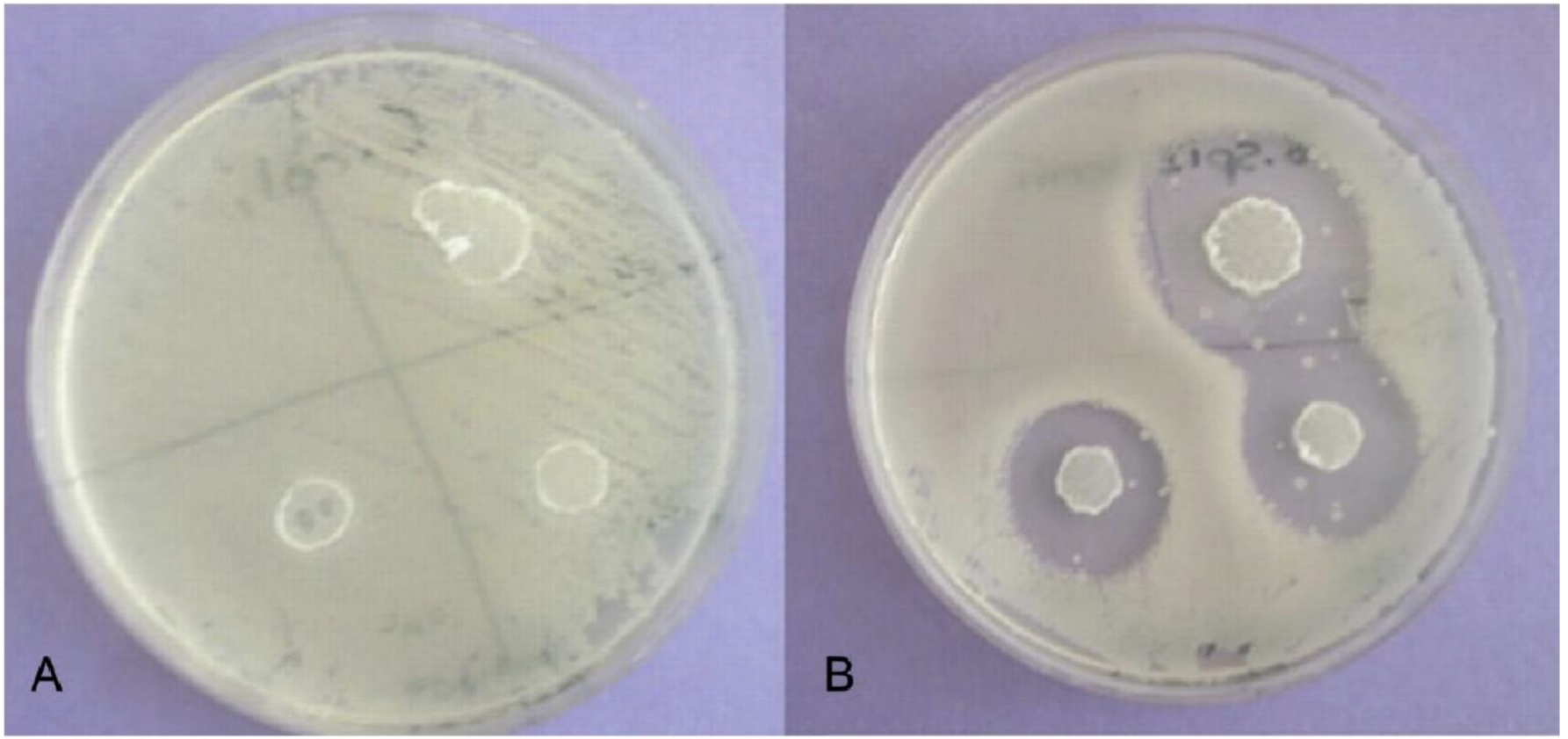


Figure 2. Photograph showing no inhibition of growth of a Gram-negative bacteria (A) and inhibition of growth of a Gram-positive bacteria (B) around the pellets of Dermabond®

Secureport IV

Approved and licensed to secure catheters

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Indications for Use

Form Approved: OMB No. 0910-0120
Expiration Date: January 31, 2017
See PRA Statement below.

510(k) Number *(if known)*
K170505

Device Name
SecurePortIV Catheter Securement Adhesive

Thin and precise applicator with **patented design**, created for vascular access

Unique formulation combining **flexibility and fast drying** (80% 2-octyl CA and 20% n-butyl CA)

Right volume:
0.15 ml

Cyanoacrylate glue as part of a new bundle to decrease neonatal PICC-related complications

Fiammetta Piersigilli ✉, Giulia Iacona, Sarah Yazami, Katherine Carkeek, Catheline Hocq, Cinzia Auriti & Olivier Danhaive

Conclusion: The implementation of the new bundle to secure neonatal PICCs in our NICU was associated with a significant reduction in CLABSI and dislodgment rates, without glue-related complications. Active surveillance of CVC placement procedure, positioning, and management, as well as analysis of related complications is crucial for improving patient safety. Continuous implementation of up-to-date central line bundles based on best practice recommendations is a key for quality improvement in NICUs.

Needle free connectors

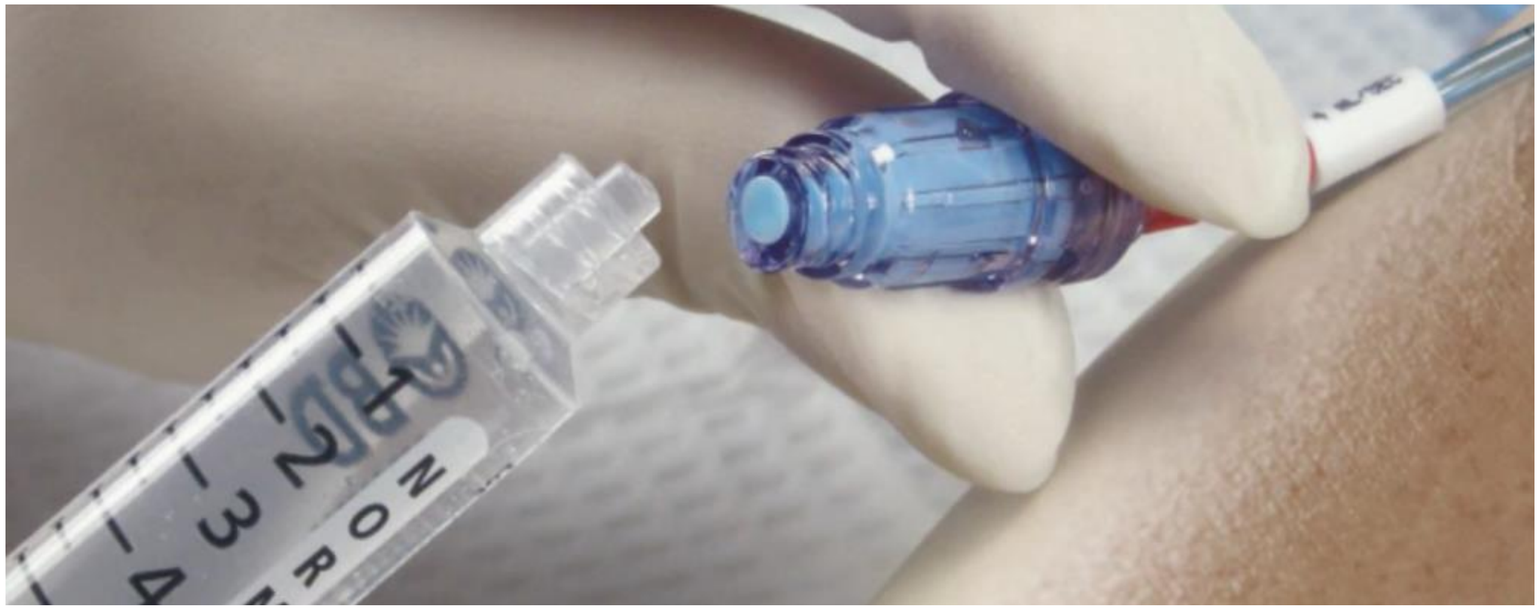
Use needleless injection valves and scrub them to minimise risk of contamnination Category 1A (Guidelines for the prevention of Intravascular Catheter-Related Infections 2011CDC)

Increased infection rate because of inadequate sterilization

Needle free connectors

Scrub the hub!

Disinfection for **5-15 sec** with chlorhexidine



Allow time for the alcohol to dry

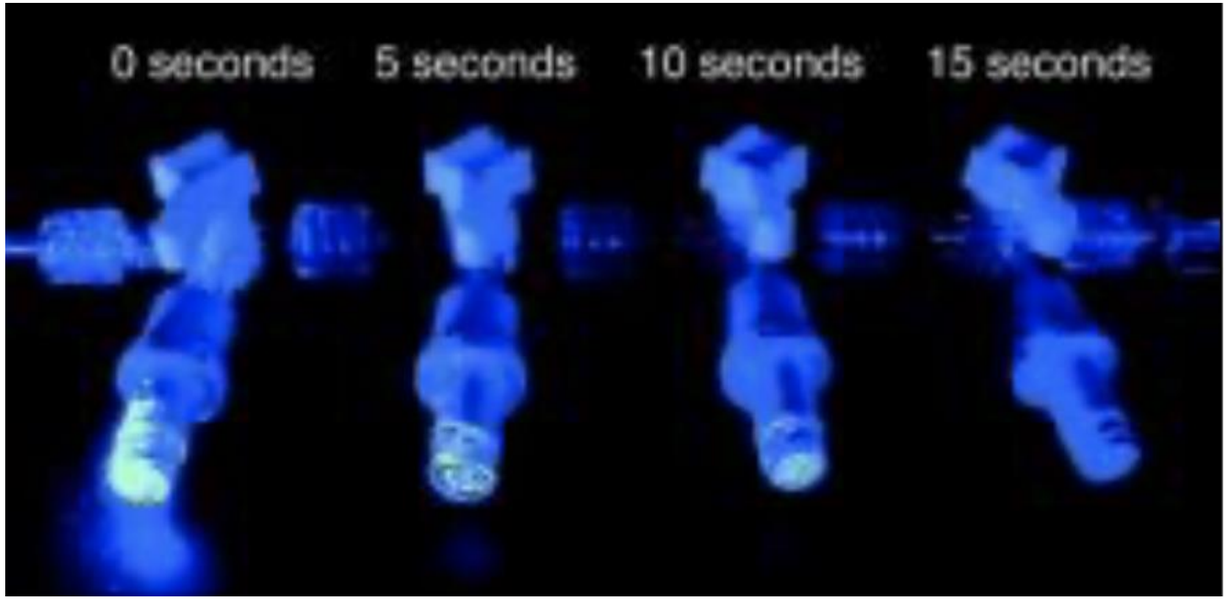
Scrub the Hub! Catheter Needleless Port Decontamination.

Lockman, Justin; Heitmiller, Eugenie; Ascenzi, Judith; Berkowitz, Ivor

Anesthesiology. 114(4):958, April 2011.

DOI: 10.1097/ALN.0b013e3182054bd1

Things get really cleaner when you wash them!!



Port protectors

Protectors containing 70% isopropyl alcohol

Single use

AJIC
American Journal of Infection Control

Impact of universal disinfectant cap implementation on central line–associated bloodstream infections

Katreena Collette Merrill, RN, PhD • Sharon Sumner, RN, BS • Lorraine Linford, RN, BS, CNSC • Carrie Taylor, RN, MS, CIC • Christopher Macintosh, RN, BS

↓ 40% decrease of CLABSI

Saline solution

Pre filled syringes

A. Use single-dose systems (eg, single-dose vials or pre-filled labeled syringes) for all VAD flushing and locking.
   1. Commercially available prefilled syringes may reduce the risk of CR-BSI and save staff time for syringe preparation.[1-3] (IV)
   2. If multiple-dose vials must be used, dedicate a vial to a single patient (see Standard 49, *Infection*).[4] (V)
   3. Do not use intravenous (IV) solution containers (eg, bags or bottles) as a source for obtaining flush solutions.[3-6] (IV)

Infusion Therapy Standards of Practice

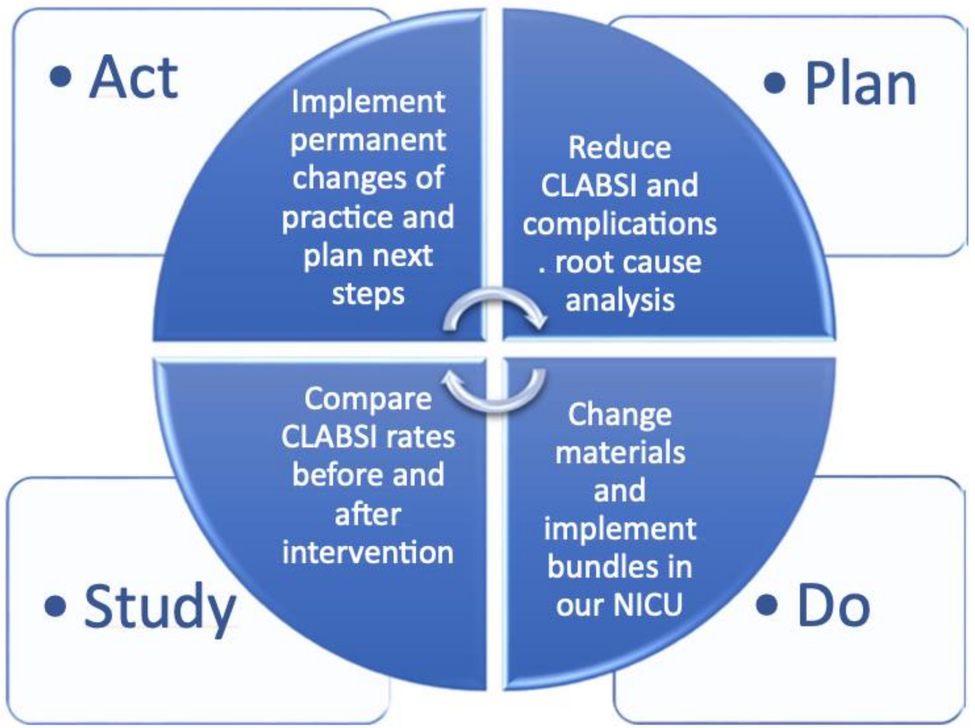
Dedicated trolley

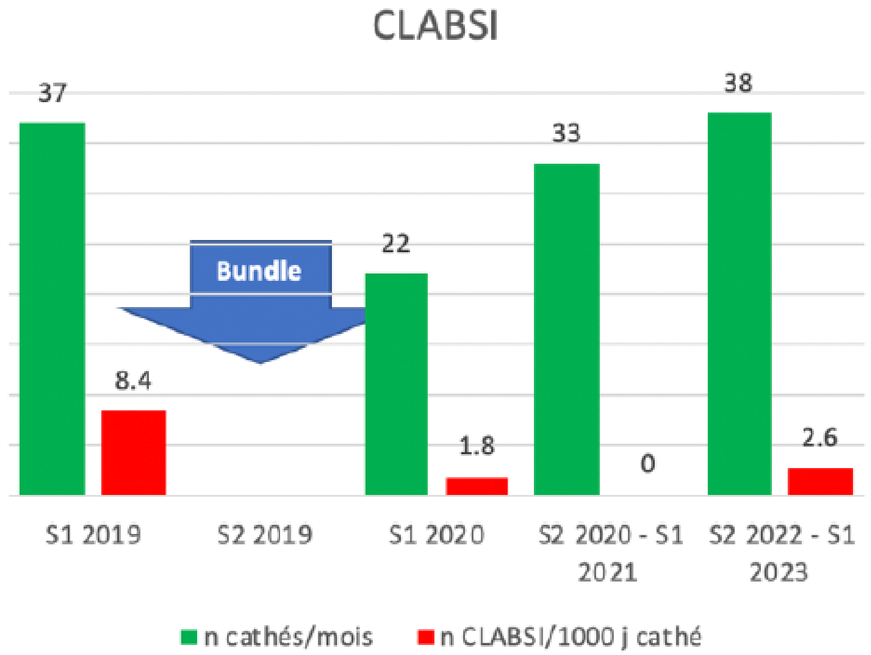
European Journal of Pediatrics
https://doi.org/10.1007/s00431-020-03844-9

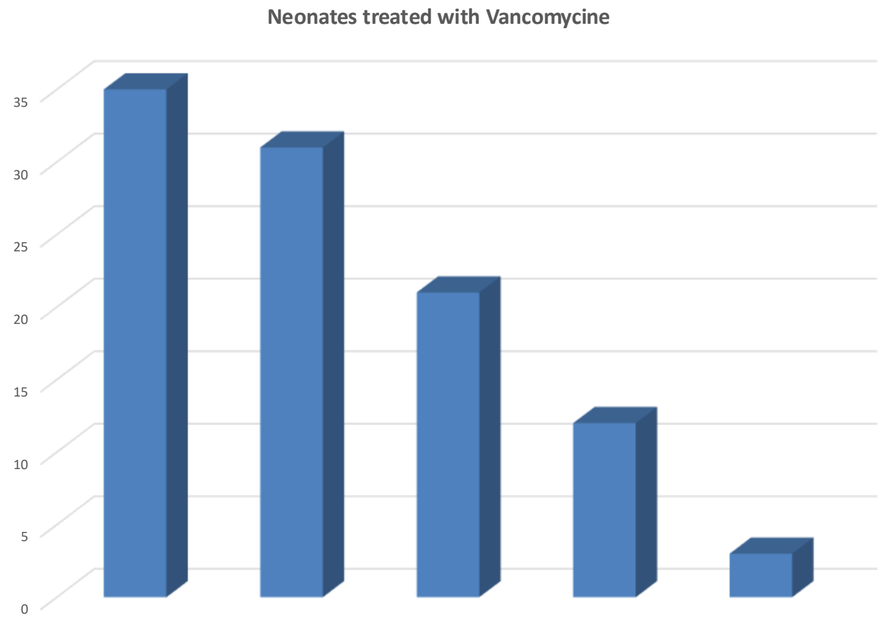
ORIGINAL ARTICLE

How to minimize central line–associated bloodstream infections in a neonatal intensive care unit: a quality improvement intervention based on a retrospective analysis and the adoption of an evidence-based bundle

Stéphanie Bierlaire [1] · Olivier Danhaive [1,2] · Katherine Carkeek [1] · Fiammetta Piersigilli [1,3]







Should we use antibiotic prophylaxis?

Cochrane studies	Year	Recommend.
Profylactic antibiotics umbilical artery catheters	2007	No
Profylactic antibiotics umbilical venous catheters	2005	No
Profylactic antibiotics ventilated newborns	2007	No
Profylactic Vancomycin for preterms	2000	No
Prophylactic antibiotics for intercostal catheters	2012	No
Profylactic antifungals in VLBW	2015	Yes (sepsis but not death)

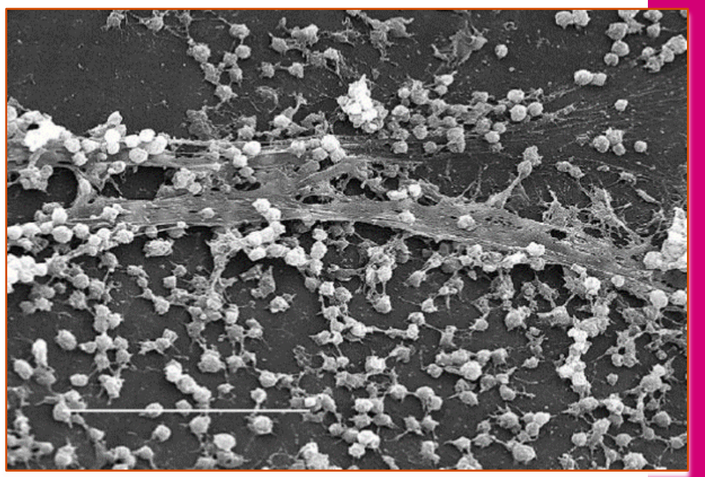
CDC Guidelines

Do not administer systemic *antimicrobial* prophylaxis routinely before insertion or during the use of an intravascular catheter to prevent catether colonization or CRBSI

Use antimicrobial locking solutions for therapeutic and prophylactic purposes in patients with long-term CVADs in the following circumstances: patients with a history of multiple CABSIs, high-risk patient populations, and in facilities with unacceptably high rates of CVAD-associated BSI, despite implementation of other meth-ods of infection prevention.[27,62-79] (II)

CLABSI

Our enemy → The Biofilm



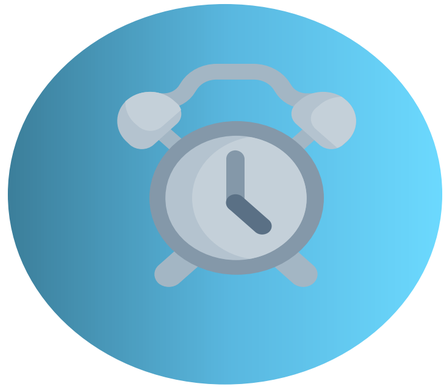
Extracellular matrix
Polysaccharides, lipids, proteins, DNA

Remove the catheter

If S. aureus, Pseudomonas, Gram neg infection AND
patient not improving in 72 hours after the start of antimicrobial therapy

Immediately if fungal infection

Lock therapy



Instillation into the catheter lumen of a dose of

antibiotic up to 1000 times the MIC

for a duration that can go from 12 to 48 hours,

for several days,

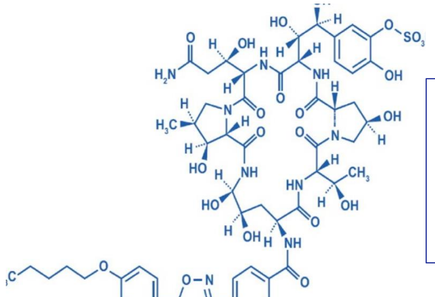
in combination with systemic antibiotics

Vancomycin
5 mg/ml
10 mg/ml

Cefazoline
10 mg/ml

Ceftazidime
20 mg/ml

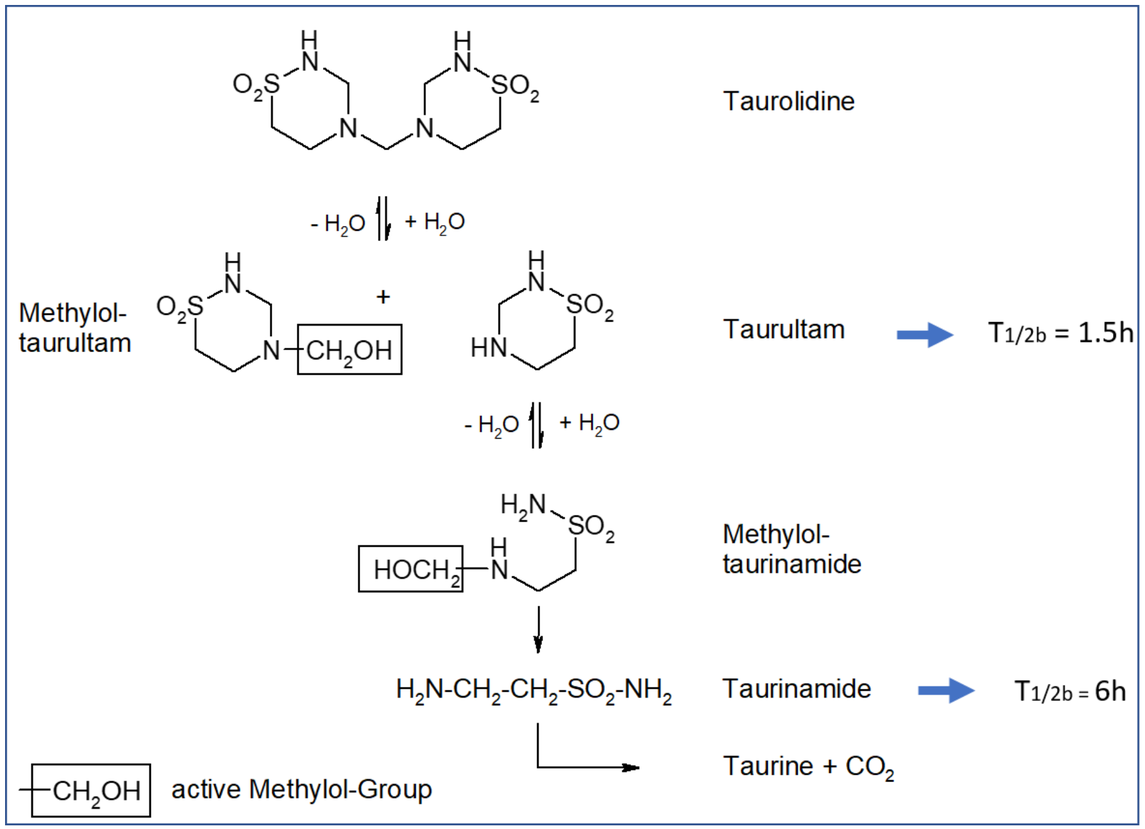
Gentamycin
4 mg/ml



Micafungin
5mg/L

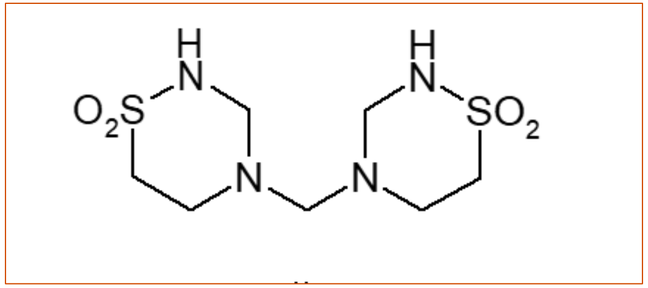
Taurolidine

Derived from the amino acid taurine



Taurolidine is metabolized rapidly
via other metabolites to taurine

Taurolidine

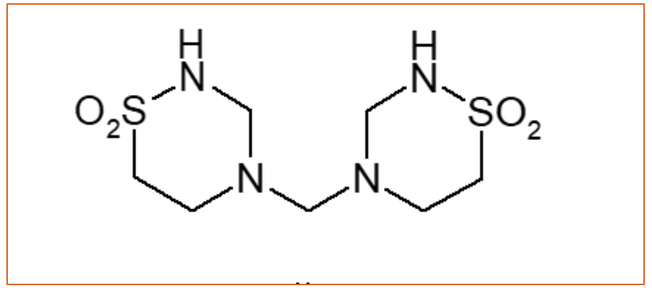


Broad spectrum antimicrobial activity

Taurolidine reacts with bacterial fimbriae

Destroys bacterial cell wall

Taurolidine



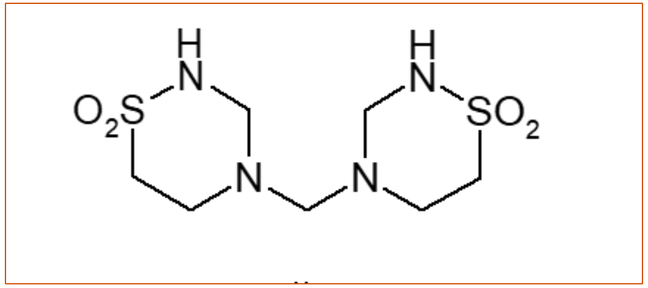
Activity extends across a wide-spectrum of aerobic and anaerobic bacteria and fungi

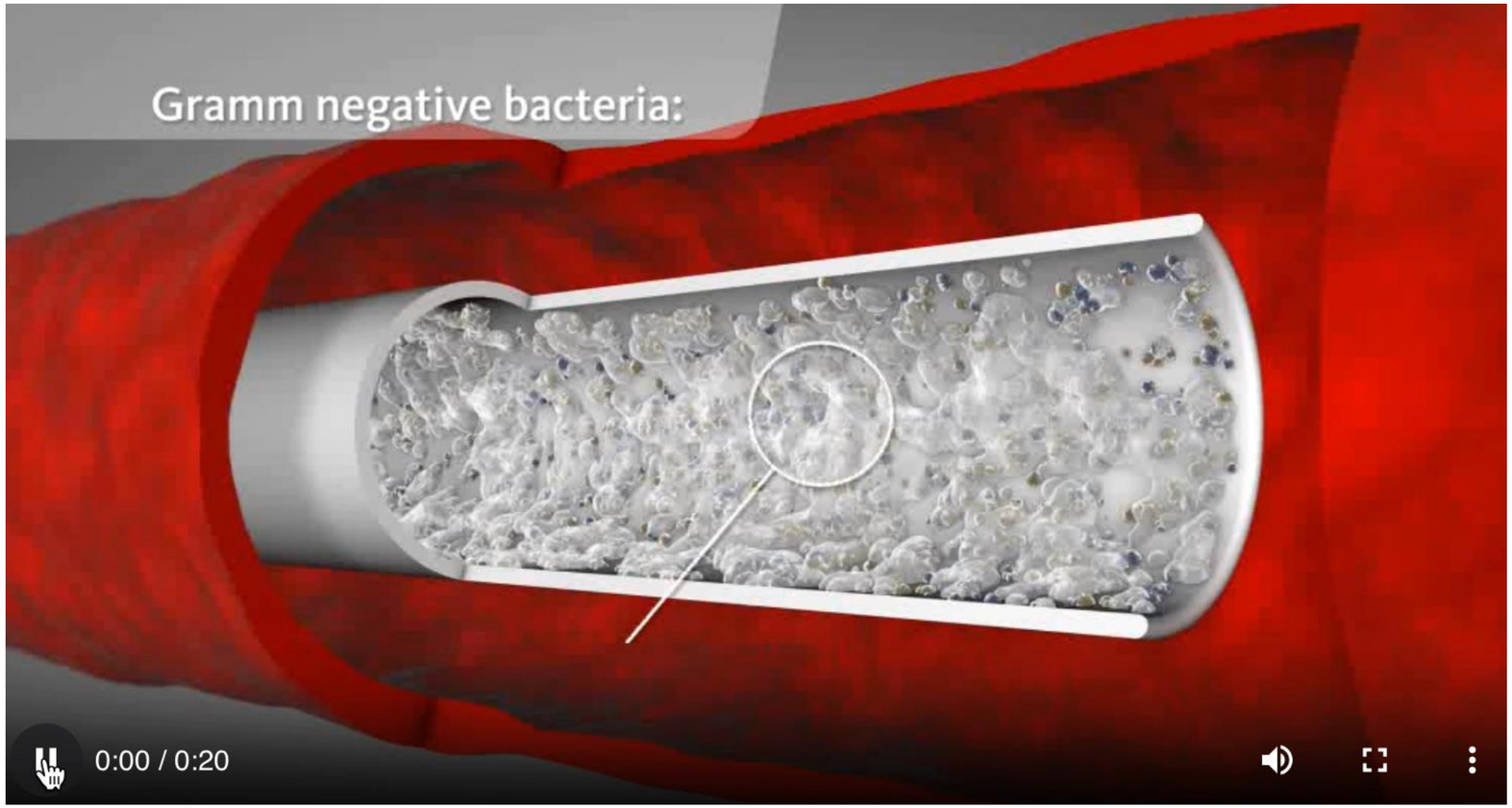
Antimicrobial spectrum

In vitro activity of taurolidine (MIC_{50} mg/ml)

Staph aureus	0,25 – 0,5	Acinetobacter spec.	0,5
Staph. epidermidis	0,25 – 0,5	Moraxella catarrhalis	0,5
Enterococcus feacalis	0,25	Pseud. aeruginosa	0,5 – 1,0
Strept. haemolyticus	0,125 – 0,25	Bacteroides fragilis	0,25
Strept. pneumoniae	0,125 – 0,25	Bact. thetoiotaomicron	0,25
Strept. viridans	0,25	Burkholderia cepacia	0,5
Klebs. pneumoniae	0,25 – 0,5	Clostridium difficile	0,125
Klebs. oxytoca	0,125 – 0,5	Clostridium perfringens	0,125
Enterobacter cloacae	0,5	Corynebacterium spec.	0,25
Enterobacter aerogenes	0,5	Peptostreptococcus spec.	0,125 – 0,25
Citrobacter freundii	0,5	Peptococcus spec	0,125
Proteus mirabilis	0,25 – 0,5	Fusobacterium	0,125 – 0,25
Proteus vulgaris	0,25 – 0,5	Salmonella thypimurium	0,8
Morganella morganii	0,25 – 0,5	Shigella flexneri/sonnei	0,8
Serratia marcescens	0,125 – 0,5	Candida albicans	0,5 – 1,0
Listeria monocytogenes	0,5	Rhodotorula spec.	0,125 – 0,5

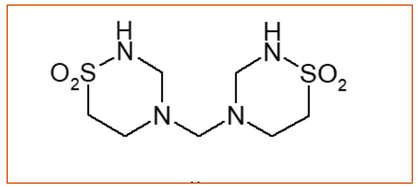
Taurolidine





Lock for 30 minutes

Therapeutic lock



Original research article

JVA The Journal of Vascular Access

Taurolidine lock in the treatment of colonization and infection of totally implanted venous access devices in cancer patients

The Journal of Vascular Access
1–5

DOI: 10.1177/1129729821026453
journals.sagepub.com/home/jva
SAGE

Fabrizio Brescia[1], Mauro Pittiruti[2], Giancarlo Scoppettuolo[3], Chiara Zanier[1], Elisa Nadalini[1], Paola Bottos[1], Chiara Moreal[1], Valentina Da Ros[4] and Fabio Fabiani[1]

Comparative Study › Zentralbl Chir. 2009 Aug;134(4):350-6. doi: 10.1055/s-0028-1098929. Epub 2009 Aug 17.

[Spectrum of indications and perioperative management in i. v. port-a-cath explantation--alternative administration of taurolin in case of i. v. port-a-cath infection]

ELSEVIER

International Journal of Antimicrobial Agents 2

Taurolidine is effective in the treatment of central venous catheter-related bloodstream infections in cancer patients

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Lock the catheter for 2 hours

Prophylactic lock

HEPATOLOGY AND NUTRITION

Significant Reduction in Central Venous Catheter–related Bloodstream Infections in Children on HPN After Starting Treatment With Taurolidine Line Lock

Chu, Hui-Ping; Brind, Joanne; Tomar, Rajeev; Hill, Susan

heparin / taurolidine

↓ 8.6 vs 1.1 CRBSI

Effects of prophylactic use of taurolidine-citrate lock on the number of catheter-related infections in children under 2 years of age undergoing surgery

M. Łyszkowska • G. Kowalewski • M. Szymczak • D. Polnik • A. Mikołajczyk • P. Kaliciński

Standard / taurolidina

↓ 16 vs 1 CRBSI

Advantages

JVA
ISSN 1129-7298

J Vasc Access 2016; 17 (6): 453-464
DOI: 10.5301/jva.5000576

REVIEW

Evidence-based criteria for the choice and the clinical use of the most appropriate lock solutions for central venous catheters (excluding dialysis catheters): a GAVeCeLT consensus

Clinical Nutrition 32 (2013) 538–542

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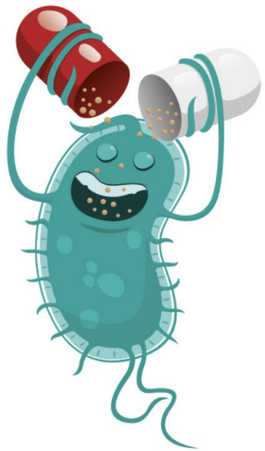
Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

Original article

Absence of microbial adaptation to taurolidine in patients on home parenteral nutrition who develop catheter related bloodstream infections and use taurolidine locks☆,☆☆

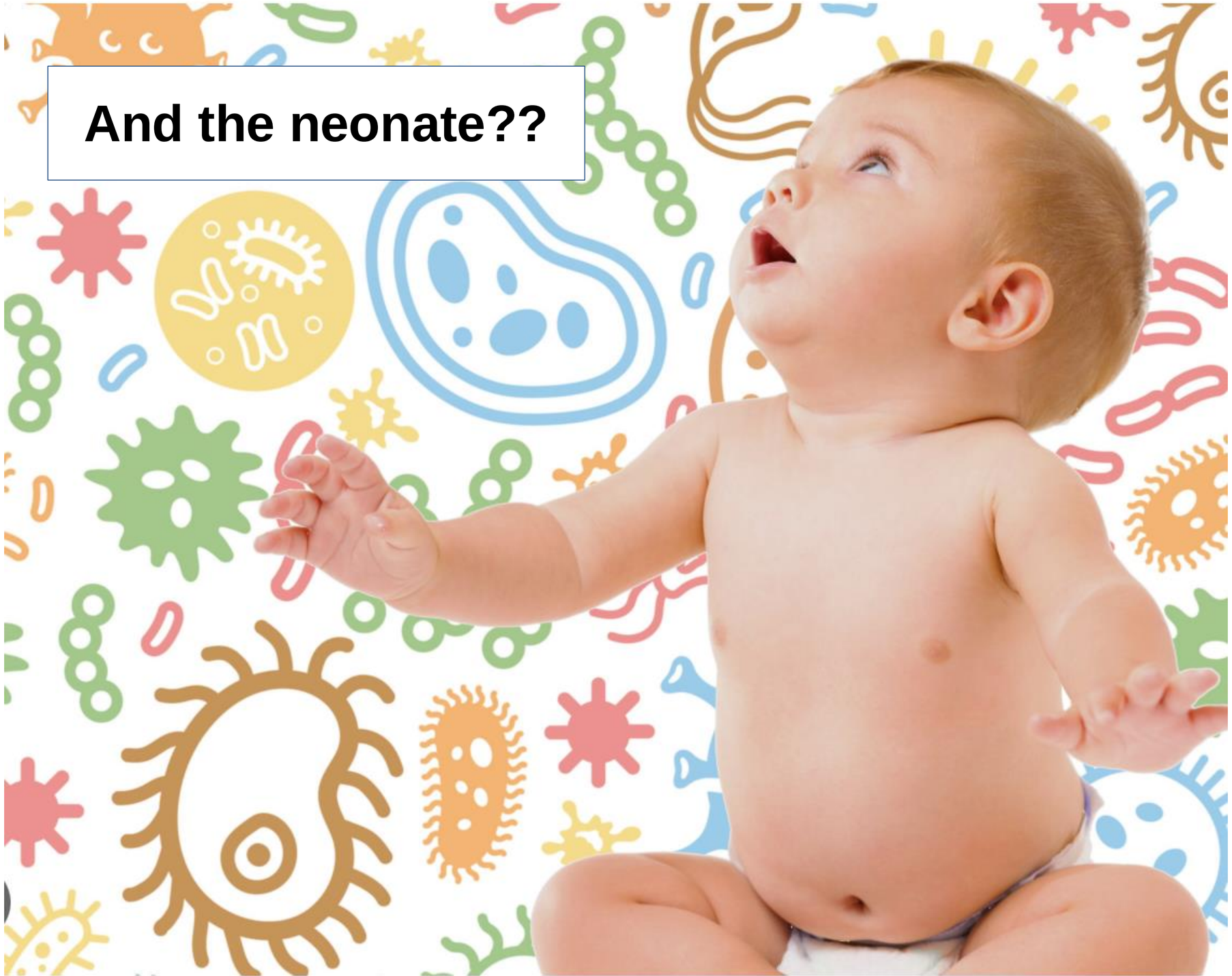
E.D. Olthof[a,*], R.J. Rentenaar[b], A.J.M.M. Rijs[b], G.J.A. Wanten[a]



No resistance

Short action

And the neonate??



Use of 2% taurolidine lock solution for treatment and prevention of catheter-related bloodstream infections in neonates: a feasibility study

I. Savarese • S. Yazami • D.U. De Rose • ... C. Auriti • O. Danhaive • F. Piersigilli • Show all authors

37 neonates

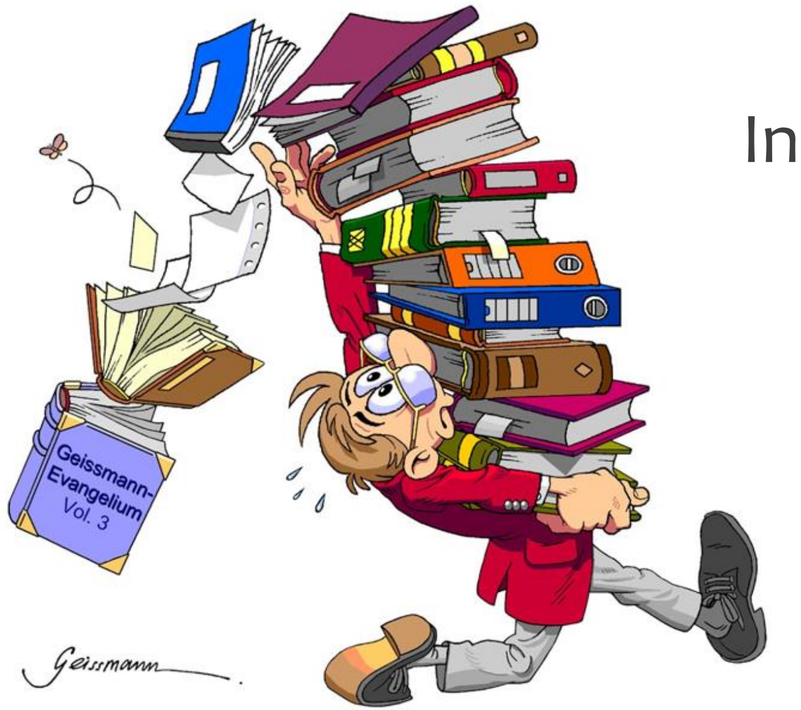
- **21 therapeutic Lock**
- **16 prophylactic Lock**

Lock: 0,5 ml
Dwell time: 30 min to 2 hours

After the lock withdrawal if possible, otherwise flush with saline

No side effects

Take home message



No magic bullets!!

Insertion bundles

Correct management of the exit site

Maintenance bundles

Consider the use of taurolidine

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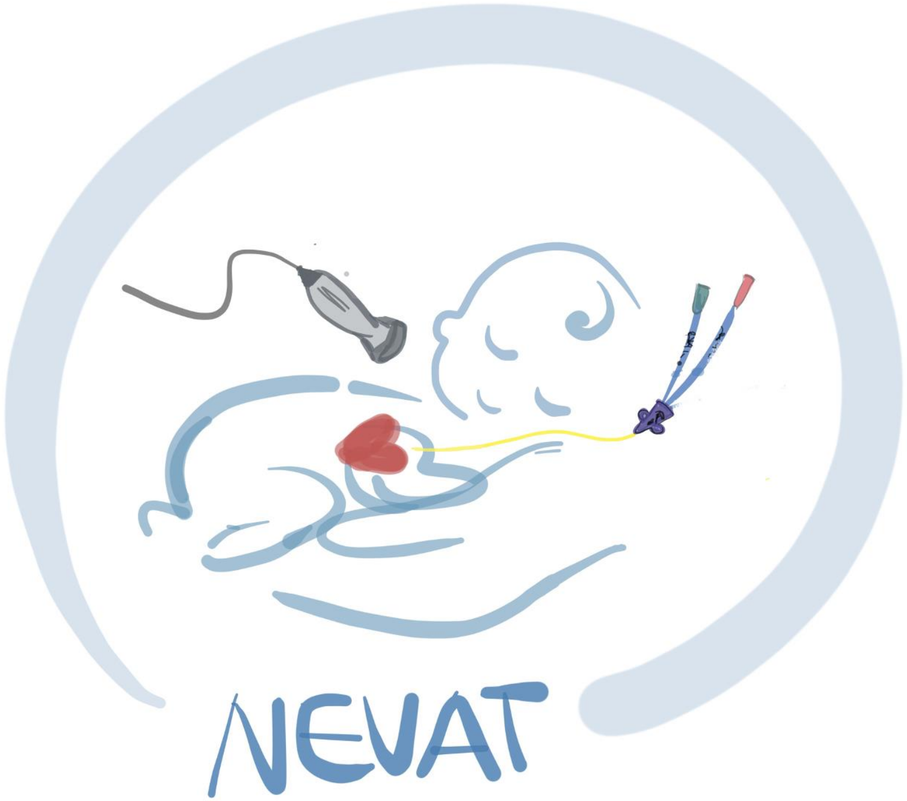

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Thank you for being a part of EAPS 2024 in Vienna!