emelli

zione Policlinico Universitario A. Gemelli
sità Cattolica del Sacro Cuore

GAVeCeLT

Gli Accessi Venosi Centrali a Lungo Termine

evenzione delle infezioni ociate a catetere vascolare bambino e nel neonato

CARLO SCOPPETTUOLO

, ROMA


Patient
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SAFETY
NATIONAL PATIENT
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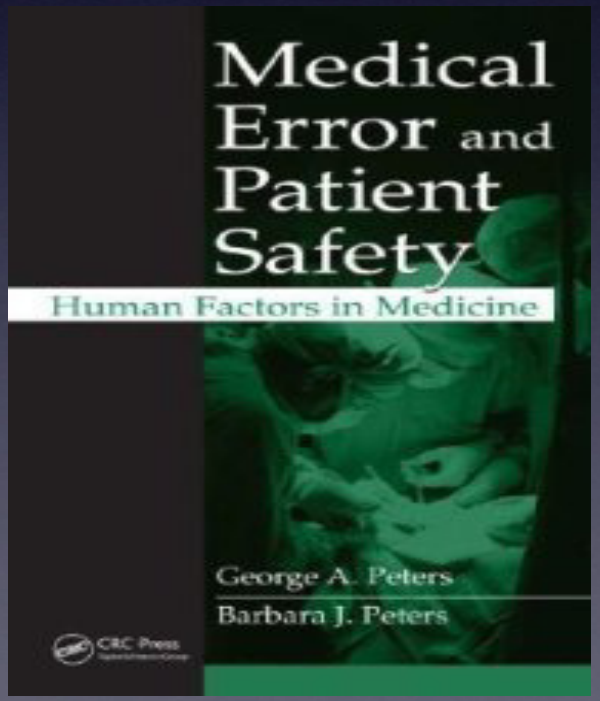
Medical
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Safety
Human Factors in Medicine
George A. Peters
Barbara J. Peters
CRC Press


WORLD ALLIANCE
for PATIENT SAFETY
Solutions
to improve patient safety

Annals of Internal Medicine | SUPPLEMENT

The Top Patient Safety Strategies That Can Be Encouraged for Adoption Now

Paul G. Shekelle, MD, PhD; Peter J. Pronovost, MD, PhD; Robert M. Wachter, MD; Kathryn M. McDonald, MM; Karen Schoelles, MD, SM; Sydney M. Dy, MD, MSc; Kaveh Shojania, MD; James T. Reston, PhD, MPH; Alyce S. Adams, PhD; Peter B. Angood, MD; David W. Bates, MD, MSc; Leonard Bickman, PhD; Pascale Carayon, PhD; Sir Liam Donaldson, MBChB, MSc, MD; Naihua Duan, PhD; Donna O. Farley, PhD, MPH; Trisha Greenhalgh, BM BCH; John L. Haughom, MD; Eileen Lake, PhD, RN; Richard Lilford, PhD; Kathleen N. Lohr, PhD, MA, MPhil; Gregg S. Meyer, MD, MSc; Marlene R. Miller, MD, MSc; Duncan V. Neuhauser, PhD, MBA, MHA; Gery Ryan, PhD; Sanjay Saint, MD, MPH; Stephen M. Shortell, PhD, MPH, MBA; David P. Stevens, MD; and Kieran Walshe, PhD

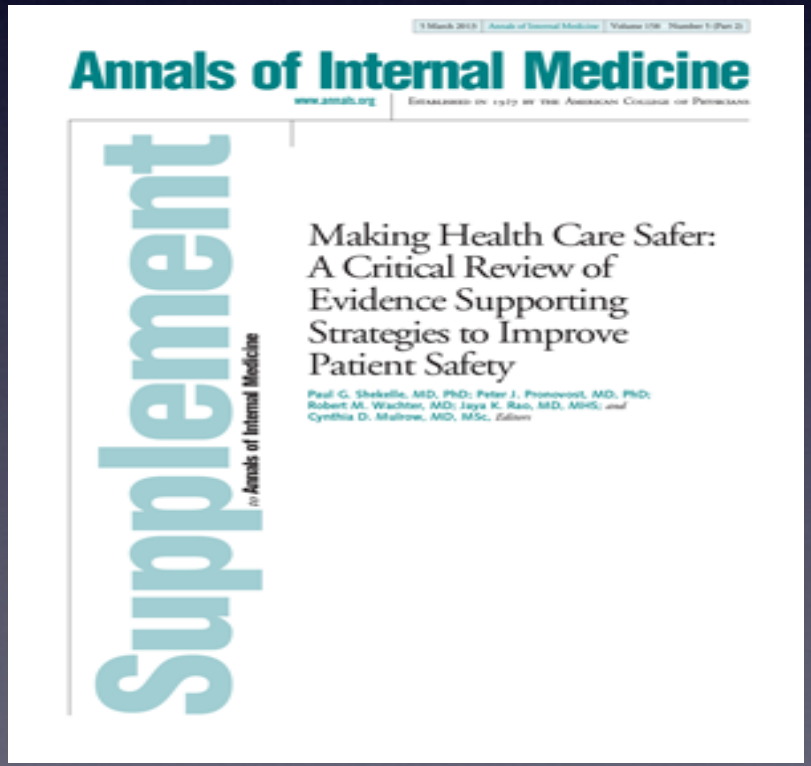

Table 2. Patient Safety Strategies Ready for Adoption Now

Strongly encouraged

- Preoperative checklists and anesthesia checklists to prevent operative and postoperative events
- Bundles that include checklists to prevent central line–associated bloodstream infections
- Interventions to reduce urinary catheter use, including catheter reminders, stop orders, or nurse-initiated removal protocols
- Bundles that include head-of-bed elevation, sedation vacations, oral care with chlorhexidine, and subglottic suctioning endotracheal tubes to prevent ventilator-associated pneumonia
- Hand hygiene
- The do-not-use list for hazardous abbreviations
- Multicomponent interventions to reduce pressure ulcers
- Barrier precautions to prevent health care–associated infections
- Use of real-time ultrasonography for central line placement
- Interventions to improve prophylaxis for venous thromboembolisms

Encouraged

- Multicomponent interventions to reduce falls
- Use of clinical pharmacists to reduce adverse drug events
- Documentation of patient preferences for life-sustaining treatment
- Obtaining informed consent to improve patients' understanding of the potential risks of procedures
- Team training
- Medication reconciliation
- Practices to reduce radiation exposure from fluoroscopy and CT
- The use of surgical outcome measurements and report cards, such as those from ACS NSQIP
- Rapid-response systems
- Use of complementary methods for detecting adverse events or medical errors to monitor for patient safety problems
- Computerized provider order entry
- Use of simulation exercises in patient safety efforts

NIVERSITY HOSPITAL
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500 BEDS
CLINICAL AREAS (CARDIOVASCULAR, WOMAN, EMERGENCY,
EUROSCIENCES, CANCER)
ICC TEAM

PICC TEAM UCSC

Proactive Vascular Planning

Kokotis, JIN 2005

Accesso venoso periferico

pH 5-9
farmaci con osmolarità <600
farmaci non vescicanti
farmaci non irritanti

Agocannula

vene superficiali del braccio disponibili
accesso periferico < 1 settimana
uso esclusivamente intraospedaliero

Cannula periferica lunga

vene superficiali del braccio non disponibi
accesso periferico > 1 settimana

Catetere Midline

accesso periferico > 3 settimane
accesso periferico ad uso extraospedalier

Accesso venoso centrale

pH >9 o <5
farmaci con osmolarità >600
farmaci vescicanti
farmaci irritanti
nutrizione parenterale con osmolarità >800
necessità di prelievi ripetuti e frequenti
necessità di monitoraggio emodinamico

USO INTRA-OSPEDALIERO

tetere ad inserzione periferica PICC
e profonde del braccio disponibili
anto in elezione

tetere ad inserzione centrale CICC
e profonde del braccio non disponibili
erzione in condizioni di urgenza
essità di catetere 'medicato'
essità di > 3 lumi

tetere ad inserzione femorale
tunnellizzato
ituazioni di emergenza
nellizzato
senza di ostruzione vena cava superiore

USO EXTRA-OSPEDALIERO
Day Hospital, Domicilio, Hospice

ACCESSI A MEDIO TERMINE (< 4 MESI)

PICC
- vene profonde del braccio disponibili

CICC tunnellizzato
- vene profonde del braccio non disponibili

ACCESSI A LUNGO TERMINE (> 4 MESI)

uso episodico: < 1/settimana:
Port

uso frequente: > 1/settimana:
Catetere Cuffiato Tunnellizzato CCT
ad inserzione periferica/centrale/femorale

Linee guida aziendali per la prevenzione delle complicanze associate agli accessi venosi
Parte seconda: Raccomandazioni per il corretto impianto dell'accesso venoso

(LG.POL.RMA.030)

	NOME	DATA	FIRMA
Redatto da:	Dott. Giancarlo Scoppettuolo Dott. Mauro Pittiruti Dott.ssa Laura Dolcetti Dott. Alessandro Emoli Dott. Filippo Berloco	16. 3.2015 16 - 3 - 15 16 - 3 - 2015 16 - 3 - 2015 16 - 3 - 2015	
Verificato da:	CLIO	20 - 3 - 2015	
Approvato da:	Dott. Enrico Zampedri	20/3/15	

Linee guida aziendali per la prevenzione delle complicanze associate agli accessi venosi
Parte terza: Raccomandazioni per la gestione corretta dell'accesso venoso

(LG.POL.RMA.031)

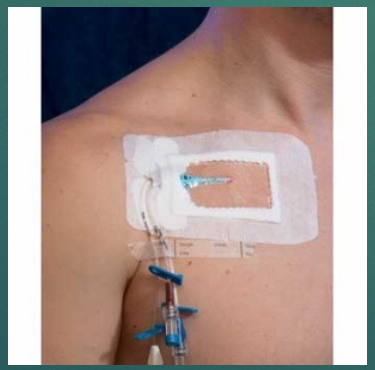
	NOME	DATA	FIRMA
Redatto da:	Dott. Giancarlo Scoppettuolo	16.3.2015	
	Dott. Mauro Pittiruti	16.3.15	
	Dott.ssa Laura Dolcetti	16-3-2015	
	Dott. Alessandro Emoli	16-3-2015	
	Dott. Filippo Berloco	16/3-2015	
Verificato da:	CLIO	20-3-2015	
Approvato da:	Dott. Enrico Zampedri	20/3/15	

GAVeCeLT

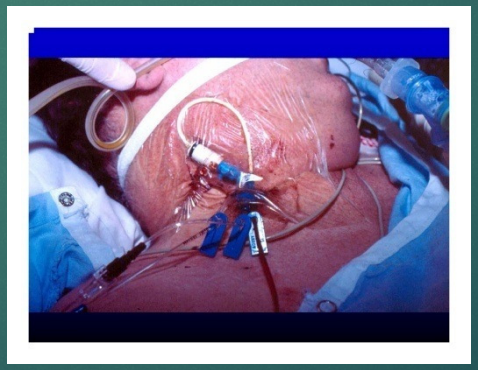
Gli Accessi Venosi Centrali a Lungo Termine

- Agocannule periferiche
- Cateteri arteriosi per monitoraggio emodinamico
- CVC non cuffiati e non tunnellizzati
  - CVC multilume
  - Cateteri di Swan-Ganz
  - Cateteri per emodialisi non tunnellizzati a doppio lume

120.000.000



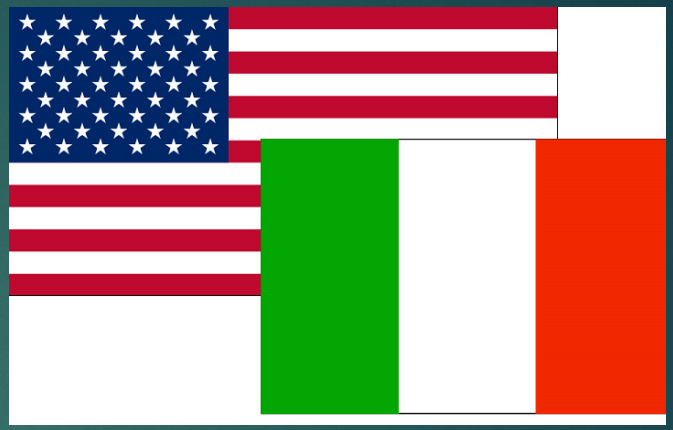
20.000.000

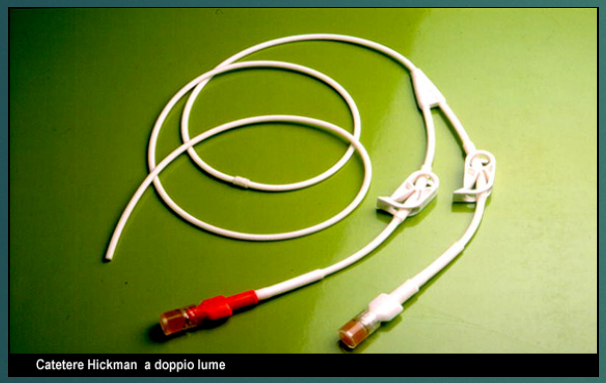


5.000.000-7.000.000

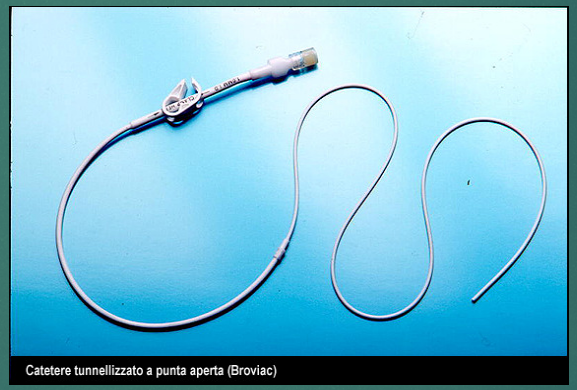
700.000

- CVC con cuffia e tunnellizzati (100.000)
  - CVC tipo Hickman/Broviac/Groshong
  - Cateteri per emodialisi tunnellizzati
- Port sottocutanei (200.000)
- In Italia circa 30.000 cumulativamente



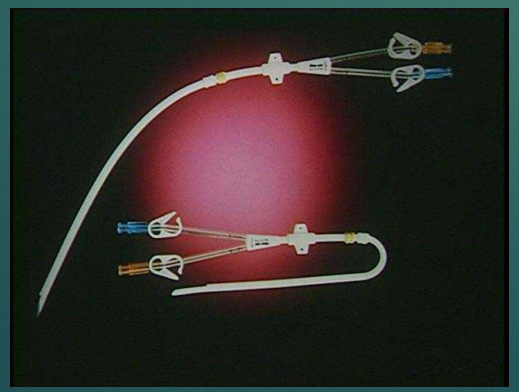


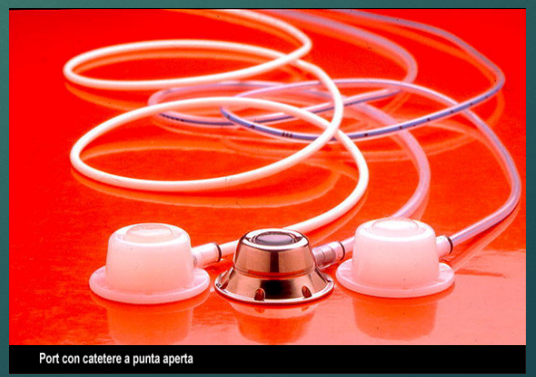
Catetere Hickman a doppio lume



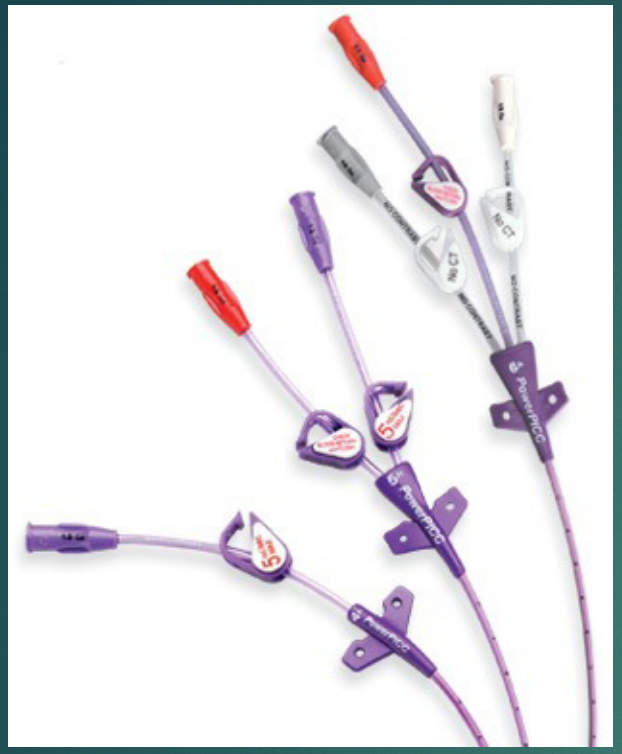
Catetere tunnellizzato a punta aperta (Broviac)

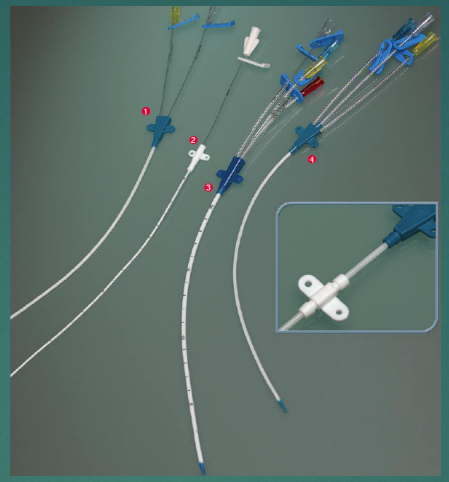
Catetere tunnellizzato con valvola (Groshong)

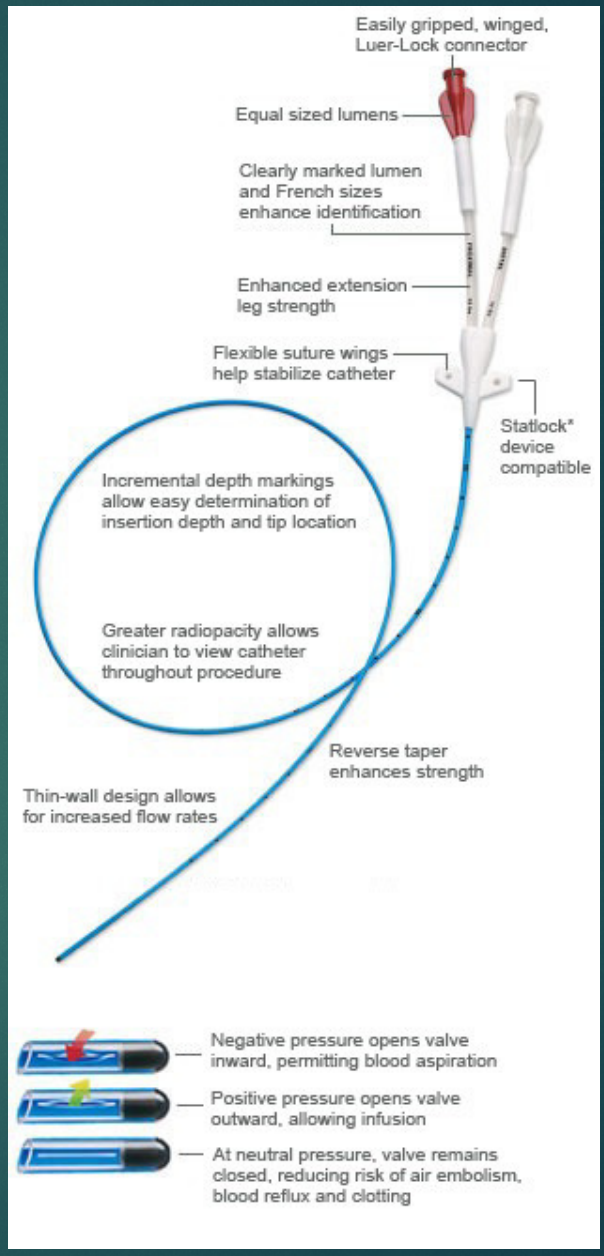




Port con catetere a punta aperta



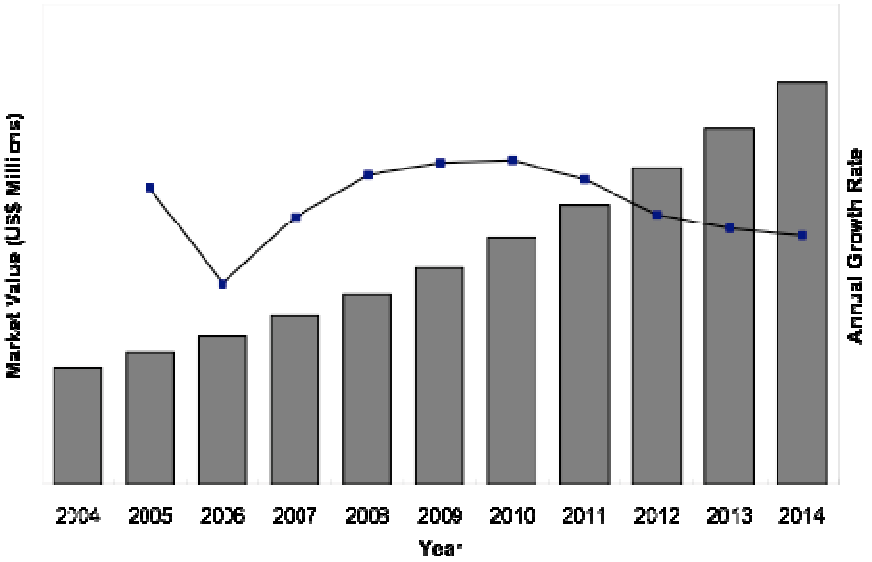



Easily gripped, winged, Luer-Lock connector
Equal sized lumens
Clearly marked lumen and French sizes enhance identification
Enhanced extension leg strength
Flexible suture wings help stabilize catheter
Statlock* device compatible
Incremental depth markings allow easy determination of insertion depth and tip location
Greater radiopacity allows clinician to view catheter throughout procedure
Reverse taper enhances strength
Thin-wall design allows for increased flow rates
Negative pressure opens valve inward, permitting blood aspiration
Positive pressure opens valve outward, allowing infusion
At neutral pressure, valve remains closed, reducing risk of air embolism, blood reflux and clotting

Mercato dei PICC in USA

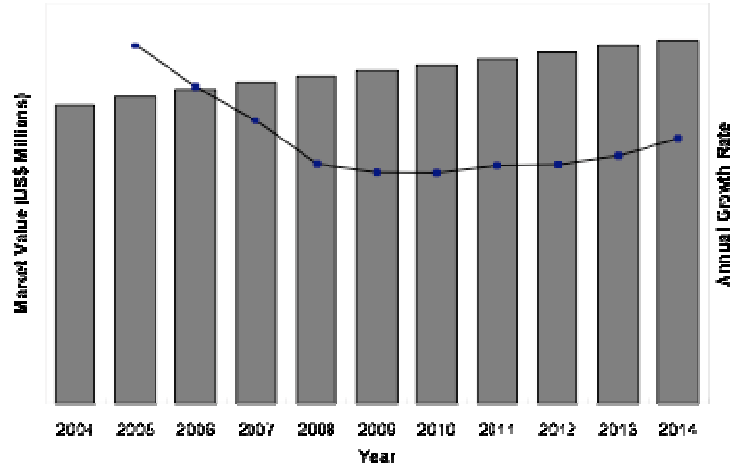
5.000.000/anno (85 % power injectable)

Chart 1-7: Peripherally Inserted Central Line Catheter Market, U.S., 2004-2014



Source: iData Research Inc.

Chart 1-5: Central Venous Catheter Market, U.S., 2004-2014

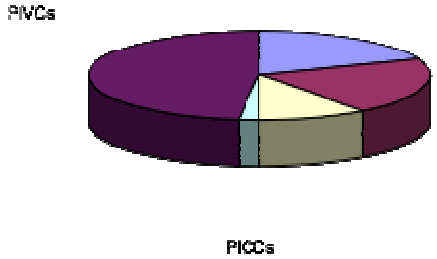


Source: iData Research Inc.

Mercato dei PICC in Europa

Chart 1-2 and Chart 1-3 illustrate the relative values of the segments in 2007 and 2014

Chart 1-2: Vascular Access Device Market by Segment, Europe, 2007



Source: Data Research Inc

Chart 1-3: Vascular Access Device Market by Segment, Europe, 2014

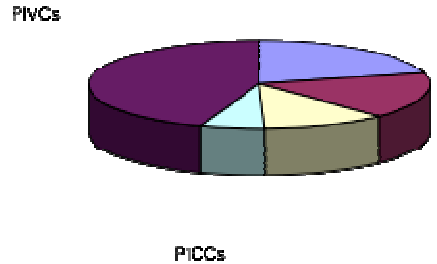


Chart 1-4: CAGR for the Vascular Access Device Market by Country, 2007

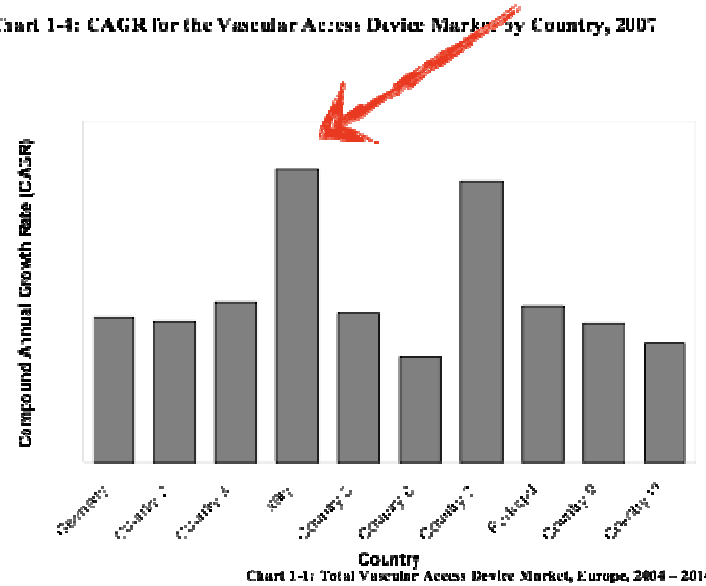
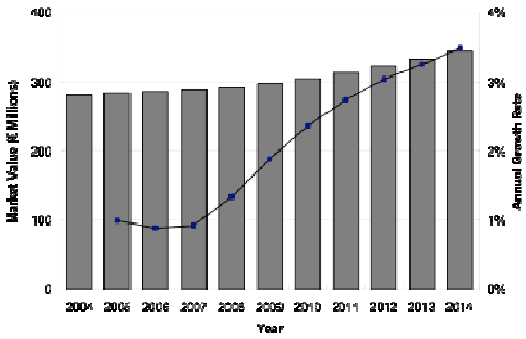


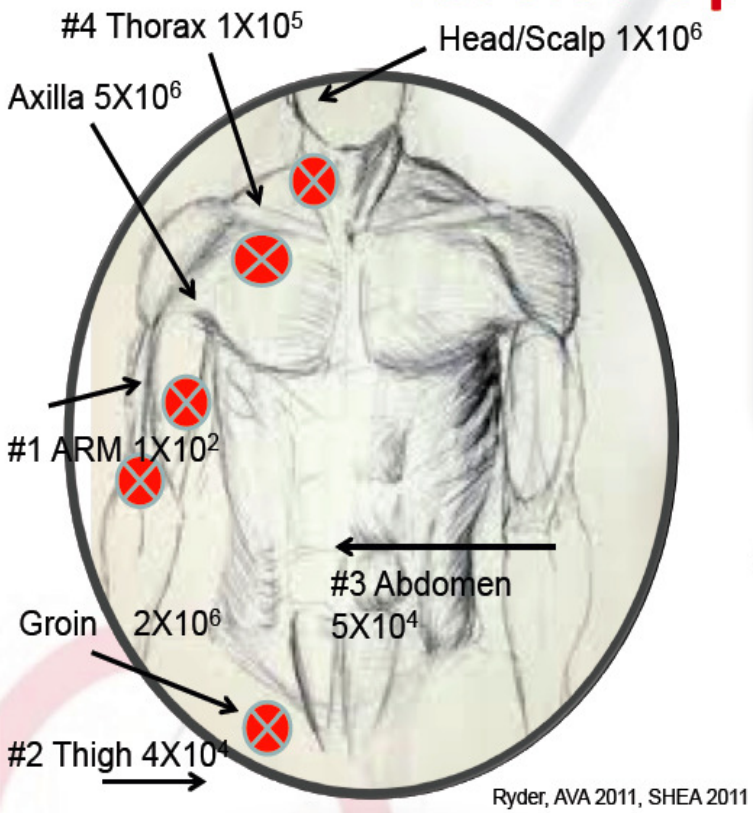
Chart 1-1: Total Vascular Access Device Market, Europe, 2004 – 2014 (E)

Source: Data Research Inc

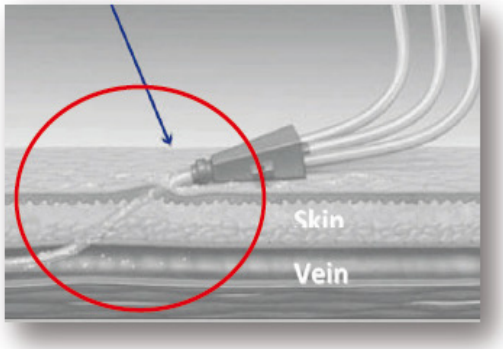


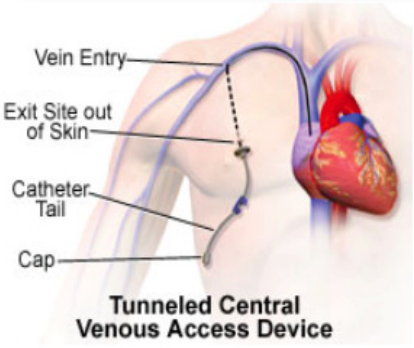
Source: Data Research Inc

Exit Site Options

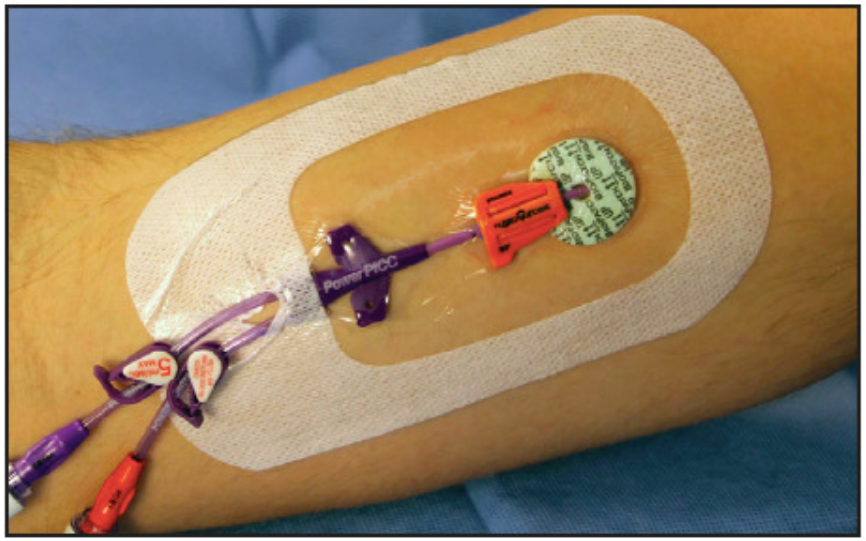


Ryder, AVA 2011, SHEA 2011



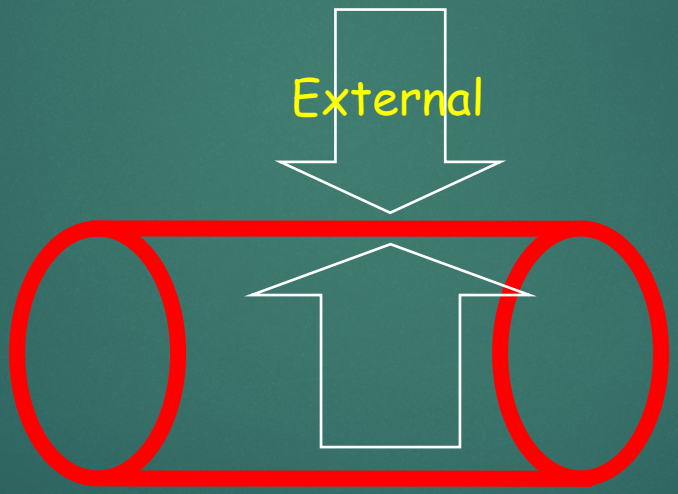


Courtesy of N. Moreau


PowerPICC

Colonizzazione

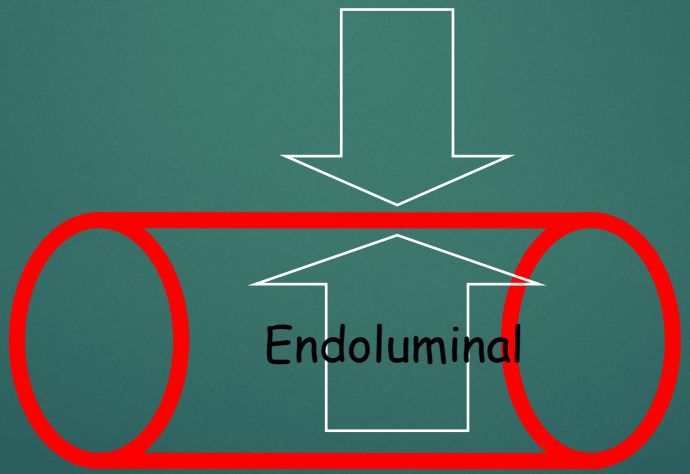
- La colonizzazione di un dispositivo intravascolare può avvenire per via EXTRALUMINALE:
  - Microrganismi dalla cute circostante
  - Colonizzazione per via ematogena



Eggimann, 2007; Byrnes, 2007; Raad, 2007

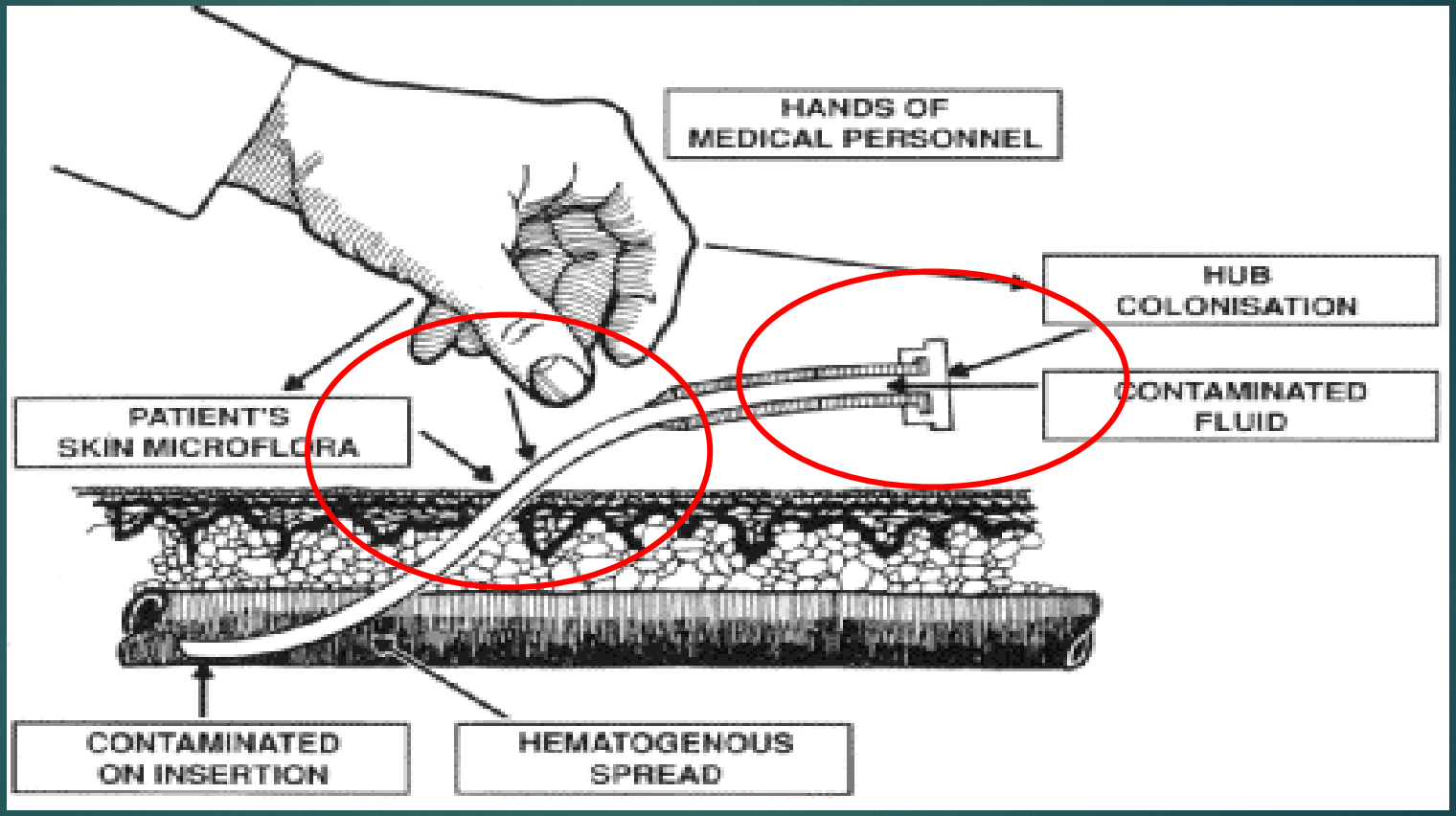
Colonizzazione

- La colonizzazione di un dispositivo intravascolare può avvenire per via INTRALUMINALE:
  - Contaminazione dai raccordi (rubinetti, rampe) delle vie di infusione
  - Somministrazione di infusioni contaminate



Eggimann, 2007; Byrnes, 2007; Raad, 2007

PATOGENESI



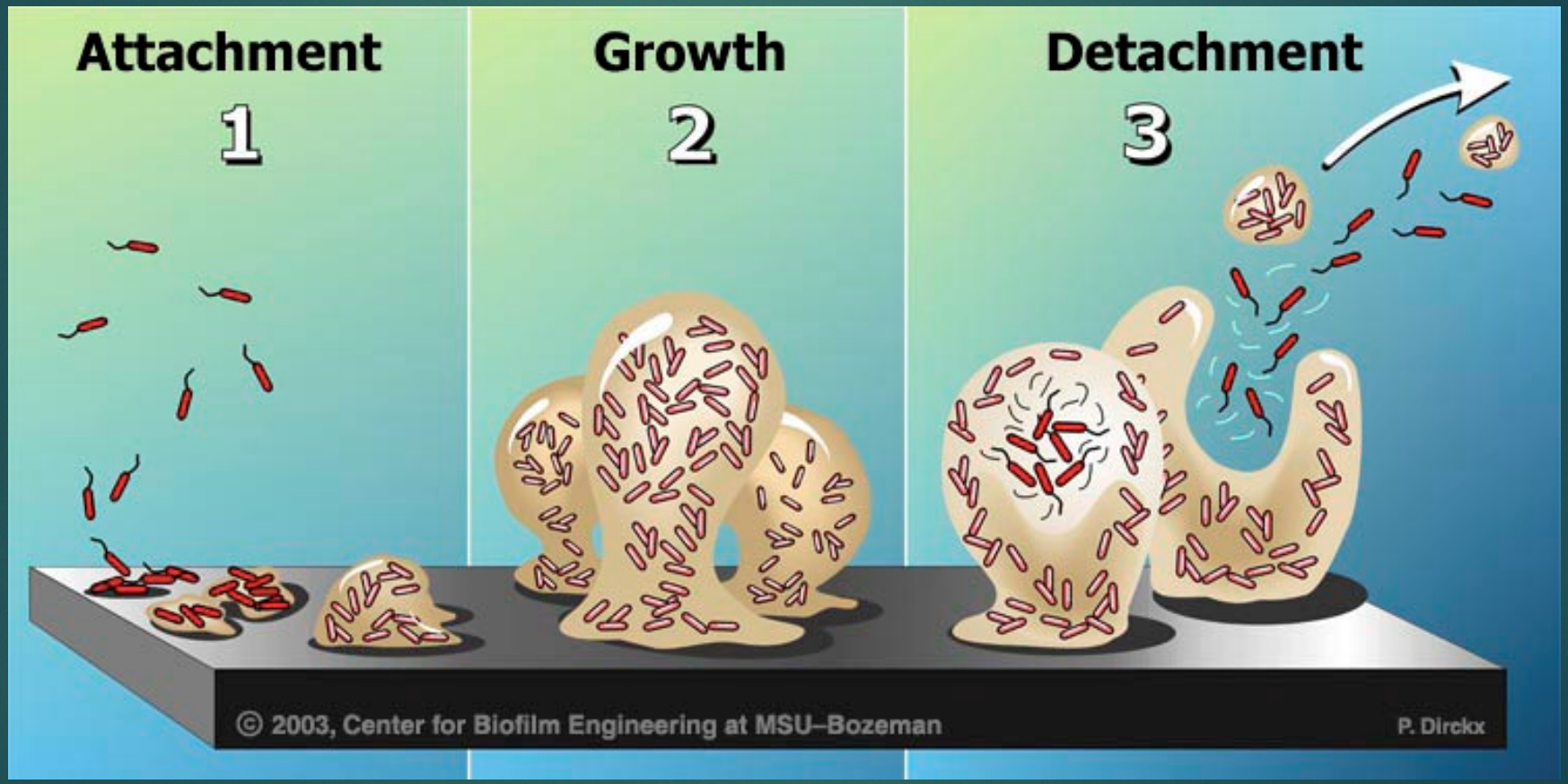
Maki, 2001

PATOGENESI

Due vie principali:

- 'SKIN' = microorganismi dalla cute circostante
- 'HUB' = contaminazione dai raccordi (rubinetti, rampe) delle vie di infusione

Formazione del Biofilm



Biofilm

- Le caratteristiche fondamentali delle infezioni correlate alla presenza di un biofilm sono:
- Resistenza agli antibiotici
- Resistenza alle cellule del sistema immunitario
- Alcune infezioni croniche si presentano con cicliche esacerbazioni e remissioni proprio perché rifornite da un biofilm.

Ryder, 2005

Table 2
Organisms isolated from catheter tip samples

EU countries (n = 132)		Non-EU countries (n = 36)	
Organism	No. (%)	Organism	No. (%)
CNS	68 (51.5%)	CNS	14 (40%)
Candida spp	12 (9.1)	*S aureus*[a]	12 (34.3)
S aureus[a]	8 (6.1)	*Acinetobacter* spp	2 (5.7)
Pseudomonas spp	7 (5.3)	*Corynebacterium* spp	2 (5.7)
Enterobacter spp	6 (4.5)	*Enterococcus* spp	2 (5.7)
Enterococcus spp	6 (4.5)	*Enterobacter* spp	1 (2.9)
Acinetobacter spp	5 (3.8)	*Klebsiella* spp	1 (2.9)
Klebsiella spp	5 (3.8)	*Pseudomonas* spp	1 (2.9)
Proteus spp	4 (3)	Others	1 (2.9)
Escherichia coli	3 (2.3)		
Corynebacterium spp	2 (1.5)		
Others	6 (4.5)		

Abbreviations: CNS, coagulase-negative staphylococci; EU, European Union.
[a] $P < .0001$.

Data from Munoz P, Bouza E, San Juan R, et al. Clinical-epidemiological characteristics and outcome of patients with catheter-related bloodstream infections in Europe (ESGNI-006 Study). Clin Microbiol Infect. 2004;10(9):843–5.

Munoz, 2004; Sligl, 2006

IMPACT OF 500,000 CVC-RELATED BSIs / YEAR IN U.S. HEALTHCARE CENTERS

Prolongation of hospitalization, 11 - 23 days

- Arnow PM, et al. *Clin Infect Dis* 1993;16:778-784
- Pattet D, et al. *JAMA* 1994;271:1598-1601
- Collignon PJ. *Med J Aust* 1994;161:374-378
- Rello J, et al. *Am J Respir Crit Care Med* 2000;162:1027-1030

Cost to healthcare system, $33,000-$35,000/episode

- Arnow PM, et al. *Clin Infect Dis* 1993;16:778-784
- Pattet D, et al. *JAMA* 1994;271:1598-1601
- Rello J, et al. *Am J Respir Crit Care Med* 2000;162:1027-1030

Attributable mortality, 12-25%

- Smith RL, et al. *Chest* 1991;100:164-167
- Arnow PM, et al. *Clin Infect Dis* 1993;16:778-784
- Pattet D, et al. *JAMA* 1994;271:1598-1601
- Collignon PJ. *Med J Aust* 1994;161:374-378

ARTICLE IN PRESS

Journal of Hospital Infection (2009) ■, 1–7

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REVIEW

Epidemiology, medical outcomes and costs of catheter-related bloodstream infections in intensive care units of four European countries: literature- and registry-based estimates

E. Tacconelli [a], G. Smith [b], K. Hieke [c], A. Lafuma [d,*], P. Bastide [e]

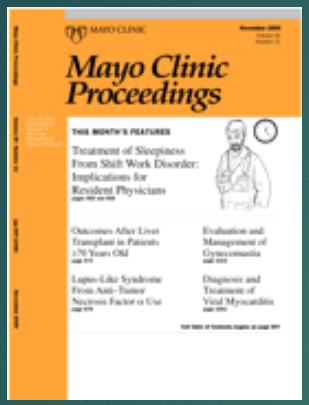
[a] *Department of Infectious Diseases, Catholic University, Rome, Italy*
[b] *Department of Microbiology, Royal Liverpool Hospital, Liverpool, UK*
[c] *NeosHealth, Binningen, Switzerland*
[d] *Cemka Eval, Bourg-la-Reine, France*
[e] *Johnson&Johnson Wound Management (a division of Ethicon), Issy-Les-Moulineaux, France*

Received 5 November 2008; accepted 18 December 2008

Table I Key results for the four European countries

	France	Germany	Italy	UK
Total population 2005[a] (millions)	60.2	82.5	57.5	59.8
No. of implanted central venous and arterial catheters in ICUs	1 000 000	1 750 000	490 000	210 000
Incidence rate of CRBSIs (per 1000 catheter days)	1.23	1.5	2.0	4.2
No. of CRBSIs per year	14 400	8400	8500	8940
Estimate of mortality related to CRBSI	1580	1000–1300	1500	NA
Additional LOS per CRBSI episode (in days)	9.5–14	4.8–7.2 (modelled)	12.7	1.9–4.0 (modelled)
No. of ICU days due to CRBSIs per year	136 700–201 475	40 000–60 000	109 220	15 960–33 600
Additional cost per CRBSI episode	€7,730–€11,380	€4,200	€13,030	£2,949–£6,209 (€4,392–€9,251)
Annual costs related to CRBSIs (€ million) for the healthcare systems	100.0–130.0	59.6–78.1	81.6	£19.1–£36.2 (€28.5–€53.9)

ICU, intensive care unit; CRBSI, catheter-related bloodstream infections; LOS, length of stay.
[a] Data from Organisation for Economic Co-operation and Development (OECD).



The Risk of Bloodstream Infection in Adults With Different Intravascular Devices: A Systematic Review of 200 Published Prospective Studies

Dennis G. Maki, Dalniel M. Kluger, Christopher J. Crnich

Mayo Clin Proc. September 2006; 81 (9): 1159-1171

TABLE 3. **Rates of Intravascular Device–Related Bloodstream Infection Caused by Various Types of Devices Used for Vascular Access***

Device	No. of studies	No. of catheters	No. of IVD (d)	No. of BSIs	Rates of IVD-related bloodstream infection			
					Per 100 devices		Per 1000 IVD-days	
					Pooled mean	95% CI	Pooled mean	95% CI
Peripheral IV catheters								
Plastic catheters	110	10,910	28,720	13	0.1	0.1-0.2	0.5	0.2-0.7
Steel needles	1	148	350	3	2.0	0.0-4.3	8.6	0.0-18.2
Venous cutdown	1	27	111	1	3.7	0.0-10.8	9.0	0.0-26.6
Midline catheters	3	514	9251	2	0.4	0.0-0.9	0.2	0.0-0.5
Arterial catheters for hemodynamic monitoring	14	4366	21,397	37	0.8	0.6-1.1	1.7	1.2-2.3
Peripherally inserted central catheters								
Inpatient and outpatient	15	3566	105,839	112	3.1	2.6-3.7	1.1	0.9-1.3
Inpatient	6	625	7137	15	2.4	1.2-3.6	2.1	1.0-3.2
Outpatient	9	2813	98,702	97	3.5	2.8-4.1	1.0	0.8-1.2
Short-term noncuffed central venous catheters								
Nonmedicated								
Nontunneled	79	20,226	322,283	883	4.4	4.1-4.6	2.7	2.6-2.9
Tunneled	9	741	20,065	35	4.7	3.2-6.2	1.7	1.2-2.3
Medicated								
Chlorhexidine-silver-sulfadiazine	18	3367	54,054	89	2.6	2.1-3.2	1.6	1.3-2.0
Minocycline-rifampin	3	690	5797	7	1.0	0.3-1.8	1.2	0.3-2.1
Silver impregnated	2	154	1689	8	5.2	1.7-8.7	4.7	1.5-8.0
Silver iontophoretic	2	396	4796	16	4.0	2.1-6.0	3.3	1.7-5.0
Benzalkonium chloride	1	277	2493	12	4.3	1.9-6.7	4.8	2.1-7.5
Pulmonary artery catheters	13	2057	8143	30	1.5	0.9-2.0	3.7	2.4-5.0
Hemodialysis catheters								
Temporary, noncuffed	16	3066	51,840	246	8.0	7.0-9.0	4.8	4.2-5.3
Long-term, cuffed and tunneled	16	2806	373,563	596	21.2	19.7-22.8	1.6	1.5-1.7
Cuffed and tunneled central venous catheters	29	4512	622,535	1013	22.5	21.2-23.7	1.6	1.5-1.7
Subcutaneous venous ports								
Central	14	3007	983,480	81	3.6	2.9-4.3	0.1	0.0-0.1
Peripheral	3	579	162,203	23	4.0	2.4-5.6	0.1	0.1-0.2
Intra-aortic balloon pumps	1	101	414	3	3.0	0.0-6.3	7.3	0.0-15.4
Left ventricular assist devices	3	157	19,653	41	26.1	19.2-33.0	2.1	1.5-2.7

*BSI = bloodstream infection; CI = confidence interval; IV = intravenous; IVD = intravascular device.

GUIDELINES

Guidelines for the Prevention of Intravascular Catheter–Related Infections

Naomi P. O'Grady,[1] Mary Alexander,[2] E. Patchen Dellinger,[5] Julie L. Gerberding,[6] Stephen O. Heard,[3] Dennis G. Maki,[8] Henry Masur,[1] Rita D. McCormick,[9] Leonard A. Mermel,[10] Michele L. Pearson,[7] Issam I. Raad,[11] Adrienne Randolph,[4] and Robert A. Weinstein[12]

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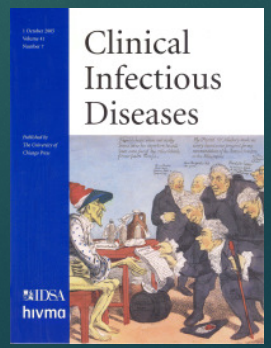
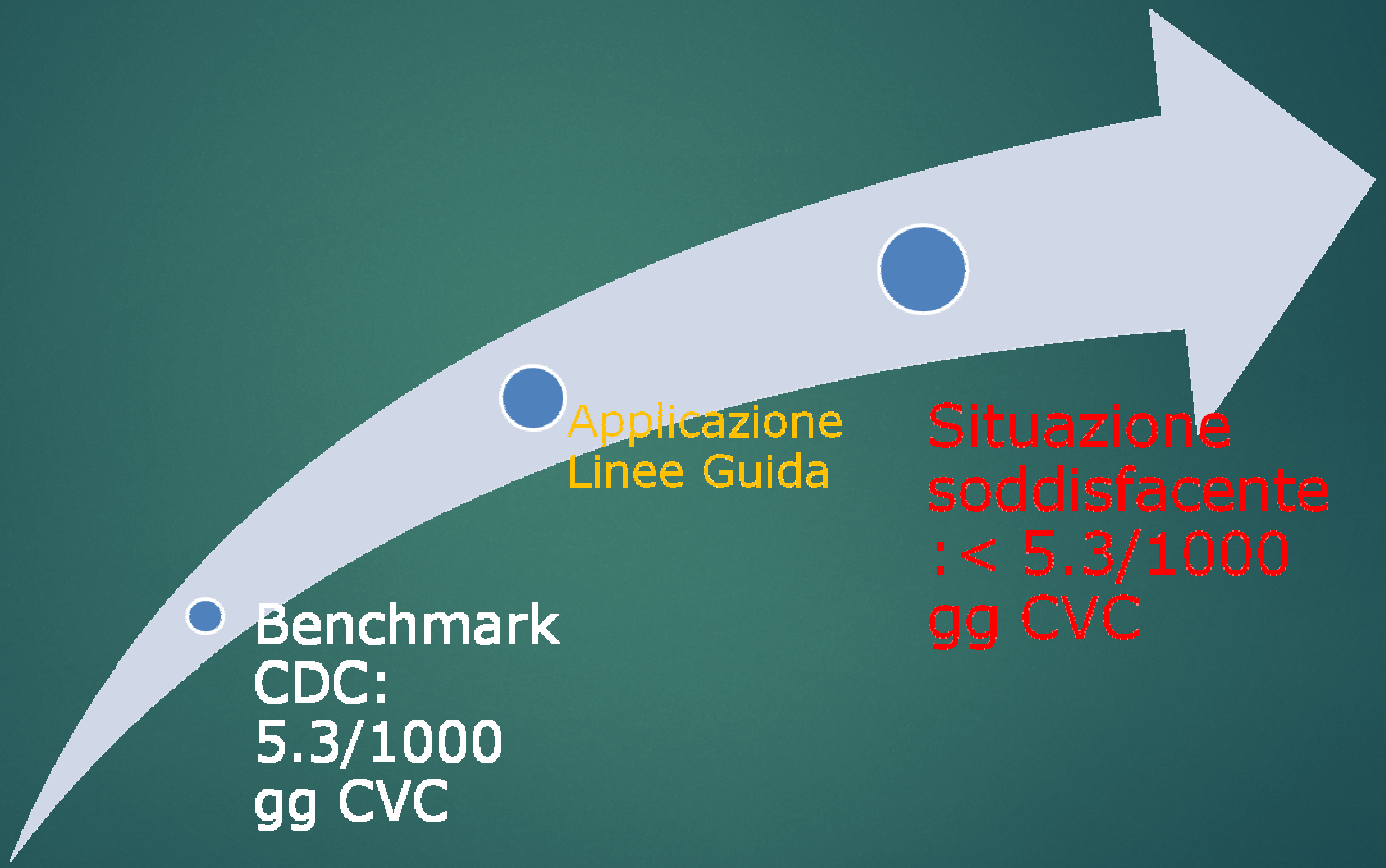
Clinical Infectious Diseases 2002; 35:1281–307

1058-4838/2002/3511-0001

IDSA
Infectious Diseases Society of America




Benchmark
CDC:
5.3/1000
gg CVC
Applicazione
Linee Guida
Situazione
soddisfacente
:< 5.3/1000
gg CVC

Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011

The goal of an effective prevention program should be the elimination of CRBSI from all patient-care areas. Although this is challenging, programs have demonstrated success, but sustained elimination requires continued effort. The goal of the measures discussed in this document is to reduce the rate to as low as feasible given the specific patient population being served, the universal presence of microorganisms in the human environment, and the limitations of current strategies and technologies.


LEI HA UN TUMORE.
E SONO IO.
MAURO BIANI 2008

For HAIs, it is widely demonstrated that all are preventable, but some are partly preventable and some others (CLABSI), on the contrary, are completely preventable and avoidable.

Institute For Healthcare Improvement's

www.ihi.org

2005

Six Changes that Save Lives

- Deploy Rapid Response Teams
- Deliver Reliable, Evidence-Based Care for Acute Myocardial Infarction (Heart Attacks)
- Prevent Adverse Drug Events (ADEs)
- Prevent Surgical Site Infections
- Prevent Ventilator-Associated Pneumonia
- **Prevent Central Line Infection**

IHI, 2005

Journal of Hospital Infection (2007) 65(S2) 3-9

Available online at www.sciencedirect.com

SCIENCE DIRECT

www.elsevierhealth.com/journals/jhin

The United States approach to strategies in the battle against healthcare-associated infections, 2006: transitioning from benchmarking to zero tolerance and clinician accountability[1]

William R. Jarvis*

Jason and Jarvis Associates, Hilton Head Island, SC, USA

KEYWORDS
Nosocomial infections;
Healthcare-associated infections;
Infection control;
Prevention

Summary Approximately 2,000,000 healthcare-associated infections (HAIs) annually occur in US healthcare facilities and lead to approximately 60,000–90,000 deaths and cost $17–29 billion dollars. Such HAIs are an equal, if not more common problem, worldwide. Many evidence-based HAI prevention guidelines exist. However, despite knowing what to do, the challenge remains of getting clinicians to comply with these recommendations. In the USA, a variety of forces, including the public and legislators, are demanding HAI prevention. This is illustrated by the Consumer's Union's effort to get legislation in every state for public HAI rate reporting. In addition, a number of profit-making and non-profit-making organizations have initiated major HAI prevention interventions. At least three common themes for these interventions exist. First, no single intervention prevents any HAI; rather a "bundle" approach, using a package of multiple interventions based on evidence provided by the infection control community and implemented by a multidisciplinary team is the model for successful HAI prevention. Second, benchmarking is inadequate and a culture of zero tolerance is required. Third, a culture of accountability and administrative support is required. Such interventions have illustrated that much greater levels of HAI prevention can be accomplished than ever estimated in the past. Implementation of evidence-based HAI prevention interventions should be a high priority for all healthcare facilities to reduce preventable HAIs to the greatest extent possible.

APIC - Targeting Zero

According to IHI's experiences and Campaigns, the best tool to Target Zero Infections is the "Bundle"

What is a "bundle"?

- IHI developed the concept of "bundles" to help health care providers more reliably deliver the best possible care for patients undergoing particular treatments with inherent risks. A bundle is a structured way of improving the processes of care and patient outcomes: **a small, straightforward set of practices — generally three to five — that, when performed collectively and reliably, have been proven to improve patient outcomes.**

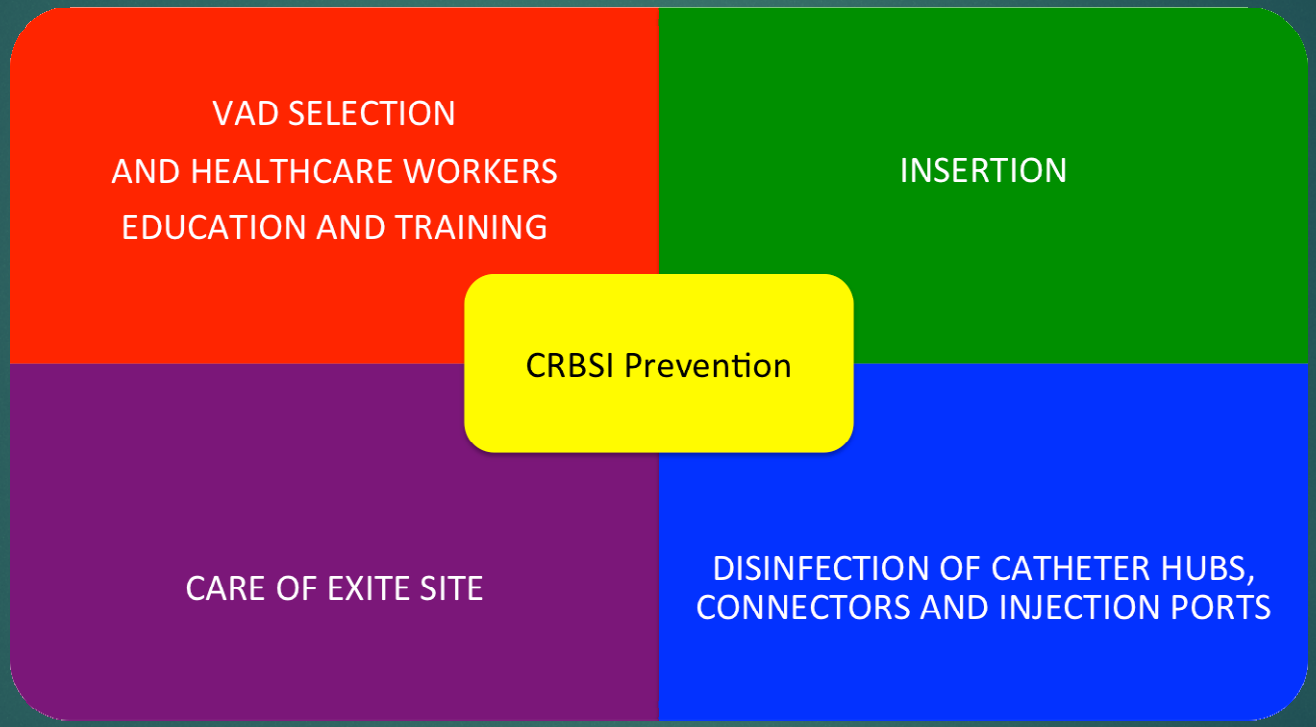
Linee Guida di Riferimento per la prevenzione delle CRBSI

- CDC Atlanta 2002 (Centers for Disease Control, USA)
- RCN 2005 (Royal College of Nurses, UK)
- INS 2006 (Infusion Nursing Society, USA)
- BCSH 2006 (British Committe for Standards in Hematology, UK)
- **EPIC 2007 (Evidence -Based Practice in Infection Control, UK)**
- **SHEA/IDSA 2008**
- **ESPEN 2009**
- **RCN 2010**
- **INS 2011**
- ***CDC 2011***
- ***EPIC 3 2014***
- ***SHEA 2014***
- ***INS 2016***
- ***RCN 2016***

epic2: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England

R.J. Pratt, C.M. Pellowe, J.A. Wilson, H.P. Loveday, P.J. Harper, S.R.L.J. Jones, C. McDougall, M.H. Wilcox

BCSH Guidelines

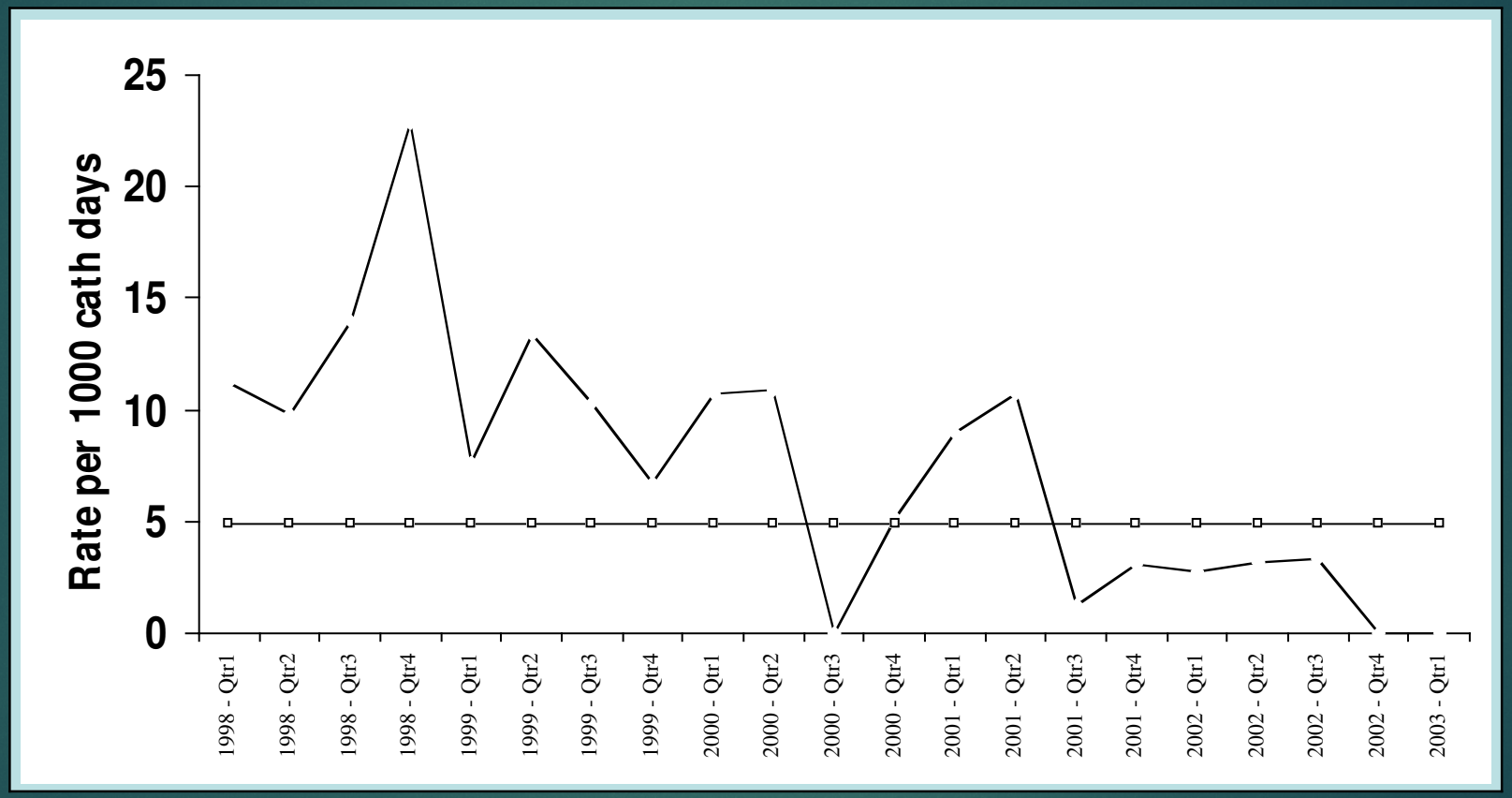

VAD SELECTION
AND HEALTHCARE WORKERS
EDUCATION AND TRAINING
INSERTION
CRBSI Prevention
CARE OF EXITE SITE
DISINFECTION OF CATHETER HUBS,
CONNECTORS AND INJECTION PORTS

Central Line Bundle

- Hand Hygiene
- Maximal Barrier Precautions Upon Insertion
- Chlorhexidine Skin Antisepsis
- Optimal Catheter Site Selection, with Subclavian Vein as the Preferred Site for Non-Tunneled Catheters
- Daily Review of Line Necessity with Prompt Removal of Unnecessary Lines

www.ihi.org, 2008

But, Does It Work?



Berenholtz, 2004

Rate of CRBSI fell from 11.3 to 0/1000 catheter days

Prevented annually (estimated)
43 CRBSI

8 deaths
559 ICU days

Estimated savings to hospital: $ 1.824.447

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 DECEMBER 28, 2006 VOL. 355 NO. 26

An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU

Peter Pronovost, M.D., Ph.D., Dale Needham, M.D., Ph.D., Sean Berenholtz, M.D., David Sinopoli, M.P.H., M.B.A., Haitao Chu, M.D., Ph.D., Sara Cosgrove, M.D., Bryan Sexton, Ph.D., Robert Hyzy, M.D., Robert Welsh, M.D., Gary Roth, M.D., Joseph Bander, M.D., John Kepros, M.D., and Christine Goeschel, R.N., M.P.A.

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MEDICINE
QUALITY AND SAFETY
RESEARCH GROUP

JOHNS HOPKINS QUALITY AND SAFETY RESEARCH GROUP (QSRG)

ON THE CUSP: STOP BSI

CENTRAL LINE-ASSOCIATED BLOOD STREAM INFECTION TOOLKIT

How to Use This Toolkit

The purpose of this toolkit is to support your efforts to implement evidence-based practices and eliminate Central Line Associated Blood Stream Infections (CLABSIs) in your clinical area. The strategies in this toolkit have nearly eliminated CLABSIs in participating Michigan ICUs (Appendix A). These strategies have been adopted by over 100 ICUs in large and small, academic and community hospitals that we have worked with to date. Most of these ICUs have demonstrated a significant reduction in their CLABSI rates and many have not had a CLABSI in >6 months.

Nevertheless, your leadership is needed to achieve these results in your clinical area. Most of your efforts will be working with staff that insert and assist with the insertion of central lines. We developed a model to help disseminate this, and other, interventions. This model includes 4 stages that answer the following questions:

1. **Engage**: How will this make the world a better place?
2. **Educate**: How will we do this?
3. **Execute**: What do I need to do?
4. **Evaluate**: How will we know we made a difference?

This toolkit provides details of what you should do in each of these stages. In the appendices, we provide all the tools you will need to eliminate CLABSIs in your clinical area; the rest is up to you.

Checklist for Prevention of Central Line Associated Blood Stream Infections

Based on 2011 CDC guideline for prevention of intravascular catheter-associated bloodstream infections: http://www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf

For Clinicians:

Promptly remove unnecessary central lines

- ☐ Perform daily audits to assess whether each central line is still needed

Follow proper insertion practices

- ☐ Perform hand hygiene before insertion
- ☐ Adhere to aseptic technique
- ☐ Use maximal sterile barrier precautions (i.e., mask, cap, gown, sterile gloves, and sterile full-body drape)
- ☐ Perform skin antisepsis with >0.5% chlorhexidine with alcohol
- ☐ Choose the best site to minimize infections and mechanical complications
    - o Avoid femoral site in adult patients
- ☐ Cover the site with sterile gauze or sterile, transparent, semipermeable dressings

Handle and maintain central lines appropriately

- ☐ Comply with hand hygiene requirements
- ☐ Scrub the access port or hub immediately prior to each use with an appropriate antiseptic (e.g., chlorhexidine, povidone iodine, an iodophor, or 70% alcohol)
- ☐ Access catheters only with sterile devices
- ☐ Replace dressings that are wet, soiled, or dislodged
- ☐ Perform dressing changes under aseptic technique using clean or sterile gloves

For Facilities:

- ☐ Empower staff to stop non-emergent insertion if proper procedures are not followed
- ☐ "Bundle" supplies (e.g., in a kit) to ensure items are readily available for use
- ☐ Provide the checklist above to clinicians, to ensure all insertion practices are followed
- ☐ Ensure efficient access to hand hygiene
- ☐ Monitor and provide prompt feedback for adherence to hand hygiene
  http://www.cdc.gov/handhygiene/Measurement.html
- ☐ Provide recurring education sessions on central line insertion, handling and maintenance

Supplemental strategies for consideration:

- 2% Chlorhexidine bathing
- Antimicrobial/Antiseptic-impregnated catheters
- Chlorhexidine-impregnated dressings

BUNDLE 2017

- VERIFICA DELLA CORRETTA INDICAZIONE ALL'INSERIMENTO DEL CVC
- IGIENE DELLE MANI CON GEL IDROALCOLICO PRIMA DELL'IMPIANTO E PRIMA E DOPO OGNI MANOVRA SUL CVC E IMPIEGO DI KIT DI INSERIMENTO CONTENENTI ANCHE LE MASSIME PRECAUZIONI DI BARRIERA
- SCELTA CORRETTA DEL SITO DI INSERZIONE, UTILIZZANDO I PICC COME CATETERI DI SCELTA
- IMPIANTO ECOGUIDATO, OVUNQUE POSSIBILE, SIA PER I CATETERI A INSERZIONE CENTRALE CHE PER I CATETERI A INSERZIONE PERIFERICA
- UTILIZZO DI CLOREXIDINA AL 2% IN APPLICATORI MONODOSE STERILI PER L'ANTISEPSI CUTANEA AL MOMENTO DELL'IMPIANTO E PER LA GESTIONE DELL'EXIT SITE AL CAMBIO DI MEDICAZIONE
- UTILIZZO DI DISPOSITIVI A RILASCIO CONTINUO DI CLOREXIDINA PER LA PROTEZIONE DELL'EXIT SITE
- IMPIEGO DI "SUTURELESS DEVICES" PER IL FISSAGGIO DEL CATETERE
- IMPIEGO DI MEDICAZIONI SEMIPERMEABILI TRASPARENTI, OVUNQUE POSSIBILE

BUNDLE 2017

- UTILIZZO DI CIANOACRILATO STERILE PER LA PROTEZIONE DELL'EXIT SITE AL MOMENTO DELL'IMPIANTO
- DISINFEZIONE DEI PUNTI DI ACCESSO (HUB O NEEDLEFREE CONNECTORS DI UN CVC MEDIANTE SCRUBBING CON SOLUZIONI ALCOLICHE (PREFERIBILMENTE CLOREXIDINA 2% IN SOLUZIONE ALCOLICA) OPPURE DISINFEZIONE PASSIVA DEI NFC MEDIANTE PORT PROTECTORS.
- UTILIZZO DI SIRINGHE PRERIEMPITE STERILI PER IL FLUSH E IL LOCK DEI CVC
- UTILIZZO DI UN CARRELLO DEDICATO PER L'IMPIANTO
- UTILIZZO DI CHECKLIST PER LA VERIFICA DELLA CORRETTA APPLICAZIONE DEL BUNDLE
- RIMOZIONE IMMEDIATA DEL CATETERE VENOSO CENTRALE NON PIÙ INDISPENSABILE

Targeting zero CLABSI in patients with PICC lines: a case-control study

G. Scoppettuolo§, L. Dolcetti§, C. Taraschi§, C. Chiarini§, C. Donato§, S. Lardo§, A. La Greca*, M. Pittiruti*

§ Clinic of Infectious Diseases, * Dpt. of Surgey, Catholic University, Rome

AVA 2011

Patients and Methods

- Setting: Clinic of Infectious Diseases, Catholic University, Rome
- Study: Case-Control (1:3)
- Duration: 12 months

Results

	CASES (Infectious Diseases)	CONTROLS (Other wards)	P
CLABSI	0	14	< 0.001
CLABSI/1000 catheter days	0	2.66	< 0.001
Diagnosis - **DTP** - **Blood culture + tip culture**		10 4	
Median time for CLABSI onset	NA	21+12	
Etiology of CLABSI - **Candida albicans** - **Candida parapsilosis** - **CONS** - **S. aureus** - **E. coli** - **K. pneumoniae**	NA	 3 2 3 1 3 2	
CLABSI related deaths	0	0	NS

Pittiruti et al. Critical Care 2012, 16:R21
http://ccforum.com/content/16/1/R21

CRITICAL CARE

RESEARCH Open Access

Clinical experience with power-injectable PICCs in intensive care patients

Mauro Pittiruti[1*], Alberto Brutti[2], Davide Celentano[2], Massimiliano Pomponi[2], Daniele G Biasucci[2], Maria Giuseppina Annetta[2] and Giancarlo Scoppettuolo[3]

See related Letter by Zampieri,

http://ccforum.com/content/16/2/425

Abstract

Introduction: In the ICU, peripherally inserted central catheters (PICCs) may be an alternative option to standard central venous catheters, particularly in patients with coagulation disorders or at high risk for infection. Some limits of PICCs (such as low flow rates) may be overcome with the use of power-injectable catheters.

Methods: We retrospectively reviewed all of the power-injectable PICCs inserted in adult and pediatric patients in the ICU during a 12-month period, focusing on the rate of complications at insertion and during maintenance.

Results: We collected 89 power-injectable PICCs (in adults and in children), both multiple and single lumen. All insertions were successful. There were no major complications at insertion and no episodes of catheter-related bloodstream infection. Non-infective complications during management were not clinically significant. There was one episode of symptomatic thrombosis during the stay in the ICU and one episode after transfer of a patient to a non-intensive ward.

Conclusion: Power-injectable PICCs have many advantages in the ICU: they can be used as multipurpose central lines for any type of infusion including high-flow infusion, for hemodynamic monitoring, and for high-pressure injection of contrast media during radiological procedures. Their insertion is successful in 100% of cases and is not associated with significant risks, even in patients with coagulation disorders. Their maintenance is associated with an extremely low rate of infective and non-infective complications.

J Vasc Access. 2017 Nov 8:0. doi: 10.5301/jva.5000797. [Epub ahead of print]

Targeting zero catheter-related bloodstream infections in pediatric intensive care unit: a retrospective matched case-control study.

Biasucci DG[1], Pittiruti M[2], Taddei A[3], Picconi E[1], Pizza A[1], Celentano D[1], Piastra M[1], Scoppettuolo G[4], Conti G[1].

Author information

Abstract

INTRODUCTION: The aim of this study was to evaluate the effectiveness and safety of a new three-component 'bundle' for insertion and management of centrally inserted central catheters (CICCs), designed to minimize catheter-related bloodstream infections (CRBSIs) in critically ill children.

METHODS: Our 'bundle' has three components: insertion, management, and education. Insertion and management recommendations include: skin antisepsis with 2% chlorhexidine; maximal barrier precautions; ultrasound-guided venipuncture; tunneling of the catheter when a long indwelling time is expected; glue on the exit site; sutureless securement; use of transparent dressing; chlorhexidine sponge dressing on the 7th day; neutral displacement needle-free connectors. All CICCs were inserted by appropriately trained physicians proficient in a standardized simulation training program.

RESULTS: We compared CRBSI rate per 1000 catheters-days of CICCs inserted before adoption of our new bundle with that of CICCs inserted after implementation of the bundle. CICCs inserted after adoption of the bundle remained in place for a mean of 2.2 days longer than those inserted before. We found a drop in CRBSI rate to 10%, from 15 per 1000 catheters-days to 1.5.

CONCLUSIONS: Our data suggest that a bundle aimed at minimizing CR-BSI in critically ill children should incorporate four practices: (1) ultrasound guidance, which minimizes contamination by reducing the number of attempts and possible break-down of aseptic technique; (2) tunneling the catheter to obtain exit site in the infra-clavicular area with reduced bacterial colonization; (3) glue, which seals and protects the exit site; (4) simulation-based education of the staff.

PMID: 29148002 DOI: 10.5301/jva.5000797

An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU

eter Pronovost, M.D., Ph.D., Dale Needham, M.D., Ph.D., Sean Berenholtz, M.D., David Sinopoli, M.P.H., M.B.A., Haitao Chu, M.D., Ph.D., Sara Cosgrove, M.D., Bryan Sexton, Ph.D., Robert Hyzy, M.D., Robert Welsh, M.D., Gary Roth, M.D., Joseph Bander, M.D., John Kepros, M.D., and Christine Goeschel, R.N., M.P.A.

BUNDLES

Fig. 5 Overview of Results

Central Line Descriptors	2005	2006/1st Q 2007
Average Monthly PICC Volume	60	139
Annual PICC Volume	767	2083
Insertion Success Rate	92%	98%
Interventional Radiology Rate	8%	2%
Insertion Location	Antecubital	Upper Arm, Basilic Vein (preferred)
Insertion Technique SonoSite® (iLook® 25)	Traditional/ Modified Seldinger	100% Ultrasound Guided
Maximum Barrier	PICC Team Only	All central lines
Skin Preparation ChloraPrep®	Inconsistent	Consistent
Insertion Site Antimicrobial BIOPATCH®	Inconsistent	Consistent
Line Stabilization Statlock®	Inconsistent	Consistent
Connector InVision Plus® Neutral®	Positive Pressure Device	Neutral Device
RN Training	Annual In-Service Day	One-on-One Training at the bedside
Flushing Protocol	Normal Saline followed by Heparin (positive pressure flush)	Flush 10ml NS every 8 hours and PRN use (push/pause technique)
Dressing	24 hour pressure gauze dressing then weekly	No pressure dressing (exception excessive bleeding) Weekly dressing change
Line Monitoring	Completed q week with dressing change	Completed daily during site checks

The Bundle "Plus": The Effect of a Multidisciplinary Team Approach to Eradicate Central Line-Associated Bloodstream Infections

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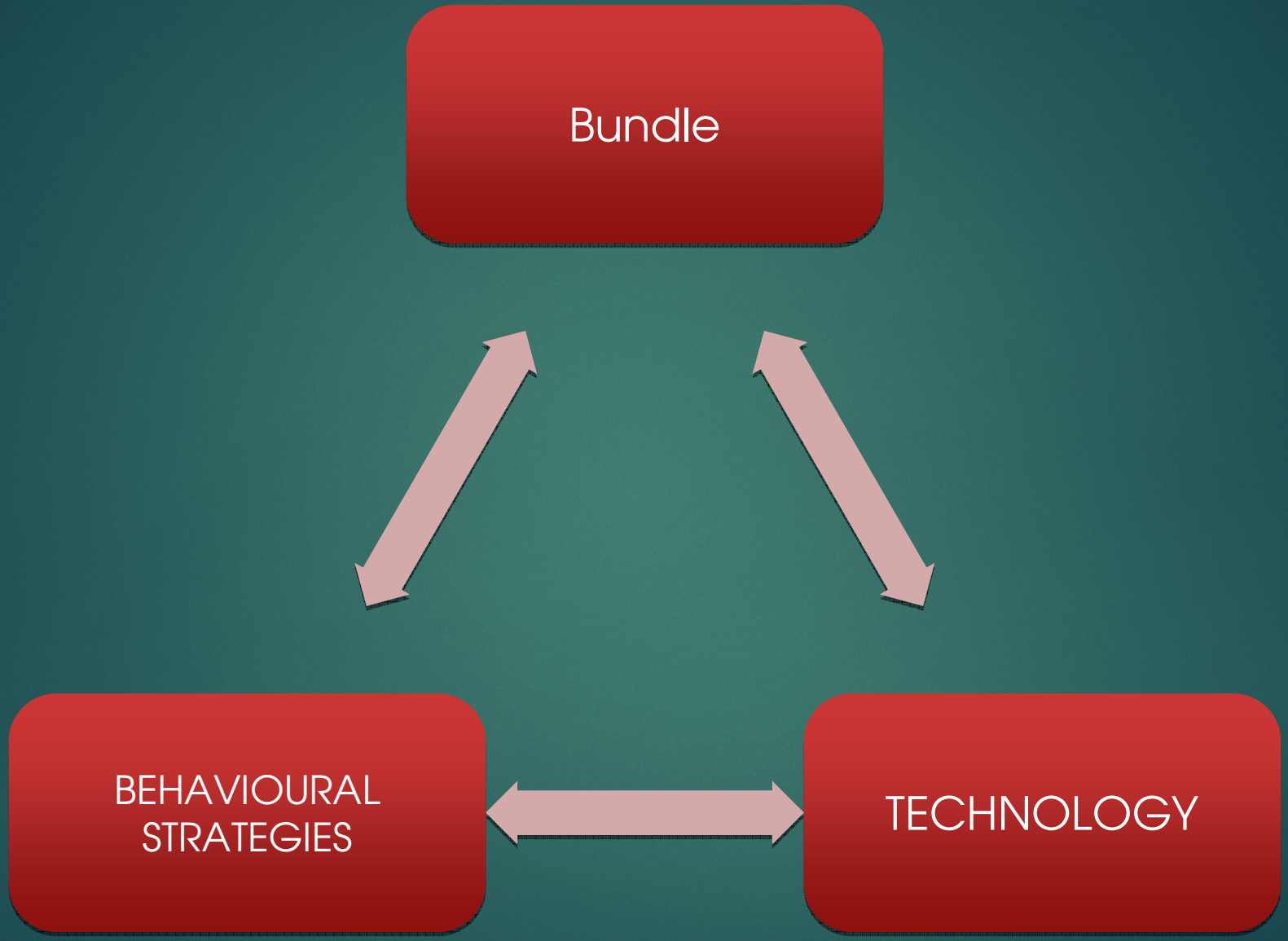
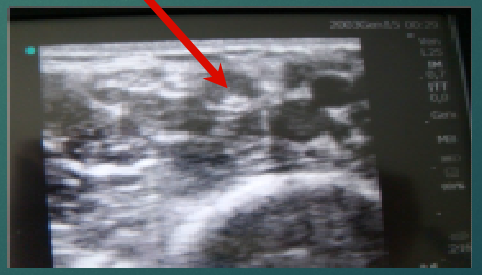

Bundle
BEHAVIOURAL STRATEGIES
TECHNOLOGY

- Ultrasound Guidance
- 2% Chlorhexidine
- Chlorhexidine impregnated dressing
- Sutureless Devices
- Transparent dressing
- All inclusive kit for insertion
- All inclusive kit for manteinance
- Port protectors
- Cyanoacrilate glue
- Antimicrobial catheters

aad & Maki, 2007; Timsit, 2007; Mermel, 2007;Jarvis, 2007; Eggimann, 2007;Pratt, 2007; Gallieni, 2008; Cheung, 2009; McGoldrick, 2009; oede, 2009; Pittiruti, 2009; RCN, 2010; INS, 2011; O'Grady, 2011; Lamperti, 2012

Ultrasound guidance



esearch

Open Access

al-time ultrasound-guided catheterisation of the internal jugular ein: a prospective comparison with the landmark technique in ritical care patients

mitrios Karakitsos[1], Nicolaos Labropoulos[2], Eric De Groot[3], Alexandros P Patrianakos[4], regorios Kouraklis[5], John Poularas[1], George Samonis[6], Dimosthenis A Tsoutsos[7], anousos M Konstadoulakis[8] and Andreas Karabinis[1]

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tical Care 2006, **10**:R162 (doi:10.1186/cc5101)
s article is online at: http://ccforum.com/content/10/6/R162

Critical Care, 2006

d by the present data. We found that the incidence of -BSI in the ultrasound group of patients was significantly r compared with that documented in the landmark group. number of CVC-BSIs was significantly correlated to the ber of needle passes in the total study population. We d speculate that repeated attempts might lead to a break- n of aseptic technique and more colonisation of skin- ed pathogens [17]. The above findings may be of clinical

Table 2

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)
Success rate	450 (100%)[a]	425 (94.4%)
Carotid puncture	5 (1.1%)[a]	48 (10.6%)
Haematoma	2 (0.4%)[a]	38 (8.4%)
Haemothorax	0 (0%)[a]	8 (1.7%)
Pneumothorax	0 (0%)[a]	11 (2.4%)
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%)

[a]Comparison of the outcome measures between the ultrasound group and the landmark group of patients ($p < 0.001$). Access time and av number of attempts are expressed as mean ± standard deviation (95% confidence interval). Success rate, carotid puncture, haematoma, haemothorax, pneumothorax, and CVC-BSI are expressed as the absolute number of patients and percentage of their group. CVC-BSI, cer venous catheter-associated blood stream infection.

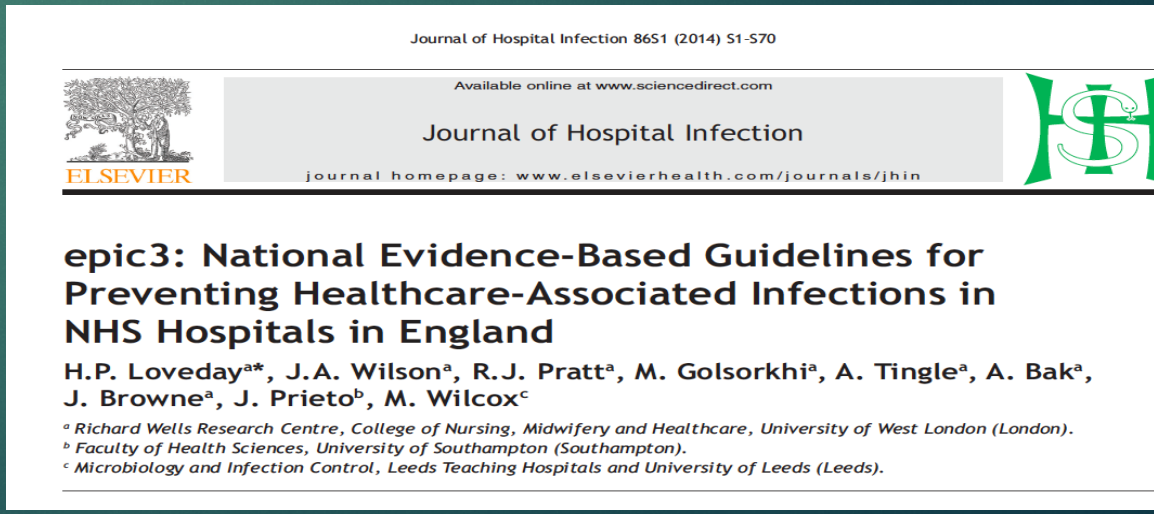
CDC 2011

Usare la guida ecografica per posizionare i cateteri venosi centrali (ovunque questa tecnologia sia disponibile) così da ridurre il numero di tentativi di incannulamento e le complicanze meccaniche da venipuntura. La guida ecografica dovrebbe essere utilizzata da personale pienamente addestrato nell'utilizzo di questa tecnica. [60–64]. Categoria 1B

CENTERS FOR DISEASE CONTROL AND PREVENTION

Linee Guida EPIC 2014

"… L'uso dell'ecografia può indirettamente ridurre il rischio di infezione facilitando il posizionamento del catetere venoso centrale…"



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

ELSEVIER

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).

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JULY 2014, VOL. 35, NO. 7

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, MPH[12]

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]

Consensus 2012

Intensive Care Med
DOI 10.1007/s00134-012-2597-x

CONFERENCE REPORTS AND EXPERT PANEL

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

e 6 Recommendations regarding sterility using ultrasound guidance and prevention of infectious and mechanical complica ultrasound-guided cannulation

ity during ultrasound vascular procedures

ain	Suggested definition	Level of evidence	Degree of consensus	Strength of recommend
1	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
ention of infectious and mechanical complications with ultrasound-guided cannulation				
S2	Ultrasound guidance should be used in order to decrease the rate of CRBSI in adults and children	C	Very good	Strong
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
S5	Ultrasound guidance should be used to avoid cannulation of thrombotic sites	A	Very good	Strong
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

INS 2016

22. VASCULAR VISUALIZATION

Standard

22.1 To ensure patient safety, the clinician is competent in the use of vascular visualization technology for vascular access device (VAD) insertion. This knowledge includes, but is not limited to, appropriate vessels, size, depth, location, and potential complications.

22.2 Vascular visualization technology is used in patients with difficult venous access and/or after failed venipuncture attempts.

22.3 Vascular visualization technology is employed to increase the success with peripheral cannulation and decrease the need for central vascular access device (CVAD) insertion, when other factors do not require a CVAD.

- Ultrasound Guidance
- 2% Chlorhexidine
- Chlorhexidine impregnated dressing
- Sutureless Devices
- Transparent dressing
- All inclusive kit for insertion
- All inclusive kit for manteinance
- Port protectors
- Cyanoacrilate glue
- Antimicrobial catheters

aad & Maki, 2007; Timsit, 2007; Mermel, 2007;Jarvis, 2007; Eggimann, 2007;Pratt, 2007; Gallieni, 2008; Cheung, 2009; McGoldrick, 2009; oede, 2009; Pittiruti, 2009; RCN, 2010; INS, 2011; O'Grady, 2011; Lamperti, 2012

HEALTHCARE EPIDEMIOLOGY INVITED ARTICLE

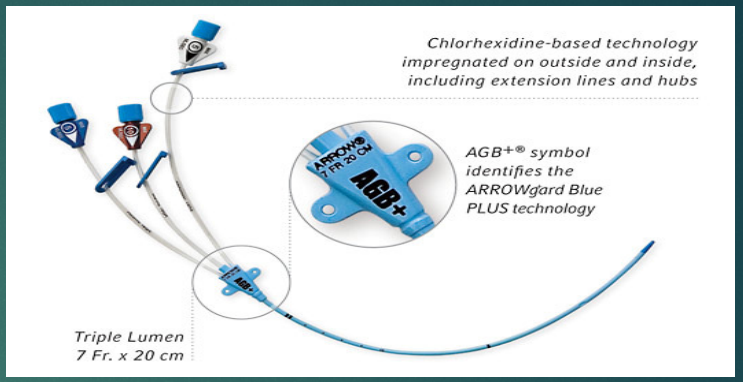
Robert A. Weinstein, Section Editor

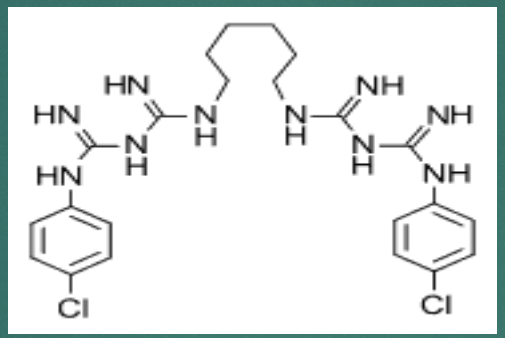
Chlorhexidine: Expanding the Armamentarium for Infection Control and Prevention

Aaron M. Milstone,[1,3] Catherine L. Passaretti,[2,3] and Trish M. Perl[2,3]

[1]Division of Pediatric Infectious Diseases, Department of Pediatrics, and [2]Division of Infectious Diseases, Department of Medicine, Johns Hopkins University School of Medicine, and [3]Department of Hospital Epidemiology and Infection Control, The Johns Hopkins Hospital, Baltimore, Maryland

Health care–associated infections (HAIs) result in increased patient morbidity and utilization of health care resources. Rates of HAI are increasing despite advances in health care technology. Limited antimicrobial agents and a dry drug pipeline make novel prevention efforts critical. Chlorhexidine, an antiseptic solution that has been used worldwide since the 1950s, is a safe and effective product with broad antiseptic activity. Novel uses of chlorhexidine-containing products are being implemented to promote antisepsis and prevent bacterial colonization and infection. We review some of the many infection control applications of chlorhexidine in the battle against HAI, such as general skin cleansing, skin decolonization, preoperative showering and bathing, vascular catheter site preparation, impregnated catheter site dressings, impregnated catheters, and oral decontamination. As mandatory public reporting and pay for performance force infection control issues to the forefront, chlorhexidine-containing products may provide a vast armamentarium for the control and prevention of HAI.


Chlorhexidine-based technology impregnated on outside and inside, including extension lines and hubs
AGB+® symbol identifies the ARROWgard Blue PLUS technology
Triple Lumen
7 Fr. x 20 cm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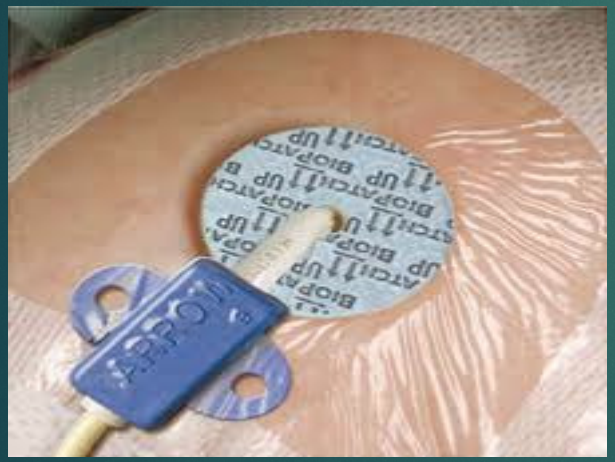
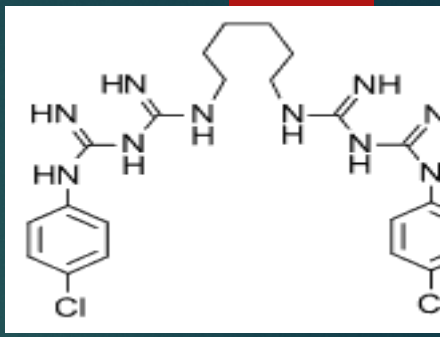


Vantaggi della Clorexidina



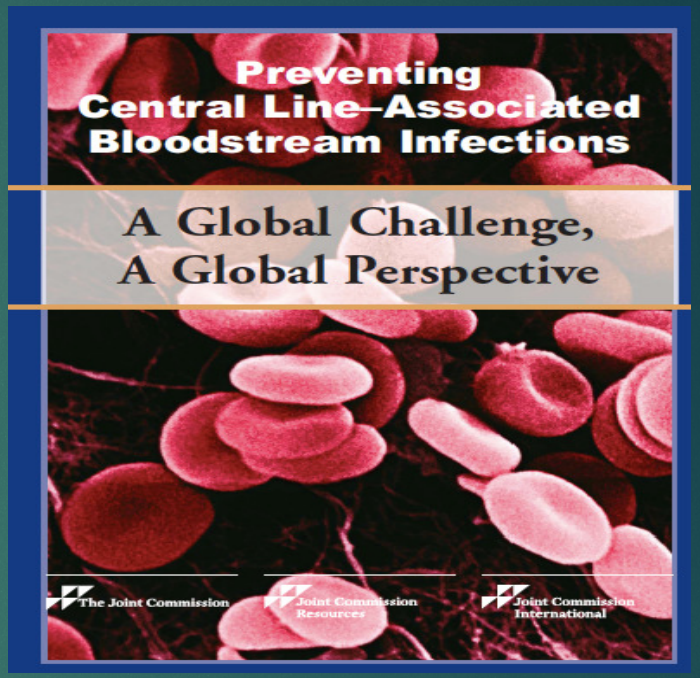
- Battericida
- Ampio spettro (Gram positivi, Gram negativi, anaerobi facoltativi, funghi, virus – incluso HIV – ma non sporicida)
- Rapido inizio di attività
- Effetto antimicrobico prolungato
- Effetto sinergico con alcool
- Attivo in presenza di sangue o siero

Infusion Nursing Standards of Practice

G. Chlorhexidine solution is preferred for skin antisepsis. One percent to two percent tincture of iodine, iodophor (povidone-iodine), and 70% alcohol may also be used. Chlorhexidine is not recommended for infants under 2 months of age.[4,9](I)

The following summarizes current recommendations for skin antisepsis prior to CVC insertion and during dressing changes[13,14,18,19,36]:

- Apply antiseptics to clean skin.
- Apply chlorhexidine/alcohol in a concentration greater than 0.5% in alcohol.
- If there is a contraindication to chlorhexidine, apply tincture of iodine, an iodophor, or alcohol as an alternative.
- Allow the antiseptic solution to dry before placing the catheter.



INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JULY 2014, VOL. 35, NO. 7

SHEA/IDSA PRACTICE RECOMMENDATION

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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.

AD14 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

AD15 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 before inserting a peripheral vascular access device.

New recommendation *Class D/GPP*

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).*


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Journal of Perinatology (2012) 32, 4–9

www.nature.com/jp

STATE-OF-THE-ART

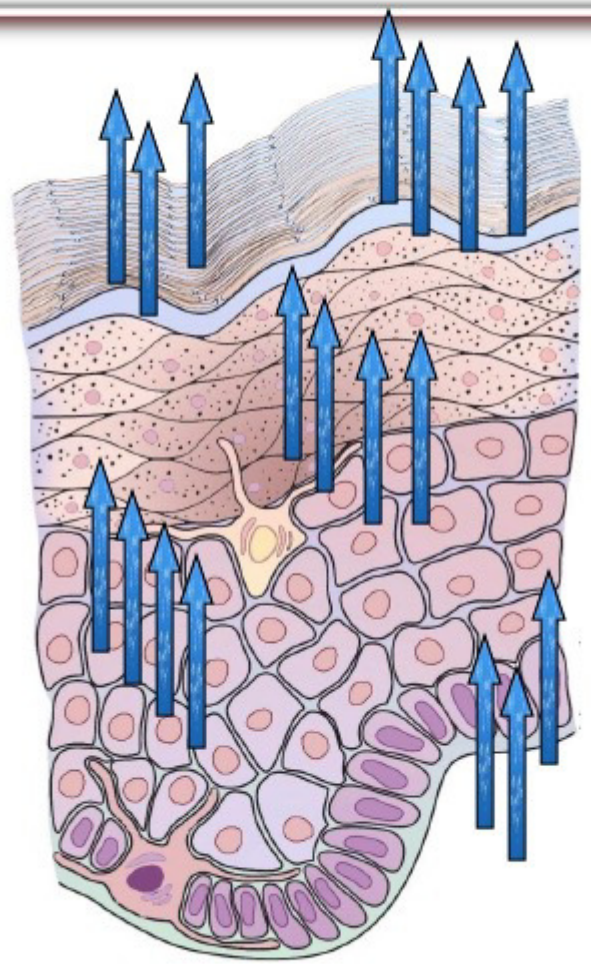
Safety of chlorhexidine gluconate used for skin antisepsis in the preterm infant

AK Chapman[1], SW Aucott[1] and AM Milstone[2,3,4]

[1]Division of Neonatology, Department of Pediatrics, Johns Hopkins University School of Medicine, Baltimore, MD, USA; [2]Division of Pediatric Infectious Diseases, Department of Pediatrics, Johns Hopkins University School of Medicine, Baltimore, MD, USA; [3]Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA and [4]Johns Hopkins Hospital, Department of Hospital Epidemiology and Infection Control, Baltimore, MD, USA

Transepidermal Water Loss (TEWL)

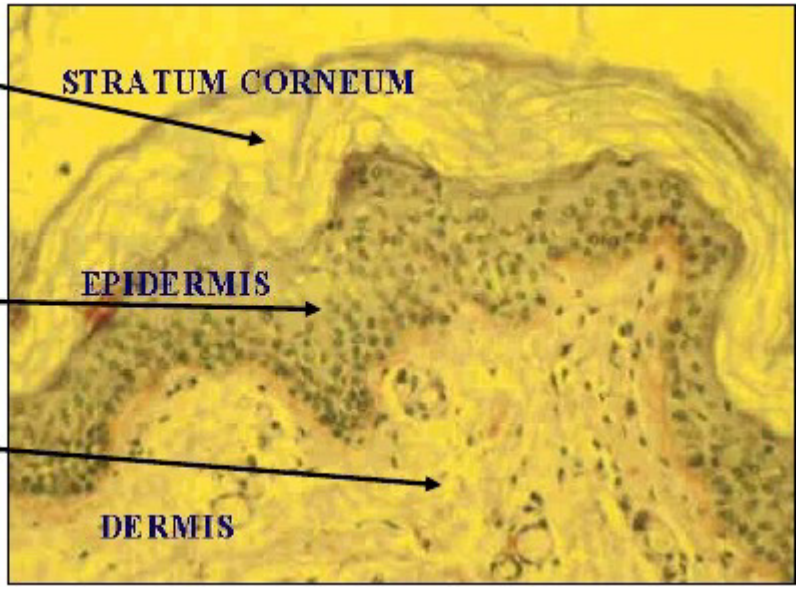
- Water of respiration normally moves through the stratum corneum from below.
- The rate of transepidermal water loss (TEWL, g/m2/hr) is a measure of skin barrier integrity
- TEWL is higher (faster) when the barrier is damaged.



Full Term Infant Skin

Healthy infants

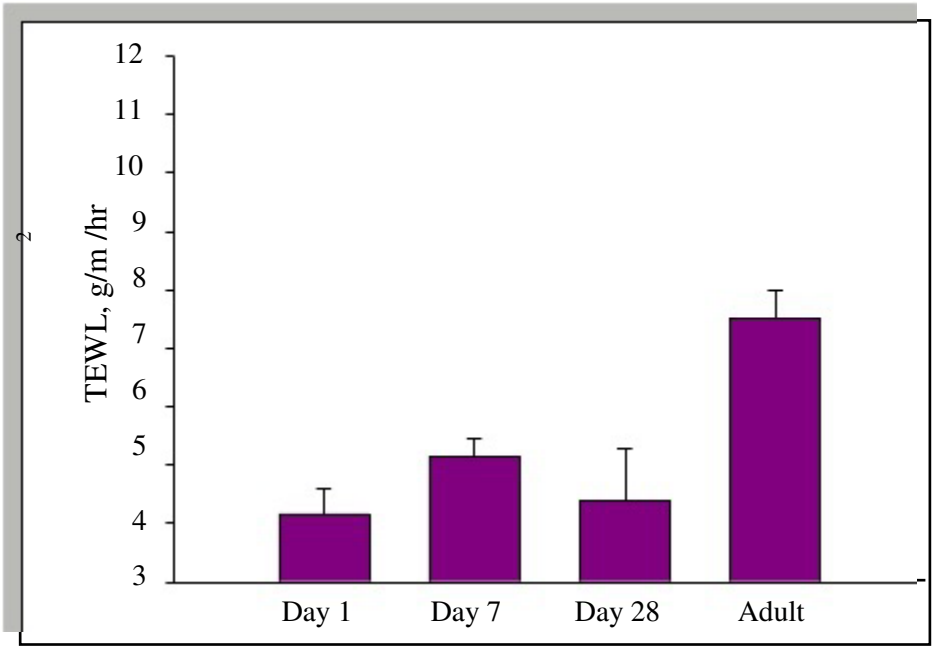
- Well-formed stratum corneum…..note multiple layers
- Thick epidermis
- Structural proteins present in the dermis



Full-Term Newborn Skin Barrier

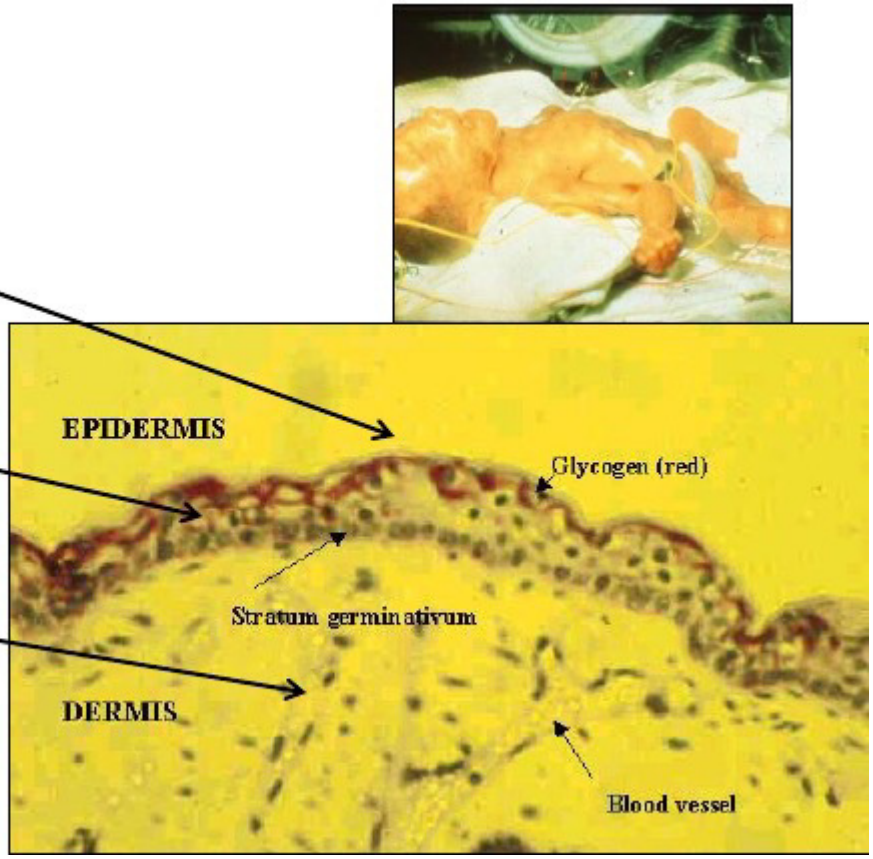
TEWL

- very low at birth
- 4-6 g/m2/hr
- remains low over first month
- lower than adult values of 6-8 g/m2/hr



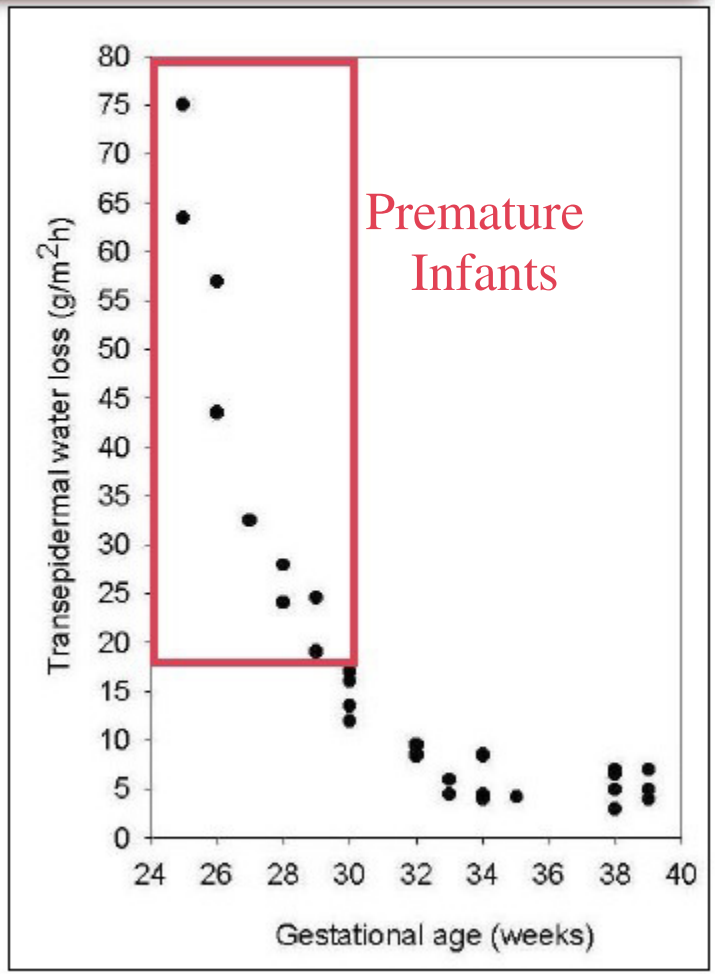
Premature Infant Skin

- Stratum corneum poorly developed or absent
- Thin epidermis
- Dermis not fully formed and deficient of structural proteins



Premature Skin Barrier

- Premature infant skin barrier integrity varies greatly with gestational age.
- TEWL for 24 – 25 wks gestation is very high, comparable to epidermis without a SC barrier.



Sedin et al., Acta Paediatr Scand Suppl (1983);305:27-31.

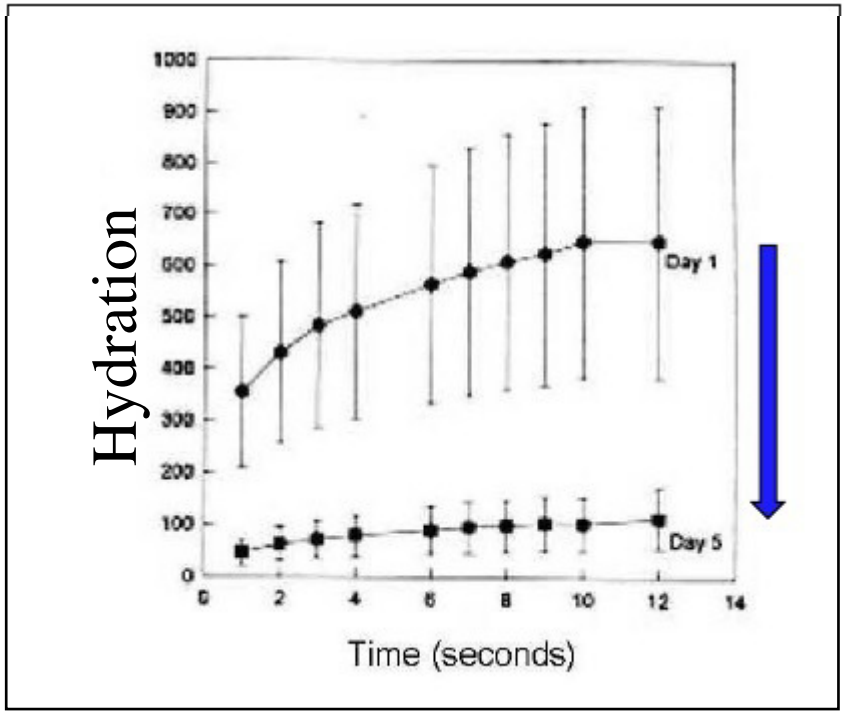
Pedivan

"Shaping the Future of Pediatric Vascular Access 2012"

AVA

Premature Skin Barrier Development

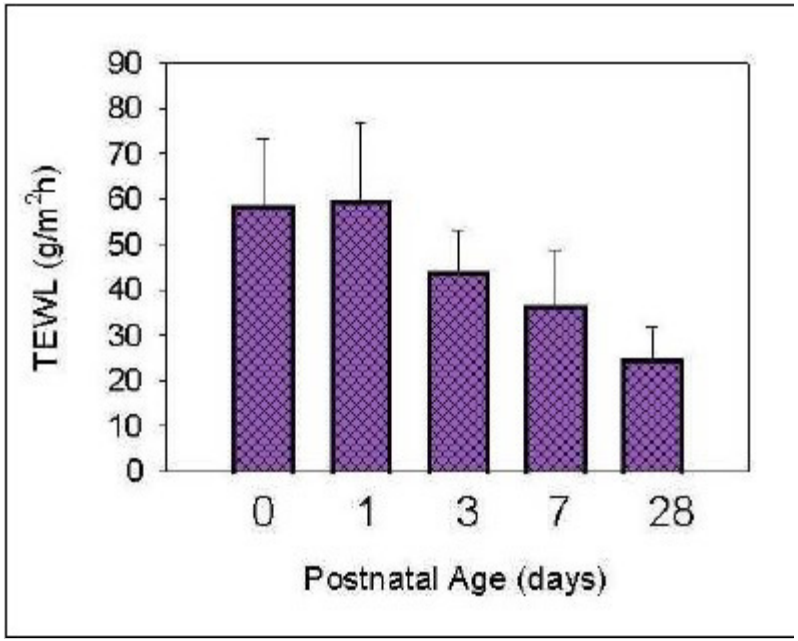
- Premature infants experience high fluid loss, thermal instability, electrolyte imbalance.
- However, the SC barrier forms rapidly after birth.
- Surface hydration decreases over a few days.



Okah, et al, Pediatrics (1995);96(4):668-692.

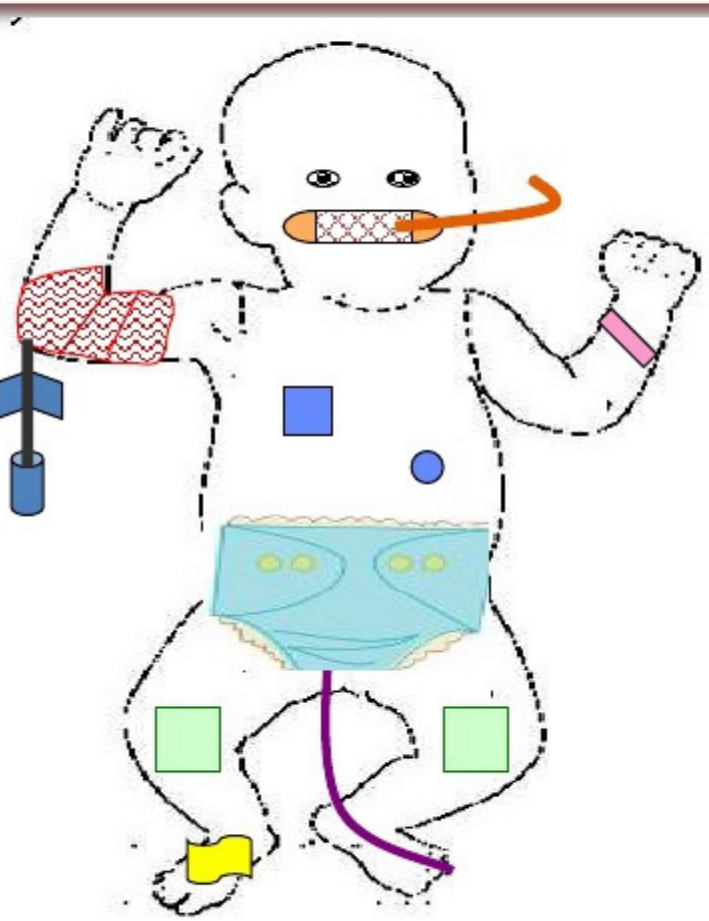
Premature Skin Barrier Development

- At one month post birth, TEWL is *significantly higher* for the preterm infant than for the full term newborn.
- May lead to increased susceptibility to infection and penetration of exogenous agents.



Agren et al, Acta Paediatr Scand (1999);72(5):721-728.

“Dressing” the NICU Patient



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Chlorhexidine Gluconate, Skin Antiseptics and Neonatal Skin Integrity

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“Shaping the Future of Pediatric Vascular Access 2012”

AVA

Significance

- Skin disinfection helps prevent intravascular catheter related infections
- CDC guideline: No recommendation for infants < 2 months due to limited evidence or lack of consensus

CHG Safety in Premature Infants

- Issues: **systemic absorption, skin toxicity**
- Concern: *hexachlorophene* caused neurotoxicity
- Hexachlorophene:
  - Bacteriostatic
  - disrupts bacterial cell wall
  - slow onset efficacy
- CHG:
  - Bacteriocidal
  - increases cell membrane permeability
  - rapid onset
  - binds to SC proteins

Chapman A, et al. J Perinatol (2012); 32(1):4-9

CHG Premature Skin Permeation

- Three studies: preterms ≥ 27 and < 32 wks GA
- Age at evaluation: 0 – 28 days
- CHG blood levels: 0 – 214 ng/ml
- No infants 23 – 26 wks GA

Aggett P et al. Arch Dis Child (1981); 56(11):878-880
Cowen J, et al. Arch Dis child (1979); 54(5):379-383
Garland J, et al. J Perinatol (2009); 29:808-813

Skin Effects in Premature Infants

- There are reports of burns in infants of 24 - 26 weeks GA from alcohol-based preparations, including CHG in 70% isopropanol.

Reynolds P et al, Arch Dis Child Fetal Neonatal Ed 2005; 90:F10.
Watkins A et al, J Paediatr Child Health 1992; 28:306-8.
Lashkari H et al, Arch Dis Child Fetal Neonatal Ed 2012;97:F64.

Skin Effects in Premature Infants

- Parallel groups of 715 NICU patients with central venous catheters.
- Skin treated with isopropanol and covered with
  - polyurethane dressing
  - chlorhexidine patch (early version)
- Severe contact dermatitis in 5.7% of CHG patch group 22.5 - 26.5 wks GA
- Patch effects not determined

Garland J, et al. Pediatrics 2001; 107:1431-6.

CHG versus PI in Neonates

- Pilot parallel comparison: 2% CHG (alcohol) vs. 10% Povidone Iodine
- 48 neonates ≥ 1500 g (~ ***30wks GA***) and ≥ 7 days
- No catheter related BSIs in either group
- ***No dermatitis - CHG or PI*** (i.e., ≥ 2,no pink-red all area)
- CHG absorption occurred:
  - 7 of 10 had blood CHG between 13 – 100 ng/ml
- ***Studies needed in younger preterms***

Garland J, et al. J Perinatol (2009); 29:808-813

Investigator Comments

- "The FDA limited study enrollment to neonates who were at least 7 days old and weighed more than 1500 g because of concerns for the development of contact dermatitis in low-birth-weight neonates exposed to topical CHG."
- This restriction was applied because a previous study (same author) had 6% of subjects with contact dermatitis from a CHG-impregnated dressing.

Garland J, et al. J Perinatol (2009); 29:808-813

Published in final edited form as:
Infect Control Hosp Epidemiol. 2010 August ; 31(8): 846–849. doi:10.1086/655017.

Chlorhexidine use in the Neonatal Intensive Care Unit: Results from a National Survey

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Pranita D. Tamma: ptamma1@jhmi.edu

CHG Use in NICUs

- A survey of 90 NICU training units found:

55	Used CHG, central venous catheter care
39	No restrictions
14	Restrictions: GA, actual age or birth weight
28	Reported adverse reactions, all skin related 17 burns, 2 erosions, 9 erythema
59	Had concerns: Off label use, ***Immature skin, Limited safety data***

Tamma P, et al. Infect Control Hosp Epidemiol (2010);31(3):846-849

There were 96 respondents (96%). Ninety (90%) respondents completed the survey in its entirety and only these respondents were included in the analysis. All respondents practiced at level 3b or higher NICUs in the United States. Compared with participants in the field for ≤30 years, those in the field for >30 years were less likely to report using CHG (77% and 23%, p=.05) and trended to have had a greater past experience with hexachlorophene (62% and 38%, p=.08). There was no significant association between involvement of infection control staff and use of CHG (56% and 44%, p=0.42).

Of those 55 NICU's that utilized CHG, the most commonly reported use was CVC maintenance (78%), including dressing changes and catheter hub cleaning. Other uses of CHG included CVC insertion site preparation (70%), peripheral venous catheter insertion (60%), and skin preparation for umbilical catheter insertion (51%). One institution reported routinely bathing neonates with CHG and four institutions used CHG for MRSA decolonization.

Of respondents that use CHG, 28 (51%) NICUs limit CHG use based on birth weight, gestational age, or chronological age [Figure 1]. Twenty- three (42%) restricted use by gestational age (median 28 weeks), 22 (40%) restricted use by birth weight (median 1000 grams), and 14 (26%) restricted use by chronological age (median 2 weeks).

Twenty-eight participants (51%) who used CHG in their NICU reported adverse reactions. All were skin reactions and included erythema (32%), erosions (7%), or burns (61%). Of the reported skin burns, 13 of 17 (76%) commented that the burns occurred in neonates with a birth weight of less than 1500 grams; the other four did not comment on the infant's birth weights. Of the 37 respondents that were aware of CHG formulations used in their NICUs, 21 (57%) employed alcohol-based CHG products. There was no difference in reported adverse effects comparing NICUs utilizing different CHG formulations (p=.50). No neurologic toxicities were reported by any respondents.

Of all participants, 59 (65%) reported concerns regarding the use of CHG in the neonatal population. Common themes from open-ended questions included concerns about off-label, unapproved use of CHG in neonates with immature skin and limited safety data in premature infants.

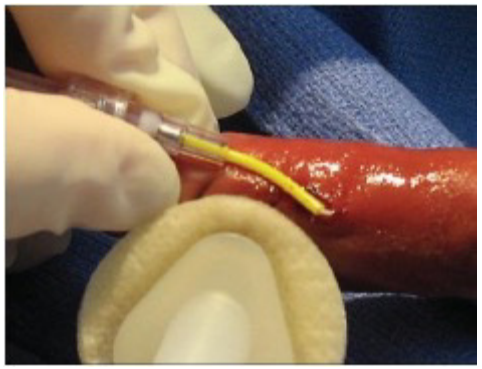
Infect Control Hosp Epidemiol. Author manuscript; available in PMC 2011 August 1.

Effect of CHG on Skin Integrity

Hypothesis

- Treatment with CHG will not alter the normal skin barrier development in the high risk neonate.
  - Skin treated with CHG and a semipermeable dressing (Tegaderm™) will not differ from skin treated with the dressing alone (no CHG).

Disinfect, Dress & Secure



1. Disinfect with Chloroprep®

2. Apply transparent semipermeable dressing

3. Secure PICC with steri strips

Sharpe E. Advances in Neonatal Care (2008); 8(3):150-162

Methods

- Within subject design
- Compare three regions
  - PICC site with CHG and semipermeable dressing (Tegaderm™)
  - Contralateral site with dressing only (2.5 cm_2)
  - Adjacent site untreated control
- Immediate response to CHG application
- Skin effects over time
  - At insertion, dressing changes at weeks 1, 2, 3

Dressing Removal

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Clinical Response

PICC site – dressing removed

Dressing only site – dressing removed

U.S. Department of Health & Human Services

U.S. Food and Drug Administration

Protecting and Promoting Your Health

U.S. Food & Drug Administration

Safety

Home Safety MedWatch The FDA Safety Information and Adverse Event Reporting Program Safety Information

2% Chlorhexidine Gluconate (CHG) Cloth

Detailed View: Safety Labeling Changes Approved By FDA Center for Drug Evaluation and Research (CDER) – May 2012

Summary View [1]

Drug Facts Box

Directions for Use in Infants

- added.....use with care in premature infants or infants under 2 months of age. These products may cause irritation or chemical burns.

American Journal of Infection Control ■■ (2017) ■■-■■

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jor Article

in antisepsis with 0.05% sodium hypochlorite before central venous theter insertion in neonates: A 2-year single-center experience

tilde Ciccia MD [a,*], Roksana Chakrokh MD [a], Dario Molinazzi NS [b], Angela Zanni RN [c], rizia Farruggia MD [c], Fabrizio Sandri MD [a]

natal Intensive Care Unit, Department of Women's and Children's Health, Maggiore Hospital, Bologna, Italy
nagement Control and Information Flow Unit, Local Health Authority, Bologna, Italy
pital Infection Control Unit, Local Health Authority, Bologna, Italy

rds:
otic
line-associated bloodstream
tion
scular device
t dermatitis

Aim: The study reports a 2-year single-center experience of the practice of skin antisepsis using a 0.
sodium hypochlorite solution before central venous catheter placement in neonates.
Methods: Eligible subjects included any hospitalized neonate who needed a central line for at leas
hours. Infants were excluded if they had a generalized or localized skin disorder. An ad hoc Excel (Micro
Corp, Redmond, WA) file was used to record the data from each patient. The catheter sites were mo
tored daily for the presence of contact dermatitis. Central line-associated bloodstream infection
diagnosed according to Centers for Disease Control and Prevention definition.
Results: One hundred five infants underwent central venous catheter placement and were enrolle
total of 198 central lines were inserted. The median gestational age was 31 weeks (range, 23-41 wee
and median birth weight was 1,420 g (range, 500-5,170 g). There were no signs of 0.05% sodium hypochlo
related skin toxicity in any infant. Of 198 catheters (1,652 catheter-days) prospectively studied, 9 w
associated with bloodstream infections (5.4 per 1,000 catheter-days).
Conclusion: During the observation period, no local adverse effects were observed suggesting that 0.
sodium hypochlorite may be a safe choice in this context.

Table 1
Baseline characteristics of patients

Variable	Result
Number of patients	105
Birth weight, g	
Median	1,420
Range	500-5,170
Gestation age at birth, wk	
Median	31
Range	23-41
Gender	
Male	61
Female	44
Types of central venous catheter	
Umbilical catheter	87
Peripherally inserted central catheter	108
Broviac catheter	3
Patients needing more than 1 peripherally inserted central catheter	
2	20
3	5
4	3
5	1

eight distribution of central line-associated bloodstream infection (CLABSI) rates and central line use ratios

weight category	Patients	Central line- days	Patient-days	Central line use ratio*	No. of CLABSIs	CLABSI
0 g	23 (21.9)	524	1,627	0.32	4	7.6
-1,500 g	34 (32.4)	491	1,632	0.3	2	4
-2,500 g	23 (21.9)	295	696	0.42	2	6.7
0 g	25 (23.8)	342	1,094	0.31	1	2.9
ll	105	1,652	5,049	0.32	9	5.4

Values are presented as n (%), n, ratio, or %.

er of central line-days
nber of patient-days

umber of CLABSIs
er of central line-days $\times 1000$

WJCP World Journal of Clinical Pediatrics

bmit a Manuscript: http://www.wjgnet.com/esps/
lp Desk: http://www.wjgnet.com/esps/helpdesk.aspx
OI: 10.5409/wjcp.v5.i2.159

World J Clin Pediatr 2016 May 8; 5(2): 159-171
ISSN 2219-2808 (online)

REVIEW

tiseptic use in the neonatal intensive care unit - a emma in clinical practice: An evidence based review

ar Sathiyamurthy, Jayanta Banerjee, Sunit V Godambe

ble 1 Characteristics of topical antiseptic agents used in neonates (World Health Organization 2009)

iseptic agent	Mechanism of action	Advantages	Disadvantages	Preparations/ compounds
orhexidine	Disruption of cytoplasmic membranes Denaturation of proteins	Broad spectrum antimicrobial activity Kills yeasts Intermediate onset of action Activity not affected by organic material Residual activity	Non-sporicidal Not effective against mycobacteria Local dermatitis Neurotoxicity Non-sporicidal	0.25%, 0.5%, 1%, 2%, - aqueous and alcoh based
ohols	Damages cell membrane Denaturation of proteins	Broad spectrum antimicrobial activity Faster onset of action	Not active in presence of organic material No residual activity Skin reactions Systemic absorption	Ethanol, isopropyl alcohol, methanol
ne	Forms complexes with proteins and lipids Impaired protein synthesis and alteration of cell membranes	Broad spectrum antimicrobial activity Sporicidal Effective against mycobacteria Has some residual activity	Skin irritation Systemic absorption with hypothyroidism	10% povidone-iodi
achlorophene	Inactivates essential enzyme systems	Good activity against gram positive, weak against gram negative	Residual activity Neurotoxicity	Currently not recommended for bathing neonates

Recommendations

CHG and Alcohol preparations have been associated with severe local reactions, whereas Iodophors are associated with increased risk of systemic absorption and potential toxicity. Large studies are urgently needed to establish the safety of topical antiseptics used in neonates especially in preterm infants with focus on following: (1) differentiate Aqueous or alcoholic component of CHG as the reason for skin irritation in preterm neonates; (2) ideal CHG concentration that can be safely used in preterm neonates; (3) CHG concentrations in blood and their effect on long-term neurodevelopment outcomes; (4) isopropyl alcohol absorption studies and effect on short term and long term outcomes; and (5) systemic absorption of topical iodine containing solutions and their effects on thyroid function and long-term neurodevelopmental outcomes.

In the meantime we recommend the following on the basis of current evidence: (1) Extreme caution is recommended for use of topical antiseptics particularly alcohol based preparations in extreme preterm infants (Level 2D); (2) Care must be taken to avoid pooling of the solution under infant and washing with normal saline after cleansing with topical antiseptic may prevent severe chemical burn in extreme premature babies (Level 2D); and (3) Povidone Iodine for skin antisepsis should be avoided in extreme preterm infants (Level 2C).

Original article

2% chlorhexidine–70% isopropyl alcohol versus 10% povidone–iodine for insertion site cleaning before central line insertion in preterm infants: a randomised trial

Emily A Kieran[1, 2, 3], Anne O'Sullivan[4], Jan Miletin[4], Anne R Twomey[1], Susan J Knowles[1], Colm Patrick Finbarr O'Donnell[1, 2, 3]

Author affiliations +

Abstract

Objective To determine whether 2% chlorhexidine gluconate–70% isopropyl alcohol (CHX–IA) is superior to 10% aqueous povidone–iodine (PI) in preventing catheter-related blood stream infection (CR-BSI) when used to clean insertion sites before placing central venous catheters (CVCs) in preterm infants.

Design Randomised controlled trial.

Setting Two neonatal intensive care units (NICUs).

Patients Infants <31 weeks' gestation who had a CVC inserted.

Interventions Insertion site was cleaned with CHX–IA or PI. Caregivers were not masked to group assignment.

Main outcome measures Primary outcome was CR-BSI determined by one microbiologist who was masked to group assignment. Secondary outcomes included skin reactions to study solution and thyroid dysfunction.

Results We enrolled 304 infants (CHX–IA 148 vs PI 156) in whom 815 CVCs (CHX–IA 384 vs PI 431) were inserted and remained in situ for 3078 (CHX–IA 1465 vs PI 1613) days. We found no differences between the groups in the proportion of infants with CR-BSI (CHX–IA 7% vs PI 5%, p=0.631), the proportion of CVCs complicated by CR-BSI or the rate of CR-BSI per 1000 catheter days. Skin reaction rates were low (<1% CVC insertion episodes) and not different between the groups. More infants in the PI group had raised thyroid-stimulating hormone levels and were treated with thyroxine (CHX–IA 0% vs PI 5%, p=0.003).

Conclusions We did not find a difference in the rate of CR-BSI between preterm infants treated with CHX–IA and PI, and more infants treated with PI had thyroid dysfunction. However, our study was not adequately powered to detect a difference in our primary outcome and a larger trial is required to confirm our findings.

Child Fetal Neonatal Ed. 2017 Oct 26. pii: fetalneonatal-2016-312193. doi: 10.1136/archdischild-2016-312193. [Epub ahead of print]

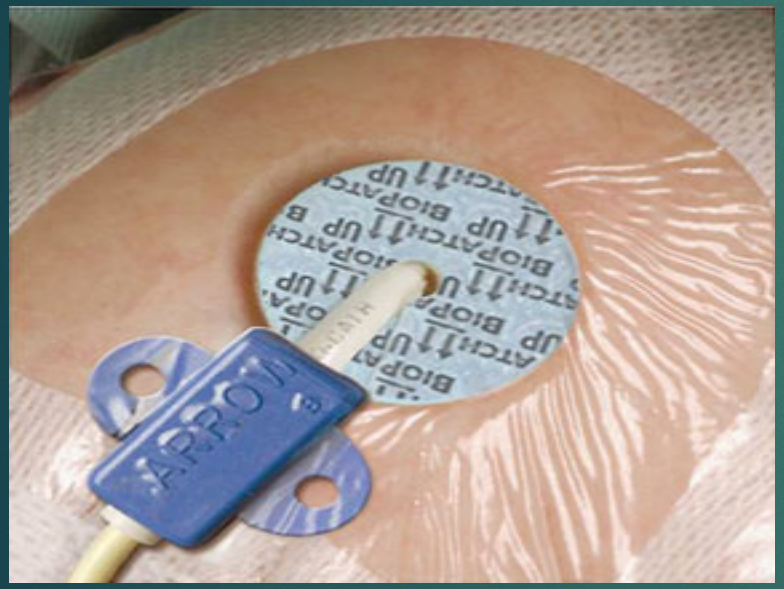
hlorhexidine-70% isopropyl alcohol versus 10% povidone-iodine for insertion site clean
e central line insertion in preterm infants: a randomised trial.

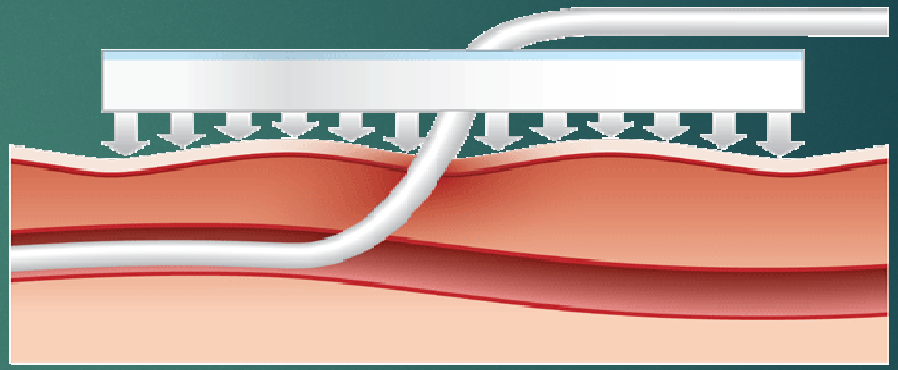
A[1,2,3], O'Sullivan A[4], Miletin J[4], Twomey AR[1], Knowles SJ[1], O'Donnell CPF[1,2,3].

- Ultrasound Guidance
- 2% Chlorhexidine
- Chlorhexidine impregnated dressing
- Sutureless Devices
- Semipermeable transparent dressing
- All inclusive kit for insertion
- All inclusive kit for manteinance
- Port protectors
- Cyanoacrilate glue
- Antimicrobial catheters

aad & Maki, 2007; Timsit, 2007; Mermel, 2007;Jarvis, 2007; Eggimann, 2007;Pratt, 2007; Gallieni, 2008; Cheung, 2009; McGoldrick, 2009; oede, 2009; Pittiruti, 2009; RCN, 2010; INS, 2011; O'Grady, 2011; Lamperti, 2012

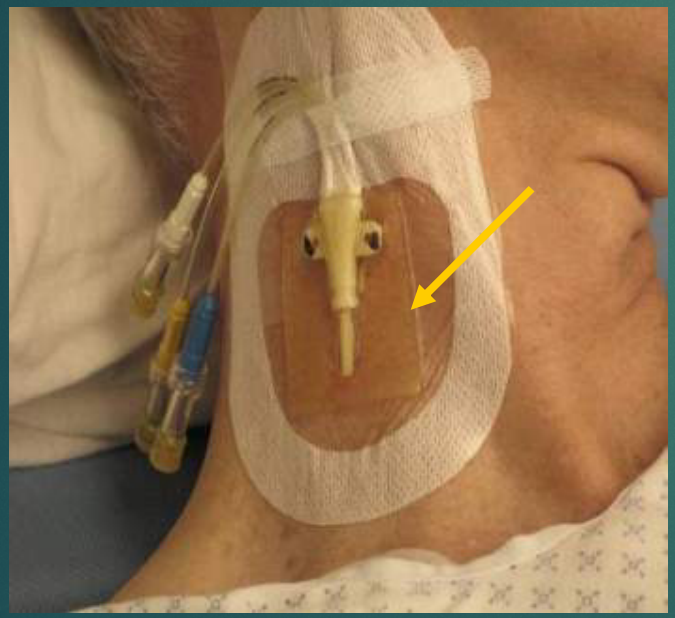
HLORHEXIDINE IMPREGNATED SPONGES



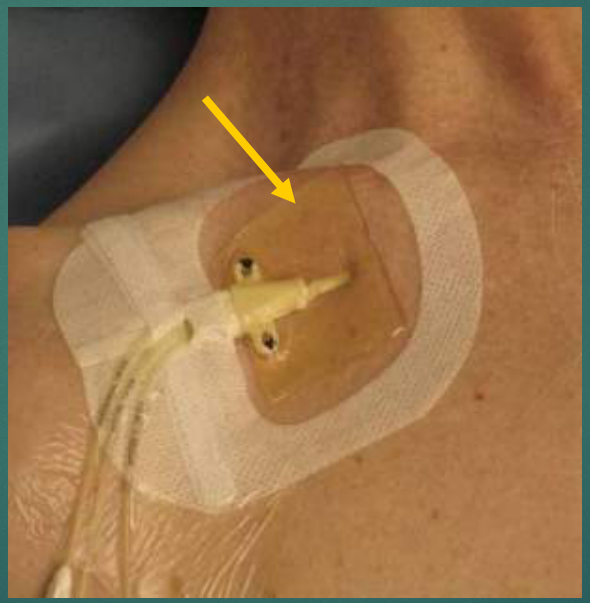


Continuous release of CHG provides 360° protection for 7 days — for ongoing antisepsis between dressing changes

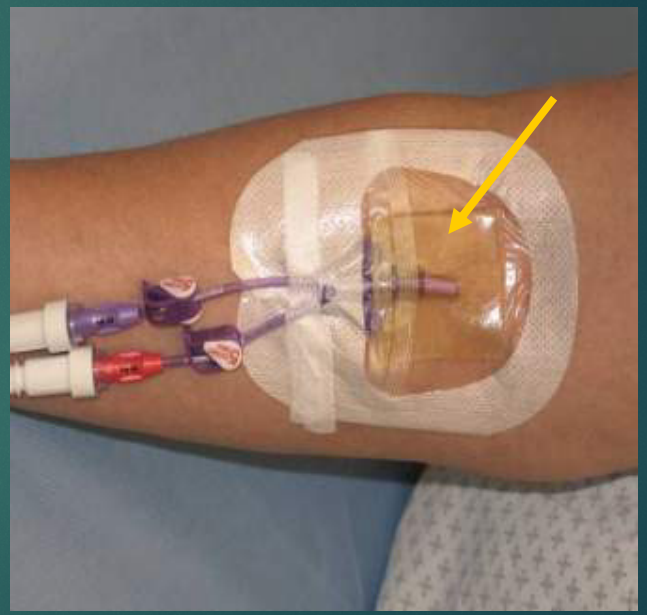
Internal Jugular*



Subclavian Site*



Peripherally Inserted Central Catheter



Tegaderm™ CHG Dressing

Journal of Antimicrobial Chemotherapy (2006) **58**, 281–287
doi:10.1093/jac/dkl234
Advance Access publication 6 June 2006

JAC

Use of chlorhexidine-impregnated dressing to prevent vascular and epidural catheter colonization and infection: a meta-analysis

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Department of Intensive Care, Royal Perth Hospital, Perth 6000, Western Australia, Australia

Received 3 February 2006; returned 20 April 2006; revised 2 May 2006; accepted 12 May 2006

Results: Eight studies assessing a single type of chlorhexidine-impregnated dressing were identified and subjected to meta-analysis. The chlorhexidine-impregnated dressing reduced the risk of epidural [3.6% versus 35%, odds ratio (OR) 0.07, 95% CI: 0.02–0.31, $P = 0.0005$] and intravascular catheter or exit-site bacterial colonization (14.8% versus 26.9%, OR 0.47, 95% CI: 0.34–0.65, $P < 0.00001$) (overall 14.3% versus 27.2%, OR 0.40, 95% CI: 0.26–0.61; $P < 0.0001$). The use of chlorhexidine-impregnated dressing was associated with a trend towards reduction in catheter-related bloodstream or CNS infections (2.2% versus 3.8%, OR 0.58, 95% CI: 0.29–1.14, $P = 0.11$). Local cutaneous reactions to chlorhexidine-impregnated dressing were reported in 5.6% of the patients in three studies (OR 8.17, 95% CI: 1.19–56.14, $P = 0.04$), and 96% of these reactions occurred in neonatal patients. The number needed to prevent one episode of intravascular catheter-related bloodstream infection was 142 for an average period of catheter *in situ* of 10 days and a change of dressing every 5 days. The cost of preventing one vascular catheter-related bloodstream infection was estimated to be £298 (US$532.5).

Conclusions: Chlorhexidine-impregnated dressing is effective in reducing vascular and epidural catheter bacterial colonization and is also associated with a trend towards reduction in catheter-related bloodstream or CNS infections. A large randomized controlled trial is needed to confirm whether chlorhexidine-impregnated dressing is cost-effective in preventing bacterial infection related to vascular and epidural catheters.

CARING FOR THE
CRITICALLY ILL PATIENT

Chlorhexidine-Impregnated Sponges and Less Frequent Dressing Changes for Prevention of Catheter-Related Infections in Critically Ill Adults

A Randomized Controlled Trial

Jean-François Timsit, MD, PhD
Carole Schwebel, MD, PhD
Lila Bouadma, MD
Arnaud Geffroy, MD
Maïté Garrouste-Orgeas, MD
Sebastian Pease, MD
Marie-Christine Herault, MD
Hakim Haouache, MD
Silvia Calvino-Gunther, RN
Brieuc Gestin, PhD
Laurence Armand-Lefevre, PharmD
Véronique Lafon, PharmD

Context Use of a chlorhexidine gluconate–impregnated sponge (CHGIS) in intravascular catheter dressings may reduce catheter-related infections (CRIs). Changing catheter dressings every 3 days may be more frequent than necessary.

Objective To assess superiority of CHGIS dressings regarding the rate of major CRIs (clinical sepsis with or without bloodstream infection) and noninferiority (less than 3% colonization-rate increase) of 7-day vs 3-day dressing changes.

Design, Setting, and Patients Assessor-blind, 2×2 factorial, randomized controlled trial conducted from December 2006 through June 2008 and recruiting patients from 7 intensive care units in 3 university and 2 general hospitals in France. Patients were adults (>18 years) expected to require an arterial catheter, central-vein catheter, or both inserted for 48 hours or longer.

Interventions Use of CHGIS vs standard dressings (controls). Scheduled change of unsoiled adherent dressings every 3 vs every 7 days, with immediate change of any soiled or leaking dressings.

(Reprinted) JAMA, March 25, 2009—Vol 301, No. 12 **1231**

Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011

12. Use a chlorhexidine-impregnated sponge dressing for temporary short-term catheters in patients older than 2 months of age if the CLABSI rate is not decreasing despite adherence to basic prevention measures, including education and training, appropriate use of chlorhexidine for skin antisepsis, and MSB [93, 96–98]. Category 1B

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JULY 2014, VOL. 35, NO. 7

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, MPH[12]

2. Use chlorhexidine-containing dressings for CVCs in patients over 2 months of age (quality of evidence: I).[80,155-160]

IVAD20 Consider the use of a chlorhexidine-impregnated sponge dressing in adult patients with a central venous catheter as a strategy to reduce catheter-related bloodstream infection.

New recommendation *Class B*

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).*

INS 2016

J. Use chlorhexidine-impregnated dressings over CVADs to reduce infection risk when the extraluminal route is the primary source of infection. Even when organizations show a low baseline central line-associated bloodstream infection (CLABSI) rate, further reduction in CLABSI rate has been demonstrated with use of chlorhexidine-impregnated dressings. The efficacy of chlorhexidine dressings in long-term CVAD use, beyond 14 days when intraluminal sources of infection are the primary source, has not been shown.[18] (I)

1. Do not use if any history of reactions to chlorhexidine.[5] (V)

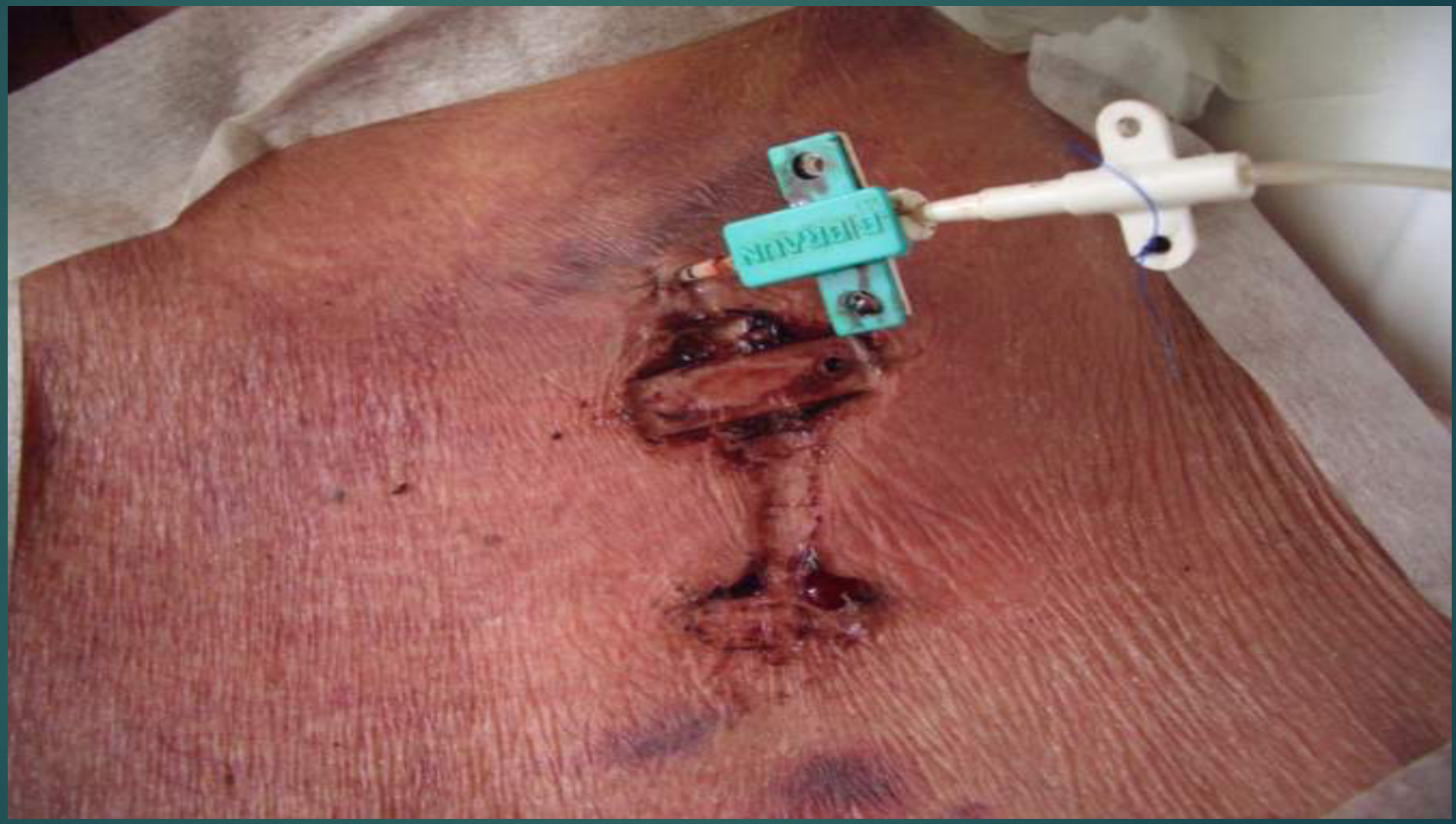
INS 2016

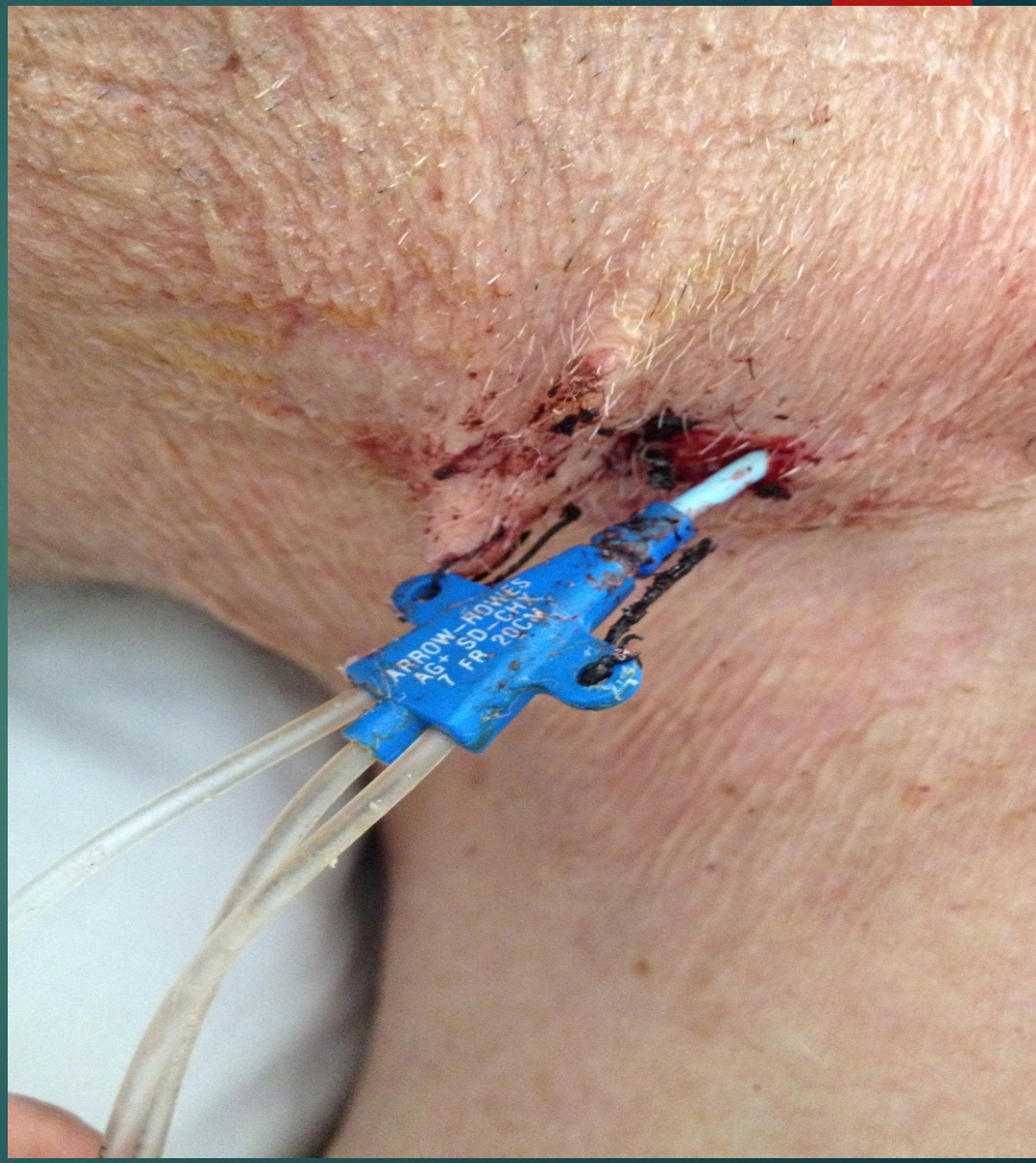
2. Use chlorhexidine-impregnated dressings with caution in premature neonates and among patients with fragile skin and/or complicated skin pathologies; contact dermatitis and pressure necrosis have occurred.[5,18-20] (V)
3. Monitor for erythema and dermatitis at the dressing site.[5,18-20] (V)

- Ultrasound Guidance
- 2% Chlorhexidine
- Chlorhexidine impregnated dressing
- Sutureless Devices
- Transparent dressing
- All inclusive kit for insertion
- All inclusive kit for manteinance
- Port protectors
- Cyanoacrilate glue
- Antimicrobial catheters

aad & Maki, 2007; Timsit, 2007; Mermel, 2007;Jarvis, 2007; Eggimann, 2007;Pratt, 2007; Gallieni, 2008; Cheung, 2009; McGoldrick, 2009; oede, 2009; Pittiruti, 2009; RCN, 2010; INS, 2011; O'Grady, 2011; Lamperti, 2012

THE RISK OF SUTURE…

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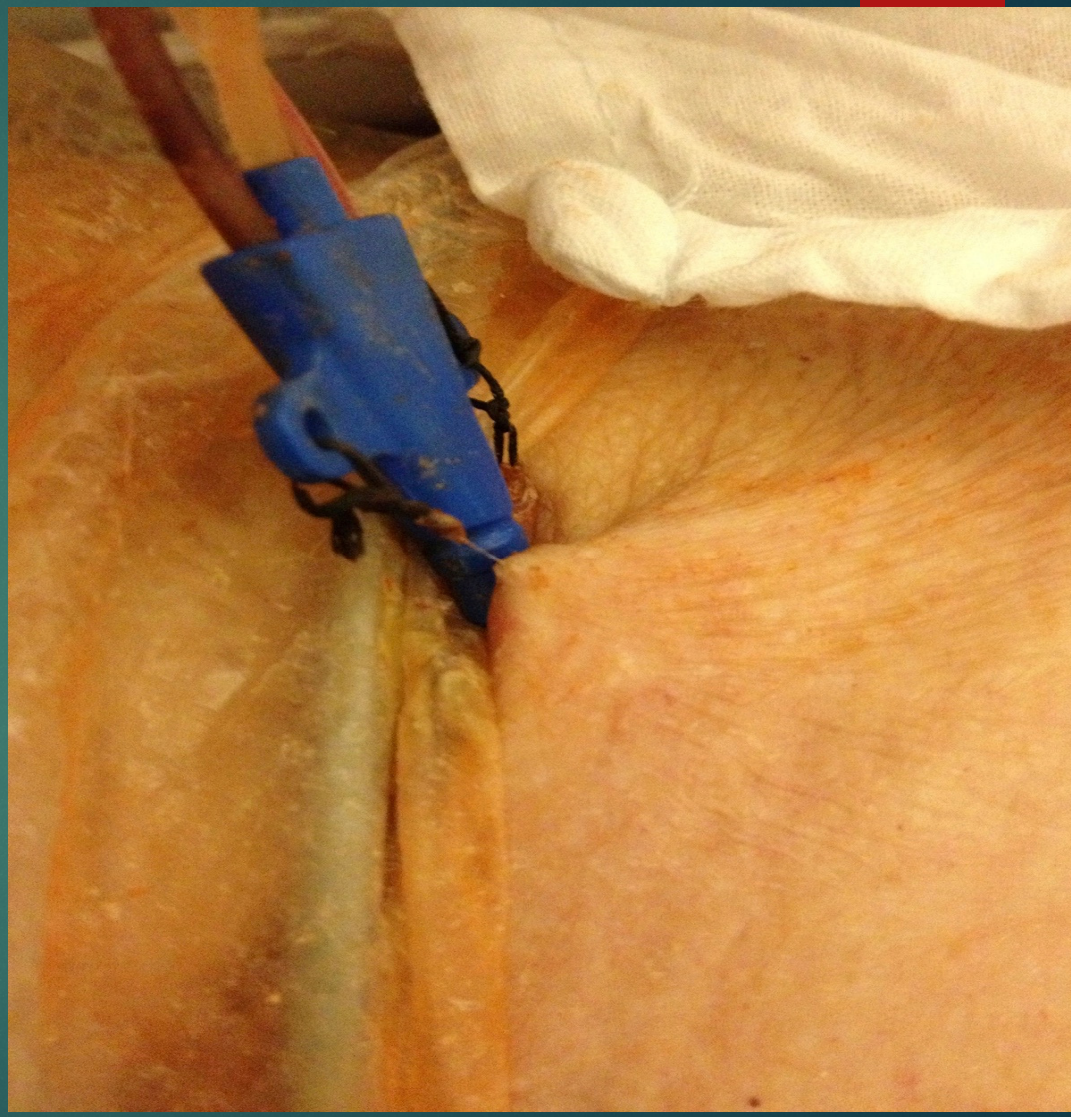

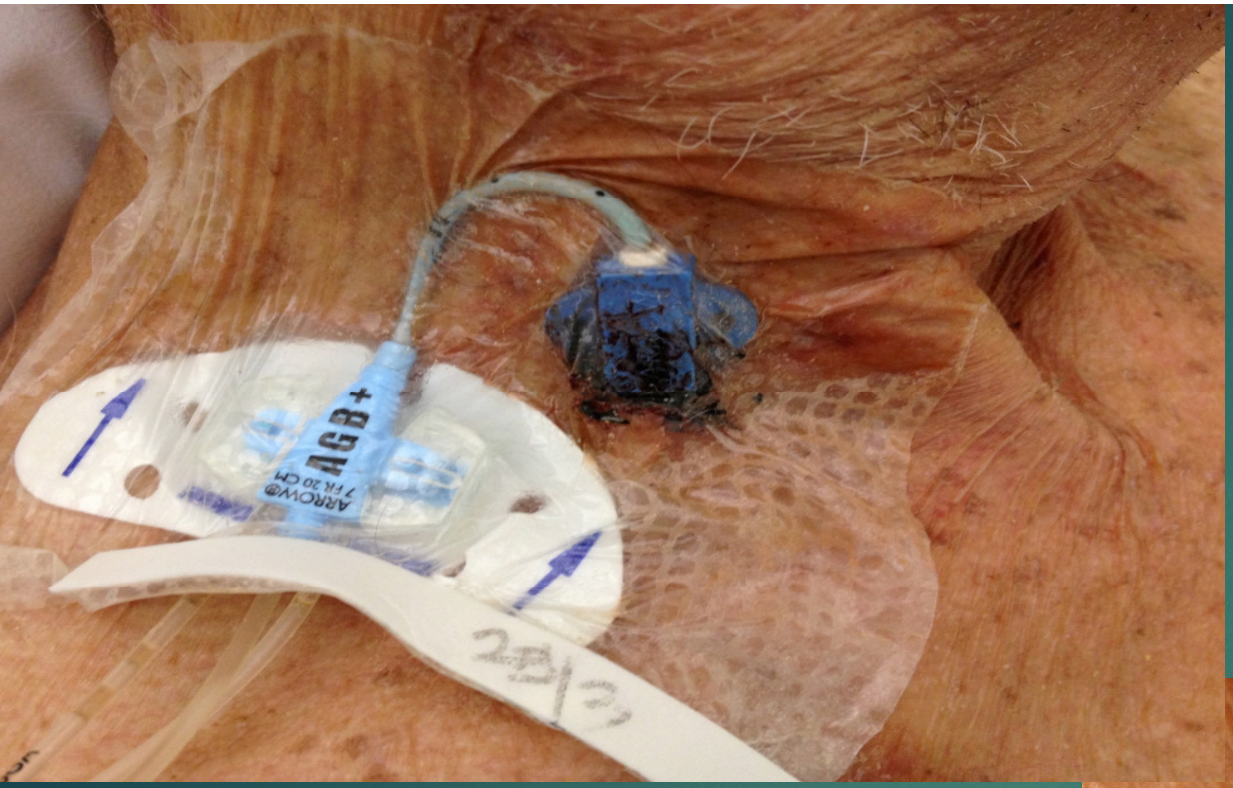
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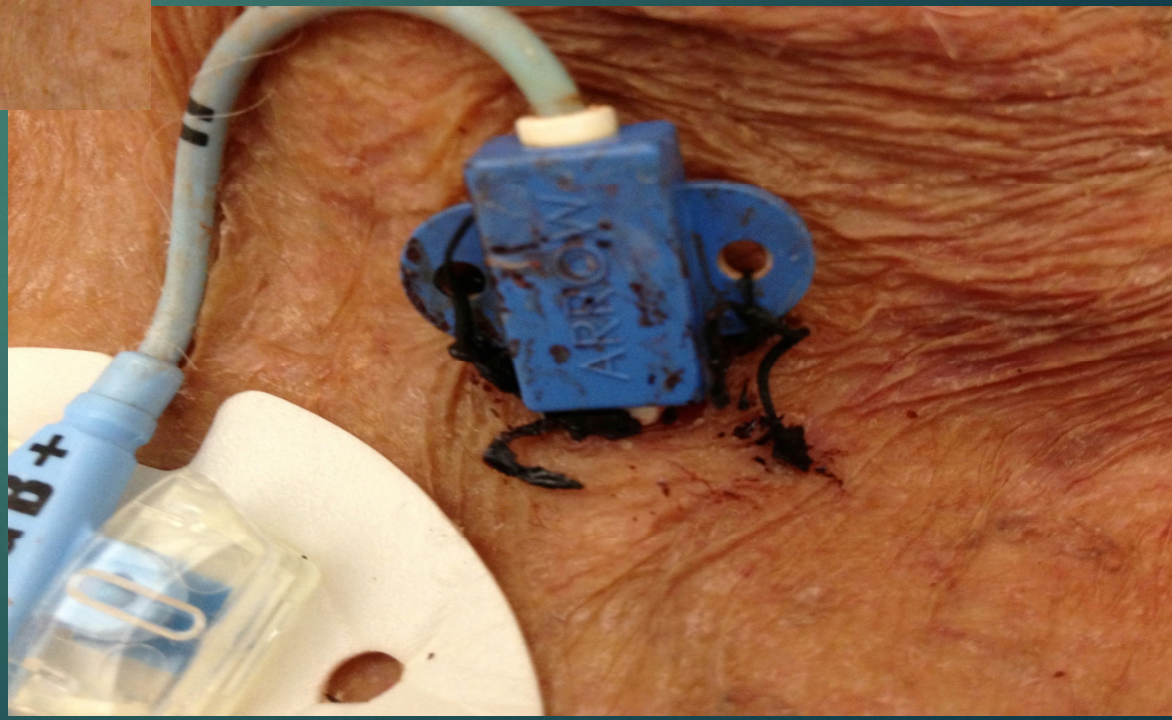
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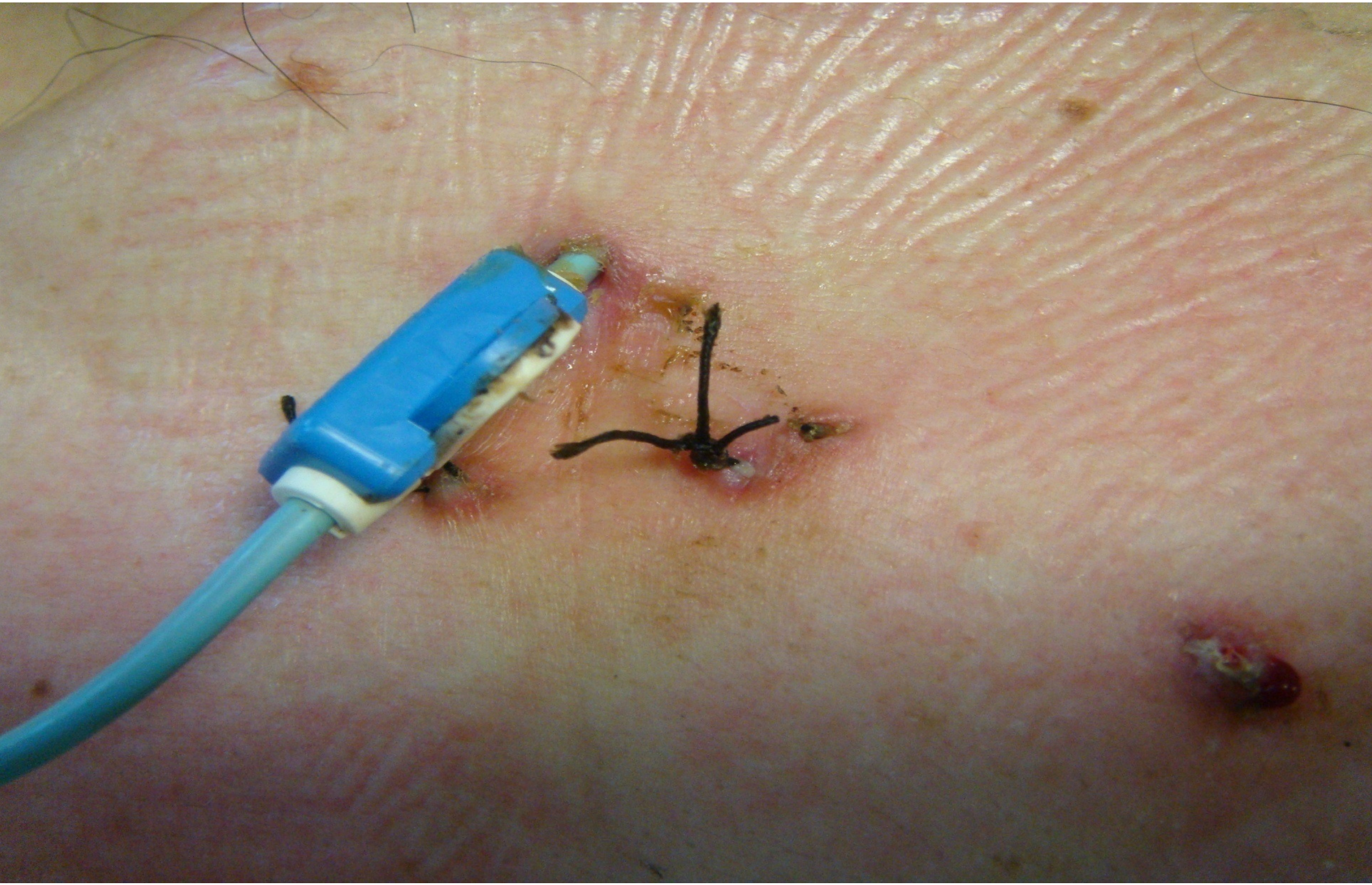

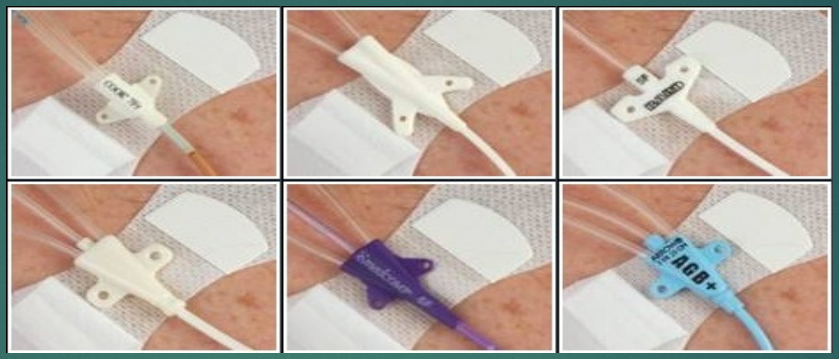


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- **Eliminates needle sticks**
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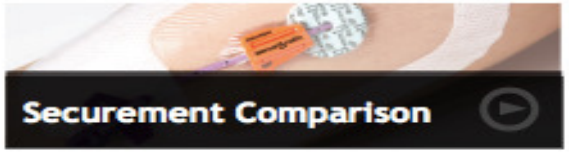
Patients Love SecurAcath


Securement Comparison


Leading Clinicians Love SecurAcath

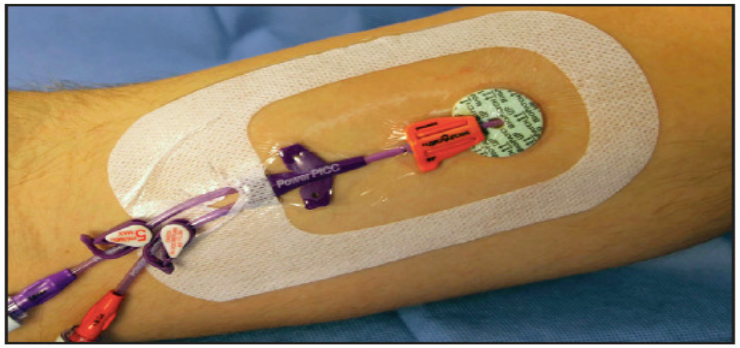
interrad MEDICAL

securAcath

SecurAcath PICC Benefits

Decreased Catheter Replacement Costs

- SecurAcath had a low rate of catheter dislodgments in clinical study[1]
  - 1.5%, 0.7/1000 catheter days
- Published adhesive device study had a 12% dislodgement rate[2]
- Facilities using the SecurAcath have reported a significant decrease in unscheduled PICC line restarts[3]
  - PICC replacement cost is approximately $500 at bedside, $1000 in IR[4], $1200 in pediatrics



Increased Stability

- SecurAcath secures right at the catheter/skin junction
- Minimizes catheter movement, pistoning and migration

547 **Catheter Securement Devices**

548 **Recommendation**

549 Use a sutureless securement device to reduce the risk of infection for PICCs [163].

550 Category II

Dispositivi per il Fissaggio del Catetere

Raccomandazioni

Usare un dispositivo di fissaggio *sutureless* al fine di ridurre il rischio di infezione per i cateteri intravascolari [105]. Categoria II

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Can J Anesth/J Can Anesth (2013) 60:504–505
DOI 10.1007/s12630-013-9897-7

CORRESPONDENCE

A prospective trial on a new sutureless securement device for central venous catheters

Daniel Cordovani, MD · Richard M. Cooper, MD

Received: 5 November 2012 / Accepted: 22 January 2013 / Published online: 2 February 2013

OSHA FactSheet

Securing Medical Catheters

What OSHA requirements cover medical catheters?

OSHA's bloodborne pathogens standard (29 CFR 1910.1030) requires that employers of workers with occupational exposure to blood or other potentially infectious materials annually consider and implement appropriate, available, and effective safer medical devices designed to eliminate or minimize that exposure [See 29 CFR 1910.1030 (c)(1)(iv)(B)]. Engineering controls that reduce the potential for needlesticks by eliminating the need to suture medical catheters in place are one option for healthcare employers to consider. As part of their annual review of methods to reduce needlesticks, employers must review options for securing medical catheters and consider appropriate engineering and work practice controls.

INS 2016

Avoid use of tape or sutures, as they are not effective alternatives to an ESD. Rolls of nonsterile tape can become contaminated with pathogenic bacteria, although its contribution to VAD infection has not been quantified. Sutures are associated with needle-stick injury, in addition to supporting the growth of biofilm and increasing the risk of catheter-related bloodstream infection.[7-10] (II, Regulatory)

INS 2016

F. Subcutaneous ESDs have been successful in stabilizing PICCs and CVADs inserted through the internal jugular vein of adults. Patient outcomes and patient and inserter satisfaction have been favorable; however, additional studies with other CVADs are needed.[21-23] (V)

- Ultrasound Guidance
- 2% Chlorhexidine
- Chlorhexidine impregnated dressing
- Sutureless Devices
- Transparent dressing
- All inclusive kit for insertion
- All inclusive kit for manteinance
- Port protectors
- Cyanoacrilate glue
- Antimicrobial catheters

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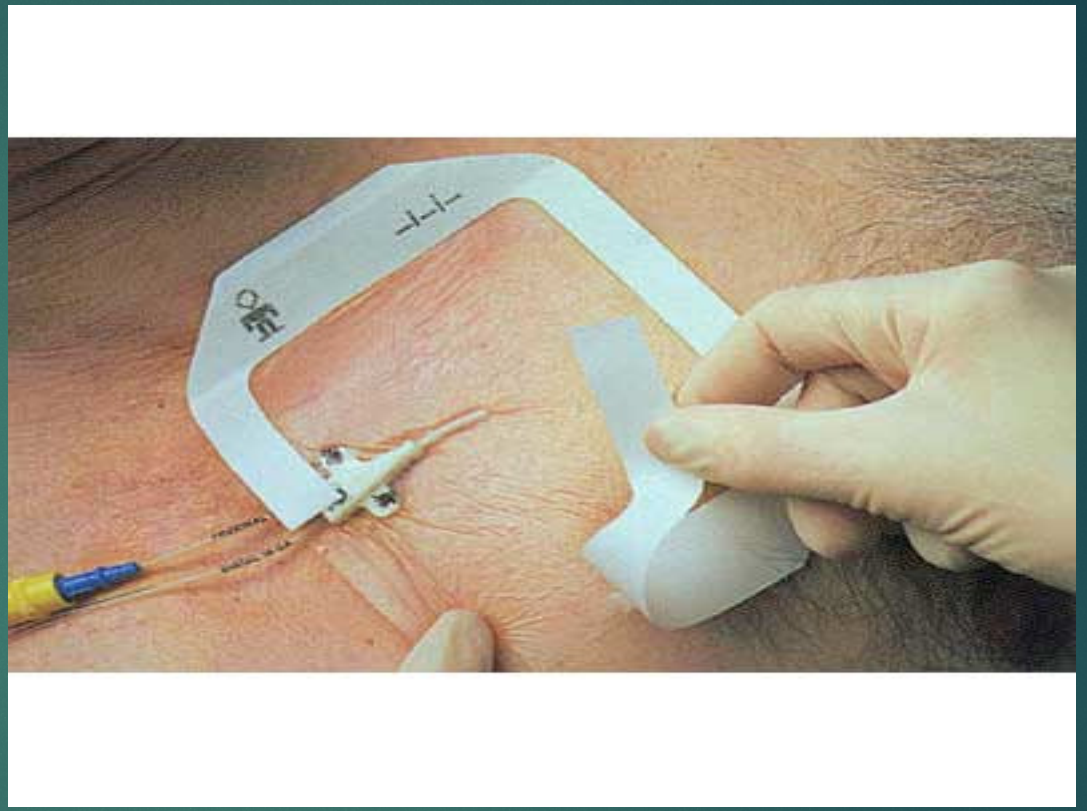


Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011

CENTERS FOR DISEASE CONTROL AND PREVENTION

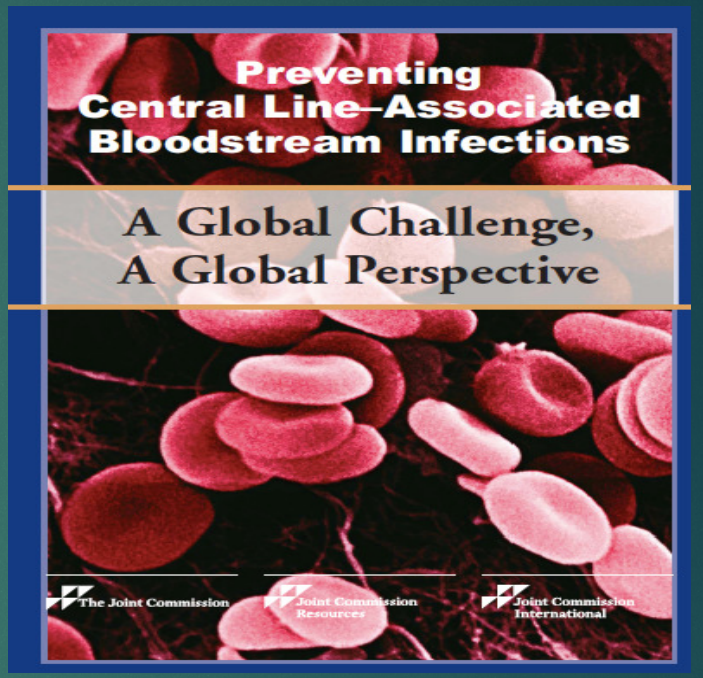
Catheter Site Dressing Regimens

1. Use either sterile gauze or sterile, transparent, semipermeable dressing to cover the catheter site [84–87]. Category IA
2. If the patient is diaphoretic or if the site is bleeding or oozing, use a gauze dressing until this is resolved [84–87]. Category II
3. Replace catheter site dressing if the dressing becomes damp, loosened, or visibly soiled [84, 85]. Category IB
4. Do not use topical antibiotic ointment or creams on insertion sites, except for dialysis catheters, because of their potential to promote fungal infections and antimicrobial resistance [88, 89]. Category IB
5. Do not submerge the catheter or catheter site in water. Showering should be permitted if precautions can be taken to reduce the likelihood of introducing organisms into the

catheter (e.g., if the catheter and connecting device are protected with an impermeable cover during the shower) [90–92]. Category IB

6. Replace dressings used on short-term CVC sites every 2 days for gauze dressings. Category II
7. Replace dressings used on short-term CVC sites at least every 7 days for transparent dressings, except in those pediatric patients in which the risk for dislodging the catheter may outweigh the benefit of changing the dressing [87, 93]. Category IB
8. Replace transparent dressings used on tunneled or implanted CVC sites no more than once per week (unless the dressing is soiled or loose), until the insertion site has healed. Category II
9. No recommendation can be made regarding the necessity for any dressing on well-healed exit sites of long-term cuffed and tunneled CVCs. Unresolved issue
10. Ensure that catheter site care is compatible with the catheter material [94, 95]. Category IB

- Use a sterile gauze or sterile, transparent semipermeable dressing to cover the insertion site.
- Use a gauze dressing if the patient is diaphoretic or if the site is oozing.
- Replace the dressing if it becomes damp, loosened, or visibly soiled.
- Replace gauze dressings every two days.
- Replace semipermeable dressings every seven days, except with pediatric patients, for whom the risk of dislodgement may outweigh the benefit of changing the dressing.



VAD17 Use a sterile, transparent, semi-permeable polyurethane dressing to cover the intravascular insertion site.

Class D/GPP

VAD18 Transparent, semi-permeable polyurethane dressings should be changed every 7 days, or sooner, if they are no longer intact or if moisture collects under the dressing.

Class D/GPP

VAD19 Use a sterile gauze dressing if a patient has profuse perspiration or if the insertion site is bleeding or leaking, and change when inspection of the insertion site is necessary or when the dressing becomes damp, loosened or soiled. Replace with a transparent semi-permeable dressing as soon as possible.

Class D/GPP

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

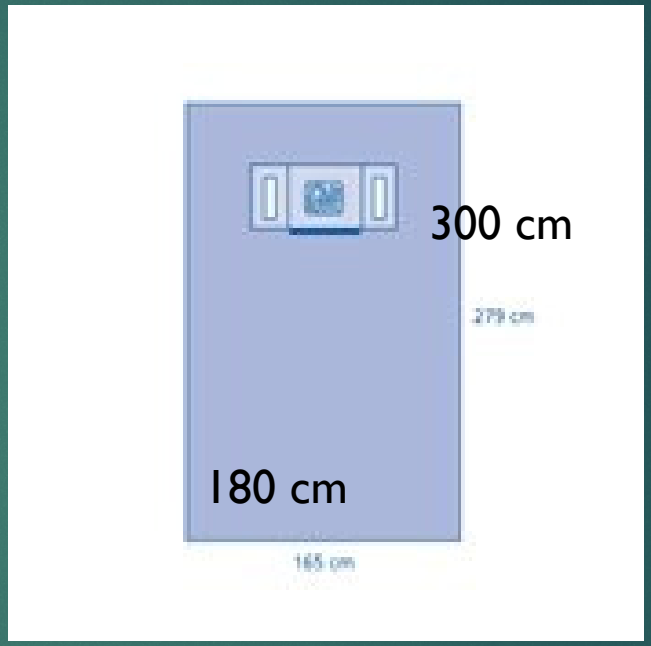
epic3: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England

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).*

- Ultrasound Guidance
- 2% Chlorhexidine
- Chlorhexidine impregnated dressing
- Sutureless Devices
- Transparent dressing
- All inclusive kit for insertion
- All inclusive kit for manteinance
- Port protectors
- Cyanoacrilate glue
- Antimicrobial catheters

aad & Maki, 2007; Timsit, 2007; Mermel, 2007;Jarvis, 2007; Eggimann, 2007;Pratt, 2007; Gallieni, 2008; Cheung, 2009; McGoldrick, 2009; oede, 2009; Pittiruti, 2009; RCN, 2010; INS, 2011; O'Grady, 2011; Lamperti, 2012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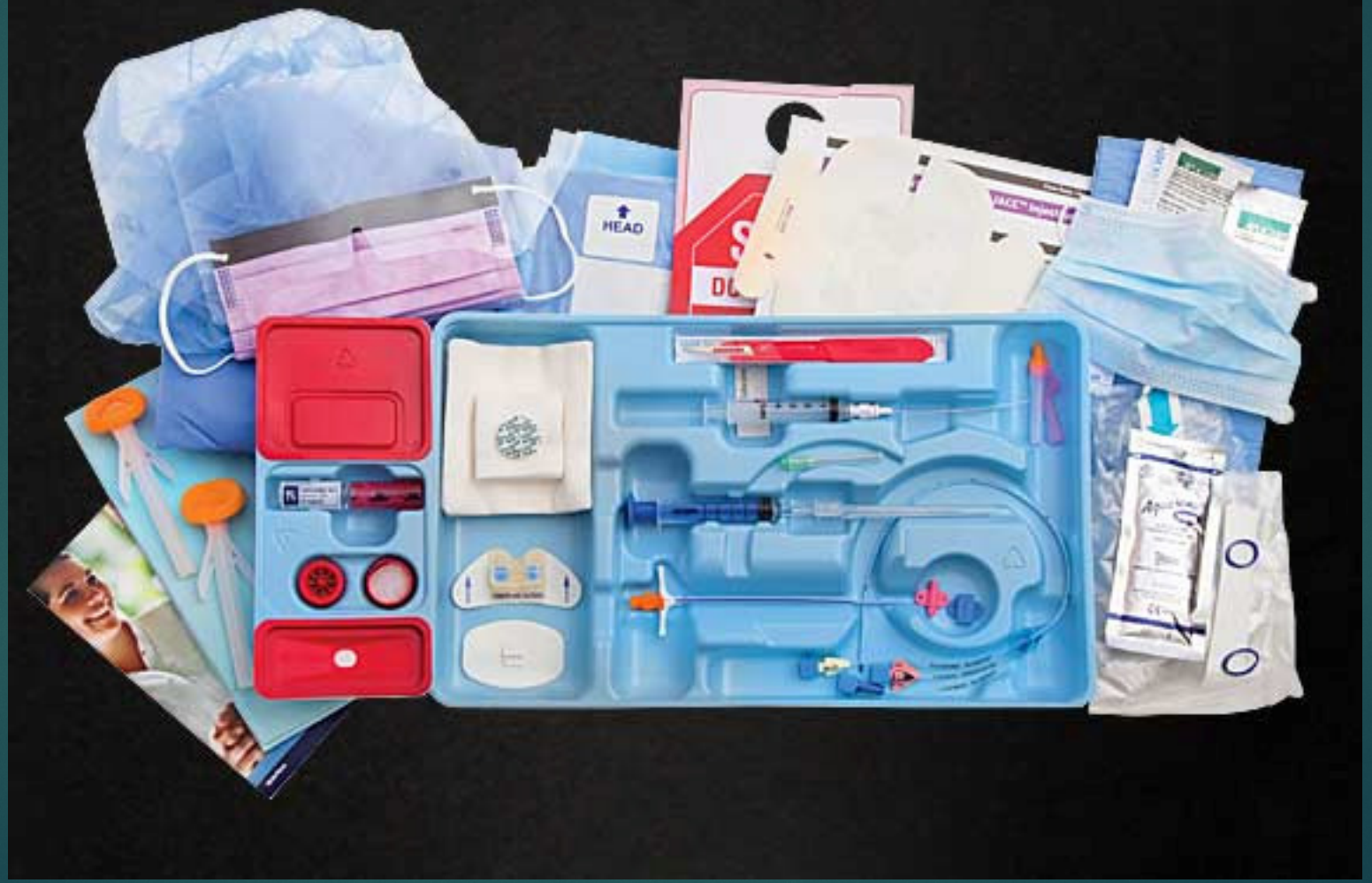


Arrow Pressure Injectable PICC Information
MAXIMUM injector pressure setting: 300 psi
Pressure Injectable PICC Information
HAND


HEAD
XL

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JULY 2014, VOL. 35, NO. 7

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, MPH[12]

4. Use an all-inclusive catheter cart or kit (quality of evidence: II).[45]

- Ultrasound Guidance
- 2% Chlorhexidine
- Chlorhexidine impregnated dressing
- Sutureless Devices
- Transparent dressing
- All inclusive kit for insertion
- All inclusive kit for manteinance
- Port protectors
- Cyanoacrilate glue
- Antimicrobial catheters

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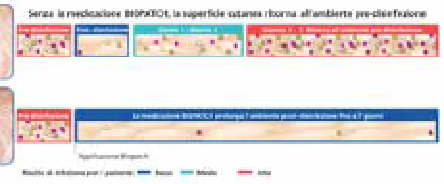

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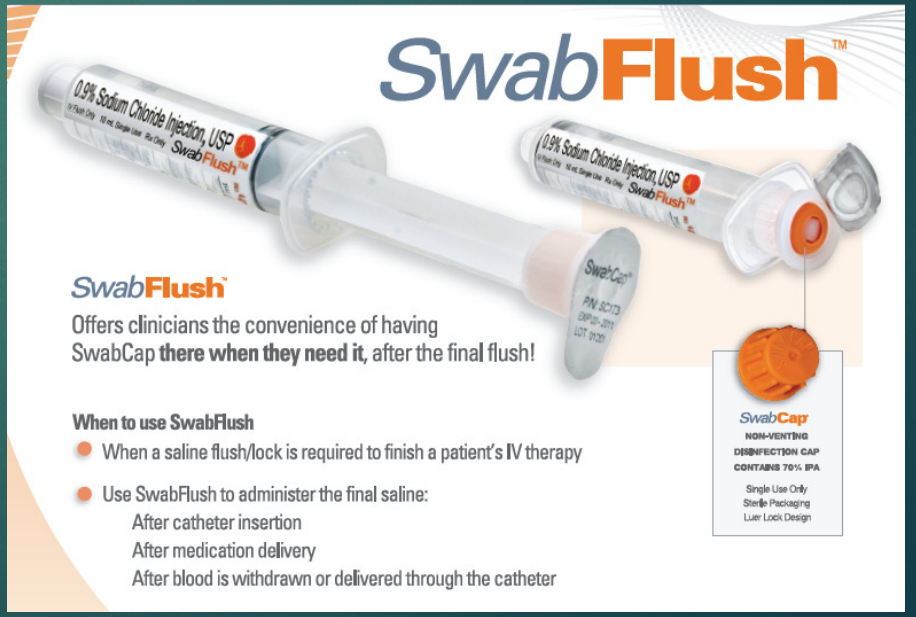
- Ultrasound Guidance
- 2% Chlorhexidine
- Chlorhexidine impregnated dressing
- Sutureless Devices
- Semipermeable transparent dressing
- All inclusive kit for insertion
- All inclusive kit for manteinance
- Port protectors
- Cyanoacrilate glue
- Antimicrobial catheters

aad & Maki, 2007; Timsit, 2007; Mermel, 2007;Jarvis, 2007; Eggimann, 2007;Pratt, 2007; Gallieni, 2008; Cheung, 2009; McGoldrick, 2009; oede, 2009; Pittiruti, 2009; RCN, 2010; INS, 2011; O'Grady, 2011; Lamperti, 2012

ORT PROTECTORS



American Journal of Infection Control 40 (2012) 931-4

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

Impact of alcohol-impregnated port protectors and needleless neutral pressure connectors on central line–associated bloodstream infections and contamination of blood cultures in an inpatient oncology unit

Michael A. Sweet PharmD [a,*], Aaron Cumpston PharmD [b], Frank Briggs PharmD, MPH [a], Michael Craig MD [c], Mehdi Hamadani MD [c]

Center for Quality Outcomes, West Virginia University Hospitals, Morgantown, WV
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Osborn Hematopoietic Malignancy and Transplantation Program, West Virginia University, Morgantown, WV

American Journal of Infection Control 41 (2013) 33-8

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

Continuous passive disinfection of catheter hubs prevents contamination and bloodstream infection

Marc-Oliver Wright MT (ASCP), MS, CIC[a,*], Jackie Tropp RN, MSN[b], Donna M. Schora MT (ASCP)[c], Mary Dillon-Grant RN, MSN[b], Kari Peterson BS[c], Sue Boehm RN[c], Ari Robicsek MD[a,d,e], Lance R. Peterson MD[a,c,e,f]

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[f] *Department of Pathology and Laboratory Medicine, NorthShore University HealthSystem, Evanston, IL*

Port protectors and educational intervention: the way to zero central line-associated bloodstream infections (CLABSIs). A randomized controlled trial.

Inchingolo R1, Magnini D.1, Montemurro G.1, Smargiassi A.1, Pasciuto G.1, Cavalletti M.1, Torelli R.2, Spanu T.2, Sanguinetti M.2, Scoppettuolo G.3, Pittiruti M.4, Valente S.1, Corbo G.M.1.

1: Pulmonary Medicine Department, Università Cattolica del Sacro Cuore, Rome, Italy.
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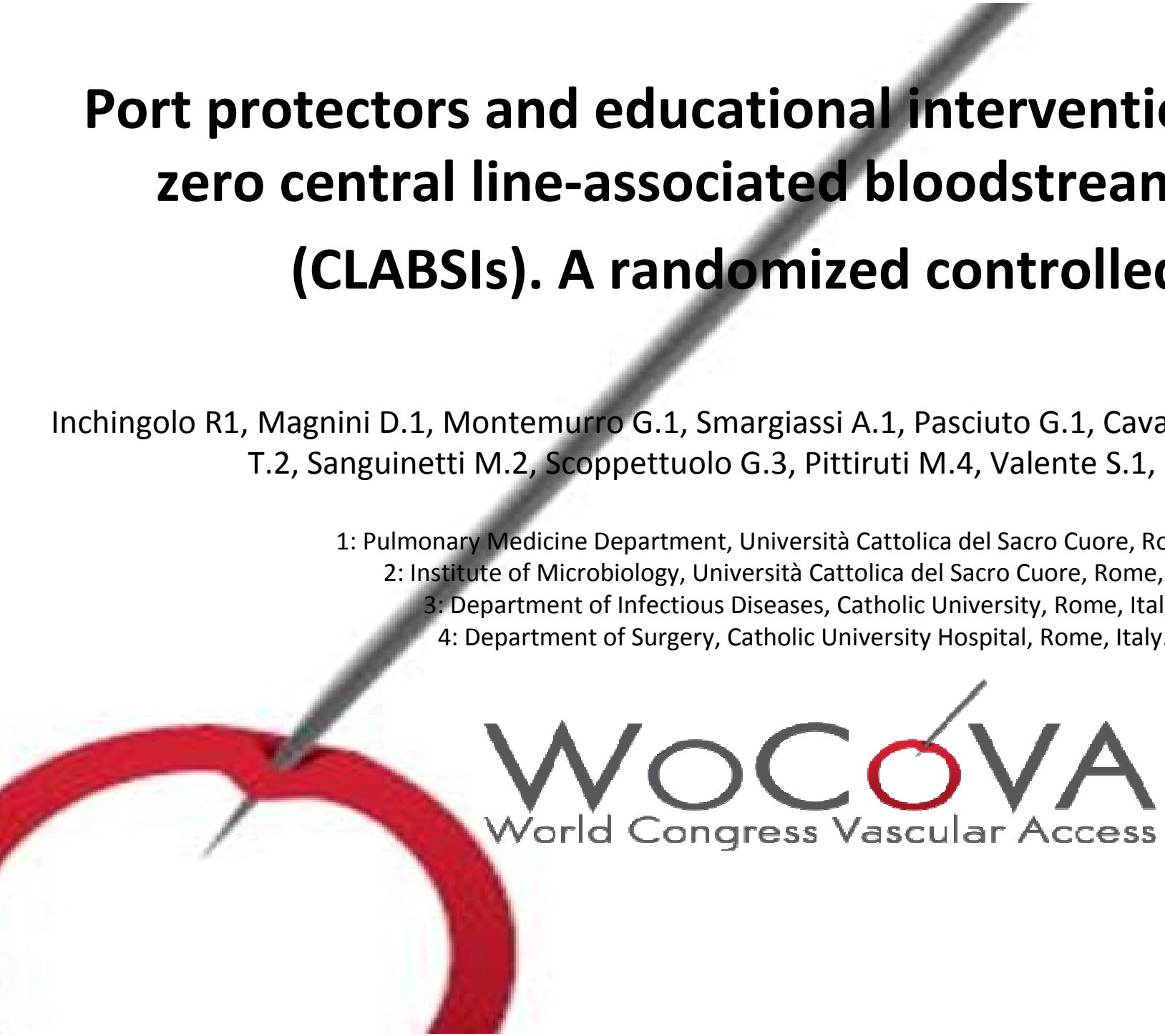
3: Department of Infectious Diseases, Catholic University, Rome, Italy.
4: Department of Surgery, Catholic University Hospital, Rome, Italy.



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INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JULY 2014, VOL. 35, NO. 7

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, MPH[12]

3. Use an antiseptic-containing hub/connector cap/port protector to cover connectors (quality of evidence: I).[161-165]

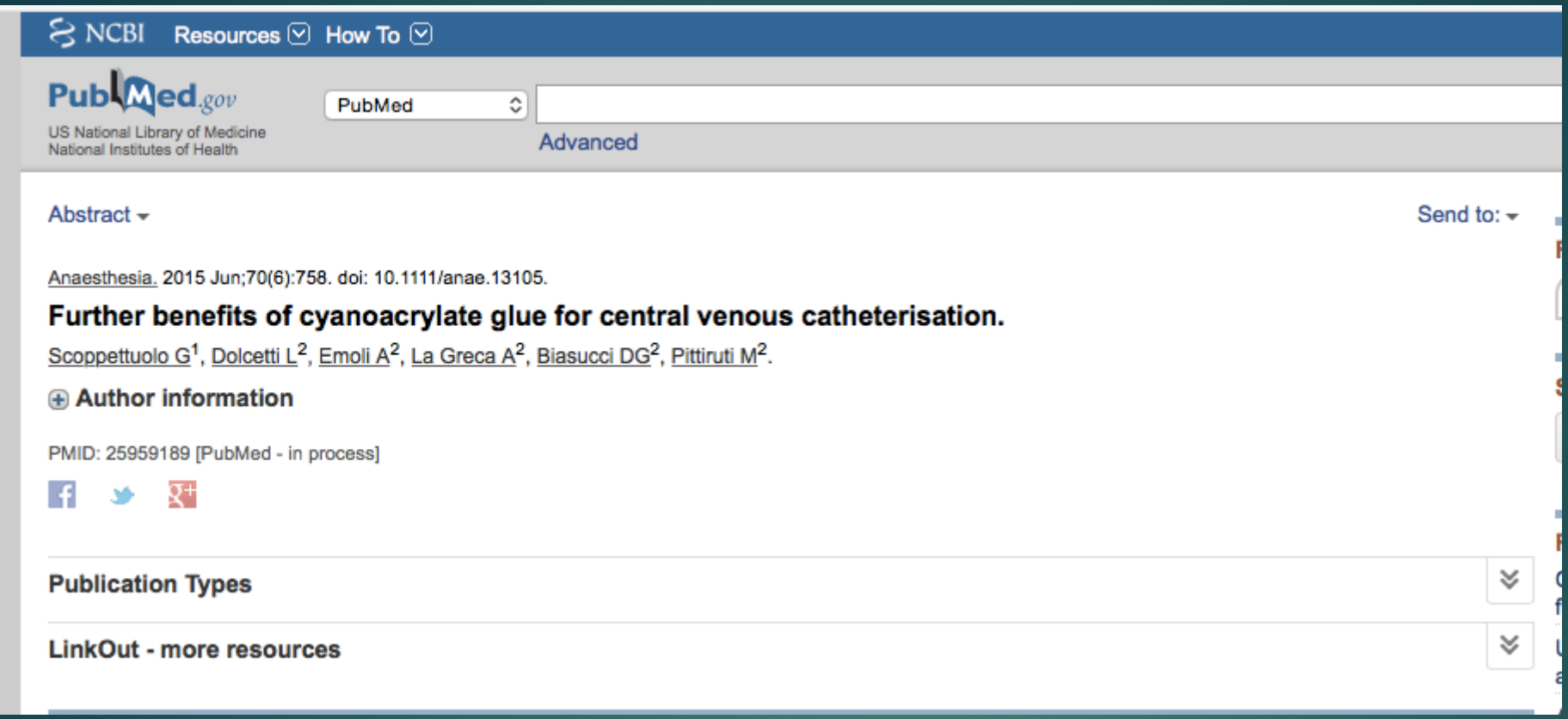
INS 2016 : port protectors

G. Use of passive disinfection caps containing disinfecting agents (eg, isopropyl alcohol) has been shown to reduce intraluminal microbial contamination and reduce the rates of central line-associated bloodstream infection (CLABSI). Use of disinfection caps on peripheral catheters has limited evidence but should be considered.

CYANOACRYLATE GLUE PREVENTS EARLY BLEEDING OF THE EXIT SITE AFTER PICC PLACEMENT

•Mauro Pittiruti, Alessandro Emoli and Giancarlo Scoppettuolo

•Catholic University, Rome, Italy



- PREVENTION OF BLEEDING
- PREVENTION OF CONTAMINATION
- PREVENTION OF DISLOCATION

American Journal of Infection Control ■■ (2015) ■■–■■

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Letters to the editor

Antimicrobial-coated catheters and catheter-over-guidewire exchange in patients with severe catheter-related bloodstream infection: Old procedure, new indications?

To the Editor:

We read with great interest the article by Lorente et al[1] dealing with the fascinating benefit of antimicrobial-coated catheters to decrease the risk of catheter-related bloodstream infections (CRBSI). This article gives us the unique opportunity to contribute to the ongoing discussion regarding the potential benefit of extending indications for these devices, including catheter-over-guidewire exchange in critically ill patients with CRBSI.[2]

Since 2002 and up to 2014, all guidelines published in the field of vascular access, including the 2014 EPIC3 guidelines,[3] recommended the use of antiseptic- or antibiotic-impregnated central venous catheters (CVCs) in a single limited situation: Adult patients whose CVCs are expected to remain in place for more than 5 days while they reside in a facility where there is an institutional CRBSI rate above the locally agreed benchmark despite the implementation of a comprehensive strategy aiming to reduce it.

Most recently, new and interesting principles have been introduced in this field by the Society for Healthcare Epidemiology of America and Infectious Diseases Society of America guidelines.[4] In fact, this document recommends a revolutionary extended bundle of 3 indications for the use of antimicrobial-coated catheters: hospital units or patient populations with a CRBSI rate above institutional goals, despite compliance with basic CRBSI prevention practices; patients with limited venous access and a history of recurrent CRBSI; and patients at heightened risk of severe sequelae from a CRBSI, such as those having recently implanted intravascular or cardiac devices (ie, prosthetic heart valves and aortic grafts).

In our institution, we have used chlorhexidine-silver sulfadiazine-impregnated catheters with extended indications since 2012. Our protocol includes the 3 above-mentioned points now approved by the Society for Healthcare Epidemiology of America and Infectious Diseases Society of America, with an extensive application of the point about patients with recently implanted orthopedic prosthesis, and a fourth indication that we believe is reasonable, beneficial, and safe: Patients with fungal or bacterial hospital-acquired bloodstream infection, irrespective of the primary source, who have a standard CVC and the absolute need of stable central venous access. In fact, chlorhexidine-silver sulfadiazine coating may prevent early colonization of the device by the hematogenous route, thereby avoiding the new catheter becoming a secondary source of sepsis and, thus, protecting this fragile subgroup of critically ill patients from a new iatrogenic complication.[2,5]

Furthermore, patients with documented CRBSI whose CVC must be removed in agreement with 2009 Infectious Diseases Society of America guidelines,[6] but with a compelling need of stable vascular access (eg, critical care, complete superficial peripheral vein exhaustion, and contraindications to peripherally inserted central catheters) and coexisting serious difficulties in cannulating a new vein (eg, morbid obesity, tracheostomy, and multiple previous cannulations), may benefit from a catheter-over-guidewire exchange with an antimicrobial-coated catheter, according to recent experiences.[7] Standard measures of CRBSI prevention do not include this procedure, nor is it considered as a treatment option in our institution, according to the international literature and guidelines.[3,4]

In this context, the known antibiofilm effect of antimicrobial catheters and specifically the anti-*Candida* effect of chlorhexidine[7] might be among the criteria for choosing this type of antimicrobial catheter for over-guidewire exchange also in candidemic patients and not only in those with *Staphylococcus aureus* CRBSI.[2] In fact, this choice could prevent the pathophysiologic and clinical sequence of *Candida* and bacteria adhesion to the catheter, colonization, biofilm formation, and early recurrent CRBSI.

In conclusion, the rationale for the above-mentioned extended use of antimicrobial catheters, specifically chlorhexidine-silver sulfadiazine-impregnated catheters, seems strong and convincing.

Acknowledgments

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Conflicts of Interest: None to report.

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