How to prevent catheter-related infections: strategies before and during VAD insertion

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WoCoVA
MEET THE EXPERTS

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

Original Investigation

Health Care–Associated Infections
A Meta-analysis of Costs and Financial Impact on the US Health Care System

Eyal Zimlichman, MD, MSc; Daniel Henderson, MD, MPH; Orly Tamir, PhD, MSc, MHA; Calvin Franz, PhD; Peter Song, BSE; Cyrus K. Yamin, MD; Carol Keohane, BSN, RN; Charles R. Denham, MD; David W. Bates, MD, MSc

IMPORTANCE Health care–associated infections (HAIs) account for a large proportion of the harms caused by health care and are associated with high costs. Better evaluation of the costs of these infections could help providers and payers to justify investing in prevention.

OBJECTIVE To estimate costs associated with the most significant and targetable HAIs.

DATA SOURCES For estimation of attributable costs, we conducted a systematic review of the literature using PubMed for the years 1986 through April 2013. For HAI incidence estimates, we used the National Healthcare Safety Network of the Centers for Disease Control and Prevention (CDC).

STUDY SELECTION Studies performed outside the United States were excluded. Inclusion criteria included a robust method of comparison using a matched control group or an appropriate regression strategy, generalizable populations typical of inpatient wards and critical care units, methodologic consistency with CDC definitions, and soundness of handling economic outcomes.

DATA EXTRACTION AND SYNTHESIS Three review cycles were completed, with the final iteration carried out from July 2011 to April 2013. Selected publications underwent a secondary review by the research team.

MAIN OUTCOMES AND MEASURES Costs, inflated to 2012 US dollars.

RESULTS Using Monte Carlo simulation, we generated point estimates and 95% CIs for attributable costs and length of hospital stay. On a per-case basis, central line–associated bloodstream infections were found to be the most costly HAIs at $45 814 (95% CI, $30 919-$65 245), followed by ventilator-associated pneumonia at $40 144 (95% CI, $36 286-$44 220), surgical site infections at $20 785 (95% CI, $18 902-$22 667), *Clostridium difficile* infection at $11 285 (95% CI, $9118-$13 574), and catheter-associated urinary tract infections at $896 (95% CI, $603-$1189). The total annual costs for the 5 major infections were $9.8 billion (95% CI, $8.3-$11.5 billion), with surgical site infections contributing the most to overall costs (33.7% of the total), followed by ventilator-associated pneumonia (31.6%), central line–associated bloodstream infections (18.9%), *C difficile* infections (15.4%), and catheter-associated urinary tract infections (<1%).

CONCLUSIONS AND RELEVANCE While quality improvement initiatives have decreased HAI incidence and costs, much more remains to be done. As hospitals realize savings from prevention of these complications under payment reforms, they may be more likely to invest in such strategies.

Editor's Note page 2046

Supplemental content at jamainternalmedicine.com

CME Quiz at jamanetworkcme.com and **CME Questions** page 2100

Author Affiliations: Author affiliations are listed at the end of this article.

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JAMA Intern Med. 2013;173(22):2039-2046. doi:10.1001/jamainternmed.2013.9763
Published online September 2, 2013.

Table 1. Estimates of Costs and LOS Attributed to the 5 Major Health Care–Associated Infections for the US Adult Inpatient Population at Acute Care Hospitals[a]

Health Care–Associated Infection Type	Cost, 2012 $US	LOS (as Total, ICU), d
Surgical site infections	20 785 (18 902-22 667)[b]	11.2 (10.5-11.9)[b]
MRSA	42 300 (4005-82 670)[b]	23.0 (14.3-31.7)[b]
Central line-associated bloodstream infections	45 814 (30 919-65 245)[b,c]	10.4, 6.9 (6.9-15.2, 3.5-9.6)[b,c]
MRSA	58 614 (16 760-174 755)[c]	15.7 (7.9-36.5)[c]
Catheter-associated urinary tract infections	896 (603-1189)[b]	NR
Ventilator-associated pneumonia	40 144 (36 286-44 220)[b,c]	13.1, 8.4 (11.9-14.3, 7.8-9.0)[b,c]
Clostridium difficile infections	11 285 (9118-13 574)[b]	3.3 (2.7-3.8)[b]

Abbreviations: ICU, intensive care unit; LOS, length of hospital stay; MRSA, methicillin-resistant *Staphylococcus aureus*; NR, not reported.

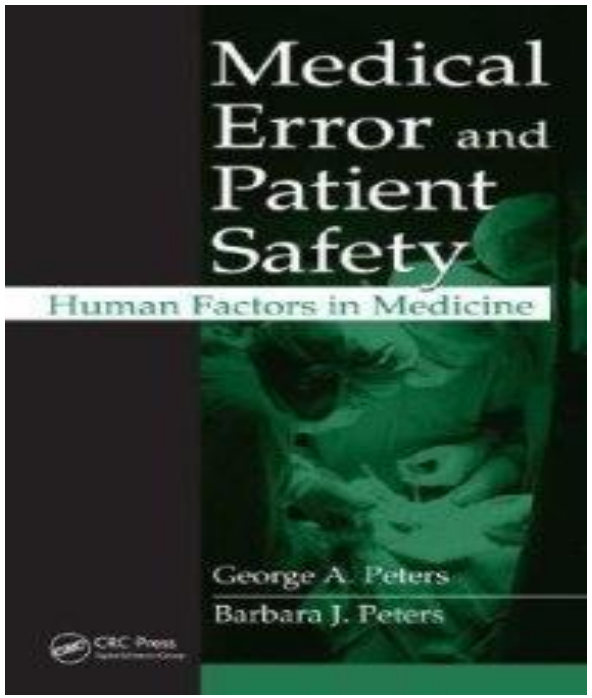
[a] Data are reported as mean (95% CI) values.

[b] Estimates obtained from literature and 100 000-trial Monte Carlo simulations using triangular distribution.

[c] Estimates obtained from literature and 100 000-trial Monte Carlo simulations, using general distribution.

STAND UP FOR PATIENT SAFETY

NATIONAL PATIENT SAFETY FOUNDATION



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

GUIDELINES

Guidelines for the Prevention of Intravascular Catheter–Related Infections

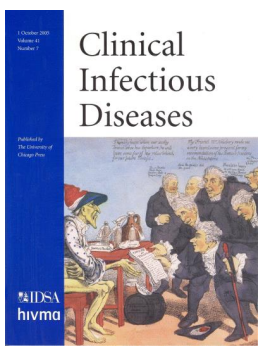
Naomi P. O'Grady,[1] Mary Alexander,[2] E. Patchen Dellinger,[5] Julie L. Gerberding,[6] Stephen O. Heard,[3] Dennis G. Maki,[8] Henry Masur,[1] Rita D. McCormick,[9] Leonard A. Mermel,[10] Michele L. Pearson,[7] Issam I. Raad,[11] Adrienne Randolph,[4] and Robert A. Weinstein[12]

[1]National Institutes of Health, Bethesda, Maryland; [2]Infusion Nurses Society, Cambridge, and [3]University of Massachusetts Medical School, Worcester, and [4]The Children's Hospital, Boston, Massachusetts; [5]University of Washington, Seattle; [6]Office of the Director, Centers for Disease Control and Prevention (CDC), and [7]Division of Healthcare Quality Promotion, National Center for Infectious Diseases, CDC, Atlanta, Georgia; University of Wisconsin [8]Medical School and [9]Hospital and Clinics, Madison; [10]Rhode Island Hospital and Brown University School of Medicine, Providence, Rhode Island; [11]MD Anderson Cancer Center, Houston, Texas; and [12]Cook County Hospital and Rush Medical College, Chicago, Illinois

Clinical Infectious Diseases 2002; 35:1281–307

1058-4838/2002/3511-0001

IDSA
Infectious Diseases Society of America



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.

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.

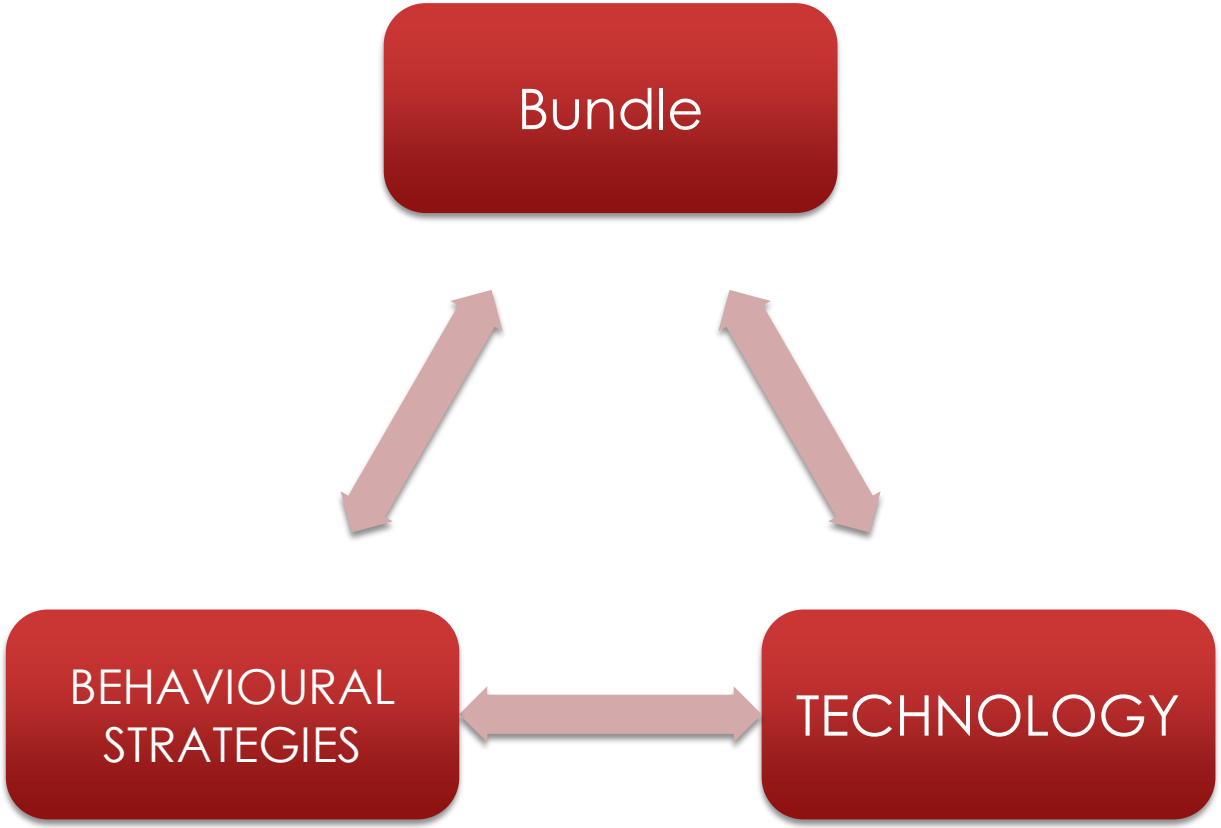
According to IHI's experiences and Campaigns, the best tool to Target Zero Infections is the "Bundle"

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.**

IHI.org | A resource from the Institute for Healthcare Improvement

2008


Bundle
BEHAVIOURAL STRATEGIES
TECHNOLOGY

Guidelines for CRBSI Prevention

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***
- ***INS 2021***


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

R.J. Pratt[a*], C.M. Pellowe[a], J.A. Wilson[a,b], H.P. Loveday[a], P.J. Harper[a], S.R.L.J. Jones[a], C. McDougall[b], M.H. Wilcox[c]

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

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.

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
    - Avoid femoral site in adult patients
- ☐ Cover the site with sterile gauze or sterile, transparent, semipermeable dressings

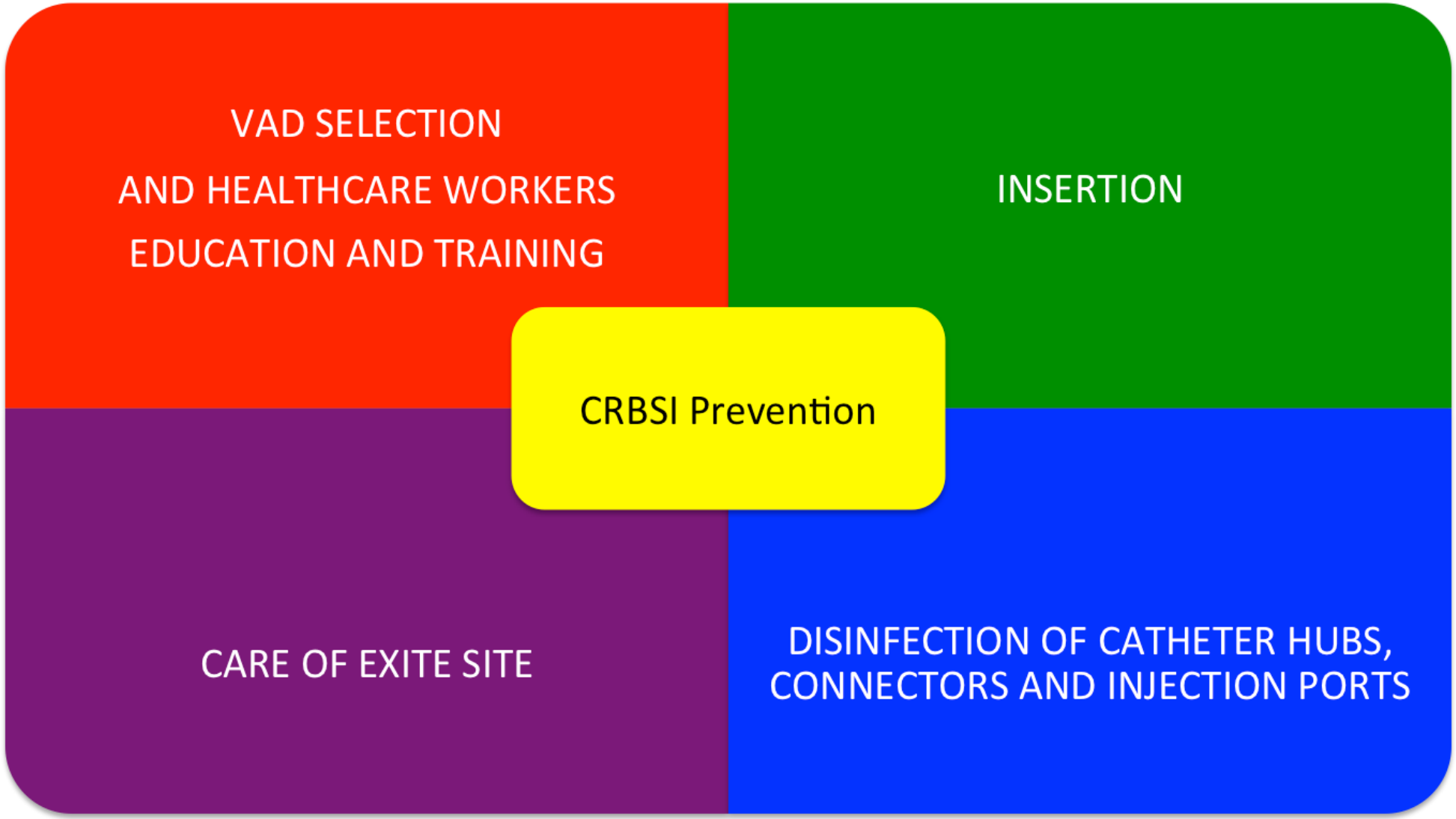
Handle and maintain central lines appropriately

- ☐ 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

GAVeCeLT BUNDLE (2017)

- CHECK FOR PROPER INDICATION TO CVC INSERTION
- HAND HYGIENE AND MAXIMAL BARRIER PRECAUTIONS (IN ALL INCLUSIVE KIT FOR INSERTION)
- PROPER CHOICE OF EXIT SITE, USING PICC AS FIRST CHOICE
- ULTRASOUND GUIDANCE
- SKIN ANTISEPSIS (2% CHLORHEXIDINE IN SINGLE USE APPLICATORS)
- CHLOREXIDINE RELEASING DRESSINGS
- SUTURELESS DEVICES FOR CATHETER SECUREMENT
- TRANSPARENT SEMIPERMEABLE DRESSINGS

- TISSUE ADHESIVE FOR EXIT SITE PROTECTION
- HUB OR NFC CONNECTORS DISINFECTION WITH 2% CHLORHEXIDINE OR PASSIVE DISINFECTION WITH PORT PROTECTORS
- PREFILLED STERILE SYRINGES TO FLUSH AND LOCK THE CATHETERS
- DEDICATED CART FOR INSERTION
- CHECKLIST
- DAILY REVIEW OF LINE NECESSITY WITH PROMPT REMOVAL OF UNNECESSARY LINES


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

- BEFORE INSERTION
  - **HEALTH CARE WORKERS EDUCATION AND TRAINING**
  - **VAD SELECTION**
  - **EXIT SITE SELECTION**
- DURING INSERTION
  - ULTRASOUND GUIDANCE
  - SKIN ANTISEPSIS (2% CHLORHEXIDINE)
  - SUTURELESS DEVICES
  - TRANSPARENT DRESSING
  - CYANOACRYLATE GLUE
  - ALL INCLUSIVE KIT INSERTION WITH MAXIMAL BARRIER PRECAUTIONS

5. COMPETENCY AND COMPETENCY ASSESSMENT

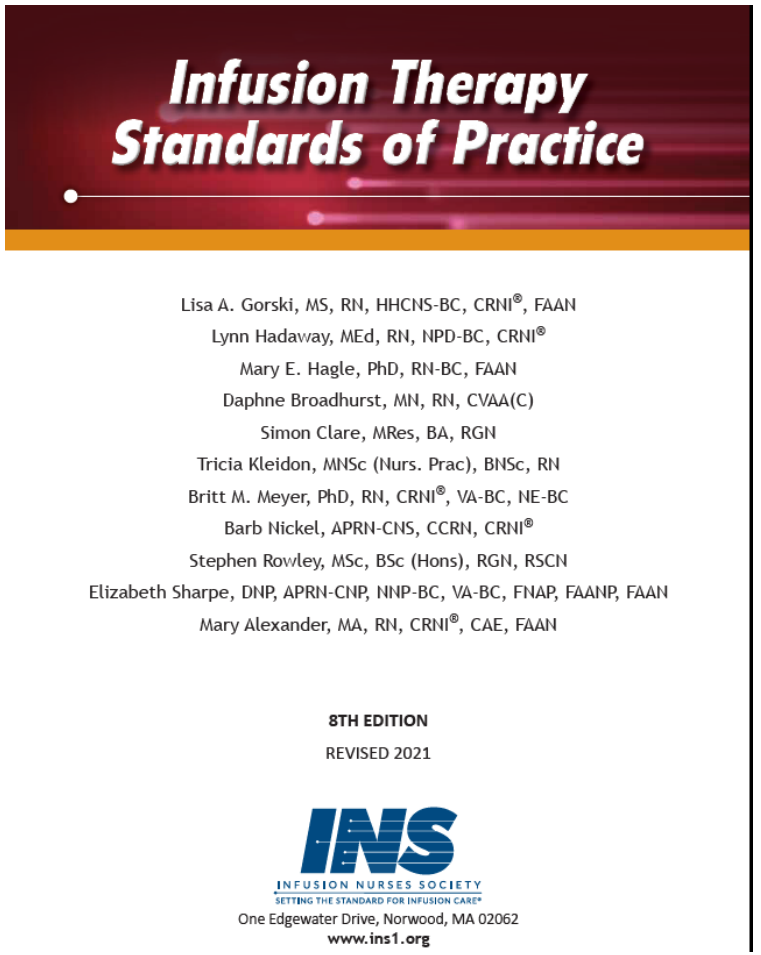
Standard

5.1 To provide for patient safety and public protection, clinicians meet licensing requirements and core competencies according to their specific profession.

5.2 Due to its invasive, high-risk nature, the clinician with responsibility for the safe delivery of infusion therapy and VAD insertion and/or management demonstrates competency with this role.

5.3 Initial competency is assessed and documented before the task or skill is performed without supervision.

5.4 Ongoing competency assessment and documentation is a continuous process driven by patient and organizational outcomes.



26. VASCULAR ACCESS DEVICE PLANNING

Standard

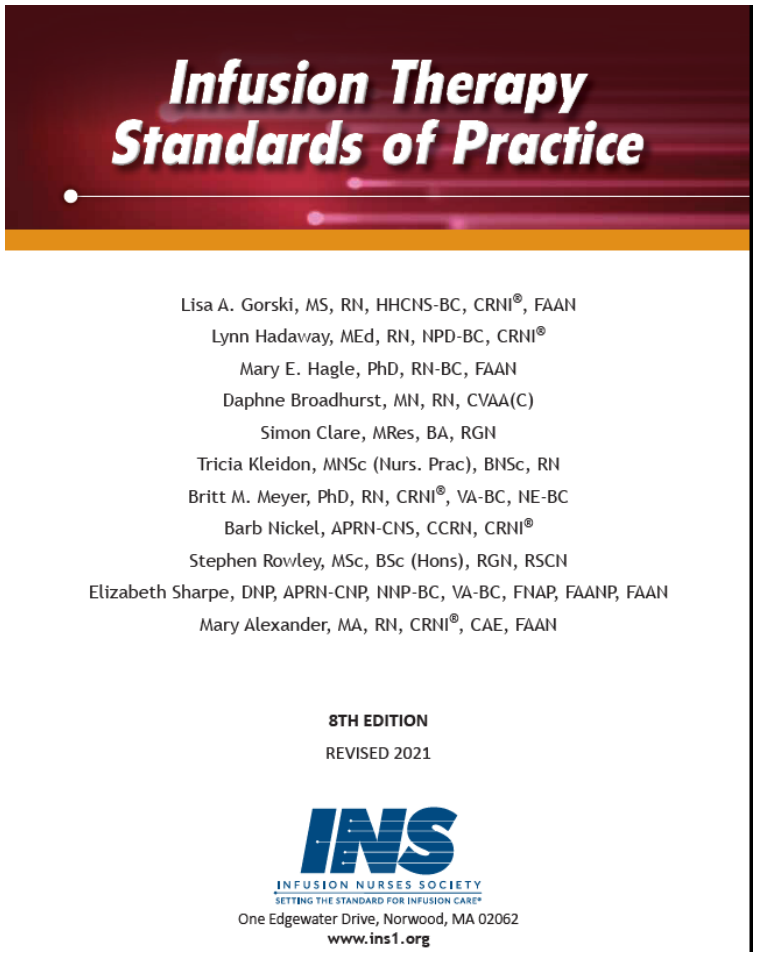
26.1 Infusion therapy is initiated based on the patient's diagnosis, review of alternative routes of therapy, and consideration of the risks versus the benefits of various treatment modalities.

26.2 The appropriate type of VAD, peripheral or central, is selected to accommodate the patient's vascular access needs based on the prescribed therapy or treatment regimen, including anticipated duration of therapy, vascular characteristics, patient's age, comorbidities, history of infusion therapy, preference for VAD type and location, and ability and resources available to care for the device.

26.3 Selection of the most appropriate VAD occurs at the earliest opportunity and is a collaborative process among the health care team, the patient, and the patient's caregiver(s).

26.4 The least invasive VAD with the smallest outer diameter and fewest number of lumens needed for the prescribed therapy is selected.

26.5 Vessel health and preservation are prioritized when planning vascular access.



KEY DEFINITIONS

Peripheral intravenous catheters (PIVCs): are inserted into and reside in veins of the periphery that includes all extremities, the external jugular vein, and scalp veins in neonates. PIVCs are inserted into superficial veins located just under the skin in the superficial tissue, as well as deep veins located under the muscle tissue.

INS categorizes 3 types of PIVCs:

Short peripheral intravenous catheter (short PIVC): an over-the-needle catheter with a hollow metal stylet (needle) positioned inside the catheter, generally inserted in superficial veins.

Long peripheral intravenous catheter (long PIVC): inserted in either superficial or deep peripheral veins and offers an option when a short PIVC is not long enough to adequately cannulate the available vein. A long PIVC can be inserted via traditional over-the-needle technique or with more advanced procedures, such as Seldinger and accelerated Seldinger techniques.

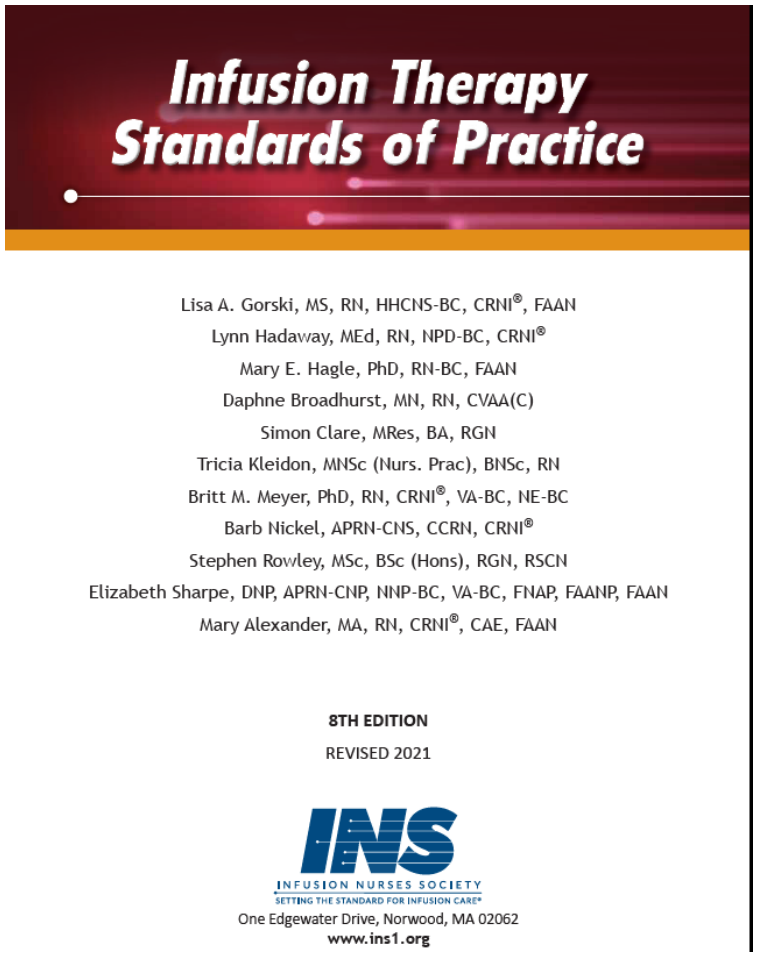
Midline catheter: inserted into a peripheral vein of the upper arm via the basilic, cephalic, or brachial vein with the terminal tip located at the level of the axilla in children and adults; for neonates, in addition to arm veins, mid-line catheters may be inserted via a scalp vein with the distal tip located in the jugular vein above the clavicle or in the lower extremity with the distal tip located below the inguinal crease.

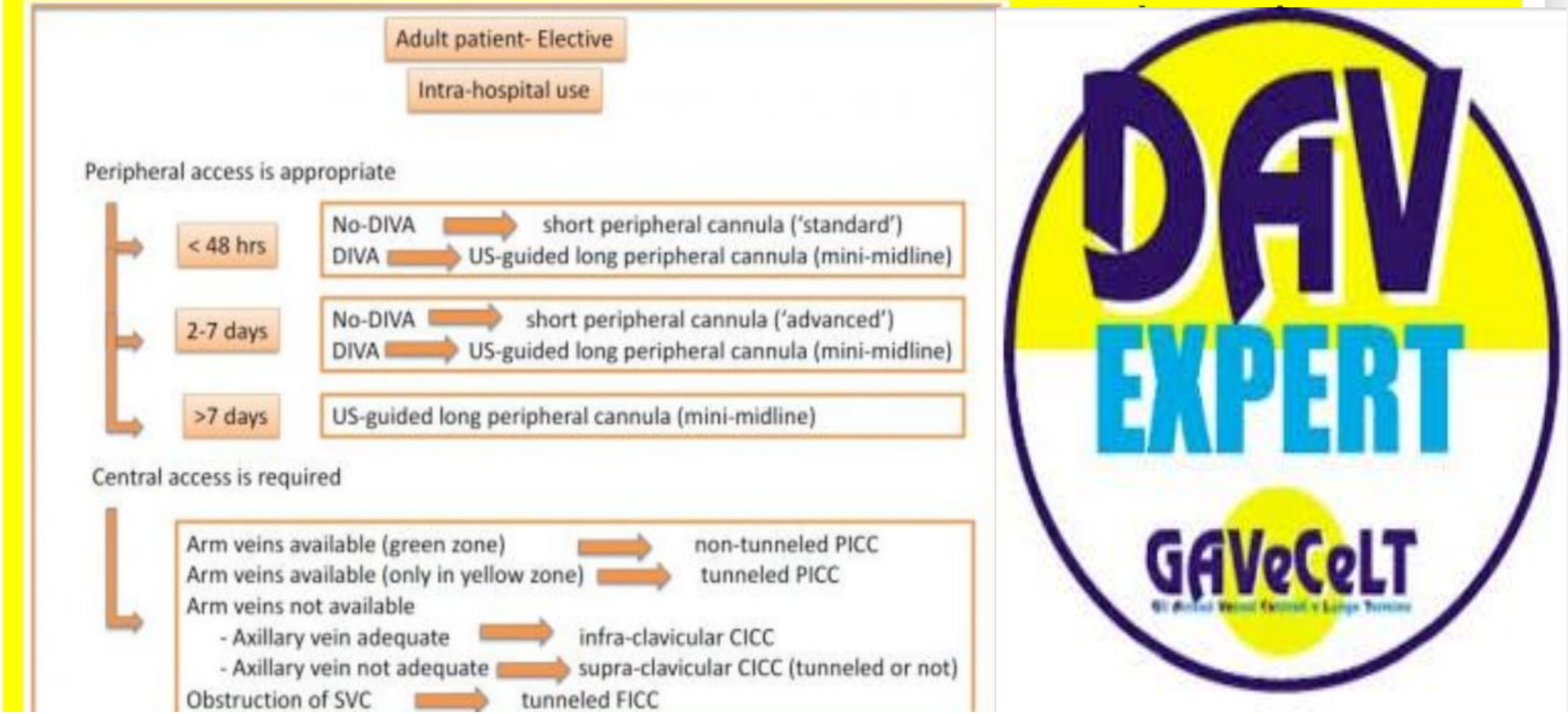
V. CVADs (PICCs; Nontunneled Catheters; Tunneled, Cuffed Catheters; Implanted Vascular Access Ports)

A. Select a CVAD to administer any type of infusion therapy in which the benefit outweighs the risk.[1,2,13,35,47] (I)

B. To minimize unnecessary CVAD insertion, use an evidence-based list of indications for CVAD use, including, but not limited to:
   1. Clinical instability of the patient and/or complexity of infusion regimen (multiple infusates).
   2. Episodic chemotherapy treatment where insufficient peripheral venous access is anticipated.
   3. Prescribed continuous infusion therapy inappropriate for peripheral infusion (eg, vesicant, PN, electrolytes, and other medications).
   4. Invasive hemodynamic monitoring.
   5. Long-term intermittent infusion therapy (eg, any medication including anti-infectives in patients with a known or suspected infection or IV therapy for chronic disease, such as cystic fibrosis).
   6. History of failed or difficult peripheral IV access when use of ultrasound guidance has failed.[1,2,13,47,70] (I)

F.





27. SITE SELECTION

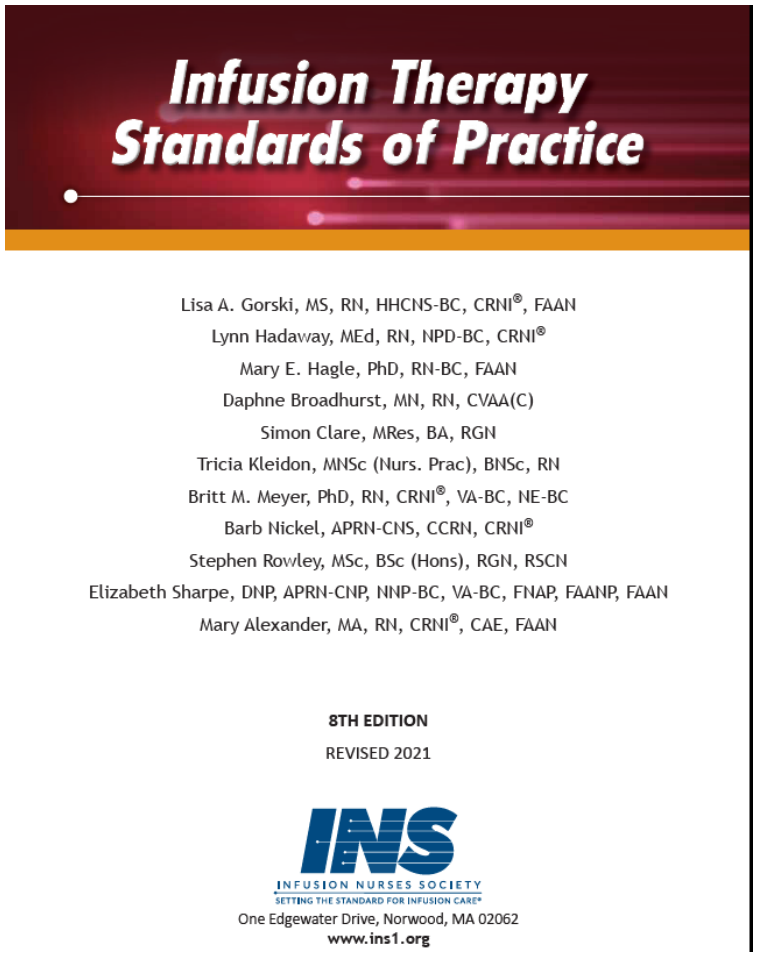
Standard

27.1 The most appropriate vein and insertion site is selected to best accommodate the VAD required for the prescribed infusion therapy.

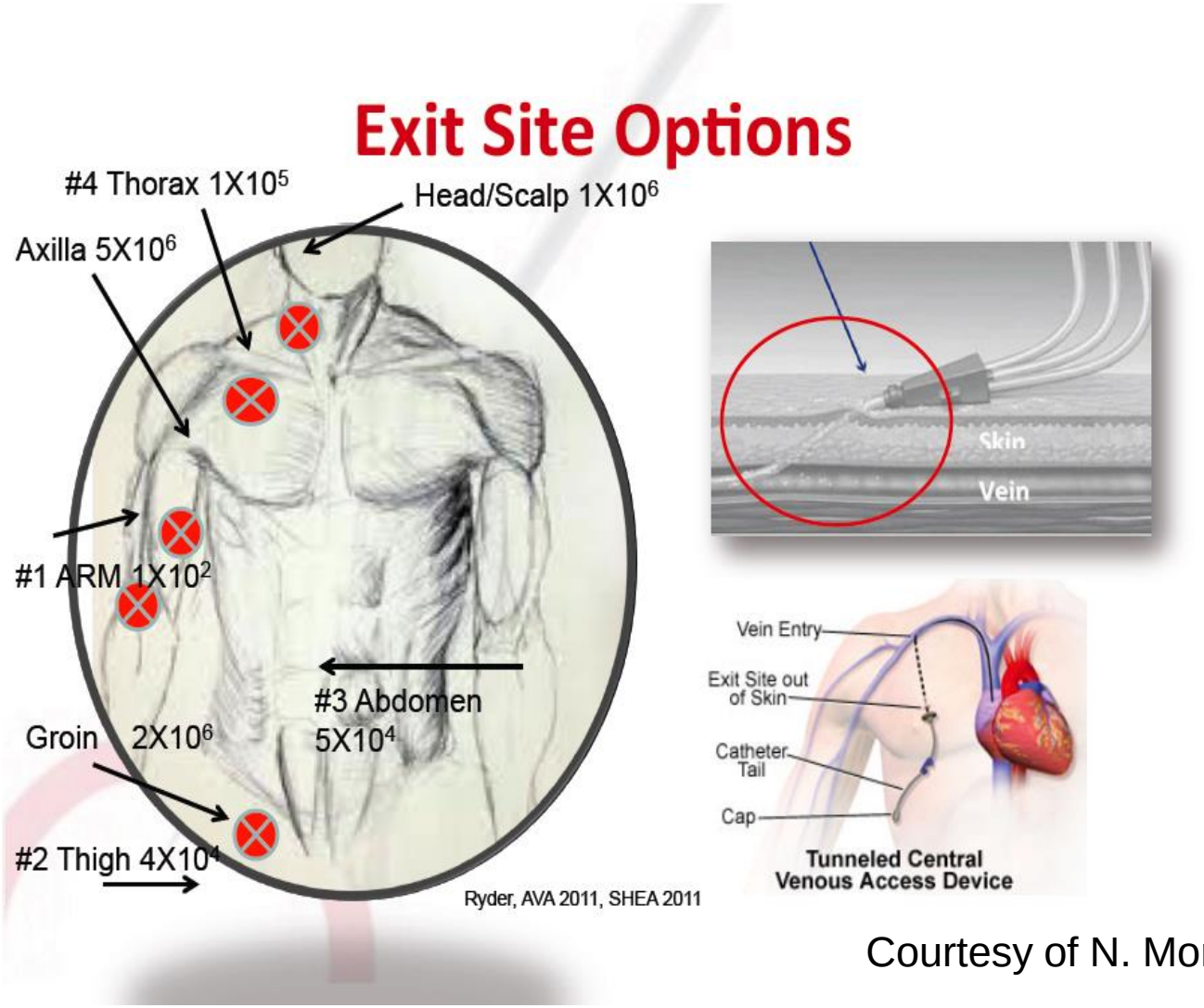
27.2 Vessel health and preservation are prioritized during site selection.

27.3 The type and duration of infusion therapy, patient preference, and the patient's physiologic condition (eg, age, diagnosis, comorbidities) and vascular condition (eg, history of vascular access attempts, vessel and skin health at site of insertion and proximal) are assessed when preparing for site selection and VAD insertion.

27.4 Selection of the most appropriate vein and insertion site occurs in collaboration with the patient/caregiver and the health care team based on the projected treatment plan.



Exit Site Options

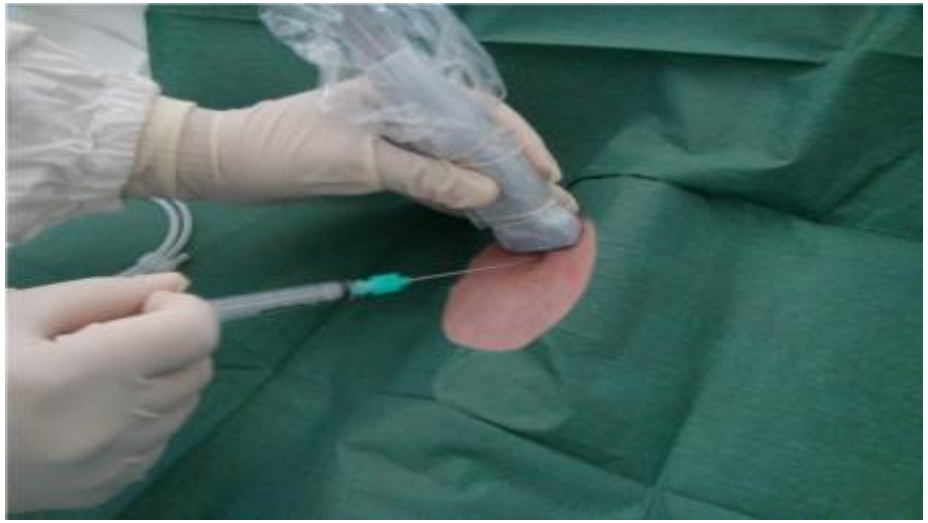


Courtesy of N. Moreau

Tunneling

- BEFORE INSERTION
  - HEALTH CARE WORKERS EDUCATION AND TRAINING
  - VAD SELECTION
  - EXIT SITE SELECTION
- DURING INSERTION
  - **ULTRASOUND GUIDANCE**
  - SKIN ANTISEPSIS (2% CHLORHEXIDINE)
  - SUTURELESS DEVICES
  - TRANSPARENT DRESSING
  - CYANOACRYLATE GLUE
  - ALL INCLUSIVE KIT INSERTION WITH MAXIMAL BARRIER PRECAUTIONS

Ultrasound guidance



Research

Open Access

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

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

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This article is online at: http://ccforum.com/content/10/6/R162

Critical Care, 2006

firmed by the present data. We found that the incidence of CVC-BSI in the ultrasound group of patients was significantly lower compared with that documented in the landmark group. The number of CVC-BSIs was significantly correlated to the number of needle passes in the total study population. We could speculate that repeated attempts might lead to a breakdown of aseptic technique and more colonisation of skin-related 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 average 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, central venous catheter-associated blood stream infection.

CDC 2011

7. Use ultrasound guidance to place central venous catheters (if this technology is available) to reduce the number of cannulation attempts and mechanical complications. Ultrasound guidance should only be used by those fully trained in its technique. [60–64]. *Category IB*

CENTERS FOR DISEASE CONTROL AND PREVENTION

Consensus 2012

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

CONFERENCE REPORTS AND EXPERT PANEL

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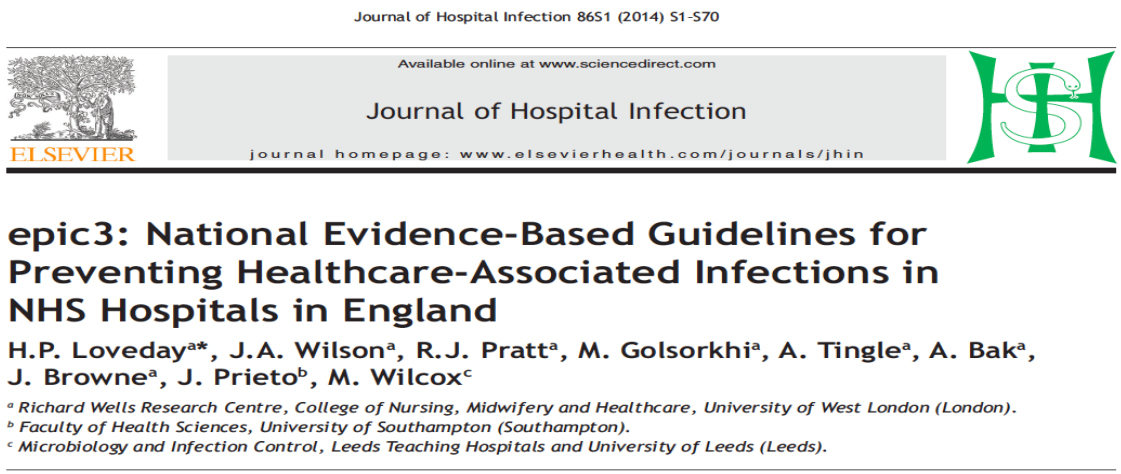
International evidence-based recommendations on ultrasound-guided vascular access

Linee Guida EPIC 2014

Consequently, the use of ultrasound may indirectly reduce the risk of infection by facilitating mechanically uncomplicated subclavian placement. In the UK, NICE guidelines provide



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

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Journal of Hospital Infection

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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 noninfectious complications of CVC placement.[100]

22. VASCULAR VISUALIZATION

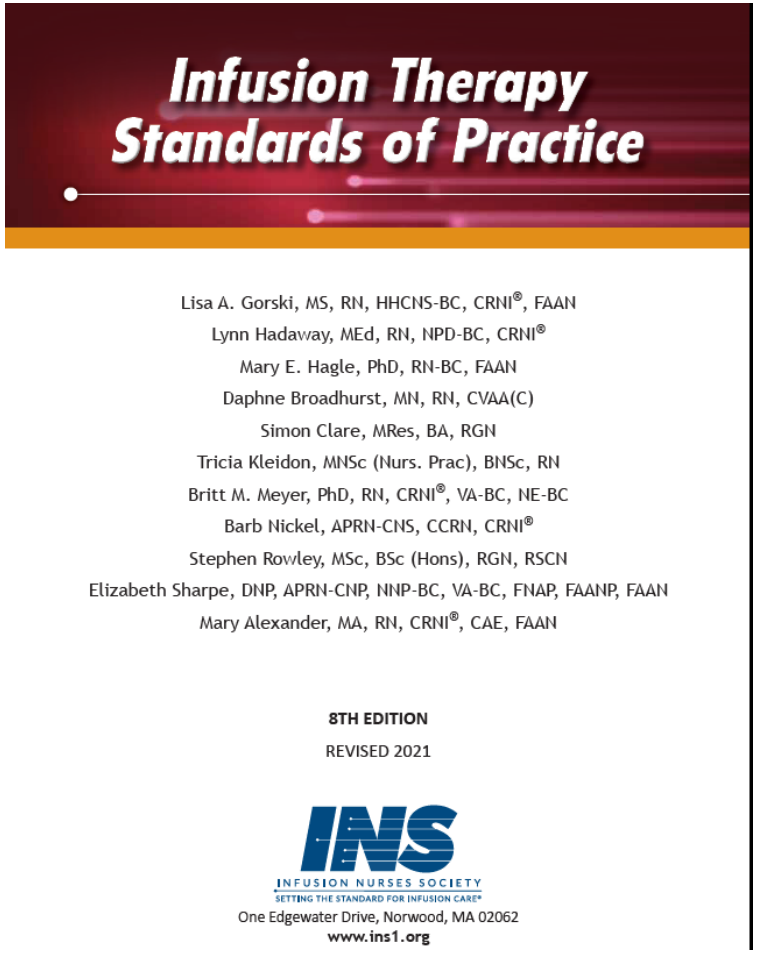
Standard

22.1 Vascular visualization technology is employed to increase insertion success of the most appropriate, least invasive vascular access device (VAD), minimizing the need to escalate to an unnecessary, more invasive device and to reduce insertion-related complications.

Practice Recommendations

A. Assess the patient's medical history for conditions that may affect the peripheral vasculature and increase the need for visualization technology to assist in locating appropriate venous or arterial insertion sites. Factors that increase difficulty with locating veins by observation and palpation (known as landmark techniques) include, but are not limited to:

1. Disease processes that result in structural vessel changes (eg, diabetes mellitus, hypertension).
2. History of frequent venipuncture and/or lengthy courses of infusion therapy.
3. Variations in skin between patient populations, such as darker skin tones and excessive hair on the skin.
4. Skin alterations, such as the presence of scars or tattoos.
5. Patient's age (both neonates and the elderly).
6. Obesity.
7. Fluid volume deficit.[1-5] (I)



- BEFORE INSERTION
  - HEALTH CARE WORKERS EDUCATION AND TRAINING
  - VAD SELECTION
  - EXIT SITE SELECTION
- DURING INSERTION
  - ULTRASOUND GUIDANCE
  - **SKIN ANTISEPSIS (2% CHLORHEXIDINE)**
  - SUTURELESS DEVICES
  - TRANSPARENT DRESSING
  - CYANOACRYLATE GLUE
  - ALL INCLUSIVE KIT INSERTION WITH MAXIMAL BARRIER PRECAUTIONS

HEALTHCARE EPIDEMIOLOGY INVITED ARTICLE

Robert A. Weinstein, Section Editor

Chlorhexidine: Expanding the Armamentarium for Infection Control and Prevention

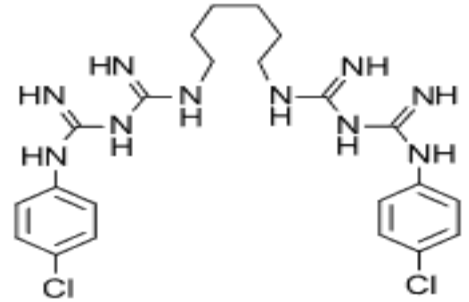
Aaron M. Milstone,[1,3] Catherine L. Passaretti,[2,3] and Trish M. Perl[2,3]

[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 Advantages

- Bactericidal
- Broad Activity on Gram +, Gram -, anaerobes and Fungi
- Rapid onset of activity
- Prolonged antimicrobial effect
- Sinergy with alcohol
- Active also in presence of blood and serum



33. VASCULAR ACCESS SITE PREPARATION AND SKIN ANTISEPSIS

Standard

33.1 Skin antisepsis is performed prior to VAD placement.

33.2 The intended VAD insertion site is visibly clean prior to application of an antiseptic solution; if visibly soiled, cleanse the intended site with soap and water prior to application of antiseptic solution(s).

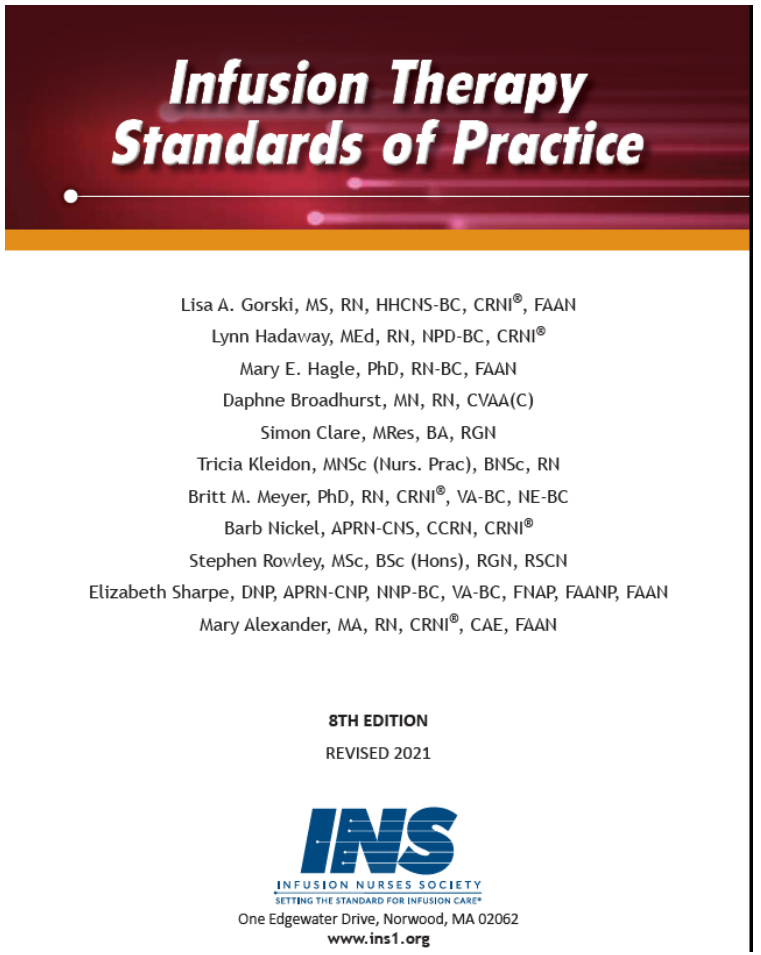
Practice Recommendations

A. Remove excess hair at the insertion site if needed to facilitate application of VAD dressings; use single-patient-use scissors or disposable-head surgical clippers; do not shave as this may increase the risk for infection.[1,2] (I)

B. Evaluate patient history of any allergy or sensitivity to skin antiseptics (see Standard 55, *Catheter-Associated Skin Injury*).[3,4] (V)

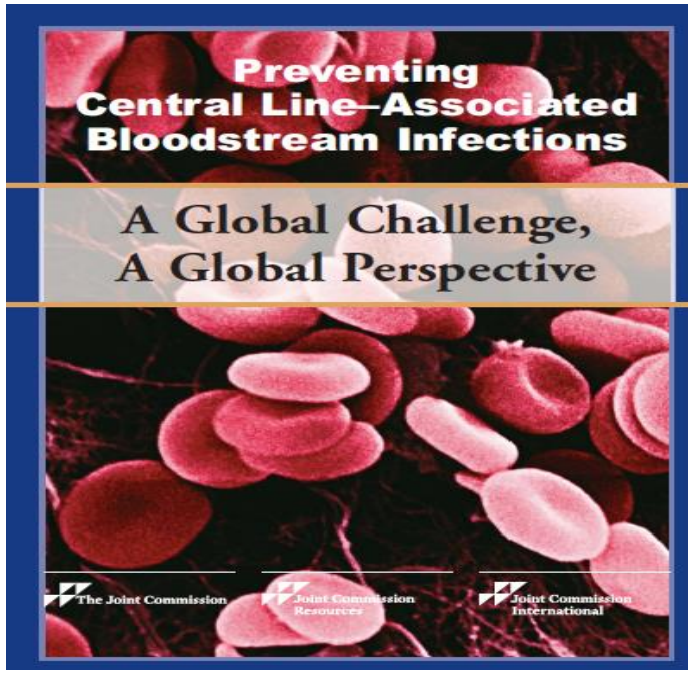
C. Perform skin antisepsis using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution.[5-10] (I)

   1. If there is a contraindication to chlorhexidine solution, an iodophor (eg, povidone-iodine) or 70% alcohol may also be used.[5,6,10] (IV)



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.



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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.

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

Class A

IVAD15 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

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

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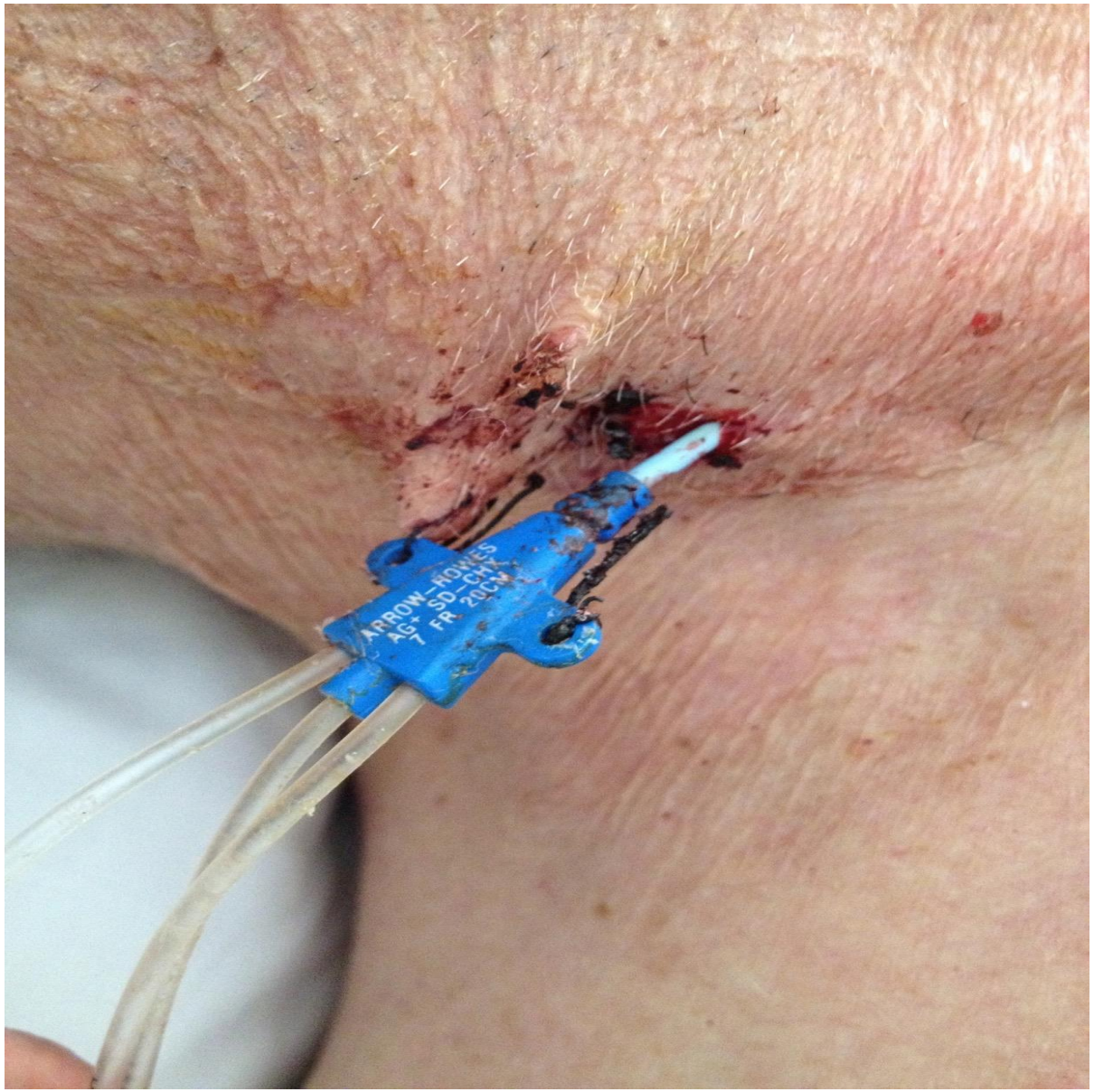
THE RISK OF SUTURE…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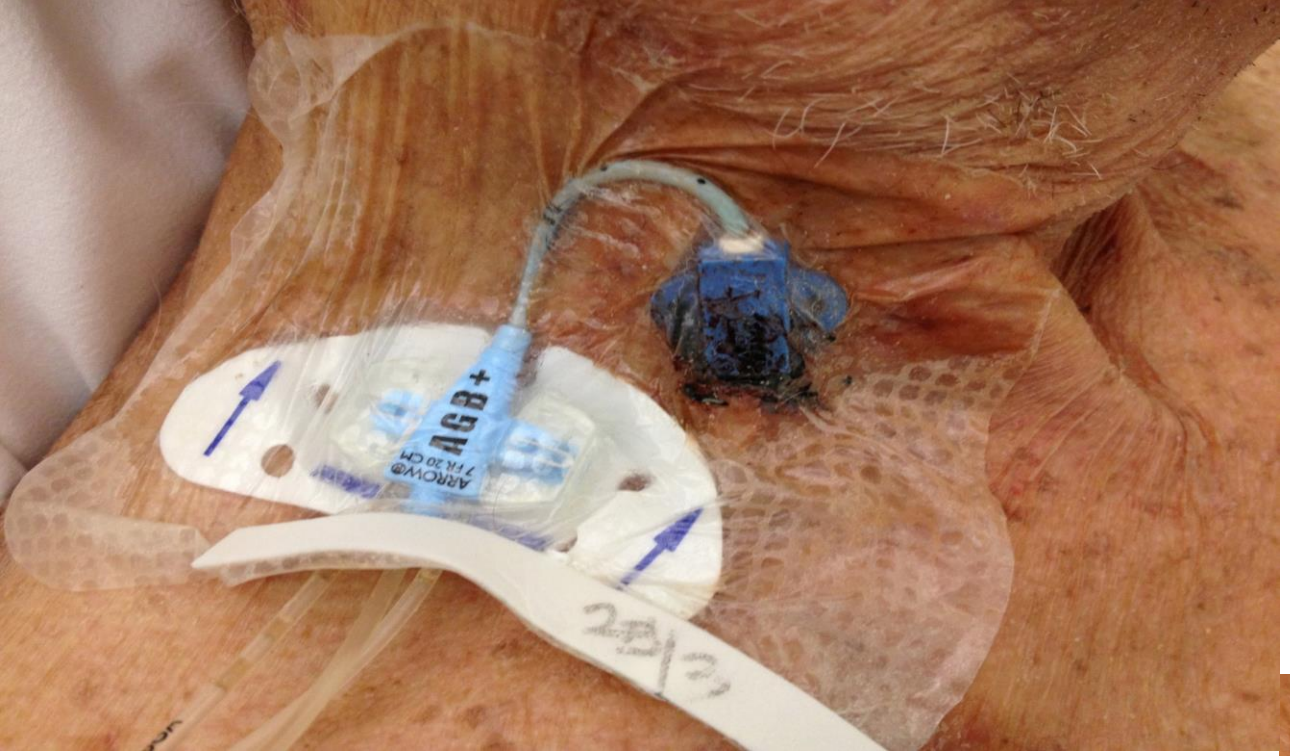
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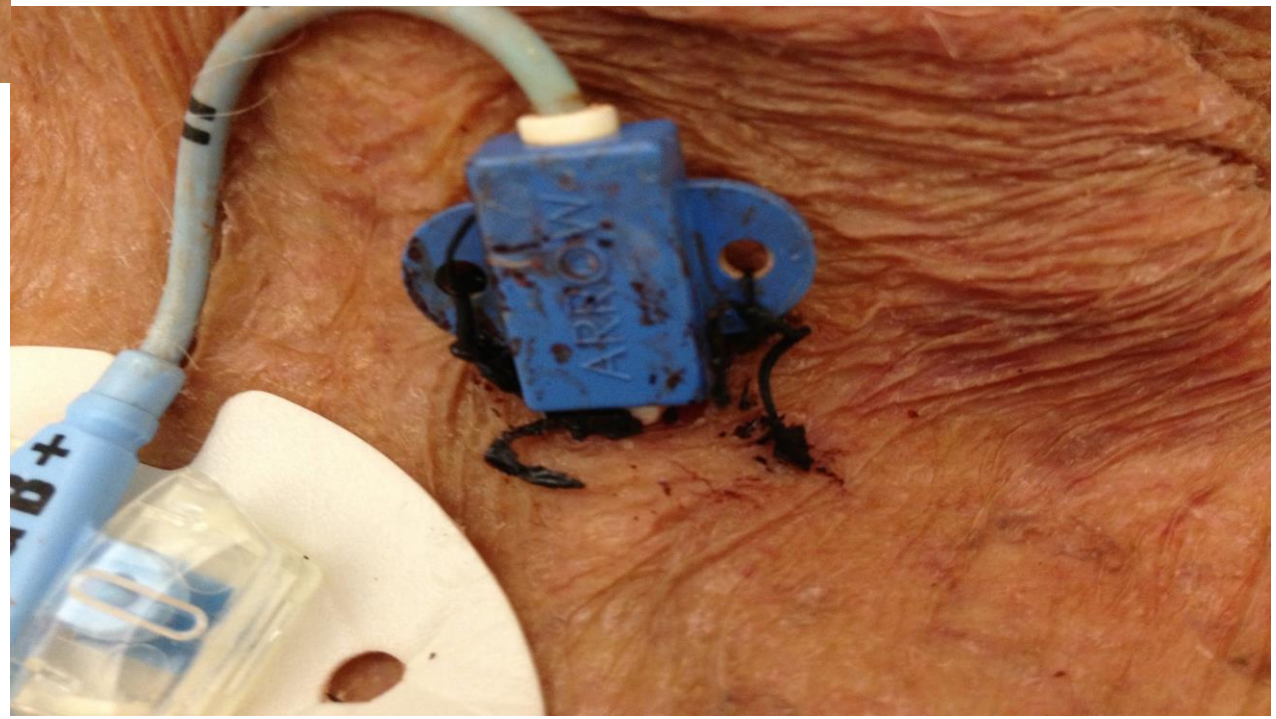

ARROW

38. VASCULAR ACCESS DEVICE SECUREMENT

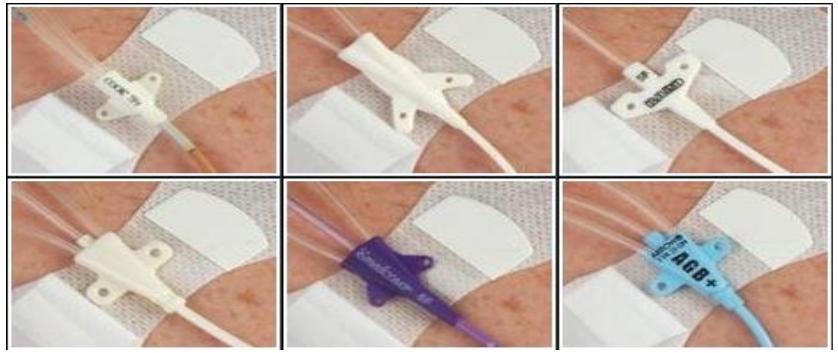
KEY DEFINITIONS

Adhesive securement device (ASD): an adhesive-backed device that adheres to the skin with a mechanism to hold the VAD in place; a separate dressing is placed over the ASD. Both the dressing and ASD must be removed and replaced at specific intervals during the VAD dwell time.

Integrated securement device (ISD): a device that combines a dressing with securement functions; includes transparent, semipermeable window and a bordered fabric collar with built-in securement technology.

Subcutaneous anchor securement system (SASS): a securement device that anchors the VAD in place via flexible feet/posts that are placed just beneath the skin; these act to stabilize the catheter right at the point of insertion. A separate dressing is placed over the SASS. The SASS does not need to be changed at regular intervals when the dressing is changed; it can remain in place if there are no associated complications.

Tissue adhesive (TA): a medical-grade cyanoacrylate glue that can seal the insertion site and temporarily bond the catheter to the skin at the point of insertion and under the catheter hub. TA should be reapplied at each dressing change.

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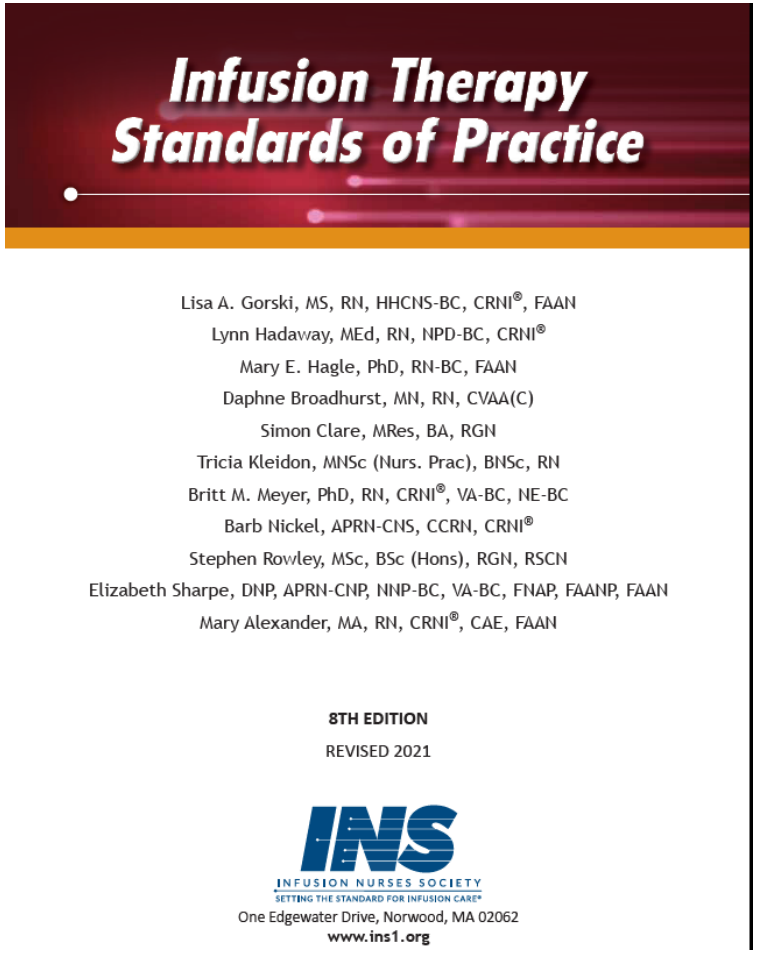
Practice Recommendations

A. Use a securement method (integrated securement device [ISD]; subcutaneous anchor securement system [SASS], tissue adhesive (TA) or adhesive securement device [ASD]), in addition to the primary dressing, to stabilize and secure VADs. Inadequate securement can cause unintentional dislodgement and complications requiring premature removal.
   1. Additional securement as an adjunct to the primary dressing reduces motion at the insertion site and subsequent complications that interrupt necessary infusion therapy; decreases pain, fear, and anxiety related to VAD replacement; and reduces the overall cost of health care.[1-12] (I)

B. Choose the most appropriate method for VAD securement based upon factors including VAD type, patient age, skin turgor and integrity, anticipated duration of therapy, previous adhesive skin injury, and any type of drainage from the insertion site.[1-7] (II)

C. Avoid use of sutures as they are not effective alternatives to a securement method; sutures are associated with needlestick injury, support the growth of biofilm, and increase the risk of CABSI.[6-12] (II)



British Journal of Nursing, Vol. 28, No. 2 · Research

Clinical experience of a subcutaneously anchored sutureless system for securing central venous catheters

Mauro Pittiruti, Giancarlo Scoppettuolo, Laura Dolcetti, Davide Celentano, Alessandro Emoli, Bruno Marche, Andrea Musarò

Published Online: 23 Jan 2019 | https://doi.org/10.12968/bjon.2019.28.2.S4

Abstract

This article reports the results of three prospective clinical studies conducted in a university hospital regarding the efficacy, safety and cost effectiveness of a subcutaneously anchored sutureless system for securing central venous catheters. The results were favourable to the adoption of such a device, and the analysis of the data allowed the authors to define those categories of patients where the device should have the most benefit: neonates, children, non-compliant older patients with cognitive difficulties, patients with skin abnormalities that may

Original research article

JVA | The Journal of Vascular Access

GAVeCeLT-WoCoVA Consensus on subcutaneously anchored securement devices for the securement of venous catheters: Current evidence and recommendations for future research

The Journal of Vascular Access
1–10

DOI: 10.1177/1129729820924568
journals.sagepub.com/home/jva
SAGE

Fulvio Pinelli[1], Mauro Pittiruti[2], Ton Van Boxtel[3], Giovanni Barone[4], Roberto Biffi[5], Giuseppe Capozzoli[6], Alessandro Crocoli[7], Stefano Elli[8], Daniele Elisei[9], Adam Fabiani[10], Cristina Garrino[11], Ugo Graziano[12], Luca Montagnani[13], Alessio Pini Prato[14], Giancarlo Scoppettuolo[15], Nicola Zadra[16], Clelia Zanaboni[17], Pietro Zerla[18], Evangelos Konstantinou[19], Matt Jones[20], Hervé Rosay[21], Liz Simcock[22], Marguerite Stas[23] and Gilda Pepe[15]

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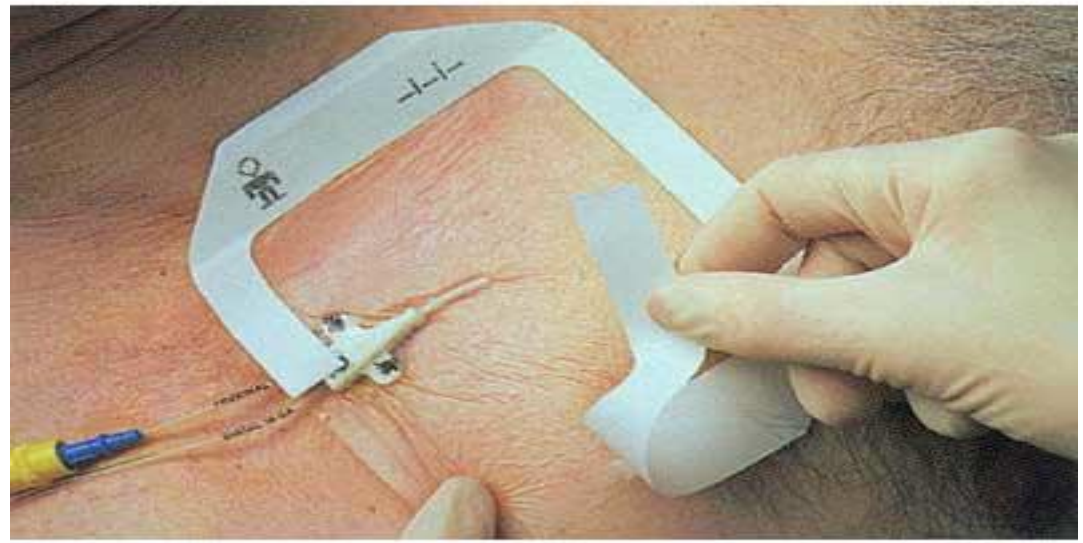

IVAD17 Use a sterile, transparent, semi-permeable polyurethane dressing to cover the intravascular insertion site.

Class D/GPP

IVAD18 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

IVAD19 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

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

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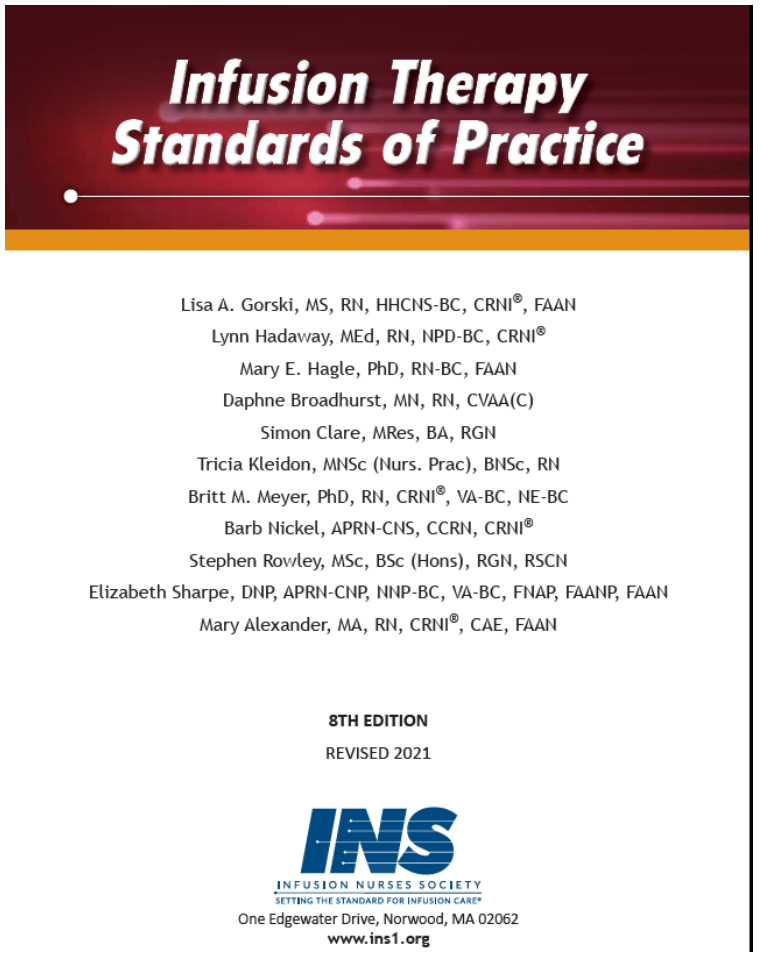
K. Select the type of sterile dressing (TSM or gauze) considering factors such as the type of VAD, risk of bleeding or infection, skin condition, known allergies or sensitivities, patient size, patient preference, cost, sterility, wear time, and ease of use of dressing, with the goal of selecting and applying a dressing that will have minimal dressing disruptions (as multiple dressing changes increase the risk of infection).[10,19,31-50] (I)

1. Limited evidence suggests a TSM dressing, which permits site visualization and reduces the number of dressing changes, is associated with less catheter failures due to dislodgement or accidental removal.[34] (I)
2. Use sterile gauze dressings for drainage from the catheter exit site (unless hemostatic agent used to absorb serosanguinous drainage) or if patient is diaphoretic.[5,14,39,51] (V)



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Further benefits of cyanoacrylate glue for central venous catheterisation

G. Scoppettuolo, L. Dolcetti, A. Emoli, A. La Greca, D. G. Biasucci, M. Pittiruti

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ALTRI VIDEO

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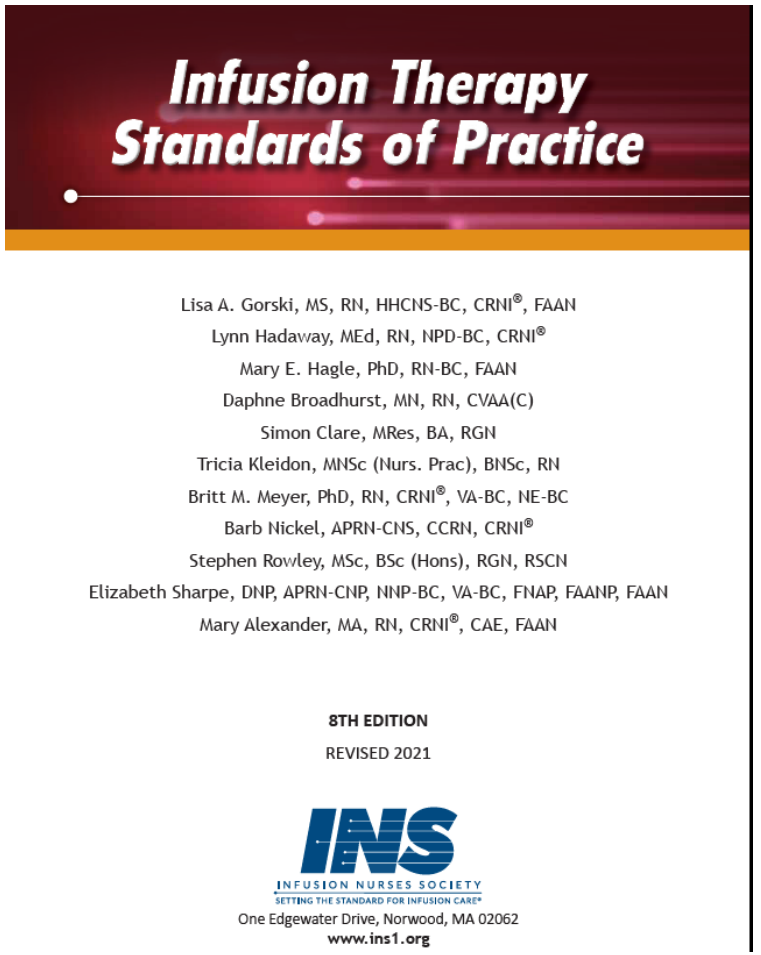
Tissue adhesive (TA): a medical-grade cyanoacrylate glue that can seal the insertion site and temporarily bond the catheter to the skin at the point of insertion and under the catheter hub. TA should be reapplied at each dressing change.

H. Assess the benefits of TA as an adjunct to the primary method of dressing and securement as it provides immediate hemostasis at the insertion site and prolongs the interval between VAD insertion and the first dressing change. The application of TA at the catheter insertion site has been demonstrated in in vivo trials, animal studies, and some small clinical trials to provide a barrier to microorganism growth on the catheter tip. Confirmatory clinical trials are inconclusive; a pediatric pilot RCT reported a reduction in catheter tip colonization; however, 1 large, adult RCT reported no reduction in microorganisms cultured on catheter tips, suggesting



Original research article

JVA | The Journal of Vascular Access

Reduction of bacterial colonization at the exit site of peripherally inserted central catheters: A comparison between chlorhexidine-releasing sponge dressings and cyano-acrylate

The Journal of Vascular Access
1–5

DOI: 10.1177/1129729820954743
journals.sagepub.com/home/jva
SAGE

Emanuele Gilardi[1], Alfonso Piano[1], Pietro Chellini[1], Barbara Fiori[2], Laura Dolcetti[3], Mauro Pittiruti[4] and Giancarlo Scoppettuolo[3]

Abstract

Introduction: A serious complication associated with Central Venous Access Device (CVAD) is infection because of bacterial contamination, either by the extra-luminal or by the intra-luminal route.

We evaluated the efficacy, the safety, and the cost-effectiveness of two strategies for non-inferiority in controlling bacterial colonization of the exit-site of Peripherally-Inserted Central Catheters (PICC).

Methods: After PICC placement, a skin swab of the exit site was taken and cultured. In group A the exit site was sealed with N-butyl-cyanoacrylate glue, while in group B a chlorhexidine-releasing sponge dressing was applied. A second skin culture was taken at day 7.

Results: A total of 51 patients were enrolled in each group. In 42 patients the second skin culture was not performed because of 20 patients were lost at follow-up or deceased and in 22 patients the dressing needed to be changed early, because of local bleeding (13 cases, in group B) or because of dressing detachment (four in group A and five in group B). The microbiological study was completed in 36 patients in group A and 24 in group B. No microorganisms were isolated in any patient.

Conclusions: Both strategies were effective in controlling bacterial colonization. Glue was effective in reducing local bleeding, and it was more cost-effective than sponge dressing. During the first week, when local bleeding and bacterial colonization must be prevented, glue might be more appropriate than chlorhexidine-releasing dressing; after the first week chlorhexidine-releasing dressing might be preferable, considering that the safety of glue application on the skin for

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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

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

COVID-19 Personal Protective Equipment (PPE) for Healthcare Personnel

Preferred PPE – Use N95 or Higher Respirator

Acceptable Alternative PPE – Use Facemask

CDC

cdc.gov/COVID19

In the field of vascular access, at the time of Covid – 19, our main goals are:

- **The safety of the operator**
  - Knowledge of proper PPE
  - Certified competency in the use of PPE (donning and doffing)
- **The safety of the patient**
  - Wise choice of vascular device (peripheral or central)
  - Wise choice of the technique of insertion
  - Wise choice of strategies to prevent contamination during insertion
    - Hand hygiene
    - 2% Chlorhexidine in 70% isopropyl alcohol skin antisepsis
    - Maximal barrier precautions

GloVANet
Global Vascular Access Network

WoCoVA
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JVA The Journal of Vascular Access

Editorial

Vascular access in COVID-19 patients: Smart decisions for maximal safety

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Abstract

The 2020 COVID pandemic has forced everyone to update the usual medical procedures and adapt them to a new situation characterized by a high risk of contamination of the health operator. The placement of a venous access device is no exception. In the experience of the vascular access team of our hospital, hit by the COVID epidemic in March 2020, the safety of both the patient and the staff can be ensured by an insertion bundle of few smart strategies, which include choice of long dwelling peripheral catheters (midline catheters) rather than short venous cannulas; use of power injectable peripherally inserted central catheters in the COVID patients in intensive care unit requiring a central line; use of wireless probes—easy to carry, easy to clean—for ultrasound guided venipuncture; avoidance of x-rays, using alternative methods for tip location such as intracavitary electrocardiography or trans-thoracic echocardiography; strict adoption of the barrier precautions recommended by the international guidelines.

Keywords

COVID, coronavirus, venous access device, central venous catheter, PICC, midline, tip location, ultrasound guidance

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- WISE CHOICE OF THE PERIPHERAL VAD
- WISE CHOICE OF THE CENTRAL VAD
- WISE CHOICE OF THE TECHNIQUE OF INSERTION
- **ADOPTION OF PRECAUTIONS FOR AVOIDING CONTAMINATION**

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Adoption of the recommended precautions for avoiding contamination

Last but not least, insertion of MC and PICC is performed following the CDC recommendations for vascular access in COVID patients:[12] the operator must strictly adopt the "standard" maximal barrier precautions (hand hygiene, surgical mask, beret, sterile impermeable gown, sterile gloves, wide sterile drapes over the patient, appropriate sterile cover for the ultrasound probe); furthermore, the patient and all other persons in the room must wear a mask. The use of N95 mask is strongly recommended for aerosol generating procedures, which is usually not the case of VAD insertion, and in particular not when the VAD (MC or PICC) is inserted at the arm. Nonetheless, in COVID patients, a N95 mask should be always considered, and used appropriately (i.e. coupled with a surgical mask).

As COVID-19 unfortunately continues, it is important to focus on infection control. For this reason, we expect that more and more hospitals will have to develop local policies for vascular access insertion in these very special patients. We hope that these few suggestions from our VAD team can aid others to develop insertion bundles apt to minimize any possible harm to the patient and to the staff.

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Critical Care

COMMENTARY Open Access

Recommendations for the use of vascular access in the COVID-19 patients: an Italian perspective

Mauro Pittiruti[1*], Fulvio Pinelli[2] on behalf of the GAVeCeLT Working Group for Vascular Access in COVID-19

Keywords: COVID-19, Vascular access devices, Central venous catheters

DONNING PPE BEFORE ENTERING THE ISOLATION ROOM

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US SCAN OF THE VEINS

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STERILE GOWN AND STERILE GLOVES

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FULL BODY STERILE DRAPE

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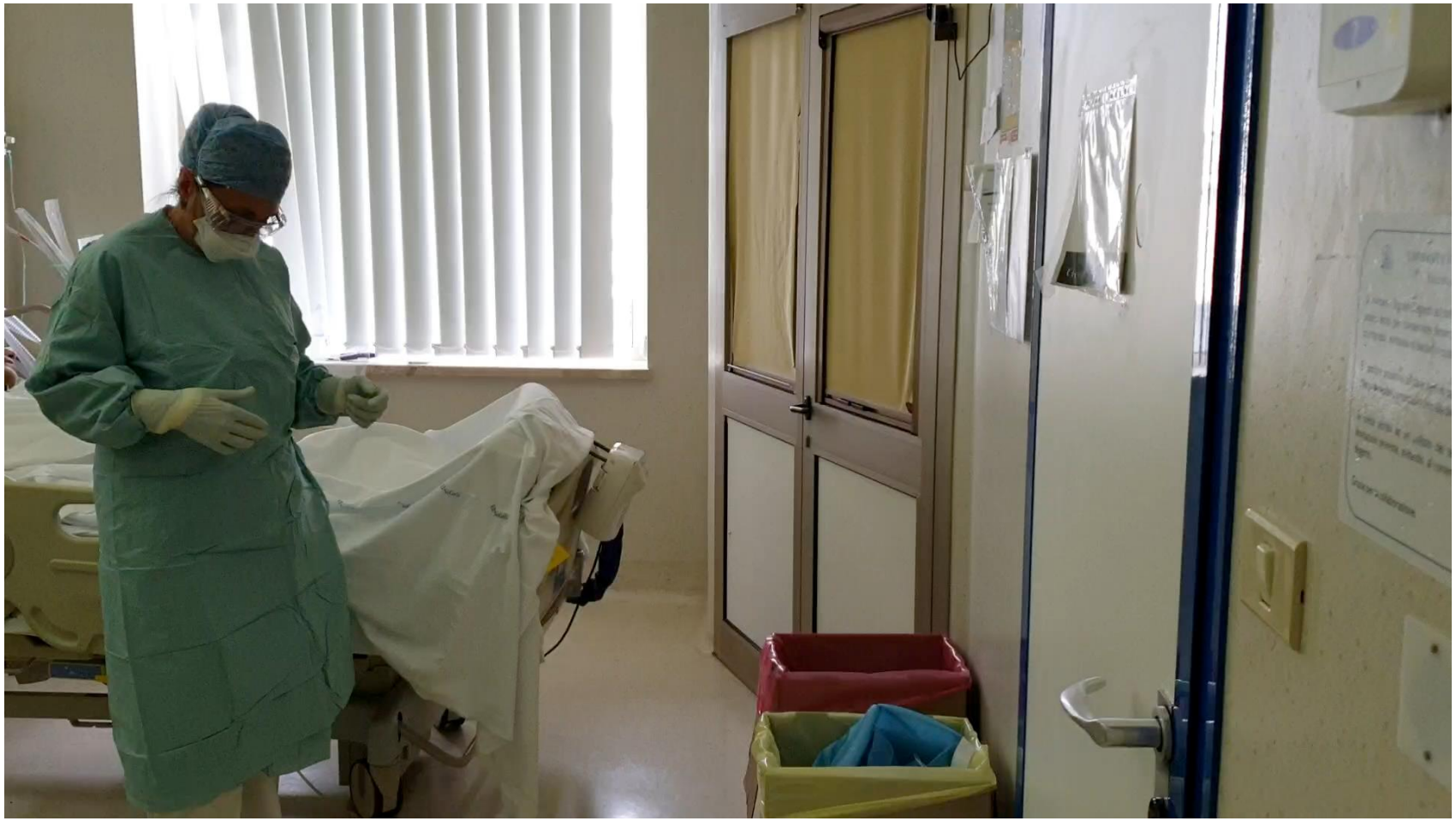
REMOVING STERILE GOWN AND STERILE GLOVES (IN THE ROOM)



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REMOVING FOOTWEARS, NON STERILE GOWN AND NON STERILE GLOVES (IN THE ROOM)

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REMOVING GOOGLES, RESPIRATOR AND CAP

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Conclusions

- CRBSI still remain a relevant problem in clinical practice
- Compared to a few years ago, there are many more possibilities for effective prevention
- The most effective weapon for prevention is the insertion and management bundle
- An effective bundle includes modern technologies and classical behaviors
- At the time of Covid 19, the bundles for prevention must be adapted to the need to protect both the patient and the operator

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Thank you very much for your attention!

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