

Prevention of Central Venous Catheter Infections: Aseptic Insertion and Site Selection

Vineet Chopra MD, MSc
Assistant Professor of Medicine
Research Scientist



Conflicts Of Interest

Grant/Contract Funding

- *Agency for Healthcare Research and Quality*
- *National Institute for Health*
- *National Institute for Aging*
- *Blue Cross Blue Shield Foundation of Michigan*
- *Veterans Health Administration*
- *Centers for Disease Control and Prevention*

Disclosure of Off-Label and/or investigative Uses

I will not discuss off label use and/or investigational use



Presenter

Vineet Chopra, MD, MSc

Assistant Professor of Medicine/Research Scientist
Patient Safety Enhancement Program
University of Michigan Health System

Contributions by

Payal Patel MD, MPH
University of Michigan

Len Mermel, DO, MS, FACP, FIDSA, FSHEA
Medical School of Brown University



Learning Objectives

- Understand the importance of preparing the site for CVC insertion
- Recognize the role of various antiseptics in preventing catheter infections
- Describe the considerations for choosing a site for CVC insertion



Preparing the Site for CVC Insertion

- Skin antisepsis is the cornerstone of prevention of CLABSI
 - Skin pathogens common cause of CLABSI
 - Esp. for CLABSI that occurs within 7-days of insertion
 - Preparing the site appropriately can reduce risk of catheter-related infection
 - Prevent transmission during infection
 - Reduce burden of bacteria on exit site



Which Skin Preparation is Best?

- Available skin preparations include
 - Chlorhexidine-gluconate
 - Aqueous
 - Alcohol-containing
 - Povidone-Iodine
 - Alcohol Preparation without Iodine or CHG



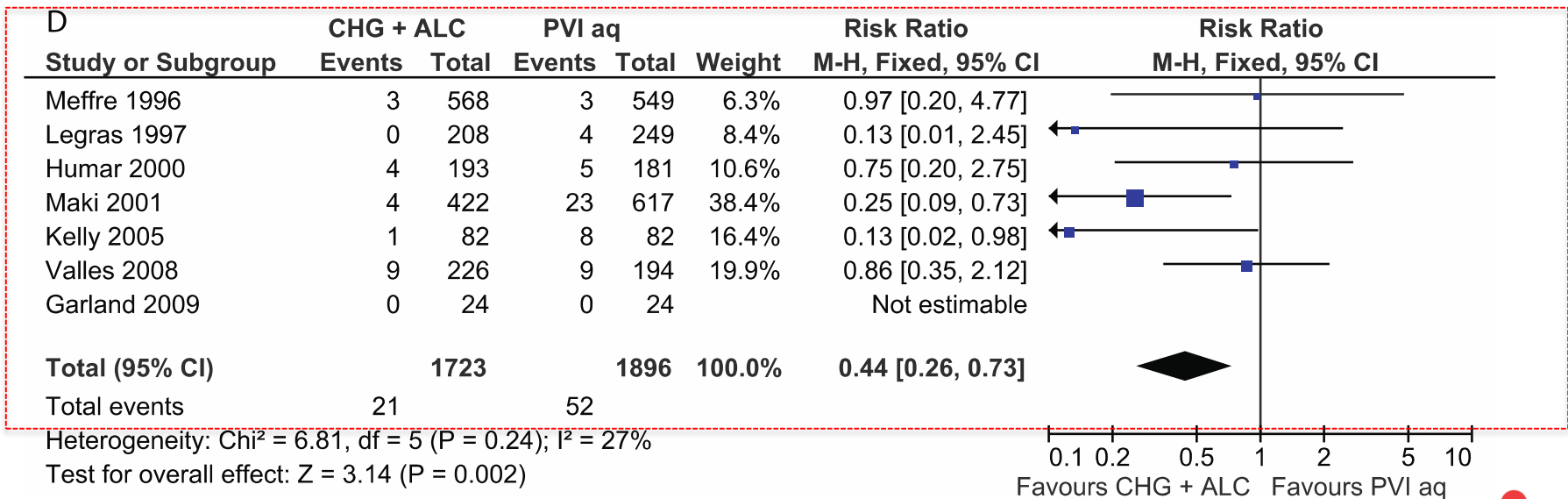
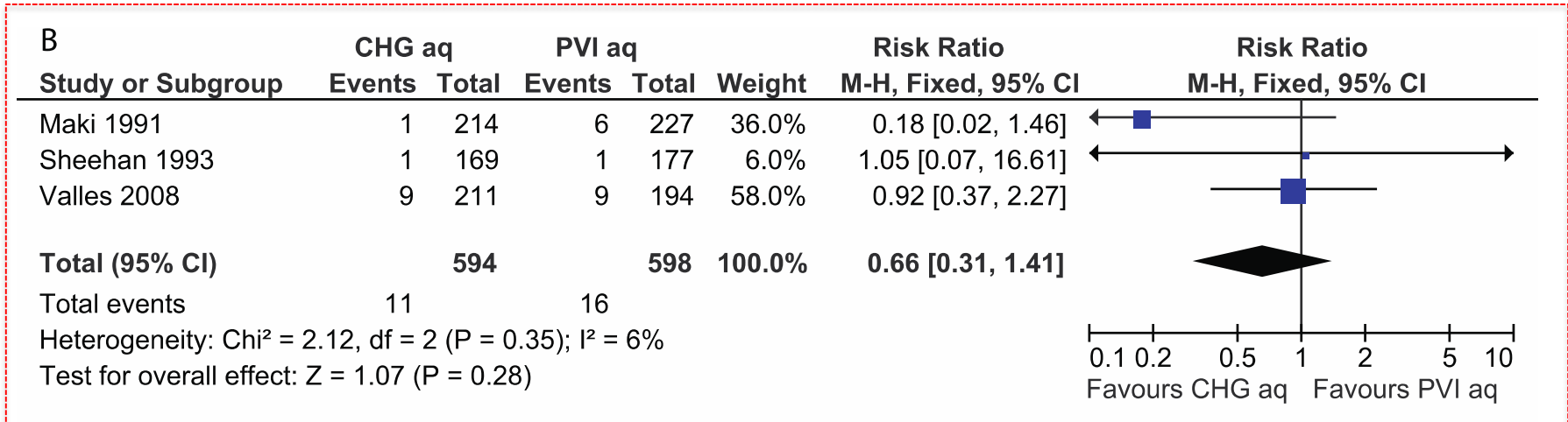
CHG as A Skin Antiseptic

**Compared to povidone iodine,
Chlorhexidine use for skin antisepsis
significantly reduced risk of CLABSI**

Risk Ratio 0.49 (95%CI 0.27-0.97%)



The Forgotten Role of Alcohol



What is the active ingredient?

- It the alcohol or the chlorhexidine that matters most?
 - In identical concentrations of alcohol, does CHG outperform povidone iodine?
- Does cleaning the skin with soap before catheter insertion make a difference?
- What concentration of chlorhexidine is best?



The CLEAN Trial

Skin antisepsis with chlorhexidine–alcohol versus povidone iodine–alcohol, with and without skin scrubbing, for prevention of intravascular-catheter-related infection (CLEAN): an open-label, multicentre, randomised, controlled, two-by-two factorial trial



*Olivier Mimoz, Jean-Christophe Lucet, Thomas Kerforne, Julien Pascal, Bertrand Souweine, Véronique Goudet, Alain Mercat, Lila Bouadma, Sigismond Lasocki, Serge Alfandari, Arnaud Friggeri, Florent Wallet, Nicolas Allou, Stéphane Ruckly, Dorothée Balayn, Alain Lepape, Jean-François Timsit, for the CLEAN trial investigators**

- Randomized controlled trial, n=2546
- 11 French ICUs, 6 different hospitals
- 2x2 factorial design, 4 treatment groups:
 - CHG or Povidone Iodine for antisepsis
 - Scrubbing with detergent vs. no scrubbing

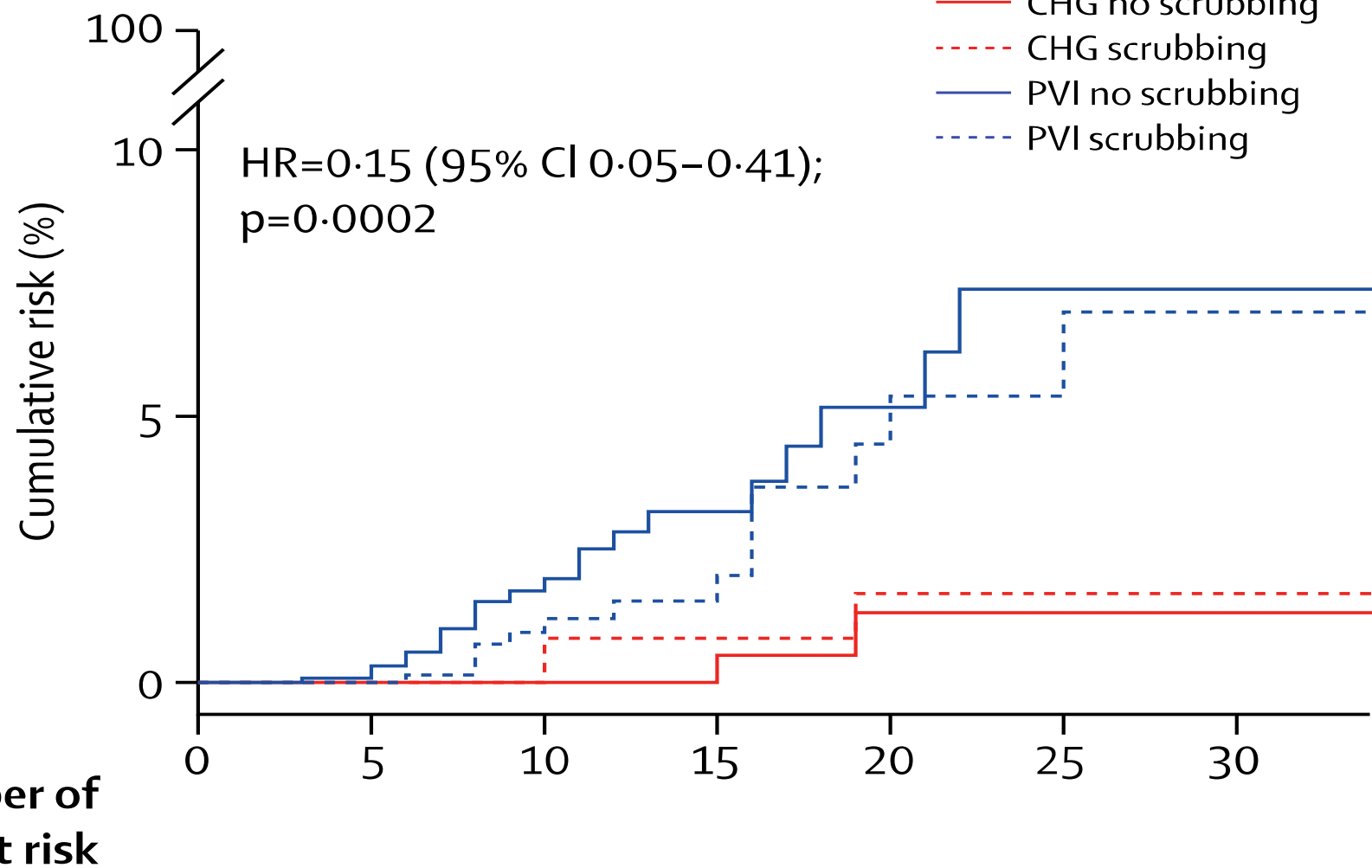


Product Used

- Chloraprep (2%CHG - 70% Isopropyl alcohol)
- 5% Povidone Iodine - 69% ethanol
- Applied either as:
 - 1 step: skin agent only
 - 2 step: clean with detergent first, then apply agent
- Because products looked different, unable to blind clinicians (but assessors were masked)



A Catheter-related infection



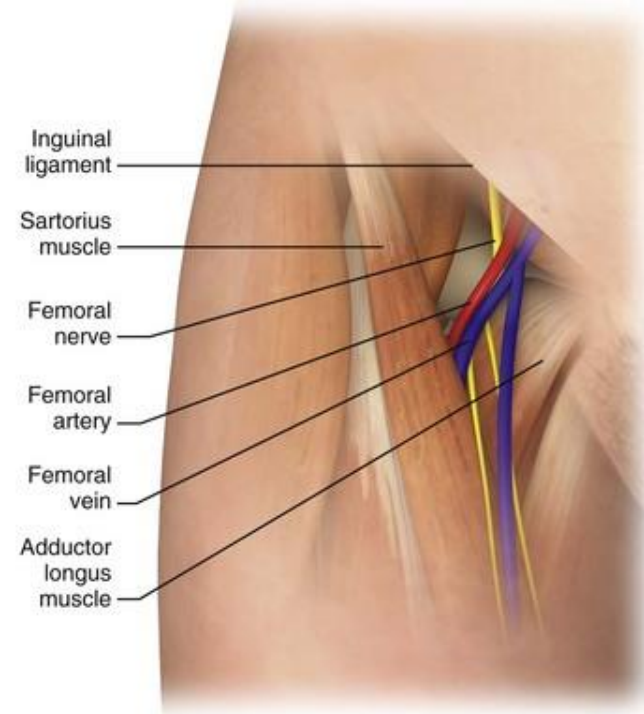
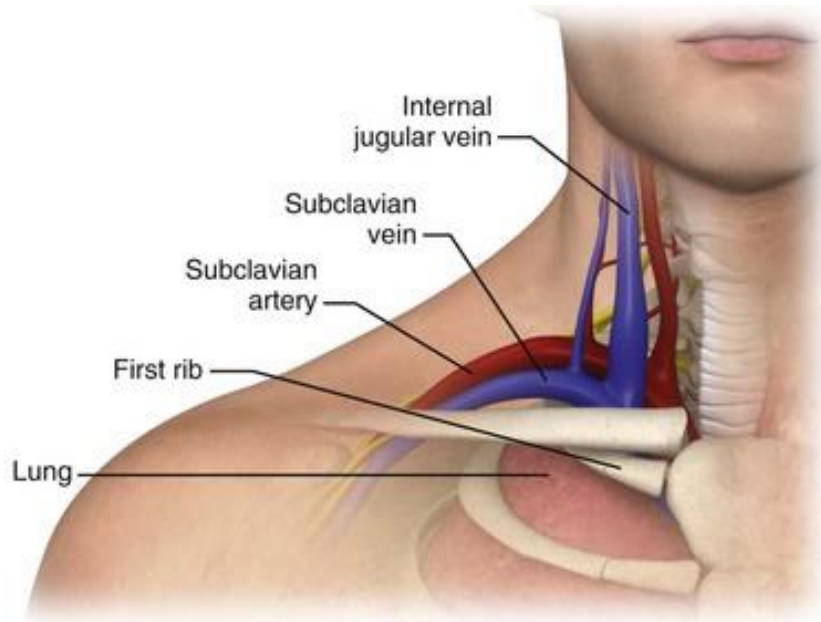
CHG—no scrubbing	1277	816	388	195	108	57	27
CHG—scrubbing	1270	792	362	180	104	56	35
PVI—no scrubbing	1326	888	418	199	100	43	20
PVI—scrubbing	1286	788	391	207	106	60	32

Summary

- CHG is superior to PI when administered head to head in the same alcohol concentration
- Skin scrubbing is a relic of the past
 - No longer necessary in an era of modern antiseptics and CHG use
- Alcohol-containing CHG: standard for skin antisepsis prior to CVC insertion
 - If pt. allergic, PI is a reasonable alternative



Site Selection for CVC Insertion



McNeil C, et al. (2015). Chapter 22: Central Venous Catheterization in Roberts and Hedges Clinical Procedures in Emergency Medicine.



Traditional Thinking About Site?

- Avoid the femoral site
 - Higher bacterial density
 - Harder to keep clean
 - Core component of keystone study, CLABSI Bundle
- What about IJ?
 - Problematic to keep site clean, dry, intact
 - Dressing, Oral Secretions, weight of catheter/tubing
- How does femoral and IJ compare to SC?



Is the Femoral Site Really Worse?

Femoral vs Jugular Venous Catheterization and Risk of Nosocomial Events in Adults Requiring Acute Renal Replacement Therapy

A Randomized Controlled Trial

- Randomized controlled trial, 750
- 9 university hospitals, 3 general hospitals
- Randomized to IJ or FV placement
- Results:
 - More hematomas in IJ
 - No difference in rate of CLABSI between IJ and FV



More Data questioning site

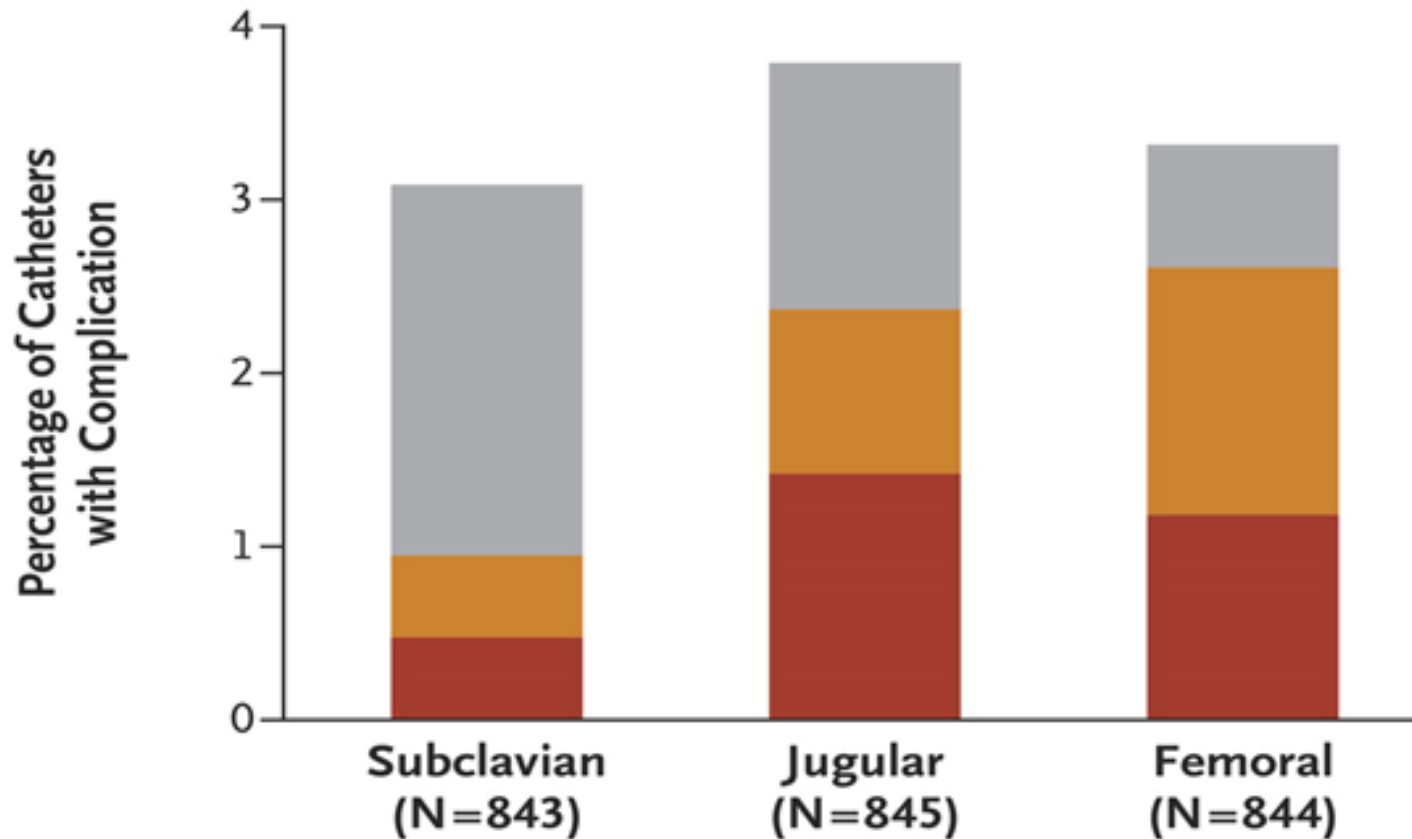
Meta-analysis of subclavian insertion and nontunneled central venous catheter-associated infection risk reduction in critically ill adults*

- Systematic Review; RCT + cohort studies
- 19 studies; 10 included in meta-analysis
 - Only one randomized site of insertion
- Results:
 - Risk of CLABSI lower for subclavian site (RR 0.47 [95%CI=0.27-0.82]) vs. others
 - When one large study excluded, no difference in risk between femoral and subclavian site

Parienti JJ et al. Crit Care Med, 2012



Definitive Data



RCT: Subclavian site associated with lower risk of catheter-related blood stream infection and DVT, but higher risk of pneumothorax



What about skin asepsis/site for PICCs?

- Limited data available!
- Avoid antecubital site or sites around elbow
 - Increase kink of catheter → increases failure
 - Higher bacterial density of skin ("groin of arm")
- Upper arm placement under US guidance associated with reduction in CLABSI
- Placement of PICCs in ICU settings – same risk of CLABSI as traditional CVCs

Harnage SA, JAVA 2007

Yokoe DS, Am J Inf Control 2014



Summary

- Alcohol-containing chlorhexidine for skin antisepsis must be effective at reducing CLABSI
- In allergic patients, PI is a suitable alternative
- Site of catheter insertion matters!
 - Subclavian: lowest risk of infection, but highest risk for insertion-related complications
 - No clear difference between IJ and FV
 - For PICCs, avoid the antecubital fossa



Further Reading

*What's new in catheter-related infection:
skin cleansing and skin antisepsis*

**Olivier Mimoz, Vineet Chopra & Jean-
François Timsit**

Intensive Care Medicine

ISSN 0342-4642

Intensive Care Med

DOI 10.1007/s00134-016-4244-4



References



THANK YOU!

