Prevention of CLABSI: From Theory to Practices in Asia Pacific

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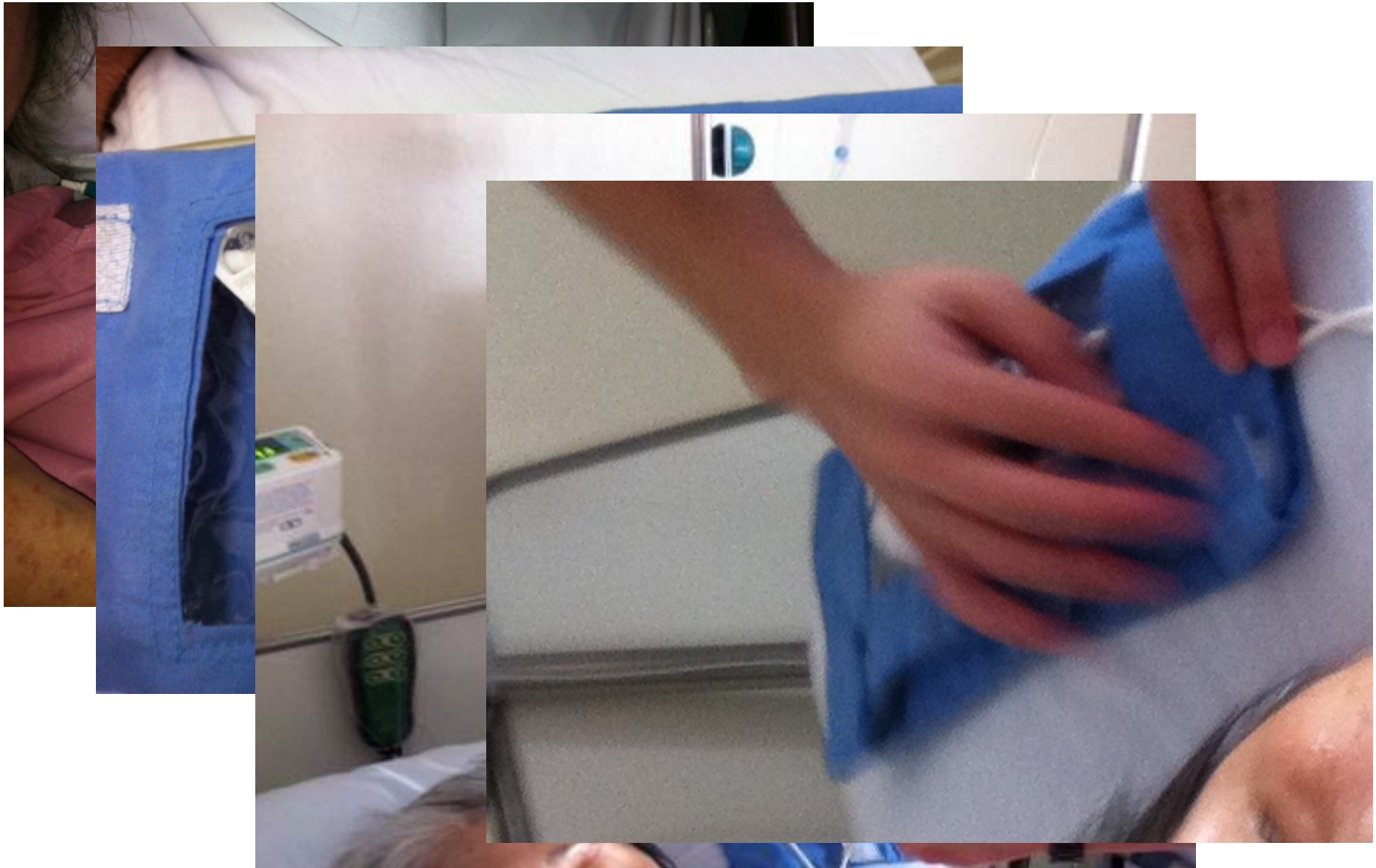
Objectives

- Share practices: what happen in reality?
- How common are those practices?
- What does it take to improve those practices?
- Emerging Issues and Technology for future

My Mother-in-Law Case



Do you think that use of plastic protector will help reduce infections?

- A) Yes
- B) No
- C) Unsure

My Mother-in-Law Case

Patient developed MRSA/VRE/ESBL CLABSI episodes

What are target for improvement to help reduce CLBASI?

- A) Reduce frequency of catheter manipulation
- B) Improve hand hygiene practice before manipulation catheter
- C) Disinfecting hub
- D) Reduce use of 3-way stop clock
- E) All of the above

Real-Life Pitfalls

- Frequent manipulation of the hubs
- No Hand Washing before and after procedure
- No disinfection at the hub
- Use of 3-way stop clock connected to each other
- Rely on unproven technology

Detection of 2 CLABSI cases due to *Candida albican*

Case

- During round with ID fellow at OB/GYN unit, 2 patients were noted to have CLABSI due to *Candida albicans*.
- Both patients had OB/GYN cancers (pt 1: ovarian cancer, pt 2: cervical cancer) with advanced stage IV and underwent surgical procedures for resection of bowel obstruction.
- Patient one admitted for 21 days and patient two for 14 days; both exposed to several antibiotics for nosocomial infections.
- Both patients had PICC line in place and receive TPN because of bowel obstruction and plan for palliative CMT.

Is this an outbreak?

- A) Yes
- B) No
- C) Not sure

Case (cont)

- On hospital day 30 (pt 1), hospital day 45 (pt 2), both developed fever and chill with T 39 C and normal physical examination.

- Hemocultures took from peripheral and PICC lines grew *C. albicans* with PICC line grow faster than peripheral 45 mins and 100 mins for patient 1 and 2, respectively.

What should be done now?

- A) Not an outbreak, do nothing
- B) Not an outbreak, just check with the ICN to do more education on line insertion
- C) Not an outbreak, but further investigation should be performed
- D) This is an outbreak and further investigation should be conducted
- E) This is an outbreak but may due poor immunocompromised host (cannot do anything more)

Diagnostic Usefulness of Differential Time to Positivity for Catheter-Related Candidemia

JCM
Journals.ASM.org

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A differential time to positivity (DTP) of ≥120 min is useful for diagnosing catheter-related bacteremia, but data on diagnosing catheter-related candidemia (CRC) in this way are limited. We wished to evaluate the usefulness of the DTP for diagnosing CRC. All adult patients who had the same *Candida* species isolated from blood cultures drawn simultaneously from a central venous catheter (CVC) and a peripheral vein were included at a tertiary care hospital over an 18-month period. A total of 105 patients with candidemia who had positive simultaneous CVC and peripheral vein blood cultures were included in our study. Sixty-one patients (58%) had CRC (47 definite and 14 probable), and 38 (36%) had candidemia from another source (non-CRC). The remaining 6 patients (6%) with indeterminate candidemia were excluded from the final analysis. The overall sensitivity and specificity of a DTP of ≥120 min for diagnosing CRC were 85% (95% confidence interval [CI], 74% to 93%) and 82% (95% CI, 66% to 92%), respectively, and for neutropenic patients, they were 75% (95% CI, 19% to 99%) and 100% (95% CI, 75% to 100%), respectively. For *Candida glabrata* infections, the optimal DTP cutoff was ≥6 h, with a sensitivity of 63% (95% CI, 35% to 85%) and a specificity of 75% (95% CI, 35% to 97%). In summary, DTP is useful for diagnosing CRC, and a DTP of ≥120 min appears to be the optimal cutoff except for CRC caused by *C. glabrata*. For neutropenic patients, DTP may be useful as an adjunct test to rule in CRC and to decide whether a catheter should be removed.

Case (cont)

- Observation was made in this unit and patients, insertion of catheters remains appropriate.

- However, several non-adherence to maintenance bundle was noted (e.g., not using glove, not using alcohol before manipulating hub, not washing hand when dressing wound near the catheter sites).

- Lessons learnt: In long-term catheter use (>6 days), maintenance bundle become more critical in these patients and thus monitoring of these components are crucial to prevent CLABSI.

Increasing in non-albicans candida spp. linked to poor maintenance care

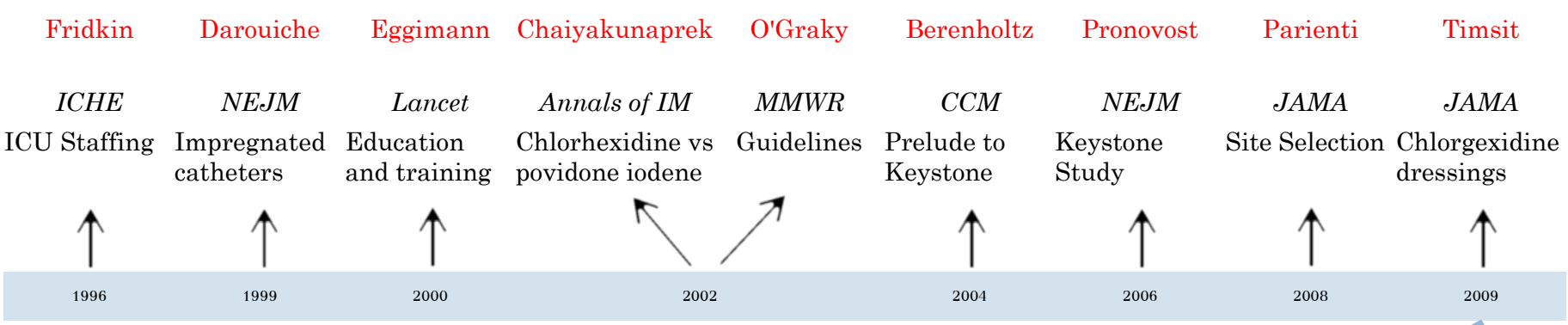
- A case-control was performed to evaluate risks for *C. parasilopsis (n = 9)* and *C. tropicalis (n= 20)* vs. *C. albicans (n = 40)*

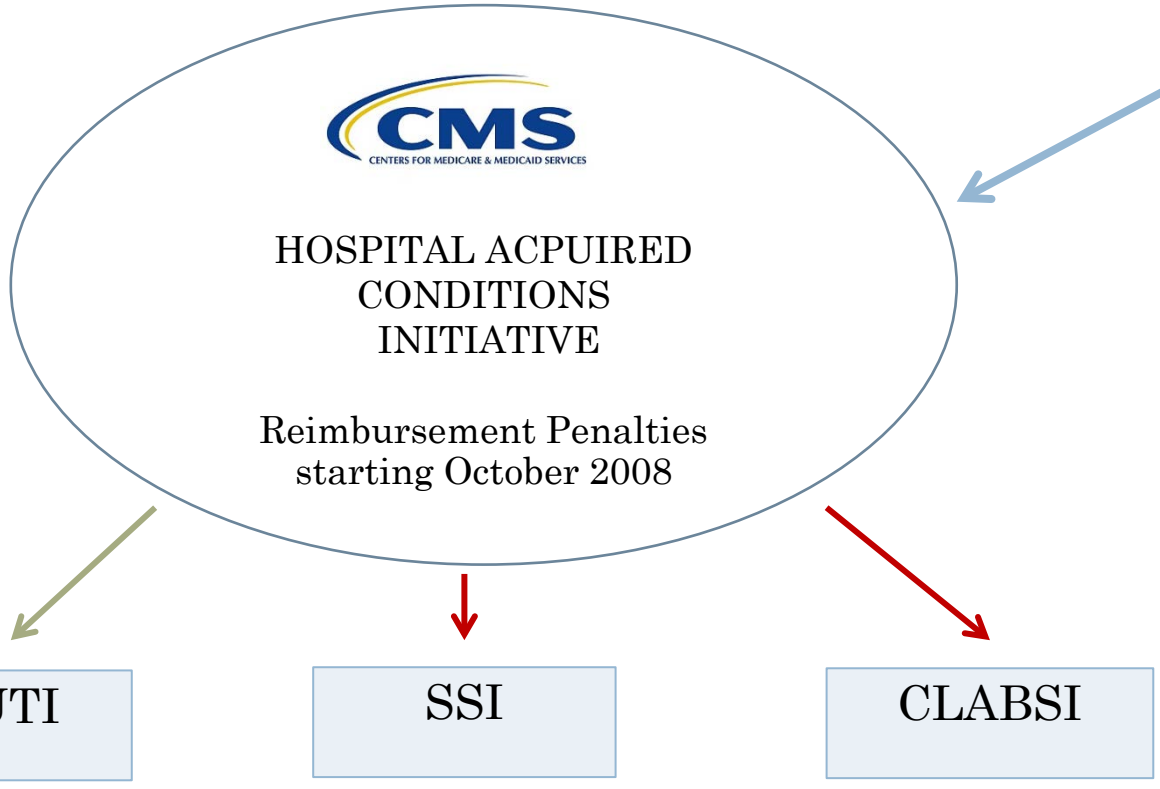
- By multivariate analysis, presence of TPN was associated with CP (aOR = 4.7), while presence of GI diseases (aOR = 7.1) and MICU admission (n = 4.1) was associated with CT (70% due to CLABSI).

- Notable, 5 of 9 cases of CP had PICC line insertion for care at home, where full compliance of maintenance bundle was observed in 20%.

Apisarnthanarak A, et al. IDWeek 2018

Novel Technology and New Strategise

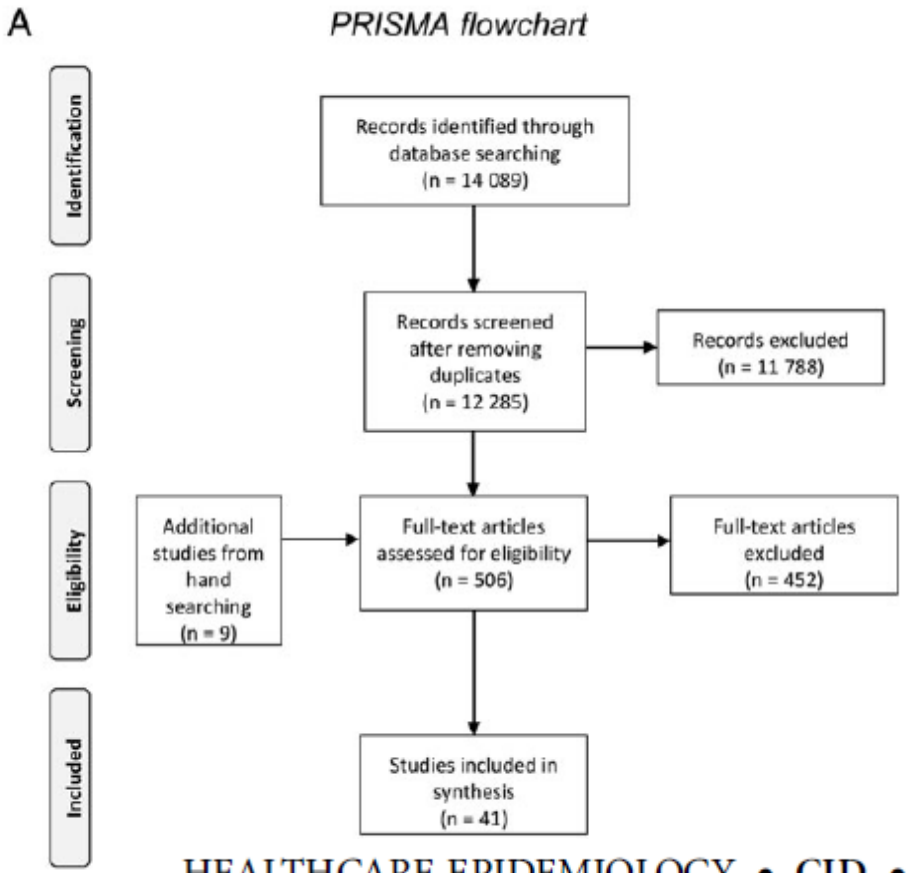


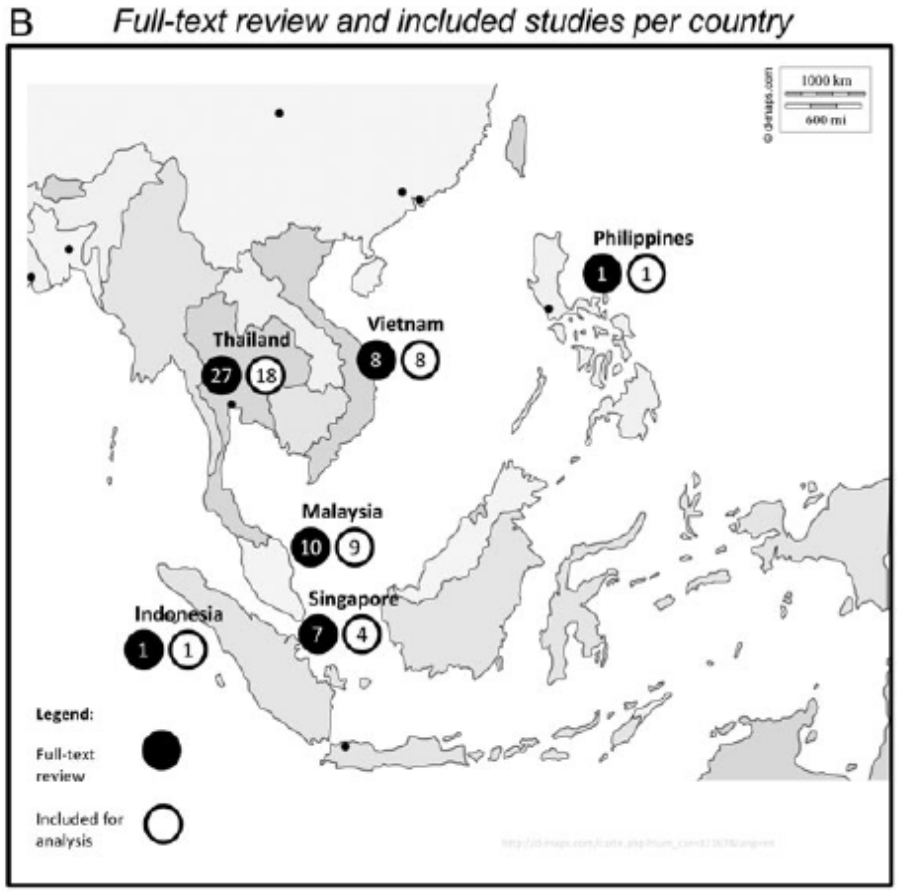


The Burden of Healthcare-Associated Infections in Southeast Asia: A Systematic Literature Review and Meta-analysis

Moi Lin Ling,[1] Anucha Apisarnthanarak,[2] and Gilbert Madriaga[3]

[1]Infection Control, Singapore General Hospital, Singapore; [2]Division of Infectious Diseases, Thammasat University Hospital, Pratumthani, Thailand; and [3]Department of Epidemiology and Biostatistics, College of Public Health, University of the Philippines, Manila





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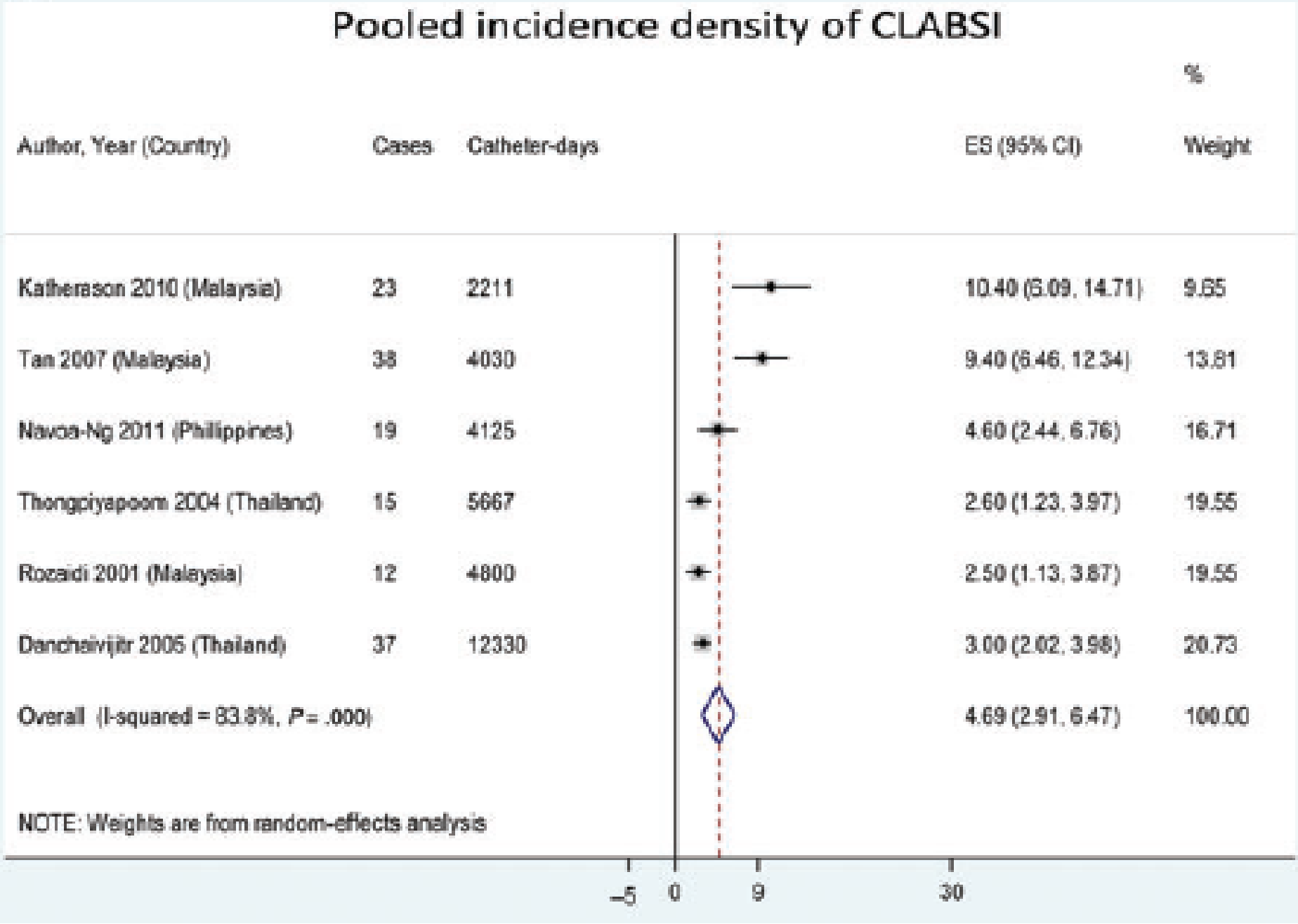

Pooled incidence density of CLABSI
Author, Year (Country)
Cases
Catheter-days
ES (95% CI)
%
Weight
Katherason 2010 (Malaysia) 23 2211 10.40 (6.09, 14.71) 9.55
Tan 2007 (Malaysia) 38 4030 9.40 (6.46, 12.34) 13.81
Navoa-Ng 2011 (Philippines) 19 4125 4.60 (2.44, 6.76) 16.71
Thongpiyapoom 2004 (Thailand) 15 5667 2.60 (1.23, 3.97) 19.55
Rozaidi 2001 (Malaysia) 12 4800 2.50 (1.13, 3.87) 19.55
Danchaivijitr 2005 (Thailand) 37 12330 3.00 (2.02, 3.98) 20.73
Overall (I-squared = 83.8%, P = .000) 4.69 (2.91, 6.47) 100.00
NOTE: Weights are from random-effects analysis
-5
0
9
30

Summary of Incidence Density Rates

Study	Country	ICU unit	ICU	VAP	CAUTI	CRBSI
Ling 2013	S. E. Asia		20.0	14.7	9.1	4.7
Rosenthal 2012	Developing	422		15.8	6.3	6.8
Allegranzi 2011	Developing		47.9	22.9	9.8	11.3
Hu 2013	China	7		10.5	1.3	7.7
Mehta 2007	India	12	9.1	10.5	1.4	7.9
Kanj 2012	Lebanon	1	11.8	8.1	4.1	5.2
Guanche-Garcell 2011	Cuba	1	31.0	52.5	8.1	2.0
Dudeck 2011	US	NHSN		1.6	1.9	1.2

Ling *et al. Antimicrobial Resistance and Infection Control* (2016) 5:16
DOI 10.1186/s13756-016-0116-5

Antimicrobial Resistance
and Infection Control

REVIEW **Open Access**

APSIC guide for prevention of Central Line Associated Bloodstream Infections (CLABSI)

Moi Lin Ling[1*], Anucha Apisarnthanarak[2], Namita Jaggi[3], Glenys Harrington[4], Keita Morikane[5], Le Thi Anh Thu[6], Patricia Ching[7], Victoria Villanueva[8], Zhiyong Zong[9], Jae Sim Jeong[10] and Chun-Ming Lee[11]

Table 3 APSIC central line maintenance checklist

Name of patient				Age	Sex	Unique ID	
Name of Treating physician/Surgeon						Unit	
Type of Central Venous Catheter	Tunneled	Non-Tunneled	PICC line	Chemoport		Any other:	
Days	1	2	3	4	5	6	7
Date							
The maintenance procedure	Y N Comment: date for change in dressing, date of IV set change	Y N Comment: date for change in dressing, date of IV set change	Y N Comment: date for change in dressing, date of IV set change	Y N Comment: date for change in dressing, date of IV set change	Y N Comment: date for change in dressing, date of IV set change	Y N Comment: date for change in dressing, date of IV set change	Y N Comment: date for change in dressing, date of IV set change
Is review done for need for central line use?							
Was hand hygiene practised before all line maintenance/access procedures?							
Was alcohol used to disinfect hub before each access?							
Was dressing changed using aseptic technique?							
Were administration sets replaced every 4-7 days?							
Signature of person in-charge:							

Appendix I: Summary Table of Recommendations for Various Catheters

Appendix II: Compliance Checklist for Catheter Associated Bloodstream Infection (CABSI)

	Central Venous Catheter	Peripheral Venous Catheter	Peripheral Arterial Catheter
Gloves and attire	☐ Wear sterile gloves ☐ Use maximal sterile barrier precautions	☐ Wear clean gloves	☐ Wear sterile gloves ☐ Use cap, mask, sterile gloves and a small sterile fenestrated drape

Appendix II: Compliance Checklist for Catheter Associated Bloodstream Infection (CABSI) (cont'd)

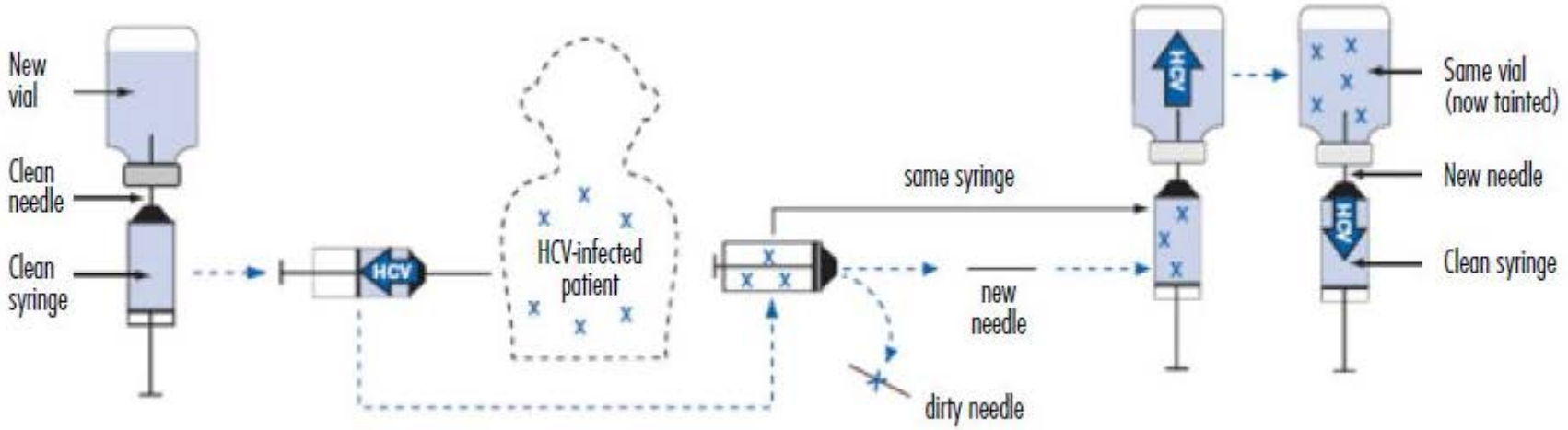
Administration set maintenance	Replace administration sets including extension tubings and add-on devices ☐ no more frequently than every 96 hours, unless CABSI is suspected or confirmed, and ☐ at least every 7 days ☐ after administration or within 24 hours when transfusing blood, blood products or lipid containing solutions Disinfect IV injection port, stopcocks, needleless intravascular device or heparin-block before access with ☐ 70% alcohol, or ☐ 2% chlorhexidine in alcohol, or ☐ iodophor preparation
Care of infusate	☐ Use single-dose vial of parenteral additive and medication as far as possible ☐ Do not combine the leftover content of single-use vials for later use
Needleless intravascular catheter systems	☐ Scrub the access port with an appropriate antiseptic for at least 15 seconds and access the port only with sterile devices
CABSI surveillance	☐ A surveillance program for CABSI is in place ☐ Use incidence density unit such as "CABSI per 1000 catheter patient days" to express infection rate

Catheter change	☐ Do not routinely replace ☐ Do not replace over guidewire if CABSI is suspected	***Adult:*** ☐ No need to replace more frequently than every 72-96 hours ***Children:*** ☐ Only when clinically indicated	☐ Only when clinically indicated
Removal	☐ Promptly remove if no longer needed ☐ If aseptic technique cannot be	☐ Remove if no longer needed ☐ Remove if there is sign of phlebitis or	☐ Remove if no longer needed

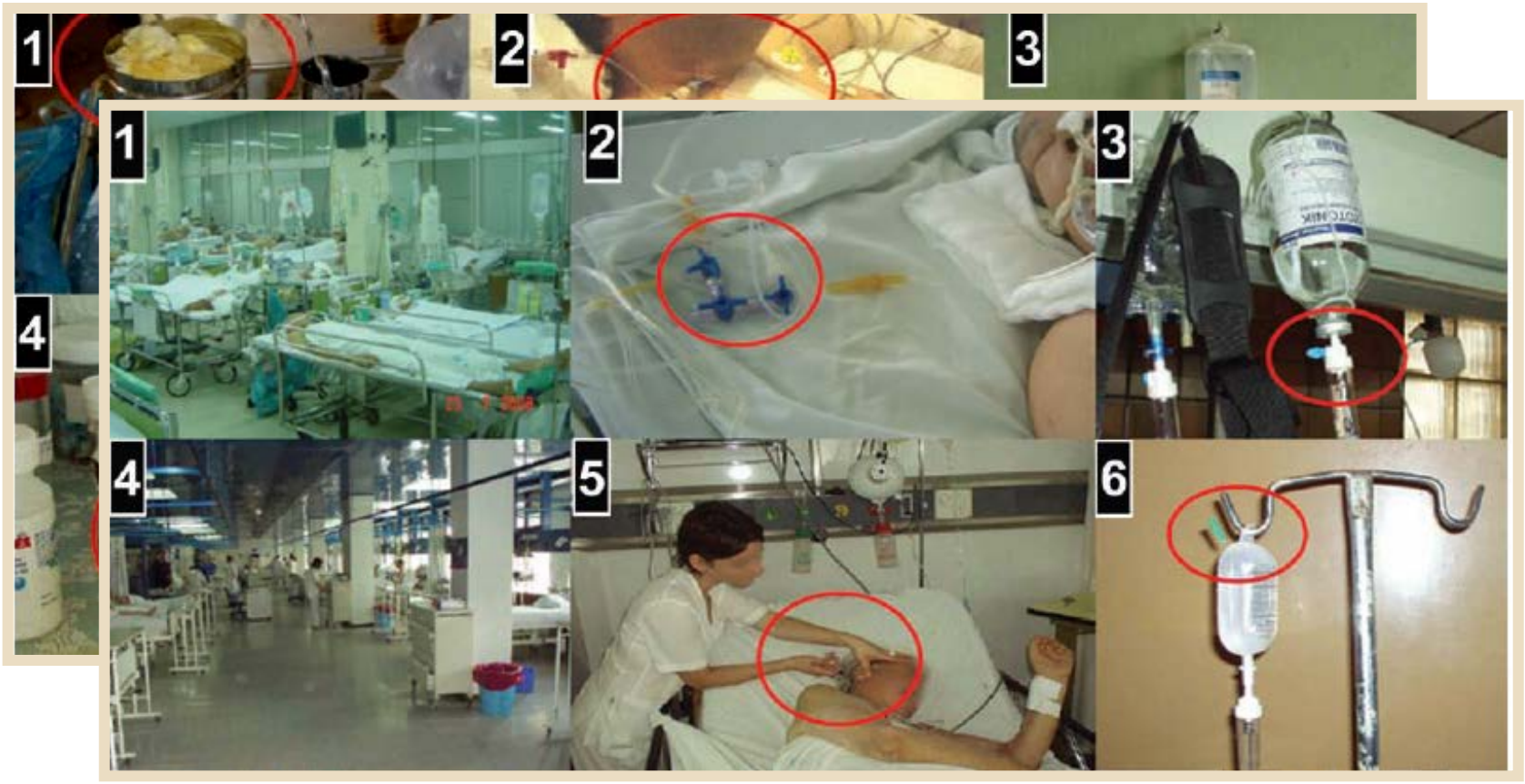
What are pitfalls?

- Use of multi-dose vial
- Cover with contaminated tape

Suboptimal Practices: Use of Multi-Dose Vial



However…Suboptimal Practices Still Commonly Seen



Rosenthal VD. CID 2009

How frequent are these practices in Thailand now?

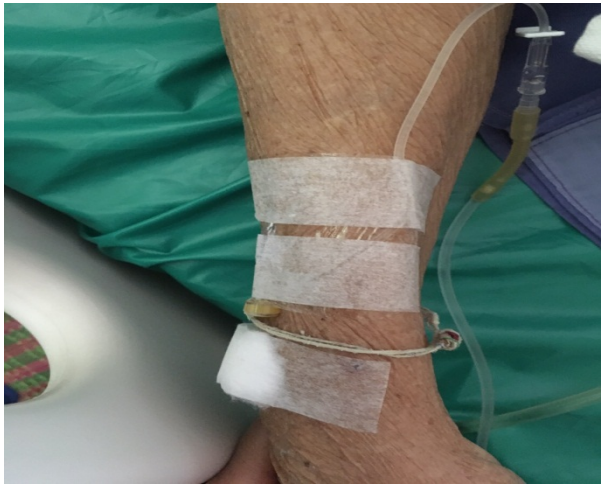
Characteristics	
General	**Number (%)**
Reported unnecessary and suboptimal practices	
Not disinfecting connectors/hubs before accessing	99(49)
Use of multi-dose vial	87(43)
Use of central venous cutdown for any CVC insertion	56(28)
Use of 3-way stopcock	50(25)
Routine submission of catheter tip for culture	43(21)
Routine CVC change	31(15)
Femoral CVC insertion in adults	0(0)

Apisarnthanarak A, et al. National survey of suboptimal and unnecessary practices. AJIC 2013

Unneccessary and suboptimal practice	Protective factor	Adjusted odds ratio (95%confidence interval)	P
Not disinfecting connectors /hubs before accessing	Having a designated CVC insertion team	0.17)0.06-0.49)	0.001
Use of multi-dose vial	Having a designated CVC insertion team	0.40(0.17-0.95)	0.04
	Use of PICC	0.37(0.18-0.75)	0.006
	Participation in a collaorative prevention effort	0.26(0.11-0.60)	0.002
Use of central venous cutdown	Having Infection Diseases-trained ICC Chair	0.18(0.08-0.40)	<0.001
	Having a designated CVC insertion team	0.26(0.11-0.61)	0.002
	Use of PICC	0.36(0.17-0.78)	0.009
	Good to excellent infection control support	0.13(0.03-0.53)	0.004
Use of 3-way stopcock	Having Infection Diseases-trained ICC Chair	0.18(0.08-0.40)	<0.001
	Having a designated CVC insertion team	0.30(0.13-0.70)	0.005
	Use of PICC	0.47(0.21-1.04)	0.06
	Having a hospital epidemiologist	0.28(0.10-0.81)	0.02
Routine submission of catheter	Having Infection Diseases-trained ICC Chair	0.12(0.04-0.32)	<0.001
tip for culture	Having a designated CVC insertion team	0.18(0.06-0.52)	0.002
	Use of PICC	0.16(0.06-0.48)	0.001
	Good to excellent infection control support	0.14(0.02-0.96)	0.04
Routine central venous catheter change	None	---	---

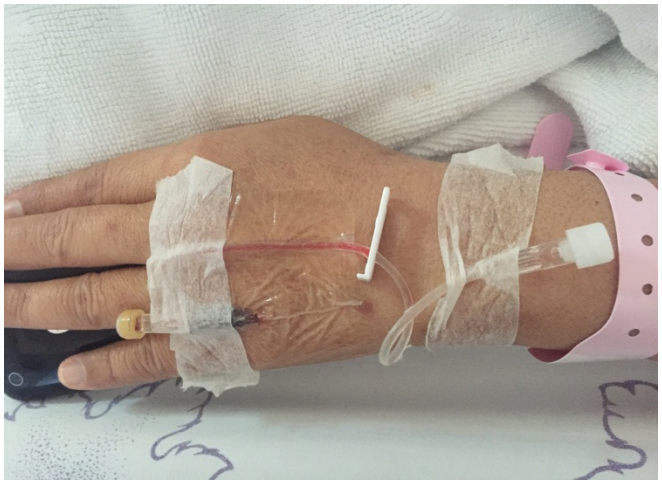
Emerging Problems

Which practice did you do?



A

B



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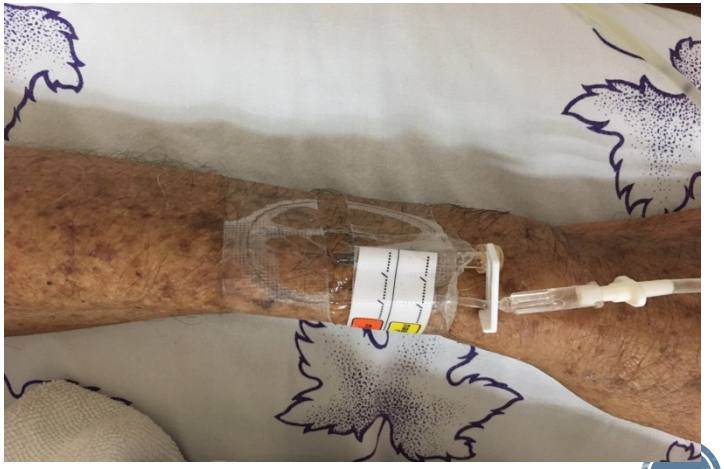
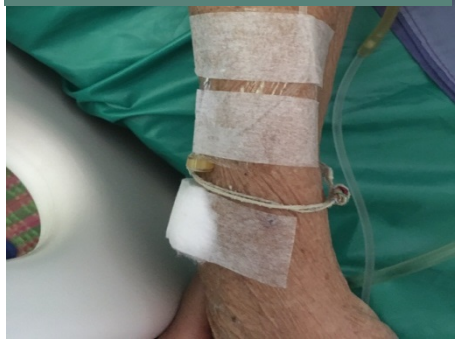


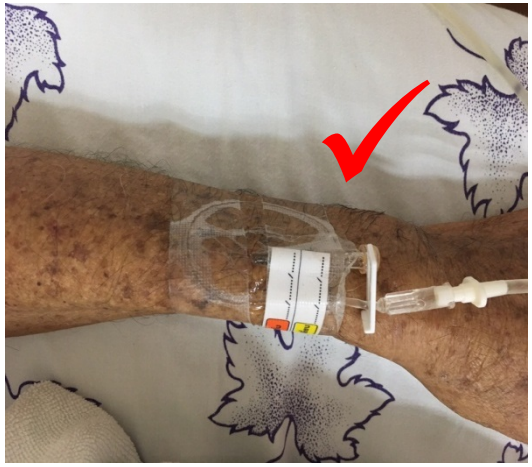
In your opinion, what are the most important predictor to prevent PIVAE?

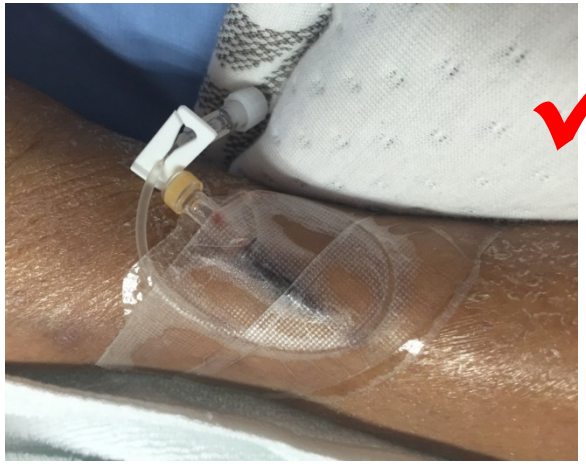
- A) Duration of insertion in tropical region should be less than what recommended in the guideline
- B) Host factors (e.g., elderly, presence of cutaneous lesion)
- C) Position of catheterization
- D) Stable fixed of the PIV line
- E) Use of transparent dressing

Example of PIV dressing

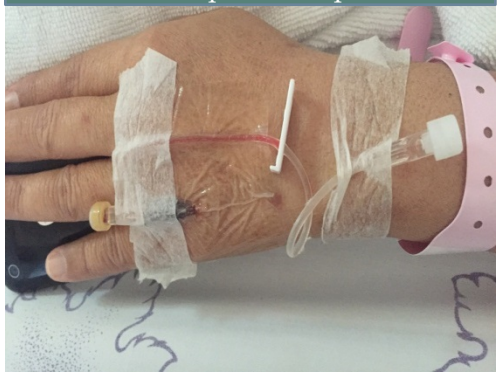
Transparent dressing but covered with non-transparent tape







Transparent dressing but covered with unstably fixed non-transparent tape



Transparent dressing with transparent tape but the edge isn't covered properly

Transparent dressing with transparent tape but the edge isn't covered properly

Peripheral venous catheter adverse events

	Year	Study type	N	PVCAEs incident (per 1000 PVC day)	Comment
Rickard CM et.al Routine resite of peripheral intravenous devices every 3 days did not reduce complications compared with clinically indicated resite	2010	RCT	362 patients (603 IVDs)	68 (Control group) 66 (routine resite group)	There is growing evidence to support the extended use of peripheral IVDs with removal only on clinical indication.
Abolfotouh MA et.al,. Prospective study of incidence and predictors of peripheral intravenous catheter-induced complications.	2014	Prospective observational study	122 patients	68	Phlebitis was the most common complication
Webster J et.al. Routine care of peripheral intravenous catheters versus clinically indicated replacement:	2008	RCT	755 patients	59.8 (intervention group) 60.9 (control group)	Same as RCT in 2010

Peripheral Venous Catheter-Related Adverse Events in a Tropical Country

Apisarnthanarak A, et al. ICHE 2017

- A prospective cohort study was conducted to evaluate the incidence, type, and associated factors of adverse events associated with PVC.
- All hospitalized patients >15 years with a PVC were consented for study participation. Every PVC in place for >24 hours of each patient was prospectively followed until PVC removal or complications occurred.
- PVC-related complications were categorized as mechanical or clinical PVCAEs.
- Mechanical PVCAEs was defined as any catheter dislodgement that was unplanned; an occlusion of the PVC, or a rupture of the closed infusion system when infusion lines were disconnected from the infusion bag or the absence of a well-sealed injection site. Clinical PVCAEs included localized edema at the site of insertion, phlebitis, hematoma at the insertion site, leakage of fluid/blood and suspected sepsis.

Table: Patient Characteristics and Peripheral Venous Catheter Associated Adverse Events

Variable	Number (%) (Sample = 500)
Age (years; median, range)	64 (49-76)
Female	256 (51.2)
Charlson's comorbidity score	
0-1	254 (51.8)
2-3	180 (36)
>3	66 (13.2)
Skin condition	
Healthy	414 (82.8)
Lesions	82 (17.2)
Number of PVCs (median, range)	1 (1-7)
Anatomical site of insertion	
Hand	281 (42)
Forearm	187 (29)
Anticubital	86 (17.2)
Arm	26 (5)
Leg	52 (10)
Foot	16 (3)
Unit at Insertion	
Medicine	200 (40)
Surgery	124 (24.8)
Intensive care	95 (19)
Others	81 (16.2)
Documentation of dressing	339 (67.8)
Type of Dressing	
Non-occlusive dressing	36 (7.2)
Unclean dressing	59 (11.8)
Covered transparent dressing	405 (81)
Duration of PVC (days; median, range)	**3 (1-24)**
Total PVC-days	**2594**
Incidence of PVCAEs (per 1000 PVC-days)	
Mechanical	**45.96**
Clinical	**27.52**
PVCAE type (per 1000 PVC-days)	
PVC-associated infection	1.53
Phlebitis	19.11
Hematoma	6.88
Occlusion	24.46
Dislodgement	5.36
Leaking	16.05

Risk factors for PVCAE:

Being male ($P = 0.02$)

Presence of cutaneous lesion ($P = 0.04$)

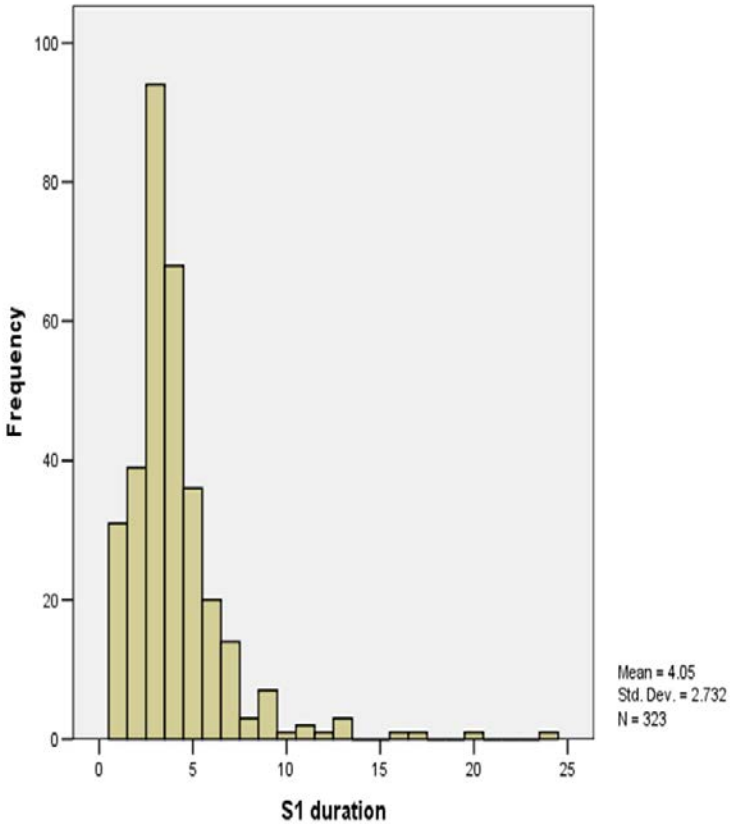
Unstable PVC ($P = 0.01$)

Protective factor for PVCAE:

A covered transparent dressing ($P = 0.01$)

total duration of insertion and complications, due to mean duration

Total durations (days)	No. of total peripheral IV catheters (%)	No. of complications (%)	P value	95%CI
<=3	164(50.8%)	44(55.0%)		
>3	159(49.2%)	36(45.0%)		
total	323(100%)	80(100.0%)	0.38	0.48-1.33



Clinical Infectious Diseases

Short-term Peripheral Venous Catheter–Related Bloodstream Infections: A Systematic Review

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Short-term peripheral venous catheters (PVCs) are commonly used in healthcare settings. To determine the magnitude of bloodstream infections (BSIs) related to their use, PubMed, article bibliographies, and the authors' library were searched for pertinent articles. The incidence of PVC-related BSIs was 0.18% among 85063 PVCs. Short-term PVCs accounted for a mean of 6.3% and 23% of nosocomial BSIs and nosocomial catheter-related BSIs, respectively. Prolonged dwell time and catheter insertion under emergent conditions increased risk of PVC-related bloodstream infection (PVCR-BSI). If approximately 200 million PVCs are successfully inserted into adult patients each year in the United States, there may be many PVCR-BSIs occurring yearly. Clinicians should obtain blood cultures in patients with evidence of PVC infection and systemic symptomatology such as fever, carefully inspect the PVC insertion site in bacteremic or fungemic patients, and remove PVCs associated with localized infection with or without associated BSI.

Keywords. catheter; catheter infection; bloodstream infection; bacteremia; peripheral venous catheter.

Table 1. Risk of Peripheral Venous Cathether–Related Bloodstream Infection Compared to Central Venous Catheter–Related Bloodstream Infection

Study, First Author [Ref]	PVCR-BSI	PVCR-BSI vs CVCR-BSI	Nosocomial CR-BSI due to PVCs	Nosocomial BSI due to PVCs vs CVCs
Noble[a] [14]	0 of 203 PVCs			
Tully[a] [15]	0 of 468 PVCs			
Tager [16]	0.02% of 6286 PVCs			
Nystrom[b] [17]		0.37% of 6253 patients vs 4.5% of 424 patients		
Collignon[c] [34]		~0.1% of 23000 PVCs vs ~1% of 2970 CVCs	43% of 61 CR-BSIs	
Cheesbrough [18]	0.2% of 519 PVCs			
Larson [19]	0 of 801 PVCs			
Gantz[a] [20]	0 of 431 PVCs			
Tomford [21]	0 of 972 PVCs			
Maki[a] [5]	0 of 2088 PVCs			
Maki [22]	0 of 878 PVCs			
Hoffmann[a] [23]	0 of 598 PVCs			
Jacquot[a] [24]	0 of 170 PVCs			
Richet[d] [25]		2.2% of 362 PVCs vs 5% of 503 CVCs (RR, 2.3; 95% CI, 1.03–4.9)		
Maki[a] [6]	0 of 1054 PVCs			
Collignon[b,c] [35]		~0.036% of 565722 PVCs vs ~2.3% of 396586 CVCs (RR, 64; 95% CI, 54–76)	47% of 491 CR-BSIs	
Fry [40]			50% of 143 CR-BSIs	
Bregenzer [10]	0 of 609 PVCs			
Soifer[a] [26]	0.3% of 875 PVCs			
Cornely [27]	0 of 412 PVCs			
Coello [41]			21% of 2377 CR-BSIs	7% due to PVCs vs 27% due to CVCs of 6956 BSIs
Bouza[a] [28]	0 of 523 PVCs			
Barbut [29]	0 of 525 PVCs			
Aygun[d] [30]	0.7% of 147 PVCs			
Collignon[c] [36]		~0.03% of 27683 PVCs vs ~0.9% of 1238 CVCs	7% of 491 CR-BSIs	
Pujol [42]			37% of 150 CR-BSIs	
Lolom[e] [31]	1.1% of 1789 PVCs			
Rickard[a] [32]	0 of 362 PVCs			
Fakih [43]	0.02–0.04/1000 patient-days[f]		60% of 10 CR-BSIs	19% due to PVCs vs 32% due to CVCs of 31 BSIs
ECDC [44]			16% of 626 CR-BSIs	6.2% due to PVCs vs 33% due to CVCs of 1585 BSIs
Fakih [45]	0.04–0.2/1000 patient-days[f]		42% of 19 CR-BSIs	
Mestre [46]			18% of 48 CR-BSIs	
Almirante [37]		0.05/1000 patient-days for PVCs vs 0.19/1000 patient-days for CVCs vs 0.02/1000 patient-days for PICCs[g]	18.8% due to PVCs vs 76.5% due to CVCs vs 4.7% due to PICCs of 2977 CR-BSIs	
Delgado-Capel [38]		0.11/1000 admissions for PVCs vs 0.17/1000 admissions for CVCs	39.3% due to PVCs vs 57.2% due to CVCs vs 3.5% due to PICCs of 28 CR-BSIs	13% due to PVCs vs 19% due to CVCs vs 1% due to PICCs of 84 BSIs
RAISIN [2]	0.19% of 64809 PVCs	20% due to PVCs of 597 CRBSIs	8.3% due to PVCs vs 33% due to CVCs of 1456 BSIs	
Freixas [39]		0.05/1000 patient-days for PVCs vs 0.12/1000 patient-days for CVCs	29% of 396 CR-BSIs	
Marsh[a] [33]	0 of 85 PVCs			

Table 2. Risk of *Staphylococcus aureus* Bloodstream Infections due to Infected Peripheral Vascular Catheters

Study, First Author [Ref]	*Staphylococcus aureus* CR-BSIs due to PVCs	*Staphylococcus aureus* BSIs due to PVCs
Mylotte [50]	50% of 28 CR-BSIs	18% of 79 BSIs
Thomas[a] [51]	50% of 305 CR-BSIs	
Kok [52]	41% of 75 CR-BSIs	25% of 123 BSIs
Bruno [55]		35% of 31 BSIs[b]
Trinh [53]	12% of 196 CR-BSIs[c]	
Mestre [46]	64% of 14 CR-BSIs	28% of 32 BSIs
Stuart [56]		24% of 583 BSIs
Morris [54]	44% of 121 CR-BSIs	20% of 261 BSIs
Rhodes [57]		24% of 151 BSIs[d]
Austin[a] [49]		7.6% of 445 BSIs

Risk of STPVCRBSI Based on Cath Dwell Time

- PVC dwell time >3 d in 54% & 60% of STPVCRBSIs
- PVC dwell time >4 d in 67% of 45 STPVCRBSIs 3
- PVC dwell time >3 d independently associated w/risk of STPVCRBSI (adj OR, 324; 95%CI 21-1139) 4

Collignon et al, Med J Aust 2013

Freixas et al, Clin Micrbiol Infect 2013

Lolom et al, Presse Med 2009

Safdar al, J Hosp Infect 2011

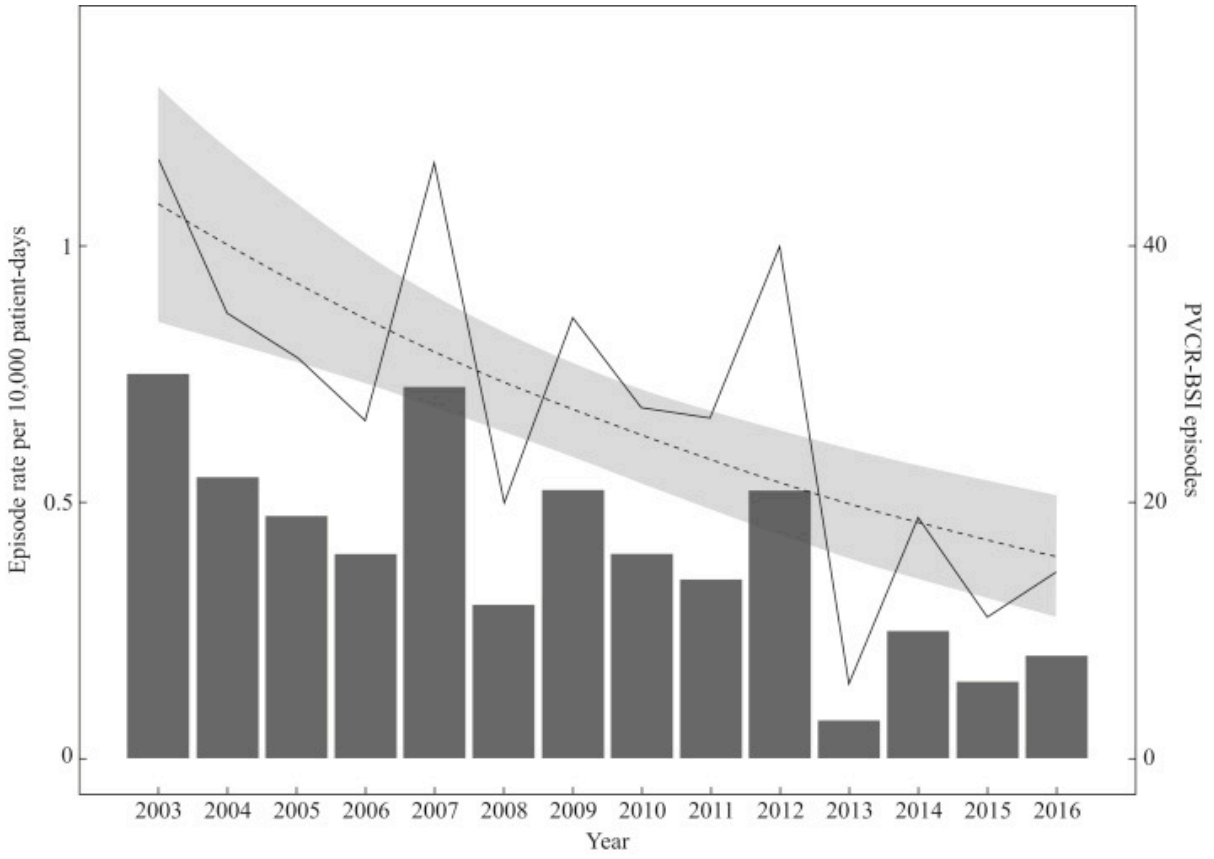
Multimodal Infection Prevention Program Reduces STPVCRBSI

- Insertion & maintenance bundles
- Educational campaigns targeting frontline staff
- Compliance monitoring (eg, ward rounds by infection control staff) to assess PVC insertion & maintenance
- Same day notification of STPVCRBSI for root-cause analysis
- Prospective and continuous STPVCRBSI surveillance

Saliba et al; JHI 2018

Multimodal Infection Prevention Program Reduces STPVCRBSI

Episodes of PVCR-BSI and rate per 10,000 hospitalizations from 2003 to 2016



Saliba et al; JHI 2018

Prevention of STPVCRBSI

- Remove emergently-inserted PVCs
- Limit non-emergently inserted PVC dwell time to 3-4 days in adults
- Insertion & maintenance by IV team
- Daily assessment of insertion site & need for continued catheterization

Arterial Catheters as a Source of Bloodstream Infection: A Systematic Review and Meta-Analysis*

John C. O'Horo, MD[1]; Dennis G. Maki, MD, MS[2]; Anna E. Krupp, RN[3]; Nasia Safdar, MD, PhD[2,3,4]

Objective: Catheter-related bloodstream infections are associated with significant costs and adverse consequences. Arterial catheters are commonly used in the critical care setting and are among the most heavily manipulated vascular access devices. We sought to evaluate the prevalence of arterial catheter-related bloodstream infection.

Data Sources: PubMed, CinAHL, EMBASE, and Web of Science.

Study Selection: Included studies reported prevalence rate of catheter-related bloodstream infection for arterial catheters used for critical illness or postoperative monitoring. For the purposes of this study, catheter-related bloodstream infection was defined as positive blood culture collected from an arterial catheter and from the periphery with the same organism in a patient demonstrating systemic signs of sepsis.

Data Extraction: The study population, site of insertion, antiseptic preparation, catheter days, and prevalence of catheter-related bloodstream infection were abstracted. When data were not available, authors were contacted for further information.

Data Synthesis: Forty-nine studies met criteria including 222 cases of arterial catheter-related bloodstream infection in 30,841 catheters. Pooled incidence was 3.40/1,000 catheters or 0.96/1,000 catheter days. Prevalence was considerably higher in the subgroup of studies that cultured all catheters (1.26/1,000 catheter days) compared with those studies that cultured only when the arterial catheter was suspected as the source for the catheter-related bloodstream infection (0.70/1,000 catheter days). Pooled data also found a significantly increased risk of infection for femoral site of insertion compared with radial artery for arterial catheter placement (relative risk, 1.93; 95% CI, 1.32–2.84; $p = 0.001$)

Conclusions: Arterial catheters are an underrecognized cause of catheter-related bloodstream infection. Pooled incidence when catheters were systematically cultured and correlated to blood culture results indicated a substantial burden of arterial catheter-related bloodstream infection. Selection of a radial site over a femoral site will help reduce the risk of arterial catheter-related bloodstream infection. Future studies should evaluate technologies applied to preventing central venous catheter-related bloodstream infection to arterial catheters as well. (*Crit Care Med* 2014; 42:1334–1339)

Key Words: arterial catheterization; catheter-related infections; critical care; meta-analysis; nosocomial infections; peripheral; prevalence

Arterial catheters are essential for hemodynamic monitoring in critically ill patients. Each year, approximately eight million arterial catheters are placed in the United States (1, 2). One of the most serious complications of all intravascular devices is catheter-related bloodstream infection (BSI) (3). Arterial catheter-related BSIs (CRBSIs)

Use of Full Sterile Barrier Precautions during Insertion of Arterial Catheters: A Randomized Trial

Bart J. A. Rijnders, Eric Van Wijngaerden, Alexander Wilmer, and Willy E. Peetermans
Department of Internal Medicine and Infectious Diseases, Universitaire Ziekenhuizen Leuven, Leuven, Belgium

Table 2. Results of primary and secondary end points in a study of the use of sterile barrier precautions during insertion of arterial catheters.

End point	SBP group (n = 129)	SOC group (n = 143)	P
Catheter colonization at time of removal, no. (%) of patients	23 (17.8)	19 (13.3)	>.1
Catheter-related infection, no. of patients (no. of cases per 1000 catheter-days)			
Exit-site infection	1 (0.9)	5 (4.2)	>.1
CRBSI	2 (1.8)	2 (1.7)	>.1
Total	3 (2.6)	7 (5.8)	>.1

Unlike the findings for CVC-related colonization and infection, this study did not show a reduction in the rate of AC colonization when SBPs were used during insertion of arterial catheters in the radial or dorsalis pedis artery without the use of a guidewire. The incidence of AC colonization and infection seems to be similar to the incidence for CVCs.

Because the frequency of colonization and infection of ACs was high in this study, other measures to prevent AC infection need to be developed. Antimicrobial- or antiseptic-coated catheters have been shown to decrease CVC-related infectious complications. The same techniques may be useful for ACs, but randomized, controlled trials will have to confirm this. Inves-

- **Minimize femoral arterial catheter insertion**

  - Femoral arterial catheters increase risk of CRBSI (RR = 1.93; 95%CI 1.32-2.84)*

- **Use CHG dressing**

  - CHG dressing reduces risk of CRBSI (RR = 0.35, 9%CI 0.13-0.91)*

O'Horo et al, Crit Care Med 2014

Arterial Catheter Use in ICUs: National Survey of Aseptic Technique & Perceived Infectious Risk Among Intensivists

- Published risk of CRBSI due to arterial catheter is 0.9-3.4/1000 catheter-days, which comparable to CVC

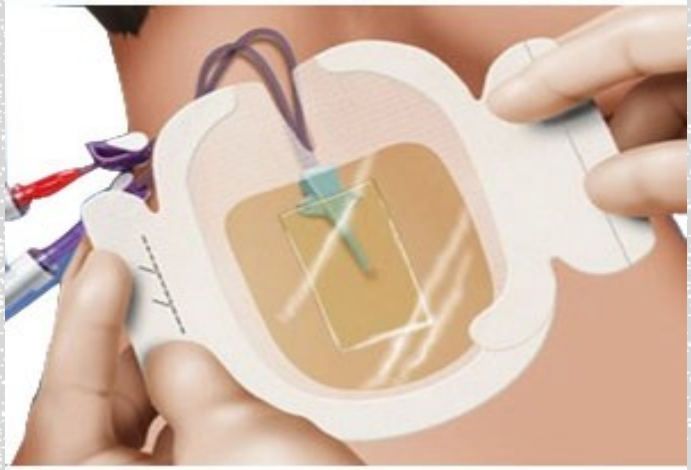
- Survey of intensivists – risk of CRBSI due to arterial catheter compared of CVC = RR 0.15 (0.1-0.3/1000 catheter-days)

- Only 11% of intensivist using full barrier precaution

  (gloves, surgical cap, surgical mask, small sterile drape)

Cohen et al, Crit Care Med 2015

Technology




NEW
BIOPATCH
Antimicrobial
Dressing
WITH
CHLORHEXIDINE
GLUCONATE

Antiseptic Impregnated Dressings Update

Previous Recommendation: Use a CHG-impregnated sponge dressing for temporary short-term catheters in patients older than 2 months of age if CLABSI rates are not decreasing despite adherence to basic prevention methods including education and training, MSB, and chlorhexidine skin antisepsis. 1B

No recommendation for other types of CHG dressings. Unresolved issue.

Antiseptic Impregnated Dressings Update

Draft Recommendations:

1. CHG-impregnated dressings are recommended to cover the site of short-term non-tunneled CVCs in patients 18 years and older. 1A
2. CHG-impregnated dressings are NOT recommended to cover the site of short-term, non-tunneled CVCs in neonates who are premature of less than 2 months of age due to risk of serious adverse skin reactions. 1A
3. No recommendation can be made about the use of CHG dressings for non-neonatal patients less than 18 years of age. Unresolved issue.

Reducing PICC CLABSI and PICC Lumen Colonization: Quasi-Experimental, Multi-Center study

	Alcohol wipe Needleless connector	Alcohol-containing Port protector +/- wipe
CLABSI/1000 PICC d	1.4	0.7”
Lumen contam	12.7%	5.5%

*p=0.4;**p=0.002

Wright et al.AJIC 2010

Reducing CVC CLABSI in Adult Trauma & Neurosurgery ICU: Quasi-Experimental, Single Center Study

	Alcohol wipe Needleless connector	Alcohol-containing Port protector +/- alcohol wipe
CLABSI/1000 CVC d	4.3	1.1

*3763 total CVC days

Paridis, Ustis, Jefferson, Mermel 2013

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Major article

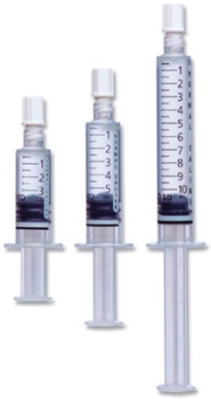
Clinical impact and cost-effectiveness of split-septum and single-use prefilled flushing device vs 3-way stopcock on central line–associated bloodstream infection rates in India: a randomized clinical trial conducted by the International Nosocomial Infection Control Consortium (INICC)

Victor Daniel Rosenthal MD [a,*], Farokh Earch Udwadia MD [b], Siva Kumar MD [c], Aruna Poojary MD [b], Rathi Sankar RN [c], Pablo Wenceslao Orellano DrPH [a,d], Shilpa Durgad MD [b], Mahendran Thulasiraman RN [c], Shweta Bahirune MBA [b], Shubhangi Kumbhar RN [b], Priyanka Patil MD [b]

Table 2
CLABSI rate and mortality in the SS and 3WSC groups

Variable	SS SUF group	3WSC group	RR (95% CI)	*P* value
Patients, n	547	549		
CL-days, n	3619	4061		
CLABSIs, n	8	26		
CLABSIs per 1000 CL-days, n	2.21	6.40	0.35 (0.16-0.76)	.006
CLABSI rate per 100 patients, %	1.5	4.7	0.31 (0.14-0.68)	.002
Deaths, n	76	84		
Deaths, %	14	15	0.91 (0.64-1.24)	.54

CLAB, central line bloodstream infection; *RR*, relative risk; *CI*, confidence interval.



Conclusions

- Several catheter practices are not supported by evidence-based
- Attempt should be made to improve catheter maintenance practices
- Increasing complications of several types of catheter are noticed in Asia Pacific
- Technology can be considered to help reduce CLABSI where appropriate

Thank you for your attentions

Table 1. Common Microorganisms Extracted From Systematic Review

Type of Infection	Microorganisms	Range, %[a]	Studies
Overall HAIs	*Pseudomonas aeruginosa*	13.4–31.5	Hughes et al, 2005 (Malaysia); Thu et al, 2011 (Vietnam); Danchaivijitr et al, 2007 (Thailand)
	Klebsiella spp	10–10.9	
	Acinetobacter baumanni	10.7–23.3	
CLABSI	*Acinetobacter* spp	11.1–50	Katherason et al, 2010 (Malaysia); Tan et al, 2007 (Malaysia); Navoa-Ng et al, 2011 (Philippines); Thongpiyapoom et al, 2004 (Thailand); Rozaidi et al, 2001 (Malaysia); Narong et al, 2003 (Thailand)
	S. aureus	9.1–16.7	
	Klebsiella spp	9.1–38.9	

Table 2. Risk Factors for Healthcare-Associated Infection From Systematic Review of Literature, 2000–2012

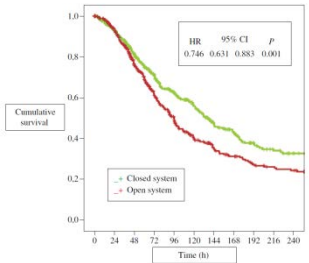
Author, Year	Type	Risk Factors	OR	95% CI
Katherason et al, 2010	CLABSI	Cancer	HR: 3.50	1.20–10.2
		Use of hydrocortisone	HR: 5.60	1.82–17.16
		Duration of infusion CVC/IVC	HR: 0.74	.65–.92
		Duration of mechanical ventilation	HR: 1.25	1.07–1.45
		Frequency of change CVC	HR: 0.00	.00–.06
		MRSA in axilla/perineum/throat	HR: 13.5	2.42–75.31
		Clinical sepsis	HR: 13.4	2.51–68.71

Indwell times, complications and costs of open vs closed safety peripheral intravenous catheters: a randomized study☆

J.L. González López[a,d,*], A. Arribi Vilela[b], E. Fernández del Palacio[c], J. Olivares Corral[c], C. Benedicto Martí[c], P. Herrera Portal[c]

Table II
Indwell time analysis for intention-to-treat (ITT) and modified ITT populations

Assigned system	Event median ITT ($N = 1183$)			Event median modified ITT ($N = 952$)			Interquartile range ($N = 952$)		
	Survival (h)	SE	95% CI	Survival (h)	SE	95% CI		Closed[a]	Open[b]
Closed	137.0	8.7	120.1–154.0	144.5	10.8	123.4–165.6	25	48.50	44.50
Open	96.0	4.3	87.5–104.5	99.0	6.0	87.2–110.8	50	79.00	70.25
Total	114.3	6.0	102.6–126.0	125.0	6.8	111.7–138.3	75	141.75	116.92
	$P = 0.003$			$P < 0.001$			$P = 0.016$		



Short report

Pre-filled normal saline syringes to reduce totally implantable venous access device-associated bloodstream infection: a single institution pilot study

S. Bertoglio [a,b,*], R. Rezzo [a], F.D. Merlo [c], N. Solari [a], D. Palombo [a], F. Vassallo [d], S. Beltramini [e], A. DeMaria [f,g]

SUMMARY

Flushing totally implantable venous access devices (TIVADs) with manually filled saline syringes may increase contamination and catheter-related bloodstream infection (CRBSI). We used a retrospective cohort study to assess the impact of changing from manually filled syringes to manufactured pre-filled syringes on the frequency of CRBSI in 718 TIVADs. Manually filled syringes were used in 269 patients and pre-filled syringes in 449. The CRBSI rate was 2.7% in the pre-filled syringe group and 6.3% in the manually filled syringe group ($P = 0.016$). Sex, tumour type and stage, access site and access body side were not independent risk factors for CRBSI.

Table II
Multivariate analysis of removal of totally implantable venous access devices for catheter-related bloodstream infection

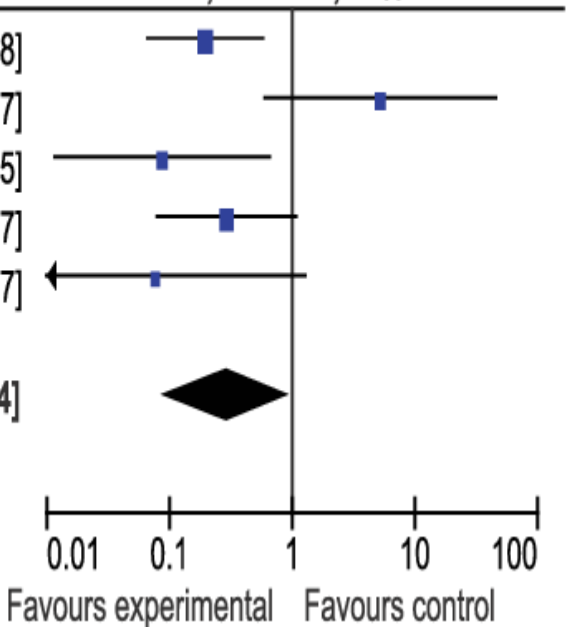
Covariates	No.	OR	95% CI	*P*-value
Flushing/locking procedure				
Manually filled normal saline syringes	449	1 (ref.)		0.019
Pre-filled normal saline syringes	269	0.40	0.19–0.87	
Sex				0.671
Male	313	1 (ref.)		
Female	405	1.23	0.57–2.68	
Pathology				0.768
Other cancer	226	1 (ref.)		
Brest cancer	335	2.72	0.95–7.77	
Colon cancer	157	1.985	0.58–6.76	
Disease stage[a]				0.648
Any T/N0	106	1 (ref.)		
Any T/N+	340	1.293	0.44–3.84	
Stage IV/M+	272	1.256	0.39–4.02	
Access site				0.710
Internal jugular vein	593	1 (ref.)		
Subclavian vein	125	0.88	0.32–2.40	
Side access				0.217
Right side	387	1 (ref.)		
Left side	331	1.925	0.88–4.21	

Meta-Analysis of Quasi-experimental Studies of TYRX (non-absorbable) Antibiotic Envelope

	Experimental		Control			Odds Ratio	Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
Citadel/Centurion	5	1129	10	451	28.2%	0.20 [0.07, 0.58]	
Hassoun et al	5	92	1	92	16.5%	5.23 [0.60, 45.67]	
Kolek et al	1	353	20	636	17.9%	0.09 [0.01, 0.65]	
Mittal et al	3	275	10	275	25.5%	0.29 [0.08, 1.07]	
Shariff et al	0	365	19	1111	12.0%	0.08 [0.00, 1.27]	
Total (95% CI)		**2214**		**2565**	**100.0%**	**0.29 [0.09, 0.94]**	
Total events	14		60				

Heterogeneity: $Tau^2 = 1.00$; $Chi^2 = 9.52$, df = 4 (P = 0.05); $I^2 = 58\%$

Test for overall effect: Z = 2.05 (P = 0.04)



- pooled odds ratio for cardiac implantable electronic device infection across cohort studies between patients with *versus* without TRYX envelope.

Ali et al, Ther dv Infectionus Dis 2017