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Alliance for Vascular Access Teaching and Research

The incidence and cumulative risk of primary bloodstream and venous infections in 12,942 peripheral intravenous catheters in Australia

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DISCLOSURES

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This presentation is independently prepared and reflects no commercial entity nor promotes particular products unless these are supported by research data.

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What will be covered?

1. The clinical problem – PIVC-BSI
2. Study aims and methods
3. Definitions and included studies
4. Findings – results of 12, 942 PIVCs in Australia
5. Clinical scenarios and conclusions

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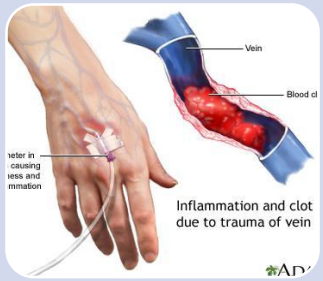
Clinical Problem: PIVC failure



Occlusion

Inability to infuse through a previously functioning PIVC

Infiltration and extravasation

Leakage of a infusate into surrounding tissue

Dislodgement

Partial or complete dislodgement of the PIVC out of the vein

Phlebitis

Irritation or inflammation of a vein wall

Infection

Local infection at the insertion site.

Catheter related blood stream infection

PIVC failure is reported to range from **33-69%**

(Bausone-Gazda et al., 2010; Dillon et al., 2008; Rickard et al., 2012; Webster et al., 2008)

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PIVC - BSI

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

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Table 1. Catheters used for arterial and venous access

Catheter type	Comments
Peripheral venous catheters	Phlebitis with prolonged use; **rarely associated with bloodstream infection**

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PIVC - BSI

Reviews

Paper	N	PRBSI % (95%CI)	/1000 days
Maki, Mayo Clin Proc 2006	10910	0.1% (0.1-0.2%)	0.5 (0.2-0.7)

- 10 prospective studies
- Risk 1 in 1000 PIVCs

Paper	N	P-BSI %	/1000 days
Mermel, Clin Infect Dis 2017	85063	0.18%	0.5

- 37 prospective & retrospective studies
- Risk 1 in 550 PIVCs
- *65,000 came from French national point prevalence report

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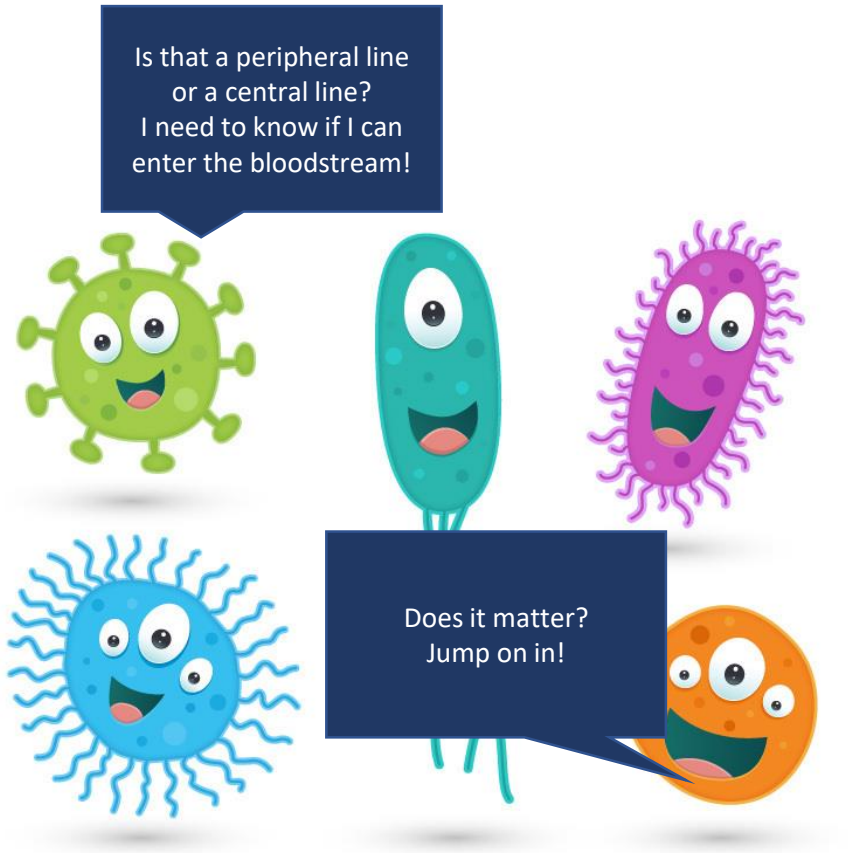
PIVC / CLABSI



- 3 000 CVADs
- Rate - 2.5%
- Total cases - **75**

- 150 000 PIVCs
- Rate – 0.1%
- Total cases - **150**

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Study Aims and Methods

Study aim:

To synthesize prospective studies for incidence of PIVC associated infections

Study questions:

1. What is the incidence of PIVC-BSI?
2. Is there a rise by day of dwell?
3. What are the common clinical scenarios ?

Inclusion:

1. AVATAR Studies
2. Prospective
3. Dwell time measured
4. Infection endpoints

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DEFINITIONS

Classified by blinded infectious diseases physician

Surveillance Definitions

CDC/NHSN Surveillance Definitions for Specific Types of Infections

VASC-Arterial or venous infection

Note: If a patient meets the criteria for an LCBI in the presence of an intravascular infection report as an LCBI not as a VASC. **

Arterial or venous infection must meet at least ***one*** of the following criteria:

1. Patient has organism(s) from extracted arteries or veins identified by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not Active Surveillance Culture/Testing (ASC/AST).
2. Patient has evidence of arterial or venous infection on gross anatomic or histopathologic exam.
3. Patient has at least ***one*** of the following signs or symptoms: fever (>38.0°C), pain*, erythema*, or heat at involved vascular site*
   AND
   More than 15 colonies cultured from intravascular cannula tip using semi-quantitative culture method.
4. Patient has purulent drainage at involved vascular site
5. Patient ≤1 year of age has at least ***one*** of the following signs or symptoms: fever (>38.0°C), hypothermia (<36.0°C), apnea*, bradycardia*, lethargy*, pain*, erythema*, or heat at involved vascular site*
   AND
   More than 15 colonies cultured from intravascular cannula tip using semi-quantitative culture method

** With no other recognized cause*

1. **VASC Infection (local)**
2. **Primary BSI (PLABSI)**
3. **BSI-LCBI (PRBSI)**
4. **SAB***

<u>*Staphylococcus aureus BSI (SAB):</u>

- Australian Commission of Safety and Quality in Healthcare criteria, and
- Stuart's criteria (Med J Aust, 2013)

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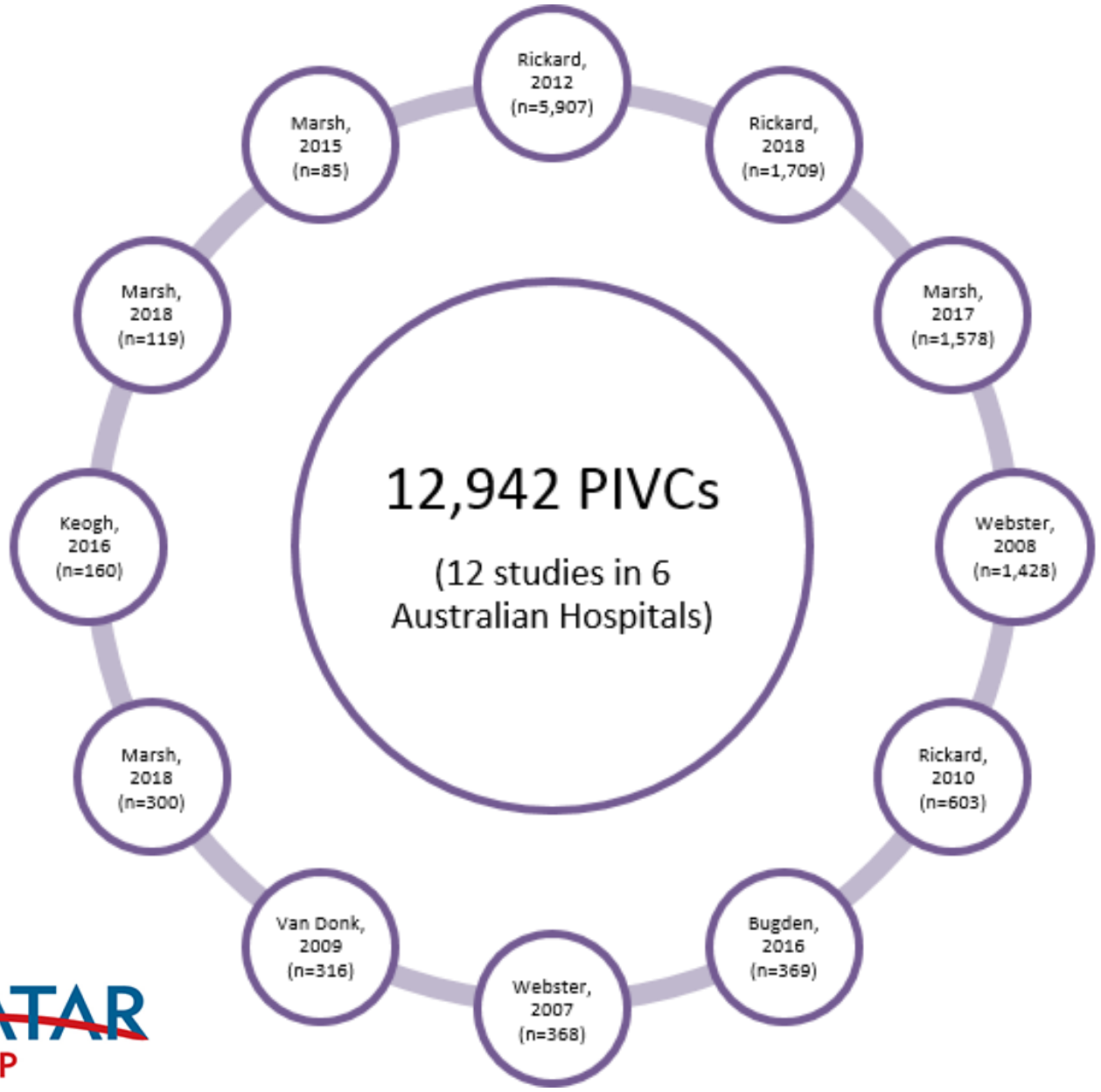
Included Studies



- ✓12 studies
  - 11 RCTs
  - 1 Cohort
- ✓12,942 PIVCs
  (44, 080 PIVC days)
- ✓6 hospitals
  - 4 regional
  - 2 metro

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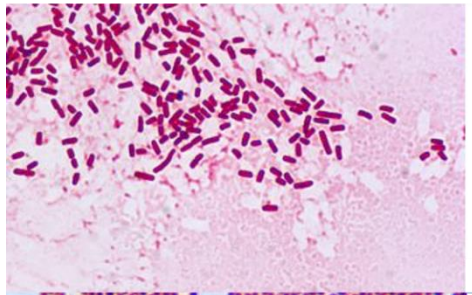
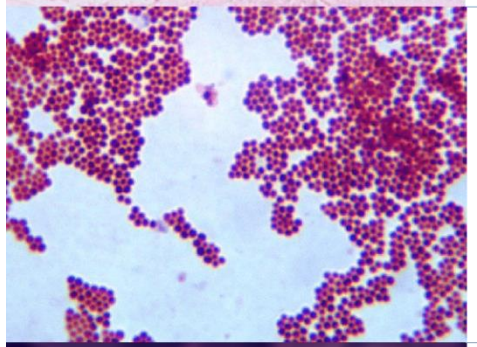
FINDINGS



Enterobacter cloacae

X 3

(1 x Primary BSI; 2 x BSI-LCBI)



Staphylococcus aureus

X 1

(Primary BSI)

Pseudomonas aeruginosa

X 1

(BSI-LCBI)

+

4 Local VASC Infections

S. aureus, GP Cocci, GP Bacilli, GN Bacilli

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FINDINGS

Infection	Cases (n=)	Incidence	/1000 device-days
CVS-VASC (Local Infection)	4	0.03%	0.09
Primary BSI (PLABSI)	5	0.04%	0.11
- BSI-LCBI (PRBSI)	3	0.02%	0.07
- SAB	1	0.01%	0.02

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Life Table of Primary BSIs by day of catheter dwell

Day	N	PLABSI	Day-specific Risk (%)	95%CI
0-1	12942	0	0.00	
1-2	11549	**2**	**0.01**	0.00-0.05
2-3	8258	0	0.00	
3-4	4940	**1**	**0.02**	0.00-0.07
4-5	2560	0	0.00	
5-6	1393	**1**	**0.07**	0.00-0.26
6-7	842	**1**	**0.12**	0.00-0.44
7-8	504	0	0.00	
8-9	295	0	0.00	
9-10	195	0	0.00	
10-42	469	0	0.00	

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FINDINGS

Clinical Scenarios

Primary BSIs were associated with:

1. GIT surgery in patients with cancer
2. suspected non-PIVC sources (not microbiologically proven)
3. asymptomatic or mildly painful insertion sites
4. symptomatic insertion sites post removal
5. non-replacement due to difficult/unsuccessful reinsertions

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CONCLUSIONS

- Complex patients most at risk
- Need better monitoring including post removal
- Need better insertions and less of them
- Each dwell day has BSI risk, but later days not worse than earlier
- About 3375 PLABSIs & 6250 CLABSIs occur p.a. in Australia
- Campaigns for BSI prevention – Improve device choice, insertion, care, monitoring, removal criteria

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REFERENCES

- Bausone-Gazda, D., Lefaiver, C. A., & Walters, S. A. (2010). A randomized controlled trial to compare the complications of 2 peripheral intravenous catheter-stabilization systems. *Journal of Infusion Nursing*, *33*(6), 371-384.
- Rickard, C.M., et al., *Routine versus clinically indicated replacement of peripheral intravenous catheters: a randomised controlled equivalence trial.* Lancet, 2012. **380**(9847): p. 1066-74.
- Webster, J., et al., *Routine care of peripheral intravenous catheters versus clinically indicated replacement: randomised controlled trial.* BMJ 2008. **337**(a339).
- O'Grady, N.P., et al., *Guidelines for the prevention of intravascular catheter-related infections.* Am J Infect Control, 2011. **39**(4 Suppl 1): p. S1-34.
- Maki, D., D. Kluger, and C. Crnich, *The risk of bloodstream infection in adults with different intravascular devices: a systematic review of 200 published prospective studies.* Mayo Clin Proc, 2006. **81**(9): p. 1159-1171.
- Mermel, L.A., *Short-term Peripheral Venous Catheter-Related Bloodstream Infections: A Systematic Review.* Clin Infect Disease, 2017. **65**(10): p. 1757-1762.
- Rickard CM, et al., *Dressings and securements for the prevention of peripheral intravenous catheter failure (SAVE Trial) in adults: a pragmatic, randomised, controlled, superiority trial.* The Lancet, 2018, 392, p.419-430.
- Marsh, N., et al., *Observational study of peripheral intravenous catheter outcomes in adult hospitalised patients – a multivariable analysis of peripheral intravenous catheter failure.* J Hosp Med, 2017. **12**: p. E1-E7.
- Rickard, C.M., et al., *Routine resite of peripheral intravenous devices every 3 days did not reduce complications compared with clinically indicated resite: a randomised controlled trial.* BMC Med, 2010. **8**: p. 53.
- Bugden, S., et al., *Skin glue reduces the failure rate of emergency department-inserted peripheral intravenous catheters: an randomized controlled trial.* Annals Emerg Med, 2016. **68**(2): p. 196-201.
- Webster, J., et al., *Developing a Research base for Intravenous Peripheral cannula re-sites (DRIP trial). A randomised controlled trial of hospital in-patients.* International Journal of Nursing Studies, 2007. **44**(5): p. 664-671.
- Van Donk, P., et al., *Routine replacement vs clinical monitoring of peripheral IV catheters in a regional hospital in the home program: A RCT.* Infect Control Hosp Epidemiol, 2009. **30**(9): p. 915-917.
- Marsh, N., et al., *A novel integrated dressing to secure peripheral intravenous catheters in an adult acute hospital: a pilot randomized controlled trial.* 2018. *Trial, 19*(1), p.596.
- Keogh, S., et al., *Varied flushing frequency and volume to prevent peripheral intravenous catheter failure: a pilot, factorial randomised controlled trial in adult medical-surgical hospital patients.* Trials, 2016. **17**: p. 248.
- Marsh, N., et al., Expert versus generalist peripheral intravenous catheter insertion: a pilot randomised controlled trial (The RELIABLE Trial). Trials, 2018, 19(1), p.564.
- Marsh, N.M., et al., *Securement methods for peripheral venous catheters: A randomised controlled pilot trial.* J Vasc Access, 2015. **16**(3): p. 237-44.
- NHSN, *National Healthcare Safety Network (NHSN) Patient Safety Component Manual*, CDC, Editor. 2018, NIH: Atlanta. p. 1-30.
- Australian Commission for Safety and Quality in Health Care, *Implementation Guide for Surveillance of Staphylococcus aureus Bacteraemia*, DoHA, Editor. 2013, Commonwealth of Australia: Sydney. p. 1-18.
- Stuart, R.L., M.L. Grayson, and P.D.R. Johnson, *Prevention of peripheral intravenous catheter-related bloodstream infections: the need for routine replacement.* MJA, 2013. **199**(11): p. 751.

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