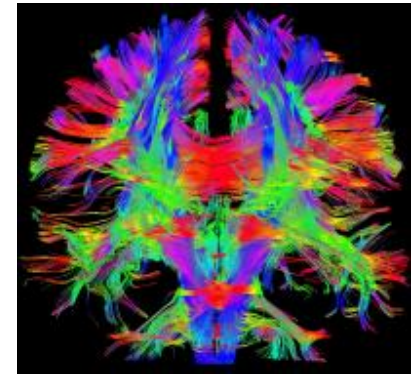




Nuovi materiali per la prevenzione di infezione e trombosi: quali evidenze?

Massimo Lamperti MD, MBA
Clinical Professor of Anesthesiology
Cleveland Clinic Lerner College of Medicine
Chief of General Anaesthesiology Department
Cleveland Clinic Abu Dhabi

Disclosures

- No conflict of interest to declare related to this topic



Risk[®] zero

This pack contains
0.9
kcal



PICC complications

- Catheter-related bloodstream infections (CRBSI)
 - high focus
 - never event
- Catheter-related thrombosis (CRT)
 - hidden problem
 - worsen outcomes

PICC-CRBSI

Bloodstream Infection, Venous Thrombosis, and Peripherally Inserted Central Catheters: Reappraising the Evidence

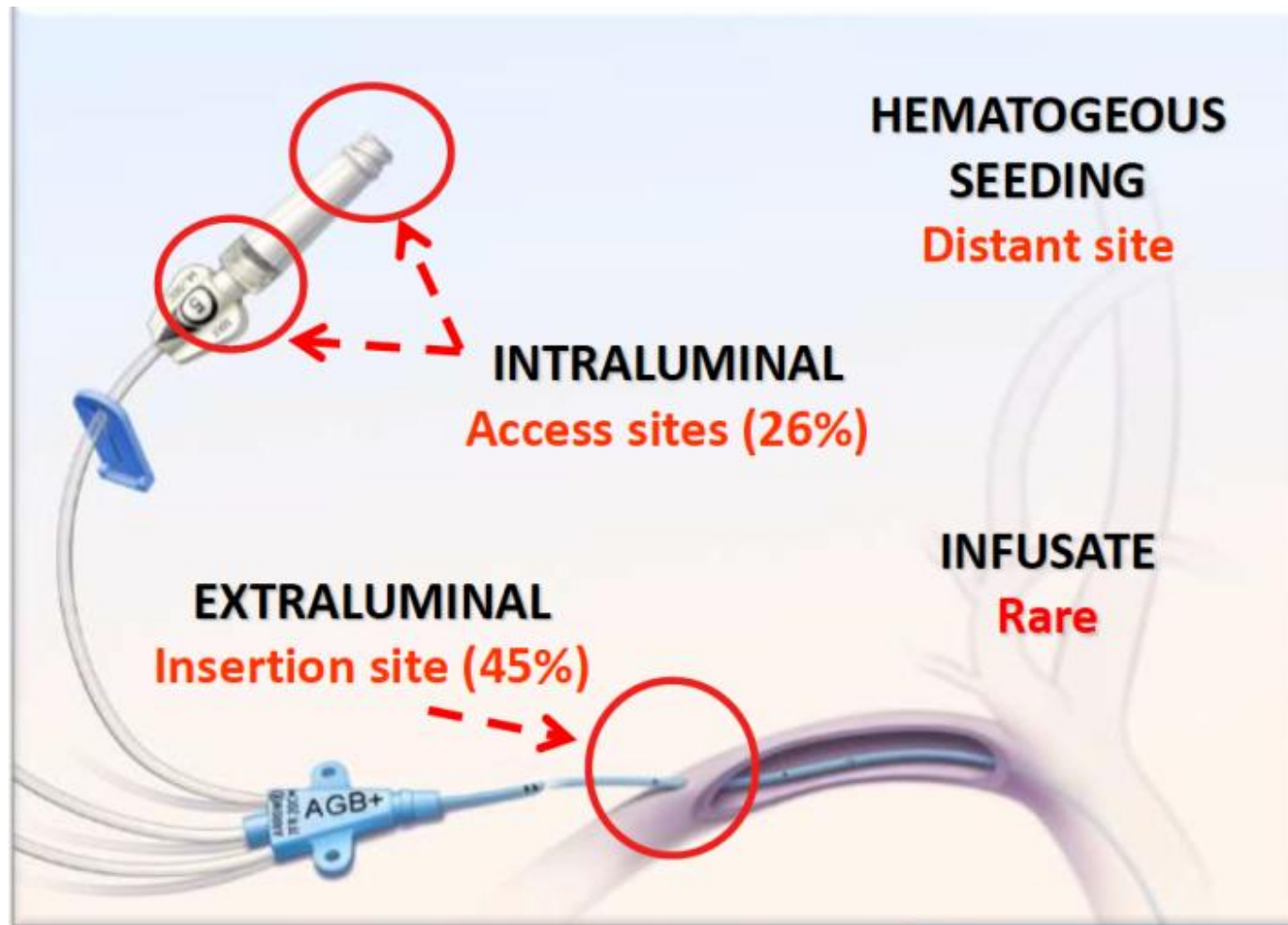
Vineet Chopra, MD, MSc,^a Sarah Anand, MD,^a Sarah L. Krein, RN, PhD,^{a,b} Carol Chenoweth, MD,^c
Sanjay Saint, MD, MPH^{a,b}

^aDivision of General Internal Medicine, ^bHospital Outcomes Program of Excellence of the Ann Arbor Veterans Affairs Medical Center,

^cThe Division of Infectious Diseases, University of Michigan Health System, Ann Arbor, Mich.

INFECTION	Patients without cancer	Patients with cancer
Incidence	1.0 to 2.1/1000 catheter days	1.8 to 7.7 catheter days
Mortality	Estimated 12-25%	Estimated 31-36%

PICC-CRBSI



PICC-CRBSI

Bloodstream Infection, Venous Thrombosis, and Peripherally Inserted Central Catheters: Reappraising the Evidence

Vineet Chopra, MD, MSc,^a Sarah Anand, MD,^a Sarah L. Krein, RN, PhD,^{a,b} Carol Chenoweth, MD,^c
Sanjay Saint, MD, MPH^{a,b}

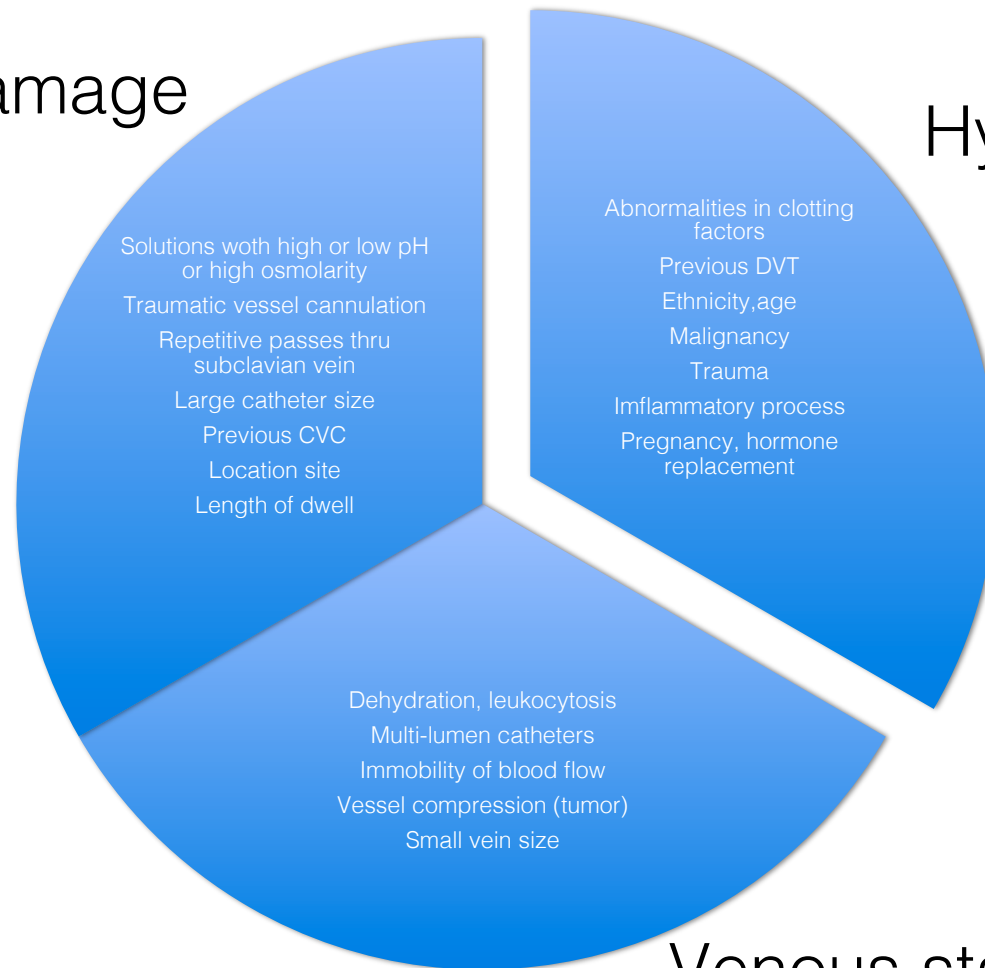
^aDivision of General Internal Medicine, ^bHospital Outcomes Program of Excellence of the Ann Arbor Veterans Affairs Medical Center,

^cThe Division of Infectious Diseases, University of Michigan Health System, Ann Arbor, Mich.

THROMBOSIS	Patients without cancer	Patients with cancer
Incidence	2.0 to 5.5% (symptomatic thrombosis)	3.4 to 7.8%
Mortality	1-2%	2-4% (50% higher for cancer patients)

PICC-CRT: risk factors

Endotelial damage



Hypercoagulability

Venous stasis

Relationship between CRBSI and CRT

Raad 1994

- Post mortem exam of 72 cancer patients
- Findings:

Fibrin layer on all

Mural thrombus on 38% veins

CR sepsis in 7%

Sepsis only in patients with thrombosis

Timsit 1998

- Critical care study
- 208 catheters
- Findings:

10 of 139 (7.2%) with CR sepsis without CRT

13 of 69 (18.8%) with CR sepsis with CRT

When CRT present, risk of CRI increased 2.6 fold

Q/A

- Materials?
- Tip?
- Valved or not valved?
- Coating?
- What is the final choice?



Table II. Performance and Complication Rates for Silicone and Polyurethane Midline and PICC Catheters

	Silicone PICCs	Polyurethane Midline & PICCs
Number of Insertions	45 to 858	28 to 147
Average Dwell (days)	12 to 38	12 to 63
Range of Indwelling Times (days)	1 to 370	4 to 139

REPORTED COMPLICATION RATES

Phlebitis	2% to 17%	1% to 4%
Thrombus of Subclavian Vein	0.3% to 3%	0
Signs/Symptoms of Infection	1% to 10%	0 to 1%
Confirmed Sepsis (Tip Culture Positive)	0 to 2%	0 to 1%
Ruptured Cannula	3% to 10%	0
Occluded Cannula	1% to 23%	0 to 1%
References	17-20, 27-30, 32-34, 39, 45	35, 46, 49

A comparison of silicone and polyurethane PICC lines and postinsertion complication rates: a systematic review

- Polyurethane PICC lines were found to provide lower rates of infection, dislodgment, thrombus and rupture complications.
- Mixed results were found with catheter line occlusions, overall averages showing polyurethane lines slightly higher rates than silicone. Oncology patients however saw opposite results.
- Phlebitis rates saw the largest division among the postinsertion complication rates, with 6.7% more phlebitis in the general patient group and 14.5% in the oncology group more for those with polyurethane PICC lines compared with the silicone.

Polyurethane versus silicone catheters for central venous port devices implanted at the forearm



Moritz Wildgruber ^{a,f,*}, Claudia Lueg ^a, Sebastian Borgmeyer ^{a,b},
Ilham Karimov ^a, Ulrike Braun ^c, Marion Kiechle ^d, Reinhard Meier ^e,
Michael Koehler ^f, Johannes Ettl ^d, Hermann Berger ^a

European Journal of Cancer 59 (2016) 113–124

- PU catheters are more susceptible to catheter-related infections and exhibit a higher thrombogenicity, compared to silicone catheters.
- Silicone catheters instead exhibit a trend towards decreased mechanical stability.

RESEARCH

Open Access

Clinical experience with power-injectable PICCs in intensive care patients

- Retrospective review of 89 Power-PICC lines
- No CRBSI
- 2 episodes of CRT (in the first 10 days dwell time)

Power-injectable PICC

- Up to 300 PSI
- Main indication if multiple CT scan are required
- Possible infusion up to 300ml/h (with infusion pumps)

A prospective, randomized comparison of three different types of valved and non-valved peripherally inserted central catheters

**Mauro Pittiruti¹, Alessandro Emoli², Patrizia Porta², Bruno Marche², Rosa DeAngelis²,
Giancarlo Scoppettuolo³**

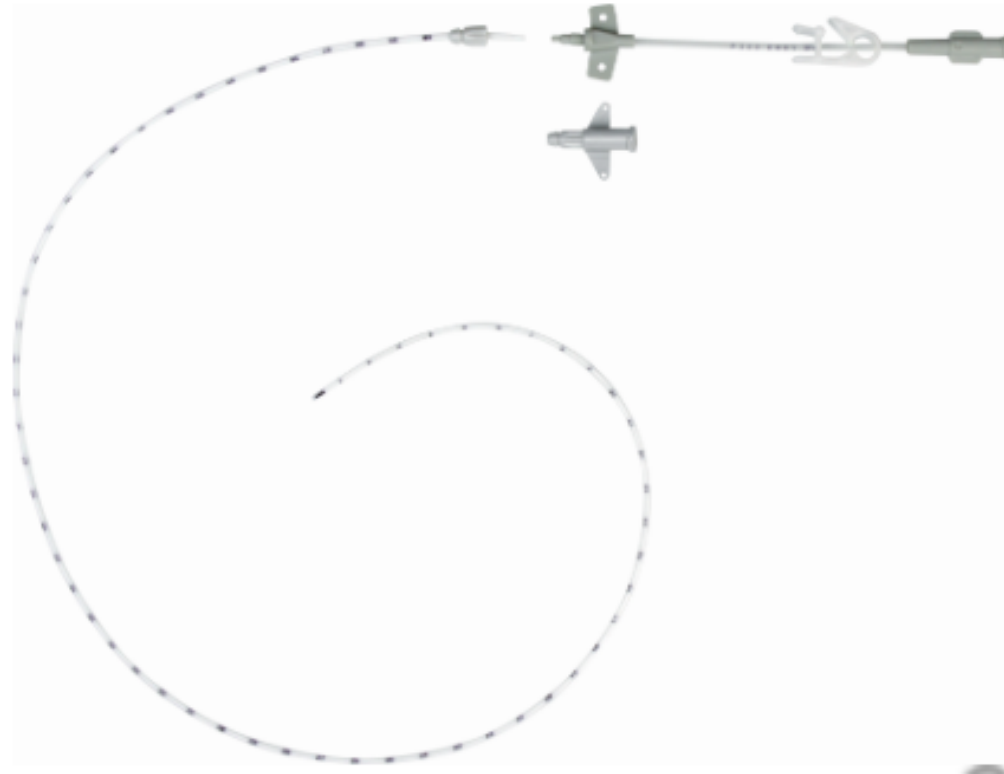
- Prospectively compared three types of third-generation polyurethane PICCs (power-injectable PICCs with Solo-2 proximal valve (Bard); power-injectable PICCs with PASV (Pressure Activated Safety Valve) proximal valve (Navilyst); and non-valved power-injectable PICCs (Medcomp).
- Incidence of occlusion, infection, malfunction and venous thrombosis.
- 1 episode of CRT in group B
- No CRBSI

Cutting Peripherally Inserted Central Catheters May Lead to Increased Rates of Catheter-Related Deep Vein Thrombosis

- Association exists between cutting or trimming peripherally inserted central catheters (PICCs) and the development of deep vein thromboses (DVTs).
- Observational, retrospective study was conducted on 634 patients who had a PICC inserted between 2011 and 2012
- The first group included patients with a reverse-taper PICC that was cut/trimmed (PC) before insertion (n = 224). The second group was made up of patients whose PICC was not cut/trimmed (PNC) before insertion (n = 410).

Cutting Peripherally Inserted Central Catheters May Lead to Increased Rates of Catheter-Related Deep Vein Thrombosis

- A statistically significant difference ($P < .001$) was found between patients in the PC group who developed a DVT (9.82%) and patients in the PNC group in which PICCs were not trimmed (1.95%).
- Further study is required to determine whether PICCs should be reduced in length or whether there is an appropriate method of trimming the catheter to ensure its stability after insertion.



Lifecath PICC Easy

A prospective, randomized comparison of three different types of valved and non-valved peripherally inserted central catheters

Mauro Pittiruti¹, Alessandro Emoli², Patrizia Porta², Bruno Marche², Rosa DeAngelis², Giancarlo Scoppettuolo³

- Prospectively compared three types of third-generation polyurethane PICCs (power-injectable PICCs with Solo-2 proximal valve (Bard); power-injectable PICCs with PASV (Pressure Activated Safety Valve) proximal valve (Navilyst); and non-valved power-injectable PICCs (Medcomp).
- No clinical advantages of valved vs. non-valved PICCs

powerPicc
solo² Catheter



Infusion



Aspiration

Xcela® PICC with PASV® Valve Technology
Redefining the PICC



Close after infusion



Infusion

Open for sampling



Aspiration

Remain closed during normal
increases in central venous pressure



Closed

PRO-PICC® CT INJECTABLE CATHETERS

Reduced Taper

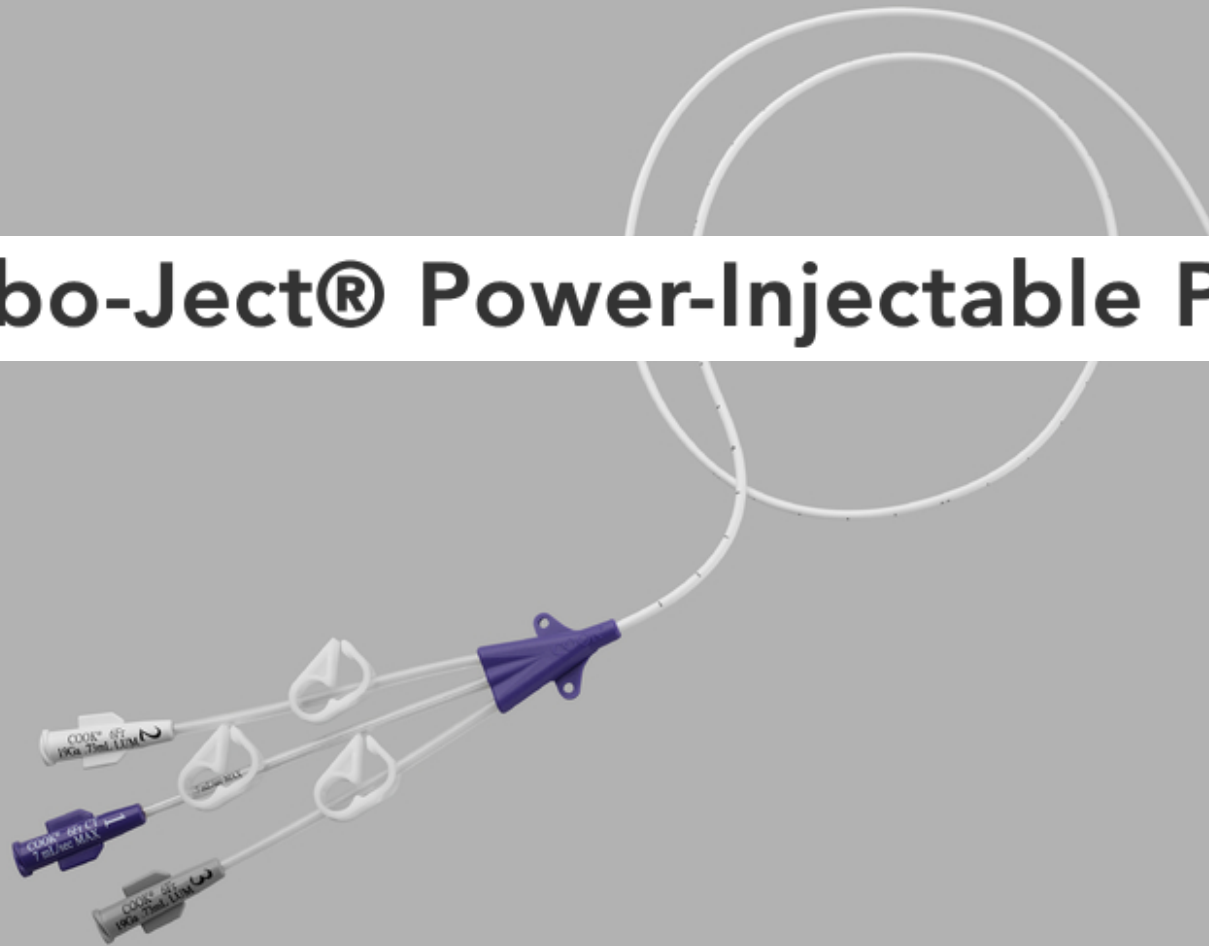
Our 3F Pro-PICC® CT combines the smallest proximal diameter and shortest taper length without compromising power injection rates.



Alcohol & iodine compatible
See our [Site Care page](#) for more information on agent compatibility.

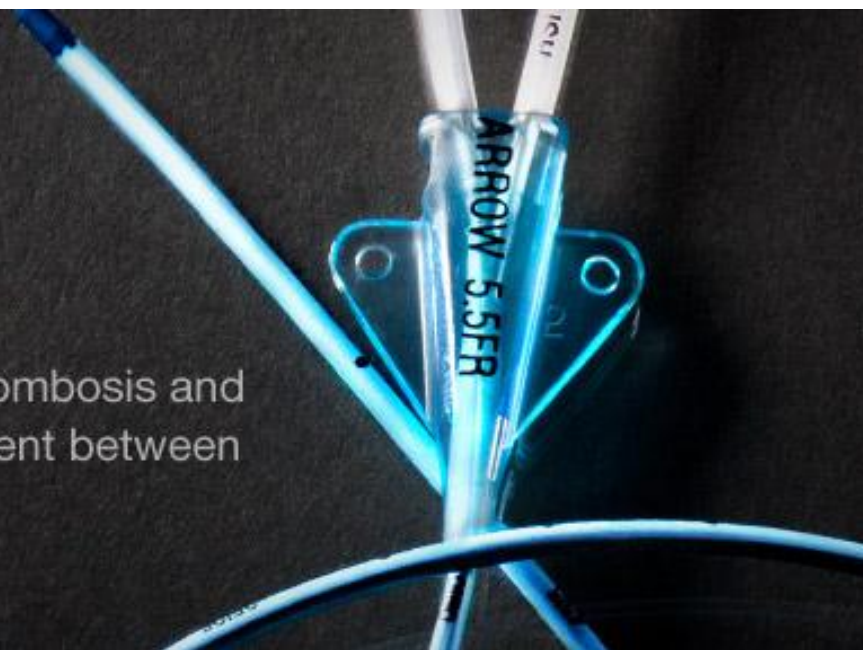


Turbo-Ject® Power-Injectable PICC



TaperFree™ Catheter Design

Minimizes risk of catheter-related thrombosis and ensures stated French size is consistent between distal and proximal ends.^{2,3,4}

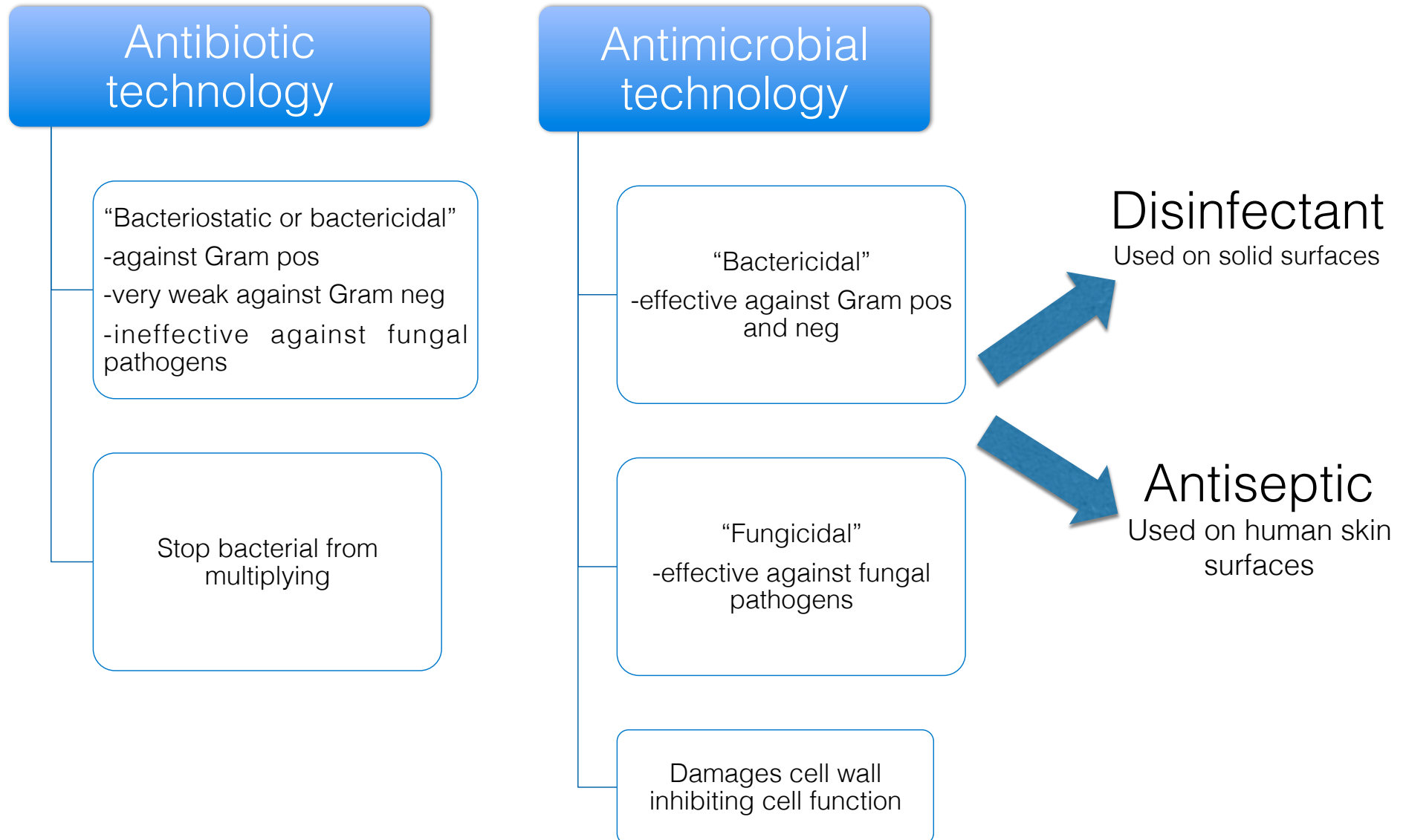


Protected PICC technology

- Antibiotic impregnated PICC (Cook Spectrum Turbo-Ject PICC)
- Antimicrobial impregnated PICC (Arrow PICC with Chloragard Technology)

These technologies damage the cell wall and inhibits bacterial growth of bacterial and/or fungal pathogens

Protected PICC technology



Cook Spectrum Turbo-Ject PICC

- Polyurethane, 60 cm, trimable
- Minocycline and Rifampin (synergistic action)
- Action on Gram pos and neg



Cook Spectrum Turbo-Ject PICC

- Impregnation on internal and external surface
- Combination of Minocycline and Rifampin makes the color orange



Cook Spectrum Turbo-Ject PICC

Contraindications

- Allergy to minocycline and rifampin
- Pregnancy

Resistance

- Questions raised about the development of resistance
- Literature support this

Evidence

- In vitro study showing 15mm zone of inhibition >30days (Sheretz 1993)

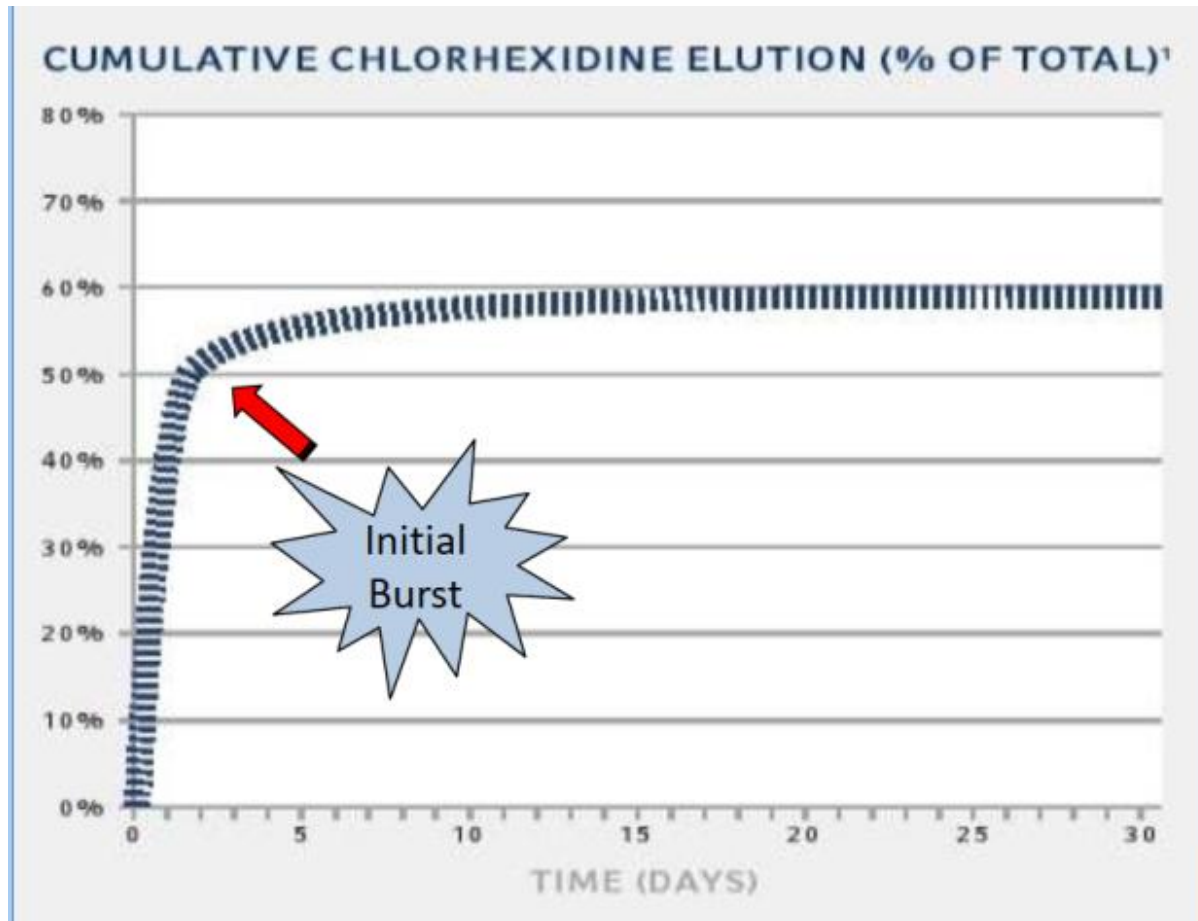
Arrow PICC with Chloragard Technology

- Chlorexidine (CH) is very effective bactericidal
- CH fast acting, damaging cell wall
- CH very effective when combined with alcohol (Adams 2005)
- CH strongly binds to proteins in skin and mucosa
- Antimicrobial activity of CH is not affected by presence of blood

Arrow PICC with Chloragard Technology

- Chlorexidine (CH) is bonded to catheter
- After 24hrs, CH is relased out of catheter surface into surroundung tissue, thus limiting infection at entry site
- Slow release

Arrow PICC with Chloragard Technology



Arrow PICC with Chloragard Technology

Contraindications

- Allergy to CH

Resistance

- Unlikely

Evidence

- Only animal studies
- Log reduction claim supported by FDA clearance

A comparative evaluation of antimicrobial coated versus nonantimicrobial coated peripherally inserted central catheters on associated outcomes: A randomized controlled trial

Susan Storey PhD, RN ^{a,*}, Jamie Brown MSN, RN ^b, Angela Foley MSN, RN ^b,
Erica Newkirk MSN, RN ^c, Jan Powers PhD, RN ^d, Julie Barger BSN, RN ^b,
Karen Paige MEd, BSN, RN ^b

American Journal of Infection Control 44 (2016) 636-41

- Patients in 3 high-risk units were randomly assigned to receive either a CHG-impregnated or non-CHG PICC line
- 167 patients
- No differences were noted in the development of CLABSI and VTE between the CHG and non-CHG groups.

The impact of antibiotic impregnated PICC lines on the incidence of bacteremia in a regional burn center

Shannon D. Armstrong^{a,*}, Wendy Thomas^b, Keith C. Neaman^a, Ronald D. Ford^c,
Jayne Paulson^d

BURNS 39 (2013) 632–635

- 19 consecutive patients, observational data
- Antibiotic impregnated PICC lines decrease the bacteremia rate in our burn population.
- This has potential benefits for both patient morbidity and mortality as well as potential cost savings for the healthcare system.

Antithrombogenic PICC technology

- Angiodynamics Bioflo with Endexo Technology
- Arrow PICC with Chloragard Technology

Angiodynamics Bioflo with Endexo Technology

- Goals for non-eluting technology
 - resists accumulation of platelets and thrombus
 - added into polyurethane during catheter manufacturing
 - designed to passivate the catheter surface
 - permanent surface modification



Angiodynamics Bioflo with Endexo Technology

- 87% reduction of thrombus accumulation on catheter surface over 2 hours (Larue 2012)
- Not clear benefit on catheter occlusion

Angiodynamics Bioflo with Endexo Technology

Contraindications

- Hypercoagulopathy unless patient is on anticoagulation therapy
- Patient with known tape or adhesive allergies

Flushing/pressure injection

- Requires heparinized saline
- Single lumen: 3.5cc/sec
- Double lumen: 4cc/sec

Length of anti-thrombogenic activity

- Not specified

Arrow PICC with Chloragard Technology

- CH reduces thrombus accumulation on catheter surface by inhibiting thrombin formation
- 62% reduction in thrombus formation after 30 days
- 51% reduction in flush pressure

Arrow PICC with Chloragard Technology

ARROW® PICC with CHLORAG+ARD® Technology: Day 31

Absence of infection; minimal thrombus formation



Unprotected Control PICC #2: Day 31

Highly infected tissue and significant thrombus formation



Unprotected Control PICC #1: Day 7

Infection present in tissue with significant thrombus formation



Arrow PICC with Chloragard Technology

Contraindications

- Hypercoagulopathy unless patient is on anticoagulation therapy
- ALLERGY TO CH

Flushing/pressure injection

- Saline or heparinized saline
- Single o double lumen: 5cc/sec

Length of anti-thrombogenic activity

- 30 days





Right choice

1. Patient first
2. Length of therapy
3. Technique
4. Management
5. Technology



CCAD data Q1-3 2017

- PCCC CLABSI: 0.3/1000 indwelling days
- CICC 1.1/1000 indwelling days
- FICC 3.2/1000 indwelling days
- No more FICC- now in training process for tunnelling
- CR-DVT: as now 12% asymptomatic DVT treated, no symptomatic DVT



docmassimomd@gmail.com