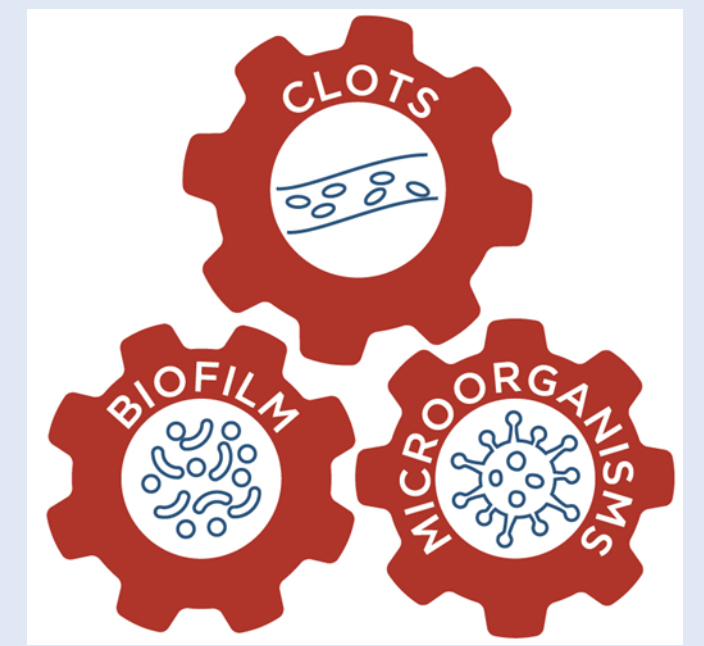




Catheter Lock Solutions: The Debate, The Triple Threat and The Solution



Karen Mueller

SterileCare Inc, 15 Allstate Parkway, Suite 600, Markham, Ontario Canada L3R 5B4

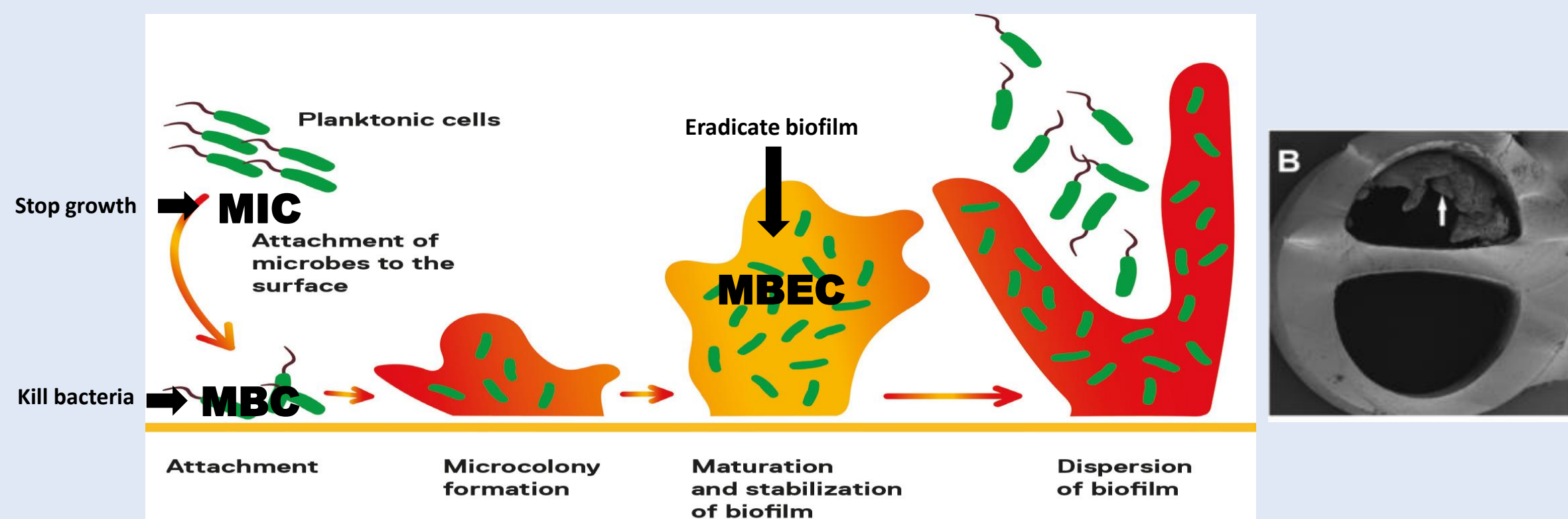
A NEW ERA OF RISK

- Antibiotic resistance (ABR) is one of the most urgent threats to public health, caused by the non-judicious use of antibiotics.
- Infection prevention in vascular access is crucial. Every single day, an estimated 34 Canadians die of a preventable bloodstream infection acquired during hospitalization.¹
- According to the Centers for Disease Control and Prevention (CDC), 70% of these infections are caused by the formation of bacterial biofilm or by the presence of harmful bacteria (including superbugs) in prolonged-use intravenous (IV) catheters.²
- In some parts of the world (ie. India), deadly superbugs are putting the use of chemotherapy into question as the risk of dying from one of these infections is greater than dying of the cancer itself.³
- 1 in 6 infections are related to antibiotic resistant bacteria (super bugs).²
- In this new era of risk, non-antibiotic solutions for the infection prevention are more important than ever to keep immunocompromised patients at home during COVID-19 and limit antibiotic use for when we need them.

THE DEBATE

Is biofilm an important factor to be considered in CVAD complications?

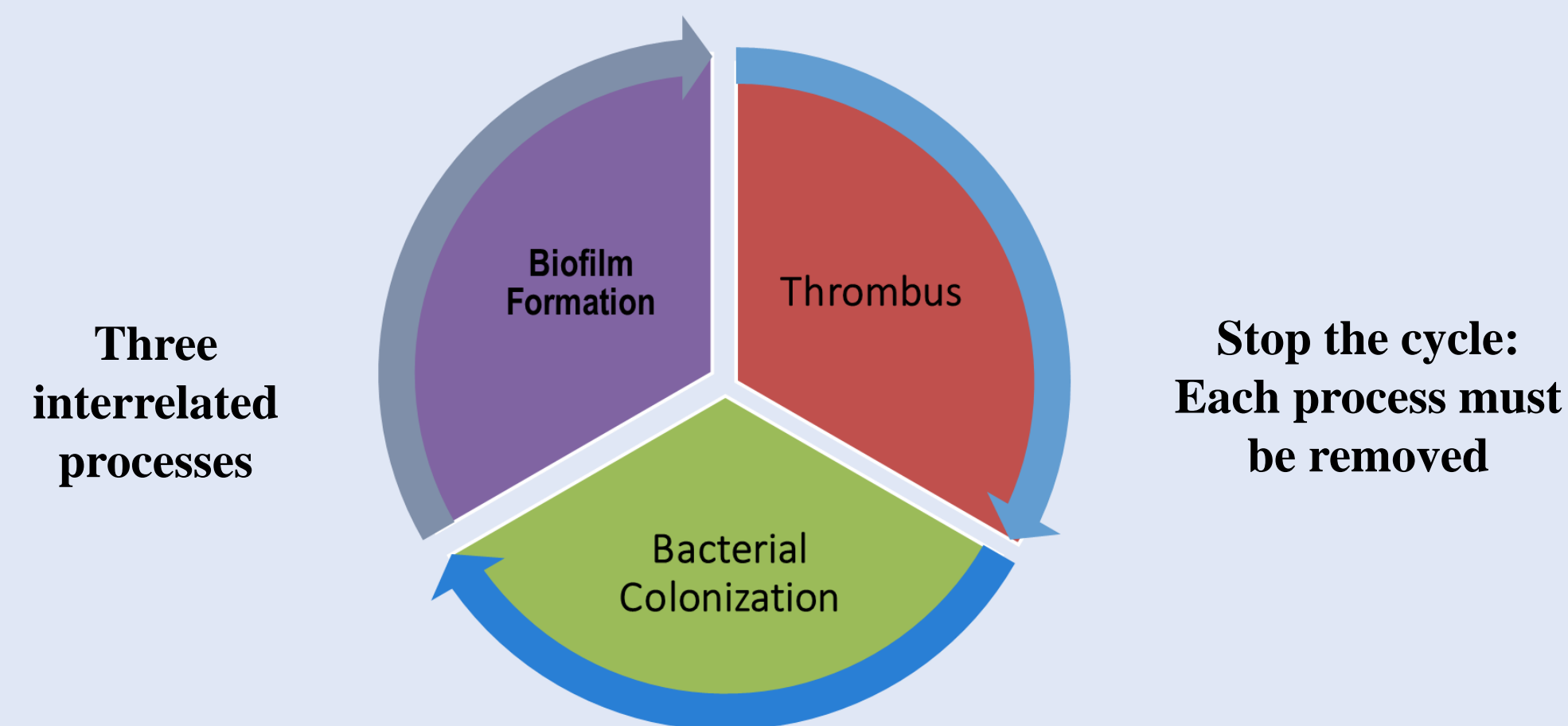
- Biofilm causes 80% of central-line associated blood stream infections (CLABSI) – continual source of bacteria.
- Important source of superbugs with drug-resistant gene transfer occurring via quorum sensing.



- Inhibiting bacterial growth or killing of the bacteria will not provide long term protection against central line infections. Biofilm within CVADs must be **eradicated** or bacteria will regrow rapidly putting patients at risk for infections.
- It is estimated that 100% of long term CVADs have intraluminal biofilm.⁴
- Heparin stimulates biofilm formation.⁵
- Biofilm is to be considered when addressing intraluminal occlusions. (Note: Alteplase is not effective if clot is covered with biofilm.)

THE TRIPLE THREAT

- A catheter lock is a solution that protects the inside the CVAD lumen when not in use.
- An effective lock solution must protect against all three interrelated processes: **clots, microorganisms and biofilm.**
- In order to inhibit all CVAD complications, a catheter lock solution **MUST** be an effective antimicrobial, anticoagulant and antibiofilm solution.



THE SOLUTION

- The only lock solution that protects against the triple threat: tetra-sodium EDTA (KiteLock 4%).
- 50-100% reduction in occlusions following KiteLock 4% use in parenteral nutrition patients.^{6,7}
- 71-100% reduction in CLABSI incidence following KiteLock 4% use in paediatric and adult patients on long-term parenteral nutrition.^{6,7}

KITELOCK 4%	PROPERTIES
Effective anticoagulant	<ul style="list-style-type: none"> • Trusted anticoagulant • 10X stronger than citrate
Effective Antimicrobial	<ul style="list-style-type: none"> • Effective against Gram positive and Gram negative bacteria; yeast
Prevent and Eradicate Biofilm	<ul style="list-style-type: none"> • Effective against multi-drug resistant bacteria • The only lock solution with the ability to eradicate biofilm of all bacterial strains, including resistant strains like MRSA, VRE, etc
Support antibiotic stewardship program	<ul style="list-style-type: none"> • Alternative to antibiotics • Does not contribute to resistance
Safe to Use	<ul style="list-style-type: none"> • The only lock solution to be approved for use in adult and children

- 63% reduction in cost when KiteLock 4% is used in 24 months compared to using 0.9% sodium chloride, heparin or taurolidine.^{6,7}

REVIEW OF LOCK SOLUTIONS

Product	Anticoagulant	Antimicrobial	Antibiofilm (prevent)	Antibiofilm (prevent)	Comments	References
Saline	X	X	X	X	Lock/ flush	
Heparin	✓	X	X	X	Stimulates biofilm; HIT	Shanks et al, 2005. Heparin stimulates Staphylococcus aureus biofilm formation. Infection and Immunity, 73(8):4596-4606.
Citrate 4%	✓	✓	✓	X	Need for thrombolytic treatment	Hemmelgarn et al, 2011. Prevention of dialysis catheter malfunction with recombinant tissue plasminogen activator. The New England Journal of Medicine, 364(4):303-312.
Citrate 4% + 30% Ethanol	✓	✓	✓	X	Protein precipitation; need for thrombolytic treatment	Schilcher et al, 2013. Ethanol protein precipitation - New safety issues for catheter locking techniques. PLOS ONE, 8(12):1-8.
Ethanol 70%	X	✓	✓	X	Stimulates biofilm; need for thrombolytic tx; CVC damage	Luther et al, 2015. Ethanol and isopropyl alcohol exposure increases biofilm formation in Staphylococcus aureus and Staphylococcus epidermidis. Infectious Diseases and Therapy, 4:219-226.
Antibiotic cocktail	X	✓	✓	X	Antibiotic resistance risk; not efficient against biofilm	Pittiruti et al, 2016. Evidence-based criteria for the choice and the clinical use of the most appropriate lock solutions for central venous catheters (excluding dialysis catheters): a GAVeCeLT consensus.
Taurolidine	X	✓	✓	X	G+ limitations; need for thrombolytic treatment	Solomon et al, 2010. A randomized double-blind controlled trial of taurolidine-citrate catheter locks for the prevention of bacteremia in patients treated with hemodialysis. American Journal of Kidney Diseases, 55(6):1060-1068; Arlt et al, 2012. Int. J. Cancer: 131, E804-E812
Alteplase	X	X	X	X	Most likely to be associated with undesired effects or hemorrhagic complications; costly	Pittiruti et al, 2016. Evidence-based criteria for the choice and the clinical use of the most appropriate lock solutions for central venous catheters (excluding dialysis catheters): a GAVeCeLT consensus.
4% T-EDTA	✓	✓	✓	✓	MBEC ≤ 4% for G+, G-, yeast including MDR microorganisms	Liu et al, 2018. Tetrasodium EDTA is effective at eradicating biofilms formed by clinically relevant microorganisms from patients' central venous catheters. mSphere 3(6):1-16

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CONTACT INFORMATION

Karen Mueller

kmueller@sterilecareinc.com