



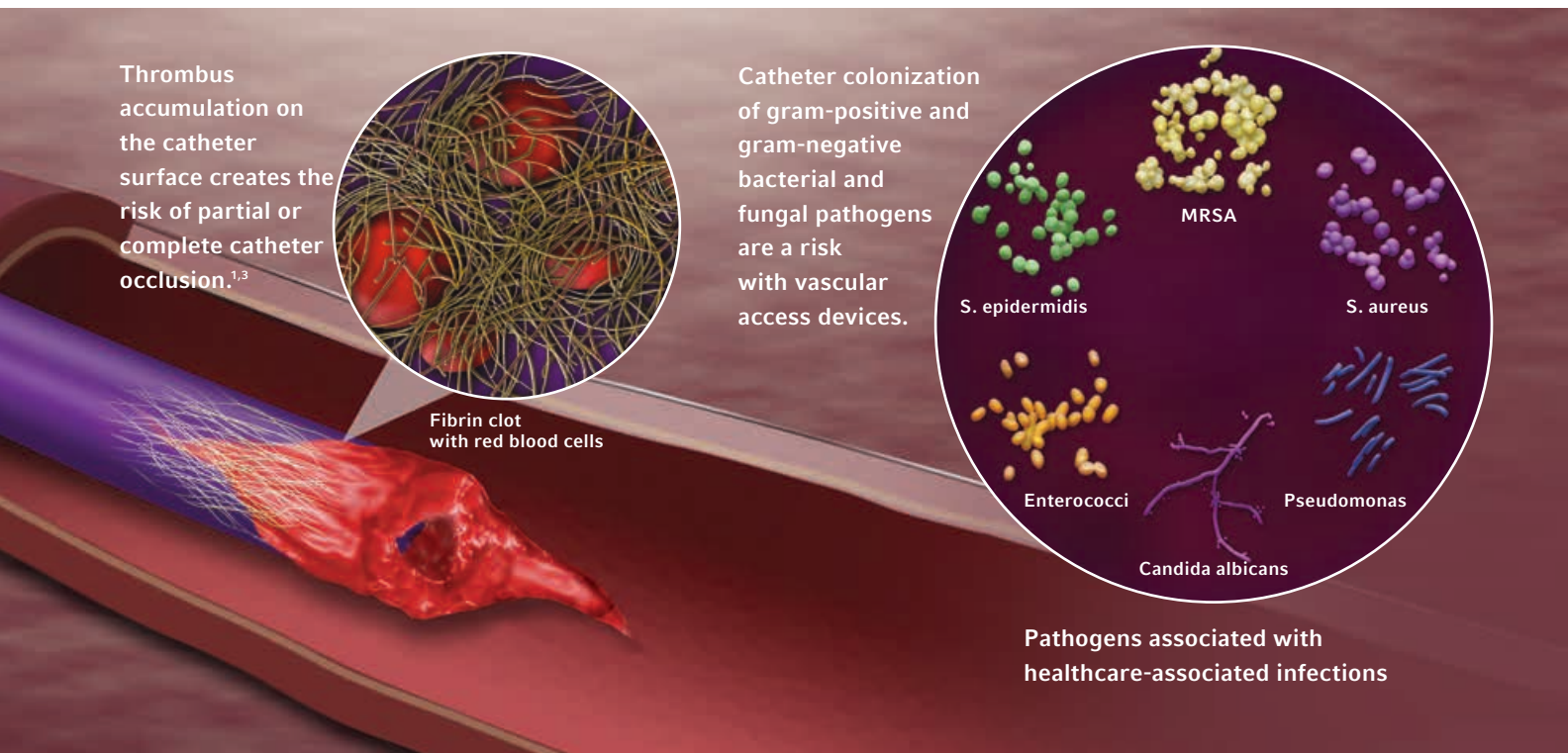
Antimicrobial
Antithrombogenic

Arrowgard Blue Advance Protection

Antithrombogenic.¹ Antimicrobial.²

Discover the Protection of Blue.

What are the Invisible Risks of Catheter Surface Thrombus Accumulation and Microbial Colonization?^{1,2}



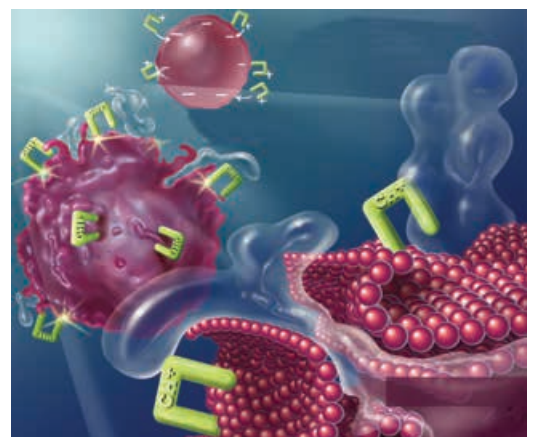
Characterization of Chlorhexidine

Chlorhexidine has been in use for almost 60 years in more than 60 pharmaceuticals and medical devices. Chlorhexidine is characterized as having a broad antimicrobial activity spectrum, including bacteriostatic and bactericidal effects on gram-positive bacteria, gram-negative bacteria, and fungi.^{4,5,6,7}

Mechanism of Action

Chlorhexidine has been shown in ovine model *in vivo* studies to minimize thrombus accumulation on the catheter surface. The antithrombogenic mechanism of action (MOA) of chlorhexidine is accomplished by interrupting the clotting cascade by inhibiting the conversion of soluble fibrinogen by thrombin into fibrin clot.

For the antimicrobial MOA of chlorhexidine, the positively charged chlorhexidine molecules are strongly attracted to the negative charges present on microbial surfaces. Chlorhexidine breaks through the cell wall, causing cell death.⁴

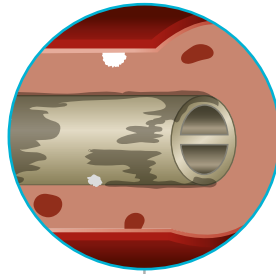


Protects Against Fibrin Sheath Formation

Fibrin sheaths can form on the catheter body or extend beyond the catheter tip. Catheter occlusion is a common complication which can inhibit or delay the delivery of medications and blood products. Arrowg+ard Blue Advance Protection shields the catheter surface, including the tip, from thrombus accumulation for at least 30 days beyond insertion.³

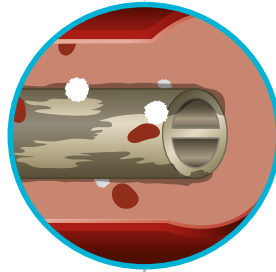
1. Insertion

Immediately after catheter insertion, proteins attach to the catheter body.



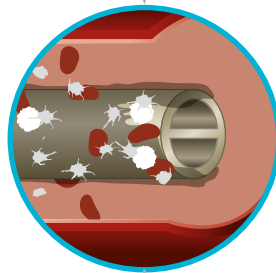
2. Attachment

A few circulating platelets, white and red blood cells attach to the protein layer.



3. Coagulation

In the common pathway of clotting, prothrombin and Factor Xa attach to create thrombin.



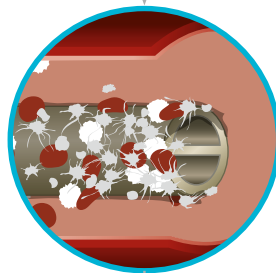
Arrowg+ard Blue Advance Protection interrupts the clotting cascade.



Arrowg+ard Blue Advance Protection inhibits the final step of the coagulation pathway, the conversion of soluble fibrinogen to fibrin clot.

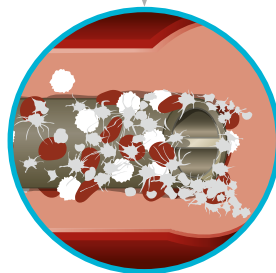
4. Thrombin

Thrombin converts circulating soluble fibrinogen into fibrin strands.



5. Fibrin Sheath

Crosslinked fibrin traps more platelets, blood cells, plasma and proteins to form a fibrin sheath.



Protects Against Catheter Colonization

Arrowg+ard Blue Advance Protection is designed to reduce microbial colonization on catheter surfaces of pathogens responsible for causing healthcare infections. The extra- and intraluminal barrier of Arrowg+ard Blue Advance Protection from tip to hub is critical to providing a defense beyond initial insertion protection strategies.



Distribution of Pathogens From Device-Associated Infections Reported to the National Healthcare Safety Network: January 2006–October 2007, 2009-2010 and 2011-2014⁵

ORGANISM	PATHOGEN	CLABSI %			RANKING PER YEAR		
		2006-2007	2009-2010	2011-2014	2006-2007	2009-2010	2011-2014
Gram-positive	Enterococcus species	16	18.1	17.2	2	2	1
	Staphylococcus epidermidis (coagulase-negative) "CoNS"	34.1	20.5	16.4	1	1	2
	Staphylococcus aureus (coagulase-positive)	9.9	12.3	13.4	4	4	4
Gram-negative	Klebsiella species	5.8	7.9	8.4	5	5	5
	Escherichia coli	2.7	4	5.4	8	7	6
	Enterobacter species	3.9	4.5	4.4	7	8	7
	Pseudomonas species	3.1	3.8	4.2	8	7	8
	Acinetobacter baumannii	2.2	2.1	2.2	9	10	9
	Serratia	N/A	2.5	2.1	N/A	9	10
Fungal	Yeast/Candida Species	11.8	14.6	15.1	3	3	3
Total Gram-positive		60	50.9	47			
Total Gram-negative		17.7	22.3	26.7			
Total Fungal		11.8	14.6	15.1			

Arrowg+ard Blue Advance Protection is proven 99.99% effective for reduction of catheter colonization against gram-positive and gram-negative bacteria as well as fungi for at least 30 days, including pathogens such as *Pseudomonas aeruginosa*, VRE, *Escherichia coli*, *Candida albicans* and *Acinetobacter baumannii*.²

3rd Generation of Catheter Protection

Arrowg+ard Blue Advance Protection is the 3rd generation of chlorhexidine-based protective treatment from Teleflex. As shown in ovine model *in vivo* studies, Arrowg+ard Blue Advance Protection provides antithrombogenic and antimicrobial protection,^{2,3} against thrombotic occlusion^{2,3} and a reduction in phlebitis and intimal hyperplasia.⁴ Catheters with Arrowg+ard Blue Advance Protection have been shown to provide a 99.99% colonization reduction against gram positive and gram negative bacteria and fungi for at least 30 days.¹



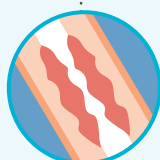
Arrowg+ard Blue Advance Protection is chemically bonded to the catheter surface to provide a controlled release. Both internal and external catheter surfaces and the entire internal fluid pathway, including the extension lines and juncture hub, are bonded with chlorhexidine to provide thorough protection.

An initial burst of chlorhexidine is released to kill pathogens that gain access to the subcutaneous tract during the insertion process. This is followed by a sustained release resulting in antimicrobial and antithrombogenic protection of the catheter surface for at least 30 days.^{1,2}



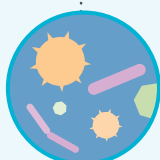
Protects Against Thrombotic Occlusion

Chlorhexidine works continuously to prevent build-up of thrombus, reducing the risk of thrombotic intraluminal occlusion^{1,3,4}



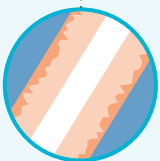
Antithrombogenic Protection

Reduces thrombus accumulation on catheter surfaces¹



Antimicrobial Protection

Extra- and intraluminal protection help reduce the colonization from pathogens responsible for most healthcare-associated infections²



Intimal Hyperplasia Protection

In vivo intravascular studies have shown an average of 72% less intimal hyperplasia after 29 days and reduction in phlebitis⁴

References:

1. As compared to uncoated PICCs, intravascular ovine model inoculated with *Staph aureus*. No correlation between *in vitro* / *in vivo* testing methods and clinical outcomes have currently been ascertained.
2. *In vitro* data on file 2010. No correlation between *in vitro* / *in vivo* testing methods and clinical outcomes have currently been ascertained.
3. As compared to uncoated PICCs, *in vitro* model measuring flush pressure post exposure to human blood. No correlation between *in vitro* / *in vivo* testing methods and clinical outcomes have currently been ascertained.
4. As compared to uncoated PICCs, intravascular ovine model. No correlation between *in vitro* / *in vivo* testing methods and clinical outcomes have currently been ascertained.
5. Weiner, L., et al. (2016). Antimicrobial-Resistant Pathogens Associated With Healthcare-Associated Infections: Summary of Data Reported to the National Healthcare Safety Network at the Centers for Disease Control and Prevention, 2011–2014. *Infection Control & Hospital Epidemiology*, 37(11), 1288-1301. doi:10.1017/ice.2016.174.
6. Byers K, et al. Catheter-related infections in the critically ill. 2004;95(Ch 6).
7. McKinnell JA, et al. Observational study of the epidemiology and outcomes of vancomycin-resistant *Enterococcus* bacteraemia treated with newer antimicrobial agents. *Epidemiol Infect* 2011 Sep;139(9):1342-50.

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MCI-2018-0406-EN· REV A · MC · 04 19 PDF