KNOWLEDGE INFUSION: FOCUS ON AABB 2016

Bacterial attachment to Apheresis and Buffy Coat Platelet Storage Bags

Prepared by Canadian Blood Services Knowledge Mobilization Team
with special thanks to Maria Loza

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Welcome to ……

KNOWLEDGE INFUSION: FOCUS ON AABB 2016

KnowledgeInfusion
SPOTLIGHT ON AABB 2016

CENTRE FOR INNOVATION PRESENTS

Name: **Maria Loza**
Title: **Postdoctoral Fellow, Centre for Innovation**
Location: **Head Office, Ottawa**

Presentation Learning Objective:

- ✓ **At the end of this session, participants will be able to describe bacterial contamination of platelet storage bags and the impact to patients of bacterial attachment to the surface of platelet bags.**

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Bacterial attachment to apheresis and buffy coat platelet storage bags

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Disclosures

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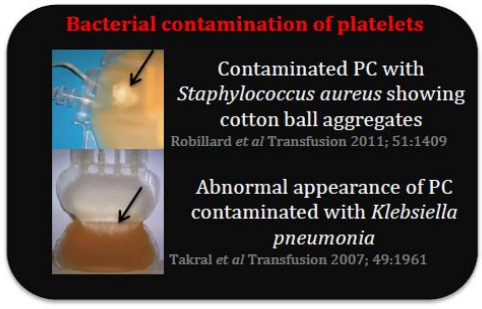
Conflict of interest:

There are no conflicts of interest

Platelet concentrates (PC) used for transfusions are susceptible to bacterial contamination

Storage conditions:

- ✓ gas-permeable plastic bags
- ✓ glucose-rich additive solution
- ✓ 20-24 ◦C
- ✓ constant agitation



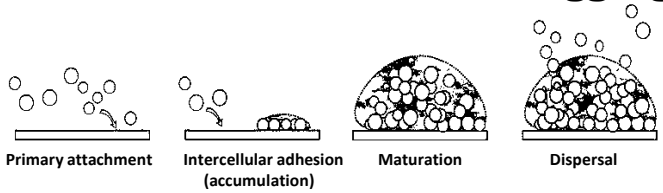
It represents the greatest post-transfusion infectious risk:

- ✓ Fatalities due to contaminated PC transfusions are reported worldwide
- ✓ *Staphylococcus epidermidis* is the most frequently isolated bacterium

Jenkins *et. al. Transfusion* 2011;51:2555-65; Benjamin & McDonald *Transfus Med Rev* 2014;28:61-71; Hong et. al. *Blood* 2016; 127:496-02

Staphylococcus epidermidis

- ✓ Part of the normal skin flora and opportunistic pathogen
- ✓ **Can form surface-attached cell aggregates**



Modified from Salwiczek et al. *Trends in Biotechnology*, 2014;32(2): 82-90

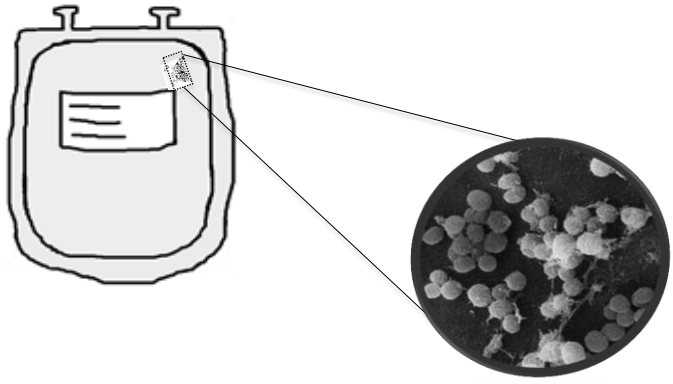
Biofilms

- ✓ Predominant contaminant of implanted-medical devices

Otto Nat Rev Microbiol 2009;7(8):555-567 ;Greco et. al. *Transfusion* 2007;47:1143-53

Staphylococcus epidermidis

- ✓ It can adhere to the inner walls of the PC collection bags → increasing chances of missed detection during PC screening



Ali et. al. *J Med Microbiol* 2014;63(6):884-91; Greco et. al. *Transfusion* 2007;47:1143-53

Canadian Blood Services produces PC for transfusion by two different methods

Apheresis :

- ✓ Single donor platelets suspended in plasma
- ✓ Stored in PC collection bags type A, made of the plastic: **P**oly**v**inyl **C**hloride and the plasticizer **B**utyryl **T**ri**h**exyl **C**itrate (PVC-BTHC**)**

Pooled platelets (buffy coat):

- ✓ Four platelet fractions (buffy coats) **+** plasma from one donation
- ✓ Stored in PC collection bags type B, made of PVC-BTHC

Levin *et. al. Transfusion* 2008;48:2331-37

Canadian Blood Services produces PC for transfusion by two different methods

Apheresis bag

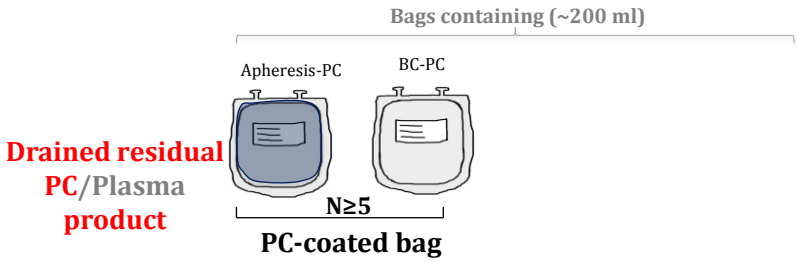
Buffy coat (BC) bag

How is bacterial attachment to the PC collection bags influenced by the presence or absence of PC residual material attached to the bag?

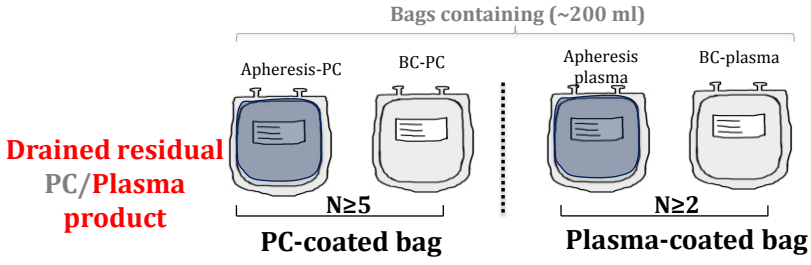
Objective:

Evaluate the ability of *S. epidermidis* to adhere to the inner surface of PC collection bags with and without the presence of PC residues

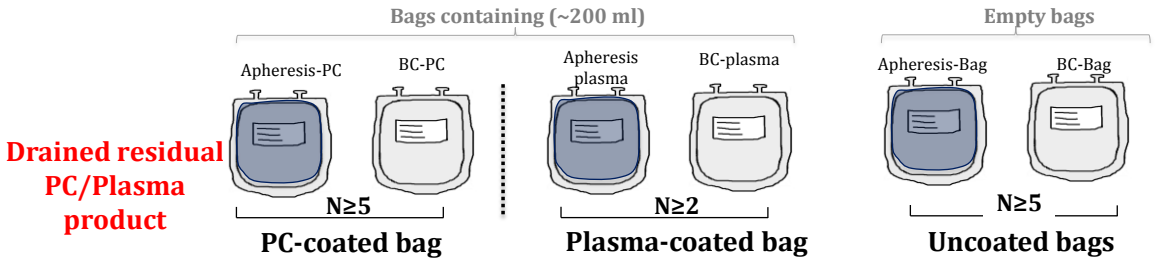
Experimental design


Bags containing (~200 ml)
Apheresis-PC
BC-PC
Drained residual PC/Plasma product
N≥5
PC-coated bag

1


Bags containing (~200 ml)
Apheresis-PC
BC-PC
Apheresis plasma
BC-plasma
Drained residual PC/Plasma product
N≥5
PC-coated bag
N≥2
Plasma-coated bag

1



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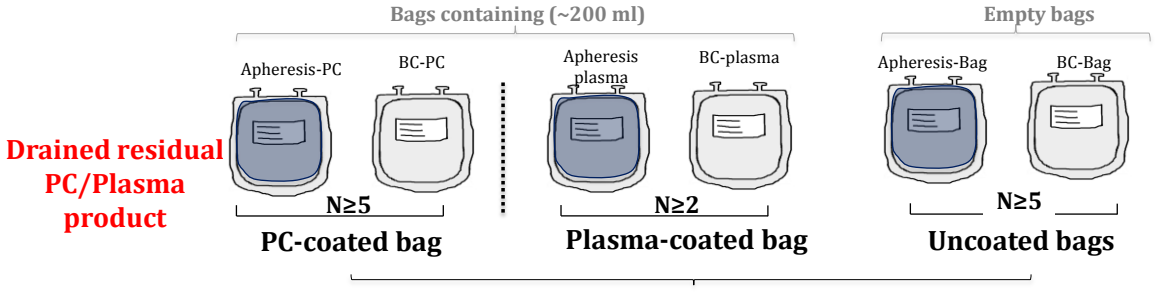
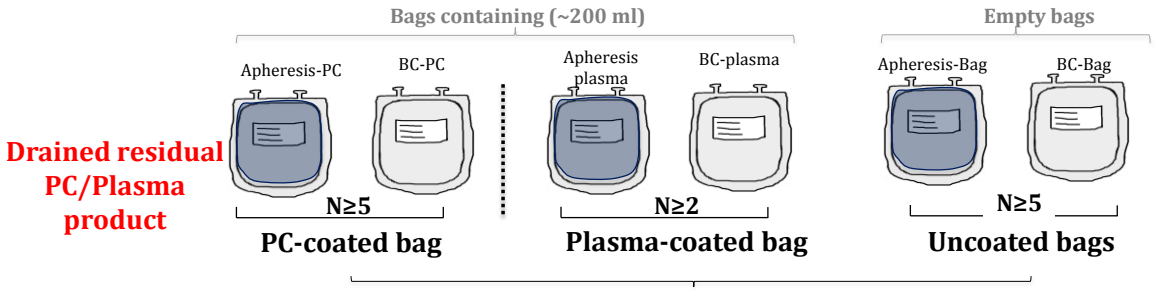


Addition of Bacteria:

- **200 mL culture medium containing low levels of *S. epidermidis* (0.5 CFU/ml)**

1



Addition of Bacteria:

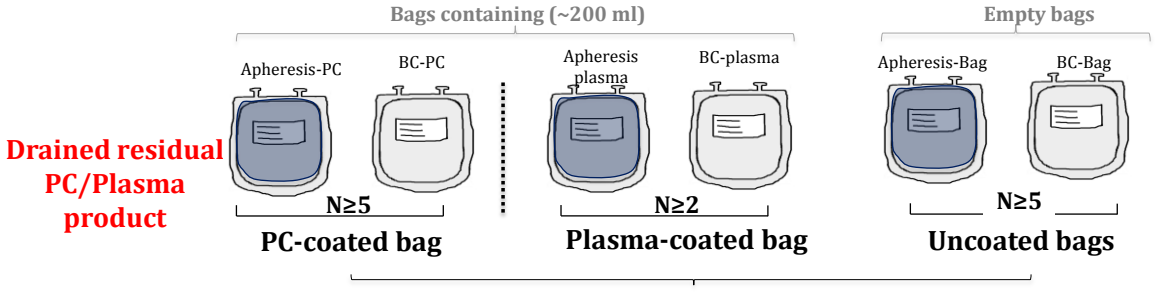
- **200 mL culture medium containing low levels of *S. epidermidis* (0.5 CFU/ml)**

↓

Bag incubation:

7 days, 20-24 °C on a PC agitator

1



Addition of Bacteria:

- **200 mL culture medium containing low levels of *S. epidermidis* (0.5 CFU/ml)**

↓

Bag incubation:

7 days, 20-24 °C on a PC agitator

↓

Analyses of bacterial attachment:

- **Dislodging to determine load of bacteria attached**
- **Preparation bag-coupons for microscopy analysis**

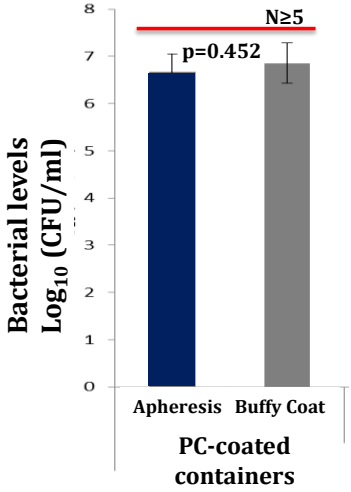
1

Results

1

S. epidermidis attachment to PC-coated bags

***S. epidermidis* ST11003**

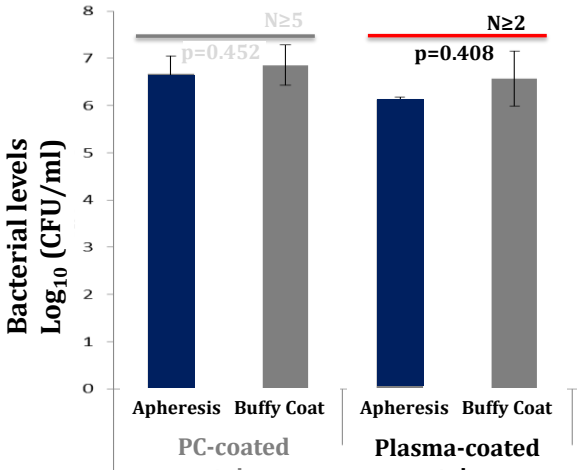


Bacteria adheres equally to both bag types

2

S. epidermidis attachment to Plasma-coated bags

***S. epidermidis* ST11003**

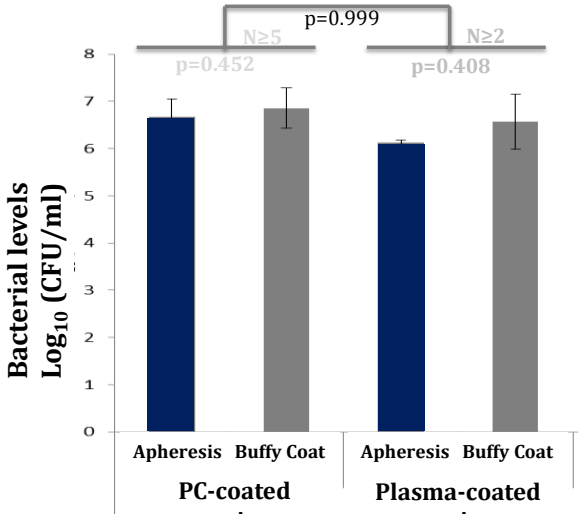


Bacteria adheres equally to both bag types

2

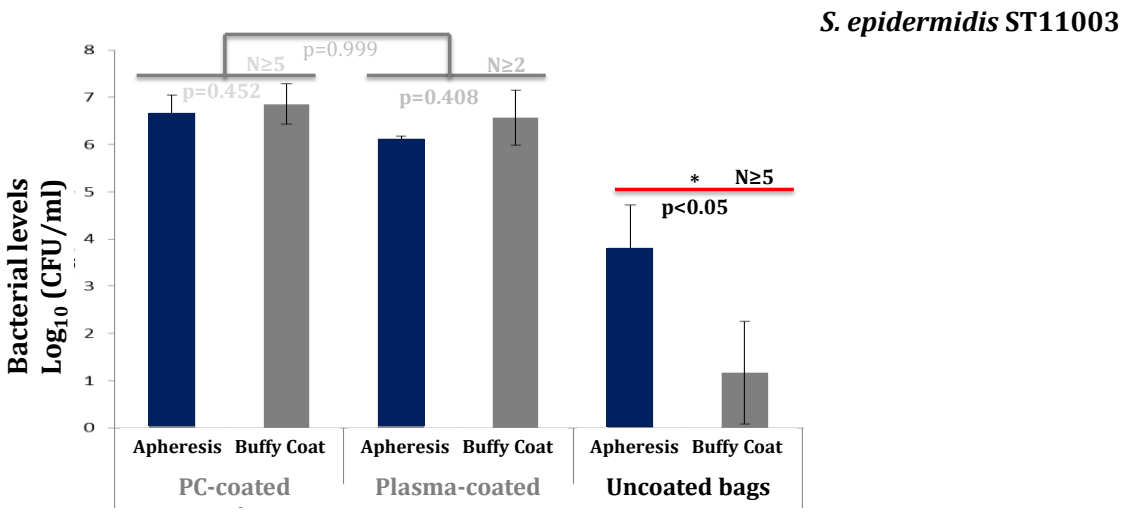
S. epidermidis attachment to PC- and Plasma-coated bags

***S. epidermidis* ST11003**



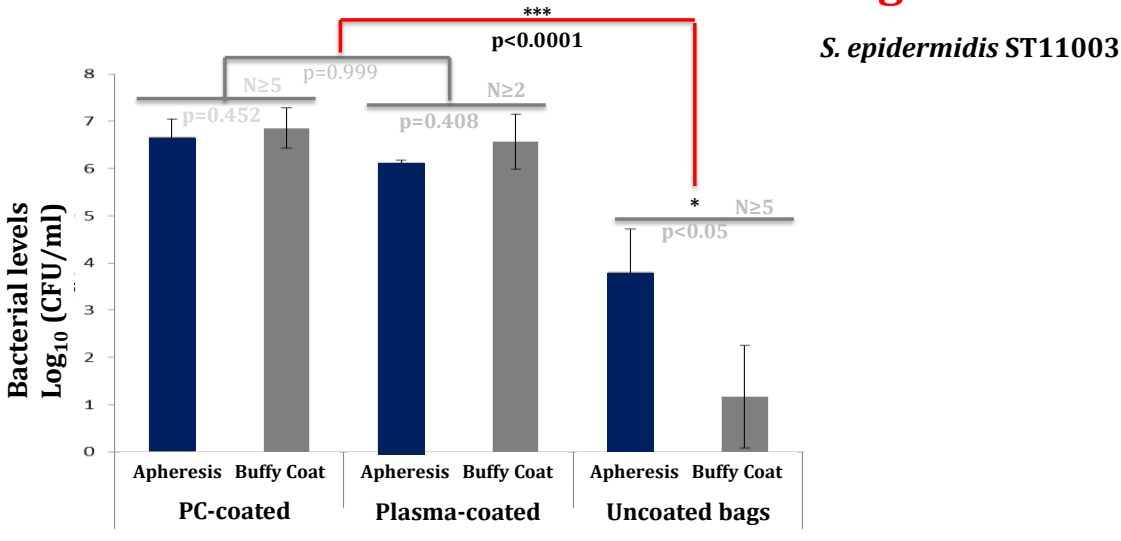
No significant differences between bacterial attachment to PC- and Plasma–coated bags

S. epidermidis attachment to uncoated bags



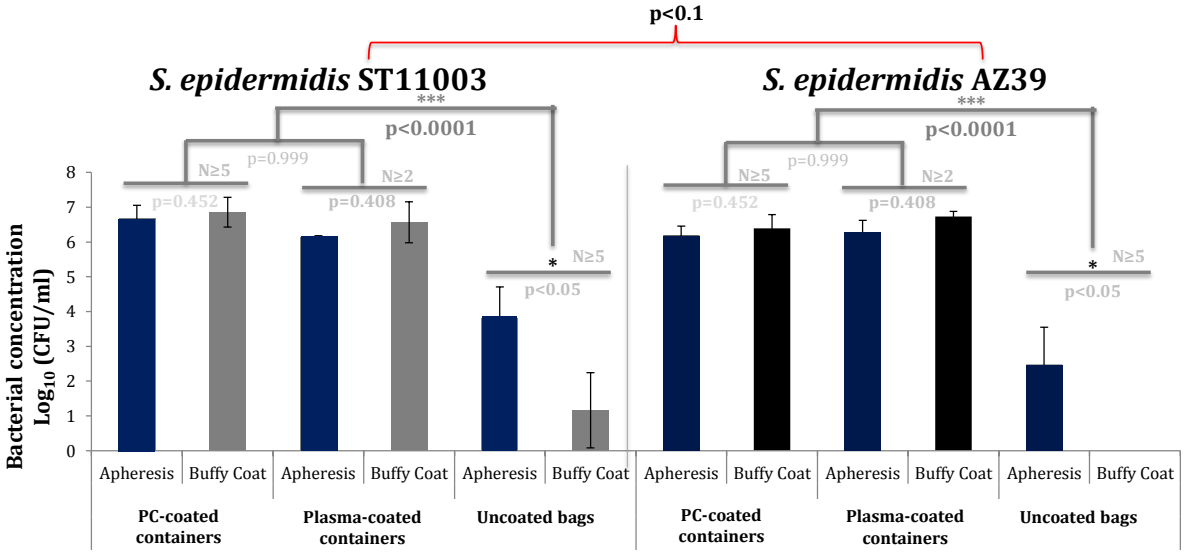
Bacterial adherence is significantly different

Coated *vs* uncoated bags



Bacterial adherence is significantly lower in uncoated bags compared to coated bags

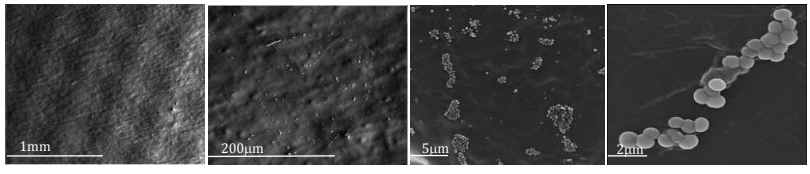
Attachment to PC-bags of two *S. epidermidis strains*



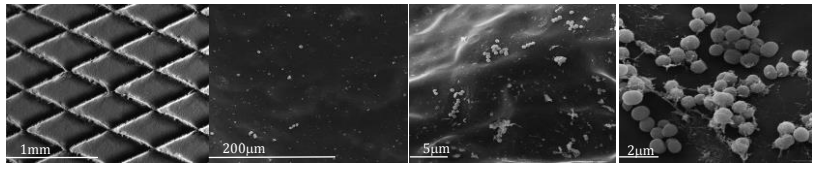
No significant difference between both strains in attachment to the bags

Scanning electron microscopy of PC-coated bags

Apheresis PC-coated bag



Buffy Coat PC-coated bag



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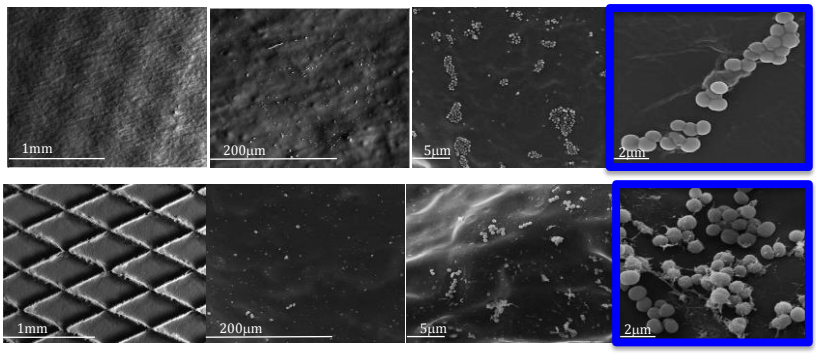
Scanning electron microscopy of PC-coated bags

Apheresis PC-coated bag

Buffy Coat PC-coated bag



Bacterial attachment was confirmed during early stages of biofilm formation

Summary:

In presence of PC or Plasma residual material:

1) **bacteria adheres equally** to the bags independent of the PC-type and bag-type

2) **bacterial attachment is significantly higher in coated-bags** compared to uncoated bags

In absence of PC or Plasma residual material, bacteria adherence is higher in apheresis bags than in BC bags

Conclusion

The ability of *S. epidermidis* to adhere to apheresis and buffy coat PC bags **depends on the presence of plasma residues coating** the inner walls of the bags

Plasma residues attached to PC bags might serve as scaffold for bacterial adhesion

Conclusion

Difference in the PC storage bag types should not represent a threat for quality and safety of PC

Efforts should be focused on reducing plasma residues attachment to PC storage containers

Thank you !

Acknowledgments

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Ramirez' group members

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