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Bacterial attachment to Apheresis and Buffy Coat Platelet Storage Bags

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

Welcome to ......
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.

Bacterial attachment to apheresis and buffy coat platelet storage bags

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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

**Staphylococcus epidermidis**

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

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

- Predominant contaminant of implanted-medical devices


**Staphylococcus epidermidis**

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

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: Polyvinyl Chloride and the plasticizer Butyryl Trihexyl Citrate (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

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

PC-coated bag

Drained residual PC/Plasma product

N≥5

PC-coated bag

Drained residual PC/Plasma product

N≥2

Plasma-coated bag
Drained residual PC/Plasma product

Addition of Bacteria:

- 200 mL culture medium containing low levels of *S. epidermidis* (0.5 CFU/ml)
Drained residual PC/Plasma product

Bags containing (~200 ml)

- Apheresis-PC
- BC-PC
- Apheresis plasma
- BC-plasma

Uncoated bags

 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
Results

**S. epidermidis** attachment to PC-coated bags

*S. epidermidis* ST11003

Bacteria adheres equally to both bag types
**S. epidermidis** attachment to Plasma-coated bags

*B. epidermidis* ST11003

Bacteria adheres equally to both bag types

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

*B. epidermidis* ST11003

No significant differences between bacterial attachment to PC- and Plasma–coated bags
**S. epidermidis** attachment to uncoated bags

**S. epidermidis** ST11003

Bacterial adherence is significantly different

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**Coated vs uncoated bags**

**S. epidermidis** ST11003

Bacterial adherence is significantly lower in uncoated bags compared to coated bags
Attachment to PC-bags of two *S. epidermidis* strains

**S. epidermidis ST11003**

- N=5, p=0.452
- N≥2, p=0.999
- N≥5, *p<0.05*

**S. epidermidis AZ39**

- N=5, p=0.408
- N≥2, p=0.0001
- N≥5, **p<0.0001**

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**
Scanning electron microscopy of PC-coated bags

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!

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Thank you!

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