Why all DCB’s are not the same: underlying material differences are important. Some thoughts about differences between In.pact, Lutonix, Stellarex, Ranger, etc.. And how they may matter.

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Why all DCB’s are not the same: underlying material differences are important. Some thoughts about differences between In.pact, Lutonix, Stellarex, Ranger, etc.. And how they may matter.

Technical differences

- Same drug (paclitaxel)
- Different:
  - Dose (2.0 - 3.5 μg/mm²)
  - Drug formulation
  - Excipient

Determinants of DCB Biological Effect

- Antiproliferative agent (Paclitaxel)
  - Drug dose, formulation and binding on balloon surface
- Loss to circulation (Insertion-transit-inflation) and risk of:
  - Particulate embolization
- Tissue transfer efficiency
  - Coating characteristics (i.e. hydrophobicity/hydrophilicity)
  - Excipient
  - Coating technique
- Paclitaxel tissue residency
  - Particle solubility
  - Homogeneity of distribution
  - Presence in tissue during restenotic cascade (duration of retention)

Paclitaxel Formulation Types
Impact on Biological Performance

- Crystalline Coat
- Amorphous Coat
- Hybrid Coat

Disclosures

- I have the following potential conflicts of interest to report:
- Receipt of grants/research support
- Receipt of honoraria and travel support
- Medtronic, Abbott Vascular, Philips, Boston Scientific
- Participation in a company sponsored speakers’ bureau
- Employment in Industry
- Shareholder in a healthcare company
- Owner of a healthcare company
- I do not have any potential conflict of interest
Architecture of DCB - Coating

**Drug-coated Balloon Coating Characteristics**

- **Polymer matrix coating**: drug molecules diffuse through a matrix
- **Porous coating**: drug molecules diffuse through pores
- **Resorbable polymer matrix coating**: drug molecules are encapsulated in the polymer and are released with resorption

**Surface deposition**: imprinting of the drug on the balloon surface

**Drug-balloon surface bonding**: strong enough to maintain drug integrity during transit while allowing efficient drug transfer:

- Minimal drug loss during transit
- Rapid and efficient drug transfer (<60 seconds)

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Coating integrity

**Simulated shake test**

- Balloon A Coating
  - Coating remained adhered to the balloon during hydration
- Balloon B Coating
  - Coating started to crack and flake off after a few minutes of hydration

**DCBs were submerged in phosphate buffered saline at 37°C and the coating was imaged at 300X.**


Loss of particles during transfer

- DCBs were delivered in a peripheral track model with fluid recirculation
- Particulates lost downstream were collected with a 5 µm polycarbonate filter and are shown as green dots

**Particulate Embolization in Different DCB Formulations**

Swine model – 28 day study

- 3X dose, same size DCB, 80s inflation
- Evaluated skeletal muscle and coronary band for potential embolic changes
- Histology (distal embolization, vascular changes)

**In-Pos DCB vs Ranger vs Stellix**

- Histology: distal embolization
- Histology: distal embolization
- Histology: distal embolization

**p-value**

- p=0.2
- p=0.05
- p=0.05
Particulate Comparison

- Total particulate counts from simulated use testing
- 6x80 mm DCBs
- Guide Sheath used (per IFU)
  - Ranger – 5F
  - In.Pact – 6F
  - Passaro – 5F
  - Lutonix – 5F
  - Stellarex – 6F
- 3 particulate size categories
  - 10-25 µm
  - 25-50 µm
  - >50 µm

Bench test results may not necessarily be indicative of clinical performance.
Data on file.

Excipient

Supports the uptake of drug by vessel tissue
- Acts as a molecular spacer to increase paclitaxel surface exposure
- Facilitates paclitaxel transfer through its hydrophylic properties

Different excipients – different properties

PTX adherence to balloon:
Lopromide versus urea coating

Coating Design: Coating Durability

Excipient and dose density can also be used to tune coating durability

Coating homogeneity

Homogenous coating
Heterogenous coating
POBA

What happens in vessel wall?

- Transfer of paclitaxel into the tissue and "storage" in the tissue occurs in the "solid phase".
- Afterwards "solid phase" paclitaxel is slowly dissolved.
- Transition from solid-phase to soluble-phase occurs at different rates
- At 24 hours, IN.PACT Admiral™ DCB retains more drug in solid-phase than Lutonix™ 035
Sustained Drug Availability

Higher percentage of solid-phase drug is associated with higher drug tissue concentration through 90 days.

IN.PACT™ Admiral™ DCB
Lutonix™

1. Data on file with Medtronic; Study PS747.

DCB Pharmacokinetics


Ranger DCB is an investigational device and not available for sale in the US. Lutonix™ Drug Coated Balloon Catheter is a trademark of C.R. Bard Inc. IN.PACT™ is a trademark of Medtronic Inc.

Peripheral Drug-Coated Balloons

IN.PACT Admiral™
Lutonix™
Stellarex™
Spectranetics Ranger™

Product Image

Paclitaxel Dose

3 µg/mm²
2.2 µg/mm²
2 µg/mm²
2 µg/mm²
2 µg/mm²

Coating Technology

FreePac™ hydrophilic (excipient: urea)
Proprietary hydrophilic nonpolymeric carrier
EnduraCoat™ coating (excipient: Poly-ethylene Glycol)
TransPax coating (excipient: Citrate ester)

Guidewire Compatibility

0.035 OTW 0.035 OTW 0.035 OTW 0.14/0.18

Matrix

SFA: 4-7 mm; 40-120 mm
BTK: Recalled
SFA: 4-6 mm; 40-100 mm
SFA: 4-6 mm; 40-120 mm
SFA: 4-8 mm; 30-200 mm
BTK: 2-4 mm; up to 150 mm

CE Mark

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FDA Approval

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Conclusion

• Unlike simple angioplasty balloons DCB’s are not purely mechanical devices but are sophisticated materials that have to transfer a drug from the package into the vessel wall.
• Drug dose, drug formulation, balloon surface, coating process, excipient all have their influence on drug availability in the vessel wall, efficacy and results.
• Individual properties of the balloon will be reflected in clinical results.

DCB’s are NOT all the same

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