Hemodialysis Catheters: New Designs, Materials and Coatings

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Current State of Catheters

- 80.2% use catheters at initiation
- 68.3% after 90 days
- 20% at 1 year

- $1 billion annually

USRDS 2015
Tip Design
New Data on Tip Design?
Palindrome vs. HemoStar
(Covidien) (Bard)

- Randomized trial 302 patients 1:1
- Primary endpoint assisted patency
  - Palindrome 135.9 days
  - HemoStar 136.5 days

Van Der Meersch, AJKD 2014 Vol 64 (6)
JVIR 2015
The Palindrome catheter achieved better blood flow rates and required less thrombolytics for patency.
33 VectorFlow vs. 46 Ash Split

![Graph showing probability of survival over time for VectorFlow and Ash Split catheters. The graph indicates a statistically significant difference between the two groups, with a p-value of 0.046.]

Catheters at risk
VectorFlow 33 22 16 11 11 8 6 5 5 2
Ash Split 46 31 17 10 8 5 4 2 2 0
Computational Fluid Dynamics Study: **Symmetrical** Catheter tips

- Regions of flow separation prone to thrombus formation
- Shear-induced platelet activation
- Recirculation
- Venous outflow deflection

Clark, JVIR 2015
None had significant recirculation when lines reversed.

The VectorFlow catheter produced less shear-induced platelet activation than the Palindrome catheter and less flow separation than the Palindrome and GlidePath catheters irrespective of line configuration.
Surface Treated Catheters
Causes of Catheter Failure

- Infection
- Thrombosis
- Fibrin Sheath
Catheter Dysfunction

- Infection
- Thrombosis
- Fibrin Sheath
It’s All About the Biofilm
80% micro-organisms

20%
protein

Outer Catheter Surface

Blood Space

platelet

protein
Ryder, MA. *Topics in Advanced Practice Nursing Journal, 2005*
Catheter Coating Types

**Antibiotic**
- minocycline/rifampin
- 5-Fluorouracil

**Antiseptic**
- chlorhexidine + silver sulfadiazine
- silver or other metals

**Antithrombotic**
- heparin
Coated, Non-tunneled Hemodialysis Catheters

ARROWGard Blue®
- 12 and 14 French
- 13, 16, 20 and 25 cm
- Chlorhexidine-SS
- Exterior of catheter only

Heparin Coated
- 12 French, 16 cm
- Heparin bonded
- Internal & external surfaces

No clinical trial data using these catheter coatings in dialysis patients.
Palindrome® catheters
(Covidien)

Ruby®
Emerald®
Sapphire®

14.5 Fr Hemodialysis Catheter
New Data Using Surface-Treated Catheters in the Hemodialysis Population?

Last publication in 2010
Conclusions:

- Symmetrical catheters have no recirculation when lines reversed
- Data supports the use of non-tunneled surface treated dialysis catheters
- Randomized, controlled trials of all coating types are needed determine their full effectiveness