What Is the Nature of In-Stent Stenosis after Venous Stenting?

David M. Williams MD
University of Michigan
Department of Radiology

Disclosures
• Boston Scientific, Medical Advisory Board
• WL Gore & Associates, Consultant

Background
• Data on venous in-stent stenosis are sparse and anecdotal.
• Data on evolution of thrombus incomplete with respect to flow conditions, inflammatory state, anti-coagulation.
• Post-operative management of venous stents varies widely

Clinical follow-up of venous stents
• Failure mode is thrombosis
• Prevention by anticoagulation and antiplatelet tx
• Windows into anticoagulation status
  - INR 2-day
  - D-dimer 2-week
  - Venous biopsy 2-month
• Different window widths permit discordant tests
• Wider window trumps narrower, regarding thrombus prevention.

Discordant d-dimer and biopsy

45 year old female
• PTS after left leg DVT
• 1-8-2016 Recanalization and stenting

1-8-2016
At completion of recanalization
Official pathology report: “Left iliac vein, excision: Fragments of vein wall and organized thrombus”

Cardiovascular pathologist: “fragments with early organization, as well as many bits of mature cellular thrombus.”

Positive biopsy trumps negative d-dimer. Patient was instructed to resume warfarin

### Unknows in D-Dimers

- “False” positives in other conditions. Get a baseline.
- D-Dimer can remain elevated up to a month after DVT
- ? Normal rebound of D-Dimer after d/c anticoagulation
- ? Minimal clot burden required to raise D-Dimer

### How much thrombus necessary to convert the d-dimer?

58 year old woman

- 4-29-2011 left iliac vein recanalization and stenting
- 9-23-2015 venography stable, d-dimer normal
- 9-25-2015 awake with distal left thigh pain, outside DVU exam said “acute iliofemoral DVT”
- 9-29-2015 d-dimer 1.68
Biopsy 9-30-2015  “Organized thrombus”

Biopsy 9-30-2015  “Fresh clot with minimal organization”

How much thrombus?

2 cc
- acute thrombus
- exposed to blood flow
- raised d-dimer from 0.28 to 1.68
Unknown biological variability

Unknows in Biopsy of Venous In-Stent Stenosis

- Biopsy forceps specimen is ~1x2x2 mm³
- Biopsy is a sampling exercise
- Histological evolution of thrombus is not precisely defined
  - Inconsistent vocabulary
  - Histological reading can be misleading.

Evolution of thrombus

- Procedural
- Minimally organizing
- Organizing
- Organized, sometimes called mature thrombus or intimal hyperplasia
11/18/2016

IVC stent with transfemoral central vein catheter

• 10-8-2014 IVC stent placed in 38 yo M
• 1-29-2015 transfemoral placement of ICD
• 10-14-2015 venography: Filling defect in IVC stent. Biopsy

10-14-2015

Procedural clot, approximately 30 min old

10-14-2015

Clot with early organization, higher power

• Thrombus from the January implantation should be fully organized 9 months later
• Either patient is slowly accumulating thrombus or there is turnover with balanced lysis and thrombogenesis; venographic stability is not a precise measure.
Conclusions

• D-dimer production and thrombus evolution are inadequately understood, presumably vary among patients.
• Biopsy of in-stent material is clinically useful, but pathological diagnosis is descriptive, non-standardized, and should not be taken for granted.
• Conventional histological staining is consistent with hypothesis that venous in-stent stenosis begins with early deposition of thrombus followed gradual organization.