Advanced Techniques Of Carotid Artery Stenting
Stent & Filter Lessons From Clinical Trials

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Objectives

- Master Anatomical Adverse Condition
- Condition dictates technique
- Technique mandates equipment and Preparation
- Preparation Prevents complications
It Is All About Technique

- Anatomical Adversity Predicts Ischemic Complications
- Co-Morbid Adversity Predicts Hemodynamic Complications
It is All About Access

- CCA Access
  - Guide catheter/sheath
  - Proximal Protection Device placement
- ICA Access
  - DPD placement
Avoidable Adversity

• Carotid Adverse Anatomy
  □ Type III arch
  □ Severe Tortuosity
  □ Sharp Entry angle at lesion
  □ Sharp Exit angle at lesion
  □ Absent Clear path across lesion
  □ Heavy Calcification
  □ Poor landing Zone
Carotid Anatomy Findings

• Source
  - CT Angiography
  - MR Angiography
  - Carotid Duplex
  - Catheter Carotid Angiography
CAS Observations

- Carotid access is not protected
- Access is the most important learning Curve issue
CAS Observations

- Early CAS Registries show 1% Contra-lateral Stroke partly access related
- MRI-DWI studies suggest embolization during Carotid angiography and Access
- EVA-3S study Access related Complications lead to emergency CEA and Cranial Nave Palsies
Critical Issues

• Which Carotid Access Technique?
  ▪ Front Loading Telescopic Technique
  ▪ Back Loading Serial Stiffening Technique
  ▪ TAD Wire Method
  ▪ Remote Carotid Access
Carotid Access Determinants

- Aortic Arch Type
- CCA/ECA Disease
- Carotid Tortuosity
Arch Types (Myla 1996)

Type I Arch

Type II Arch

Type III Arch
CCA Access
Aortic Arch Types (Myla 1996)

Type I
- Simple Curve
- Catheters HN1
- Telescopic Access
- Guide Cath or Sheath

Type II
- Reverse Curve
- Catheters SM 2
- Serial Stiffening
- Guide Cath or Sheath

Type III
- Reverse Curve
- Catheters SM 2
- JCL XB 4.0 Guide catheter

SAL
IAL
Ledge Effect
Direct Carotid Access

Dietrich and Bergeron

GA, Starclose. low dose Anticoagulation
Technical Pearls

- Deep Wire Access
- Least Manipulation
- ECA/ Subclavian Anchor Wires/ Balloons
- Don’t Ignore iliac tortuosity
- Be aware of Carotid ostial disease
Carotid Stent Issues

- Doesn’t Cross The Lesion
- Stent Maldeployed (missed target)
- Stent Migration
- Stent Thrombosis
- Stent Crush (only Balloon Expandable Stents)
Stent Doesn’t Cross

- Subtotal Occlusion
  - Pre-dilate

- Heavy calcification
  - Large balloon dilatation
  - Stiff guide wire

- Sharp lesion angle
  - Stiff guide wire

- Soft Guide wire
  - Stiff guide wire

- Blunt end stent
  - Change stent
  - without nose cone
Mal-deployment & Migration

- Direct stenting
- Nitinol stents with built in tension
- Heavy Calcification

- Pre-dilate lesion
- Release tension by prior advancement past stenosis
- Avoid them
Carotid Filter Issues

• Should I Pre-dilate Before Filter Placement?
• What to do with slow Flow/occlusion in a filter?
  - Is this Filled Filter?
  - Is this carotid Spasm?
• What do to when the retrieval sheath fails to advance?
• How to Handle a detached filter?
Carotid Filter Issues

• What to do when filter doesn’t Advance?
  ▪ Poor guide support
  ▪ Carotid tortuosity
  ▪ Severe stenosis
  ▪ Large filter
  ▪ Sharp entry angle
  ▪ Sharp exit angle
ICA Access

• What determines ICA access?
  ▪ Carotid Tortuosity
  ▪ Sharp Entry Angle
  ▪ Sharp Exit Angle
  ▪ Complex Lesion Morphology
    • Subtotal occlusion
    • Absent clear path across lesion
    • Heavy/Strategic calcification
  ▪ Landing Zone
Sharp Lesion Angles
Sharp Entry Angle

- **I**: easiest angle
- **II**: difficult entry angle
- **III**: challenging entry angle
Sharp Entry Angle

- Easy with and Without Bias
- Easy Without Bias
- Difficult with Bias
- Difficult with and without Bias
- Hard without Bias
- Impossible with Bias
Carotid Filter Issues

• What to do when filter doesn’t Advance?

  ▪ Solutions
    • Power Guide support
    • Pre-dilatation
    • Buddy Wire
    • Buddy Catheter
    • Bare wire/Spyder
    • Percusurge
    • Proximal Protection
Carotid Filter Issues

• Should I Pre-dilate Before Filter placement?
  - Carotid Complex Lesion Morphology
    • Sharp Entry Angle
    • Sharp Exit Angle
    • Absent clear path through Lesion
Carotid Stent Issues

• Should I Pre-dilate Before Stent placement?
• Should I Post Dilate After Stent Placement?
Carotid Stent Issues

- Should I Pre-dilate Before Stent placement?
  - Carotid Stent Profile
  - Carotid Lesion Severity
  - Carotid Tortuosity
  - Operator Experience
  - Carotid Lesion Complex Morphology
    - Sharp Entry Angle
    - Sharp Exit Angle
    - Heavy Calcification
Carotid Stent Issues

• Should I Post Dilate After Stent Placement?
  ▪ Objectives
    • Minimal Final lumen diameter
    • Safe retrieval of DPD
    • Avoid Stent migration
Carotid Stent Issues

- Should I Post Dilate After Stent Placement?
  - Carotid Stent Type
    - Closed Cell Design
    - Open Cell Design
  - Carotid Lesion Type
    - Heavily Calcified
  - Residual Lesion severity
    - Large residual
  - Protection device type
    - Percusurge
Carotid Landing Zone Issues

• What to do with Inadequate Landing Zone?
  ▪ Can this be modified?
    • Buddy wire
    • BareWire
    • More proximal placement of Guide sheath in CCA to relax the vessel
    • PTA/stenting of stenosis
  ▪ No
    • CEA
    • Proximal Protection
    • Unprotected stenting
Carotid Filter Issues

- What to do with slow flow/occluded Filter?
  - Are Filter Dots Closed?
    - Yes
      - Carotid Spasm
      - Give Nitro
    - No
      - Filter slow flow due to emboli
      - Retrieve Filter
Carotid Filter Issues

• What to do with slow flow/occluded Filter?
  - Angioguard/Rubicon/Filterwire/Accunet/Fibernet
    • Filling defect below filter dots
      – Aspirate with Percusurge Export
      – Close Filter
    • Filling defect above filter dots
      – Close filter and remove
  • Incidence
    – Slow flow 10-20%
    – Aspiration 2-5%
Carotid Filter Issues

• What to do when Retrieval sheath doesn’t advance?
  ▪ Anatomical Adversity Issues
    • Carotid Tortuosity
    • Sharp Lesion Angles
    • Guide wire bias
    • Inadequate post dilatation
    • Open cell stent design with “gater backing”
    • Calcified lesion
DPD Retrieval Catheter Issues

- Retrieval Catheter (RC)
  - Close Cell vs. Open Cell Design
  - Carotid Adverse Anatomy
    - Tortuosity
    - Sharp Lesion Angle
    - Heavily Calcified Lesion
    - Significant Residual Lesion
  - RC Design
    - Coaxial System
    - Single Stiff catheter
    - Single Soft Catheter
DPD Retrieval Catheter Issues

- Retrieval Catheter (RC)
  - Closed Cell stent
    - Least Problems
    - Neutralizes anatomical adversity
  - Open cell stent
    - Worst Problems
    - Single Stiff Recovery Catheter
    - Anatomical Adversity
Carotid Filter Issues

• What to do when retrieval sheath doesn’t advance?
  ▪ Don’t panic and pull on filter!
  ▪ Neck rotation
  ▪ Advance sheath distally
  ▪ Neck compression
  ▪ Bent tip retrieval sheath
  ▪ Buddy-wire
  ▪ Additional balloon dilatations
Head Tilt
Filter Detachment

- RC Catheter advancement problem
- Filter slides down and impinges on stent
- Guide catheter prolapse into Aorta pulls Filter down
Filter Detachment

- Preventive Strategies
  - Avoid cases with poor landing zone
  - Always Keep guide tip in view
  - Never force pull Filter into RC
  - Use salvage Measures for RC problems
  - Change RC type
Lessons Learned/Avoid These S

- **STEEP Arch (Type III)**
- **SEVERE tortuosity**
- **SHARP Entry Angle**
- **SHARP Exit Angle**
- **INSUFFICIENT Landing Zone**
- **UNSATISFACTORY Collaterals**
Lessons Learned/Avoid These S
Technical Pearls

- Remote Access for Type III Arch
- Liberal Use of STIFF Buddy Wire
- Know limitations of DPD Devices
Carotid Mentoring Project

- www.carotidtraining.com