

# Advanced Techniques Of Carotid Artery Stenting

Stent & Filter Lessons From Clinical Trials

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- **Research Grant**
  - **Johnson & Johnson, Abbott, Guidant, Boston Scientific, Endotex, eV3, Bard,**
- **Consultant/Advisory Board Member**
  - **Johnson & Johnson, Boston Scientific, eV3, LumenBio**
- **Stockholder**
  - **Boston Scientific, Lumen Bio**

# 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**



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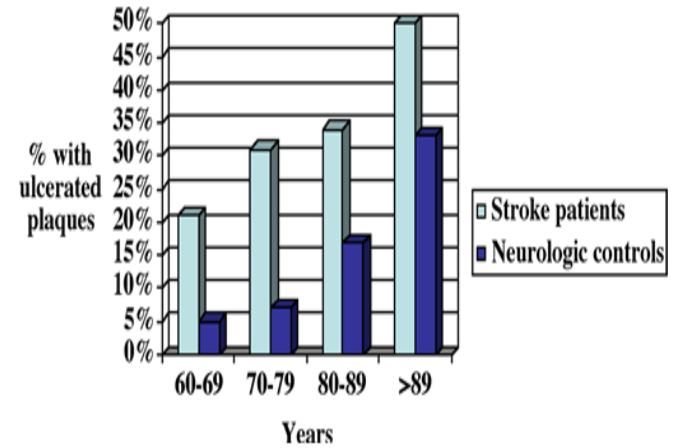
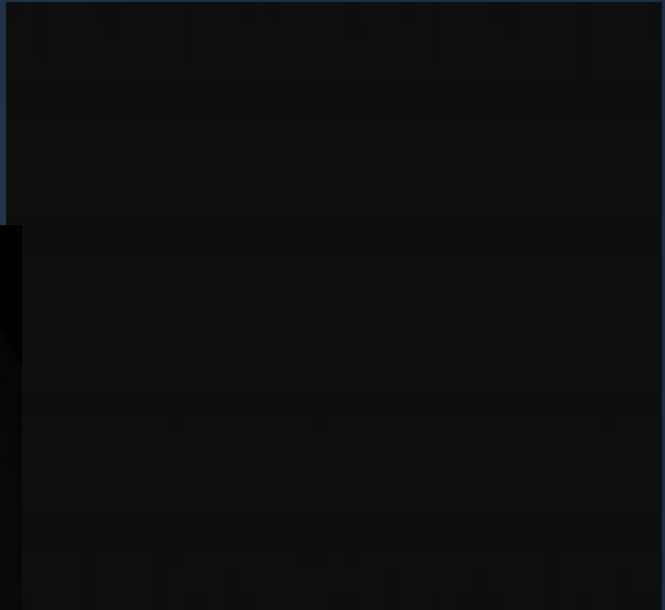


Figure 1. Prevalence of aortic atheroma according to age (6)



# 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 Nerve Palsies**

- **Which Carotid Access Technique?**
  - **Front Loading Telescopic Technique**
  - **Back Loading Serial Stiffening Technique**
  - **TAD Wire Method**
  - **Remote Carotid Access**

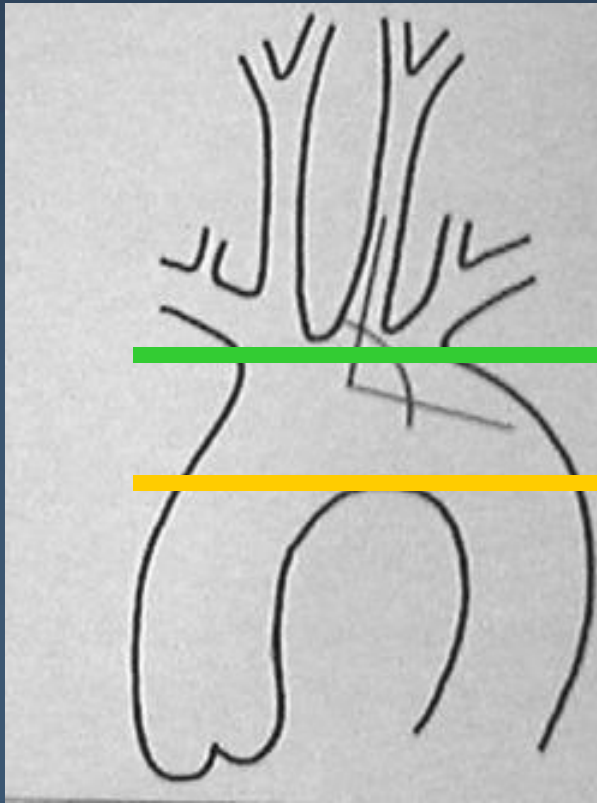


# Carotid Access Determinants

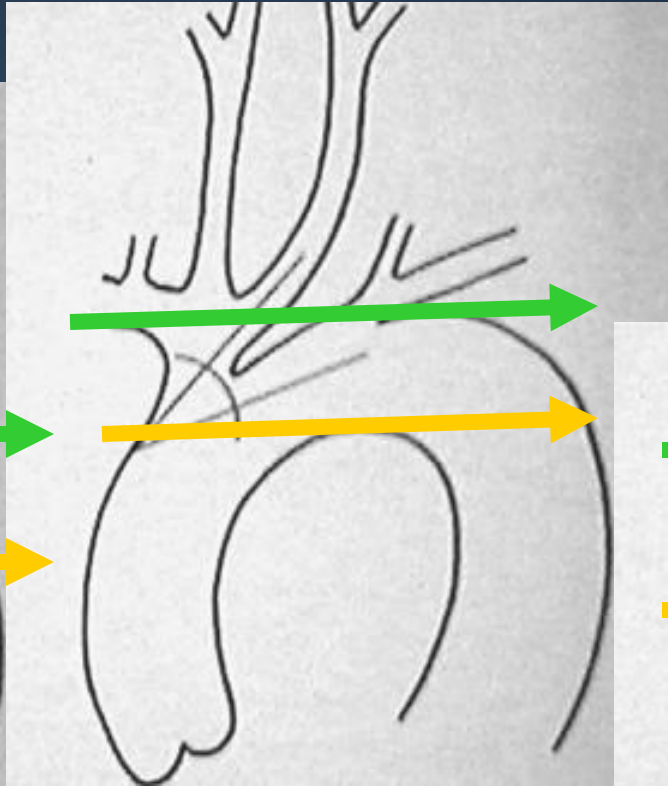
- **Aortic Arch Type**
- **CCA/ECA Disease**
- **Carotid Tortuosity**



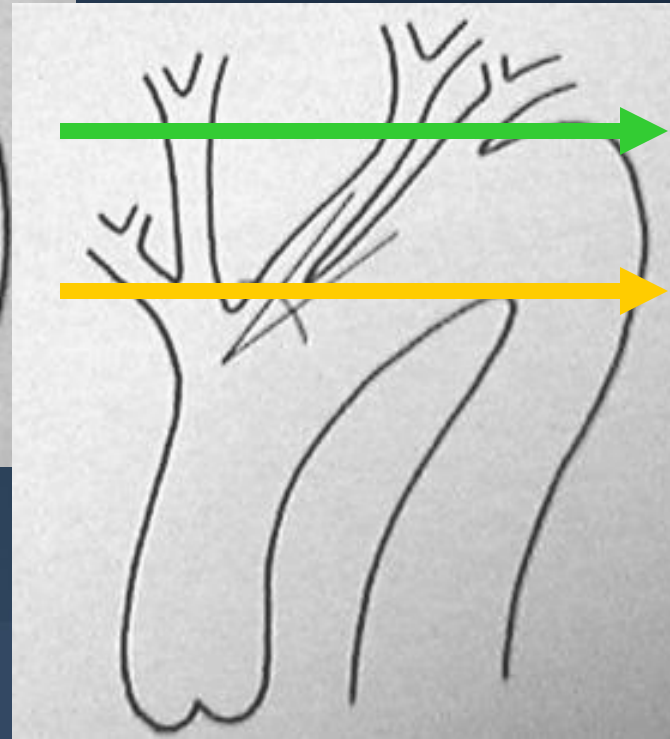
# Arch Types (Myla 1996)



Type I Arch



Type II Arch

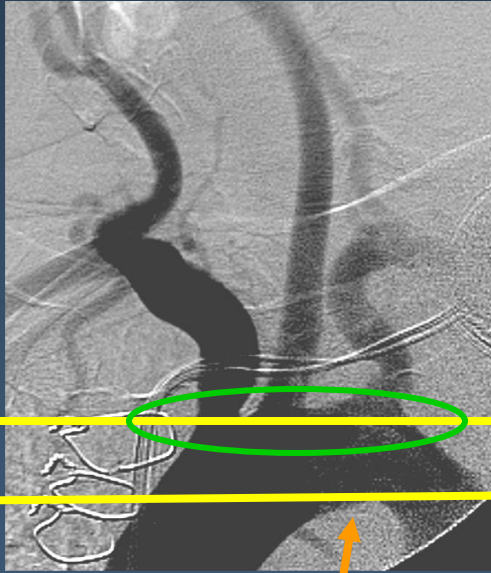


Type III Arch

# 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

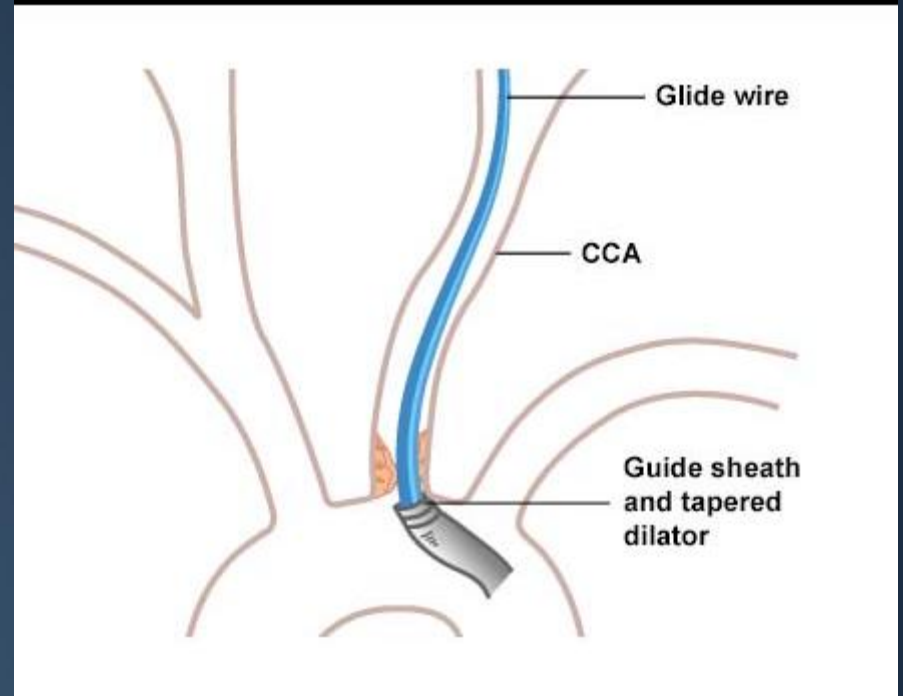
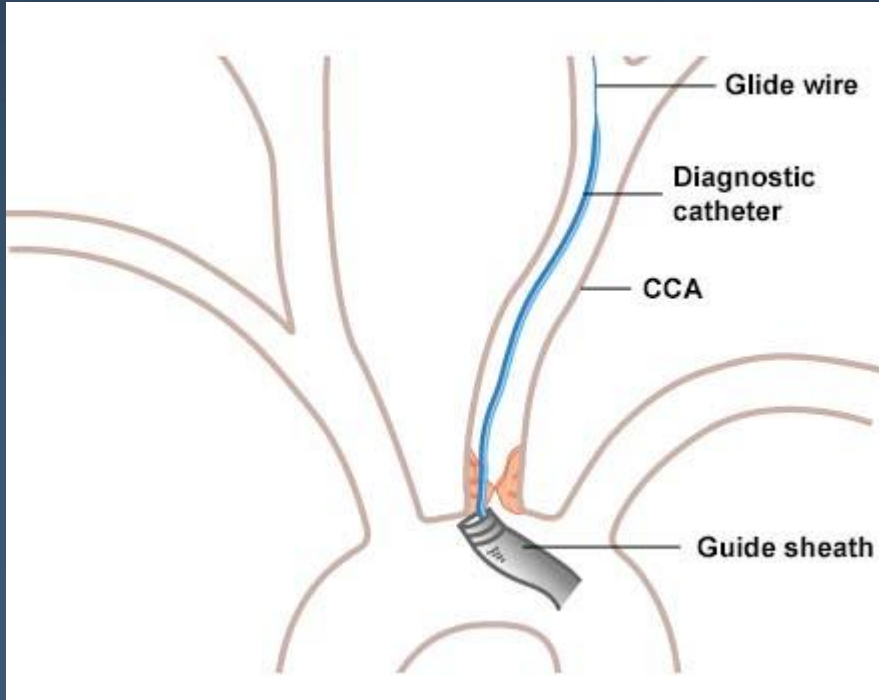
Type III



Reverse Curve  
Catheters SM 2

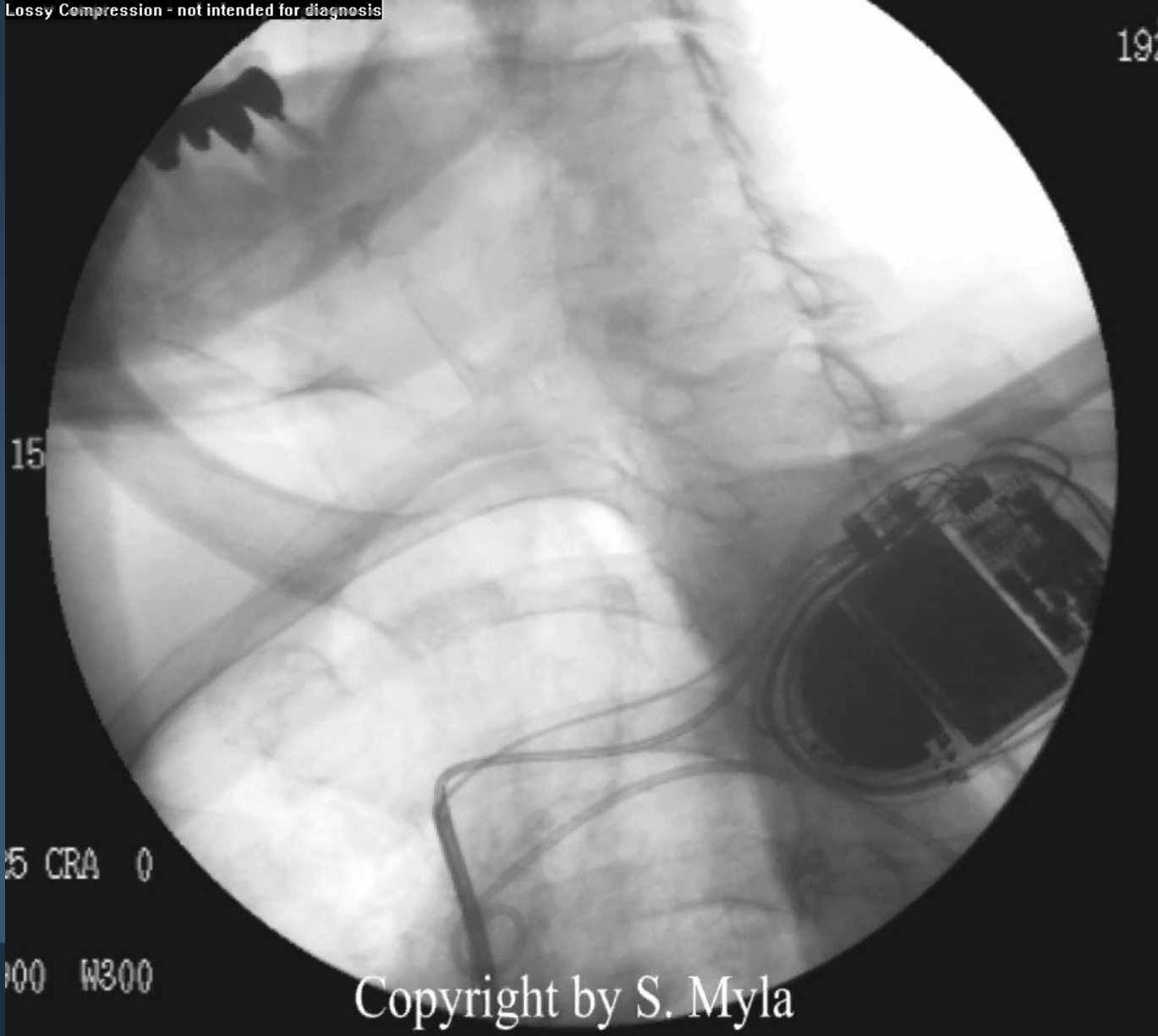
JCL XB 4.0 Guide catheter

# Ledge Effect





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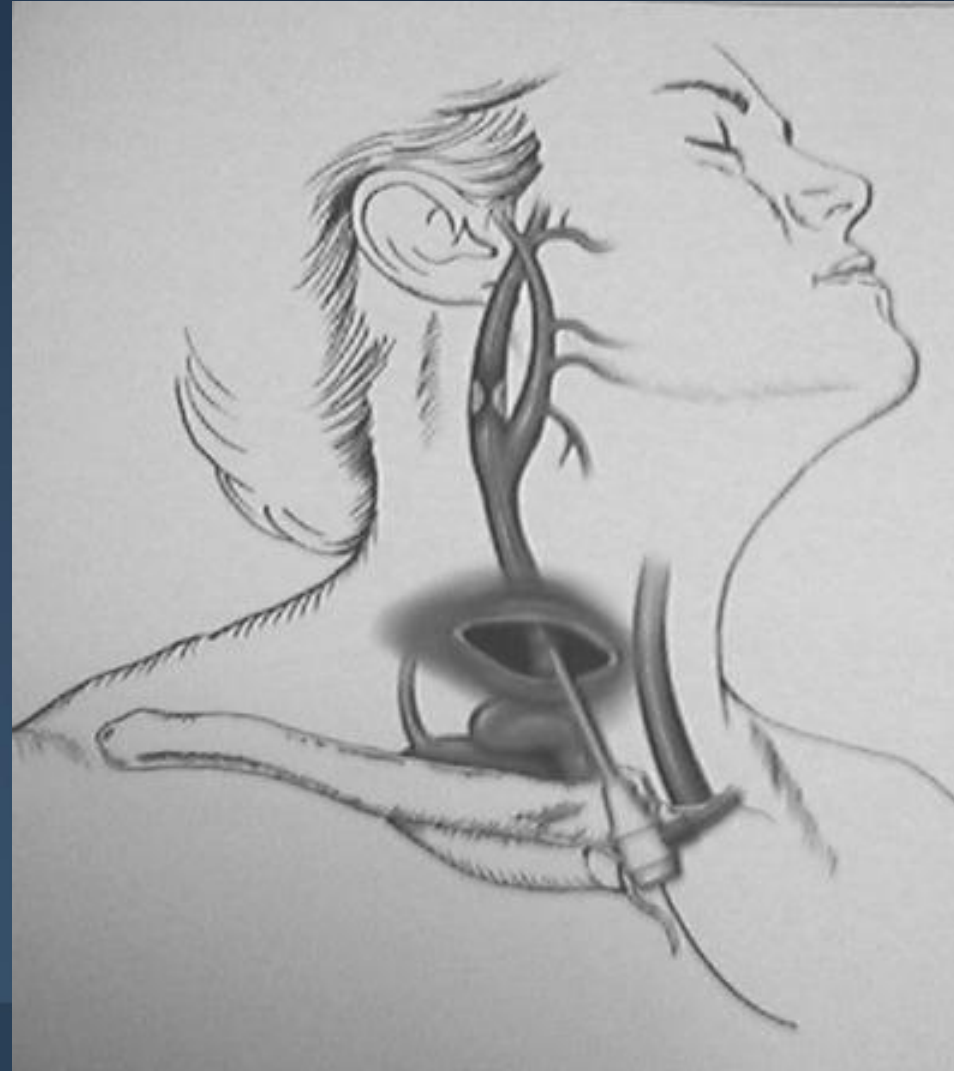




# Direct Carotid Access

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**
- **Heavy calcification**
- **Sharp lesion angle**
- **Soft Guide wire**
- **Blunt end stent**
  - **without nose cone**

**Pre-dilate**

**Large balloon  
dilatation**

**Stiff guide wire**

**Stiff guide wire**

**Change stent**



# 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**

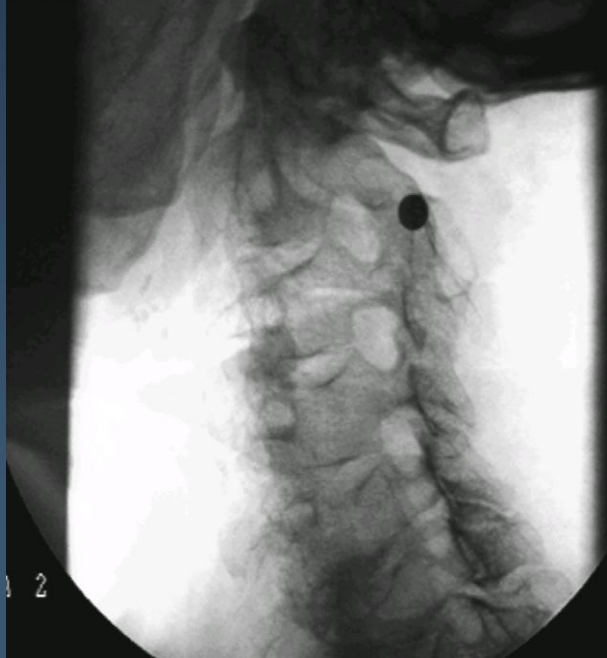


- **What determines ICA access?**
  - **Carotid Tortuosity**
  - **Sharp Entry Angle**
  - **Sharp Exit Angle**
  - **Complex Lesion Morphology**
    - **Subtotal occlusion**
    - **Absent clear path across lesion**
    - **Heavy/Strategic calcification**
  - **Landing Zone**



# Sharp Lesion Angles

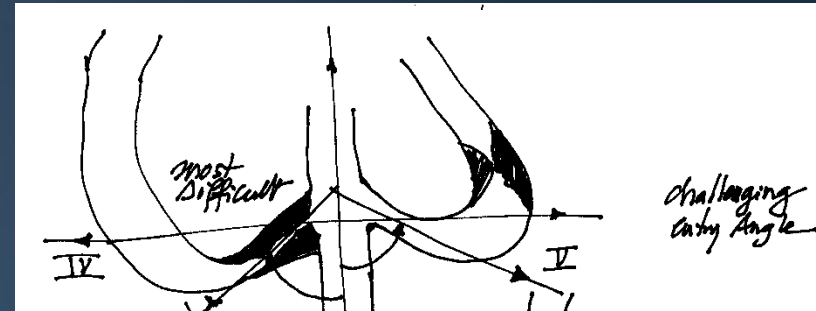
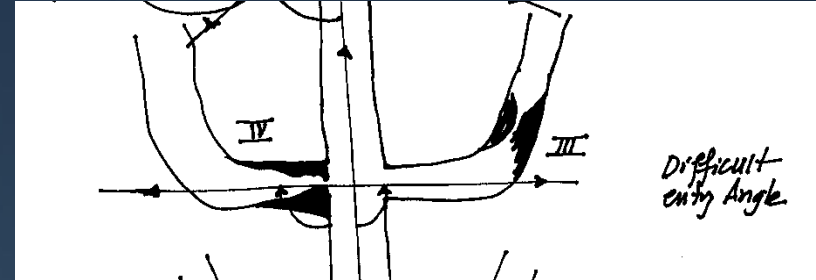
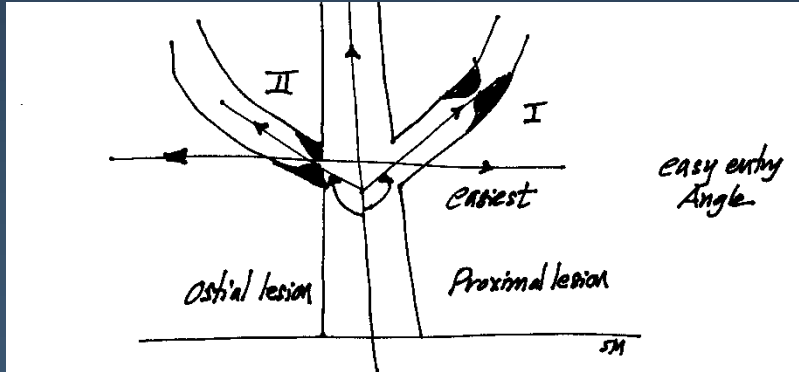
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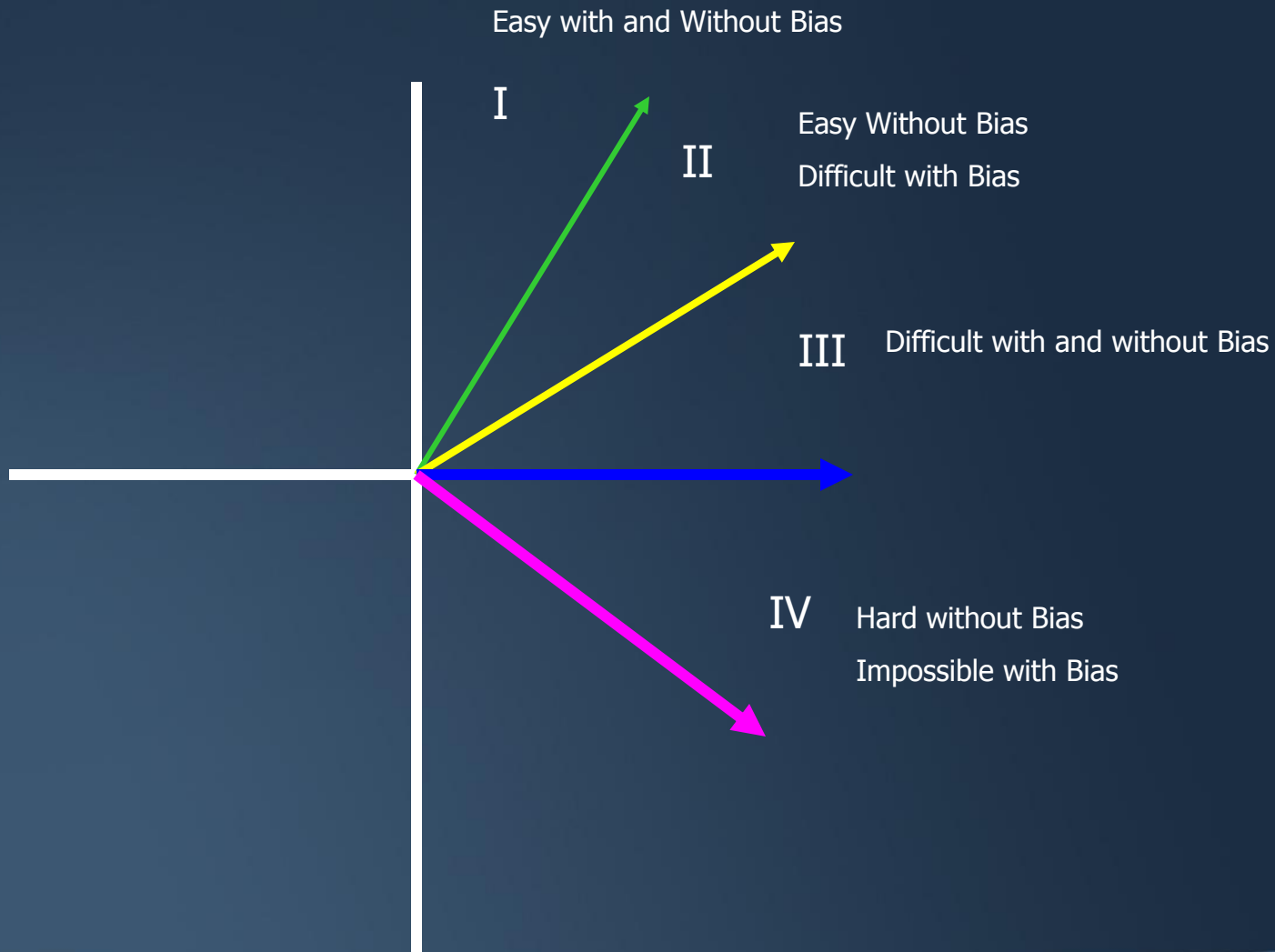
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# Sharp Entry Angle



# Sharp Entry Angle



# 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%



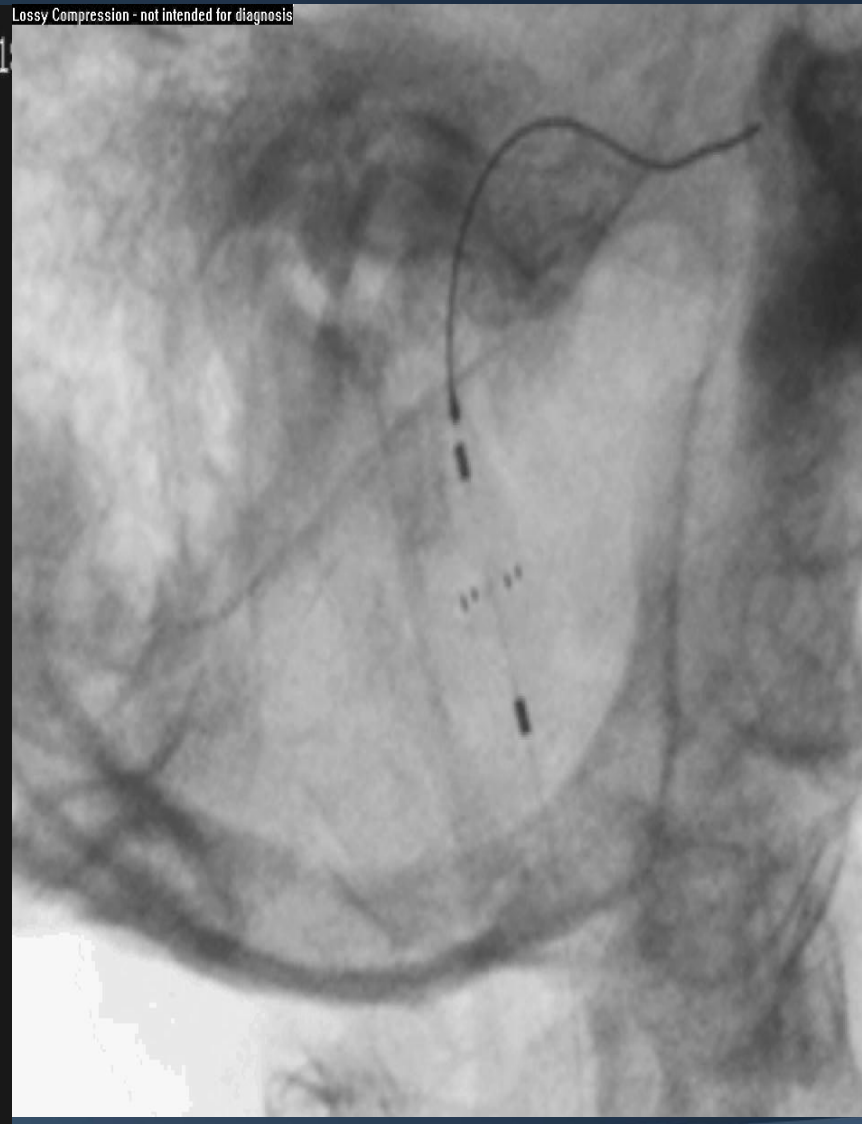
20 YEARS OF INNOVATION

TCT 2008

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FOUNDATION

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IM05

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# 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



- **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



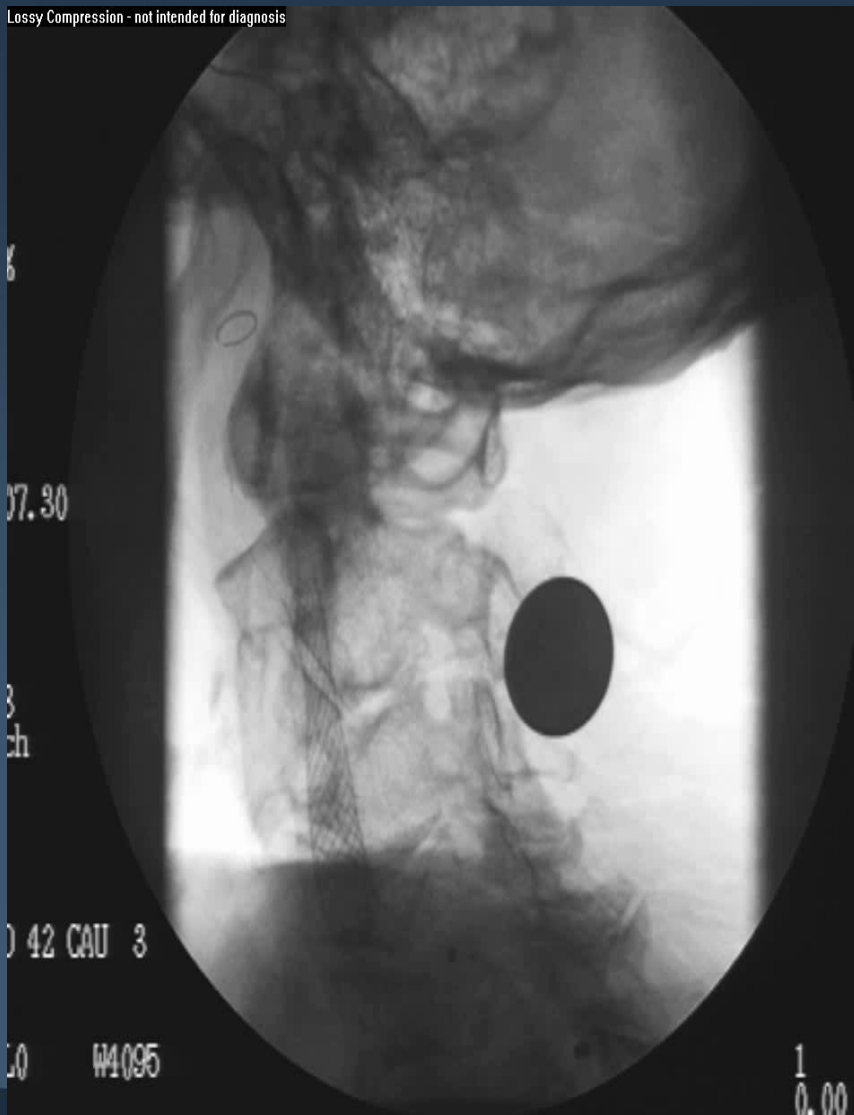
- **Retrieval Catheter (RC)**
  - **Closed Cell stent**
    - Least Problems
    - Neutralizes anatomical adversity
  - **Open cell stent**
    - Worst Problems
    - Single Stiff Recovery Catheter
    - Anatomical Adversity



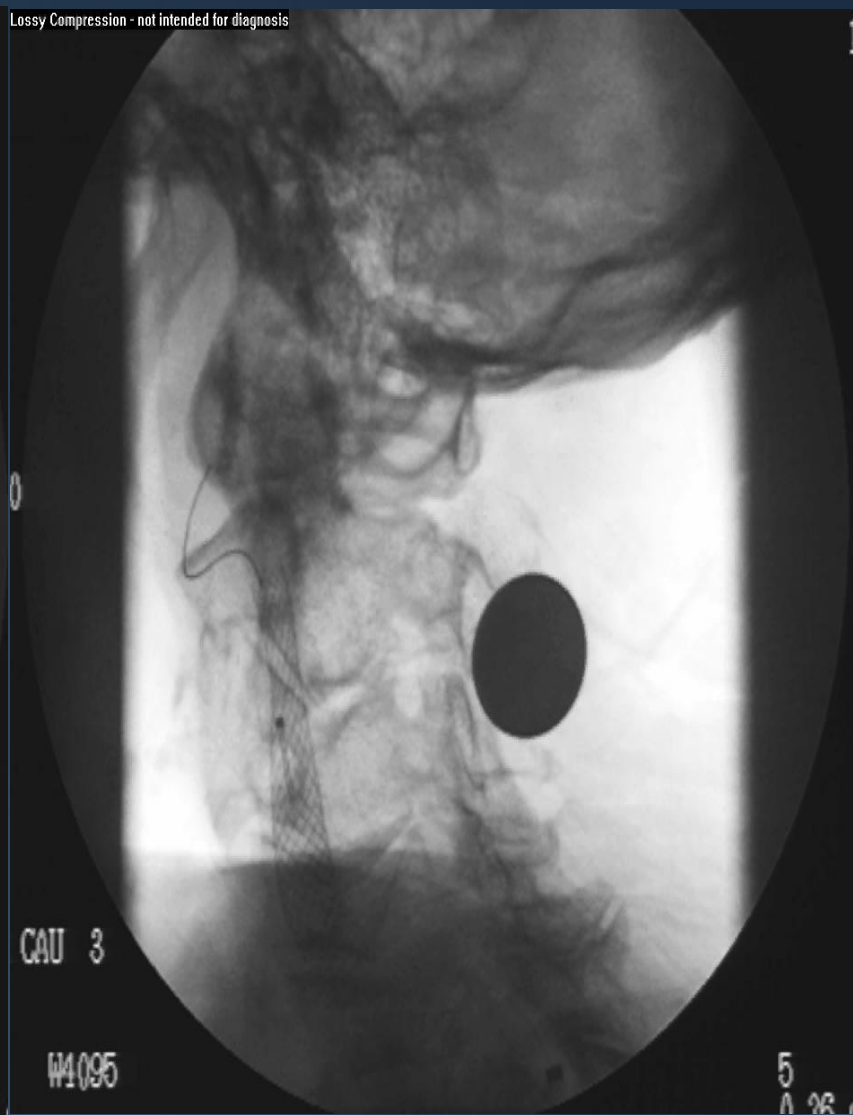
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# Carotid Filter Issues

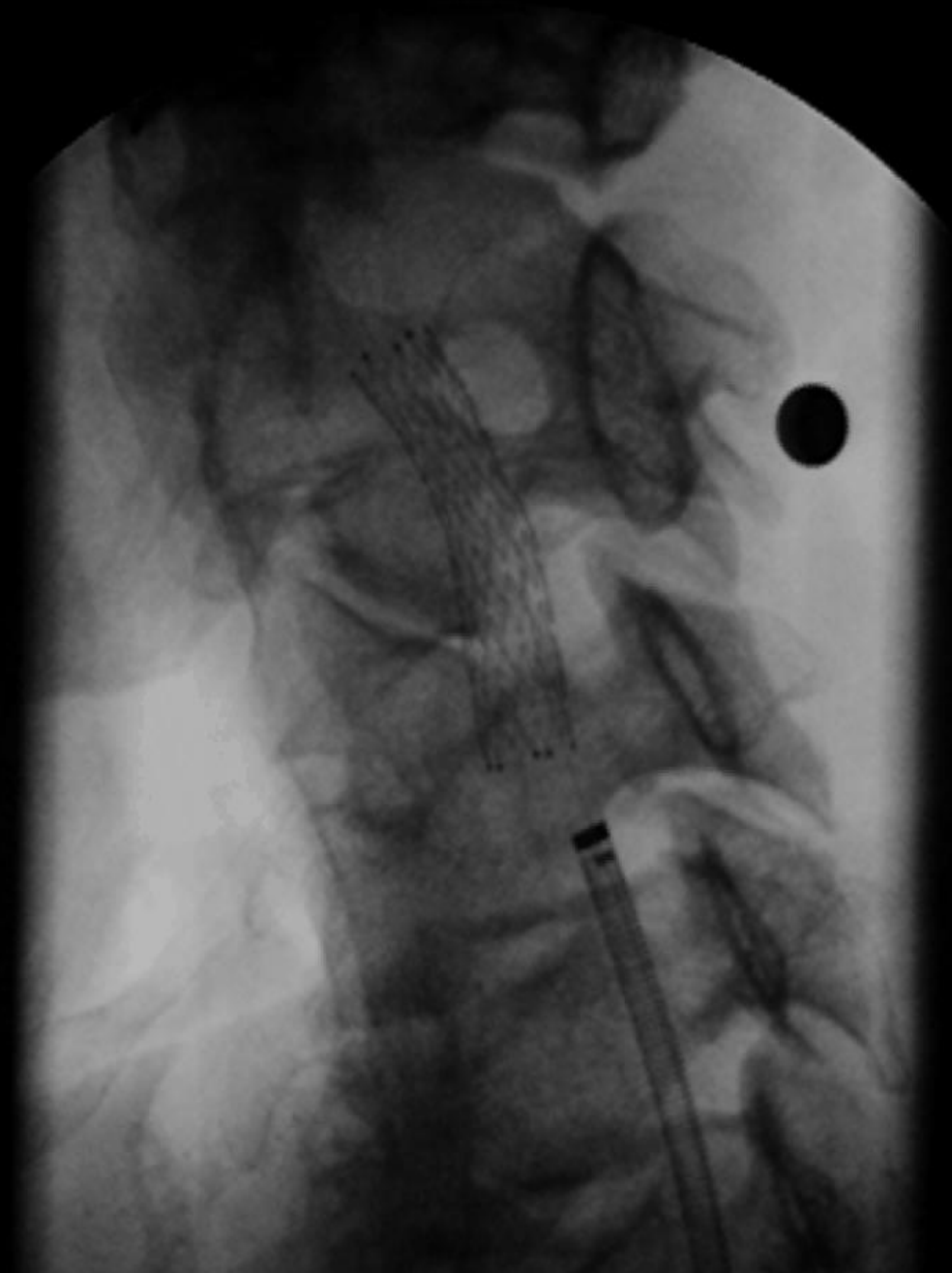
- **What to do when retrieval sheath doesn't advance?**
  - **Don't panic and pull on filter!**
  - **Neck rotation**
  - **Advance sheath distally**
  - **Neck compression**
  - **Bent tip retrieval sheath**
  - **Buddy-wire**
  - **Additional balloon dilatations**



Cath Lab  
26

# Head Tilt

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# Filter Detachment

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



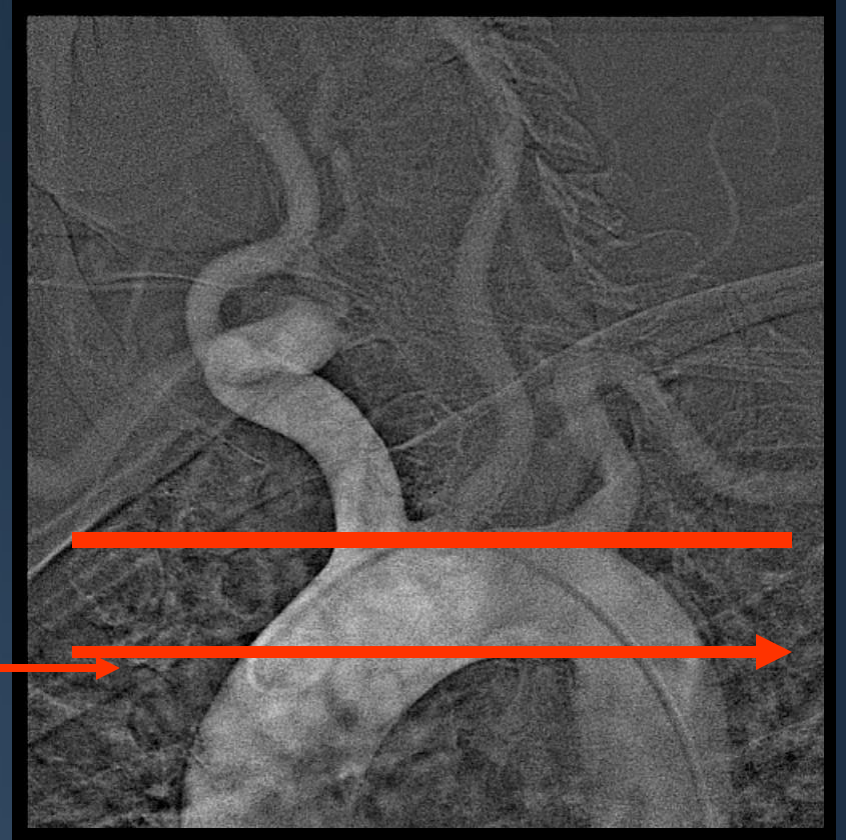
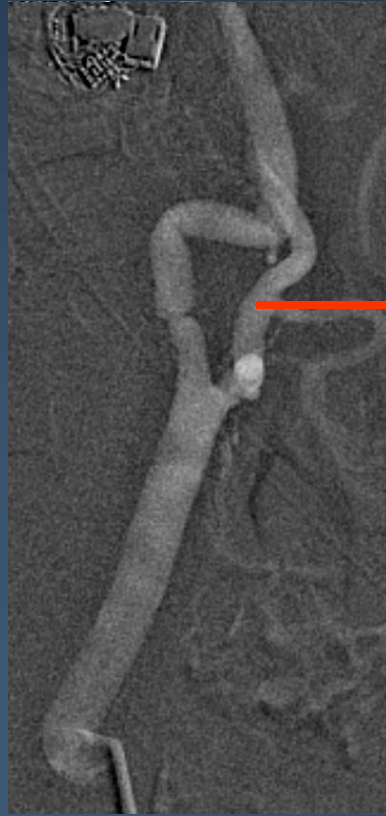
# Filter Detachment

- **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**





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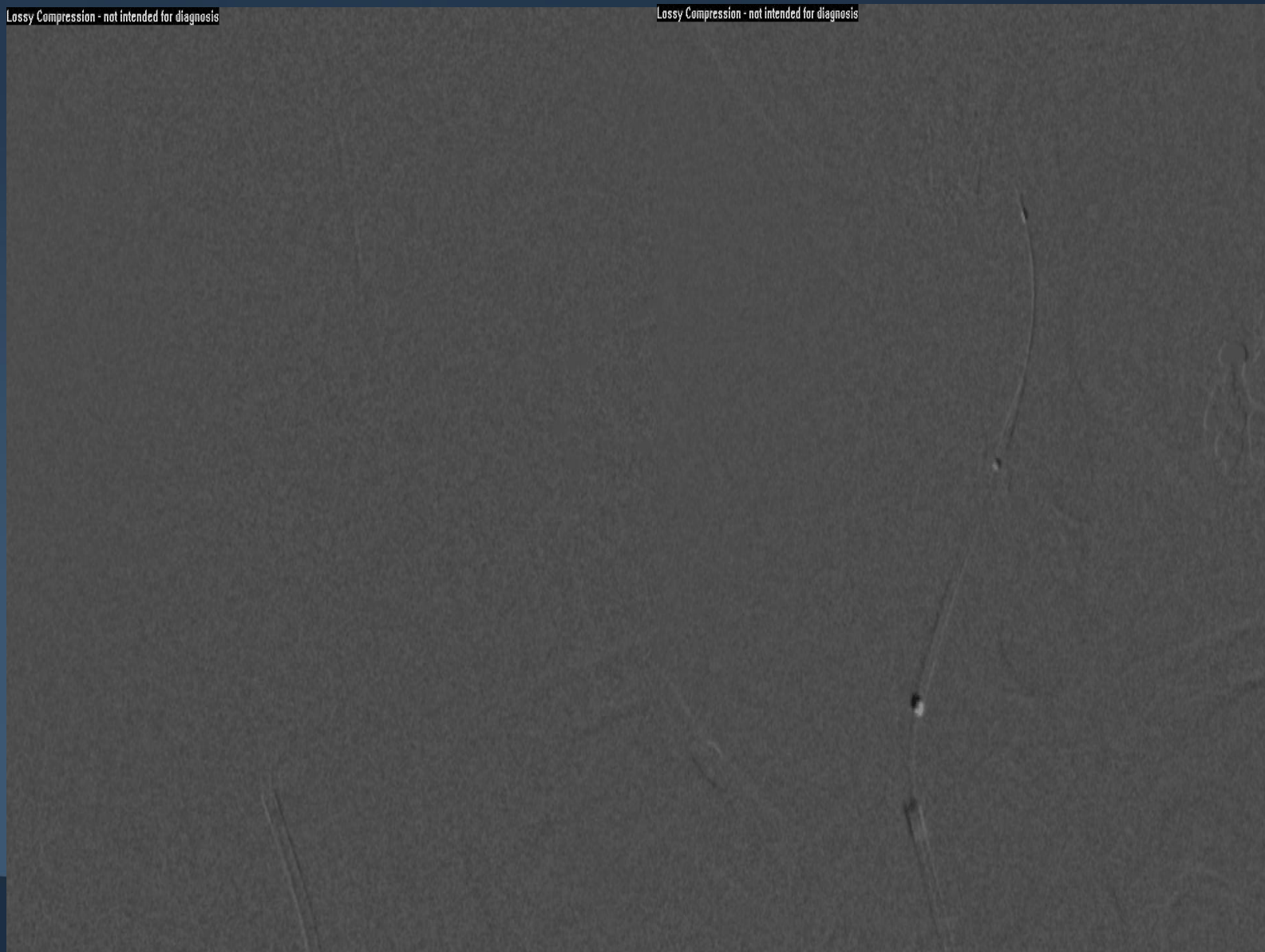


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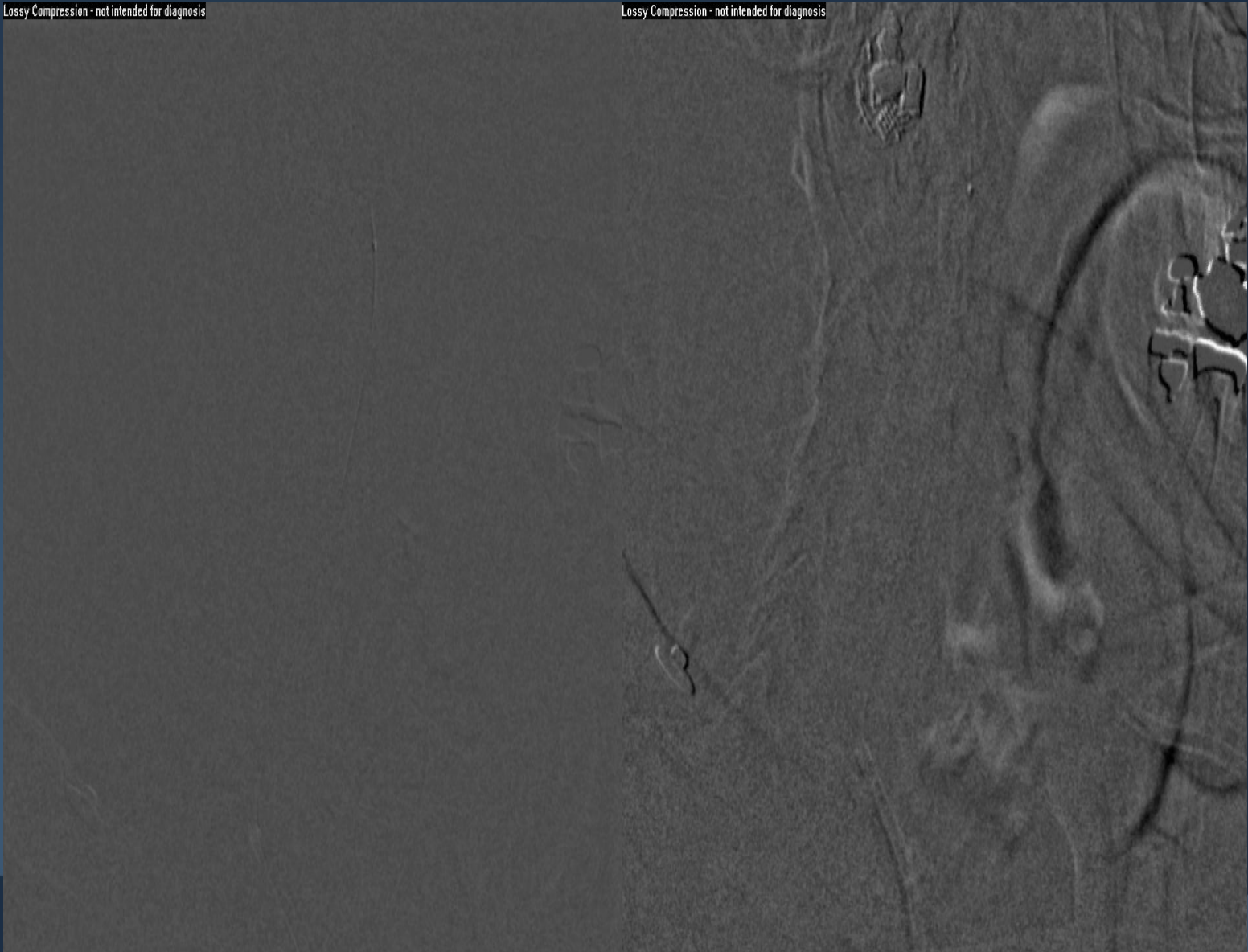


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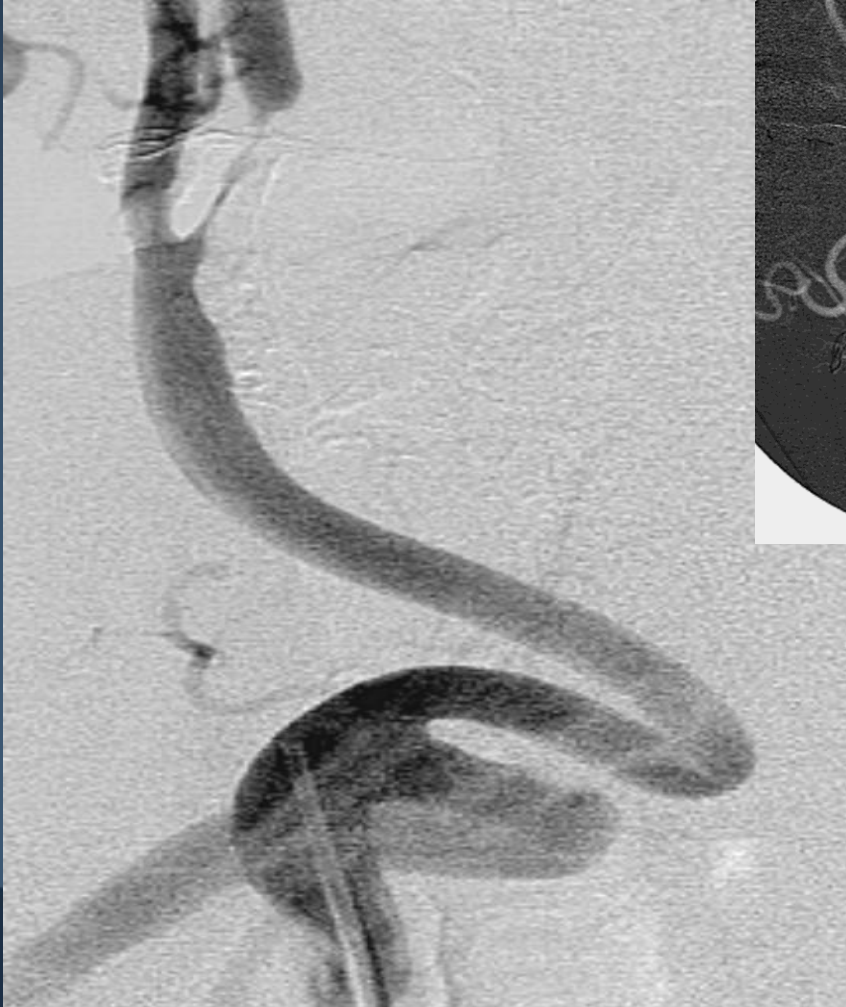
# Lessons Learned/Avoid These **S**

- **S**TEEP Arch (Type III)
- **S**EVERE tortuosity
- **S**HARP Entry Angle
- **S**HARP Exit Angle
- **I**NSUFFICIENT Landing Zone
- **U**NSATISFACTORY Collaterals



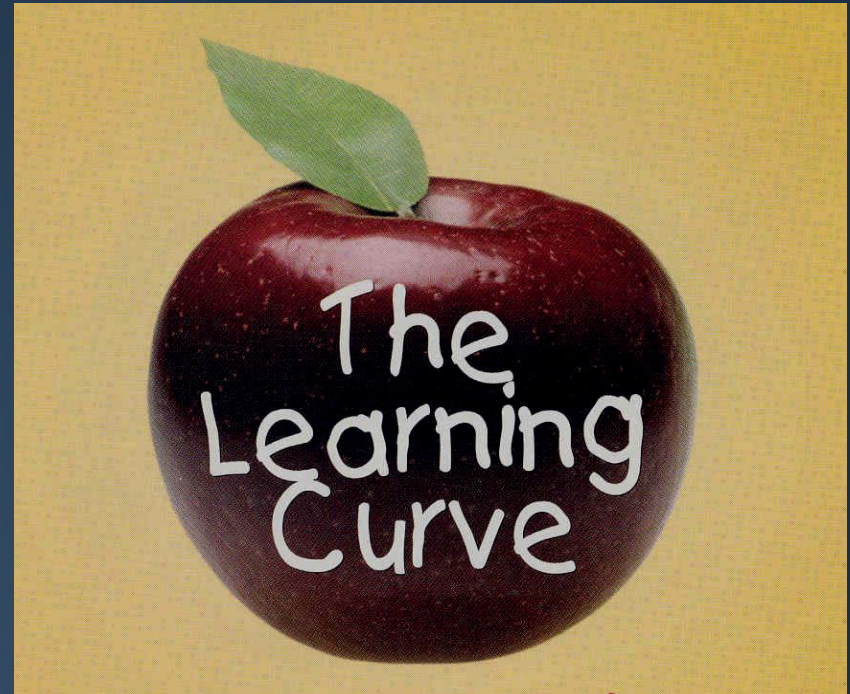


# Lessons Learned/Avoid These **S**



# 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](http://www.carotidtraining.com)

