Paul Hsien-Li Kao, MD
Associate Professor
Cardiac Cath Lab Director
National Taiwan University School of Medicine & Hospital

Carotid Artery Stenting
The Basics

Why cardiologist?

- Carotid stenting (CS) is emerging as a less invasive treatment for carotid stenosis to prevent stroke
- Neurologist, radiologist, surgeon, and interventional cardiologist are involved
- Frequently presented with multiple concurrent arterial diseases, esp. CAD
- Driving force in the device industry is from cardiologist, and 2/3 of CS done worldwide are by cardiologists

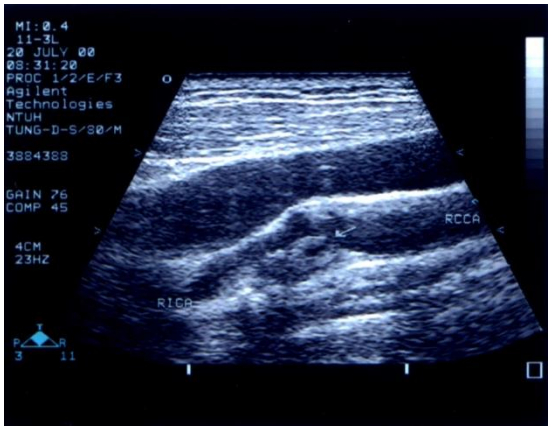
NTUH CS Program

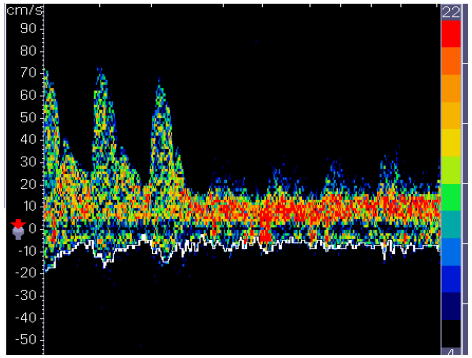
- Started in April 1998
- Combined efforts from neurology and cardiology departments
- Independent clinical/neurological evaluation and neck ultrasound by neurologist
- Angiography/intervention and post-procedural care by cardiologist
- Pre-specified stenting indications

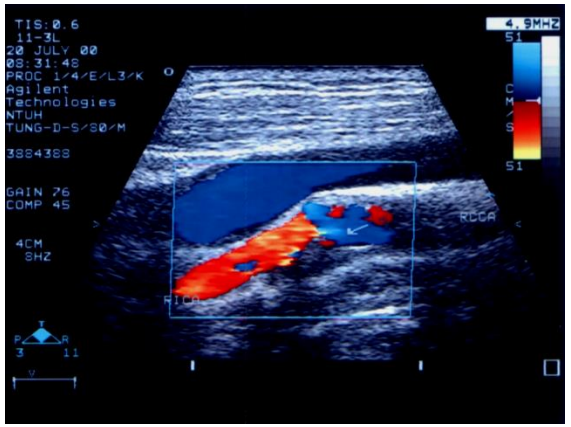
Prior to intervention

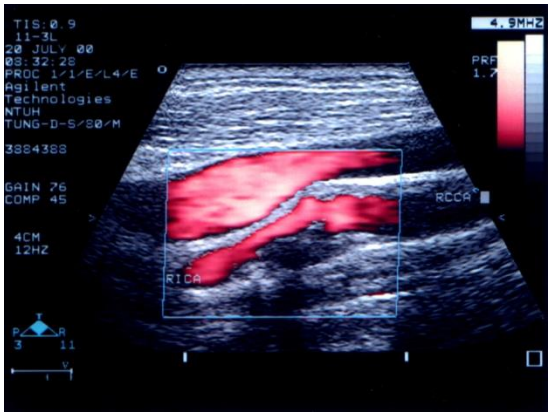
- Work with your neurologists
- Obtain clinical, physical, biochem data
- Start aspirin and clopidogrel at least 3 days prior to admission
- Well hydration
- Stop hypertension medication on the day of intervention

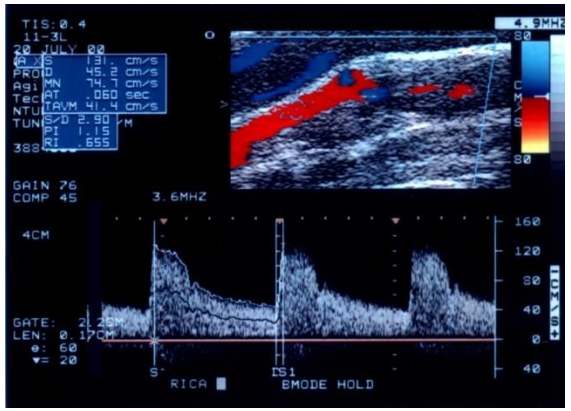
Neck ultrasound











Paul HL Kao

Highlights of the procedure

- Arch aortogram
- Selective EC-4V diagnostic study with intracranial image
- Common carotid access
- Crossing lesion with EPD
- Pre-dilatation
- Self-expanding stent deployment
- Gentle post-dilatation if necessary

Arch aortogram

- Shape and curvature of the arch
  - Type 1-3 arch
  - Deep brachiocephalic trunk (BCT)
- Congenital variations (of left arch)
  - Bovine arch
  - Common origin of left common carotid artery (CCA) and BCT
  - Aberrant right subclavian artery (SCA)
- Disease at ostia of BCT/CCA
- 6F Pigtail

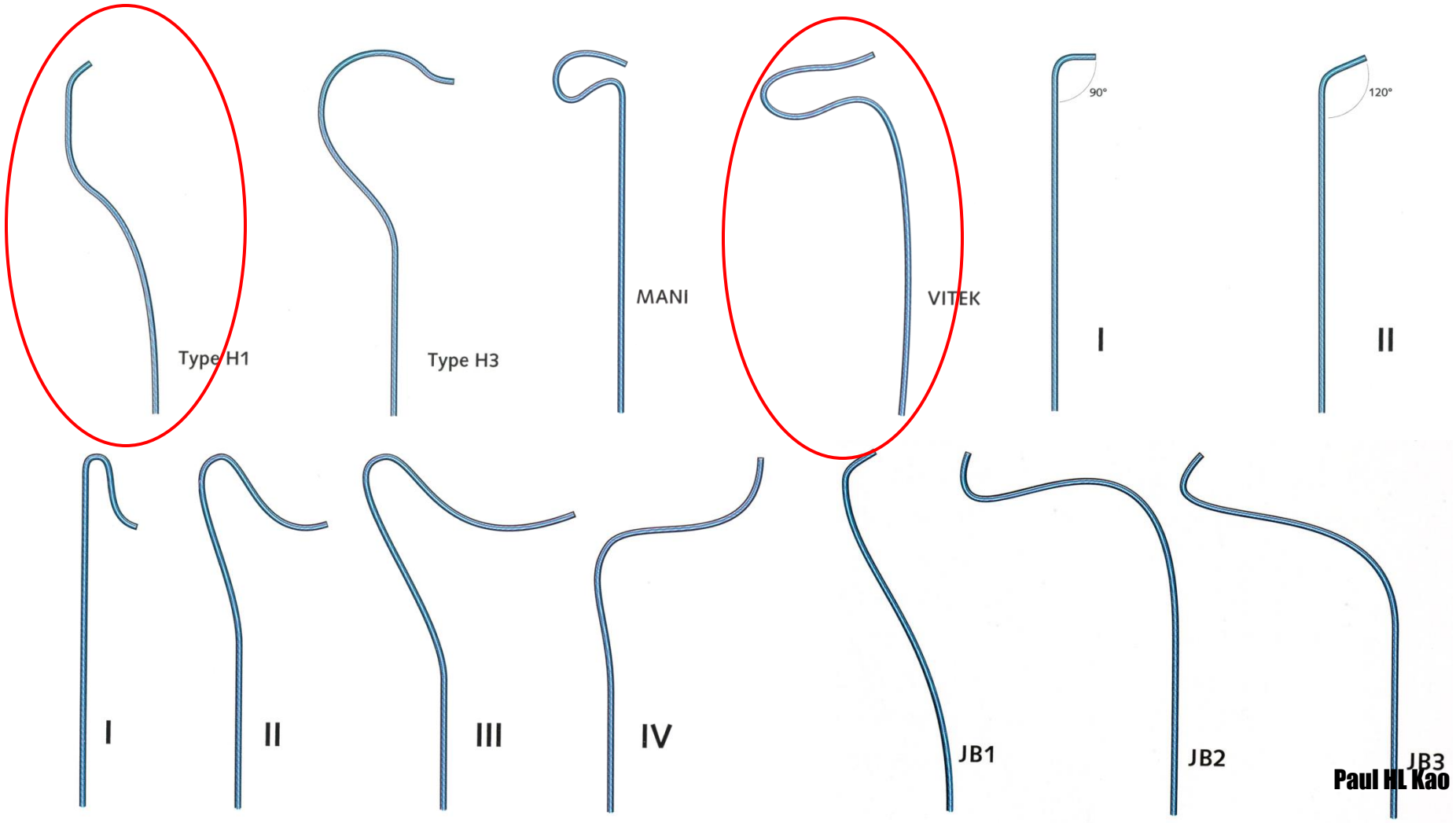
Arch anomaly

Paul HL Kao

EC-4V angiography

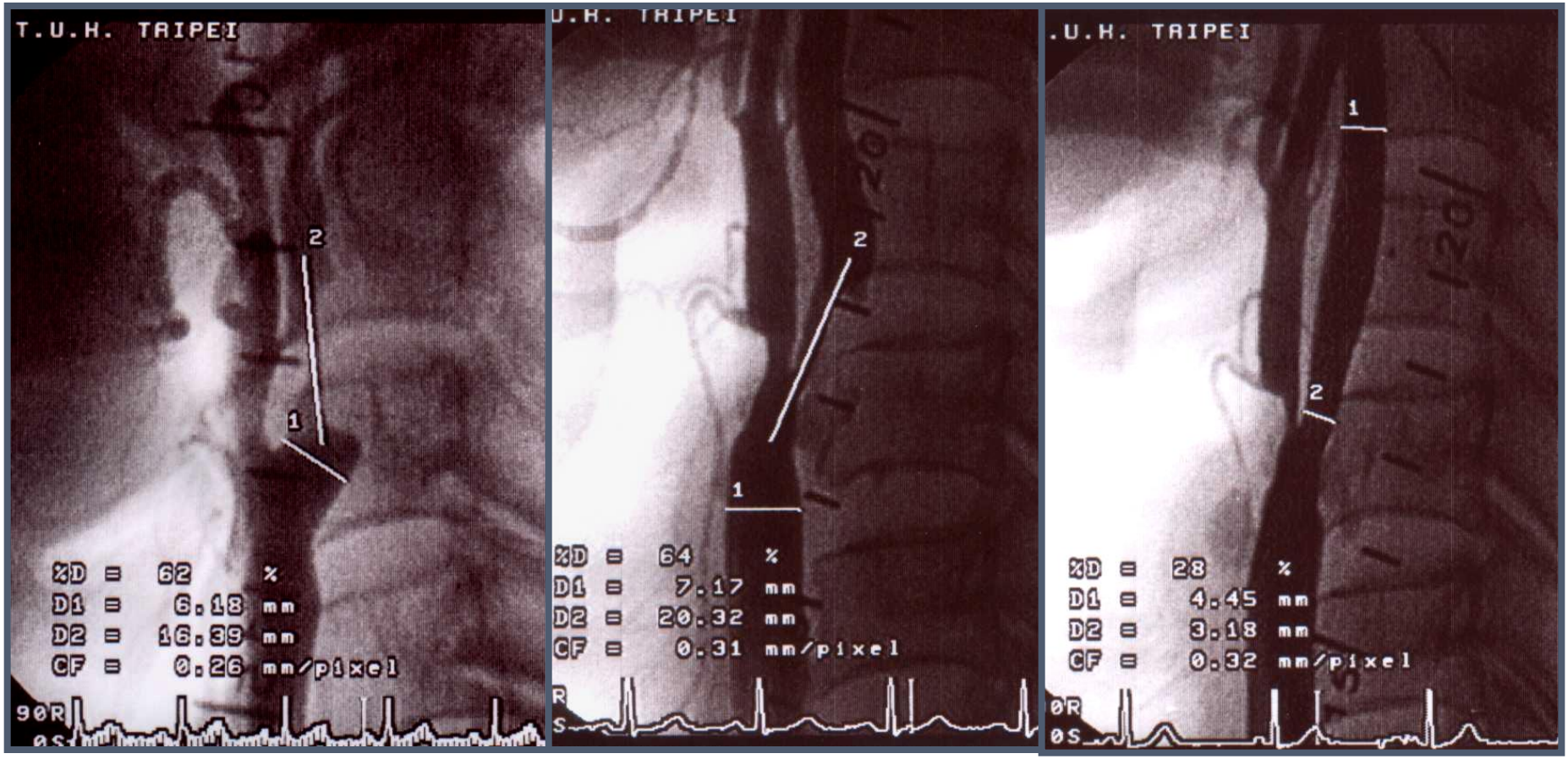
- JR4 with 0.035” Terumo wire in over 90% of the cases
- Meticulous care to avoid air emboli
- Half-strength contrast
- Always fluoro the wire/catheter tip
- Lesion visualization with bi-plane views

Different curves



Paul HL Kao

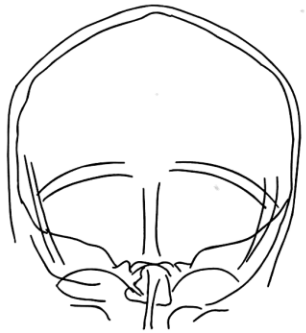
Measurements



Paul HL Kao

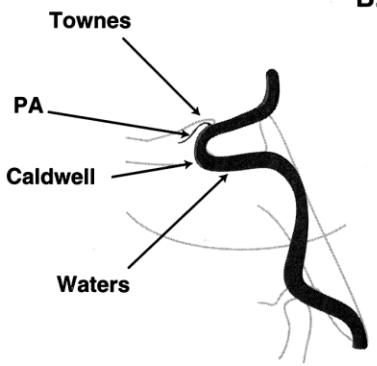
Selective IC runs

- Anterior part of the Willis circle
  - A1/Acom existence
  - Neck compression test (?)
- Intracranial disease
  - Stenosis
  - Aneurysm
- Abnormal connection/collateral
- Don’t make decision without IC views

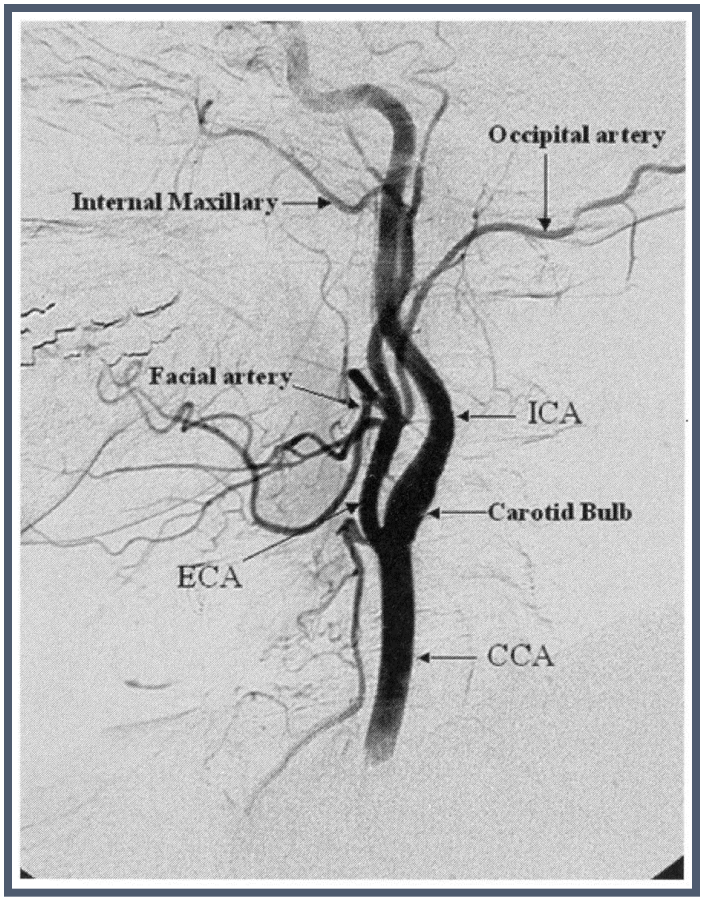


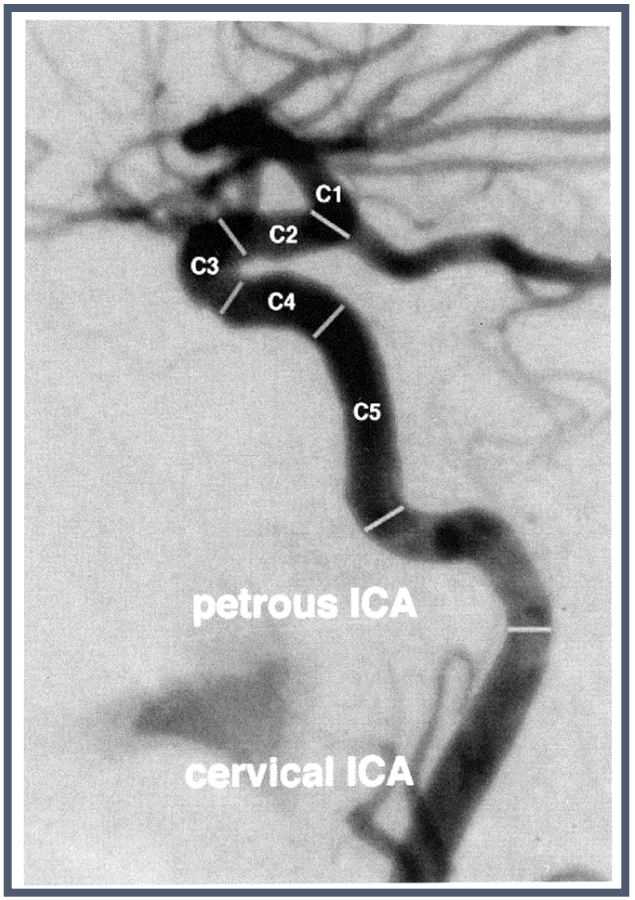
A. Townes view

B. Waters view



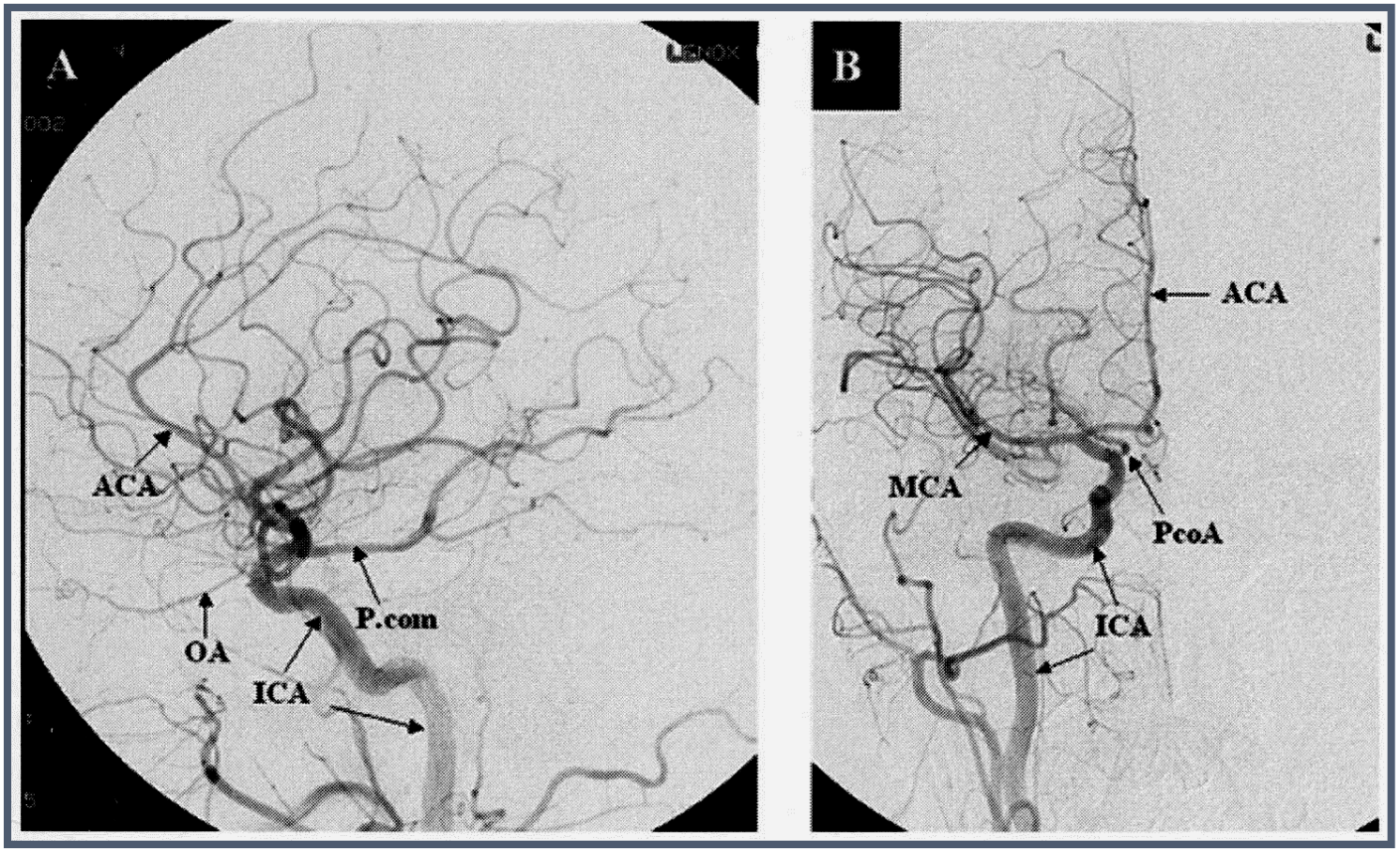
Anatomy of CCA/ICA





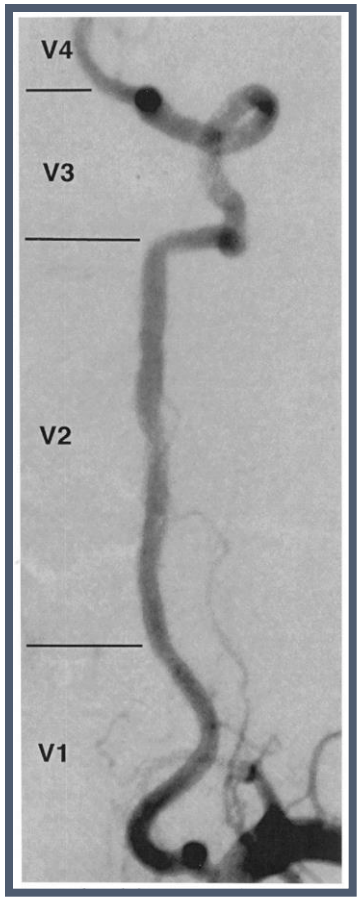
Paul HL Kao

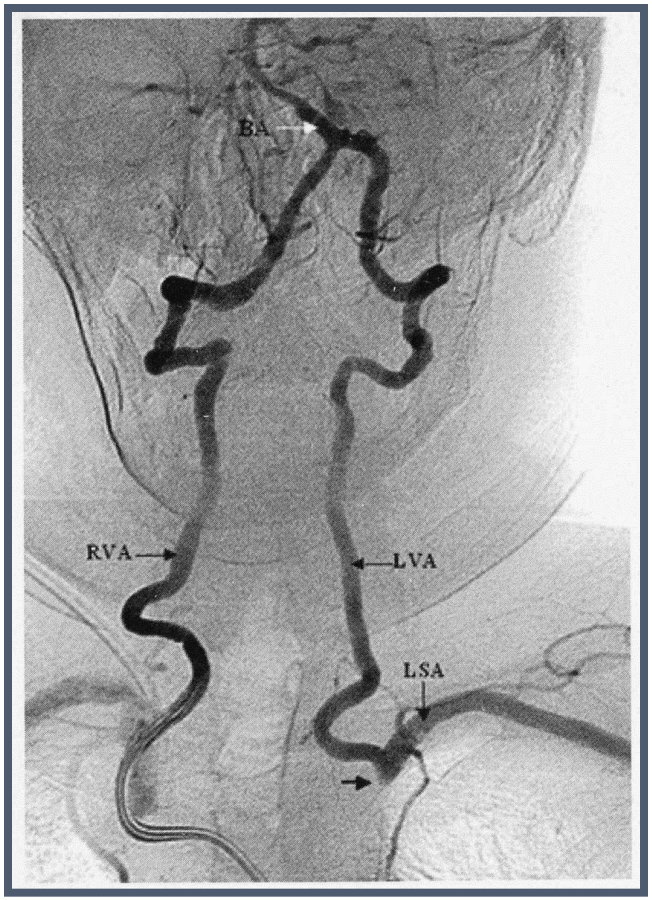
ICA branches



Paul HL Kao

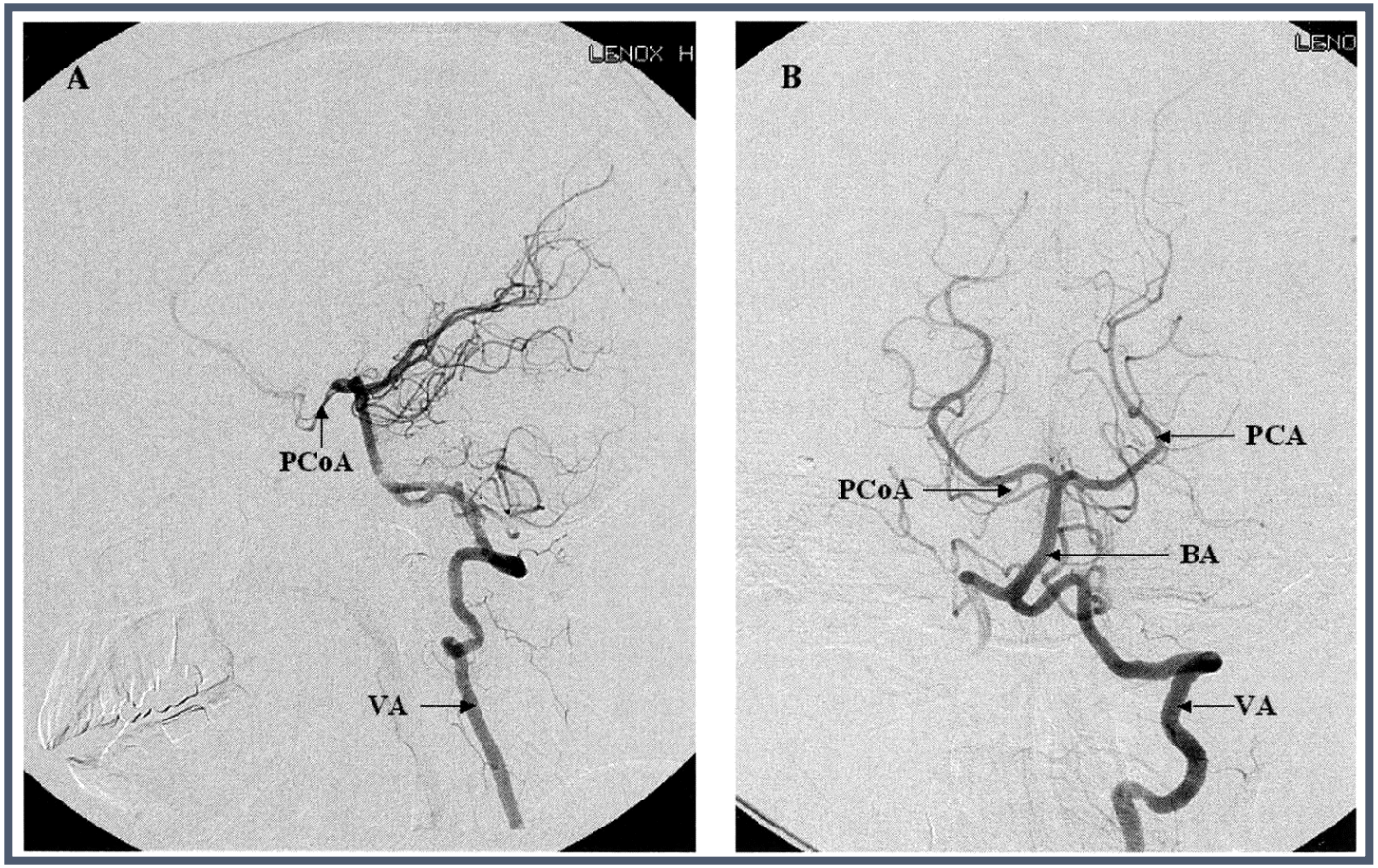
Anatomy of VA





Paul HL Kao

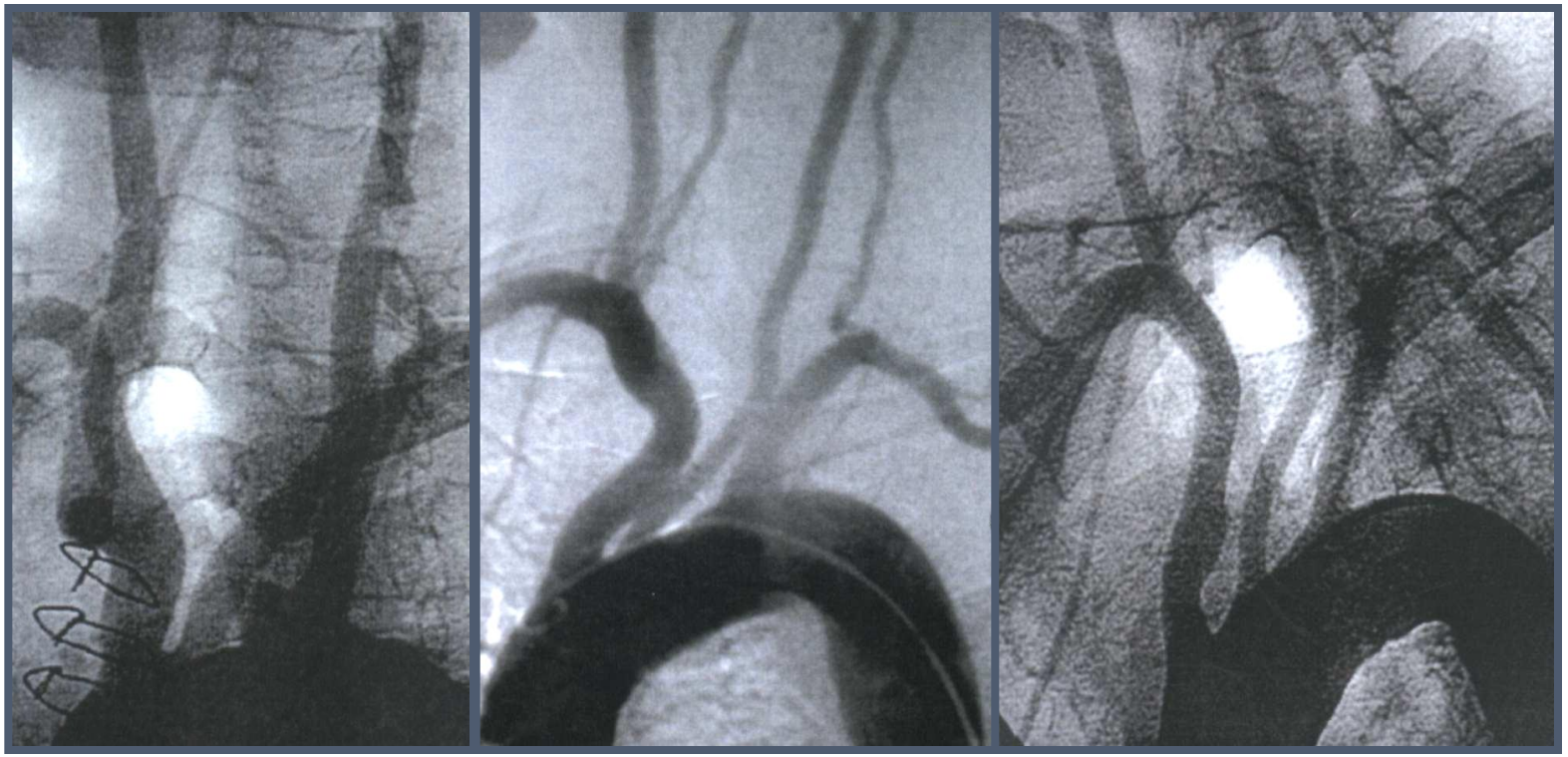
VA branches



Paul HL Kao

CCA access

- The most challenging step, especially in difficult arches



Paul HL Kao

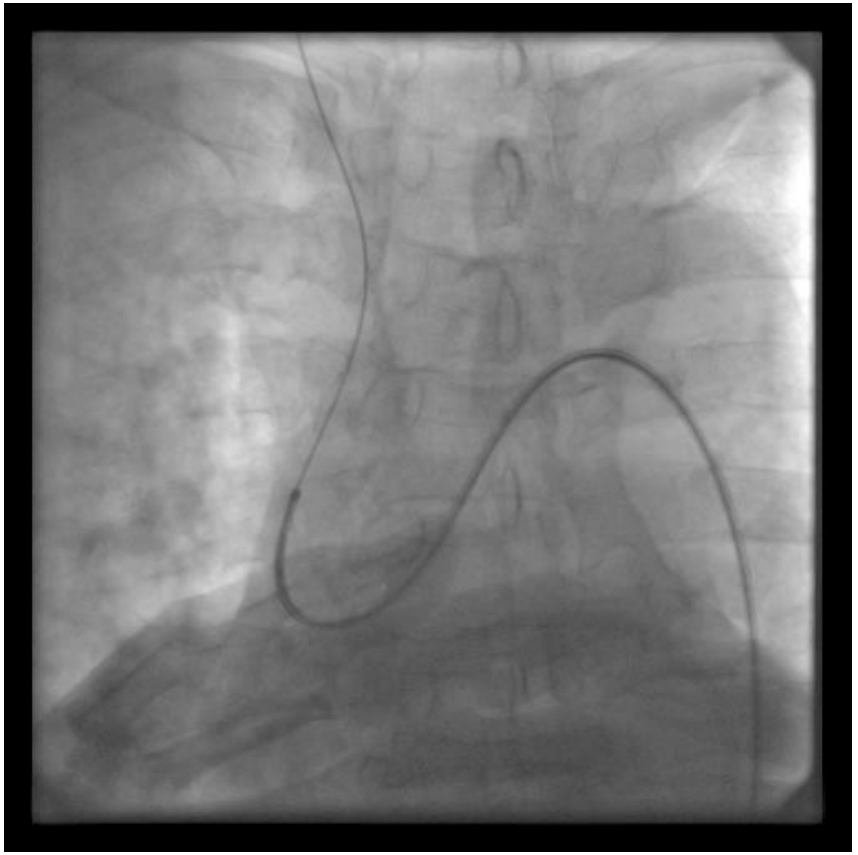
Easy CCA access

- 8F JR4 GC engaging CCA orifice
- .035” Terumo wire into ECA
- Gentle advance of GC over wire into distal CCA
- Pay attention to the CCA orifice

Difficult CCA access

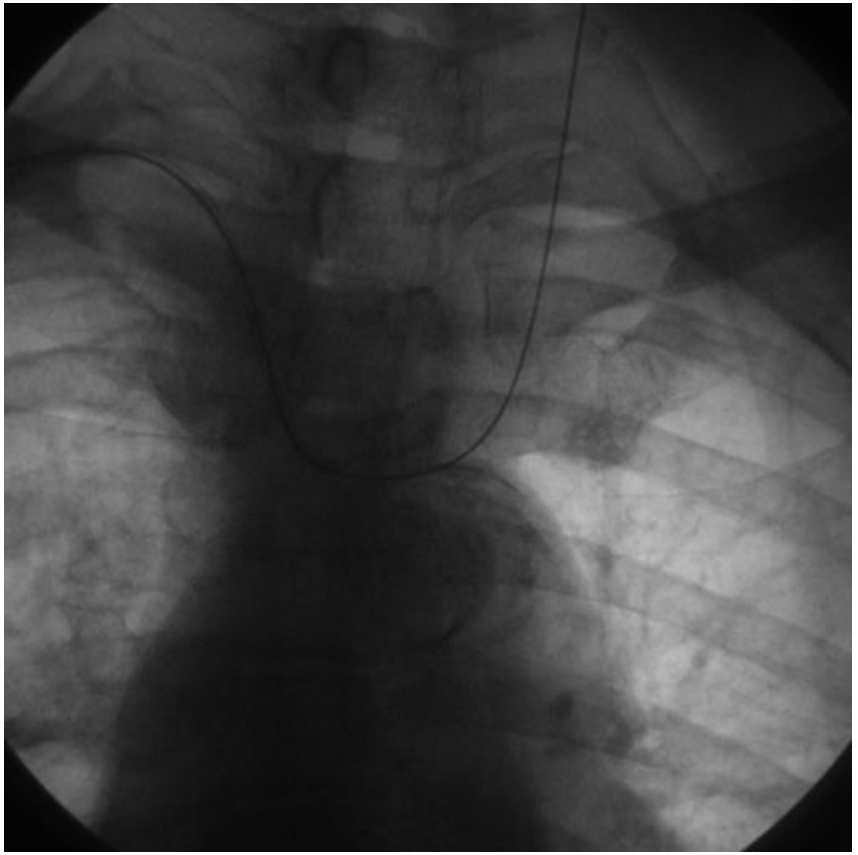
- 8F JR4 GC in the descending aorta
- 5F 125cm VTK through GC engaging CCA
- Exchange length torquable slippery wire into ECA
- Advance VTK into ECA over wire
- Change wire to stiff Amplatz wire through VTK
- Advance GC over wire/VTK into distal CCA
- Simmone's technique may be useful
- When all efforts failed, consider brachial approach

Simmone's technique



Paul HL Kao

Brachial approach

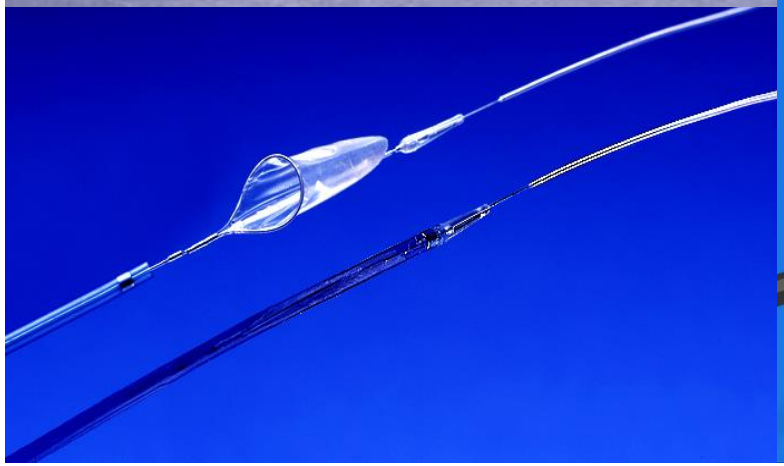


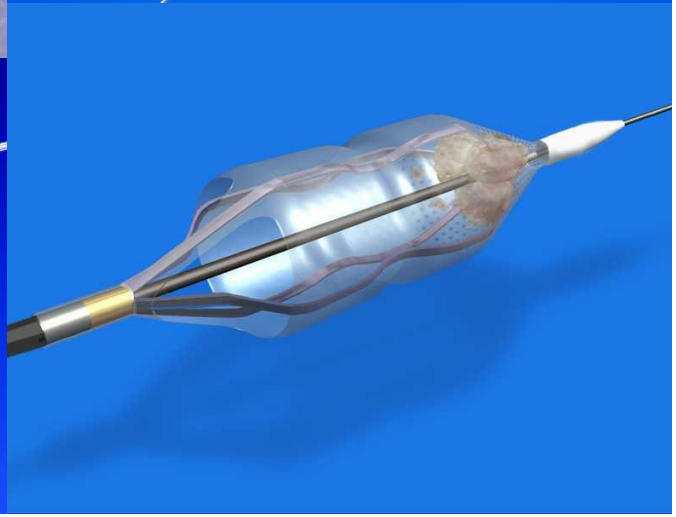
Paul HL Kao

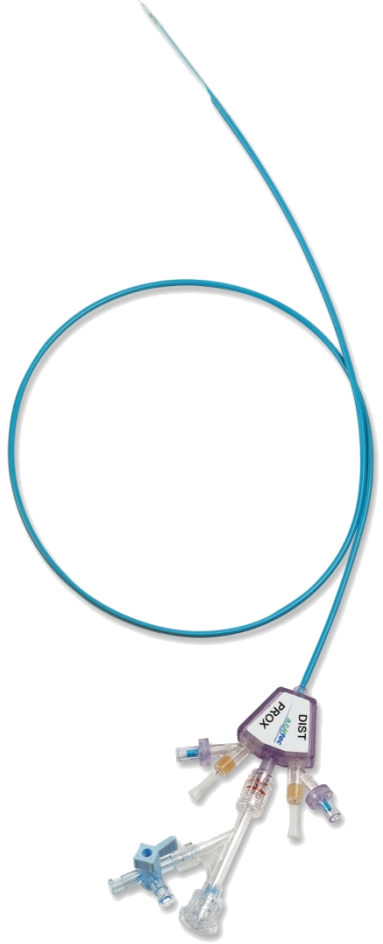
Crossing lesion

- Always use protective device wire
- 0.014” soft tip coronary angioplasty wire with good directional control and stiff shaft may be used as buddy wire
- Careful wire advancement with “one pass” concept
- Place the floppy portion of the wire just proximal to the cranial base, but pay attention to kinks

Personal experience with EPD's





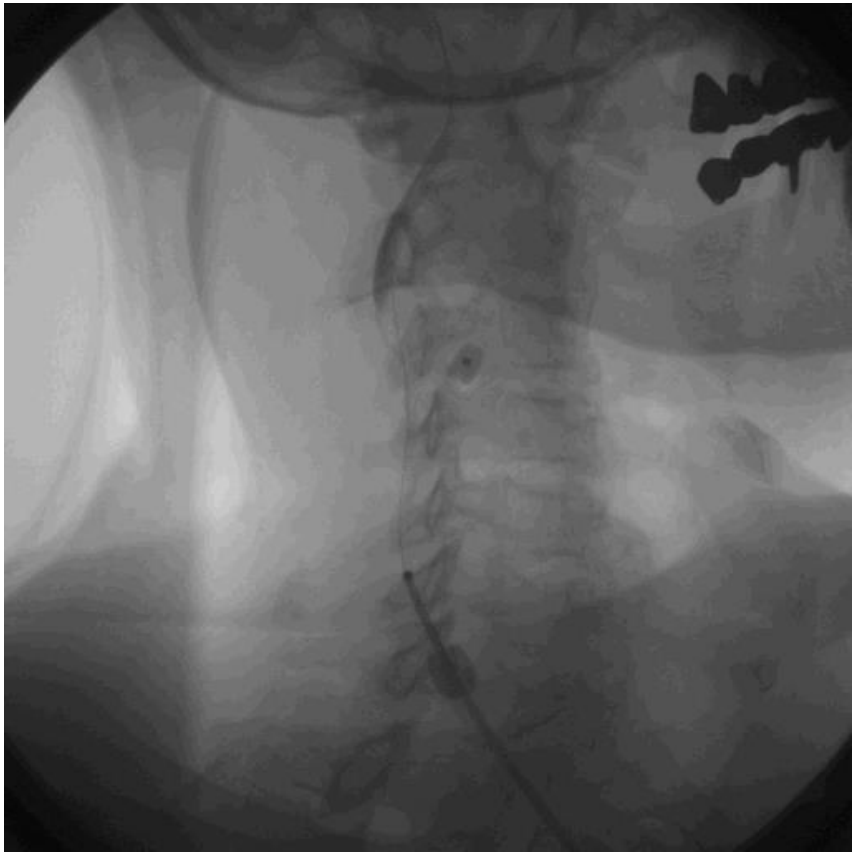


Paul HL Kao

Invatec MoMA

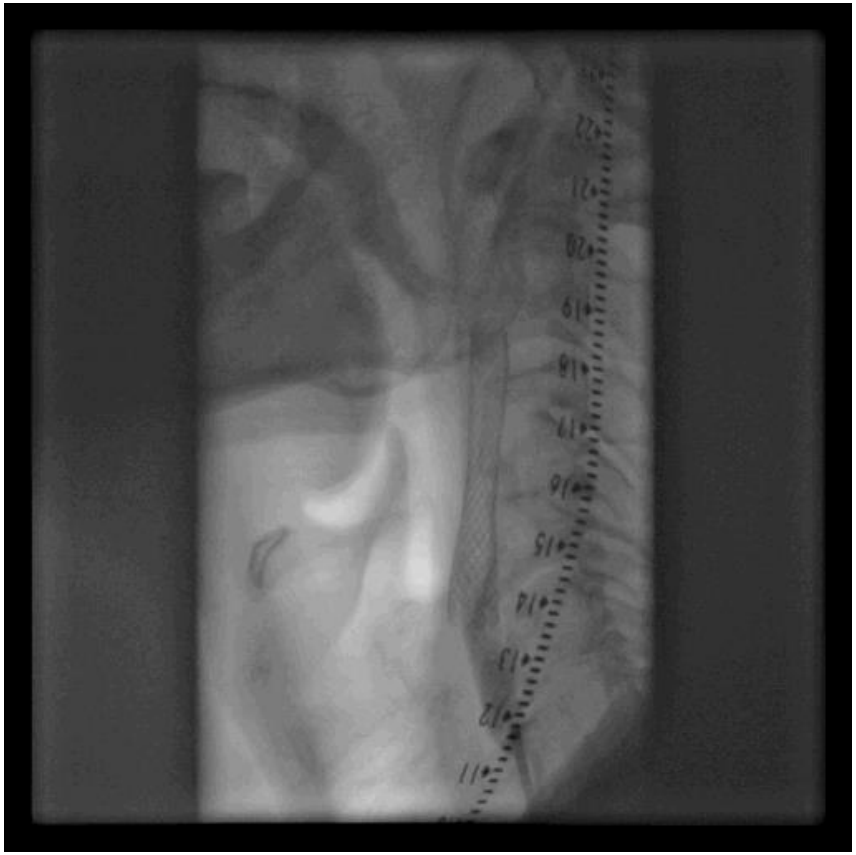
Paul HL Kao

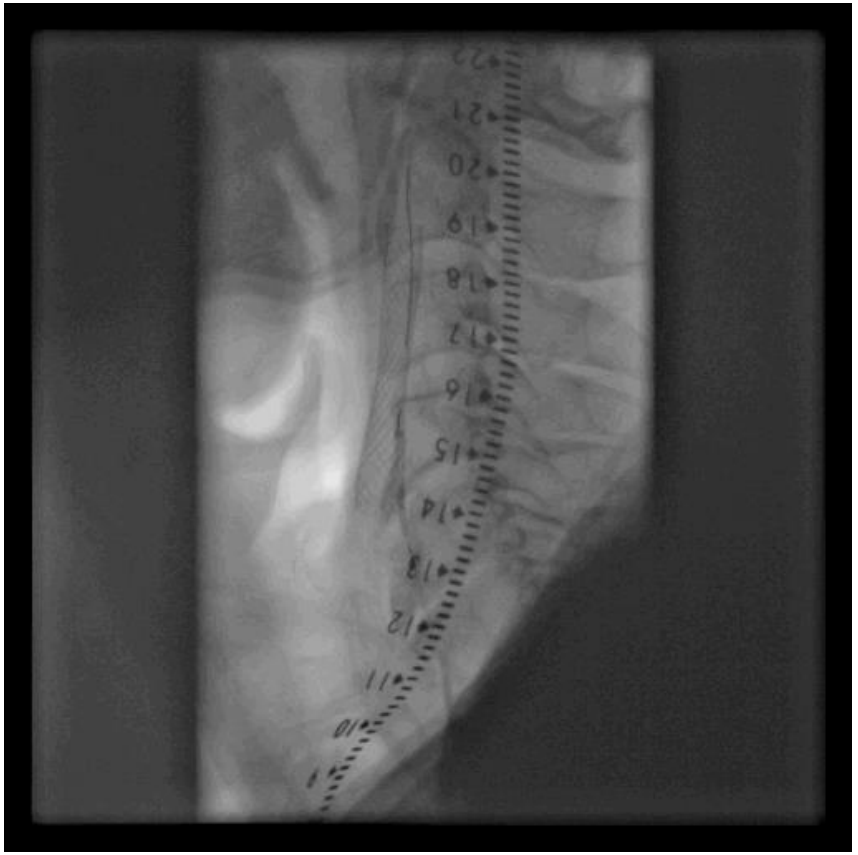
Invatec MoMA



Paul HL Kao

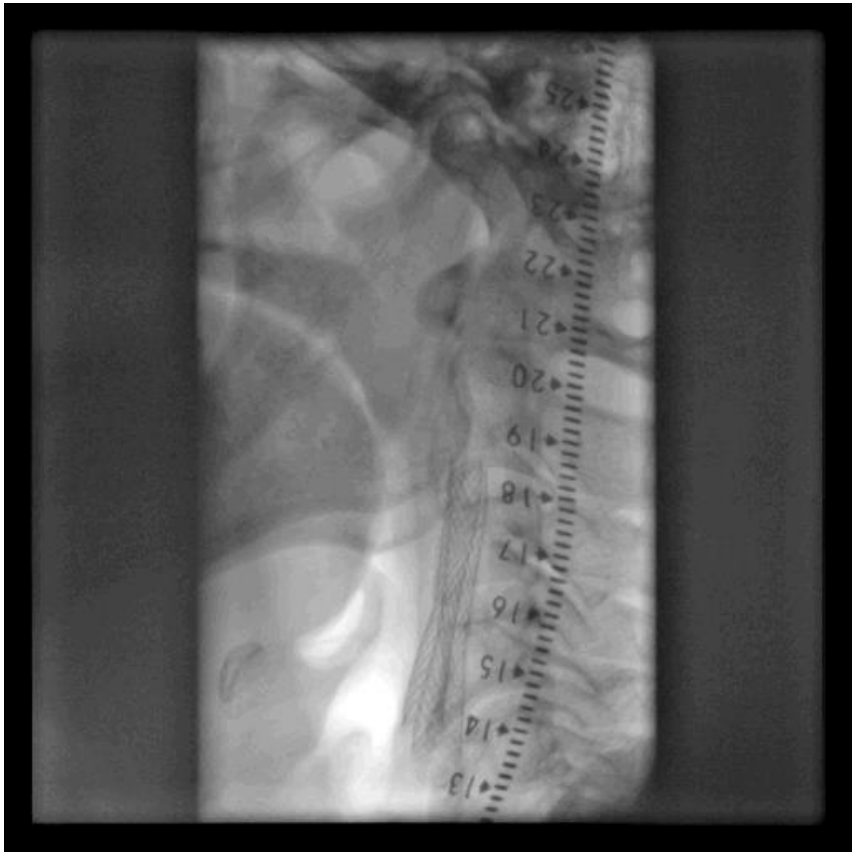
EPI FilterWire





Paul HL Kao

EPI FilterWire



Paul HL Kao

Dilatation balloon

- Pre-dilatation only when necessary
  - MLD <1mm
  - Tortuous residual lumen
  - Complex plaque with irregular surface
- Post-dilate only to facilitate stent expansion/apposition
  - Size to reference ICA (5-6mm)
  - Residual stenosis <30% is acceptable

Stent sizing

- Length
  - Complete plaque coverage with safety margins on both ends
  - Avoid excess to prevent exit kink
  - Remember “shortening” issue
- Diameter
  - Nominal diameter at least 0.5mm larger than the largest “landing zone” diameter
  - Avoid over-stretch
- ECA jailing is not an issue

Post stenting care

- Always CCU observation overnight
- Use hydration/dopamin or NTG to “clamp” the systolic BP within 100-140mmHg
- No heparin infusion, except for the 70U/Kg procedural use
- Continue aspirin and clopidogrel for at least 3 months

Summary

- CS is evolving from a “improvised” procedure to a “structured” and “standardized” one
- Cerebral circulation is different from coronary, as well as the device used and techniques required
- Carotid stenosis is a strong indicator of advanced systemic atherosclerotic arterial disease, mandating a “global” management strategy
- With proper training and experience, cardiologists provide excellent procedural and long-term clinical results

A mind once stretched by a new idea never regains its original dimension

Oliver W. Holmes