How I Do It: Tandem Internal Carotid and Proximal Common Carotid Artery Stenosis

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WVES Winnipeg Vascular & Endovascular Symposium

Presenter Disclosure

Presenter: Stephane Elkouri

I have the following relationships with commercial interests:

- **Consulting Fees:** Inari

Tandem lesion

- Rare
- Combined stenosis ICA and inflow
- Also used in VS to describe coexistent ICA and intracerebral stenosis

Guidelines

esvs

2023

Atherosclerotic Carotid and Vertebral Artery Disease

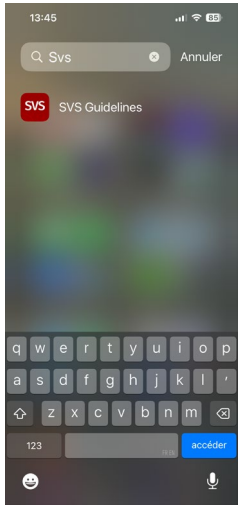
Management of Atherosclerotic Carotid and Vertebral Artery Disease (2023)

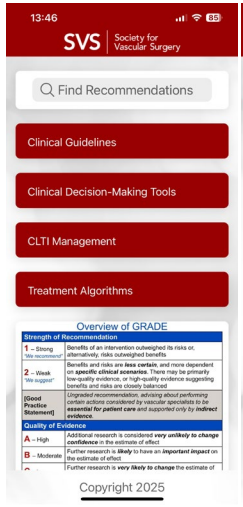
Management of Atherosclerotic Carotid and Vertebral Artery Disease (2018)

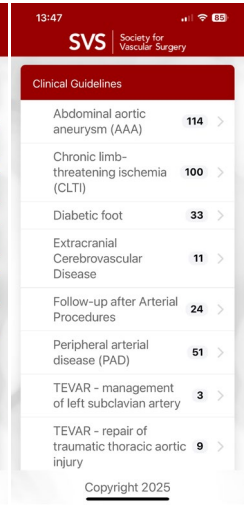
SVS

2021

Extracranial Cerebrovascular Disease







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Atherosclerotic Carotid and Vertebral Artery Disease

10.3. Indications for revascularisation

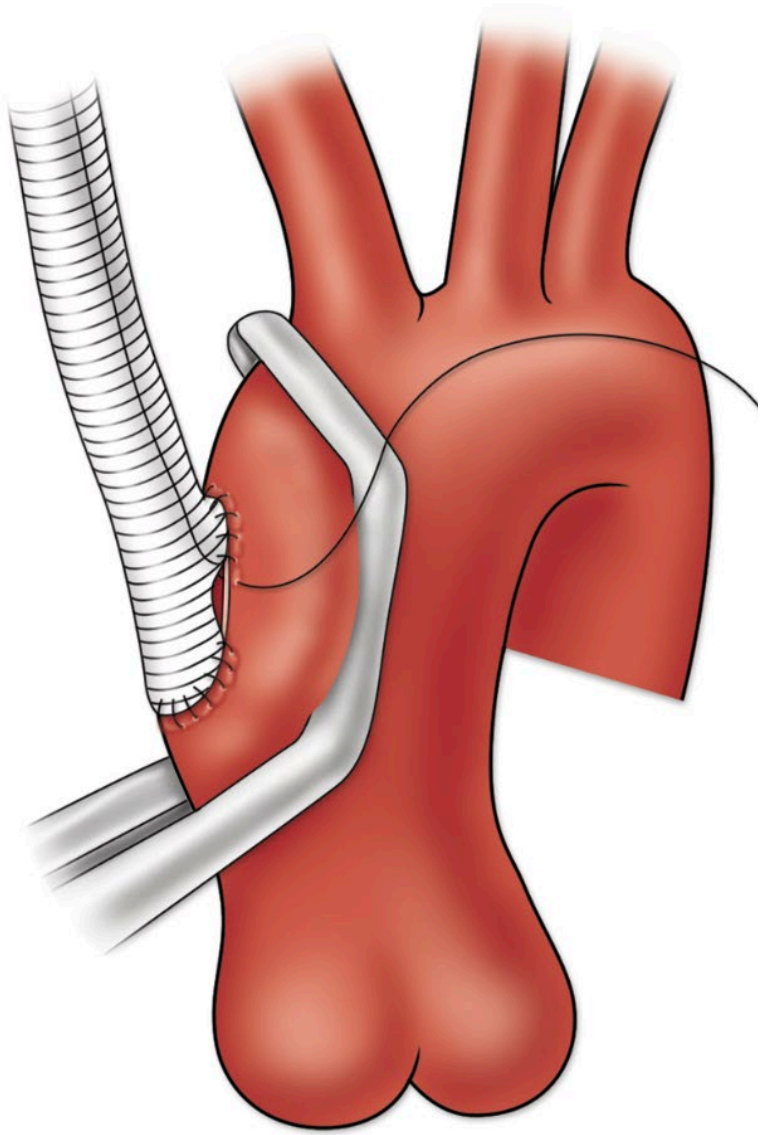
The natural history of isolated CCA and IA disease is unknown. In patients with neurological symptoms or upper limb ischaemia, indications for revascularisation are straightforward. There is no evidence supporting open or endovascular interventions in asymptomatic patients.

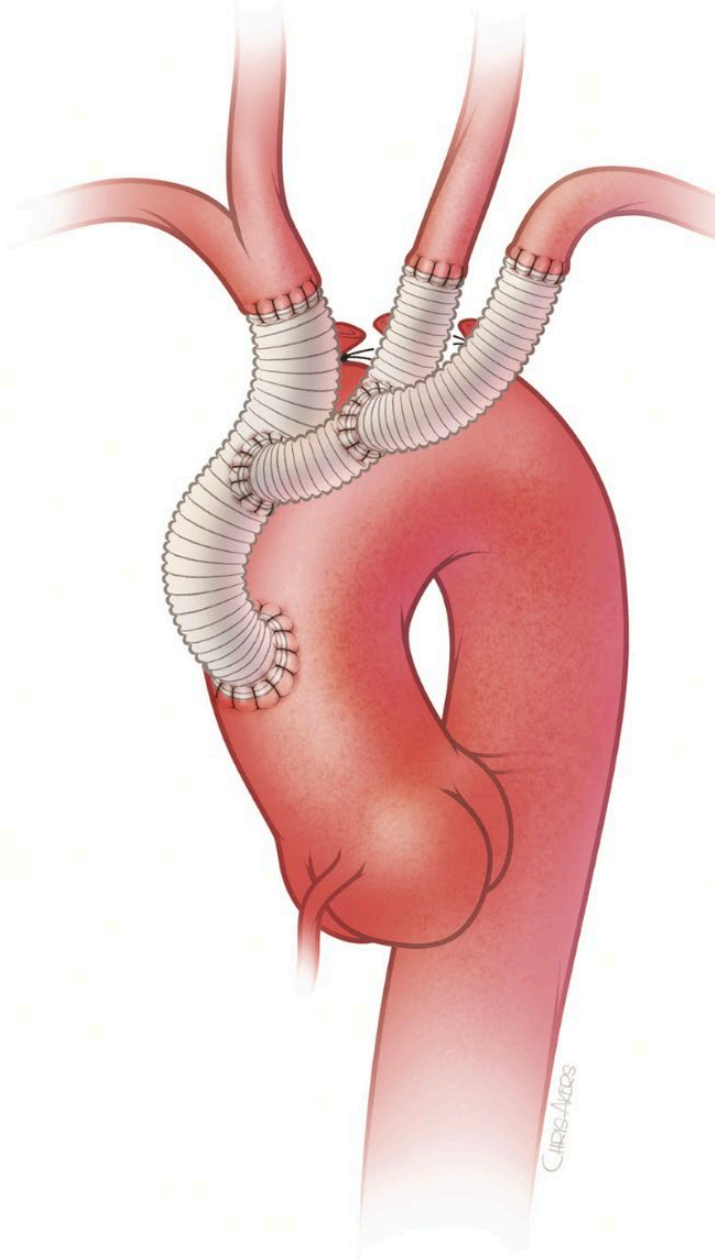
Indication for revascularisation

- Tandem lesions with **related neurological symptoms**
- Data cautiously support a **hybrid approach** for tandem lesions
- SVS 2021 recommendations are the same for tandem lesions

Open surgery

- For more severe disease (ex: long occlusion)
  - Cervical vs transthoracic approach
  - Bypass, Transposition, Endartectomy
  - Prosthetic grafts preferred as a conduit

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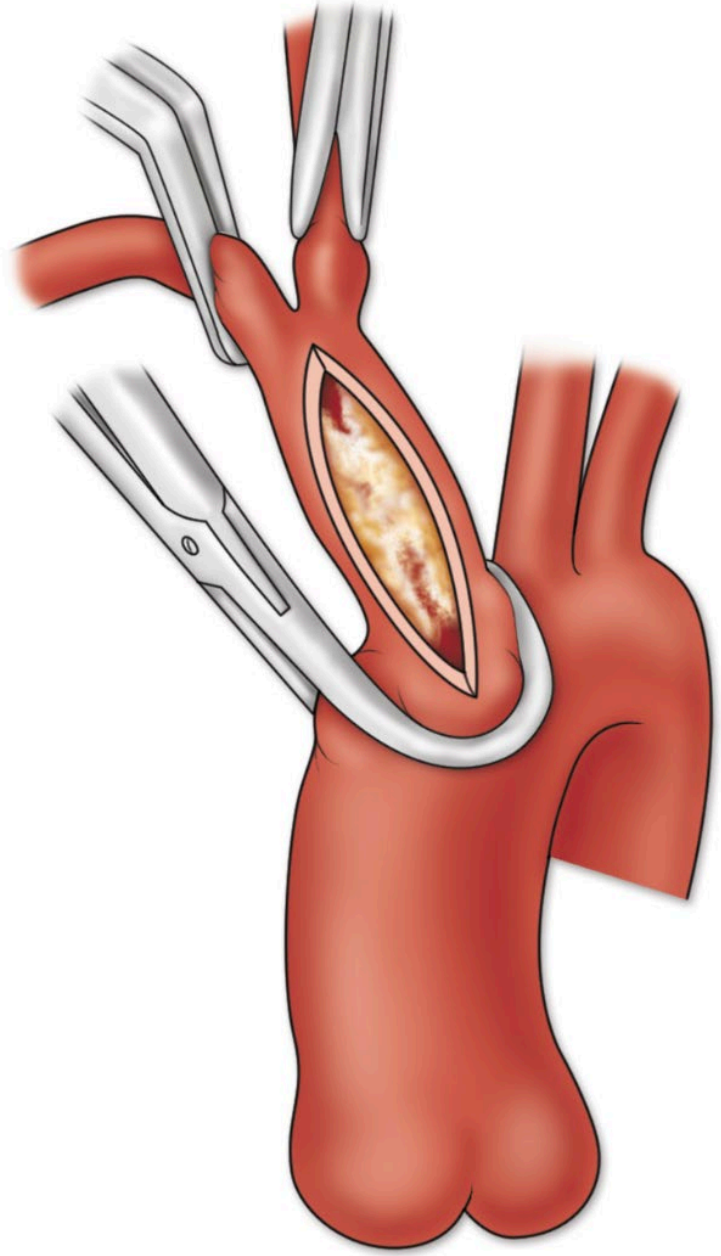

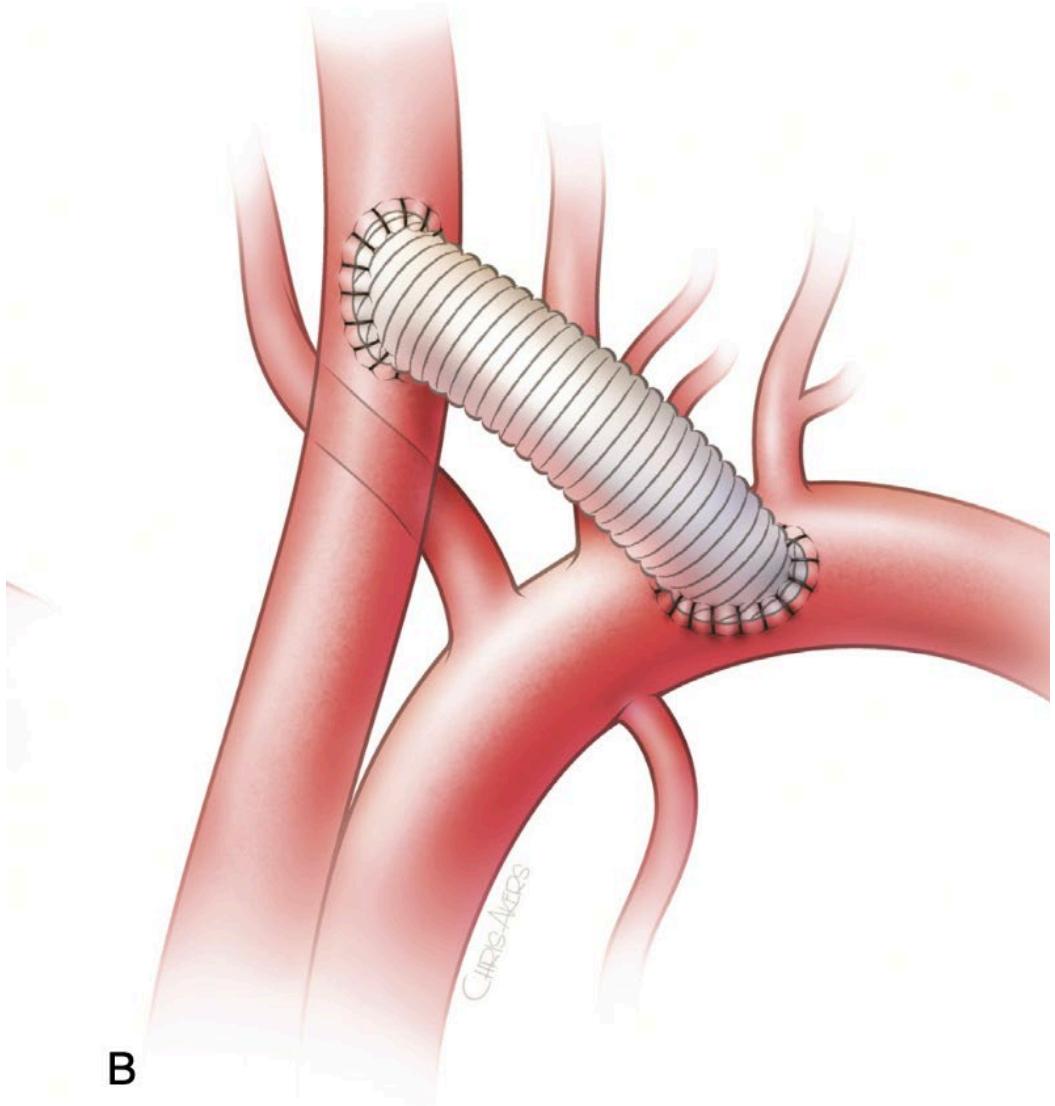
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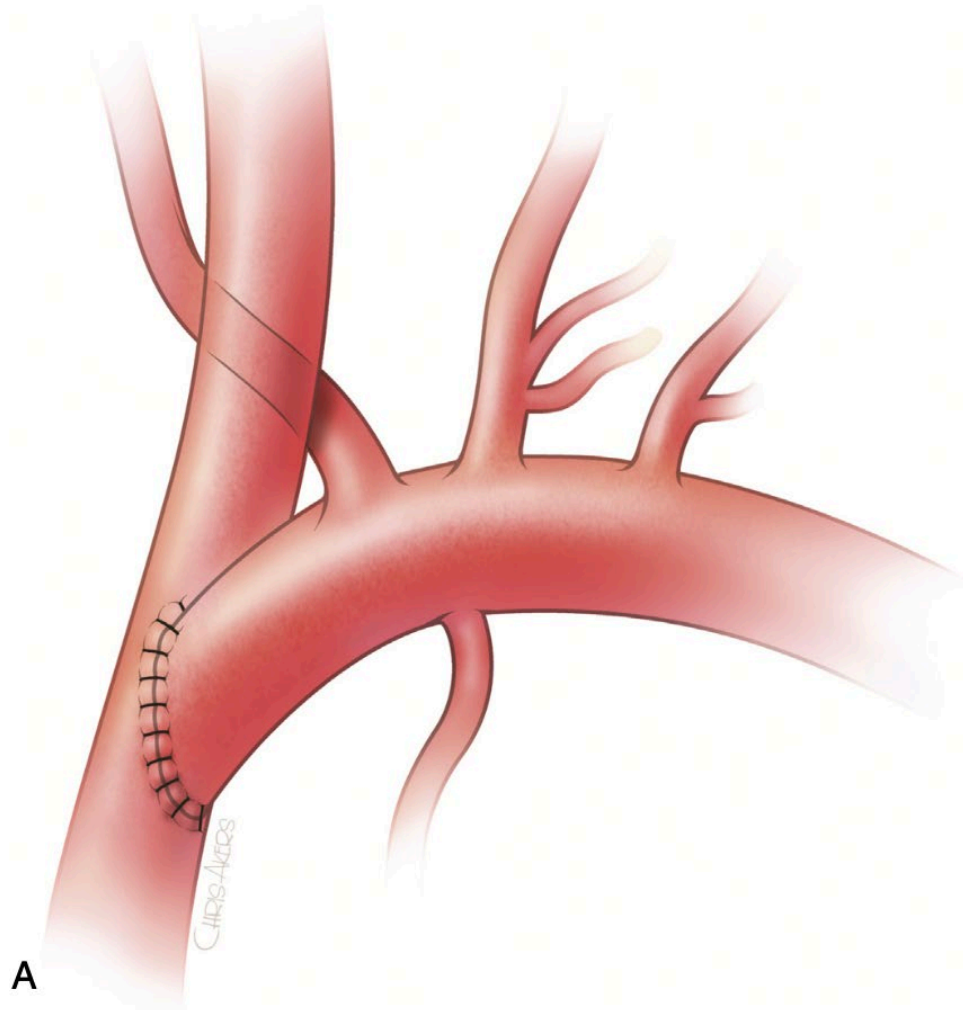
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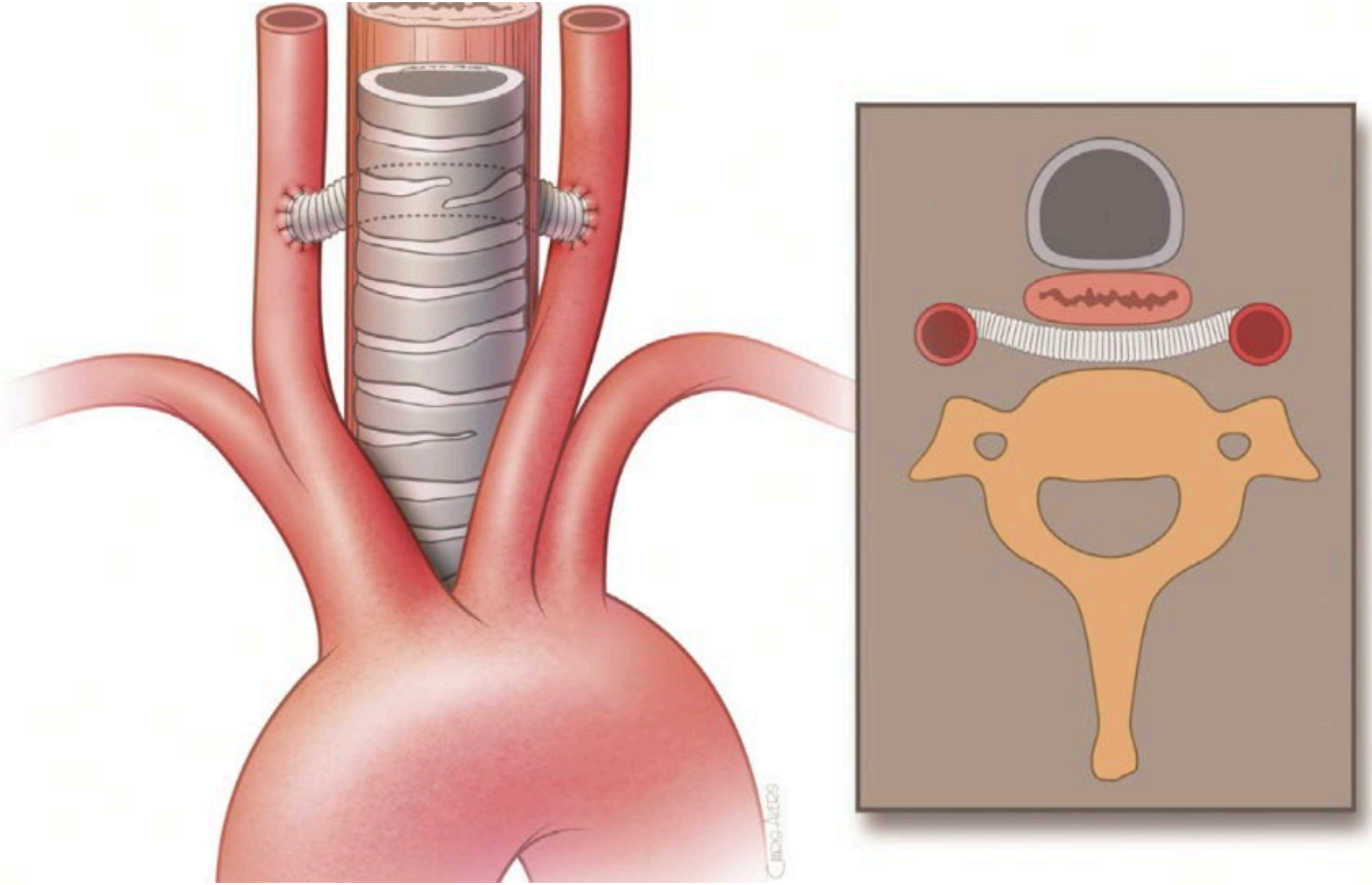

What is a « Symptomatic patients » ?

What is a « Symptomatic patients » ?

Table 13. Carotid and vertebrobasilar territory symptoms
Carotid territory symptoms
Higher cortical dysfunction (aphasia, dysgraphia, apraxia, visuospatial problems, visual field deficits)
Amaurosis fugax / transient monocular blindness blurring
Chronic ocular ischaemia syndrome
Weakness and/or sensory impairment of face/arm/leg (one or all areas may be affected)
Upper/lower limb clumsiness
"Limb-shaking TIAs" (haemodynamic events in patients with severe SCS and exhausted CVR)

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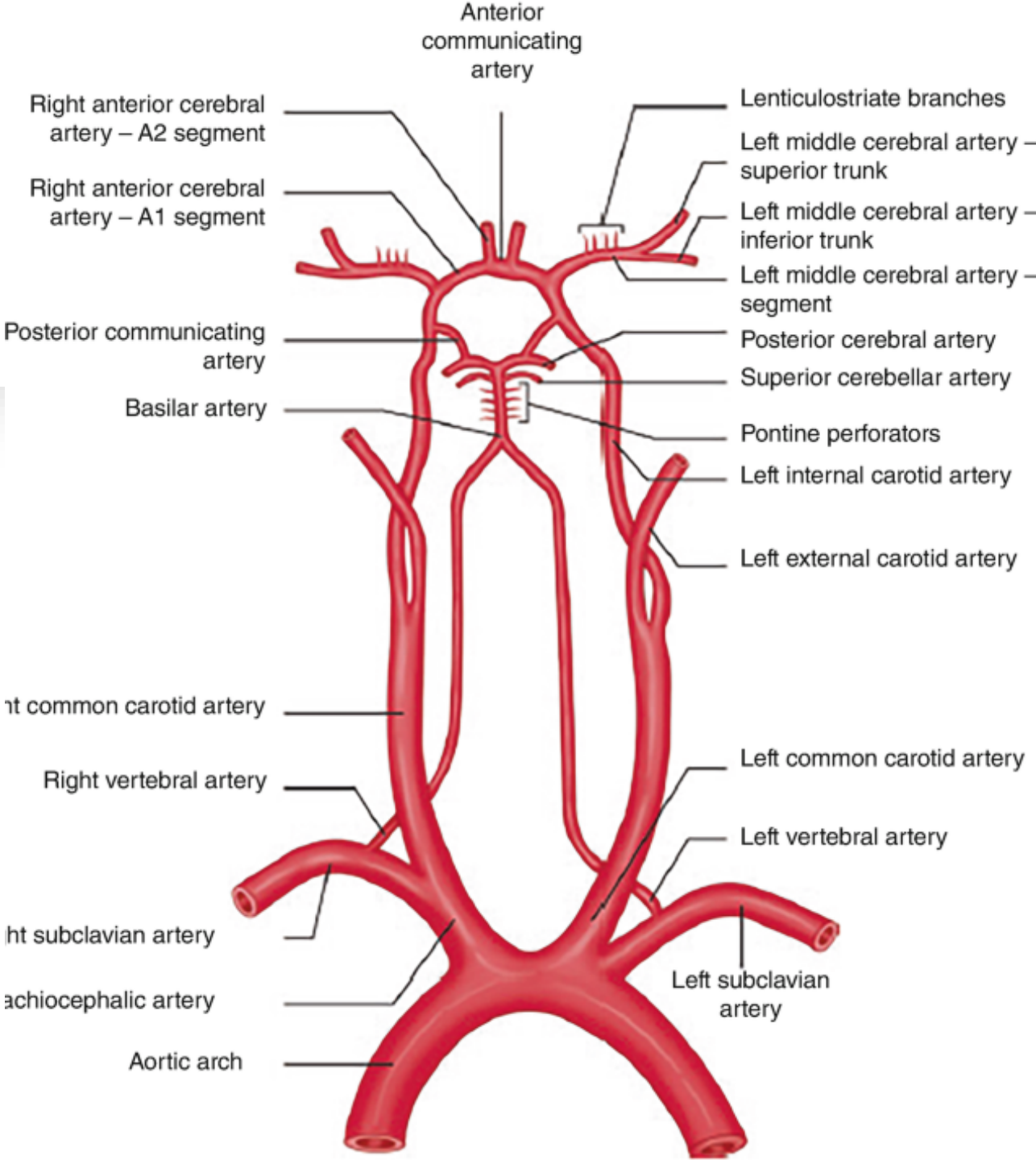
Anatomy 101

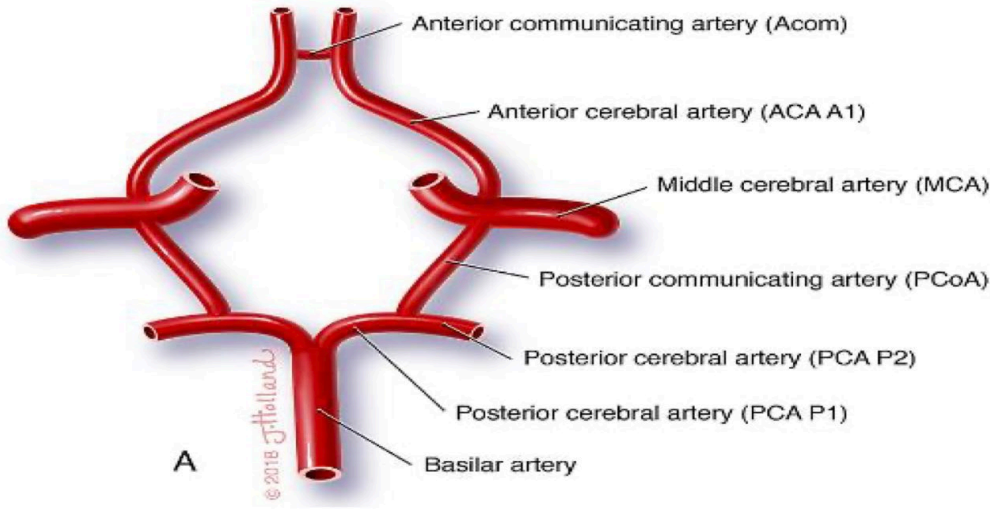
- Anterior circulation
  - Right: Arch,IA, CC, IC,EC
  - Left: Arch,CC,IC,EC

- Posterior circulation
  - Right: Arch,IA,SCA,VA
  - Left: Arch, SCA,VA

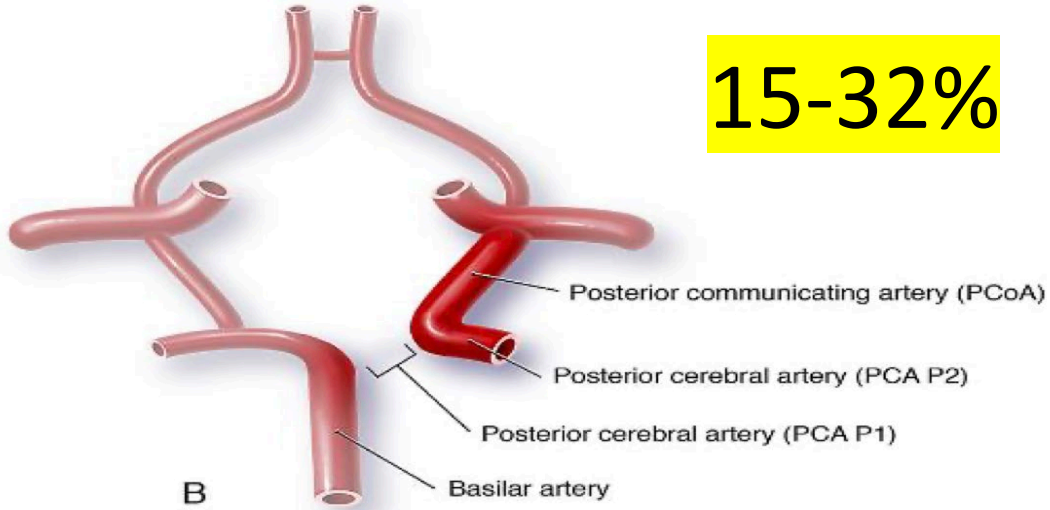


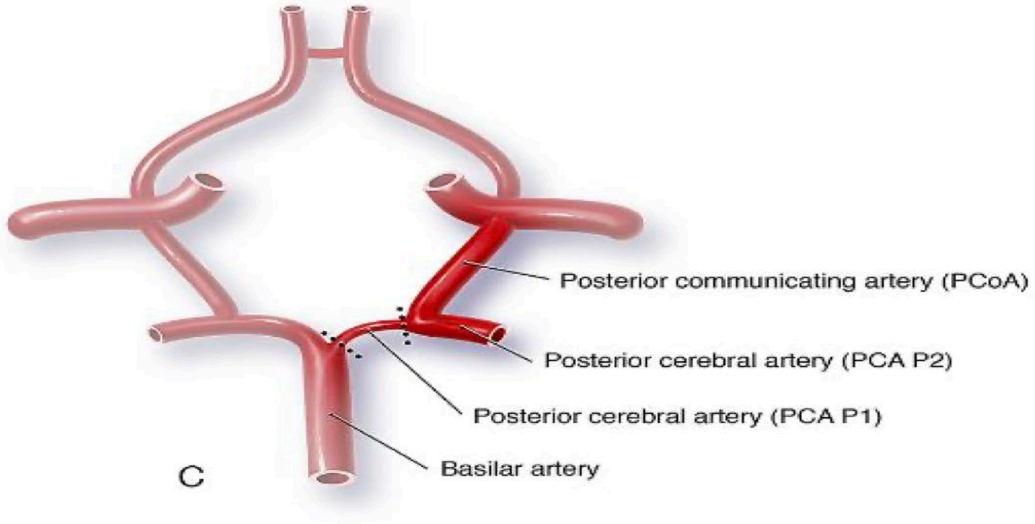
Fetal-Type Posterior Communicating Artery in a Concurrent Anterior and Posterior Circulation Infarct: A Case Report and Literature Revue

W. Chaja[1*], I. Mansir[1], Y. Bouktib[1], A. El Hajjami[1], B. Boutakioute[1], M. Ouali Idrissi[1], N. Cherif Idrissi Gannouni[1]



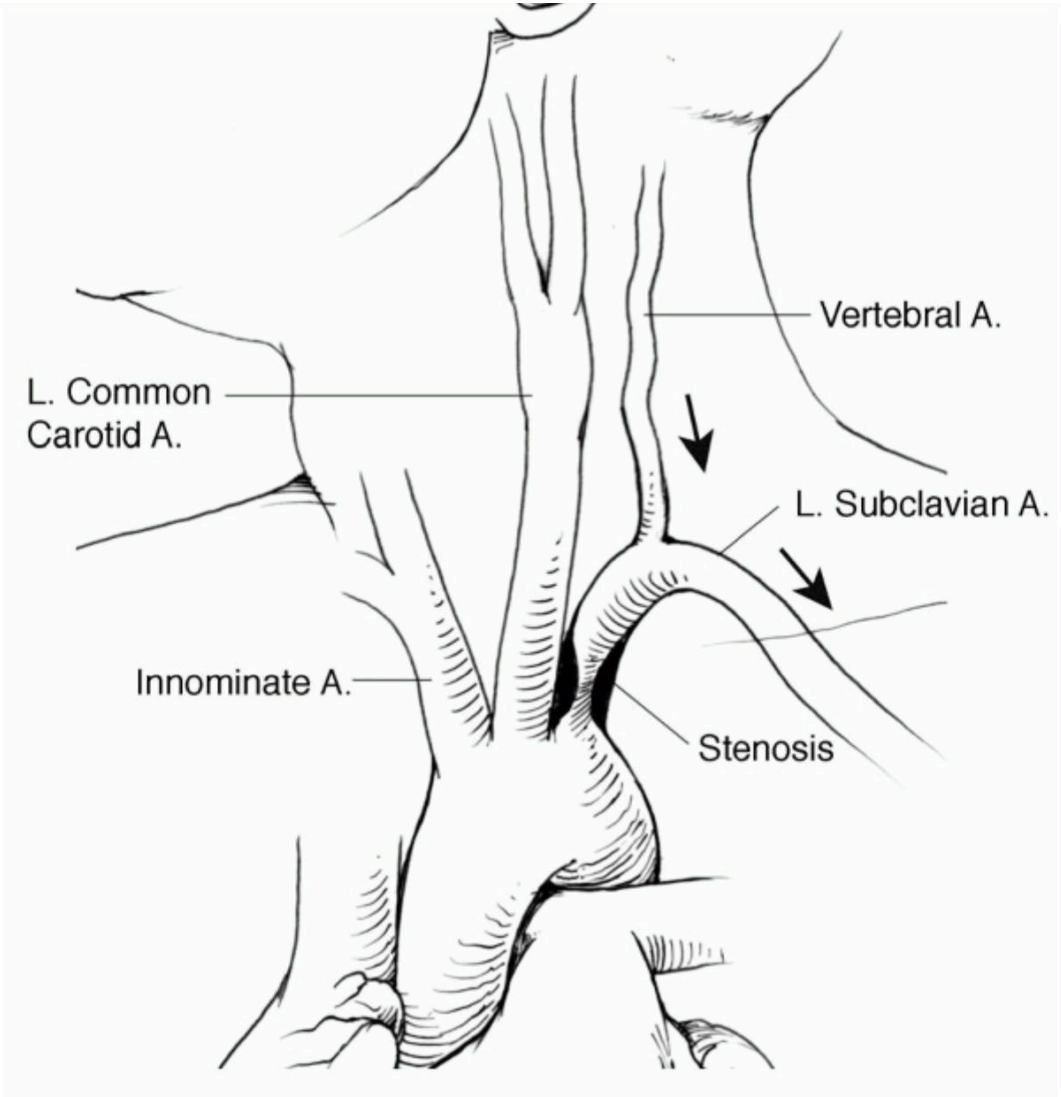
15-32%





Other symptoms related to supra aortic trunk

- **Arm fatigue**
- **Vertebral insufficiency**
- **Angina** related to CABG with internal mammary bypass



Assess the patient

- History
  - Symptoms
  - PMH: Radiotherapy, previous neck intervention, CABG
  - Meds: Optimal medical treatment (antiplatelets and statins)

- Physical examination
  - Neck rotation and extension
  - Upper arms arterial pressure and pulses

Review the imaging

- CT angiogram
  - Including arch and Willis
  - Need to assess extension of occlusive disease and type of lesion
  - Assess arch type (source of stroke)
  - 3D reconstruction
  - Measure the length and diameter of lesion to treat
  - Check the optimal angle for ostial visualization

Recommendation 1			Changed
For patients undergoing evaluation of the extent and severity of extracranial carotid stenoses, duplex ultrasound, computed tomographic angiography and/or magnetic resonance angiography are recommended.			
Class	**Level**	**References**	**ToE**
I	B	Wardlaw *et al.* (2006)[199], Patel *et al.* (2002)[200]	

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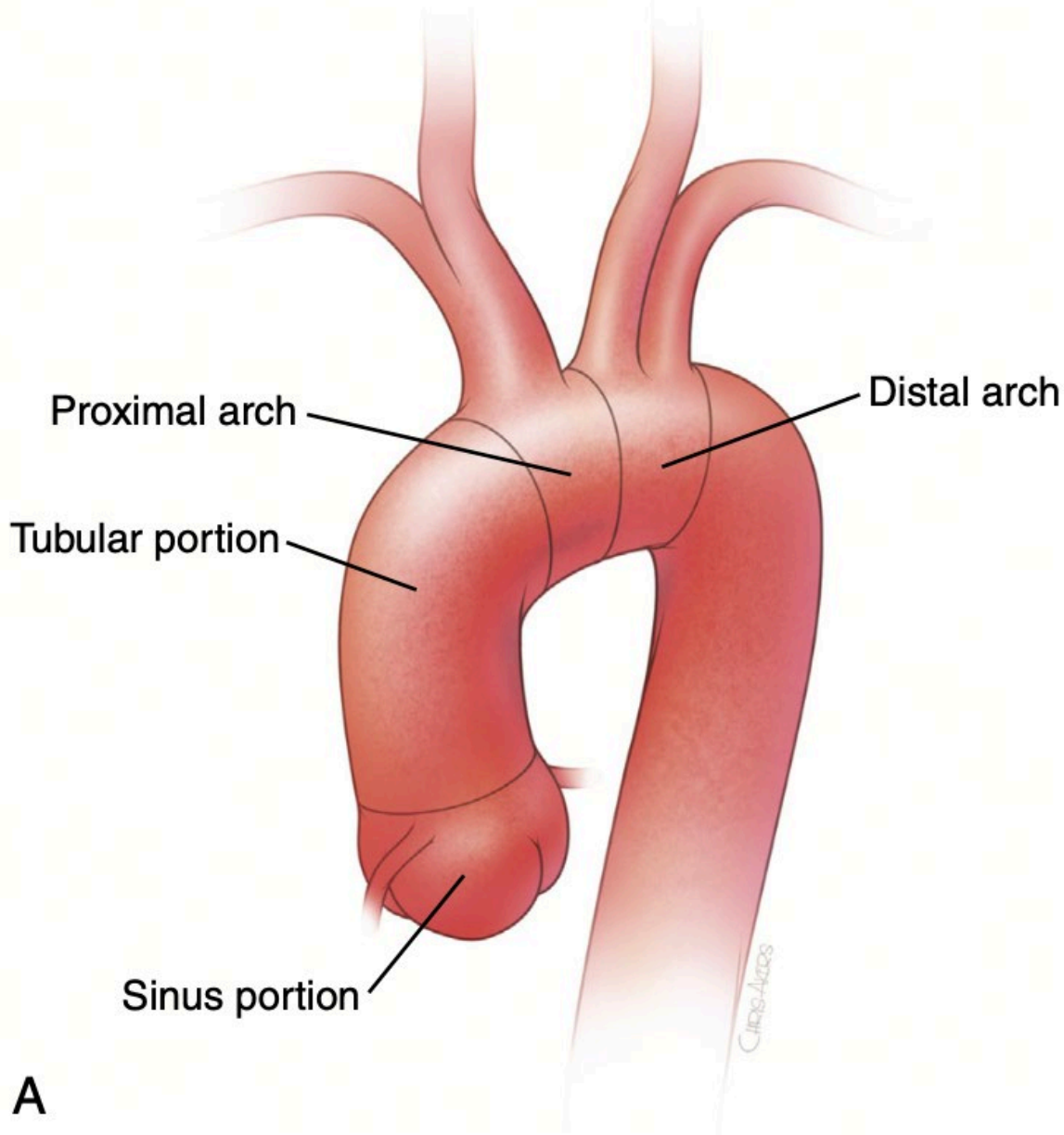
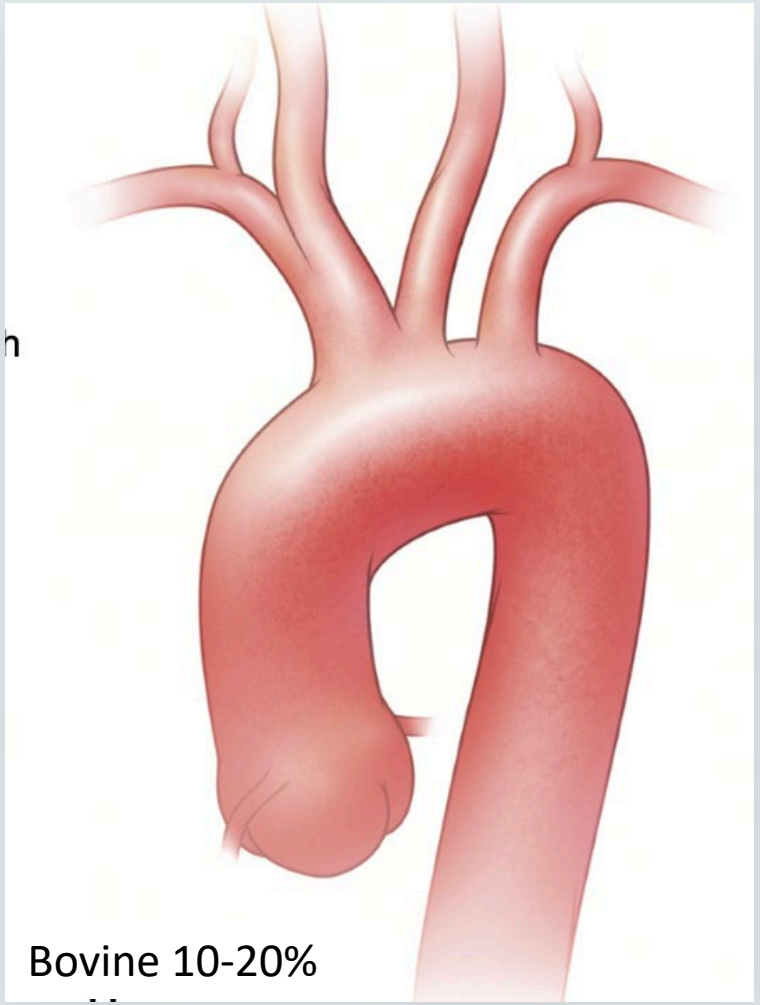
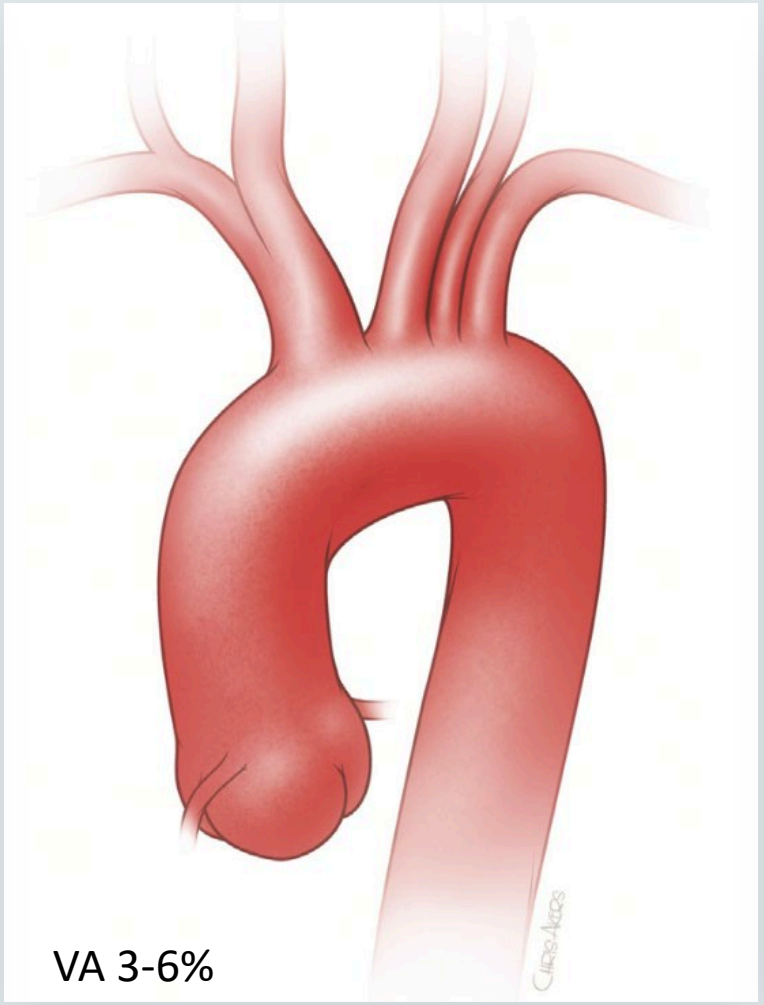
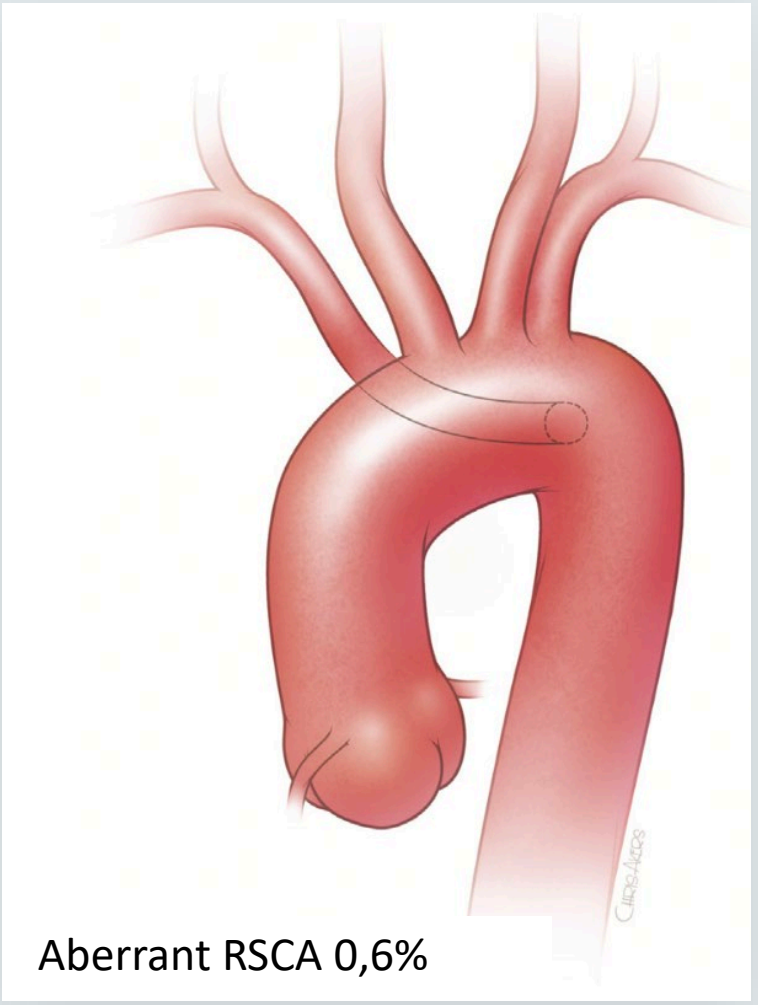

Proximal arch
Distal arch
Tubular portion
Sinus portion
A



Bovine 10-20%

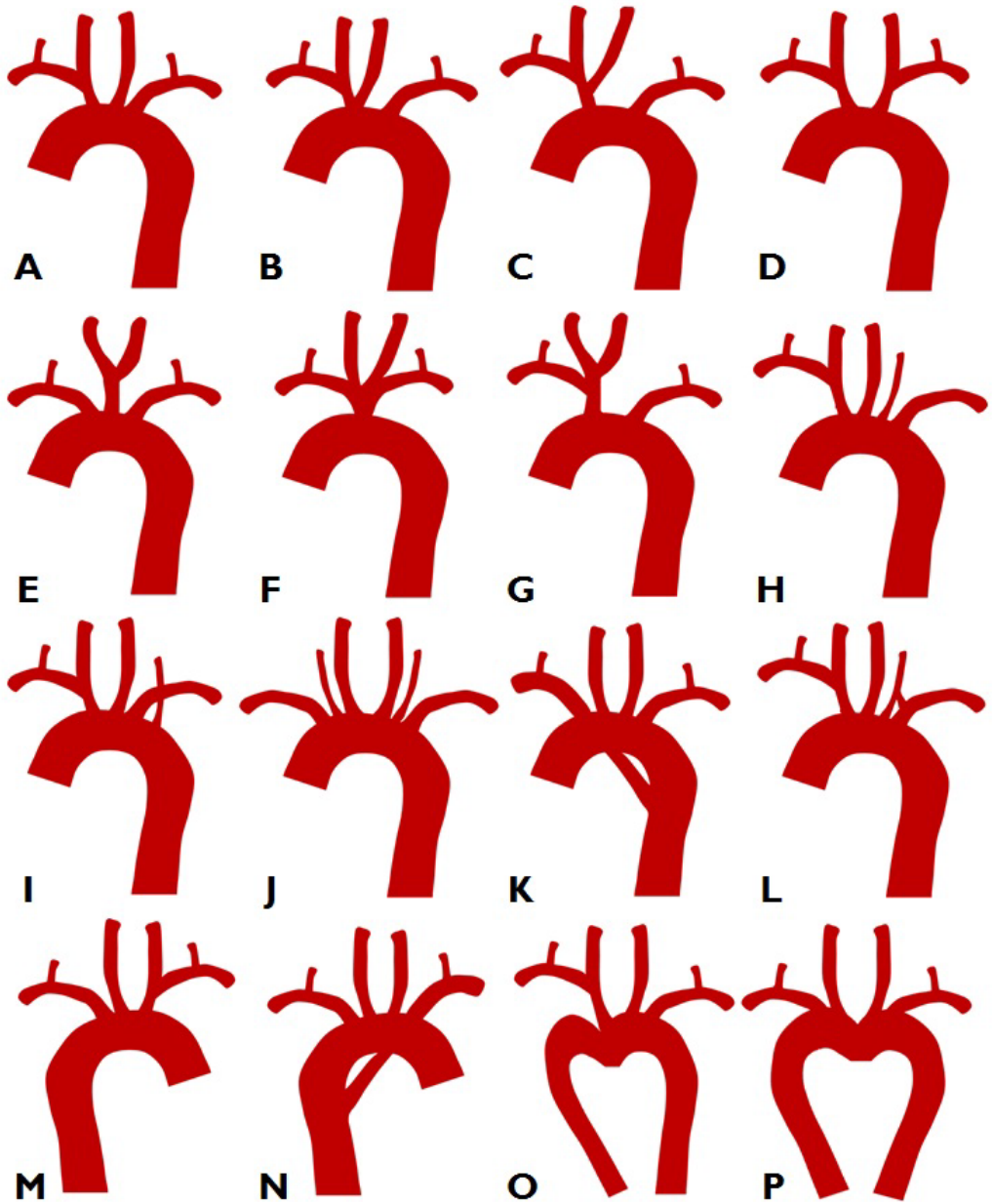


VA 3-6%



Aberrant RSCA 0,6%

MAJOR ANOMALIES AND ANATOMICAL VARIANTS OF THE AORTIC ARCH AND ORIGIN OF THE NECK VESSELS



A. NORMAL AORTIC ARCH
B. BOVINE ARCH
C. TRUNCUS BICAROTICUS
D. COMMON ORIGIN OF THE LEFT COMMON CAROTID ARTERY AND LEFT SUBCLAVIAN ARTERY

E. BICAROTID TRUNK BETWEEN THE SUBCLAVIAN
F. ARTERIES
G. EPIAORTIC SINGLE TRUNK
LEFT COMMON CAROTID ARTERY ORIGIN FROM THE
H. RIGHT COMMON CAROTID ARTERY
ARCH ORIGIN OF THE LEFT VERTEBRAL ARTERY

I. ARCH ORIGIN OF THE LEFT VERTEBRAL ARTERY BETWEEN THE ORIGIN OF THE LEFT COMMON CAROTID ARTERY AND THE LEFT VERTEBRAL ARTERY
J. ABSENCE OF THE BRACHIOCEPHALIC TRUNK
K. ABERRANT RIGHT SUBCLAVIAN ARTERY
L. LEFT VERTEBRAL ARTERY WITH ORIGIN SHARED IN AORTIC ARC AND LEFT VERTEBRAL ARTERY

M. RIGHT AORTIC ARCH
N. DOUBLE AORTIC ARCH
O. RIGHT AORTIC ARCH WITH AN ABERRANT LEFT SUBCLAVIAN ARTERY
P. RIGHT AORTIC ARCH WITH MIRROR-IMAGE

What are aortic arch types ?

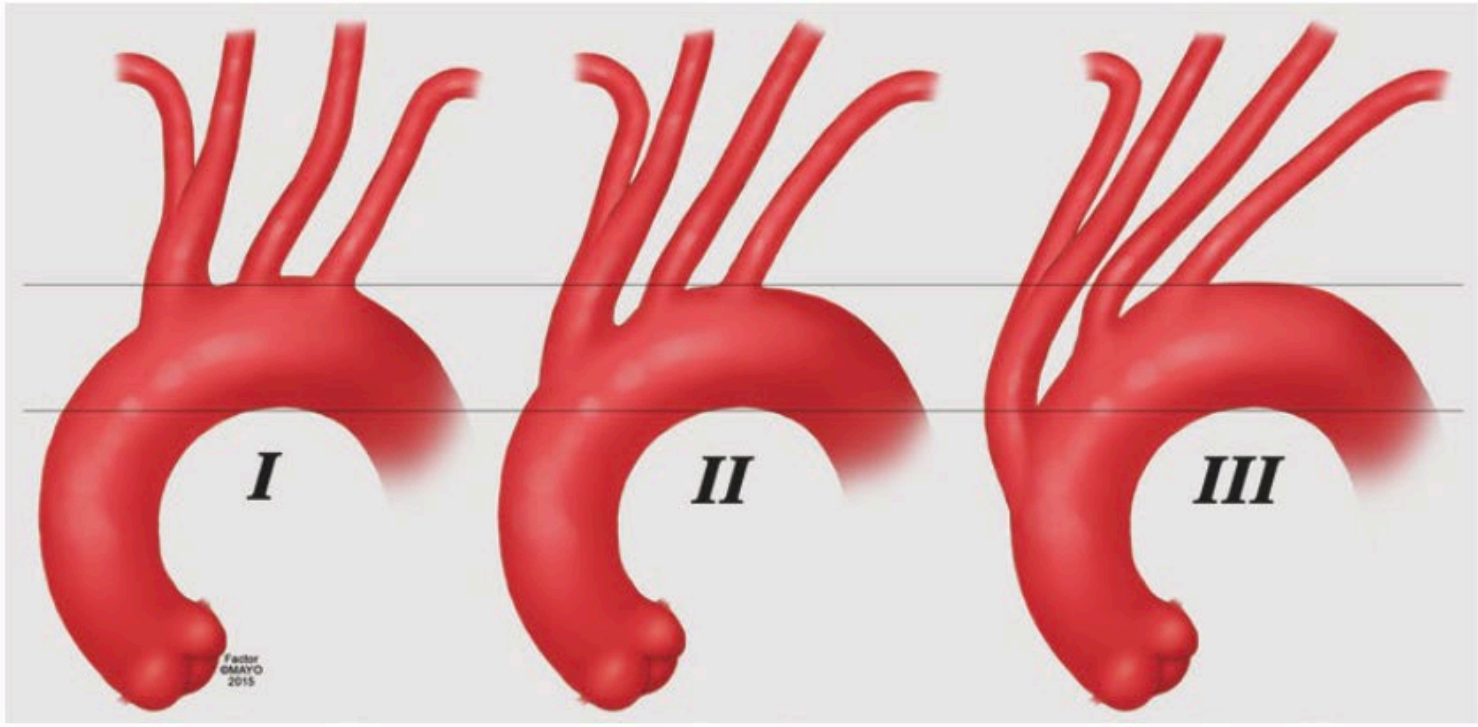


Fig. 4.6 Aortic arch types *I*, *II*, and *III*. By permission of Mayo Foundation for Medical Education and Research. All rights reserved

Few of my recent cases

Case #1 S736560

- 77 yo women , HTA, left frontal stroke in 12/2024
- Refered to VS for 2nd left hemispheric stroke 1/2025 despite OMT

Case #1

- Tandem left CCA et ICA stenosis

- Indication : Stroke prevention following embolic stroke

Preparation for hybrid approach

- General anesthesia
- Radial line
- Head position, Light position
- Large preparation of operating field to allow for other scenarios
  - Sternum, entire neck
  - Check if radioopaque stuff in the field
  - Prepare arm if needed
- Standard exposure of the cervical carotid in preparation for CEA
- Heparinization and ACT

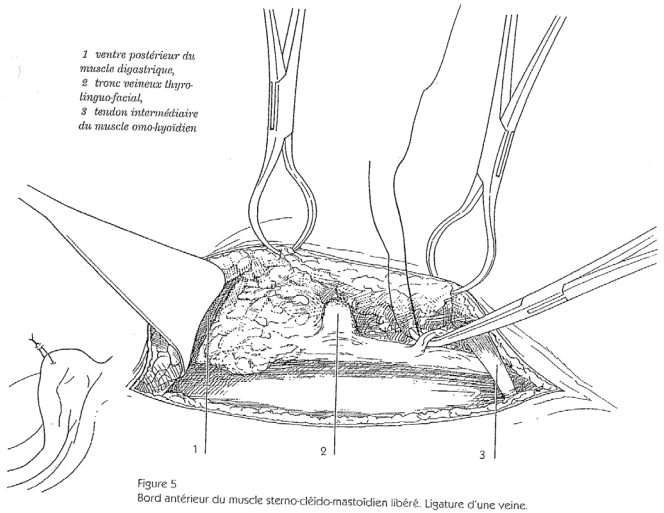
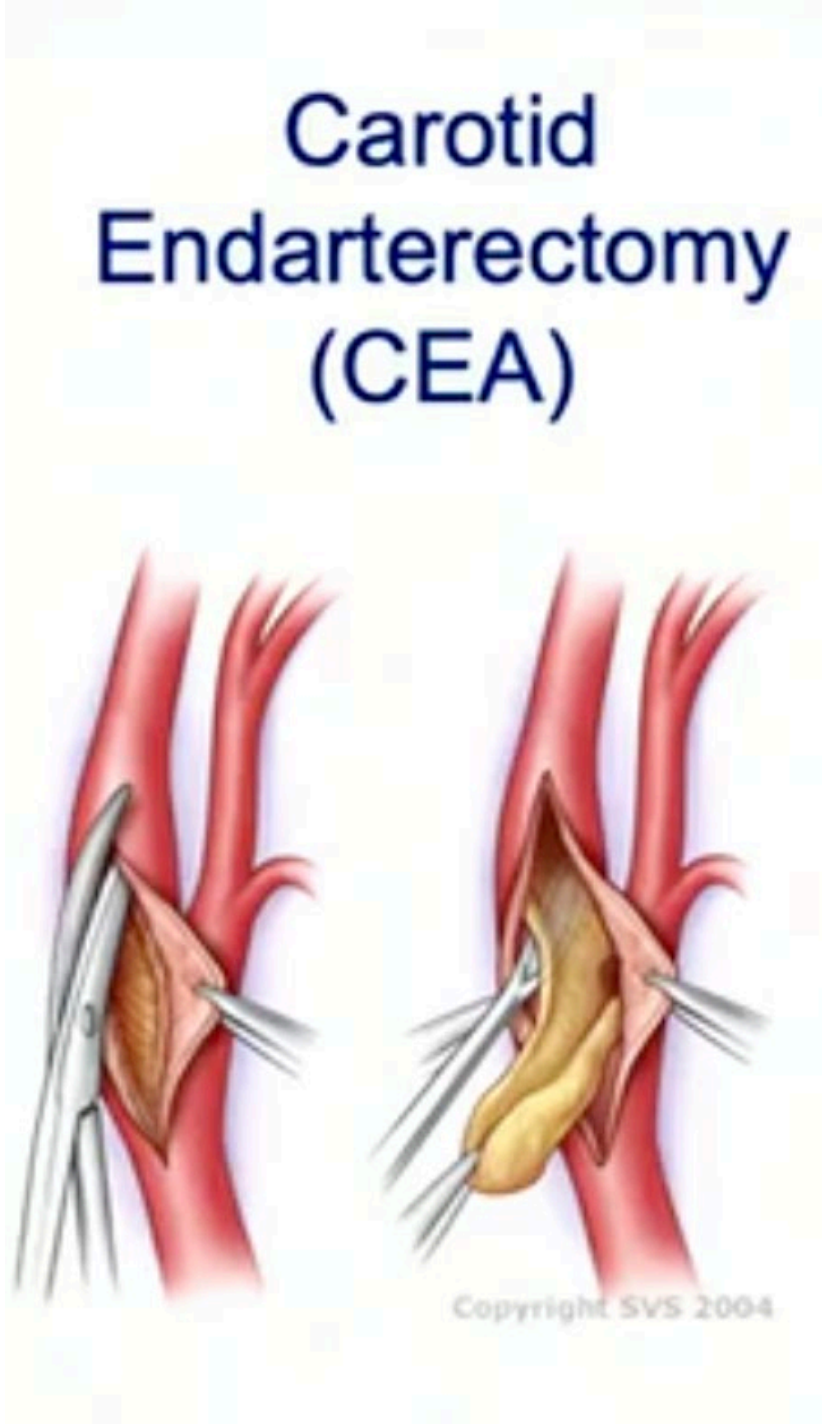


Figure 5
Bord antérieur du muscle sterno-cléido-mastoïdien libéré. Ligature d'une veine.

- Cerebral protection: Distal CCA control
- Retrograde approach
- 7F sheath
- 9x19mm balloon expandable stent
- CEA



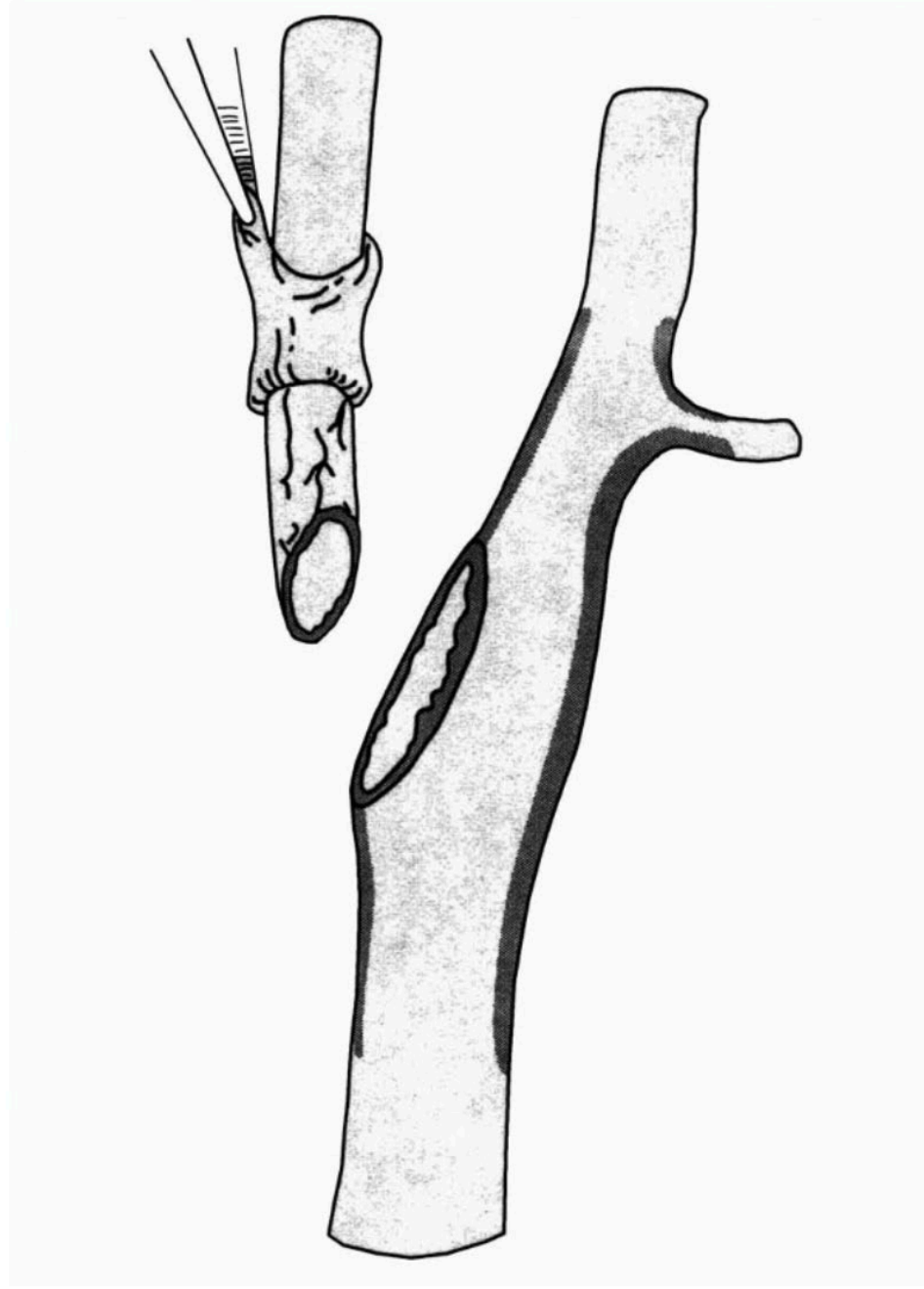


Figure 13.6. Eversion CEA. CEA, carotid endarterectomy.

Few tips

- Plan – plan – plan ERGONOMICS
- Plan your c-arm approach to the patient to be confortable
- Plan your monitor position in the room to avoid neck pain
- Plan your sterile table location to avoid delay
- Plan your puncture site to be included in your endarterectomy region if safe
- If long thrombosis of IA or LCC, bypass might be safer or a good plan B

What are the most common cause of intraoperative stroke during CEA ?

- **Emboli**
  - **During exposure**
  - **At unclamping**
- **From technical defect at endarterectomy site causing thrombus / emboli**
- **From technical defect at distal endpoint causing thrombus/emboli/thrombosis**
- **From clamp injury causing dissection**
- **From thrombus formation from insufficient heparin during case**
- From global cerebral ischemia related to hypotension during clamping
- From intracerebral bleeding after reperfusion

Case #2 S5854641

- 75 yo men
- No family doctor and no PMH, no smoking x 20 years
- Nov 20 2024: Refered to VS for worsening and frequent diziness (3-5 times a week)
- Dizzy if use his right arm, especially in upper position
- Right eye complaint and left upper limb shaking from 1-10min
- Also complain of left hand weakness

- On physical exam:

  No right radial, ulnar or brachial pulse

- IMP: symptoms suggesting cerebral ischemia

- CT angio and neurology consultation

Case #2

- IA severe stenosis/thrombosis

- Indication : symptoms relief and stroke prevention

Intervention

- General anesthesia
- Right brachial artery exposed
- 8F 45CM Sheath
- Difficulty crossing
- Covered stent 9x27mm
- Post dilated with 12mm balloon

Case #3 S358782

- 77 yo men, presenting on Dec 19 2024 with stroke and progressive aphasia
- CT Angio showing
  - occluded left common carotid artery
  - occluded M1-M2 branches of left middle cerebral artery

Case #3

- Occluded LCC and M1-M2 branches of left middle cerebral artery

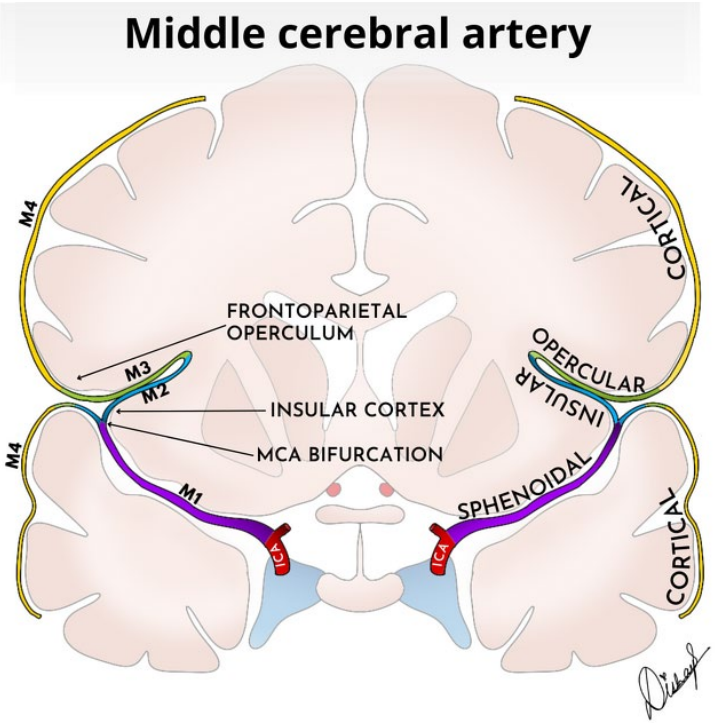
- Indication : Acute stroke

Case #3 S358782

- Direct LCC puncture 6F and succesfull thrombectomy with Solumbra technique with stent retriever (Solitaire 6x40).
- VS consulted for sheath removal which was done in OR.
- Pt recovered from stroke
- Postop CTangio : no stroke but LCC thrombosis and LIC stenosis

What is M1 thrombosis ?

- The MCA supplies blood to the frontal, temporal, and parietal lobes of the brain. It's the most common artery involved in acute stroke



Segments

The MCA is divided into four segments:

- **M1: sphenoidal or horizontal segment**
  - originates at the terminal bifurcation of the internal carotid artery
  - courses laterally parallel to the sphenoid ridge
  - terminates at one of two points (controversial; see below note*):
    - at the genu adjacent to the limen insulae
    - at the main bifurcation
- **M2: insular segment**
  - originates at the genu/limen insulae or the main bifurcation (see above)
  - courses posterosuperiorly in the insular cleft
  - terminates at the circular sulcus of insula, where it makes a right angle to hairpin turn
- **M3: opercular segment**
  - originates at the circular sulcus of the insula
  - courses laterally along the frontoparietal operculum
  - terminates at the external/superior surface of the Sylvian fissure
- **M4: cortical segment**
  - originates at the external/top surface of the Sylvian fissure
  - courses superiorly on the lateral convexity
  - terminates at their final cortical territory

What is EASI TOC ?

12-14 high-volume stroke centers in Canada

Supported by:

CIHR IRSC Canadian Institutes of Health Research / Instituts de recherche en santé du Canada

CHUM NEUROLOGIE

CaSTOR Canadian Stroke Trials for Optimized Results

CSC CNC Canadian Stroke Consortium

Fondation Brain Canada Foundation

Financial contribution from / Avec le financement de Health Canada Santé Canada

Heart&Stroke Cœur+AVC

stryker

CHUM Santé neurovasculaire

CRCHUM CENTRE DE RECHERCHE

Université de Montréal

CHUM CENTRE HOSPITALIER DE L'UNIVERSITÉ DE MONTRÉAL

EASI-TOC
Endovascular Acute Stroke Intervention
Tandem Occlusion Study

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Dr. Daniel Roy
Mr. Serge Gareau

EASI-TOC

Endovascular Acute Stroke Intervention
Tandem Occlusion Study

1. Vancouver General Hospital (T Field, F Settecase)
2. Foothills Medical Centre, Calgary (M Almekhlafi, MD Hill)
3. Hamilton Health Sciences Centre (B van Adel, L Catanese)
4. Ottawa Hospital (M Shamy, R Fahed)
5. Kingston General Hospital (A Jin, D Tampieri)
6. CHUM, Montréal (G Jacquin, D Roy)
7. Montreal Neurological Institute (C Legault, M Cortes)
8. Hôpital Enfant-Jésus de Québec (MC Camden, G Milot)
9. Queen Elizabeth II – Halifax Infirmary (D Volders)
10. St. Michael's Hospital, Toronto (A Muccilli)
11. University of Alberta Hospital, Edmonton (B Buck)
12. Health Sciences North, Sudbury (R Singh)
13. Winnipeg Health Sciences Centre (N Singh, J Shankar)
14. CHUS-Fleurimont, Sherbrooke (F Moreau)
15. Sunnybrook Health Sciences, Toronto (C Hawkes)
16. Royal University Hospital, Saskatoon (M Kelly)

Treatment

Patients will be randomized (1:1) to undergo acute ICA stenting during the thrombectomy procedure (either before or after intracranial thrombectomy, at the discretion of the treating physician) or to intracranial thrombectomy alone without ICA stenting. Deferred ICA intervention is allowed, if indicated.

Duration of Treatment

Patients will be treated acutely and followed up to one year.

Evaluation Criteria

Primary outcome:

The proportion of patients achieving a favorable modified Rankin scale score (mRS 0-2) at 90 days (dichotomized)

Case#4 S5974360

- 75 yo, transfered from OH, PMH HTA and smoking
- Present with left arm weakness Nov 25 2024

- Acute Right hemispheric Stroke with initial NIHSS 18

- CT angio:
  - R IC thrombosis to cavernous portion and M1 thrombosis

Case#4 S5974360

- Acute Right hemispheric Stroke with initial **NIHSS 18**
- R IC thrombosis to cavernous portion and **M1 thrombosis**
- Indication : Acute stroke

- Under local anesthesia, transfemoral thromboaspiration with initial mustang 4 and 5mm and the aspiration catheter Sofia 6F of MI and ICA and recanalisation **mTICI3**
- Residual severe RIC stenosis
- Randomized at **EASITOC**: no acute stenting
- CEA performed 10 days later

What is NIHSS ?

- numerical scale to determine stroke severity
- health care providers record the person's performance in 11 categories, such as sensory and motor ability

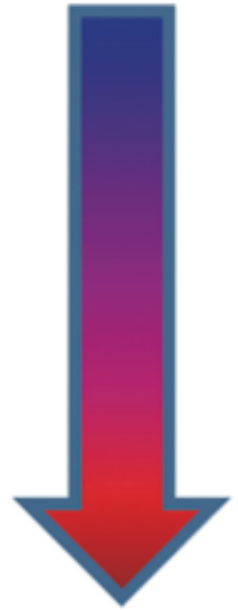
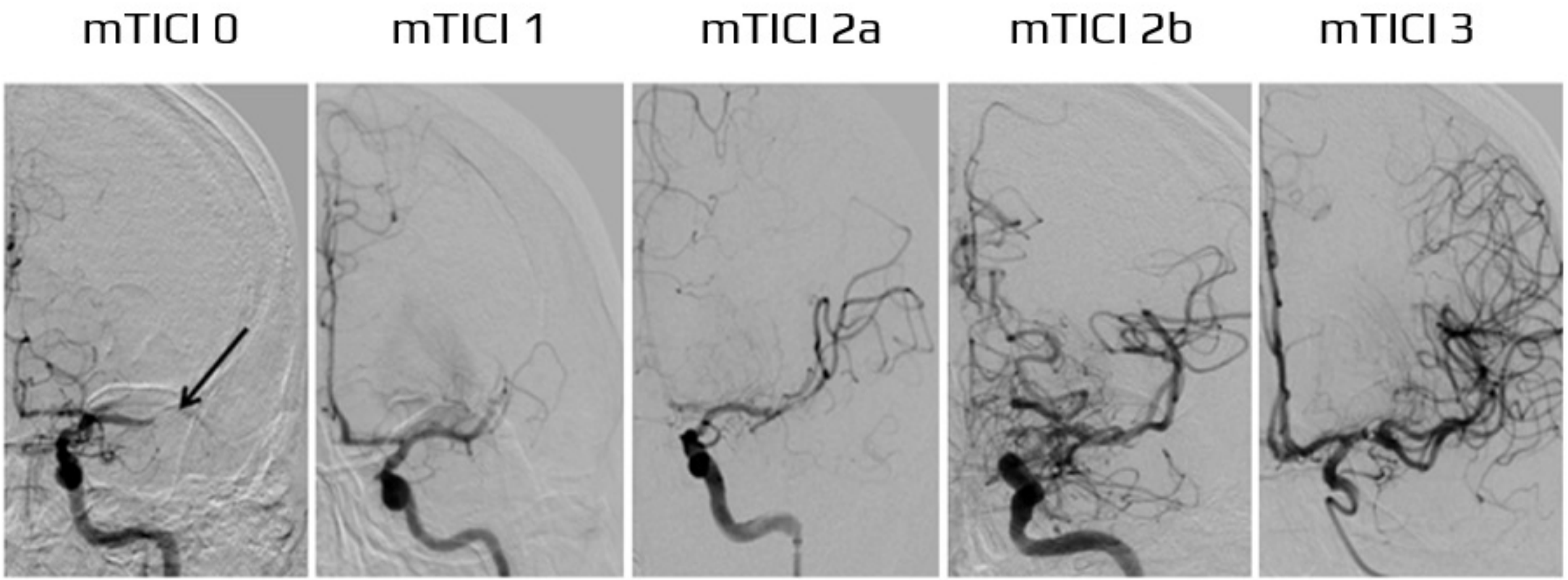
NIHSS SCORE	STROKE SEVERITY	IMPACTED BRAIN DENSITY
0	No Stroke	
0 – 4	Minor Stroke	
5 – 15	Moderate Stroke	
16– 20	Moderate to Severe Stroke	
21 - 42	Severe Stroke	

Figure 1. The National Institutes of Health Stroke Scale or NIH Stroke Scale (NIHSS) is a tool used by healthcare providers to objectively quantify and succinctly communicate the impairment caused by a stroke.

What is mTICI3 ?

- a modified thrombolysis in cerebral infarction (mTICI) score that indicates complete reperfusion after endovascular therapy (EVT) for an acute ischemic stroke.
- A mTICI 3 score is associated with improved clinical outcomes.

What is mTICI3 ?



Stent choice for common carotid ostial stenosis

- Ballon Expandable
- Greater radial force for ostial lesion
- More accurate placement

Case#5 Me P

- What about very very calcified lesions ?
- Shockwave can be used before stent
- Pt I saw in sept 2023
- Cerebral ischemia on severe radiotherapy induced arteritis

- CT Angio: occluded LCC and severe stenosis of IA and LSC with huge left vertebral

pressure where 99.9% of tested balloons ruptured

What is RBP ?

Summary

- Asymptomatic Tandem lesion: no intervention
- Symptomatic Tandem lesion :
  - If embolic symptoms: hybrid approach and clamp for cerebral protection
  - If ischemic symptoms: evaluate the best target to improve cerebral perfusion
  - If acute stroke: team work, call neurointervention, thrombectomy followed by ICA stenosis treatment, « easitoc » trial ongoing in Canada