WVES | Winnipeg Vascular & Endovascular Symposium

Management of Carotid Dissection

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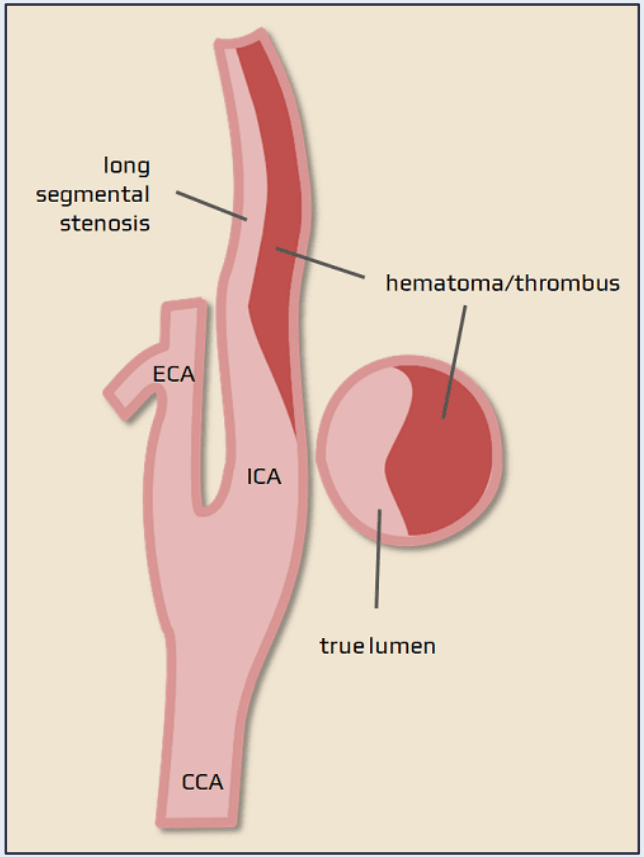


Plan

01 Introduction

02 Clinical Presentation

03 Diagnosis

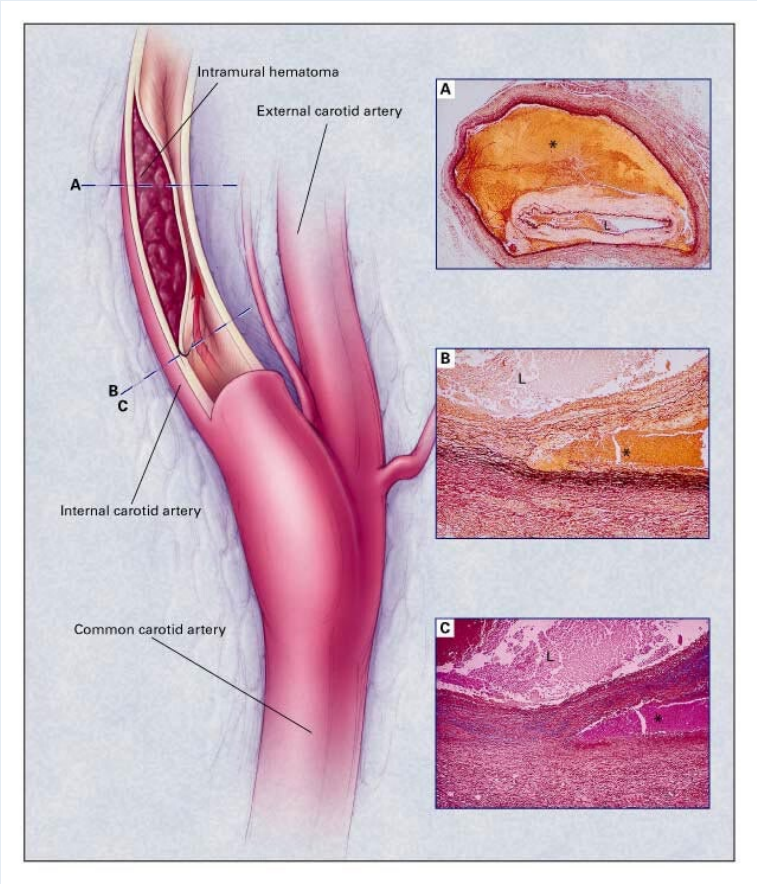
04 Treatment Medical

05 Treatment Endovascular

06 Treatment Open

Conflicts of interest

- None to declare



01

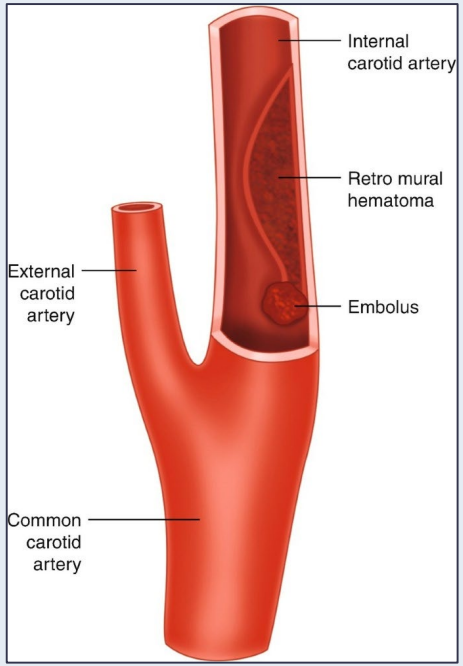
Introduction

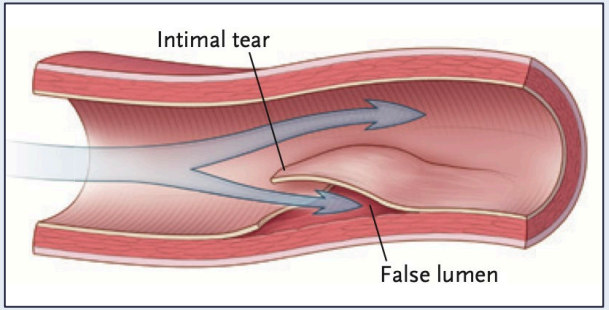
Pathophysiology

Carotidarterydissection (CAD)→ intimal tear disrupting the integrity of the arterial wall

Intra-mural hematoma (IMH) from blood accumulation →

Stenosis, aneurysm, thrombosis, rupture or cerebral embolization





Major cause of TIAs/ischemic strokes among **young** adults (<50 years)

Classification

Spontaneous vs Traumatic

Extracranial vs Intracranial

Classification

Spontaneous vs Traumatic

Asian Children

Extracranial vs Intracranial

More common
(more mobile and in contact with head & neck bones)

Spontaneous

Provoking **mechanical** event preceding sx

- Chiropractic manipulation (debated), exercise

Association with **HTN**

Association with **vascular/connective tissue diseases**

- Fibromuscular dysplasia (FMD)
- Ehler-Danlos syndrome type IV
- Marfan syndrome
- Etc.

Higher recurrence

Association with **genetic** factors

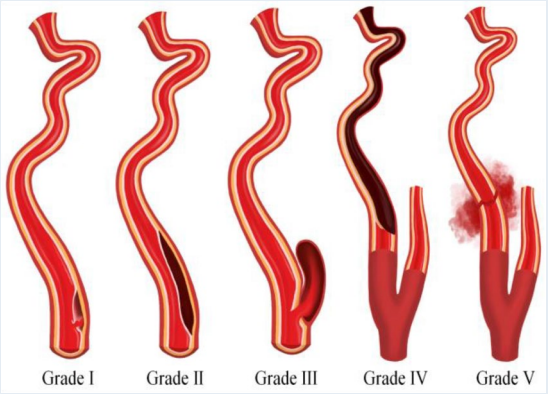
- Familial Hx + accompanying arterial diseases

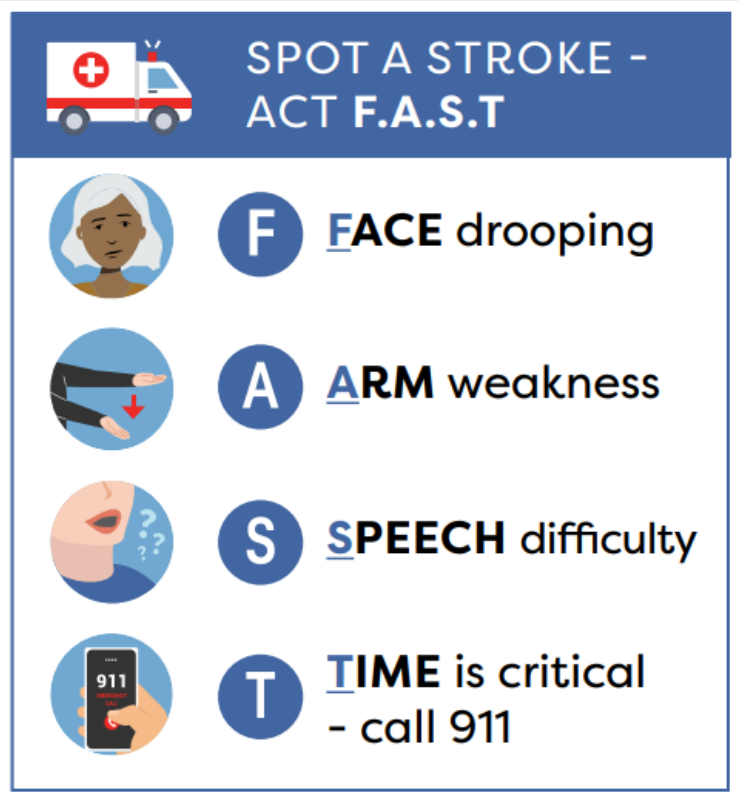
Traumatic

Blunt or penetrating trauma

- Severe neck extension/lateral flexion/rotation
- Fx of the mandible/cervical vertebrae/skull base

Iatrogenic (endovascular)





02

Clinical Presentation

Clinical Presentation

- Neck pain
- Headache
- Pulsatile tinnitus

- TIA & cerebral stroke (< 2 weeks)

- Horner syndrome (mostly partial)

- Lower CN palsies (IX-XII)
    - Most common = Hypoglossal (XII)

- Subarachnoid hemorrhage (SAH) = intracranial

03

Diagnosis

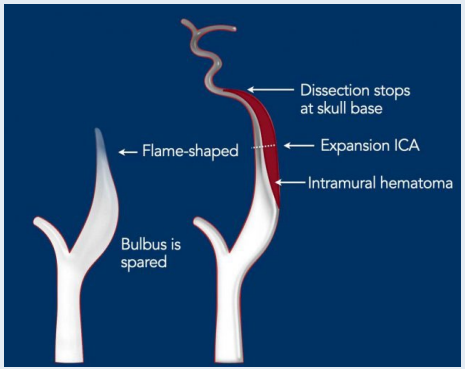
Diagnosis

CTA

Flame-shaped occlusion sparing carotid bulb

Abrupt reconstruction at the skull base

More feasible in trauma



MRA

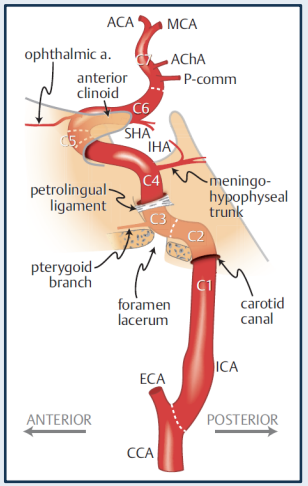
T1 with fat suppression (hypersignal)

Crescent-shaped IMH

Superior to CTA subacute and chronic IMH

Detect ischemic changes in brain parenchyma earlier

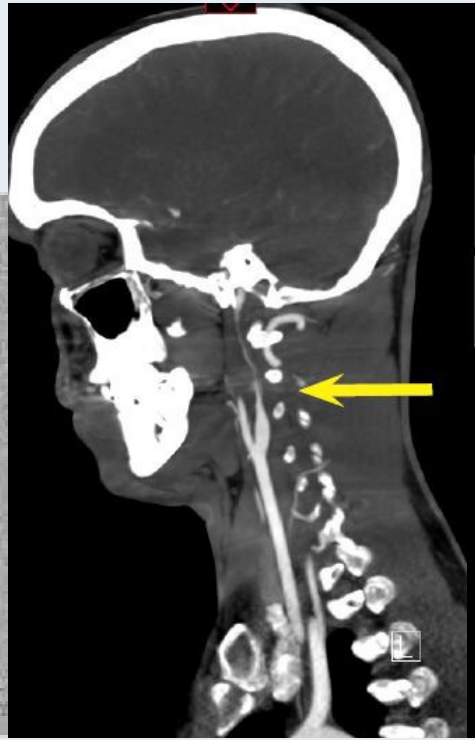
2 cm above bifurcation

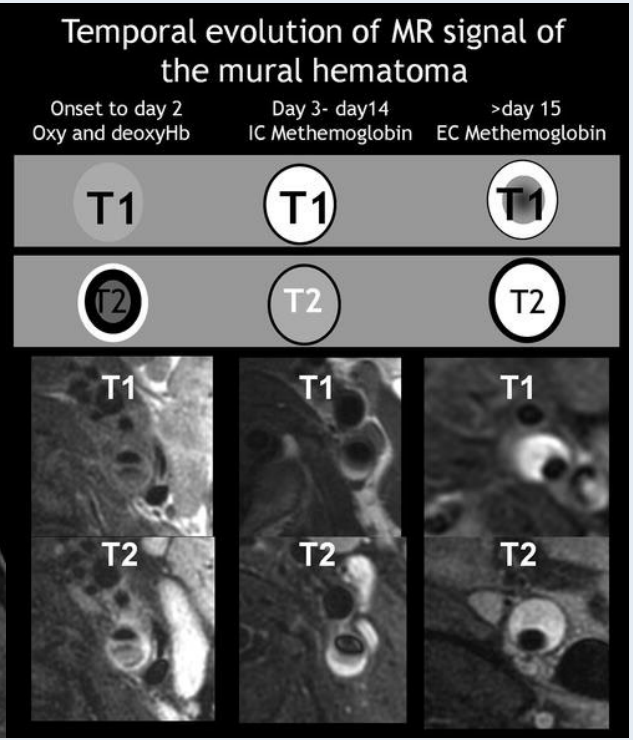


https://yenagoamedicaljournal.net/clinical-basis-for-the-knowledge-of-anatomy-of-the-carotid-artery-a-review-article/

Angiography& DUS

Largely replaced by CTA/MRA & reserved for therapeutic intervention




Temporal evolution of MR signal of the mural hematoma
Onset to day 2
Oxy and deoxyHb
Day 3- day14
IC Methemoglobin
>day 15
EC Methemoglobin
T1
T1
T1
T2
T2
T2
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T1
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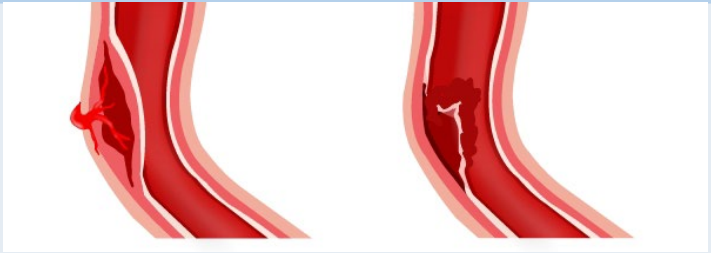
T2
T2

04

Medical Treatment

General considerations



- First-line = Antithrombotics/Anticoagulants
- If symptomatic on medical therapy :

SVS

Balloon angioplasty and stenting > Open surgery

Goal in **acute** setting = Prevent cerebral ischemia and propagation of the dissection

Medical

No clear preference
for antiplatelets or anticoagulants

- Antiplatelets (aspirin, clopidogrel, dipyridamole) and anticoagulants (warfarin, heparin)
- Alone or in combination
- Duration: 3-6 months (takes 3 months for arterial wall to mend)
- Prolonged treatment in some cases (no clear evidence)
- Patient sx and follow-up imaging guide treatment duration and need for further intervention

Canadian Stroke Best Practices

Recommendations

iii. Antithrombotic therapy for stroke prevention is recommended for individuals with a diagnosis of an acute or recent extracranial carotid or vertebral artery dissection [Evidence Level B].

a. **(New for 2020)**: There is uncertainty about the comparative efficacy of antiplatelet therapy vs. anticoagulation with heparin or warfarin; either treatment is considered reasonable based on current evidence [Evidence Level B]; decisions should be based on individual risk/benefit analysis taking into consideration the imaging features of the dissection (presence and degree of stenosis, intraluminal thrombus, vessel occlusion, pseudoaneurysm), brain imaging, patient characteristics, and estimated bleeding risk [Evidence Level C].

Tailored approach for decision-making considering:

- Individual patient bleeding risk
- Presence of high-risk radiological features

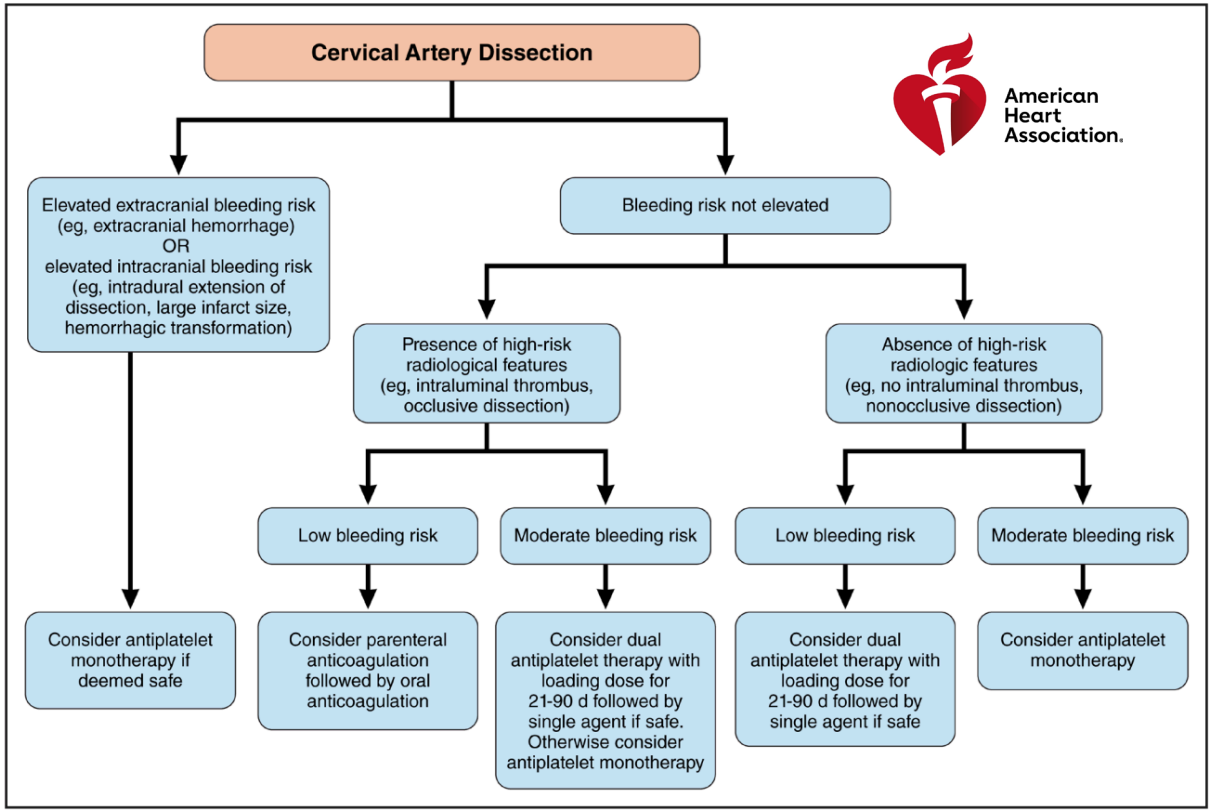


Figure 3. Suggested algorithm for antithrombotic treatment selection in patients with cervical artery dissection.
Patients are stratified according to radiological risk factors for intracranial hemorrhage (eg, large infarct, hemorrhagic transformation, and intracranial extension of the dissection) and important radiological risk factors for ischemic stroke (eg, presence of intraluminal thrombus and high-grade stenosis or occlusion).

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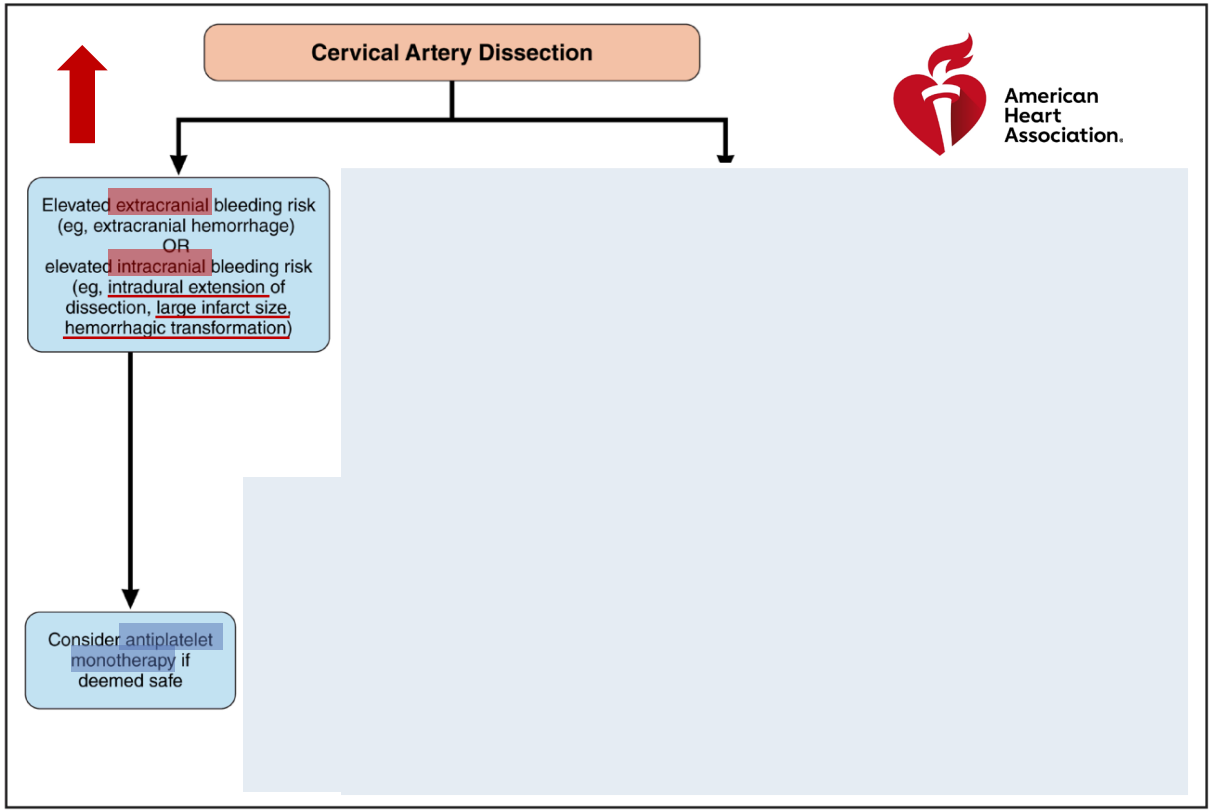

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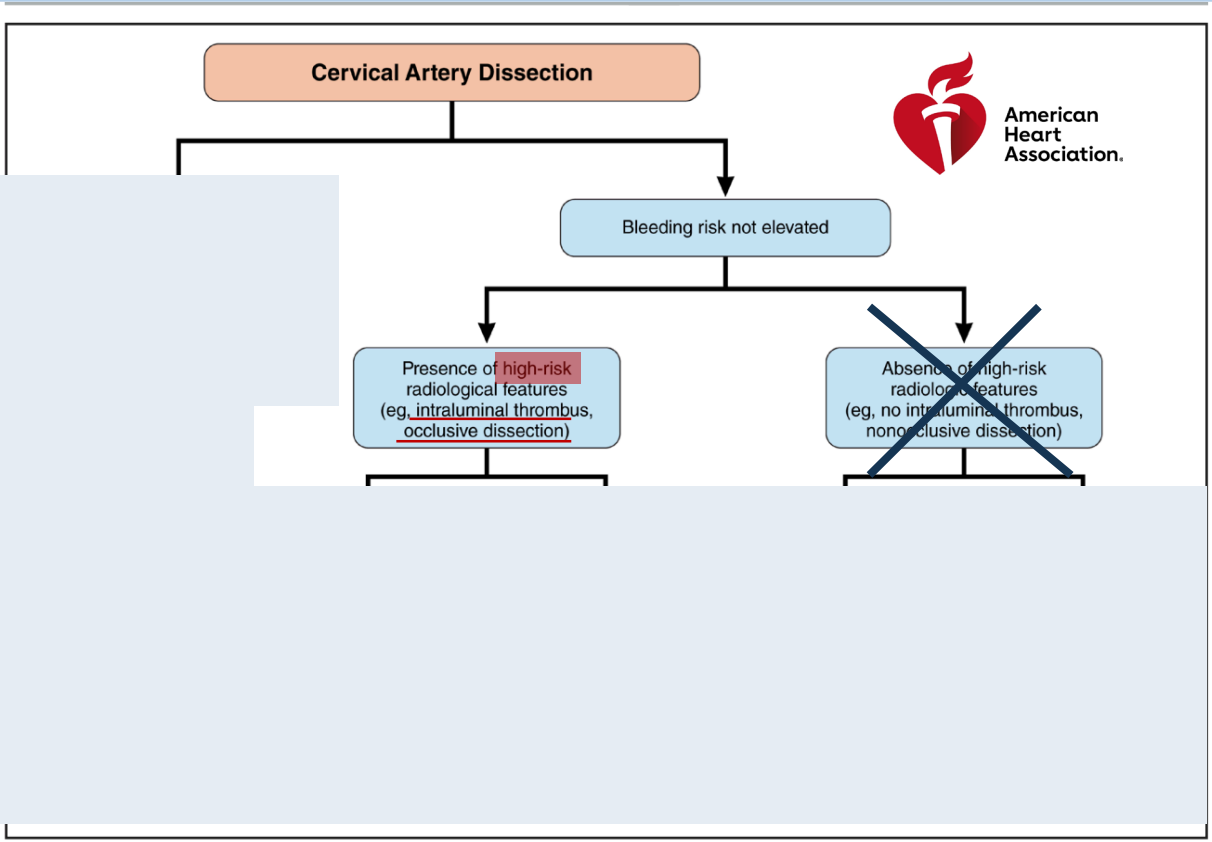

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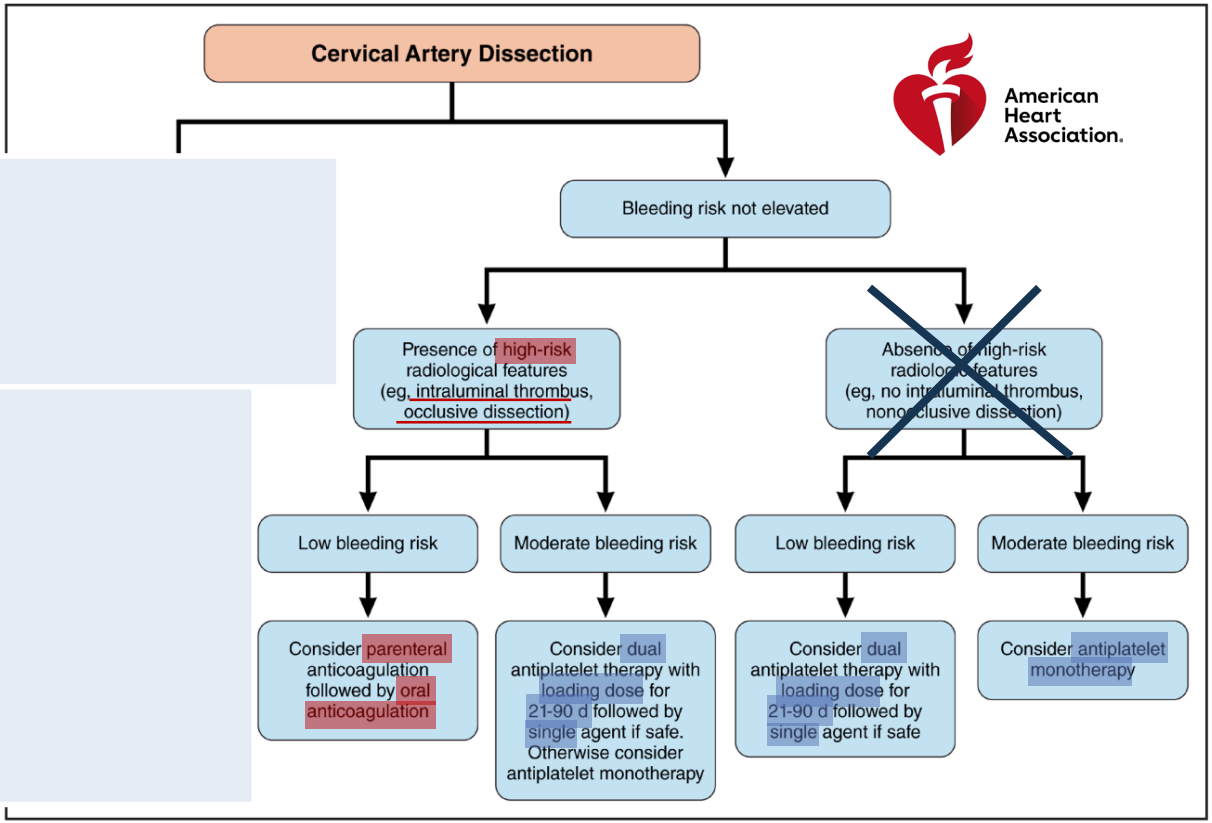
Tailored approach for decision-making considering:

- Individual patient bleeding risk
- Presence of high-risk radiological features

High-risk radiological features :

- Severe stenosis or occlusion
- Intraluminal thrombus



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Tailored approach for decision-making considering:

- Individual patient bleeding risk
- Presence of high-risk radiological features

JAMA Neurology | Original Investigation

Antiplatelet Therapy vs Anticoagulation Therapy in Cervical Artery Dissection

The Cervical Artery Dissection in Stroke Study (CADISS) Randomized Clinical Trial Final Results

Hugh S. Markus, FMedSci; Christopher Levi, MD; Alice King, PhD; Jeremy Madigan, FRCR; John Norris, MD; for the Cervical Artery Dissection in Stroke Study (CADISS) Investigators

- CADISS study: RCT
- Multicenter, N=250
- February 2019 (VKA vs antiplatelet)
- No difference in recurrent ipsilateral stroke or mortality
- One major intracranial hemorrhage in anticoagulant group
- Antiplatelets = easier to use and less costly, recommended in first-line

Aspirin versus anticoagulation in cervical artery dissection (TREAT-CAD): an open-label, randomised, non-inferiority trial

THE LANCET Neurology

Stefan T Engelter, Christopher Traenka*, Henrik Gensicke, Sabine A Schaedelin, Andreas R Luft, Barbara Goeggel Simonetti, Urs Fischer, Patrik Michel, Gaia Sirimarco, Georg Kägi, Jochen Vehoff, Krassen Nedeltchev, Timo Kahles, Lars Kellert, Sverre Rosenbaum, Regina von Rennenberg, Roman Sztajzel, Stephen L Leib, Simon Jung, Jan Gralla, Nicole Bruni, David Seiffge, Katharina Feil, Alexandros A Polymeris, Levke Steiner, Janne Hamann, Leo H Bonati, Alex Brehm, Gian Marco De Marchis, Nils Peters, Christoph Stippich, Christian H Nolte, Hanne Christensen, Susanne Wegener, Marios-Nikos Psychogios, Marcel Arnold†, Philippe Lyrer†, on behalf of the TREAT-CAD investigators‡*

- TREAT-CAD study: Non-inferiority randomized trial
- Multicenter, N=194
- May 2021 (VKA vs Aspirin)
- Composite of clinical outcomes (stroke, major haemorrhage or death) and MR outcomes (new ischaemic or haemorrhagic brain lesions)
- No major intracranial hemorrhage in anticoagulant group
- Aspirin was not shown to be non-inferior to VKA

Medical

ESO and AHA Guidelines:

Recommend thrombolysis in extracranial CAD as long as standard criteria met

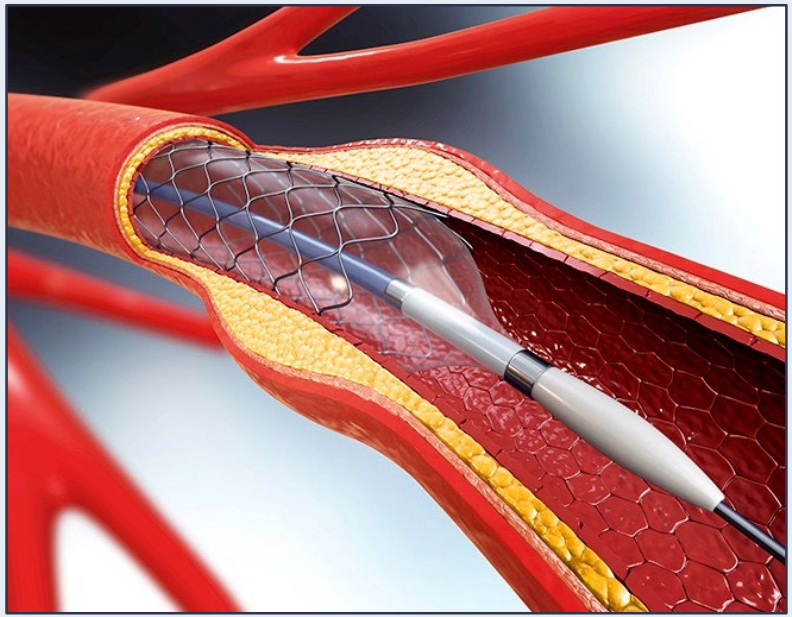
Thrombolysis

- Intravenous thrombolysis (IVT) with alteplase
- Up until 4.5 hours from acute stroke
- If standard inclusion/exclusion criteria are met
- Mechanical thrombectomy in patients with large vessel occlusion of the anterior circulation
- No safety concerns reported with strokes due to extracranial CAD vs other etiologies
- If intracranial extension of CAD, the risks and benefits of IVT are not well established

Medical

Direct oral anticoagulants?

- Limited evidence, further data needed
- While DOACs were not used in CADISS or TREAT-CAD, observational data suggests that they are safe and effective
- Experts believe DOACs can be used in place of warfarin

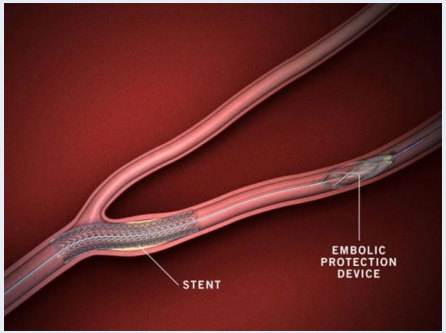


05

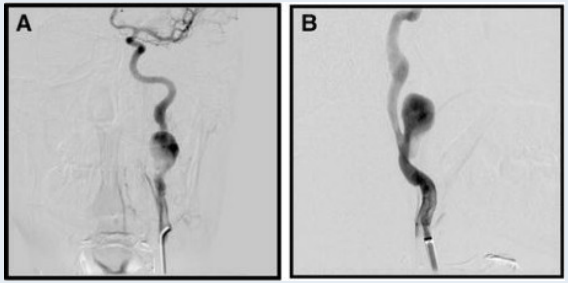
Endovascular Treatment

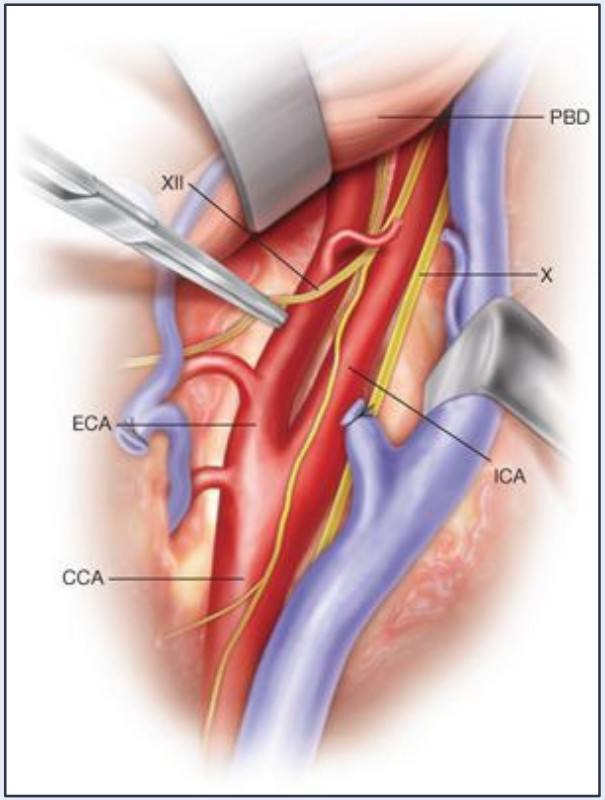
Endovascular

- Subacute phase in a minority of patients
- Angioplasty and stenting with embolic protection device
- CAD patients + low risk of recurrent ischemic stroke



1. Antithrombotics = contraindicated or fail to control sx
2. Recurrent embolism or hypoperfusion
3. Accompanying worsening pseudoaneurysm





06

Open Surgery Treatment

Open

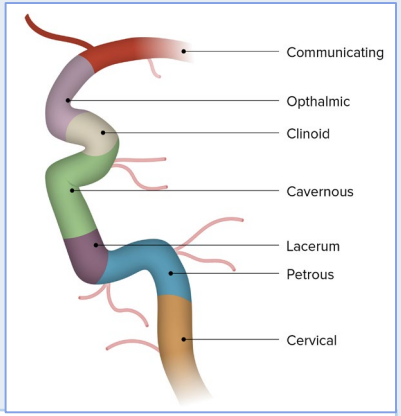
Same indications as endovascular

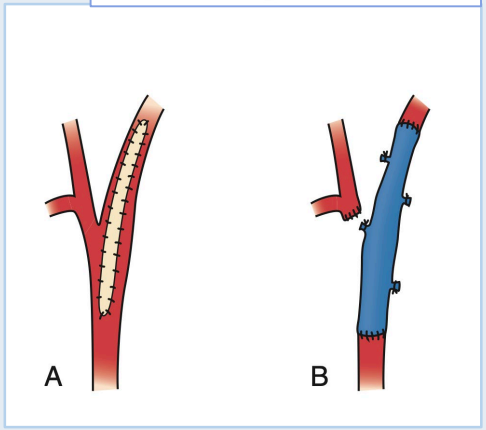
Penetrating extracranial carotid injuries and lesions **unfavorable for endovascular**

Options:
1. **Resection + saphenous vein graft (preferred, especially in young)**
2. Thromboendarterectomy and patch angioplasty

No RCT to compare endovascular vs open surgery in CAD

- Challenging : High lesions (located distally at the entry of the petrous bone)
- Higher morbidity and mortality compared to atherosclerotic carotid disease





Conclusion

WVES Winnipeg Vascular & Endovascular Symposium

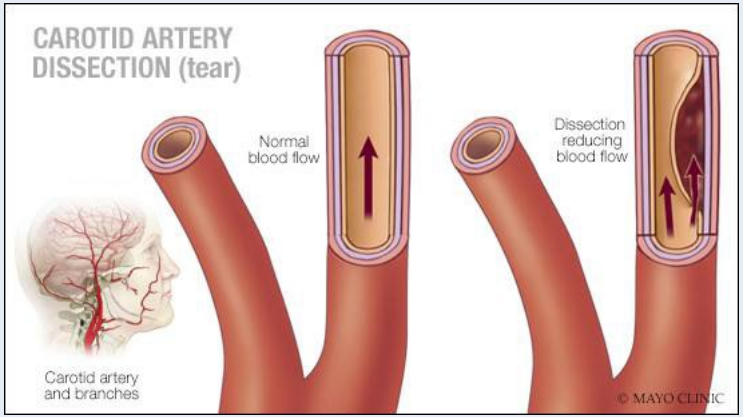
CAD = one of leading causes of stroke in young adults

First-line treatment = Medical (Antithrombotics/anticoagulants)

Decision-making based on bleeding risk profile and high-risk radiological features

Intervention (endovascular or open) in select cases

Future RCT needed to clarify the role of DOACs in medical management



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Study name	Aim	Study design and population	Baseline characteristics	Primary outcome	Follow-up	Results	Limitations
CADISS (Cervical Artery Dissection in Stroke Study)[78]	Compare antiplatelet and anticoagulant treatment for stroke prevention in cervical artery dissection	Multicenter, open-label, randomized controlled trial; extracranial cervical artery dissection within the prior 7 days; randomized to antiplatelet or anticoagulant, with specific treatment decided by the local clinician	N = 250; 118 (47%) carotid, 132 (53%) vertebral; mean time to randomization, 3.7 days; 224 (90%) patients presented with stroke or transient ischemic attack and 26 (10%) with only local symptoms	Ipsilateral stroke or death in intention-to-treat population at 90 days	3 months; 1 year	Intention-to-treat analysis: 126 (50.4%) in antiplatelet group and 124 (49.6%) in anticoagulant group Primary outcome at 3 months: 3 (2.4%) in antiplatelet group and 1 (0.8%) in anticoagulant group (odds ratio, 0.335; 95% confidence interval, 0.006 to 4.233). All events were strokes, no deaths. No significant differences in treatment groups Primary outcome at 1 year in intention-to-treat analysis: 4 (3.2%) in antiplatelet group and 2 (1.6%) in anticoagulant group (odds ratio, 0.56; 95% confidence interval, 0.10-3.21) Primary outcome at 1 year in per-protocol analysis[a]: 4 (4.0%) in antiplatelet group and 1 (1.0%) in anticoagulant group (odds ratio, 0.32; 95% confidence interval, 0.03-3.04)	(1) Time to enrollment, may have missed outcomes early in disease course; (2) central imaging review failed to confirm dissection in 20% of patients; (3) heterogeneity of antiplatelet treatment; (4) use of clinical endpoints resulted in few recurrences; study underpowered
TREAT-CAD (Biomarkers and Antithrombotic Treatment in Cervical Artery Dissection) trial[79]	Test the noninferiority of aspirin to vitamin K antagonist treatment in patients with cervical artery dissection	Multicenter, open-label, randomized noninferiority trial; symptomatic, MRI-verified extracranial cervical artery dissection within the prior 14 days, randomized to aspirin 300 mg daily or vitamin K antagonists; noninferiority margin: 12%	N = 194; 130 (67%) carotid, 67 (35%) vertebral, 14 (7%) multivessel dissection; mean time to randomization, 2.9 days; 138 (71%) presented with stroke or transient ischemic attack and 56 (29%) with only local symptoms	Composite of clinical (stroke, major hemorrhage, or death) or MRI outcomes (new ischemic or hemorrhagic brain lesions) in per protocol population at 14 days (clinical and MRI outcomes) and 90 days (clinical outcomes only) after treatment	3 months	Per-protocol analysis: 173 patients, 91 (53%) in aspirin group and 82 (47%) in vitamin K antagonist group Primary outcome: 21 (23%) in aspirin group and 12 (15%) in vitamin K antagonists group (absolute difference 8% [95% confidence interval, -4 to 21]). Noninferiority of aspirin was not shown Ischemic stroke: 7 (8%) in aspirin group and 0 (0%) in vitamin K antagonists group Major extracranial hemorrhage: 0 (0%) in aspirin group and 1 (1%) in vitamin K antagonists group No intracranial hemorrhage or deaths in either group	(1) Time to enrollment, may have missed outcomes early in disease course; (2) not powered to establish superiority of either treatment

MRI = magnetic resonance imaging

[a] Per-protocol analysis was performed in patients meeting the inclusion criteria following central review of imaging to confirm the diagnosis of dissection (n = 197).

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Stroke CURRENT ISSUE

RESEARCH ARTICLE | Originally Published 9 February 2024 |

Check for updates

Antithrombotic Treatment for Stroke Prevention in Cervical Artery Dissection: The STOP-CAD Study

Shadi Yaghi, MD, Liqi Shu, MD, Daniel Mandel, MD, Christopher R. Leon Guerrero, MD, Nils Henninger, MD, PhD, Dr Med, Jayachandra Muppa, MBBS, Muhammad Affan, MBBS, ... SHOW ALL ..., and Karen Furie, MD | AUTHOR INFO & AFFILIATIONS

Antithrombotic Therapy for STrOke Prevention in Cervical Artery Dissection (STOP-CAD)

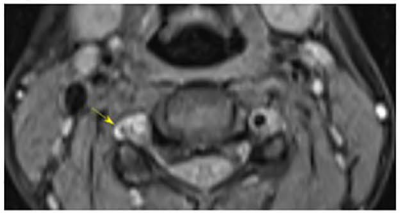
International Observational Study
63 sites, 16 countries

3636 patients with cervical artery dissection

Antiplatelets

vs.

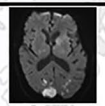
Anticoagulation



By 6 months:
4.4% ischemic stroke
0.8% major hemorrhage

87% of ischemic strokes occurred in the first 30 days

No difference in ischemic stroke risk by day 30 with anticoagulation vs. antiplatelets
(adjusted HR 0.71 95% CI 0.45-1.12, p=0.145)



Higher risk of major hemorrhage by day 180 with anticoagulation
(adjusted HR 5.56, 95% CI 1.53-20.13, p=0.009

Intracranial hemorrhage

Major extracranial hemorrhage

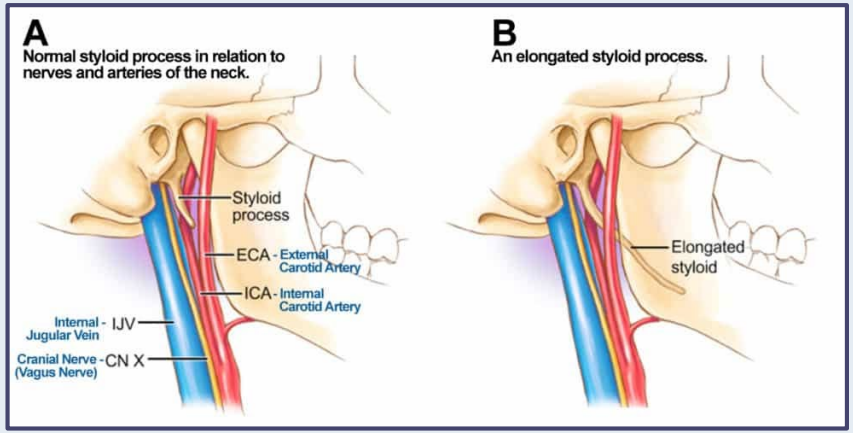
Patients with occlusive dissection had lower ischemic stroke risk with anticoagulation
(p-interaction = 0.009)

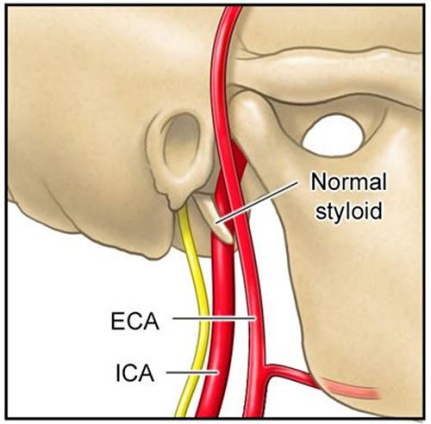
2024 Yaghi S, Shu L, Mandel D, et al. for the STOP-CAD Study

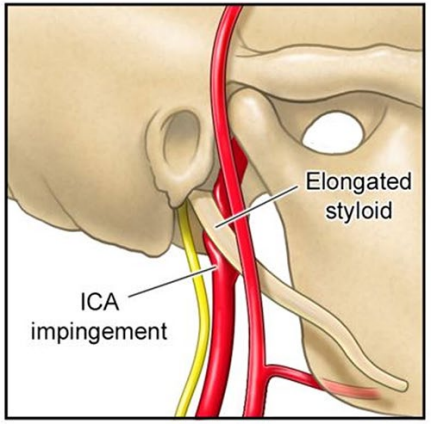
Stroke

Eagle Syndrome

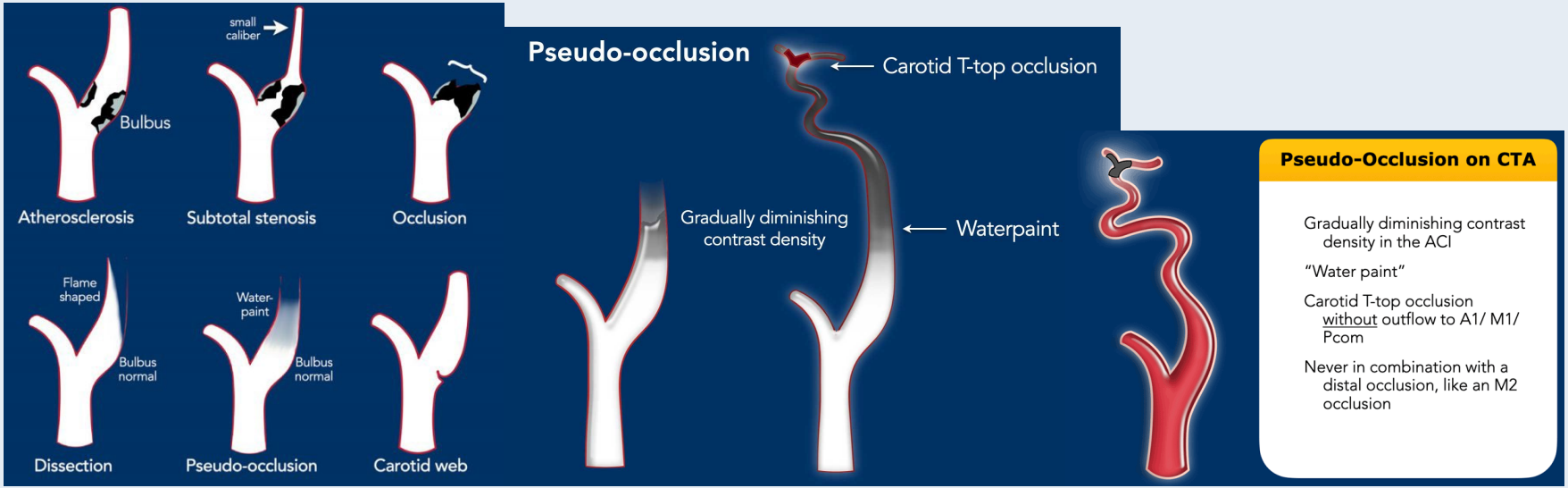
- Stylocarotid syndrome (rare)
- Elongated styloid process (≥3 cm) or a hardened stylohyoid ligament
- Cervical/facial/ear pain, triggered by neck rotation/chewing/swallowing



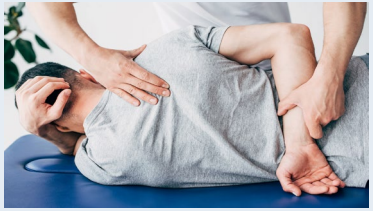




DDX


small caliber
Bulbus
Atherosclerosis
Subtotal stenosis
Occlusion
Flame shaped
Bulbus normal
Dissection
Water-paint
Bulbus normal
Pseudo-occlusion
Carotid web
Pseudo-occlusion
Carotid T-top occlusion
Gradually diminishing contrast density
Waterpaint
Pseudo-Occlusion on CTA
Gradually diminishing contrast density in the ACI
"Water paint"
Carotid T-top occlusion without outflow to A1/ M1/ Pcom
Never in combination with a distal occlusion, like an M2 occlusion

Spontaneous



Association with:

- Aortic root dilatation
- Recent infection
- HTN
- Migraine

No association with:

- Smoking
- Diabetes
- Atherosclerosis
- Oral contraceptive use

Reported but… no causality with chiropratic adjustements