Intracranial and Extracranial Arterial Dissections

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Disclosures

Beth Israel Deaconess Medical Center

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Nothing to report.

Learning Objectives

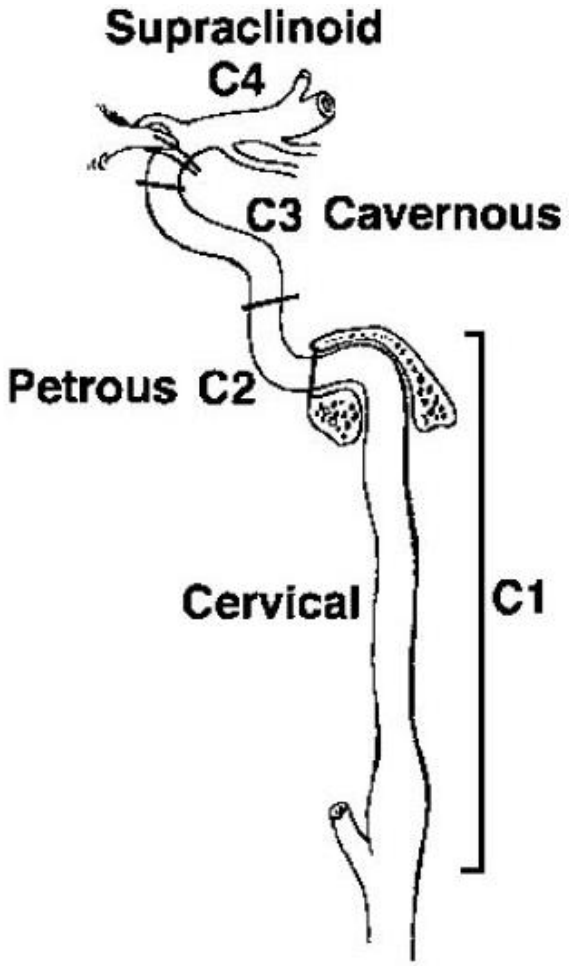
1. Recognize symptoms of craniocervical artery dissections

2. Initiate acute work-up and management for primary or secondary prevention of stroke

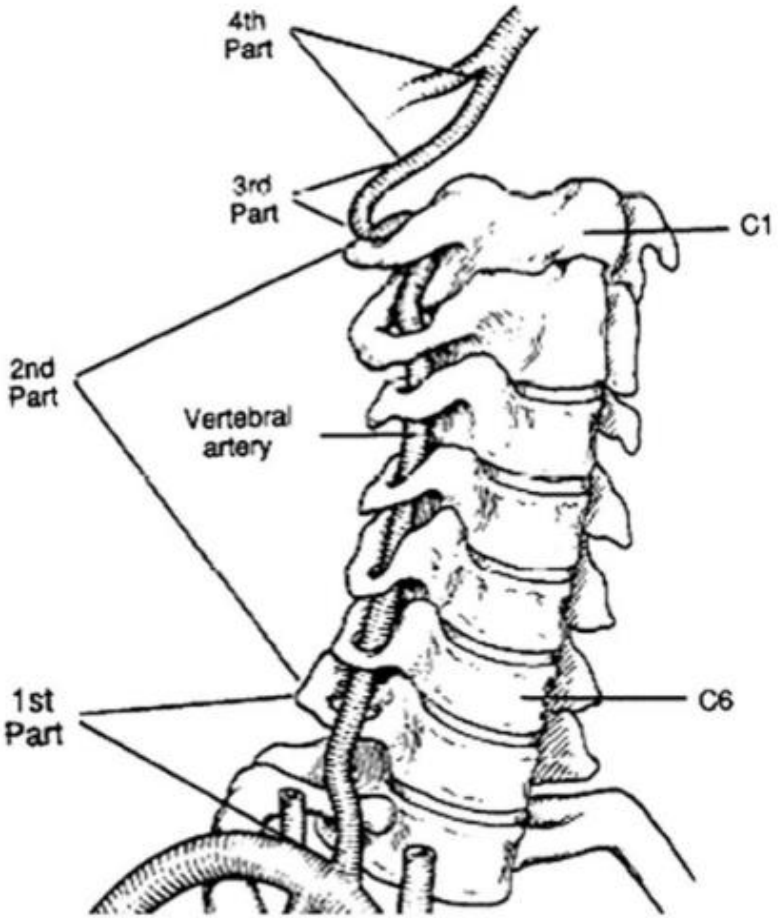
3. Understand nuances to long-term medical or surgical treatments

Anatomy & Pathophysiology

Anatomy

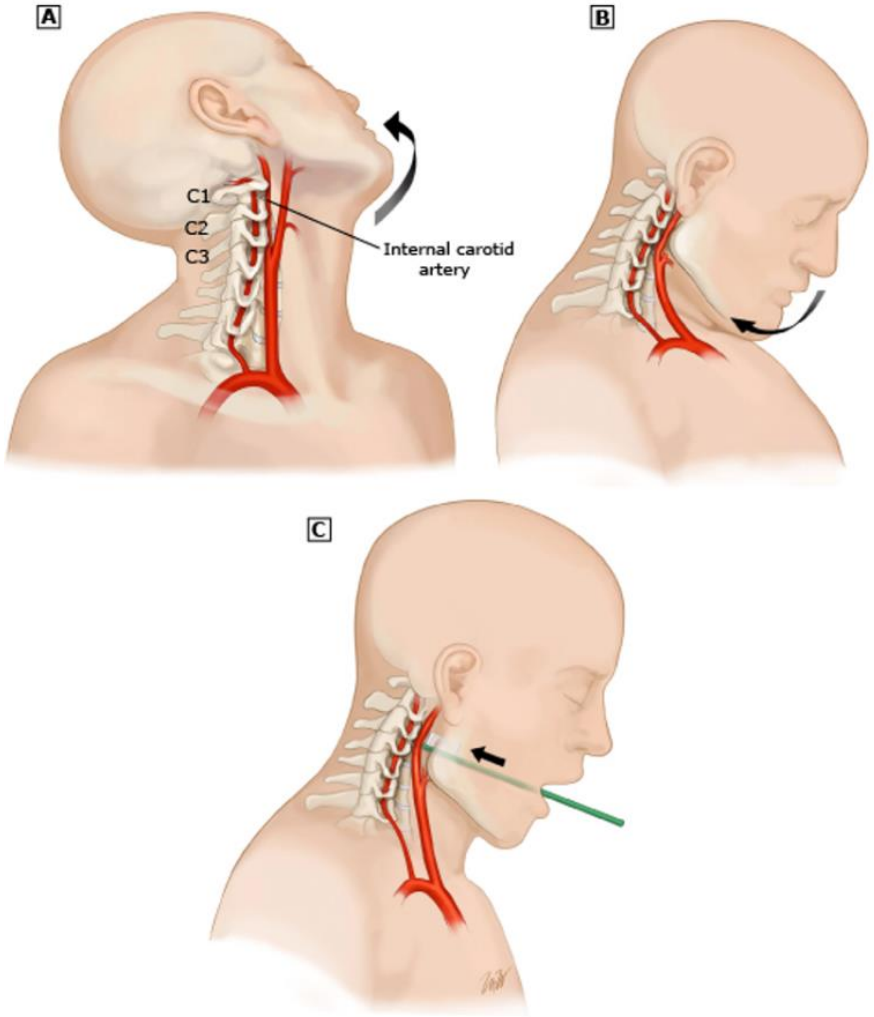


Gibo et al, 1981

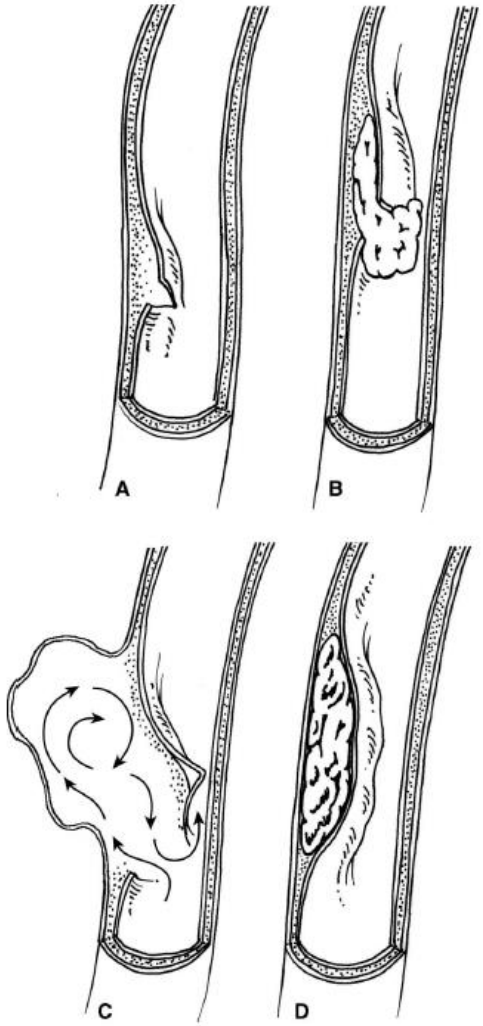


Cloud and Markus, 2003

Pathophysiology



Biffl et al 2025



Fusco & Harrigan

Diagnosis

Injury classification (Denver scale)

Injury Grade	Description	% BCVI	Risk of stroke*
I	Luminal irregularity, <25% stenosis	61%	**8%**
II	25-99% stenosis, intraluminal thrombus, raised intimal flap	17%	**14%**
III	Traumatic aneurysm	15%	**26%**
IV	Occlusion	5%	**50%**
V	Transection	4%	**100%**

*Biffl et al, 2002. Increased risk seen in BCI, but not BVI

Clinical Presentation

- Pain
  - Most common (~70%) symptom
  - Head (including thunderclap) or neck pain
- Horner syndrome
  - Only presenting symptom in 10% ICA dissections
- Stroke/TIA
  - Artery-artery embolism > watershed from stenosis
- Pulsatile tinnitus
- Cranial neuropathies (compressive & ischemic)
- SAH (intracranial dissections)

Epidemiology, Risk Factors, and Screening

Epidemiology

- "Spontaneous" dissections: 3-5 cases per 100,000/year
  - ~50% present with TIA/stroke
- Etiology of ischemic stroke in 15-20% patients < 50
- Traumatic dissections (TCVI): 2-3% of blunt force trauma patients (carotid > vertebral)
  - ~10% of TCVI lead to ischemic stroke
- 3% of intracranial aneurysms, 6% non-traumatic SAH

Risk Factors

Spontaneous

- (Minor) trauma (~20%)
- Connective tissue disorders (~5%)
  - Ehlers-Danlos, Marfan, OI, FMD, etc.
- Genetic?

Traumatic (TCVI)

- Poor GCS
- Cervical spine injury
- Basilar cranial fracture
- Cervical bruit
- Facial fractures
- Neurologic findings (Horner syndrome, CN palsy, etc.)
- Spinal cord injury
- Thoracic trauma
- Etc.

Screening Protocols

TABLE 1. Screening Criteria for BCVI[5,8]

Denver Criteria	Memphis Criteria
Signs/symptoms of BCVI	Unexplained neurologic deficit
Potential arterial hemorrhage from neck/nose/mouth	Horner's syndrome
Cervical bruit in patient <50 y old	LeFort II or III (unilateral or bilateral)
Expanding cervical hematoma	Cervical spine injury
Focal neurologic defect: TIA, hemiparesis, vertebrobasilar symptoms, Horner's syndrome	Skull base fractures involving the foramen lacerum
Neurologic deficit inconsistent with head CT	Neck soft tissue injury (e.g., seatbelt injury or hanging)
Stroke on CT or MRI	
Risk factors for BCVI	
High-energy transfer mechanism	
Displaced midface fracture (LeFort II or III)	
Mandible fracture	
Complex skull fracture/basilar skull fracture/occipital condyle fracture	
Severe TBI with GCS <6	
Cervical spine fracture, subluxation, or ligamentous injury at any level	
Near hanging with anoxic brain injury	
Clothesline type injury or seat belt abrasion with significant swelling, pain, or altered mental status	
TBI with thoracic injuries	
Scalp degloving	
Thoracic vascular injuries	
Blunt cardiac rupture	
Upper rib fractures	

MRI, magnetic resonance imaging; TIA, transient ischemic attack; GCS, Glasgow Coma Scale.

Kim et al

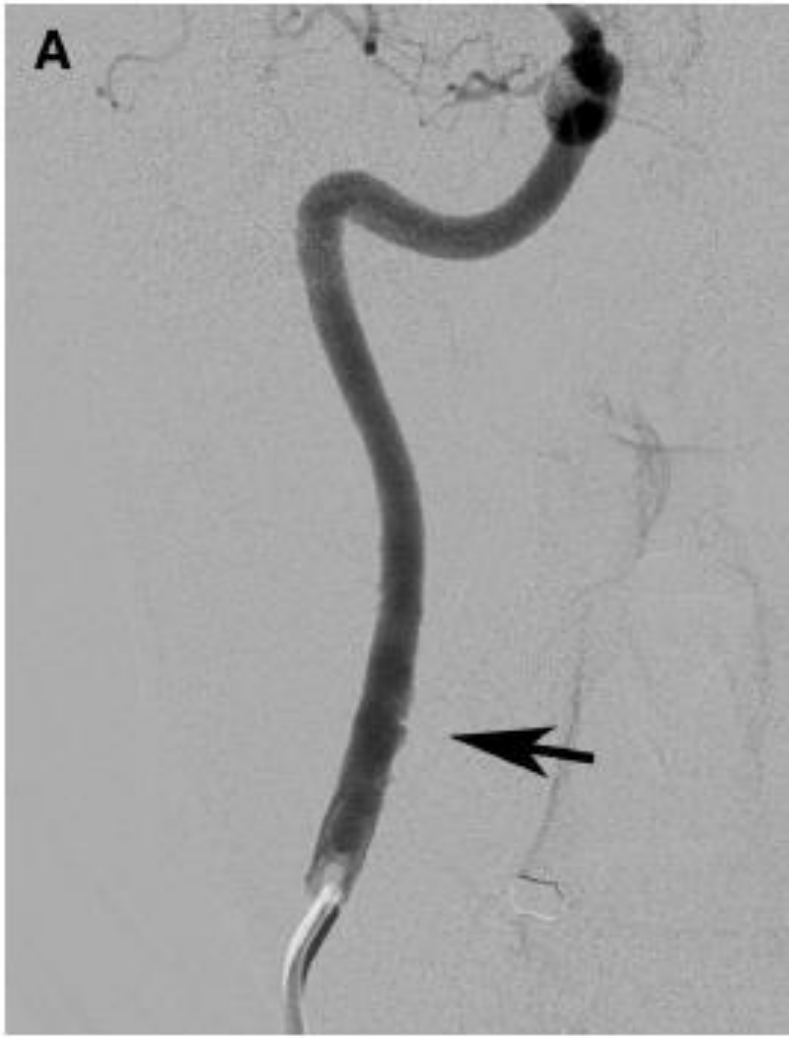
Screening Protocols

- Recommended by trauma guidelines
  - High (~17%) vs low risk (4%) cervical spine injuries
- ↑ detection rate of TCVI (especially in patients with depressed LOC)
- ↓ rate of neurovascular complications
- >20% of TCVI occur in absence of established high-risk factors

Diagnosis

Diagnosis

I. Catheter angiography (DSA)
   - Gold standard
   - Detect subtle defects
   - Concomitant treatment possible
   - Resource intensive, ↑ risk (transport, procedural, etc.)

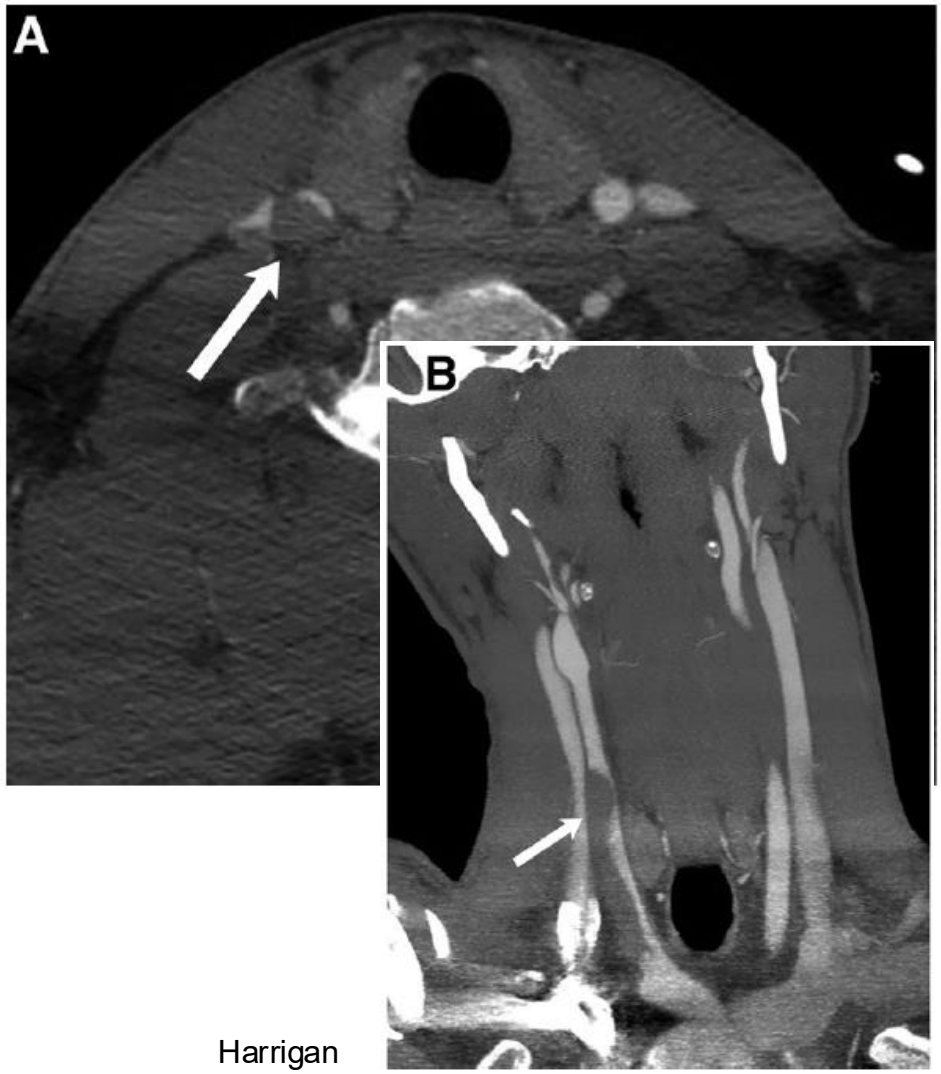


Fusco & Harrigan

Diagnosis

II. CT-angiography

- Improving sensitivity with modern technology
- Cost-effective
- Easier integration into trauma work flow (rapid acquisition)
- Lower performance with lower grade BCVI
- Artifact contamination

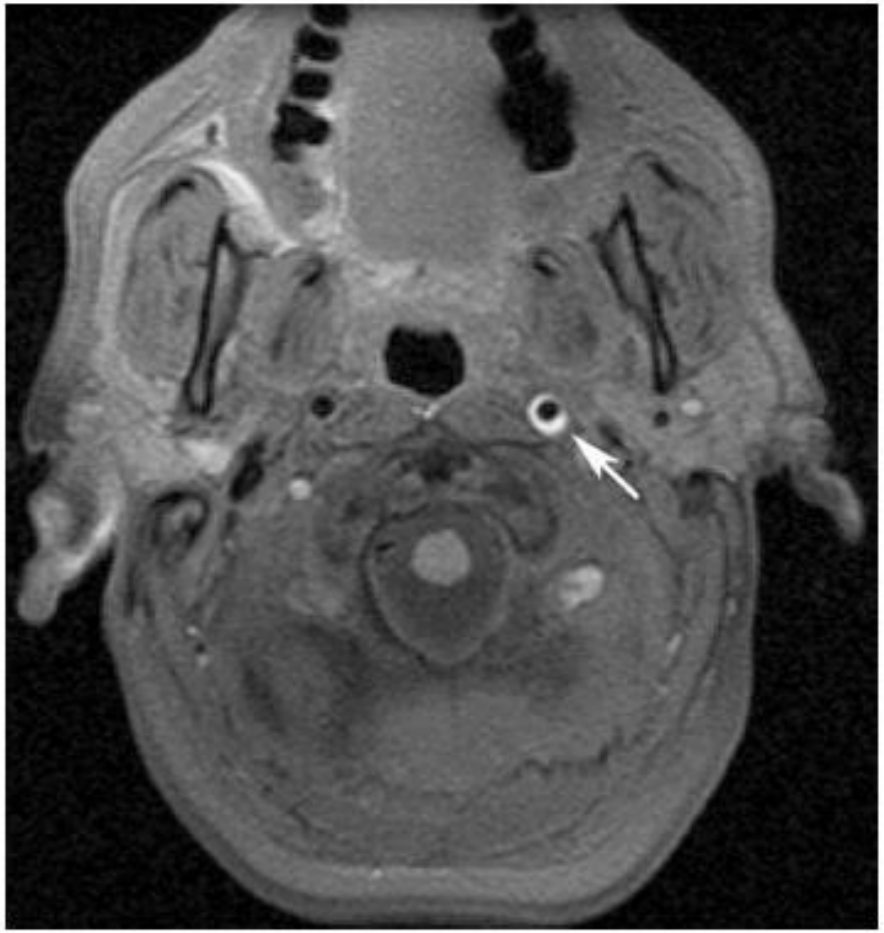


Harrigan

Diagnosis

III. Magnetic resonance

- Detailed anatomic resolution
- Detect cerebral infarction
- Sensitivity ~50%
- Not ideal for screening especially for critically ill patients



Fusco & Harrigan

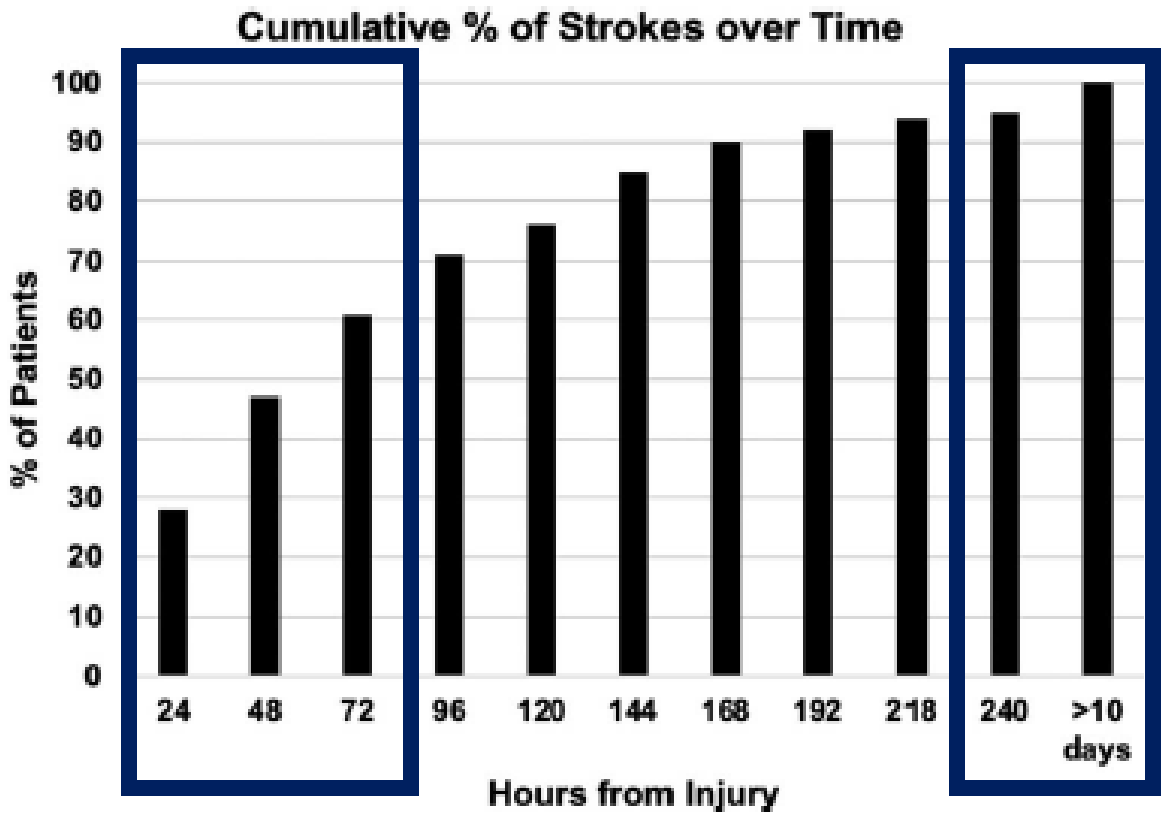
Management: Acute & Long Term

Management

1. **Acute ischemic stroke due to dissection**
   - Extracranial:
     - Intravenous thrombolysis (IVT) with standard inclusion/exclusion criteria
     - Mechanical thrombectomy (MT) ± endovascular therapy (EVT) preferred
   - Intracranial:
     - IVT safety uncertain, paucity of data
     - MT preferred, EVT dependent on location of dissection and bleeding risk

Management

2. Timing of antithrombotic therapy



Burlew et al

Management

3. Choice of antithrombotic therapy (spontaneous)

CADISS: phase II MC-RCT, n=250, EAD, VKA vs AP

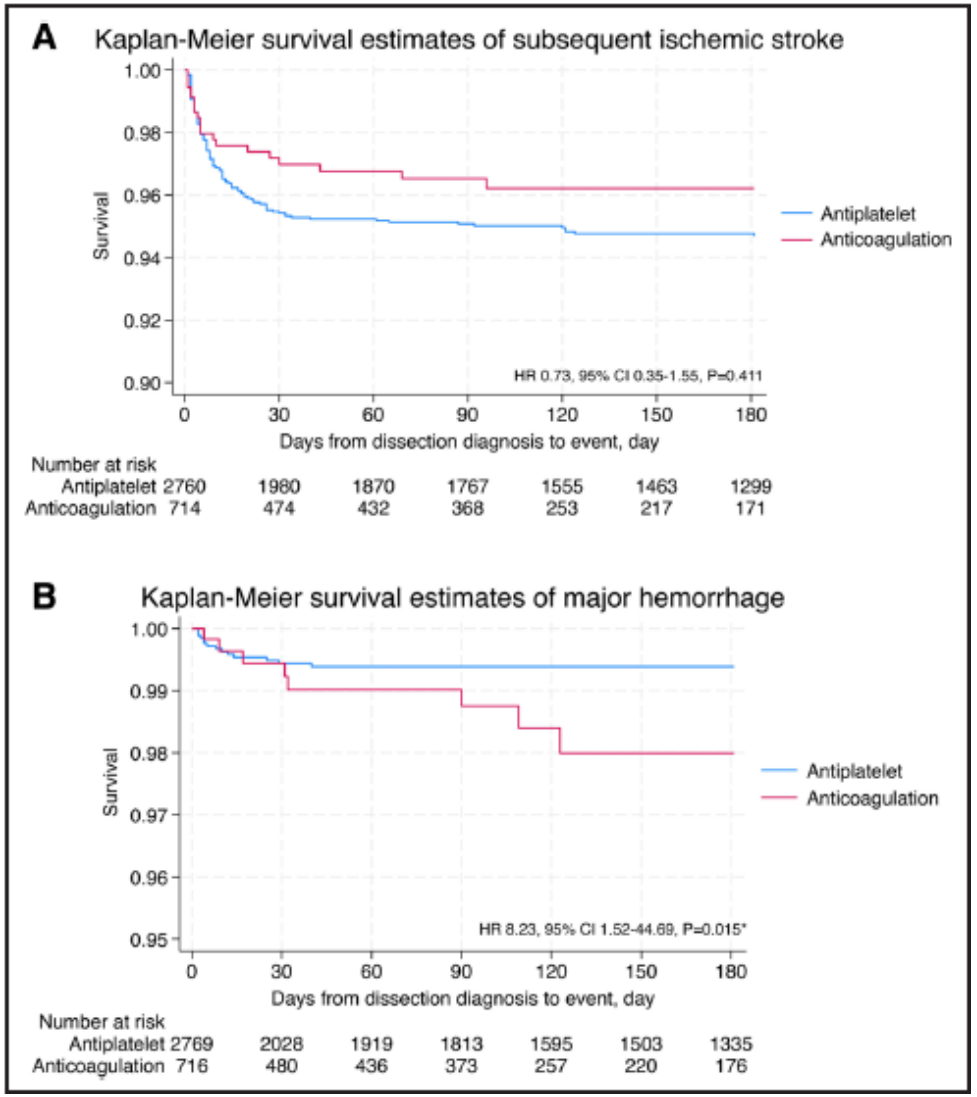
TREAT-CAD: phase II MC-RCT, n=194, EAD, VKA vs ASA

Outcome	Intention-to-treat population			
	Antiplatelet group (n = 226), No. (%)	Anticoagulant group (n = 218), No. (%)	OR (95% CI)	*P* value
Primary end point				
Ischemic stroke, death, or major bleeding	10 (4.4)	3 (1.4)	0.33 (0.08-1.05)	.06
Secondary end point				
Ischemic stroke	10 (4.0)	1 (0.5)	0.14 (0.02-0.61)	.01
Death[b]	0	0		
Major bleeding	0	2 (0.9)	5.23 (4.22-723.08)	.22

Kaufmann et al

Management

- STOP-CAD: MC (16 countries, 63 sites) retrospective study
- Real-world usage data
- AP:AC ≈ 6:1
- <5% AIS rate, <1% hemorrhage rate
- ~90% of AIS < 30 days



Yaghi et al

Management

3. Choice of antithrombotic therapy (traumatic)

- No high-quality data for AP vs AC

- Meta-analysis of 948 patients (Kim et al):
  - 10% stroke with ATT vs 34% without ATT
- Historically favored anticoagulation (incl. low dose heparin)
  - AC favored for high-risk patients (e.g. intraluminal thrombus)
  - ↑ hemorrhagic complications (8-16%)

Management

4. Treatment of dissecting aneurysms

- With associated hemorrhage/SAH: early surgical or endovascular intervention
  - ↑↑ risk of rebleeding (30-50%)

- Without hemorrhage:
  - Favorable natural history for aneurysms: >95% no growth in n=166 across 8 studies (Paraskevas et al)
  - Monitoring + AP likely enough if: < 50, size < 6mm, and no growth (Filo et al)
  - Routine stenting NOT recommended

Prognosis

Prognosis

- Spontaneous
  - Low rate of recurrent ischemic events (1-3%) esp. >2 weeks
  - Resolution: 42-68% occluded arteries recanalize ≤ 6 months

- Traumatic
  - >90% grade I healed/stable ≤ 7 days, vs 20% grade II
  - Grade III healed in 3%, grade IV unlikely to heal

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