Vascular Dissection (Carotid, Vertebral)

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Pathophysiology

- tear within arterial wall → blood extravasation (longitudinal dissection) into medial or subintimal layers → expanded arterial wall → lumen compromise.

* dissection can produce second intimal tear, allowing blood clot to reenter lumen → embolization.
* clot is absorbed within several weeks, and lumen usually returns to its normal size.
* most commonly involved – **ICA high in neck** (between C2 and skull base) - carotid artery is stretched over transverse process of C2 by any injury involving hyperextension and rotation of head and neck.
* less frequently involved – vertebrobasilar system (most mobile V1 and V3 segments), intracranial ICA, MCA.

Etiology

– **trauma** (blunt\*, penetrating, or even trivial\*\*; [see also p. TrS21 >>](http://www.neurosurgeryresident.net/TrS.%20Spinal%20trauma\TrS21.%20Anterior%20Neck%20Injury.pdf)), but may occur **spontaneously**.

\*e.g. fall on popsicle in mouth, abuse with whiplash-shake injuries

\*\*e.g. prolonged neck holding in eccentric position, chiropractic manipulation, coughing

* usually occur in young people.
* associated conditions (congenital / degenerative changes in vessel wall) - fibromuscular dysplasia (!), Marfan's syndrome, Ehlers-Danlos type IV syndrome, pseudoxanthoma elasticum, atherosclerosis, migraine, pronounced vessel tortuosity, moyamoya, cystic medial degeneration, pharyngeal infections, α1-antitrypsin deficiency, luetic arteritis.

Clinical Features

1. **Pain** (important symptom that helps to diagnose this cause of brain ischemia!!!):

**carotid dissections** → ipsilateral throbbing headache (forehead, eye, face), intense local sharp pain in neck.

**vertebral dissections** → pain in occiput, posterior neck.

1. **Ischemia** – TIAs (due to luminal compromise), stroke (due to embolization within first few days).

Arterial dissection is important cause of ischemic strokes in young people!

1. Other associated symptoms:
   1. Horner syndrome (in carotid dissection)

N.B. in ICA dissection Horner syndrome is ***incomplete*** – sympathetic fibers to face sweat glands and blood vessels travel along ECA (esp. to lower face) [see p. Eye19 >>](http://www.neurosurgeryresident.net/Eye.%20Ophthalmology\Eye19.jpg)

* 1. self-audible bruits (but auscultation is poor screening tool)
  2. tenderness over neck
  3. pulsatile tinnitus.

Complications

- if dissection extends between media and adventitia:

1. ***dissecting aneurysms*** → space-occupying lesions (compress adjacent cranial nerves, brain parenchyma), SAH. [see p. Vas25 >>](http://www.neurosurgeryresident.net/Vas.%20Vascular\Vas25.%20Aneurysms,%20SAH.pdf)
2. ***tears through adventitia*** → SAH.

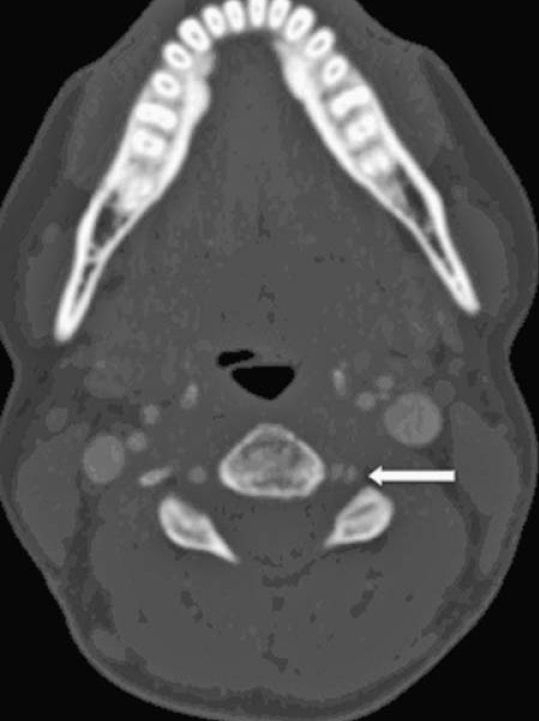
Diagnosis

**CT** / **MRI** can directly visualize intramural bleeding and expansion.

* MRI *after few days* - rim of high signal (subacute intramural hematoma) expanding outer diameter of artery and narrowing its lumen.
* MRI *in acute stage* - intramural hematoma is isointense to muscle - difficult to detect.

**CTA** – most reliable noninvasive diagnosis!

Left vertebral artery intimal flap (*arrow*) secondary to vertebral artery dissection:



**Ultrasound** - reliable screening tool:

**B-mode ultrasound** - tapering of ICA lumen, irregular membrane crossing lumen, true and false lumens.

**Duplex scans** - decreased pulsatility, intravascular abnormal echoes, decreased flow.

**TCD** - effect of neck pathology on poststenotic intracranial circulation:

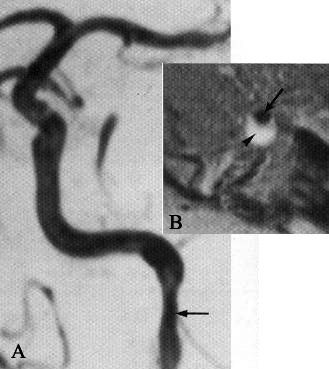
Diminished intracranial velocities in young patients who have normal ICA bifurcations → diagnosis of dissection is quite likely.

**MRA** - reliable noninvasive diagnosis for extracranial ICA.

ICA dissection (3D TOF MRA):

A. Focal narrowing as ICA enters skull base (*arrow*).

B. Axial image through that level - flow void in residual vessel lumen (*arrow*) and high signal crescent, which represents intramural hematoma (*arrowhead*).



Conventional **angiography** (more useful for VA);

* regions of *severe narrowing* ("string sign") or *total occlusion* beginning > 2 cm distal to ICA origin, sparing siphon, and having gradually tapering segment.
* aneurysmal sacs or outpouchings.

Any *trauma patient* having focal neu­rological deficits (esp. with Horner's syndrome) that cannot be explained from imaging studies → early angiography to diag­nose carotid artery dissection!

Treatment

Most extracranial dissections ***heal spontaneously***!

* if *complete occlusion* has occurred, arteries often do not recanalize.
* arteries that *retain some residual lumen* invariably heal and become normal.

**Anticoagulants** / **Antiplatelets** shortly after dissection should prevent stroke;

N.B. risk of embolization exists *only during acute period*! TIAs often precede infarction, leaving time for therapeutic intervention!

* do not seem to increase extent of dissection.
* heparin → warfarin is continued until lumen is not severely compromised (e.g. for 3-24 months; target INR 2-3) → **antiplatelet agents** for at least 2 years.
* anticoagulation is contraindicated in intracranial dissections complicated by SAH.

Surgical repair indications:

* 1. SAH
  2. persistent high-grade (s. flow-limiting) stenosis
* location high in neck makes surgical carotid repair difficult.

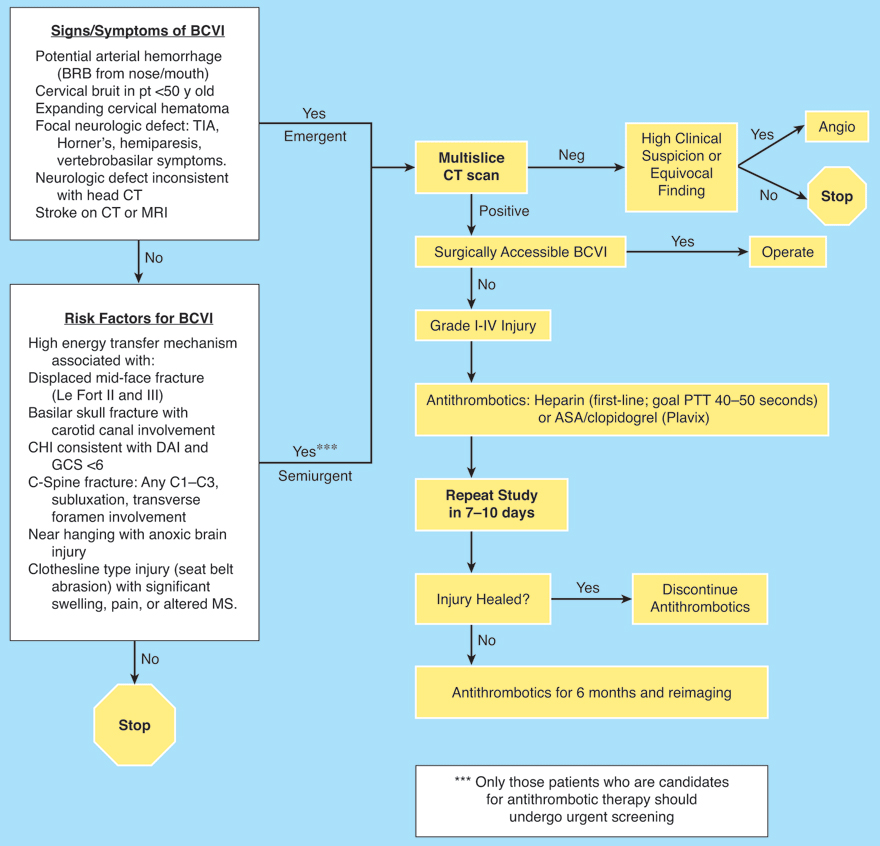
***Endovascular stenting*** is a modern option.

* stenting in mobile neck carries the risk of stent fracture (cf. intracranial stenting or stenting VA ostia – much less vessel movement); solution might be a softer stent (e.g. pipeline).
* carotid dissections:

with complete occlusion - observation (continue ASA for life)

with slight contrast wisp (high grade stenosis):

* 1. high intracranial - do not touch it if brain is well perfused (risk of even slightest dissection extension and may occlude PComA ostia --> massive stroke); if brain hypoperfused - document it with pCT and proceed with stenting
  2. low in neck (proximal) - OK to stent (e.g. pipeline)
* indications for carotid dissection stenting:
  + - worsening exam on antiplatelets
    - worsening pseudoaneurysm on repeat angio
    - brain perfusion asymmetry on angio (i.e. flow limiting dissection)



Bibliography for ch. “Neurovascular Disorders” → follow this [link >>](http://www.neurosurgeryresident.net/Vas.%20Vascular\Vas.%20Bibliography.pdf)

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