Don’t Look Back in A

author: leeminzhao
created: 20150713
updated: 20150717

Case 1 (JP Mc, 33yoM)

Context

- It’s five o’clock on a Wednesday
  - but not a teaching day like today
- The regular crowd shuffles in
  - an endless tide of category 4s and 5s
- There’s an old man in the waiting room
  - withdrawing from his tonic and gin

Case 1 (JP Mc, 33yoM)

- Triage [1725]
  - 1 month [syndrome]
  - 2 weeks of tonic-clonic 10-30 s seizures while lying supine at night
  - currently
    - Miami J collar in situ
    - GCS 15
    - no dizziness or headache
    - no ataxia
- Category? Zone?

Case 1 (JP Mc, 33yoM)

- Triage [1725]
  - 1 month [syndrome]
  - 2 weeks of tonic-clonic 10-30 s seizures while lying supine at night
  - currently
    - Miami J collar in situ
    - GCS 15
    - no dizziness or headache
    - no ataxia

    BP 134/87 PEARL 5 mm
- Category? Zone?
  - cat 3 to ETA

Case 1 (JP Mc, 33yoM)

- Seen by doctor [2014]
  - Past 2 weeks, ? seizures
    - wife reports nocturnal episodes of shaking
    - initially left arm jerk => left leg => whole body
    - no tongue biting or incontinence
    - 10-30 seconds, frequency increasing up to 4-5 /night
  - Why can't I wake up with you[1]?
    - unresponsive during episodes, difficult to rouse afterwards
    - also occur while patient is sleeping
    - no episodes during daylight hours

1. Barlow G, Donald H, Owen M, Orange J, Williams R. 1993.

Case 1 (JP Mc, 33yoM)

- Other history
  - Medical
    - Anxiety => fluoxetine 20 mg po bd
    - First presented with [syndrome] 1 month ago
      => aspirin 100 mg po mane
    - No previous hospital record
    - No recent infective symptoms; no headache
  - NKDA
  - Functional / Social
    - Lives with partner
    - Occasional ethanol use
    - No tobacco or other substance use
    - Works as packer (previously forklift driver)

Case 1 (JP Mc, 33yoM)

- Examination
  - Appears well, alert, orientated
  - Normal vital signs
  - Chest clear; heart sounds dual
  - Abdomen soft, nontender
  - Cranial nerves normal; no nystagmus
  - Upper and lower limbs: normal tone, power, reflexes, sensation
- Impression?
- Plan?

Turn Back Time[1]

- 4 weeks ago...

1. Nystrøm L, Dif R, Rasted S, Norreen C. 1998.

Case 1 (JP Mc, 33yoM)

- Pre-arrival call (GP to ED x50000)
  - Painless dizziness on turning head to left /52
  - Decreased sensation left hand

Case 1 (JP Mc, 33yoM)

- Pre-arrival call (GP to ED x50000)
  - Painless dizziness on turning head to left /52
  - Decreased sensation left hand
- Triage [1810]
  - Pt sent here from GP 3/52 hx of feeling dizzy and nausea when he turns his head to left
  - nil changes to habits last 3/52 nil trauma
  - non distressed, pink perfused, equal limb strength
  - pmhx nil, nka

Case 1 (JP Mc, 33yoM)

- Category? Zone?

- Triage [1810]
  - Pt sent here from GP 3/52 hx of feeling dizzy and nausea when he turns his head to left
  - nil changes to habits last 3/52 nil trauma
  - non distressed, pink perfused, equal limb strength
  - pmhx nil, nka

Case 1 (JP Mc, 33yoM)

- Category? Zone?
  - cat 3
  - to ETA
- Triage [1810]
  - Pt sent here from GP 3/52 hx of feeling dizzy and nausea when he turns his head to left
  - nil changes to habits last 3/52 nil trauma
  - non distressed, pink perfused, equal limb strength
  - pmhx nil, nka

RR 15 SO2 99 HR 68 BP 135/86

Case 1 (JP Mc, 33yoM)

- Seen by doctor [1944]
  - Past 2-3 weeks, recurrent episodes of syncope and presyncope when turning head to left
    - darkening of vision and rushing noise when episodes occur
    - straightening head resolves symptoms
    - asymptomatic at other times

Case 1 (JP Mc, 33yoM)

- Seen by doctor [1944]
  - Past 2-3 weeks, recurrent episodes of syncope and presyncope when turning head to left
    - darkening of vision and rushing noise when episodes occur
    - straightening head resolves symptoms
    - asymptomatic at other times
  - Occasional mild banding pain, neck to head, but not temporally associated with other symptoms
  - No palpitations, chest pain, dyspnoea
  - No recent febrile illness, no long-distance travel
  - Has not been wearing overly tight collars
  - No history of trauma

Case 1 (JP Mc, 33yoM)

- Examination
  - Appears quite well, mobilises freely
  - Chest clear; heart sounds dual
  - Abdomen soft, nontender
  - Cranial nerves normal; no nystagmus; no scalp or temporal tenderness; no bruits
  - Upper and lower limbs: normal tone, good power, subtle reflexes but all symmetrical
  - Absolutely refuses to turn head to left, resists passive movement with fearful anticipation
- Impression? Plan?

Case 2 (Jo Al, 40yoM)

- Friday morning...

Case 2 (Jo Al, 40yoM)

- Friday morning...
- Triage [0718]
  - Profusely diaphoretic and dizzy this morning for unknown reason, unsteady gait
- Category? Zone?

Case 2 (Jo Al, 40yoM)

- Friday morning...
- Triage [0718]
  - Profusely diaphoretic and dizzy this morning for unknown reason, unsteady gait
- Category? Zone?
  - cat 2
  - to resus

Case 2 (Jo Al, 40yoM)

- Seen by doctor [0758]
  - Sudden onset vertigo on waking at 0630
    - direction right to left
  - Profuse diaphoresis
  - Hearing loss to right ear, no tinnitus
  - Numbness right side of face
  - Tried to go to bathroom, unstable gait and feeling extremely nauseated; dry retching

Case 2 (Jo Al, 40yoM)

- Seen by doctor [0758]
  - Recently developed headache
    - occipital to temporal, including sore ears
    - past 6 days, fluctuating 4/10 to 8/10
    - suddenly worse 3 days ago
    - unrelieved by paracetamol / codeine
  - Attended GP when headache worsened
    - BP 170/sys
    - commenced candesartan 8 mg po mane
    - sent for renal USS and MRI brain
  - No recent febrile illness
  - No chest pain or dyspnoea

Case 2 (Jo Al, 40yoM)

- MRI brain 3 days ago
  - non contrast
  - no intracranial signal abnormality or mass lesion
  - mild left anterior ethmoidal sinus opacification
  - chronic scarring involving the subcutaneous tissue superficial to the left occipital bone, presumably post-traumatic and longstanding

Case 2 (Jo Al, 40yoM)

- Other history
  - Medical
    - nil
    - No previous hospital record (first presentation)
  - NKDA
  - Functional / Social
    - Lives with partner
    - Significant ethanol use (“a few bottles of wine” each week)
    - Occasional tobacco use
    - From New Zealand

Case 2 (Jo Al, 40yoM)

- Examination
  - Appears unwell, diaphoretic, pale
  - RR 20; SO2 96/RA; BP 126/86; HR 89; T 37.6
  - Chest clear; heart sounds dual
  - Abdomen soft, nontender
  - Cranial nerves: reduced hearing on right
  - Limbs: normal tone, power, sensation
  - Unable to stand due to nausea
  - Head impulse => horizontal nystagmus on right
- Impression? Plan?

Case 3 (He Da, 42yoF)

- Monday afternoon

Case 3 (He Da, 42yoF)

- Triage [1709]
  - ongoing migraine with aura for 2 weeks
  - altered sensation to left side
  - states has had intermittent slurred speech
  - seen at BDH 2 days ago for same; had MRI today
  - equal limb strength; PEARL 4+
  - history of migraines
- Category? Zone?

Case 3 (He Da, 42yoF)

- Triage [1709]
  - ongoing migraine with aura for 2 weeks
  - altered sensation to left side
  - states has had intermittent slurred speech
  - seen at BDH 2 days ago for same; had MRI today
  - equal limb strength; PEARL 4+
  - history of migraines

  HR 98 SO2 98% BP 126/78 T 36.6
- Category? Zone?
  - cat 2 to resus

Case 3 (He Da, 42yoF)

- Seen by doctor [1735]
  - Past 1 week, intermittent neurological symptoms
    - altered vision: lost vision in right eye; halo for 30 minutes
    - slurred speech at same time but no headache then
    - recurred with additional left forearm numbness and ataxia
    - symptoms completely resolve
  - Had MRI today (no report yet)
    - visual halo and slurred speech for 15-30 minutes
  - No vomiting or seizure activity
  - No palpitations, chest pain, dyspnoea
  - No recent febrile illness

Case 3 (He Da, 42yoF)

- Seen by doctor [1735]
  - Previous migraines
    - usually left frontal
    - associated with scintillating scotomas
    - resolve with paracetamol / codeine

Case 3 (He Da, 42yoF)

- Other history
  - Medical
    - Hypothyroid => thyroxine
    - Migraine
    - One previous SLHD attendance on record: UTI
  - Allergies / reactions
    - MSG => migraine
  - Functional / Social
    - Lives with husband and 3 children
    - Works in HR at a large company
    - No ethanol or tobacco use

Case 3 (He Da, 42yoF)

- Examination
  - Appears well, but anxious and teary
  - Normal speech and gait
  - Chest clear; heart sounds dual
  - Abdomen soft, nontender
  - Cranial nerves normal; no facial asymmetry; no nystagmus; normal visual acuity and fields
  - Upper and lower limbs: normal tone, power, reflexes; good coordination
- Impression? Plan?

Summary

- JP Mc, 33yoM
  - Forklift driver
  - Syncope with head movement
  - Mild headache
  - Minimal past history
  - Examination mostly unremarkable
  - Terrified of head movement
- Jo Al, 40yoM
  - New Zealander
  - Sudden, severe vertigo and right hearing loss
  - Significant headache
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination confirms vertigo
- He Da, 42yoF
  - Mother of three
  - Intermittent visual / ophthalmic deficits, dysarthria, left upper limb weakness / ataxia
  - Known previous migraines
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination mostly unremarkable

Differential Diagnoses

- Syncope
  - Cardiac
  - Vasovagal
  - Orthostatic

Differential Diagnoses

- Syncope *with head movement*
  - Cardiac
  - Vasovagal
  - Orthostatic
  - *Cerebral arterial insufficiency*
  - *Carotid sinus syndrome (tight collar syndrome)*

(consider but contrast to)

- Seizure

  ... as seen earlier!

Summary

- JP Mc, 33yoM
  - Forklift driver
  - Syncope with head movement
  - Mild headache
  - Minimal past history
  - Examination mostly unremarkable
  - Terrified of head movement
- Jo Al, 40yoM
  - New Zealander
  - Sudden, severe vertigo and right hearing loss
  - Significant headache
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination confirms vertigo
- He Da, 42yoF
  - Mother of three
  - Intermittent visual / ophthalmic deficits, dysarthria, left upper limb weakness / ataxia
  - Known previous migraines
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination mostly unremarkable

Differential Diagnoses

- Vertigo and/or hearing loss
  - Peripheral
  - Central

Differential Diagnoses

- Vertigo and/or hearing loss
  - Peripheral
    - benign paroxysmal positional vertigo (no effect on hearing)
    - Meniere disease (hearing loss, tinnitus)
    - labrynthitis (hearing loss, tinnitus)
  - Central
    - vestibular migraine
    - epilepsy
    - vestibular neuritis
    - multiple sclerosis
    - brainstem tumour
    - brainstem ischaemia

Summary

- JP Mc, 33yoM
  - Forklift driver
  - Syncope with head movement
  - Mild headache
  - Minimal past history
  - Examination mostly unremarkable
  - Terrified of head movement

- Jo Al, 40yoM
  - New Zealander
  - Sudden, severe vertigo and right hearing loss
  - Significant headache
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination confirms vertigo

- He Da, 42yoF
  - Mother of three
  - Intermittent visual / ophthalmic deficits, dysarthria, left upper limb weakness / ataxia
  - Known previous migraines
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination mostly unremarkable

Differential Diagnoses

- Dysarthria and limb weakness
  - Stroke

  - Seizure
  - Sepsis / Delirium
  - Brain tumour
  - Metabolic disturbance

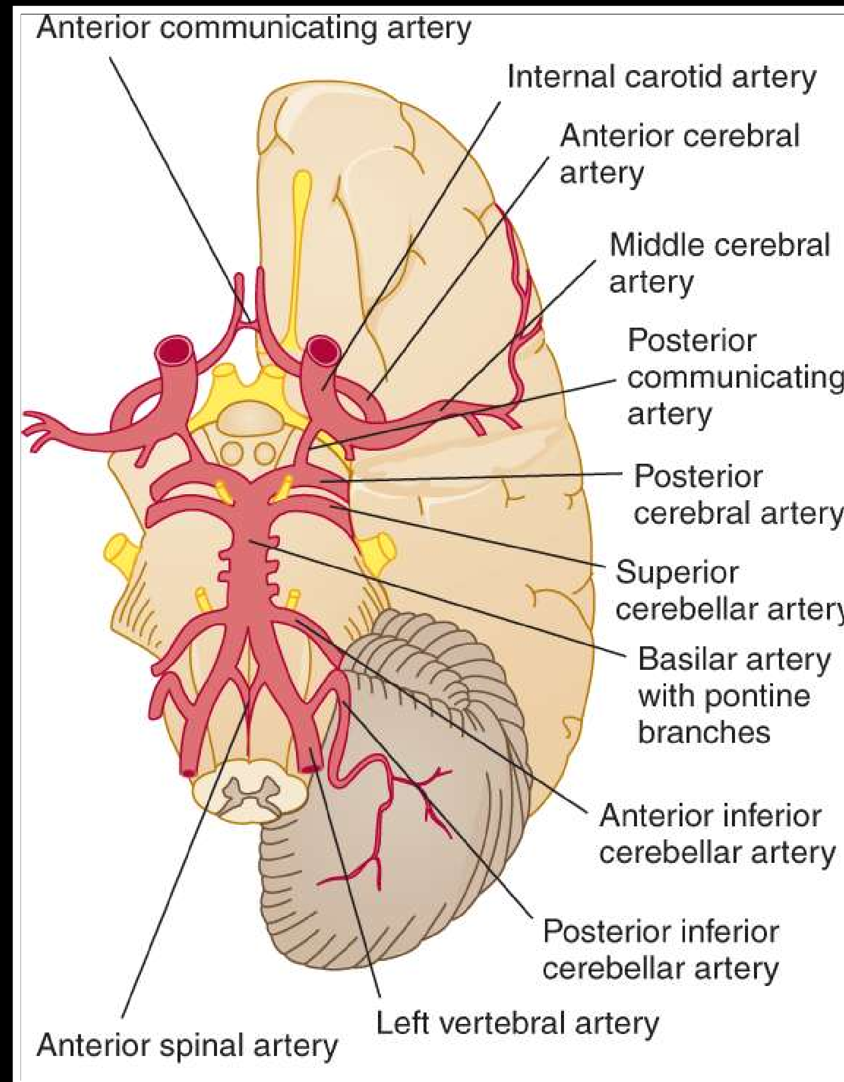
Differential Diagnoses

- Dysarthria and limb weakness
  - Stroke
    - cerebral ischaemia
    - haemorrhagic
  - Seizure
  - Sepsis / Delirium
  - Brain tumour
  - Metabolic disturbance

How are these connected?

- JP Mc, 33yoM
  - Forklift driver
  - Syncope with head movement
  - Mild headache
  - Minimal past history
  - Examination mostly unremarkable
  - Terrified of head movement
- Jo Al, 40yoM
  - New Zealander
  - Sudden, severe vertigo and right hearing loss
  - Significant headache
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination confirms vertigo
- He Da, 42yoF
  - Mother of three
  - Intermittent visual / ophthalmic deficits, dysarthria, left upper limb weakness / ataxia
  - Known previous migraines
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination mostly unremarkable

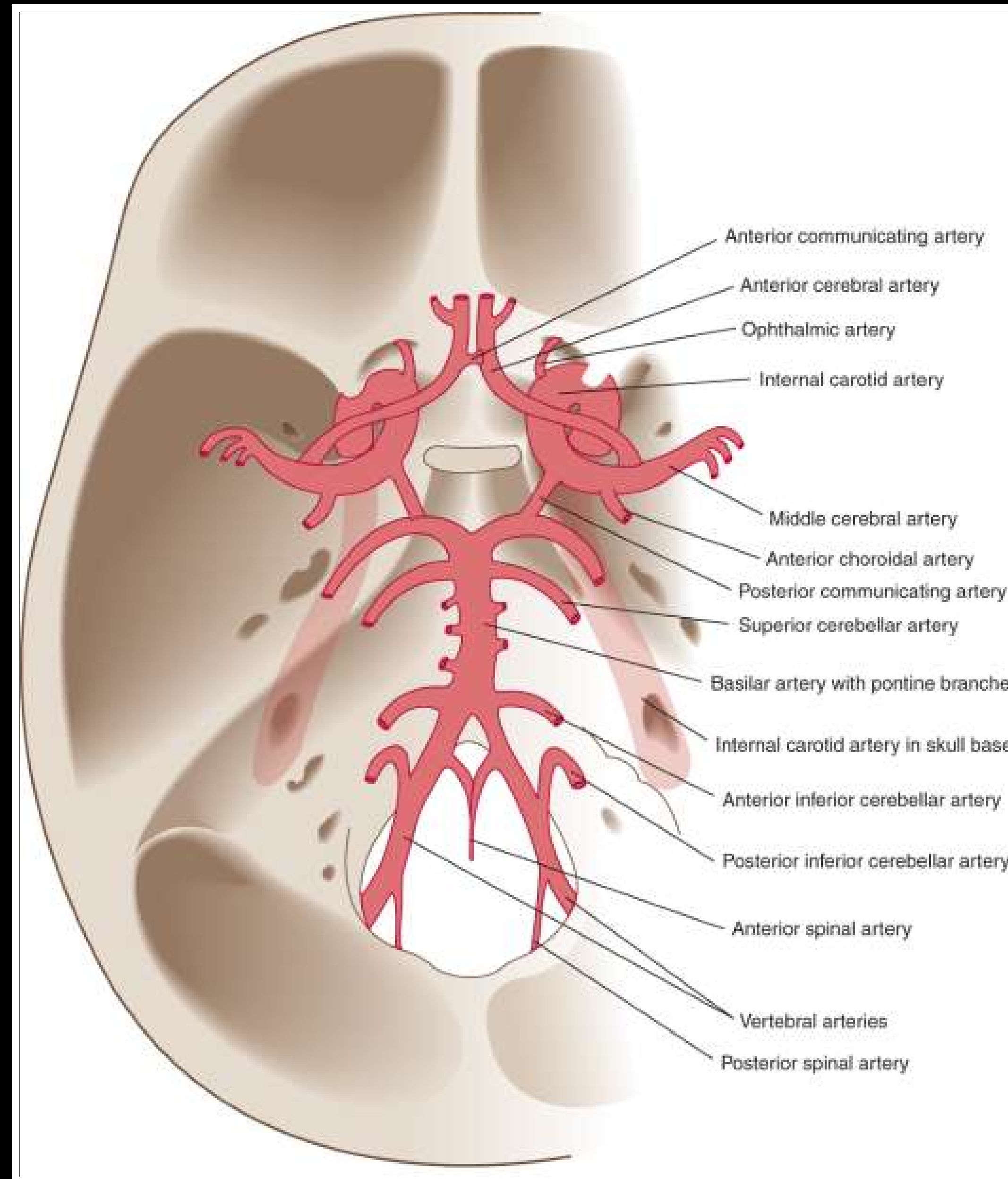
Circle of Life[1,2]



1. John E. 1994.
2. or Willis

Waxman SG: *Clinical Neuroanatomy: Twenty-Seventh Edition:* www.accessmedicine.com

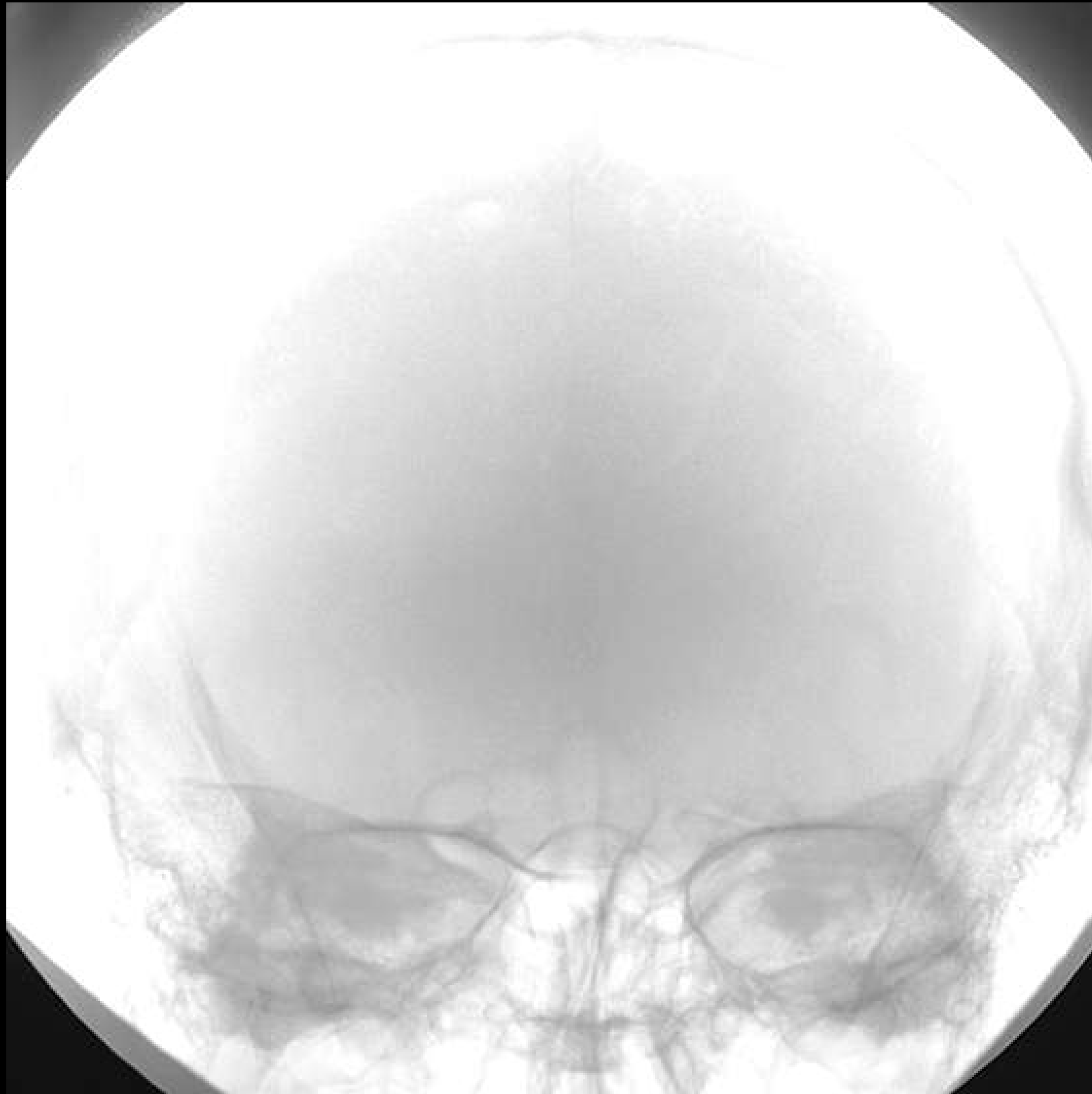
Circle of Life[1,2]



1. John E. 1994.
2. or Willis

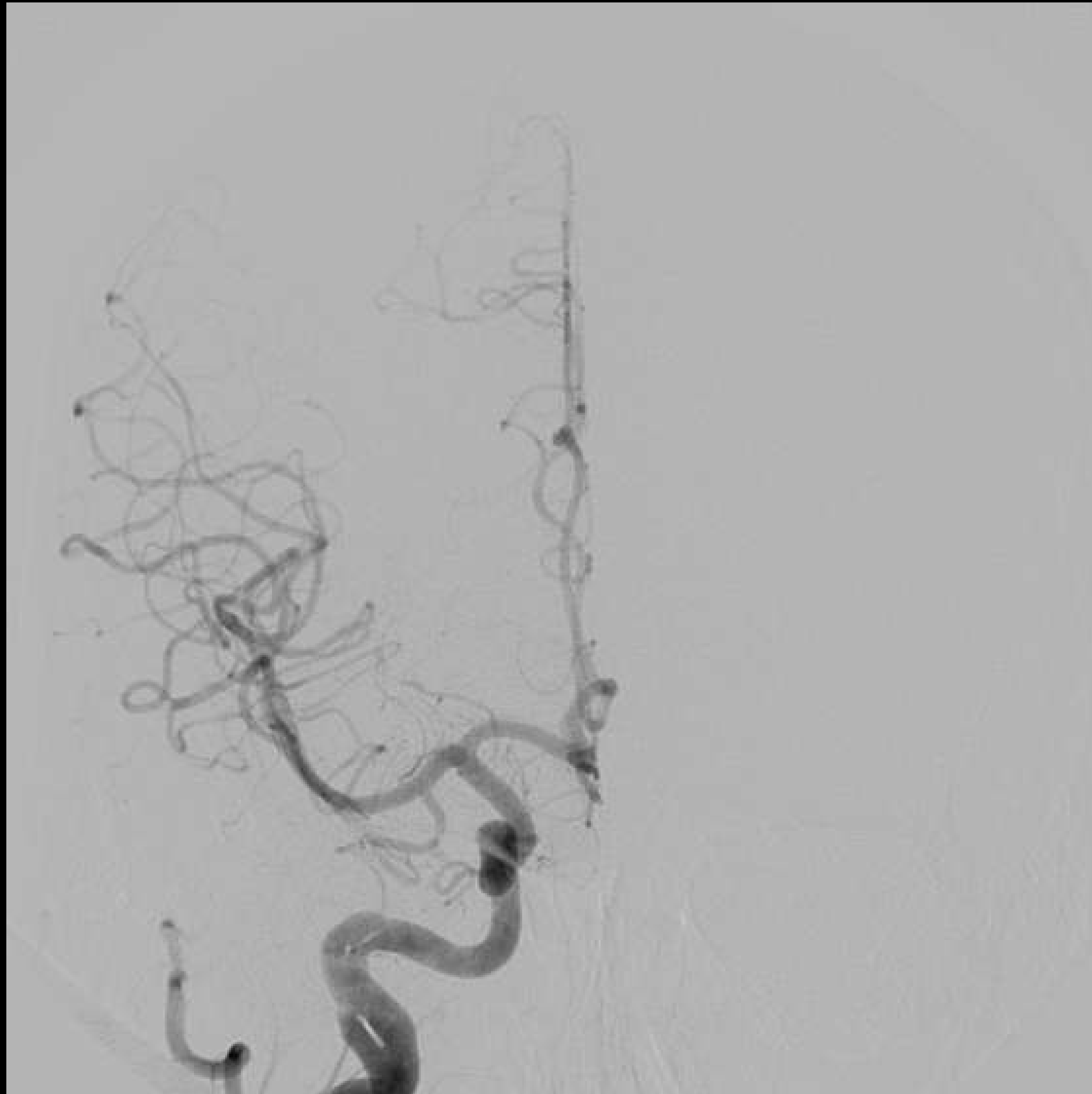
Waxman SG: *Clinical Neuroanatomy: Twenty-Seventh Edition:* www.accessmedicine.com

Limited Collateral Supply

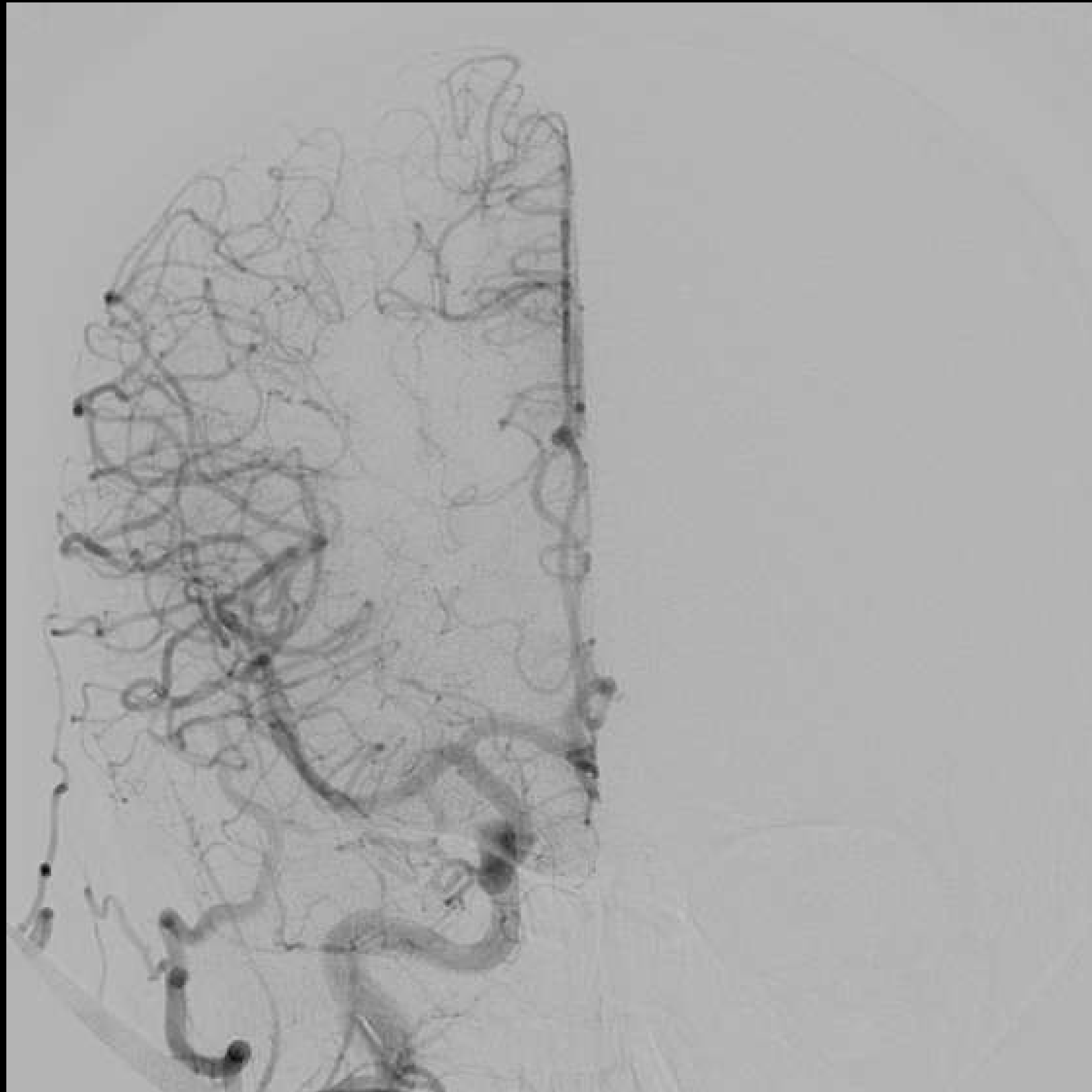


Limited Collateral Supply

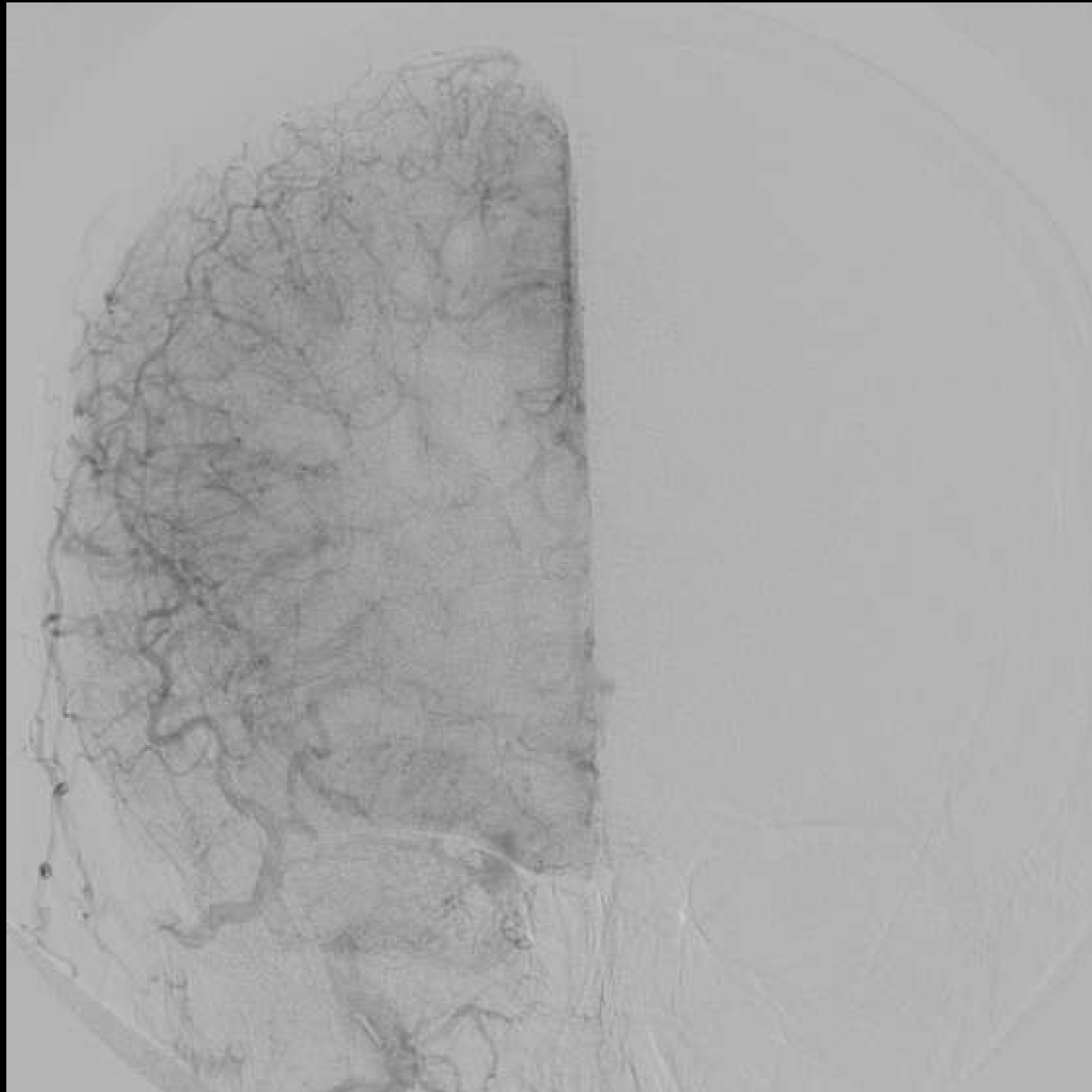
Limited Collateral Supply



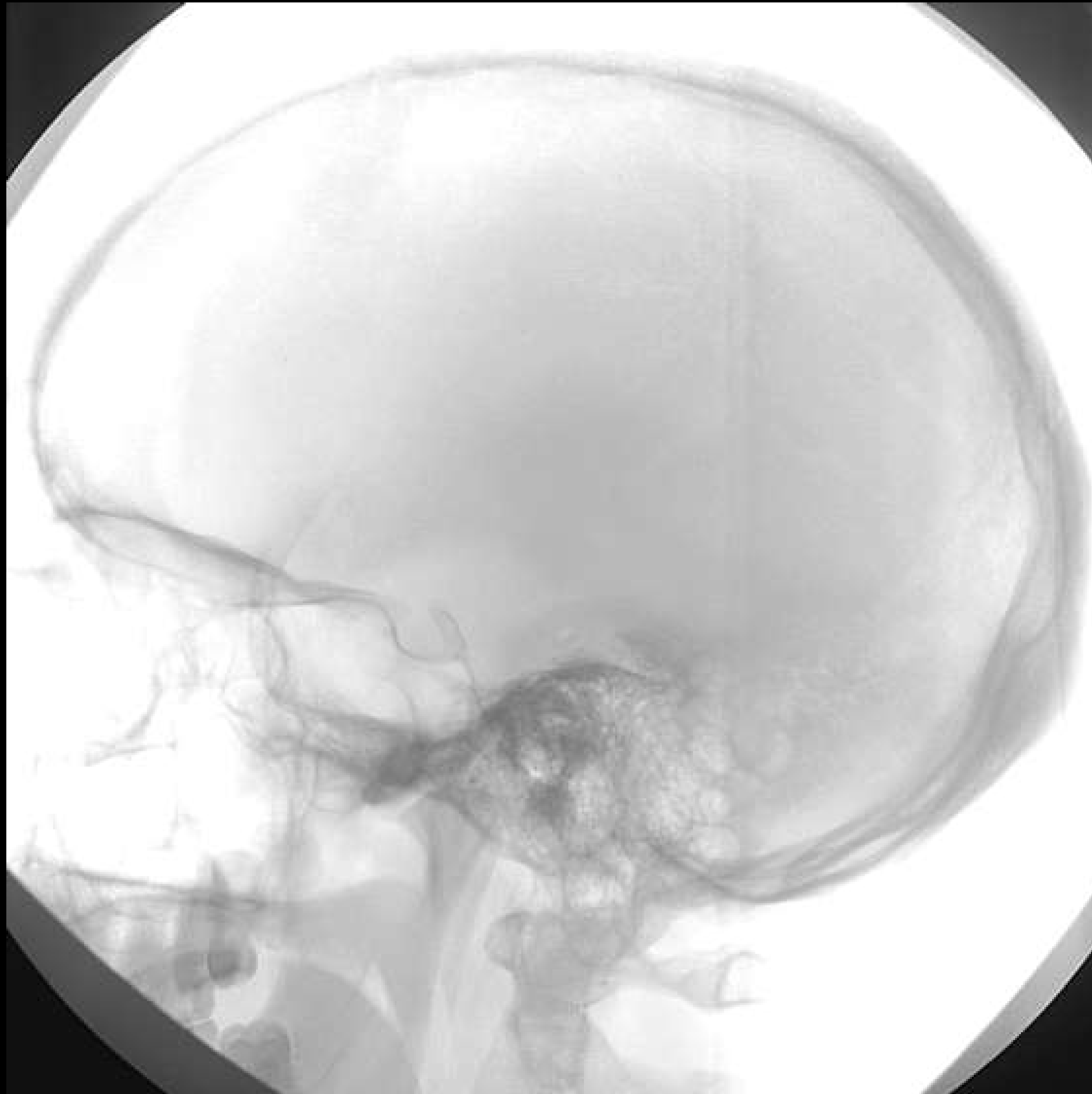
Limited Collateral Supply



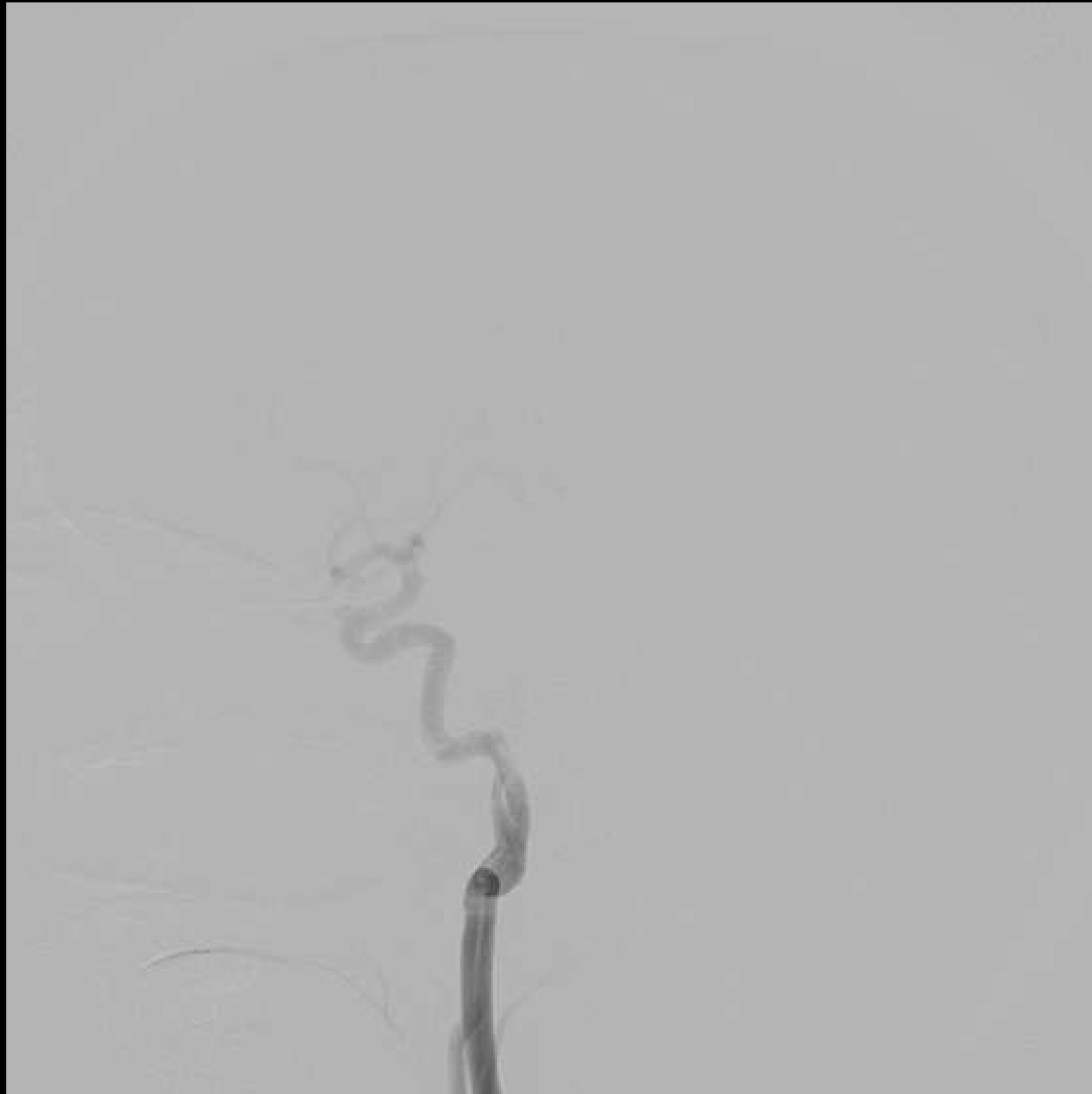
Limited Collateral Supply



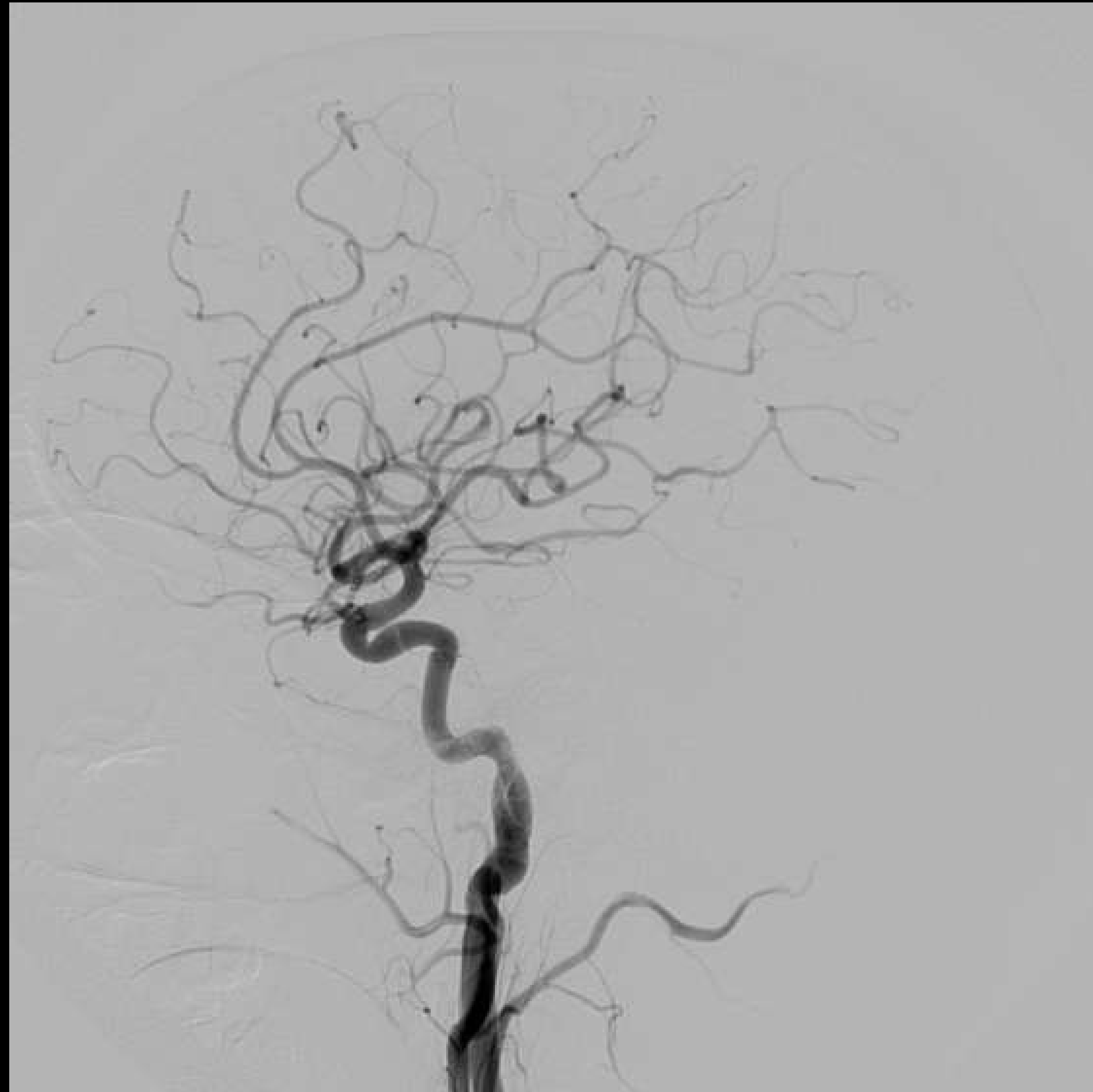
Limited Collateral Supply



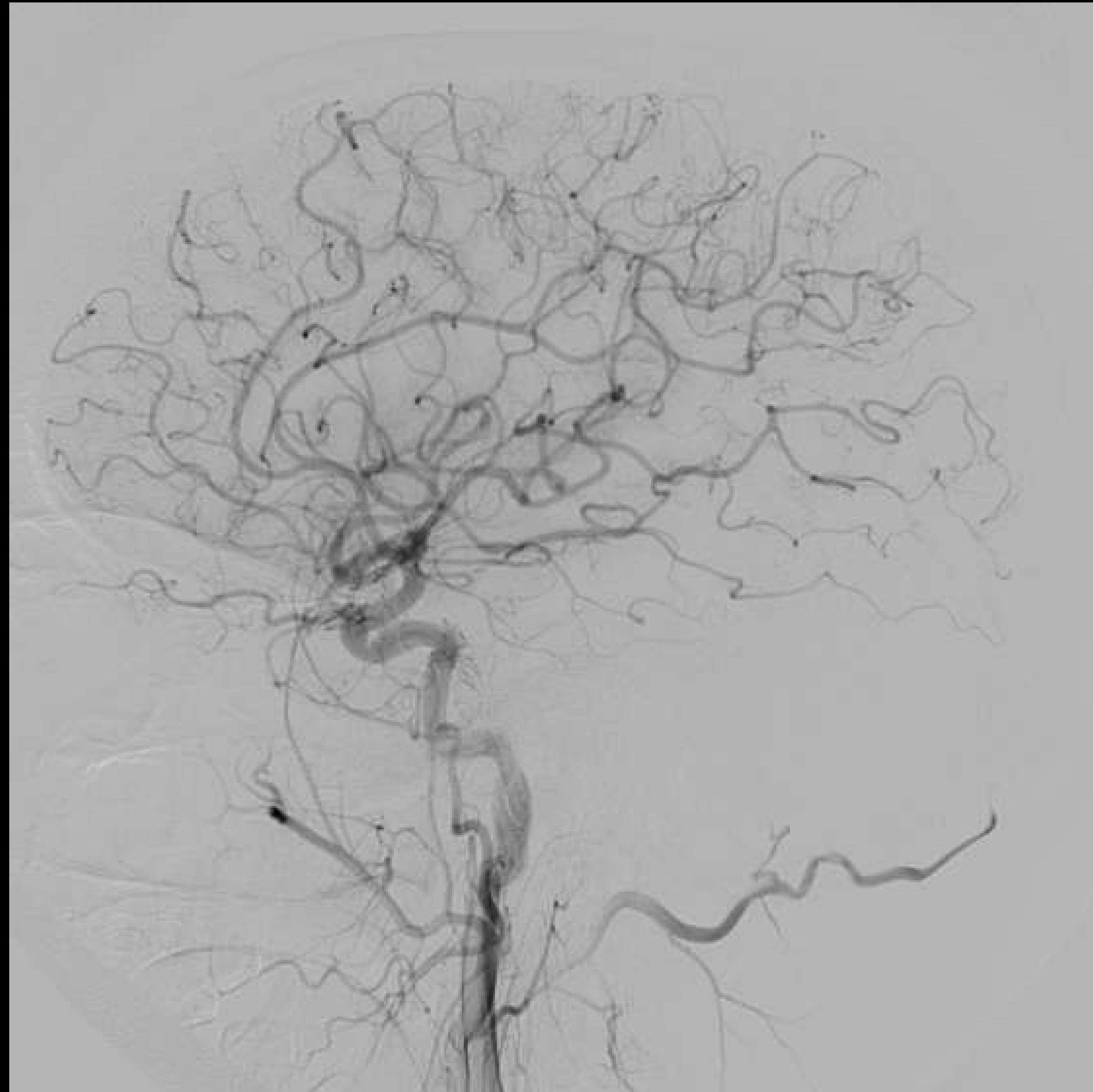
Limited Collateral Supply



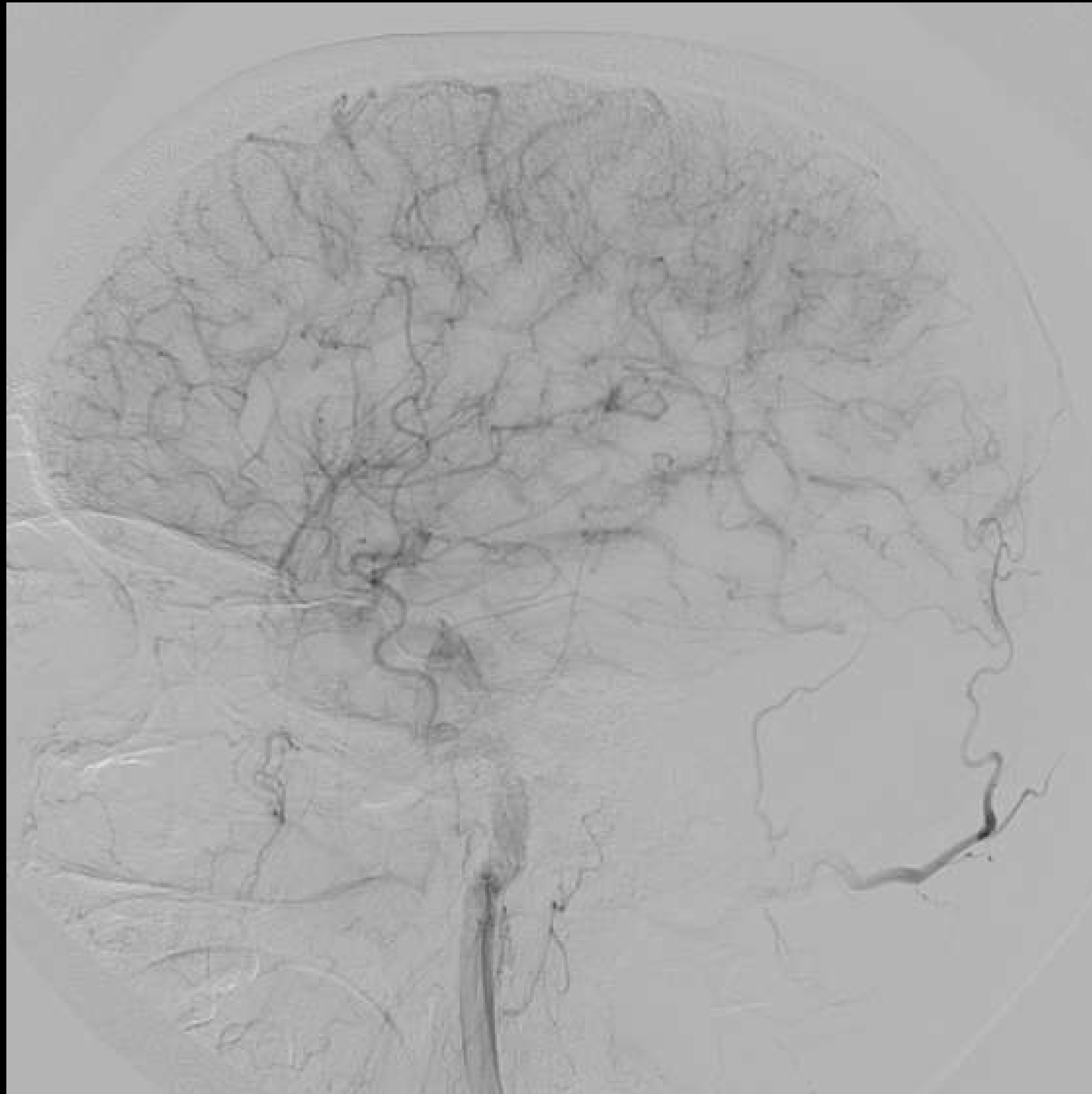
Limited Collateral Supply



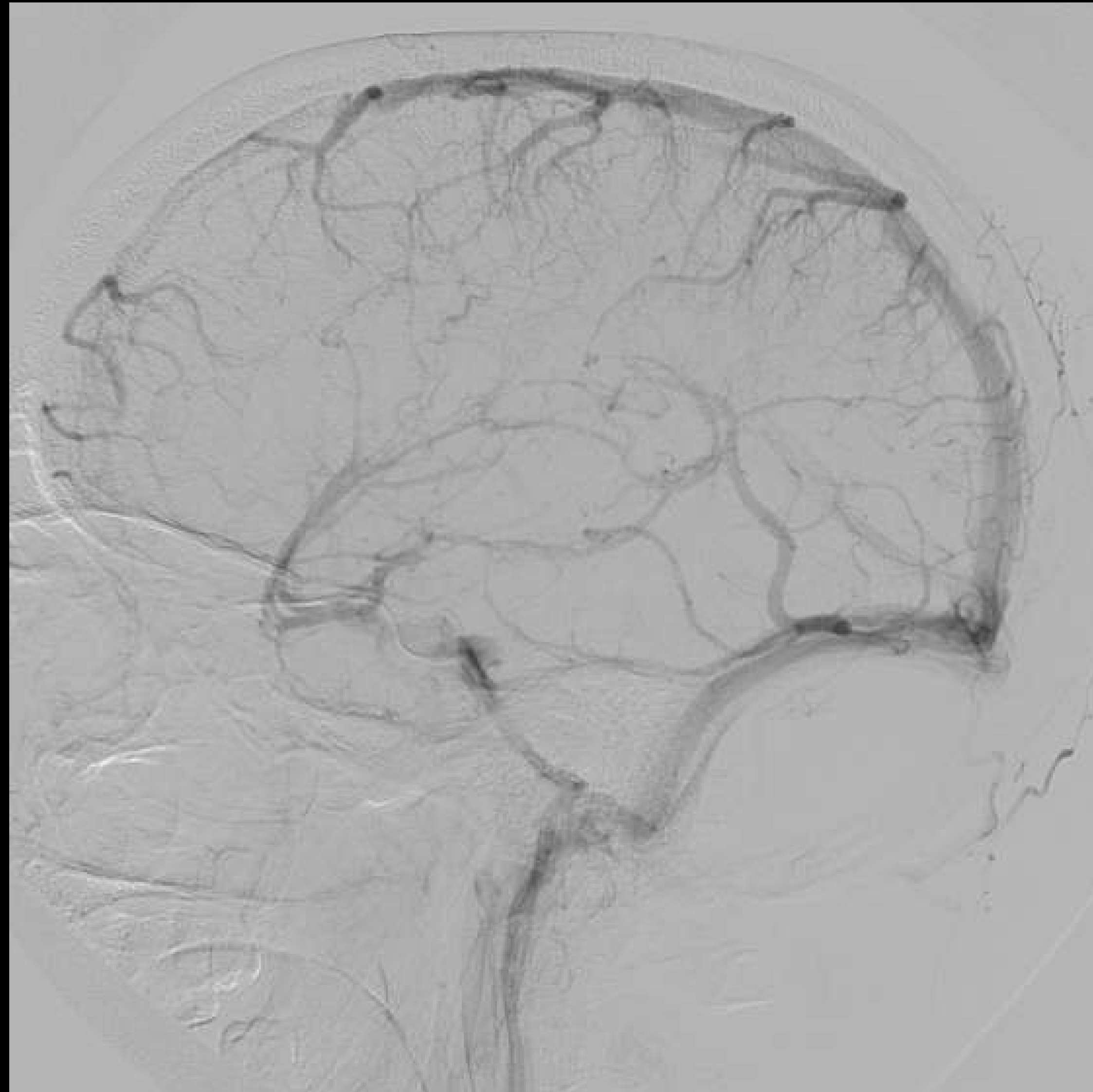
Limited Collateral Supply



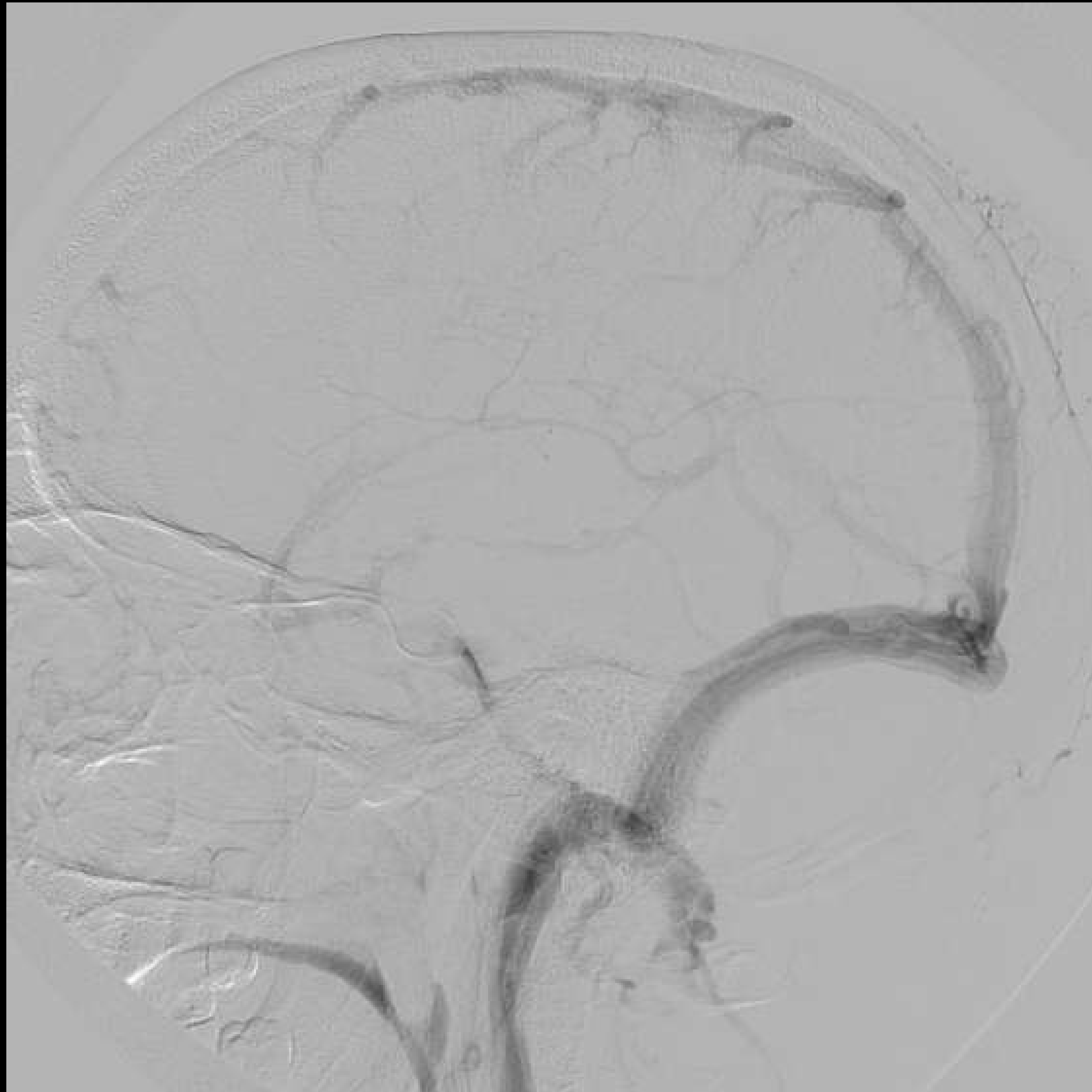
Limited Collateral Supply



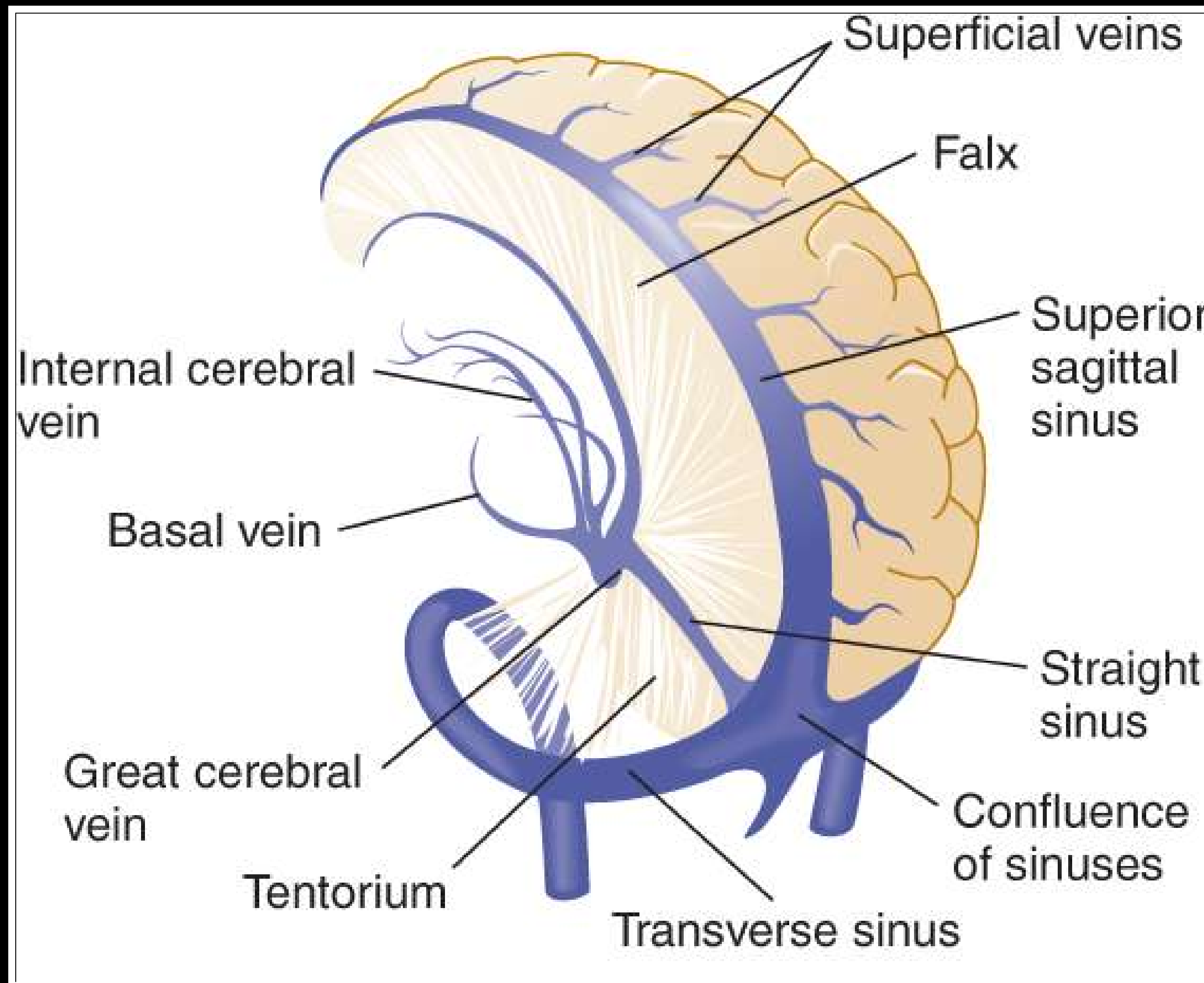
Limited Collateral Supply



Limited Collateral Supply



Venous Supply

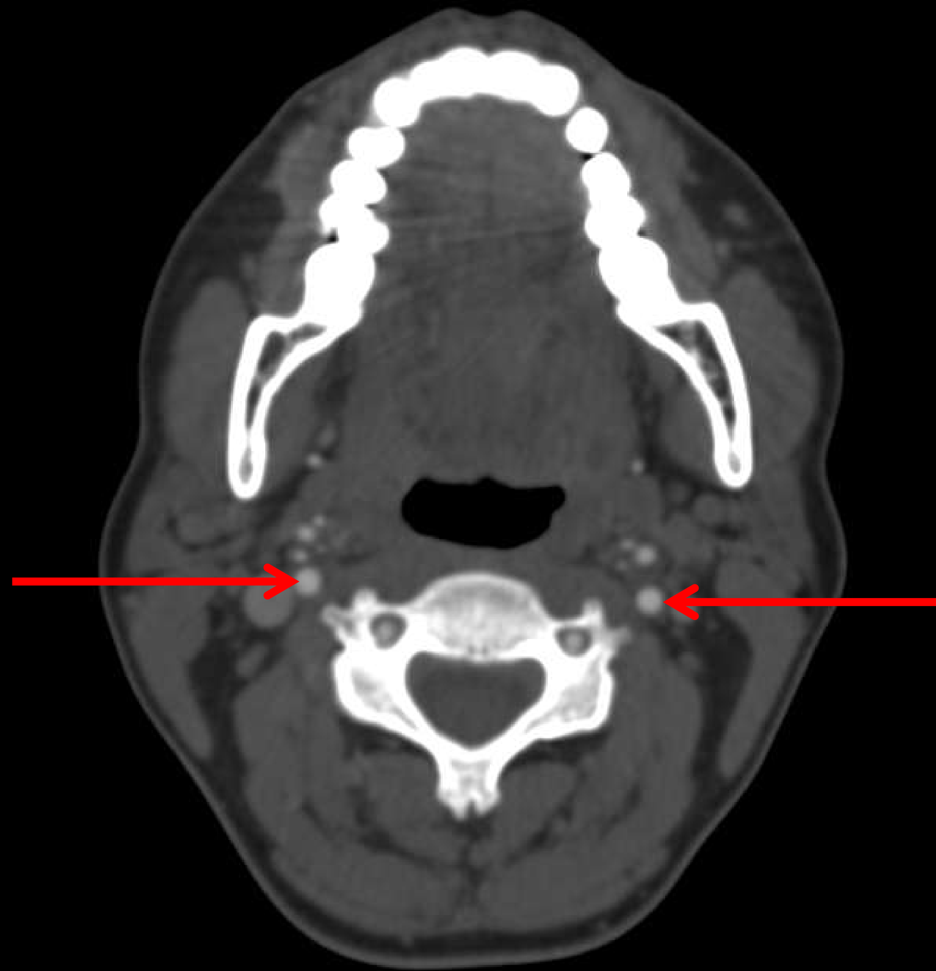


Waxman SG: *Clinical Neuroanatomy: Twenty-Seventh Edition:* www.accessmedicine.com

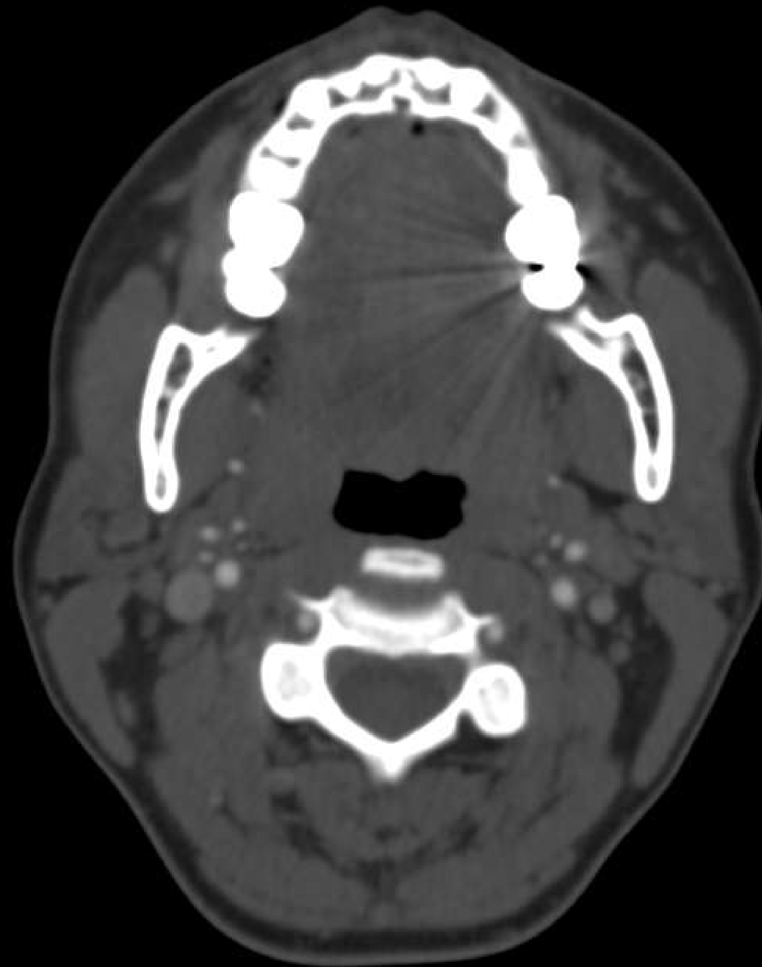
Back to the cases...

- JP Mc, 33yoM
  - Forklift driver
  - Syncope with head movement
  - Mild headache
  - Minimal past history
  - Examination mostly unremarkable
  - Terrified of head movement
- Jo Al, 40yoM
  - New Zealander
  - Sudden, severe vertigo and right hearing loss
  - Significant headache
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination confirms vertigo
- He Da, 42yoF
  - Mother of three
  - Intermittent visual / ophthalmic deficits, dysarthria, left upper limb weakness / ataxia
  - Known previous migraines
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination mostly unremarkable

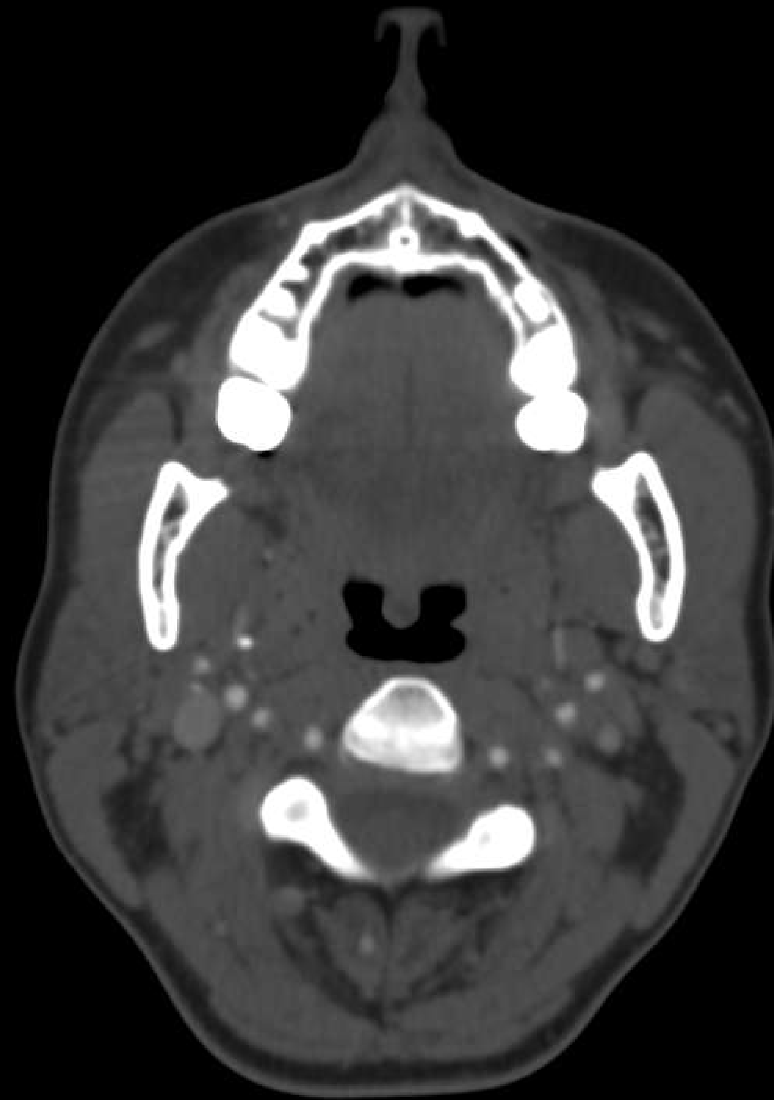
Case 3 (He Da, 42yoF)



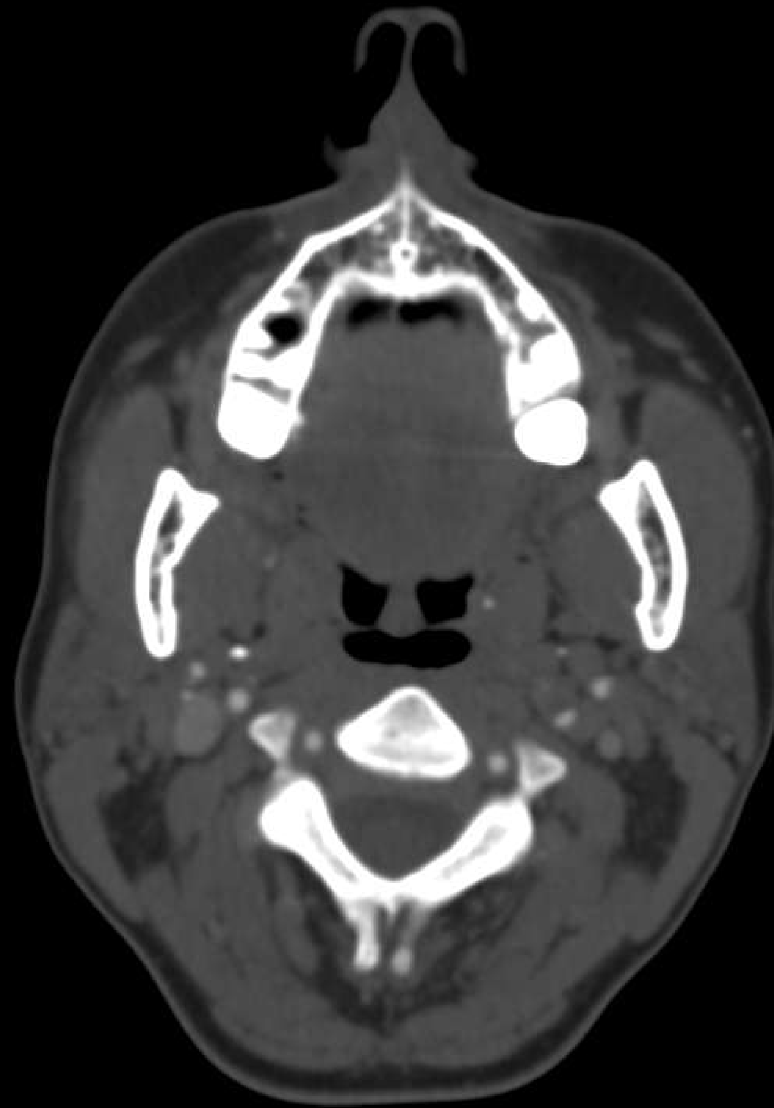
Case 3 (He Da, 42yoF)



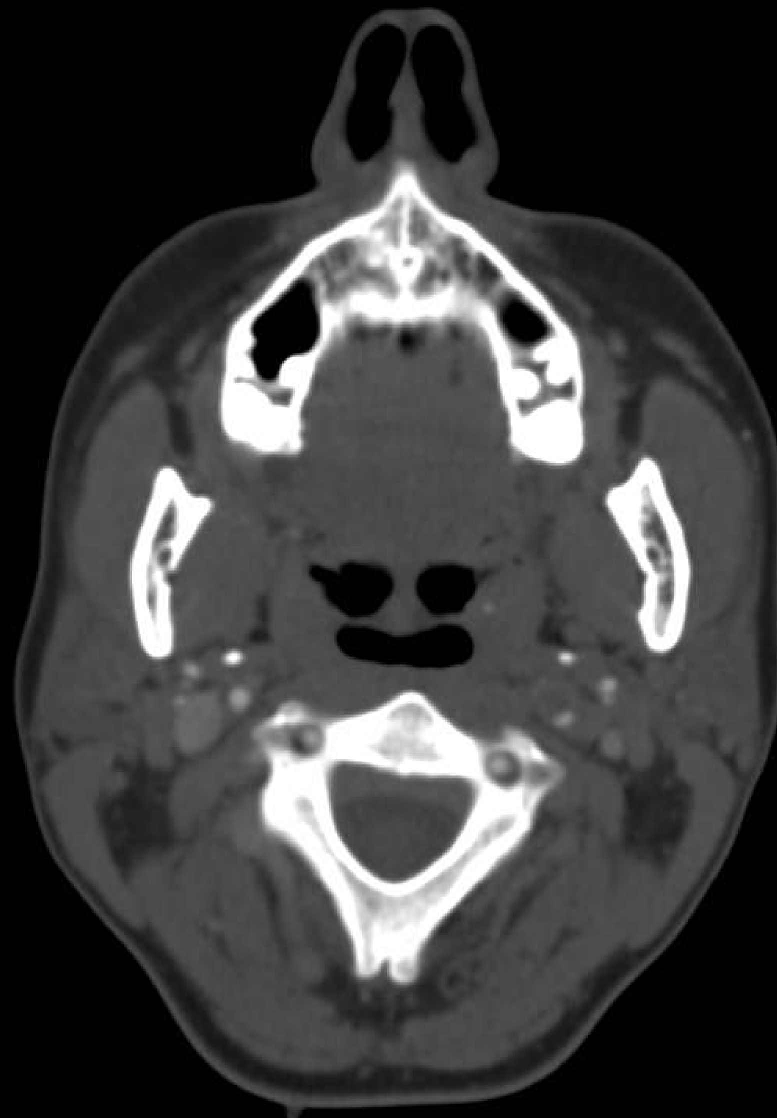
Case 3 (He Da, 42yoF)



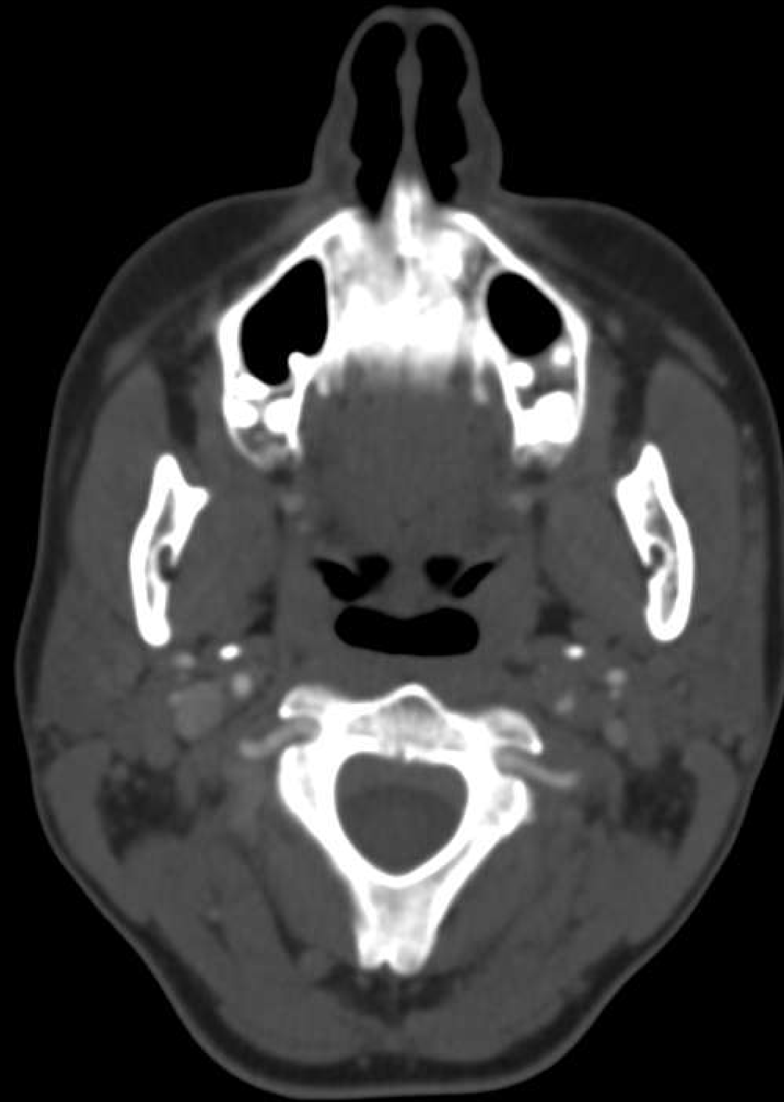
Case 3 (He Da, 42yoF)



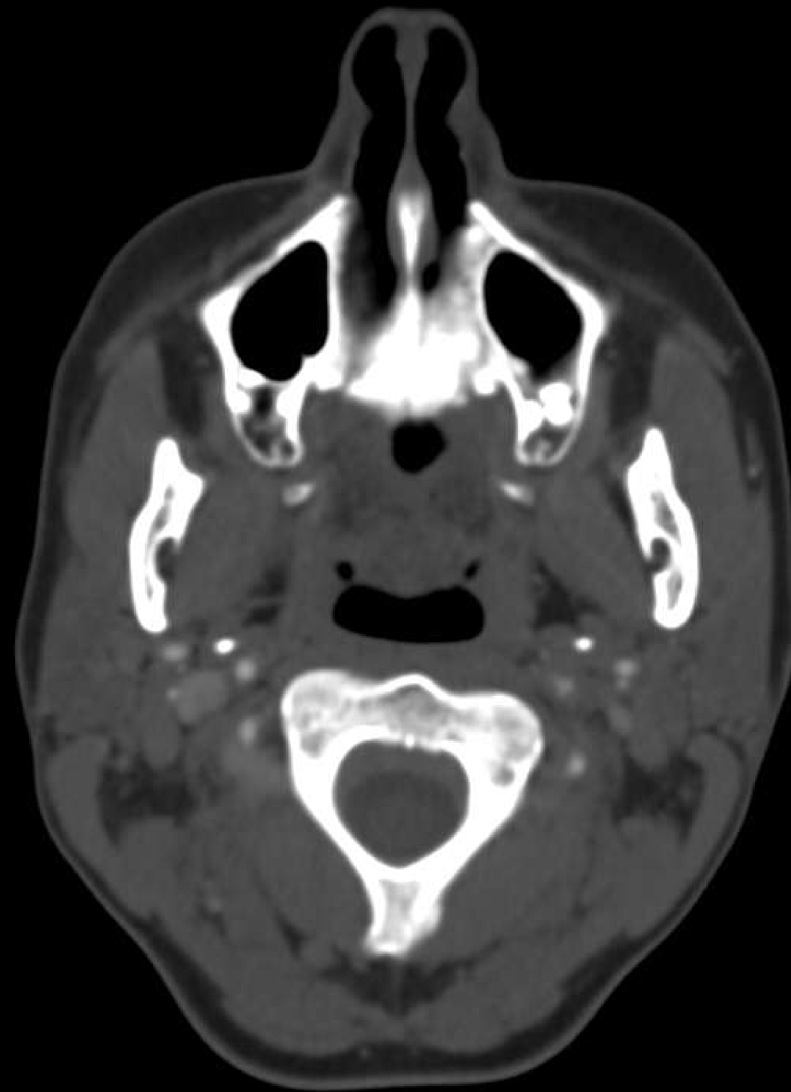
Case 3 (He Da, 42yoF)



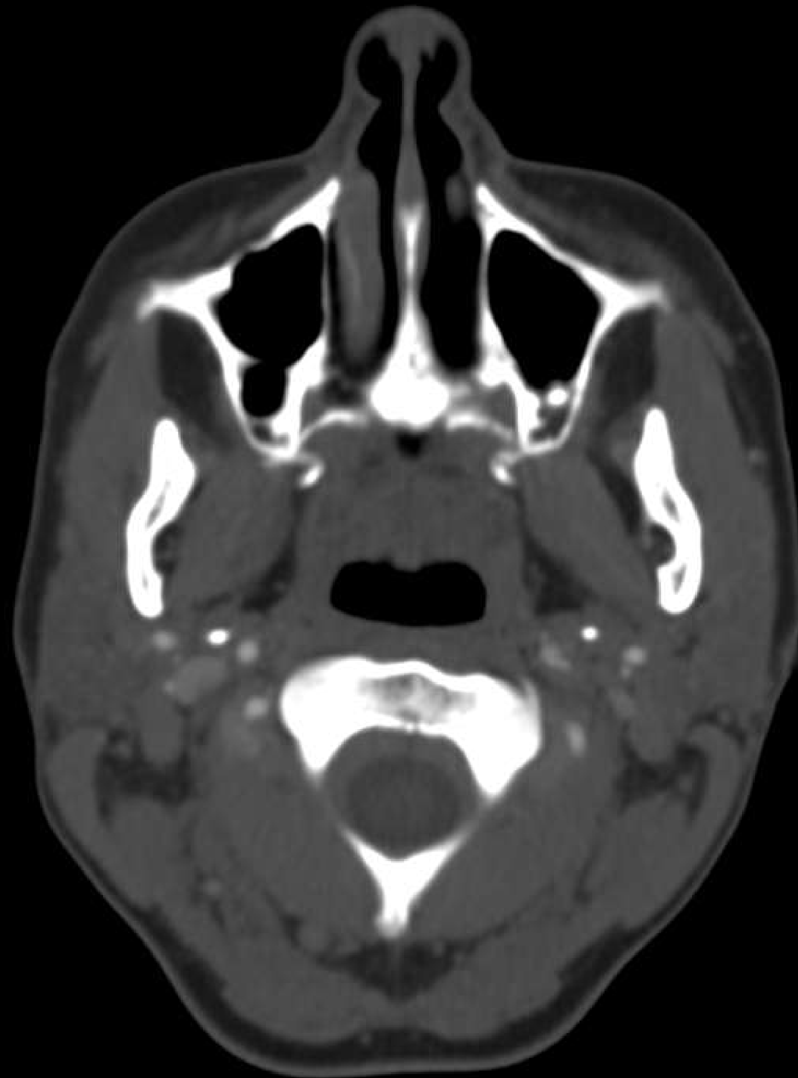
Case 3 (He Da, 42yoF)



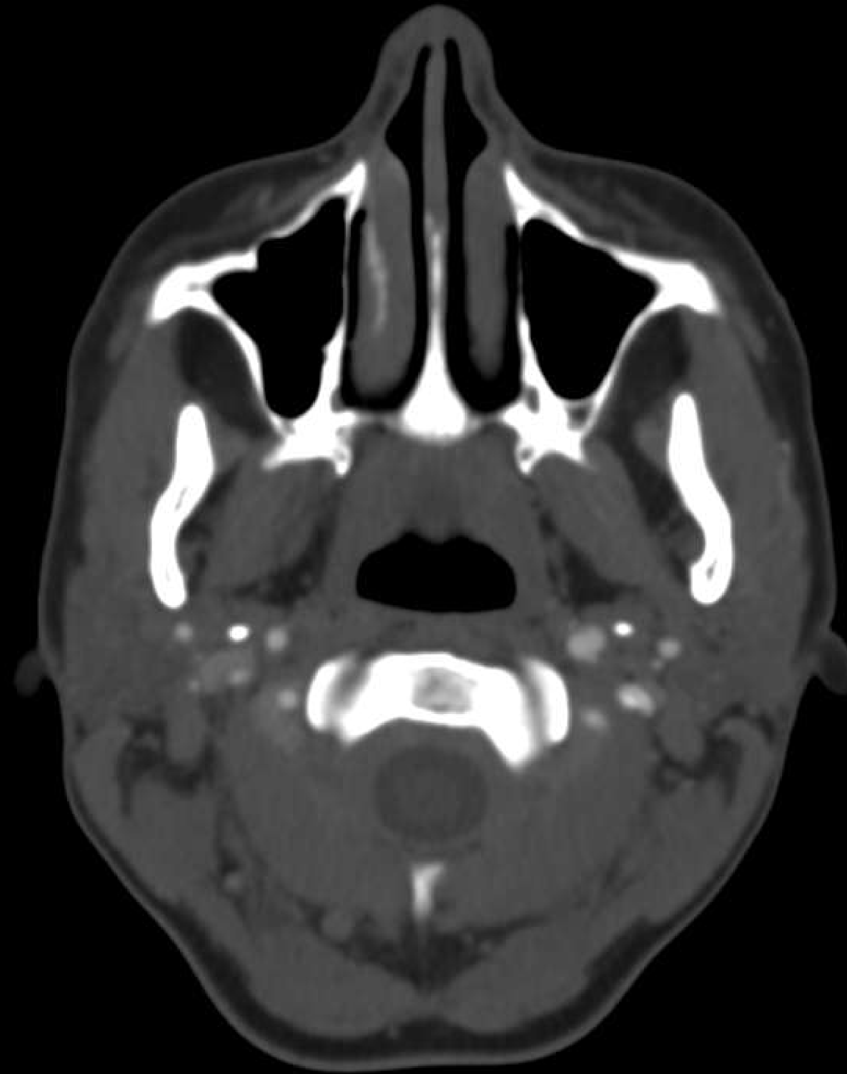
Case 3 (He Da, 42yoF)



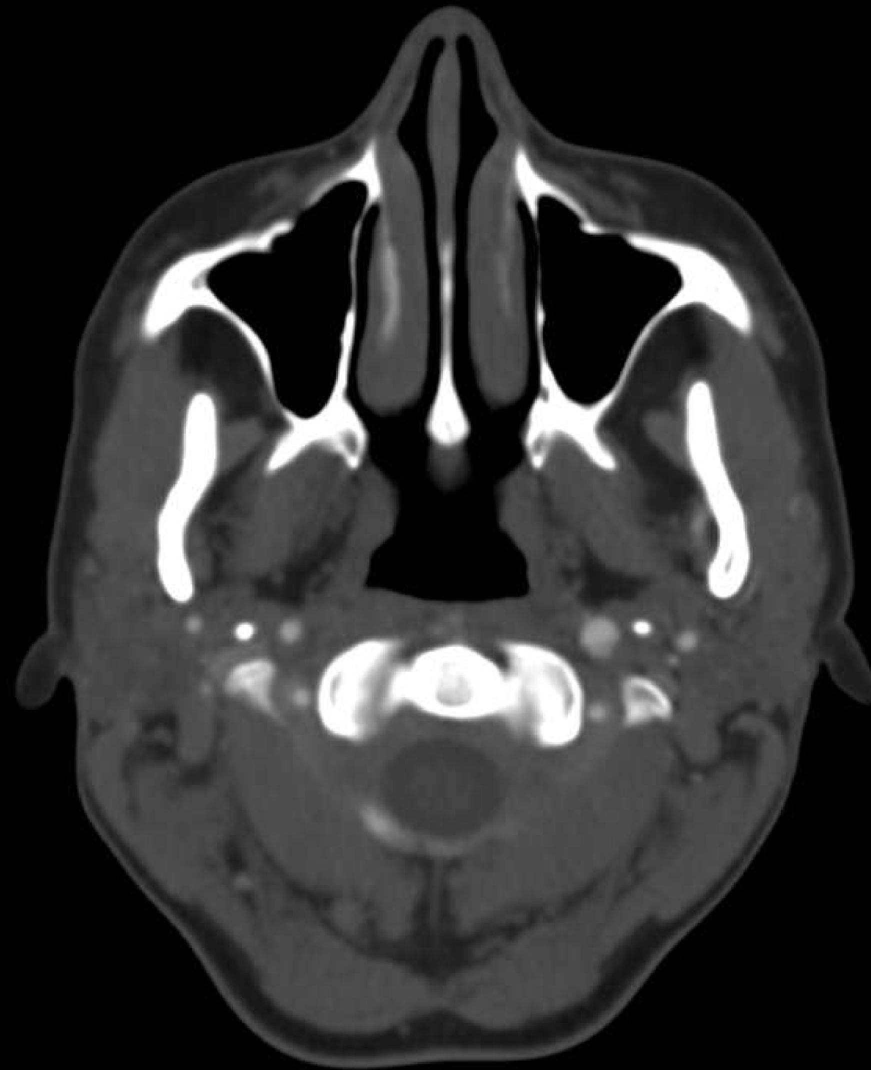
Case 3 (He Da, 42yoF)



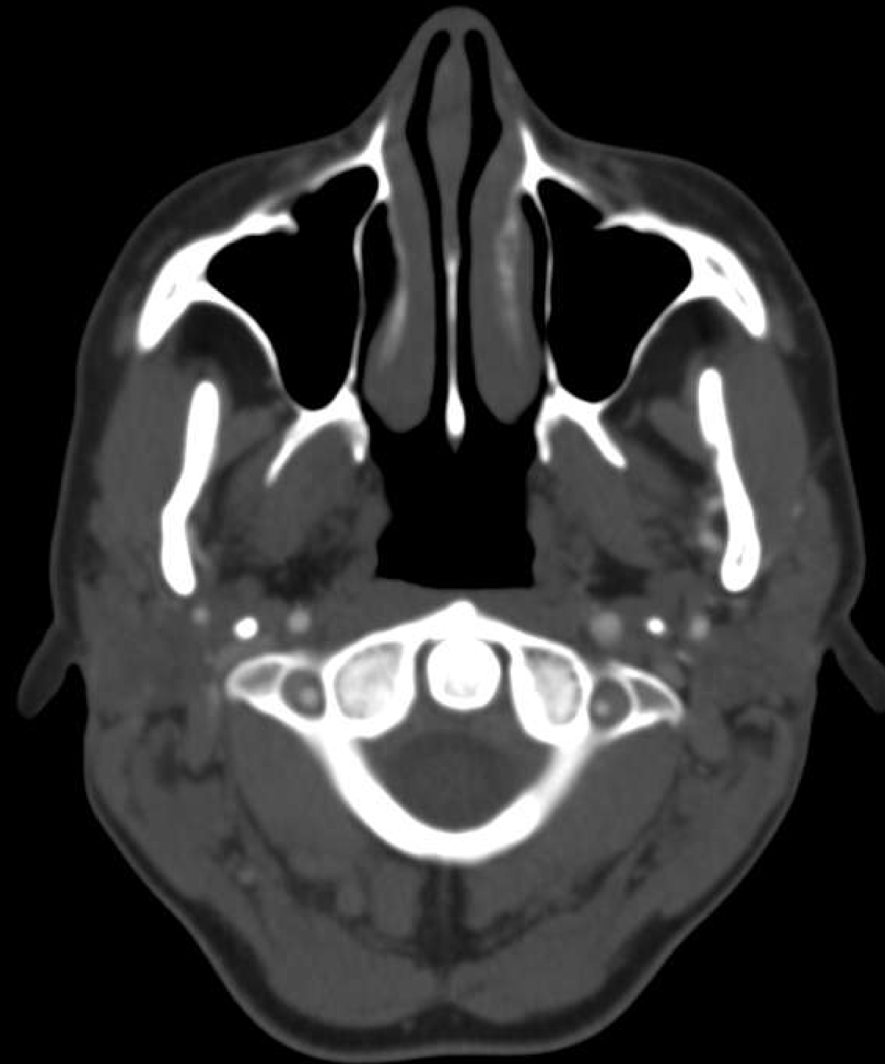
Case 3 (He Da, 42yoF)



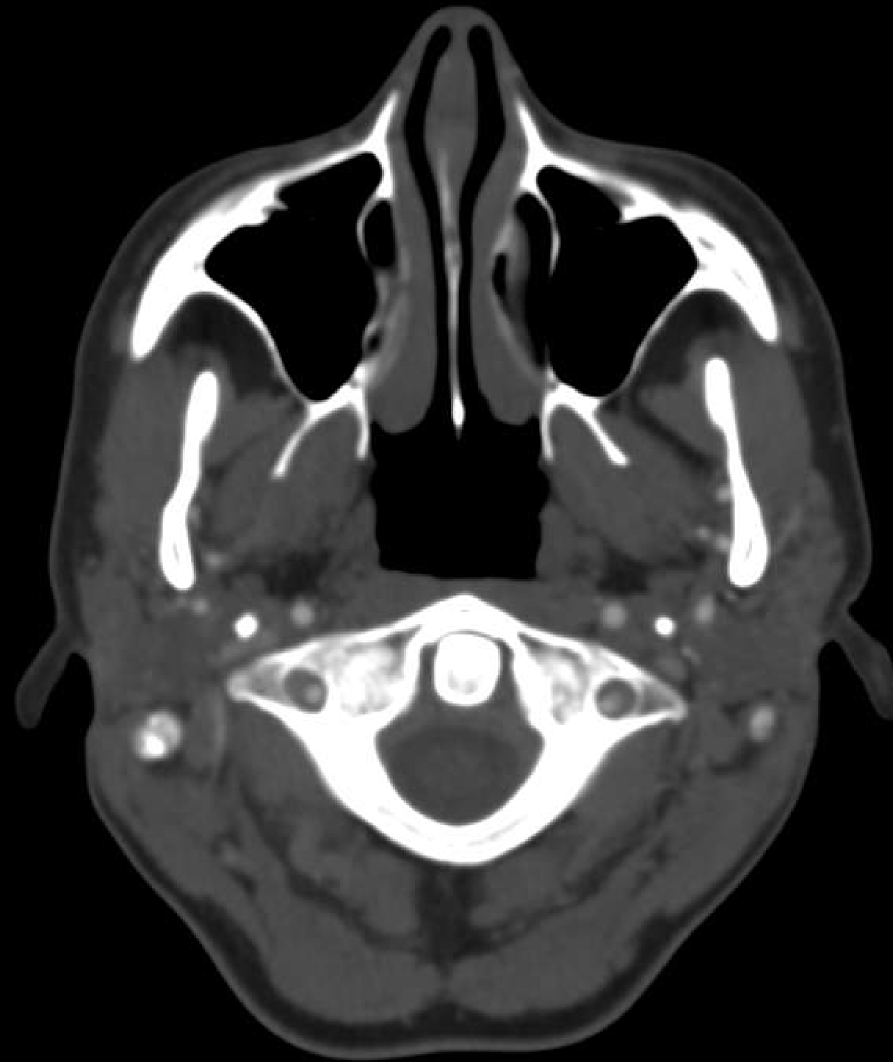
Case 3 (He Da, 42yoF)



Case 3 (He Da, 42yoF)



Case 3 (He Da, 42yoF)



Case 3 (He Da, 42yoF)

- “The cervical segment of the left internal carotid artery becomes markedly attenuated over a length of 3cm, beginning approximately 3 cm above the carotid bifurcation. At the level of C1, there is the suggestion of a linear hypodensity within the ICA suggestive of focal intimal dissection.”
- “There is the impression of rounded hypodensity along the length of abnormal vessel with reconstitution of normal vessel calibre at C1. Anterior to the dissection flap, there is a focal outpouching with contrast opacification. Appearances are suggestive of continued contrast opacification of the false lumen superiorly and partial thrombosis of the false lumen inferiorly that causes compression and attenuation of the true lumen.”

Case 3 (He Da, 42yoF)

- Dissection and compression of left internal carotid artery
- Fits with language deficit (dysarthria)
- Not so consistent with left upper limb deficit (weakness and ataxia)
  - ? complex migraine syndrome

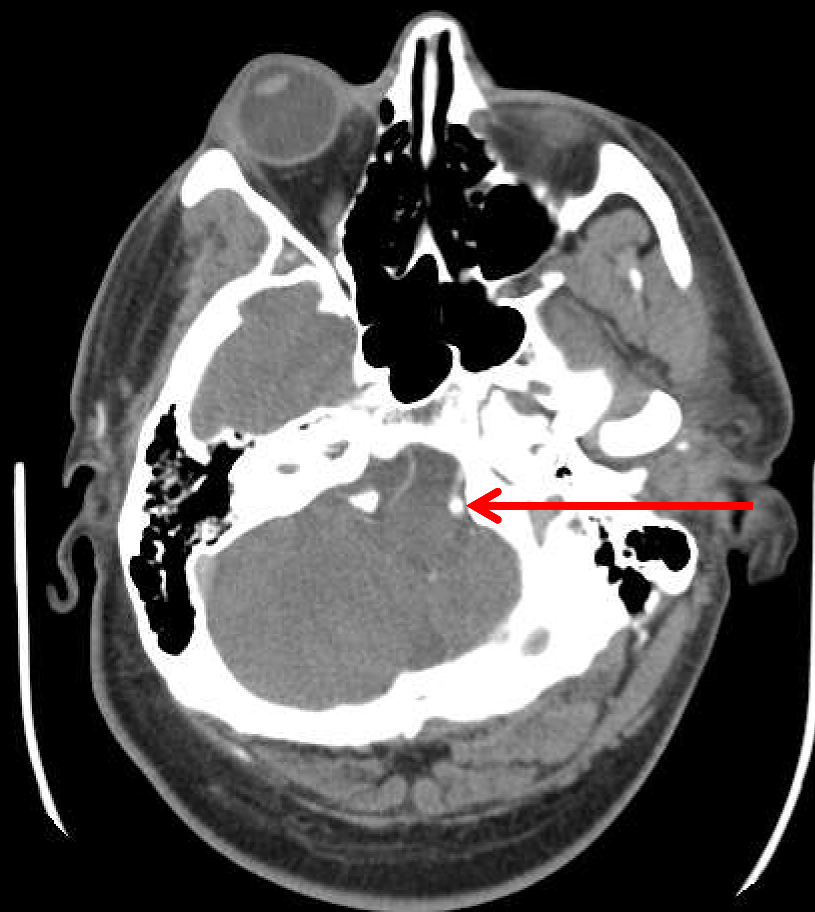
Back to the cases...

- JP Mc, 33yoM
  - Forklift driver
  - Syncope with head movement
  - Mild headache
  - Minimal past history
  - Examination mostly unremarkable
  - Terrified of head movement

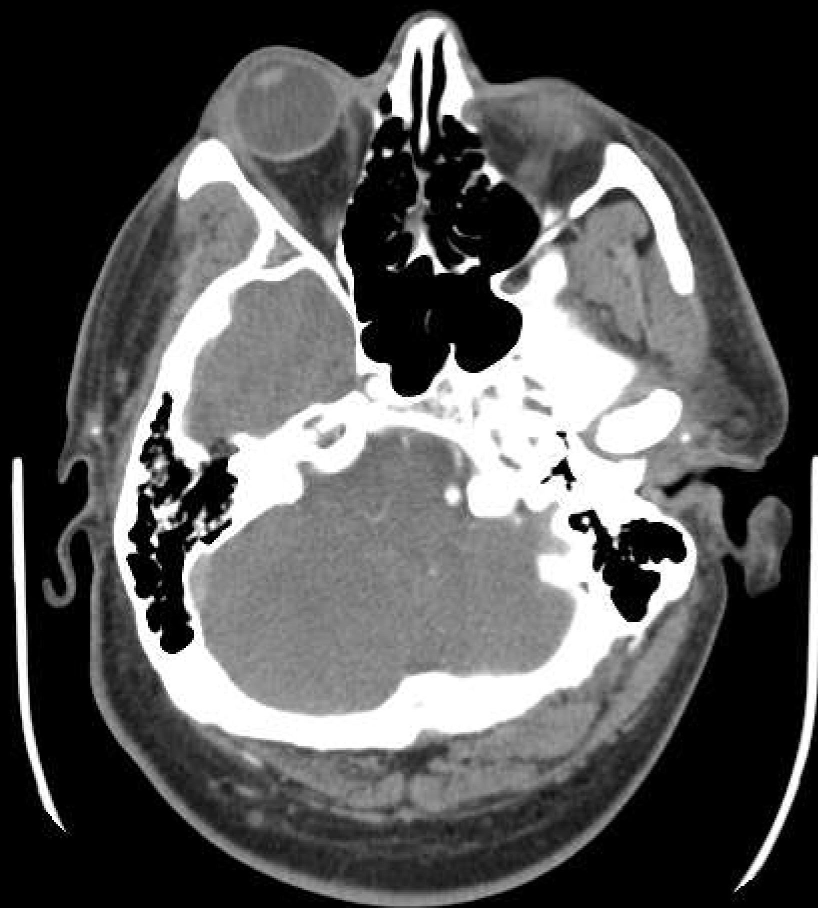
- Jo Al, 40yoM
  - New Zealander
  - Sudden, severe vertigo and right hearing loss
  - Significant headache
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination confirms vertigo

- He Da, 42yoF
  - Mother of three
  - Intermittent visual / ophthalmic deficits, dysarthria, left upper limb weakness / ataxia
  - Known previous migraines
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination mostly unremarkable

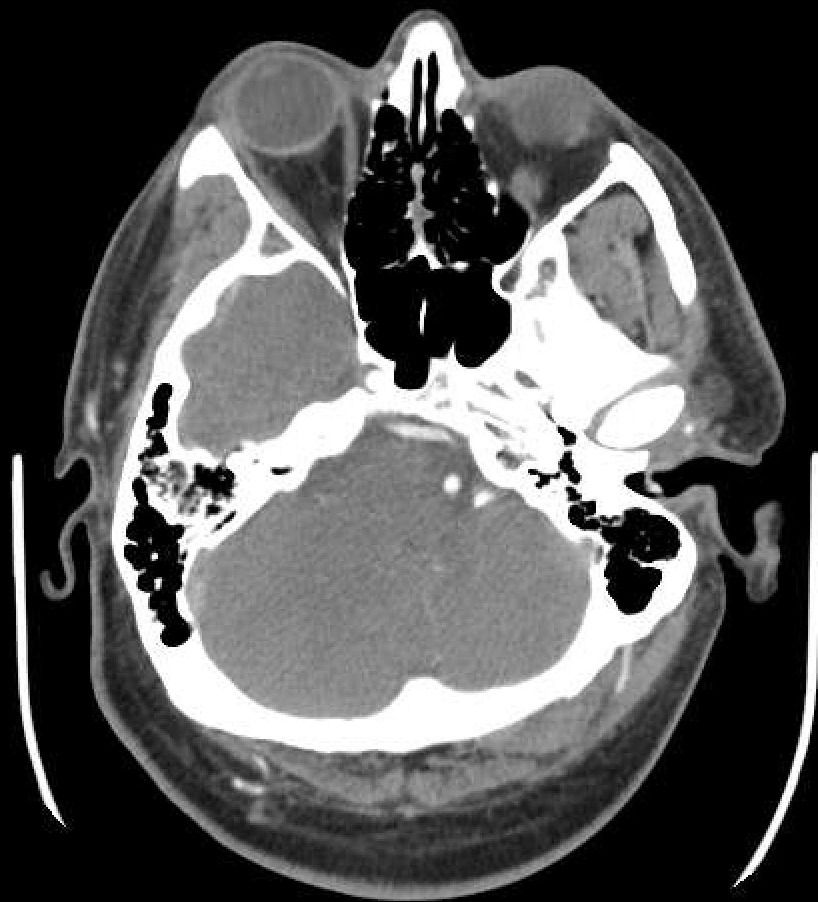
Case 2 (Jo Al, 40yoM)



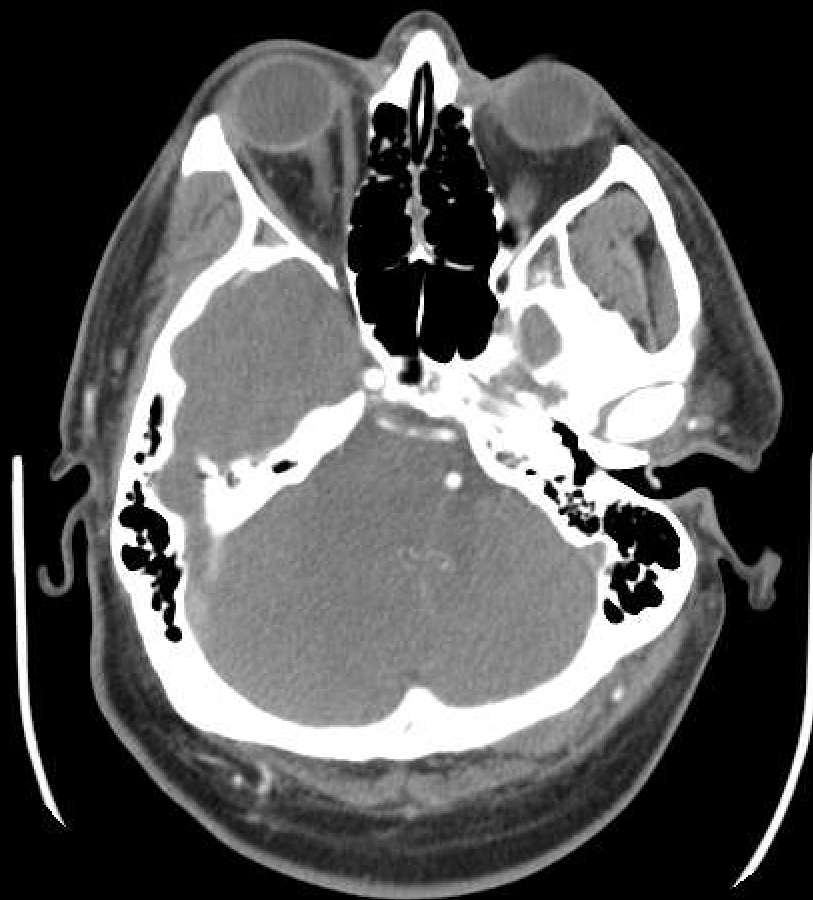
Case 2 (Jo Al, 40yoM)



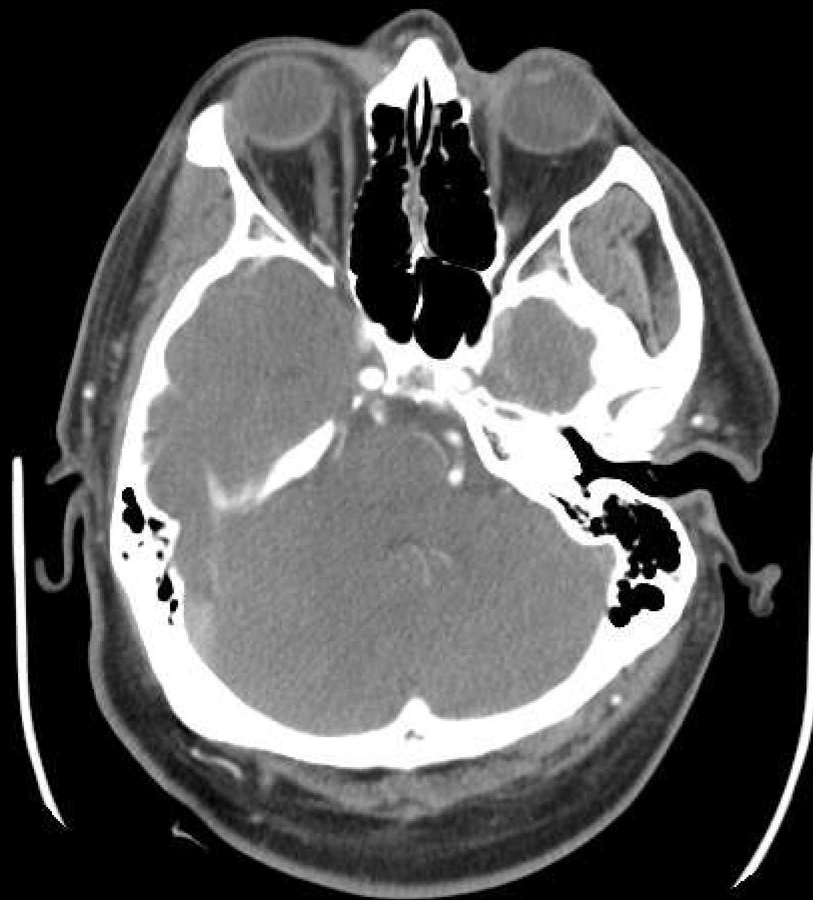
Case 2 (Jo Al, 40yoM)



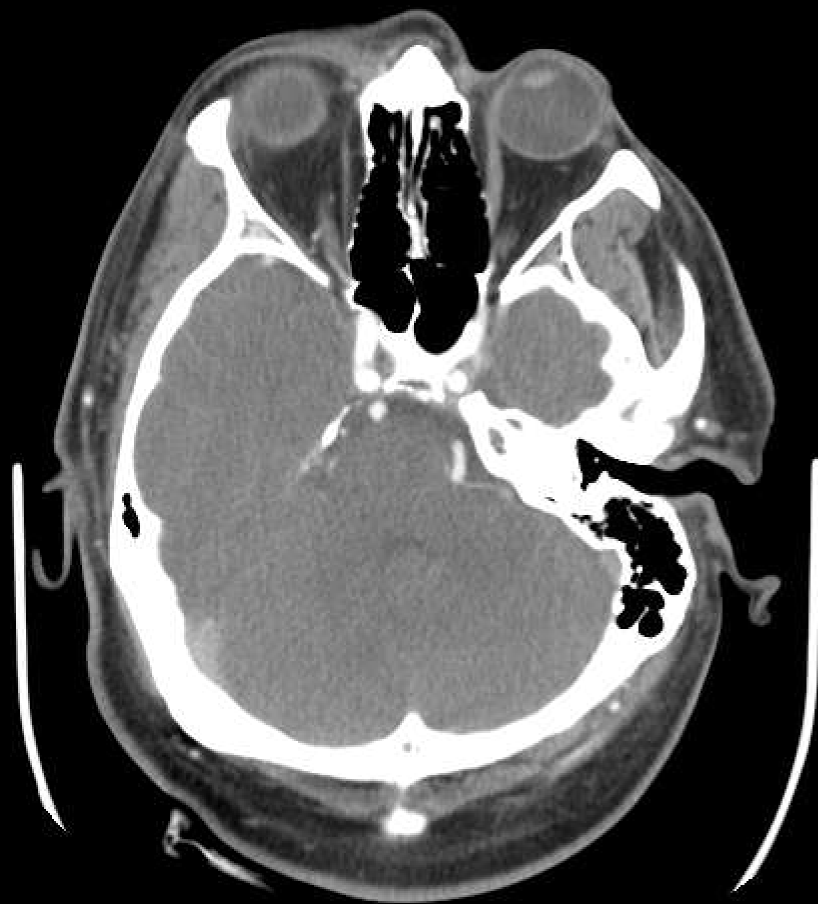
Case 2 (Jo Al, 40yoM)



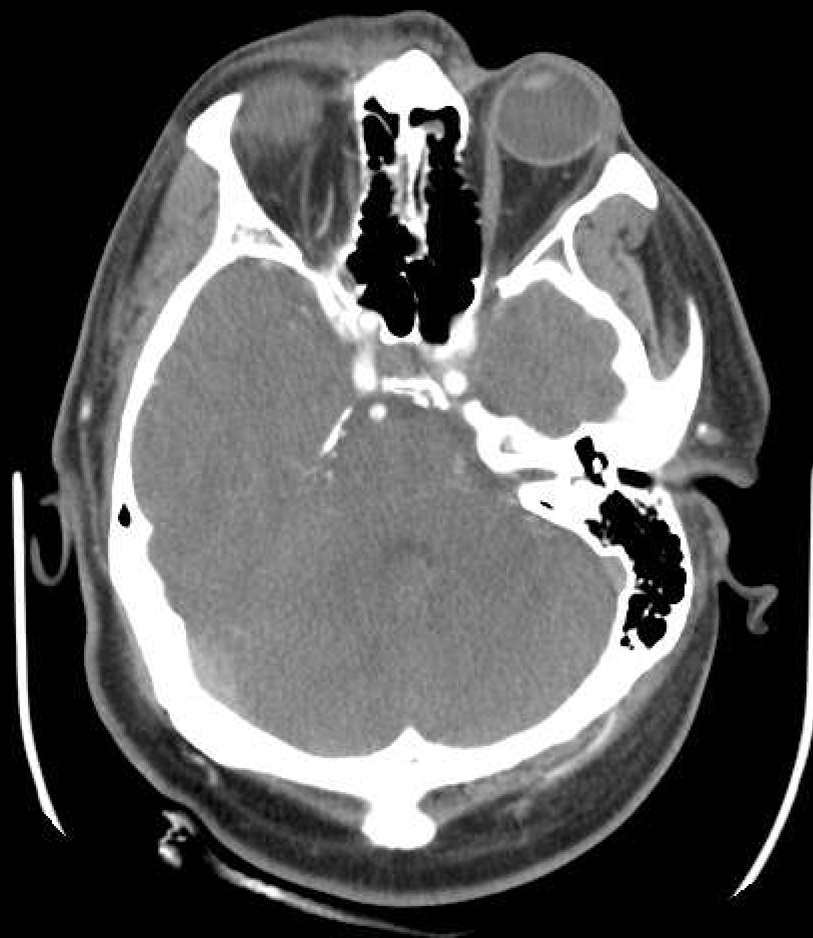
Case 2 (Jo Al, 40yoM)



Case 2 (Jo Al, 40yoM)



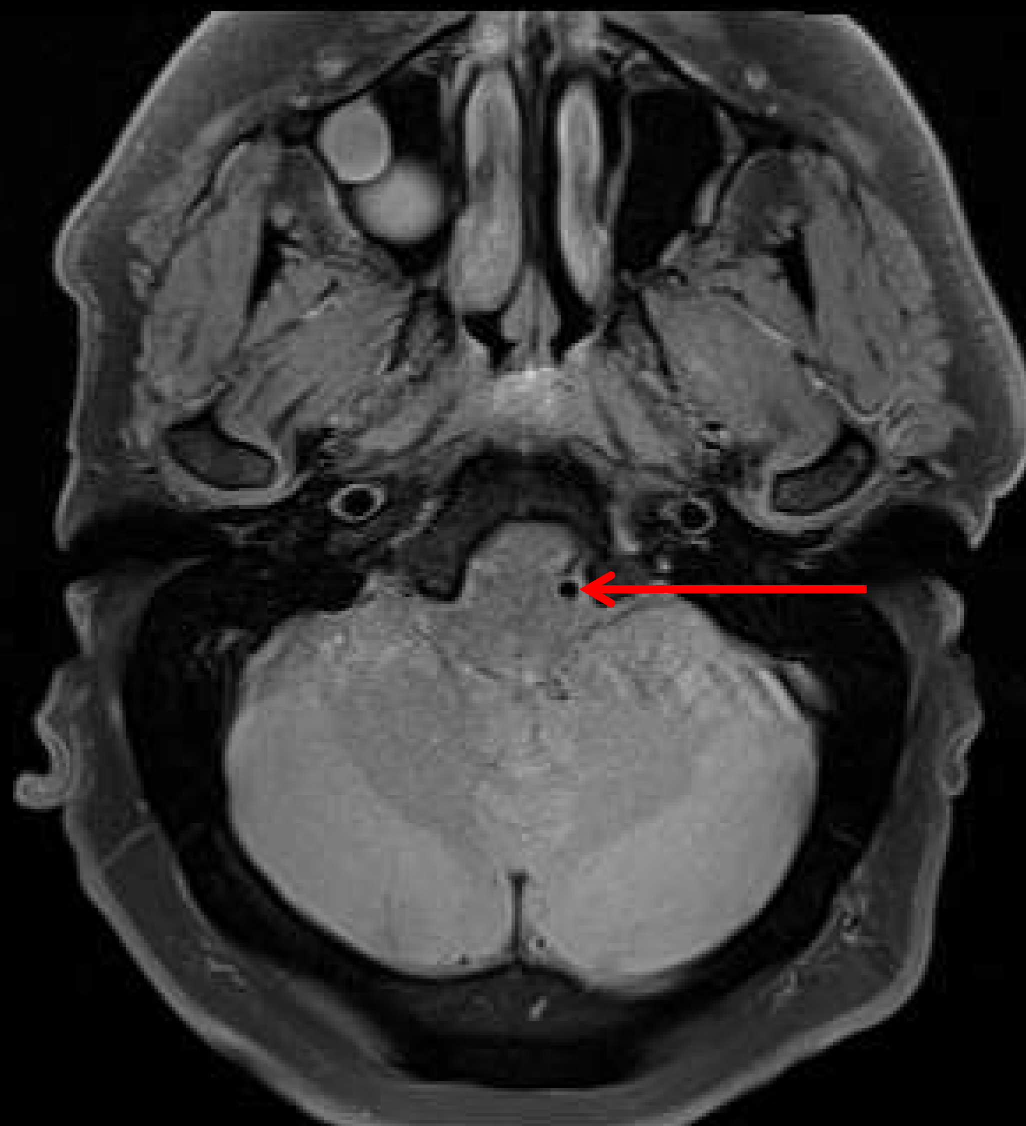
Case 2 (Jo Al, 40yoM)



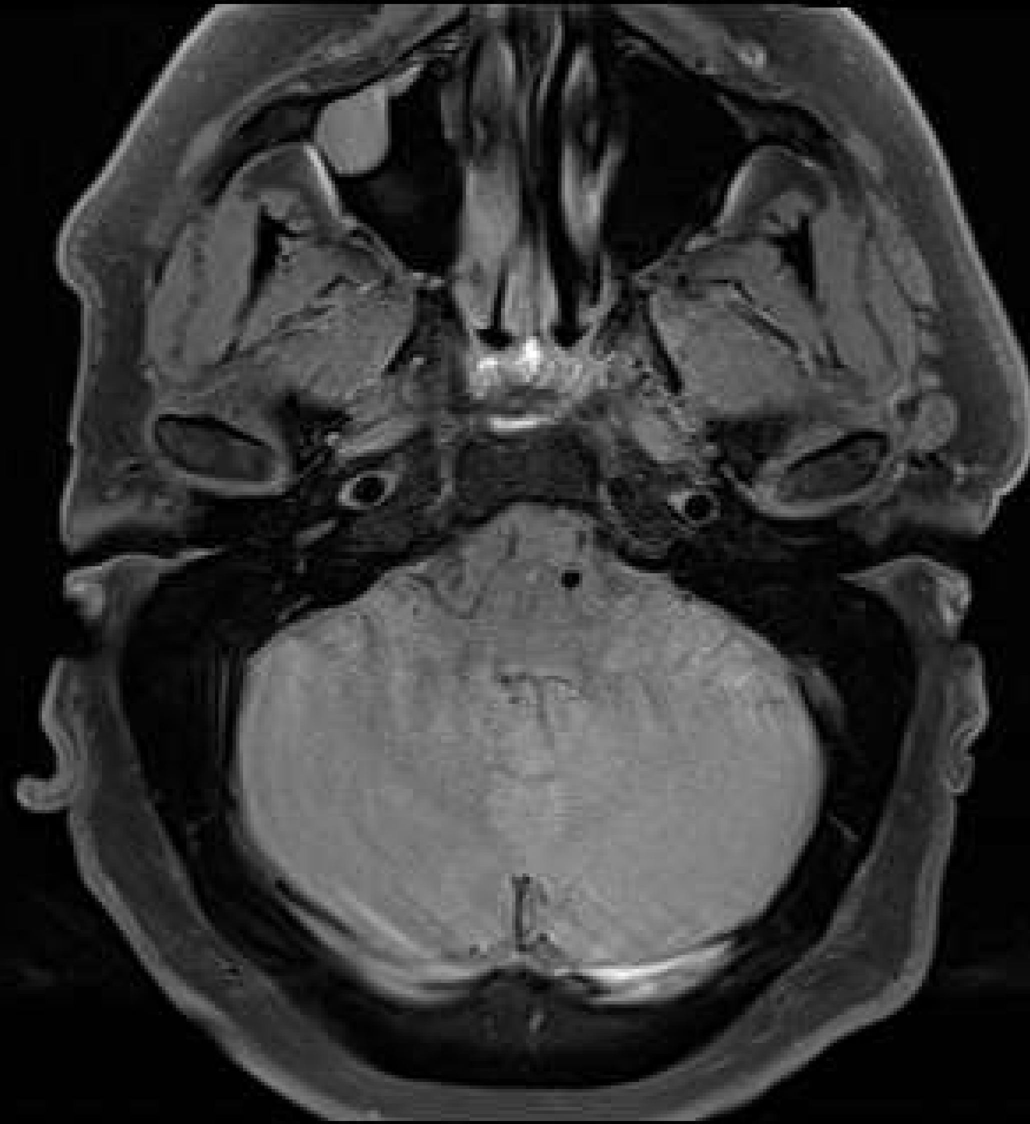
Case 2 (Jo Al, 40yoM)

- There is luminal irregularity and eccentric, shelf-like filling defect seen within the midportion of the basilar artery over a length of approximately 7mm, in keeping with dissection. No dissection flap is seen. The artery distal to this appears patent and of normal calibre. The intracranial and upper portions of the extra-cranial vertebral arteries are unremarkable in appearance, however the vertebral arteries (and carotids) are not well visualised inferiorly due to significant beam hardening . There is a dominant left vertebral artery.
- ... MRI/MRA is recommended to further evaluate.

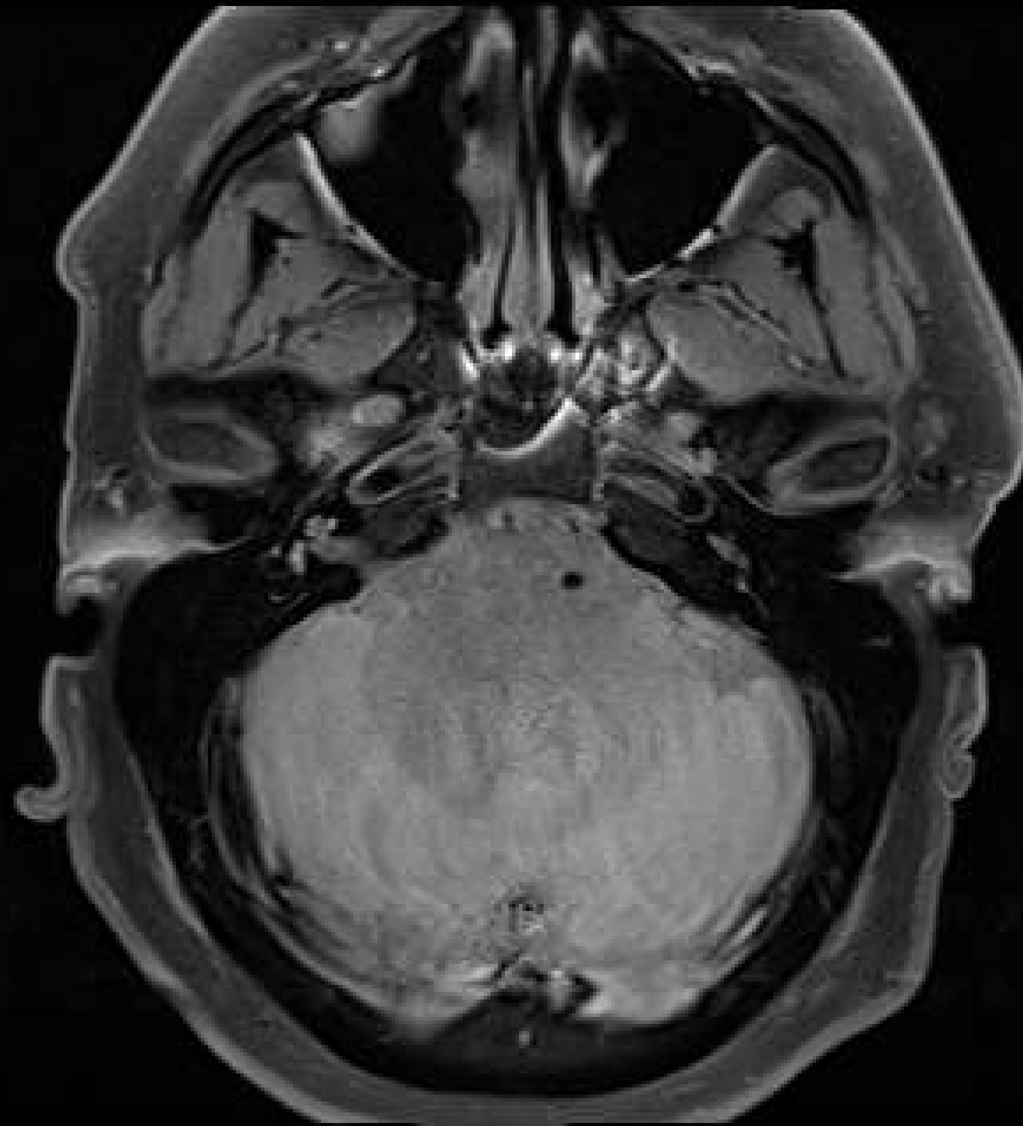
Case 2 (Jo Al, 40yoM)



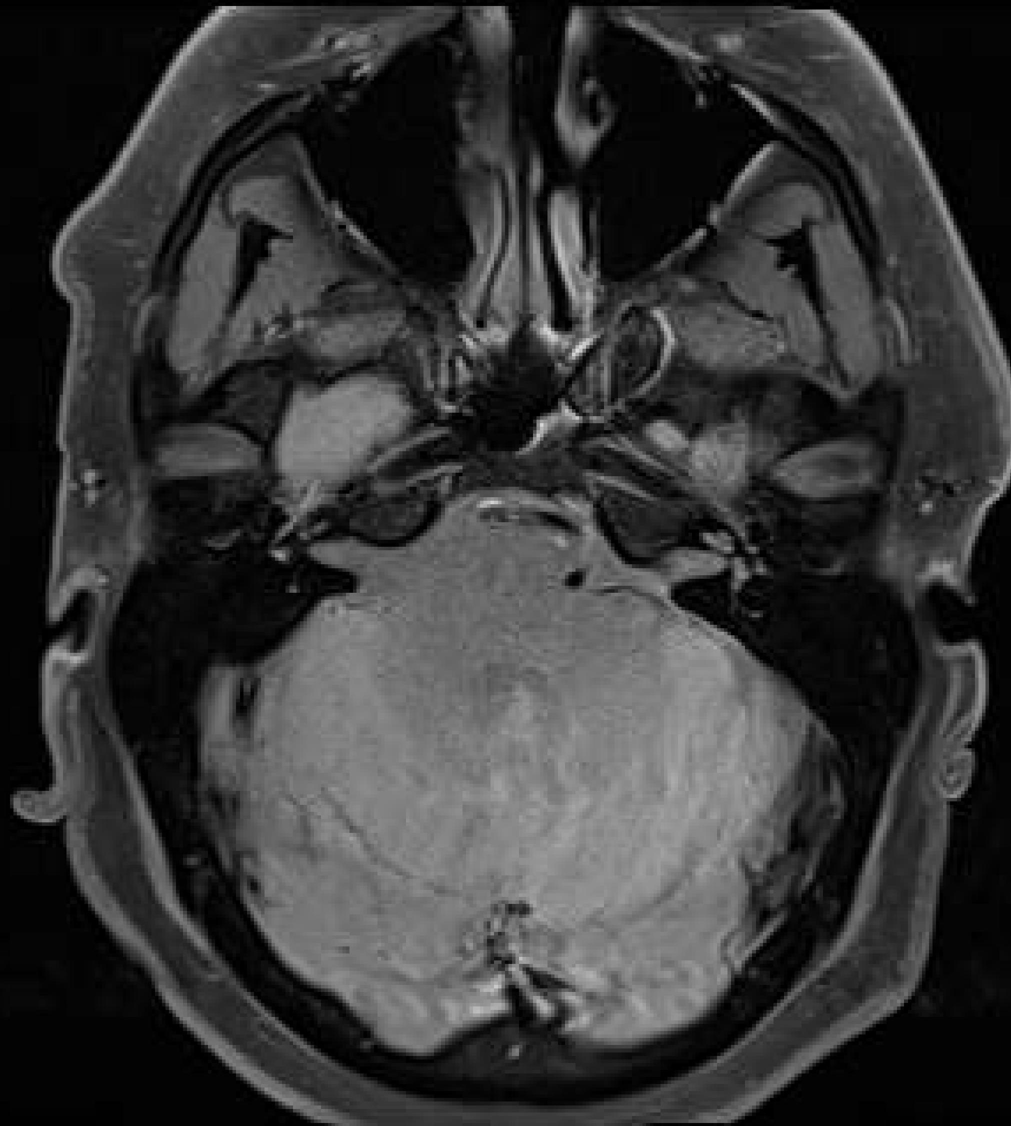
Case 2 (Jo Al, 40yoM)



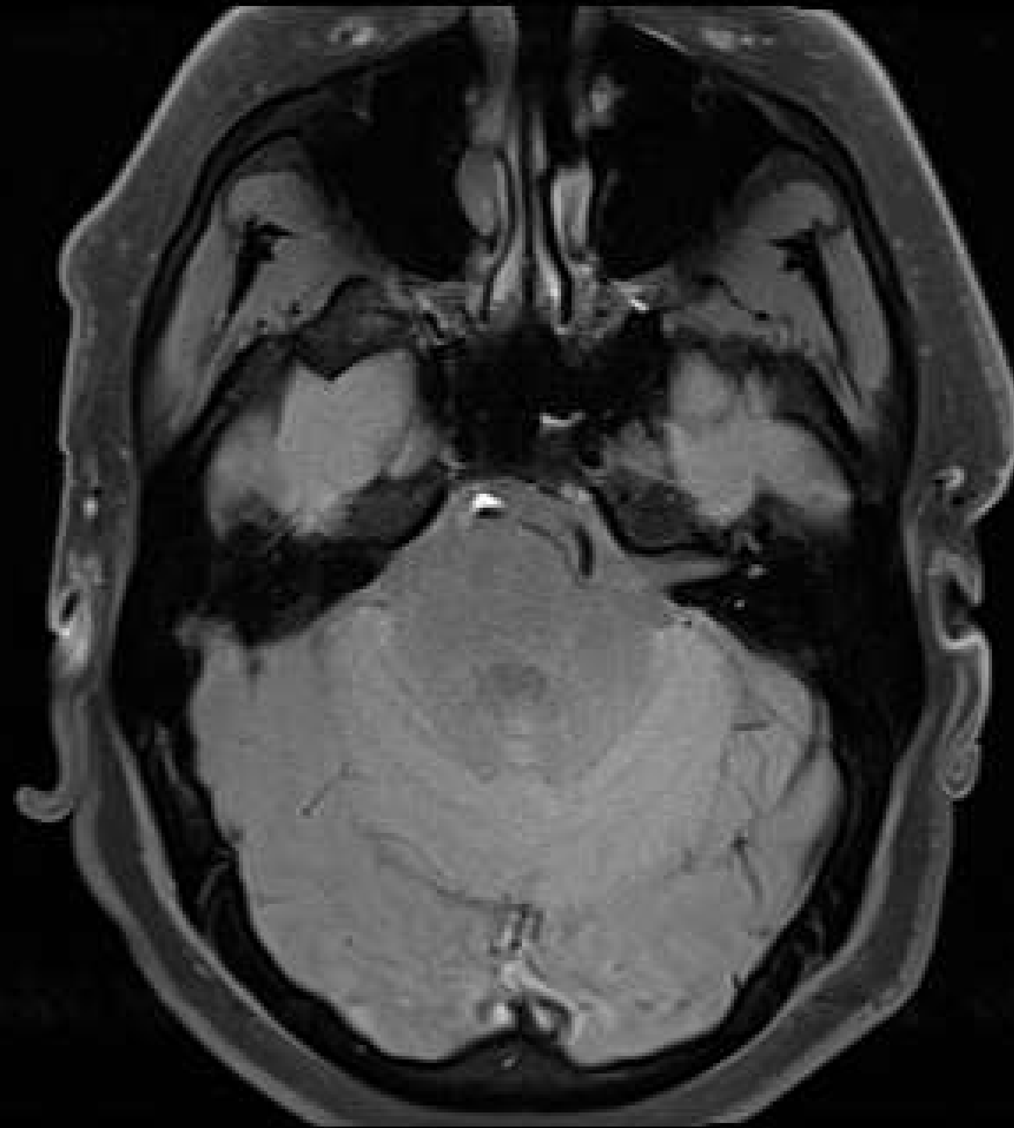
Case 2 (Jo Al, 40yoM)



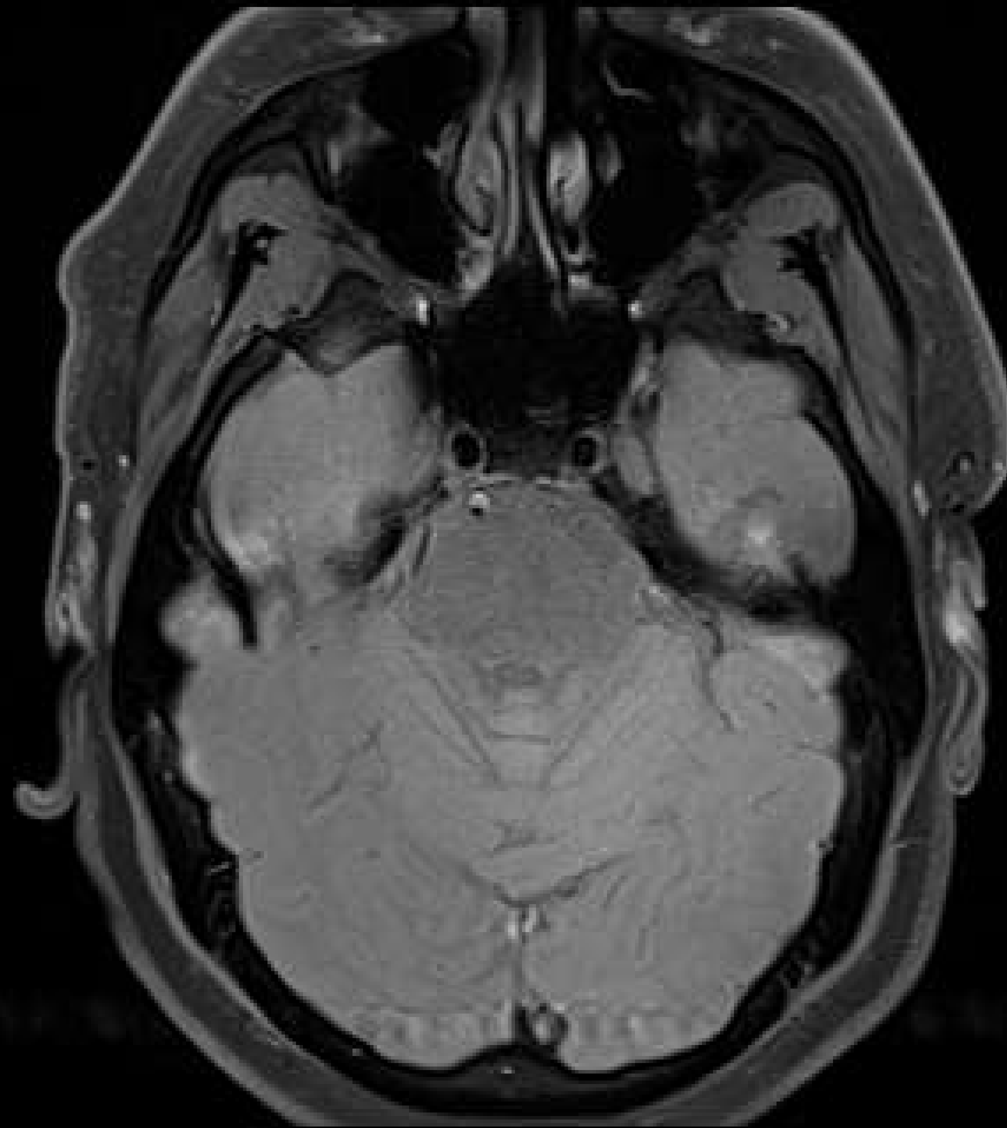
Case 2 (Jo Al, 40yoM)



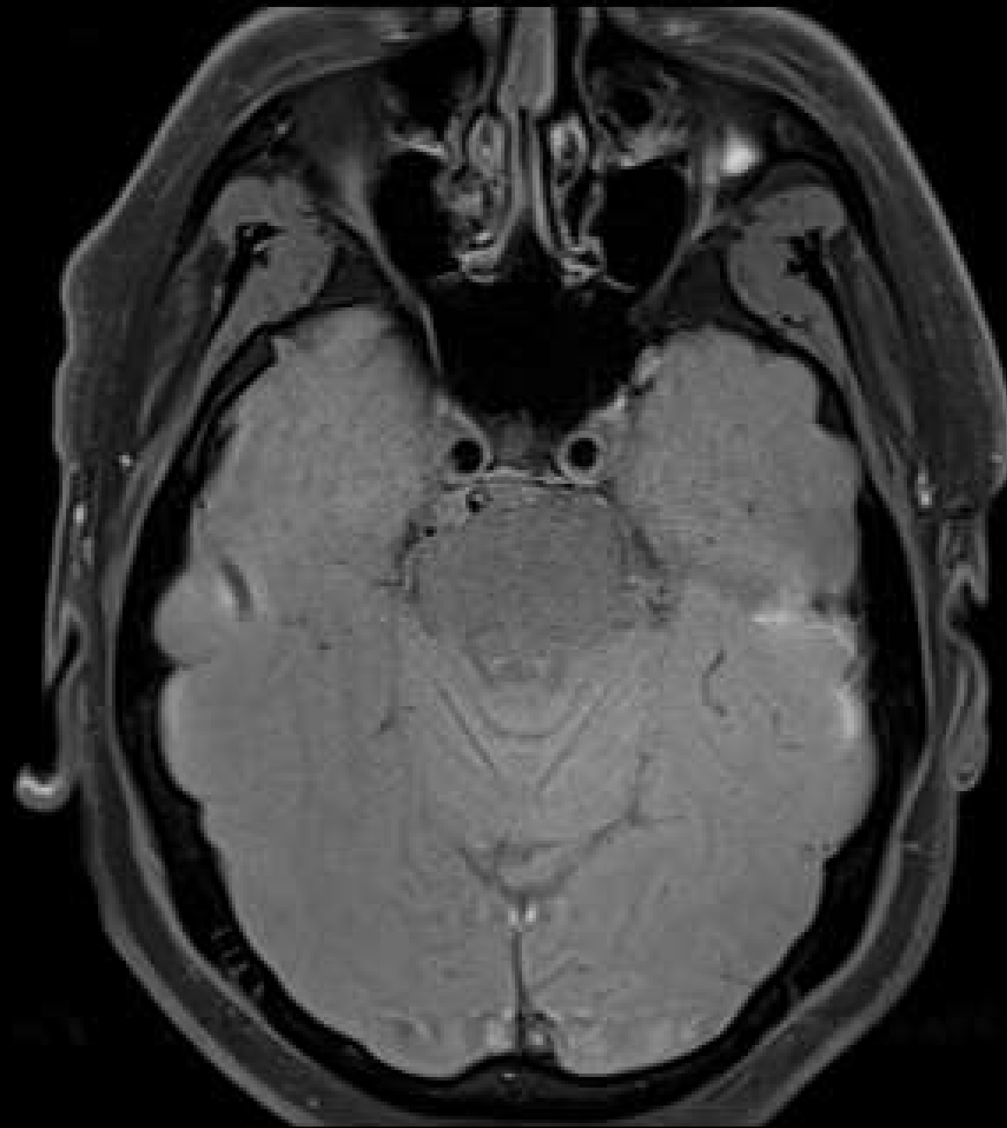
Case 2 (Jo Al, 40yoM)



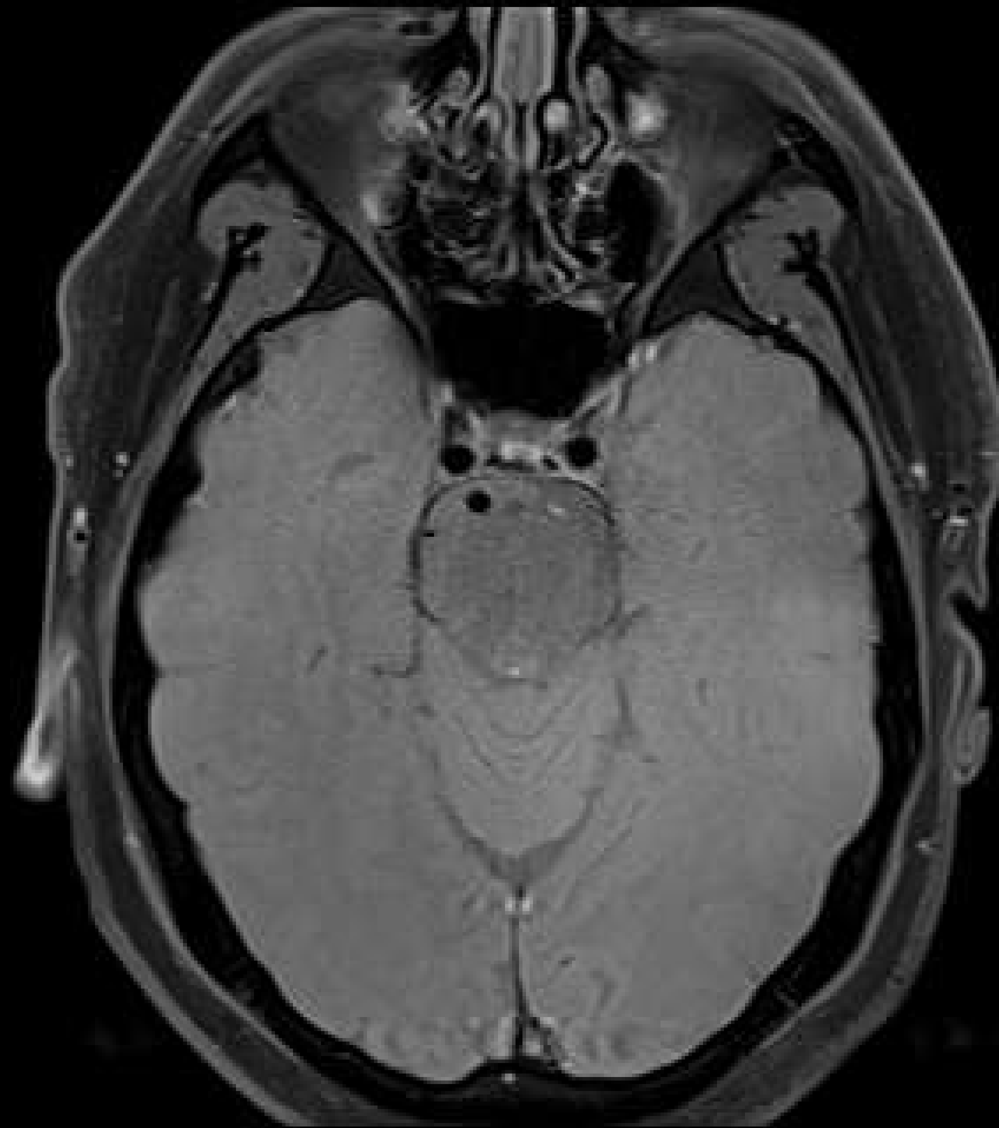
Case 2 (Jo Al, 40yoM)



Case 2 (Jo Al, 40yoM)



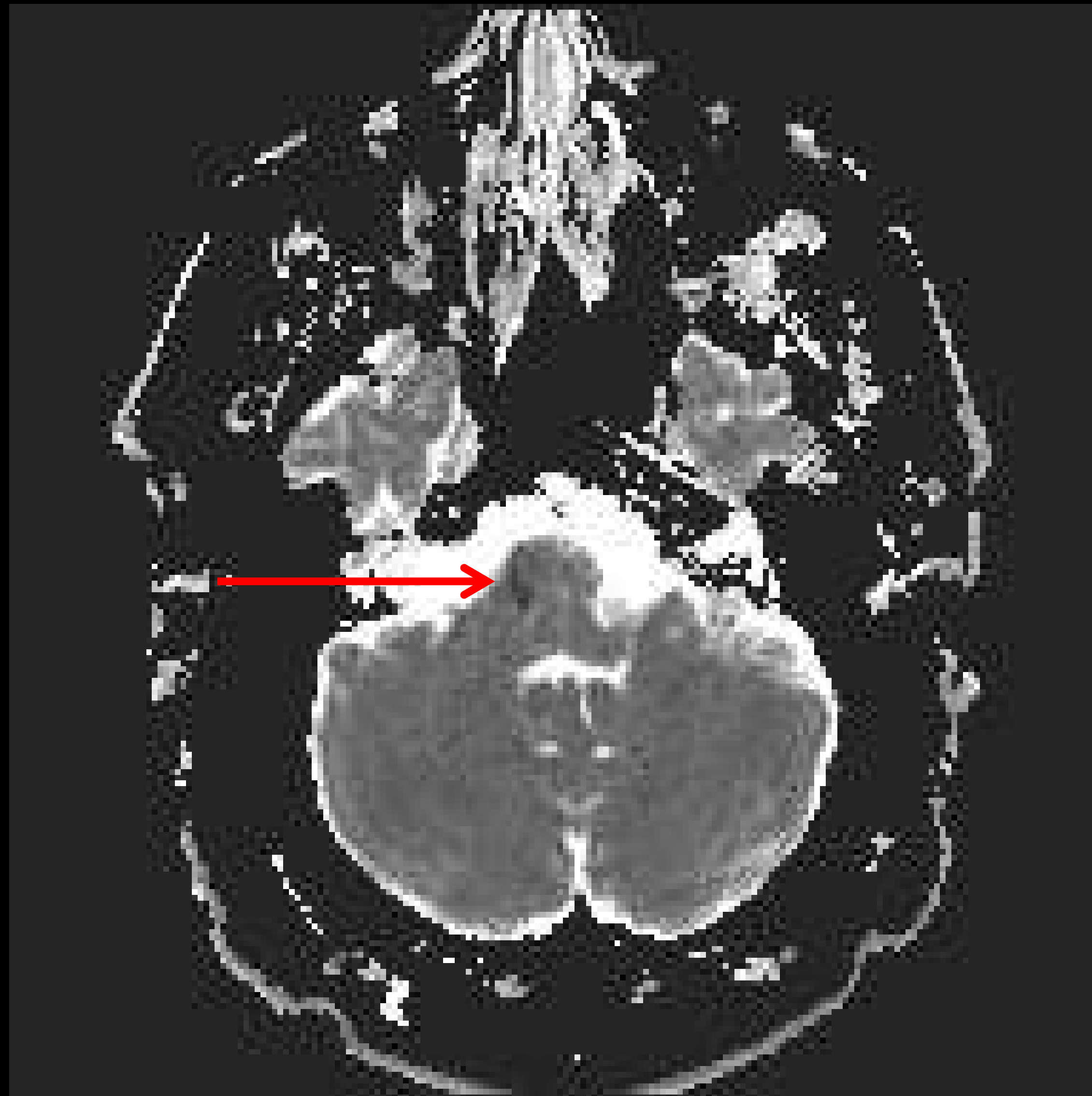
Case 2 (Jo Al, 40yoM)



Case 2 (Jo Al, 40yoM)

- The MRA demonstrates narrowing of the lumen in the proximal vertical portion of the basilar artery. In the T1 fat saturation images. This shows a clear dissection component which extends into the horizontal linear orientated component of the vessel.
- There is a small infarct of the inferior right pons. No other regions of restricted diffusion are present.

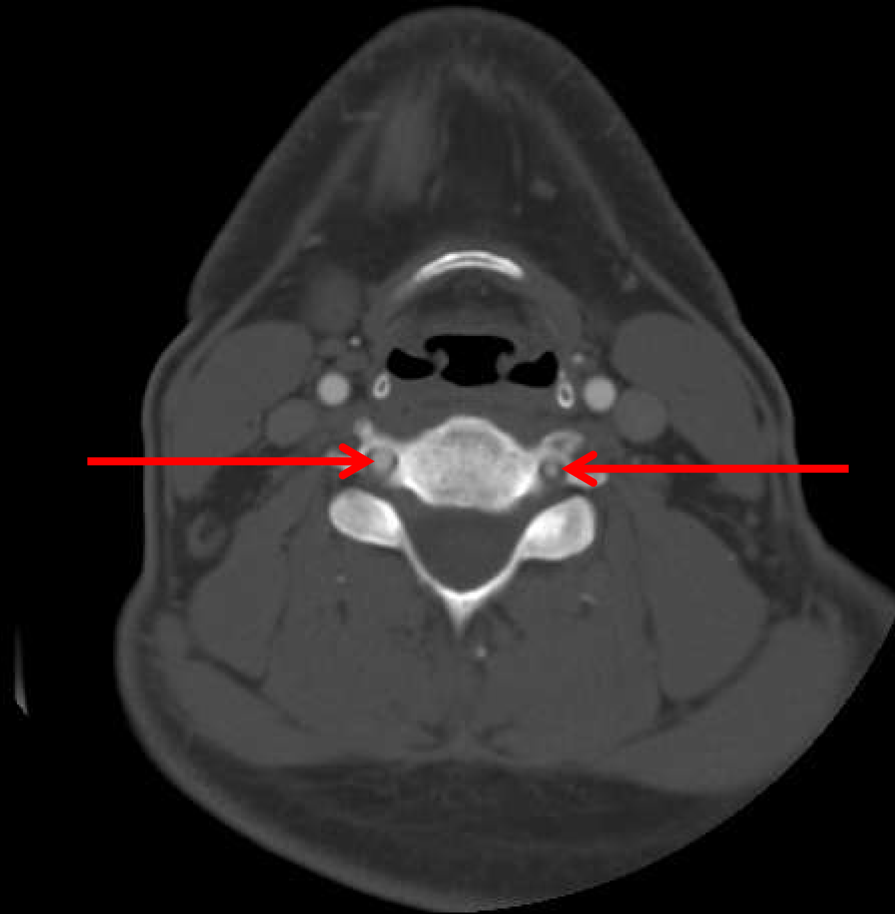
Case 2 (Jo Al, 40yoM)



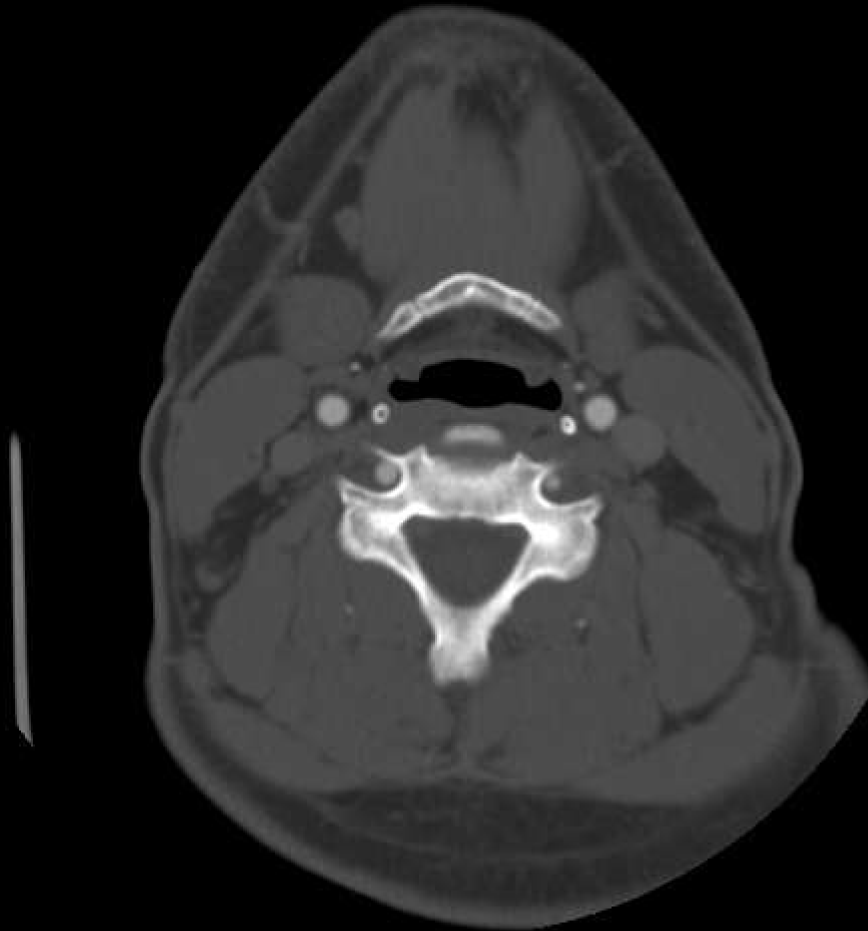
Back to the cases…

- JP Mc, 33yoM
  - Forklift driver
  - Syncope with head movement
  - Mild headache
  - Minimal past history
  - Examination mostly unremarkable
  - Terrified of head movement
- Jo Al, 40yoM
  - New Zealander
  - Sudden, severe vertigo and right hearing loss
  - Significant headache
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination confirms vertigo
- He Da, 42yoF
  - Mother of three
  - Intermittent visual / ophthalmic deficits, dysarthria, left upper limb weakness / ataxia
  - Known previous migraines
  - Had outpatient imaging (MRI)
  - Minimal past history
  - Examination mostly unremarkable

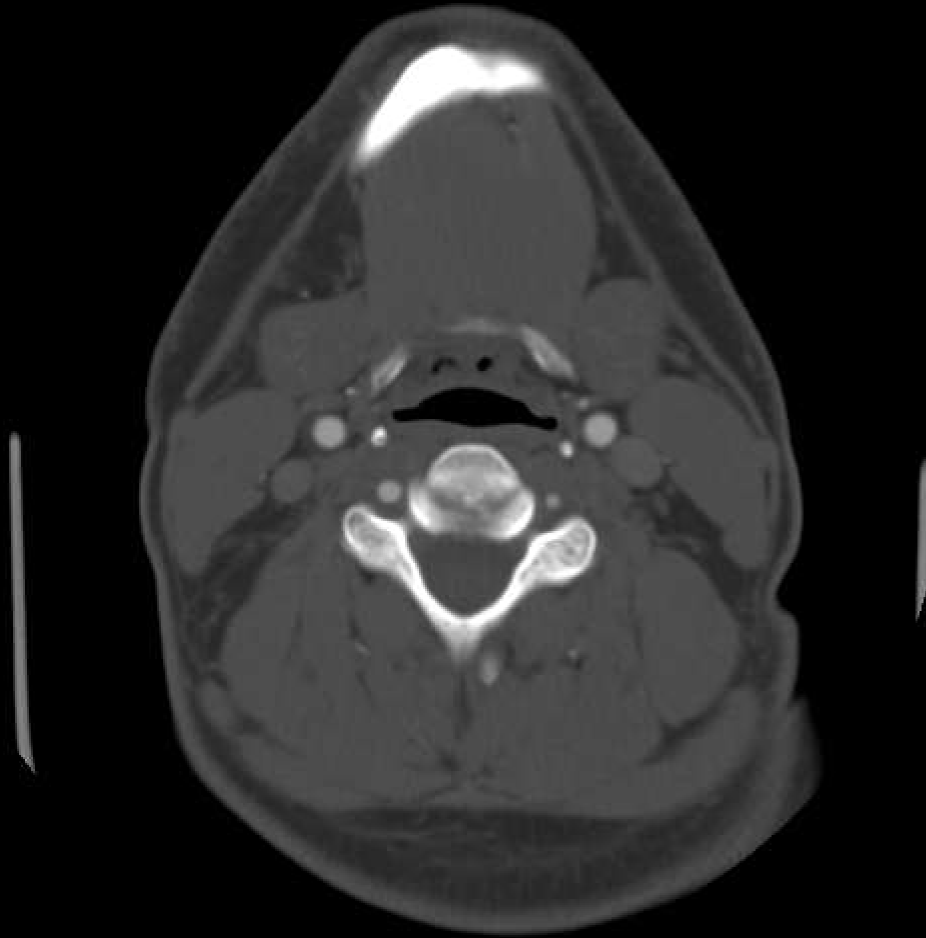
Case 1 (JP Mc, 33yoM)



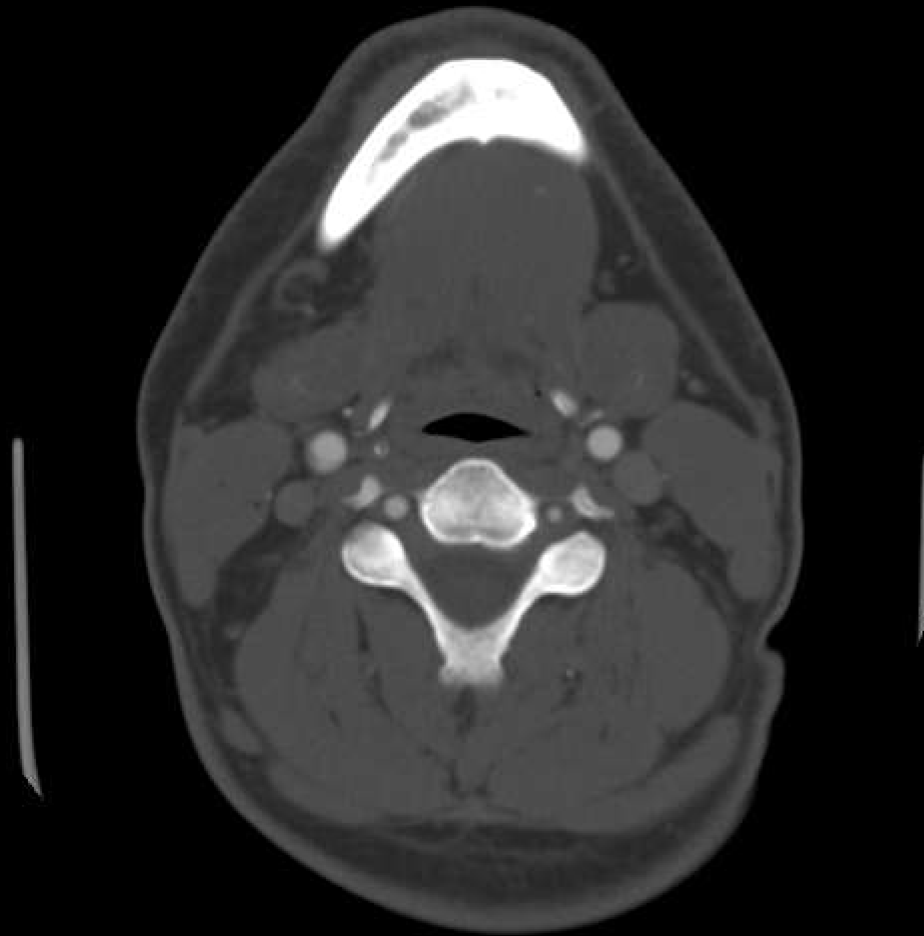
Case 1 (JP Mc, 33yoM)



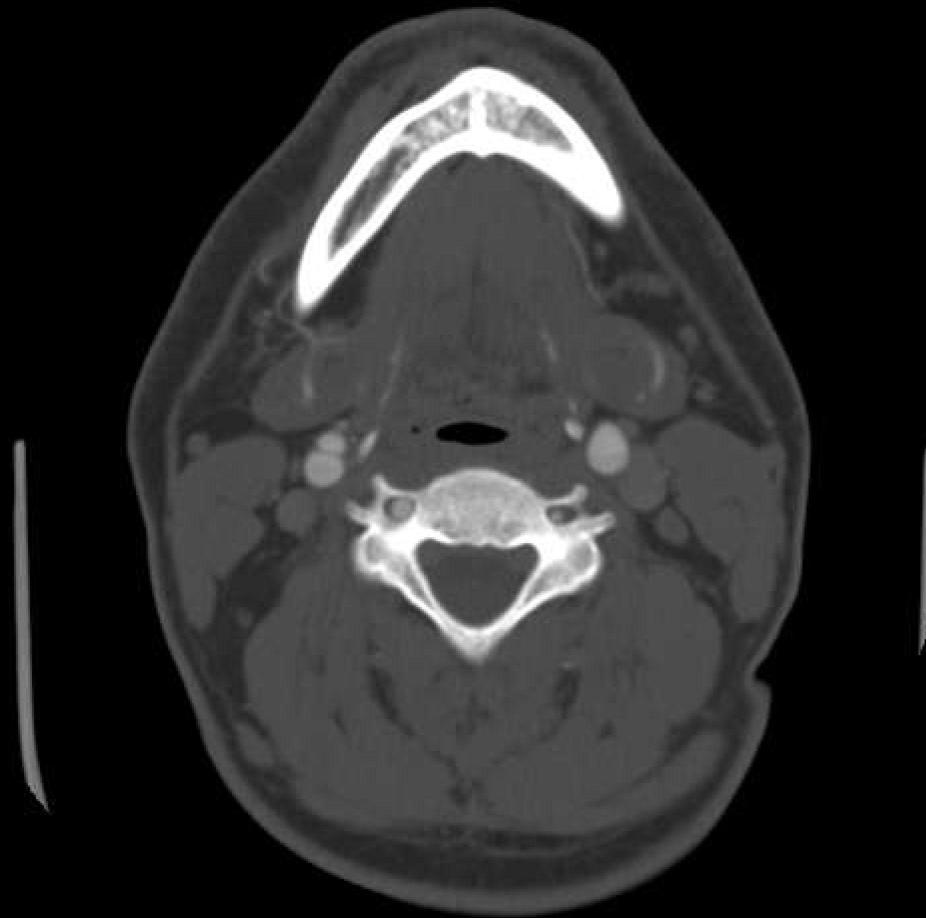
Case 1 (JP Mc, 33yoM)



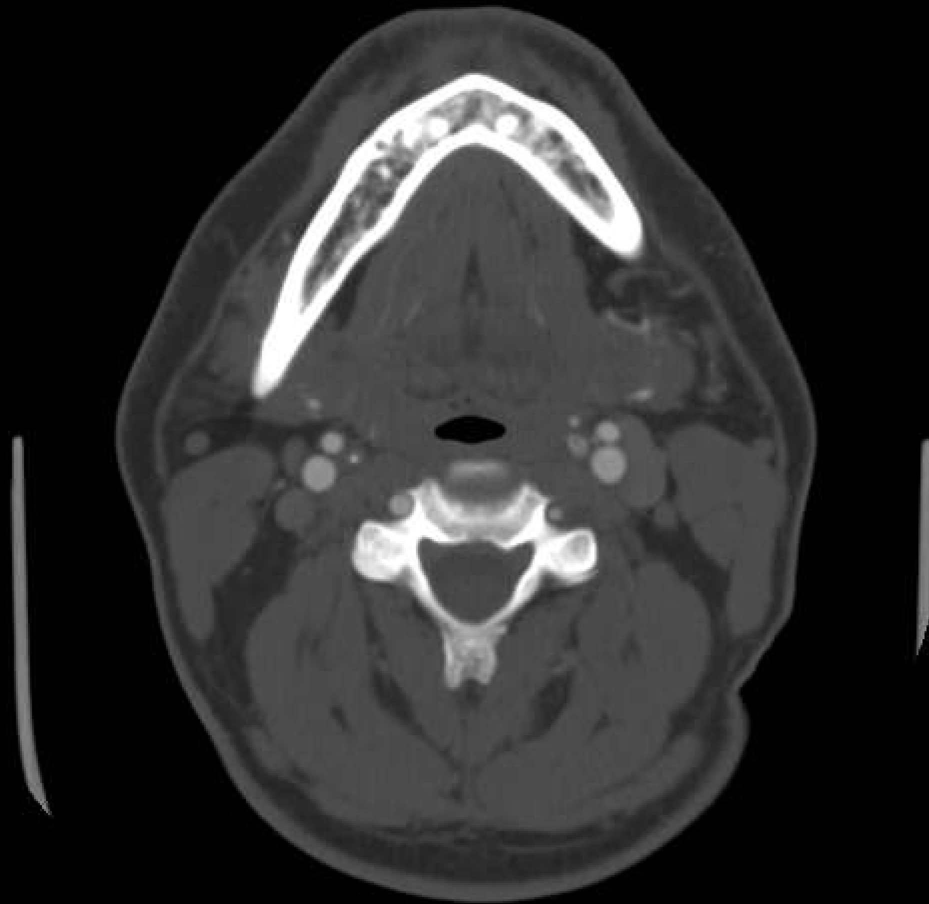
Case 1 (JP Mc, 33yoM)



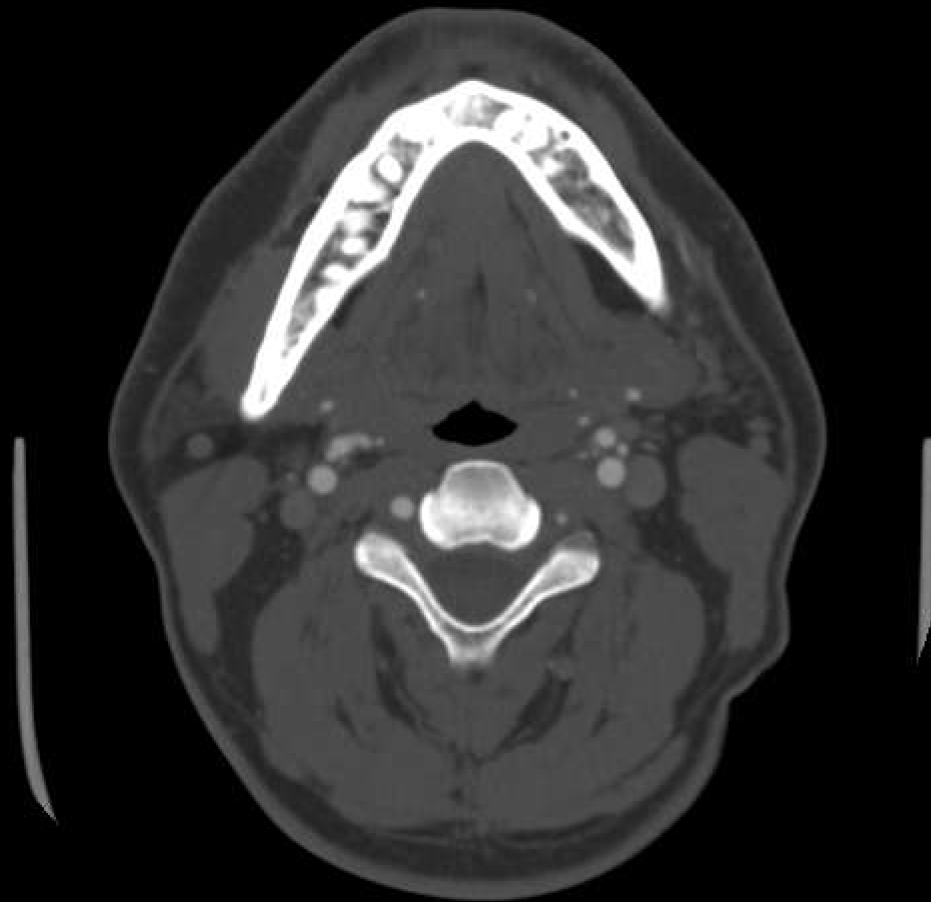
Case 1 (JP Mc, 33yoM)



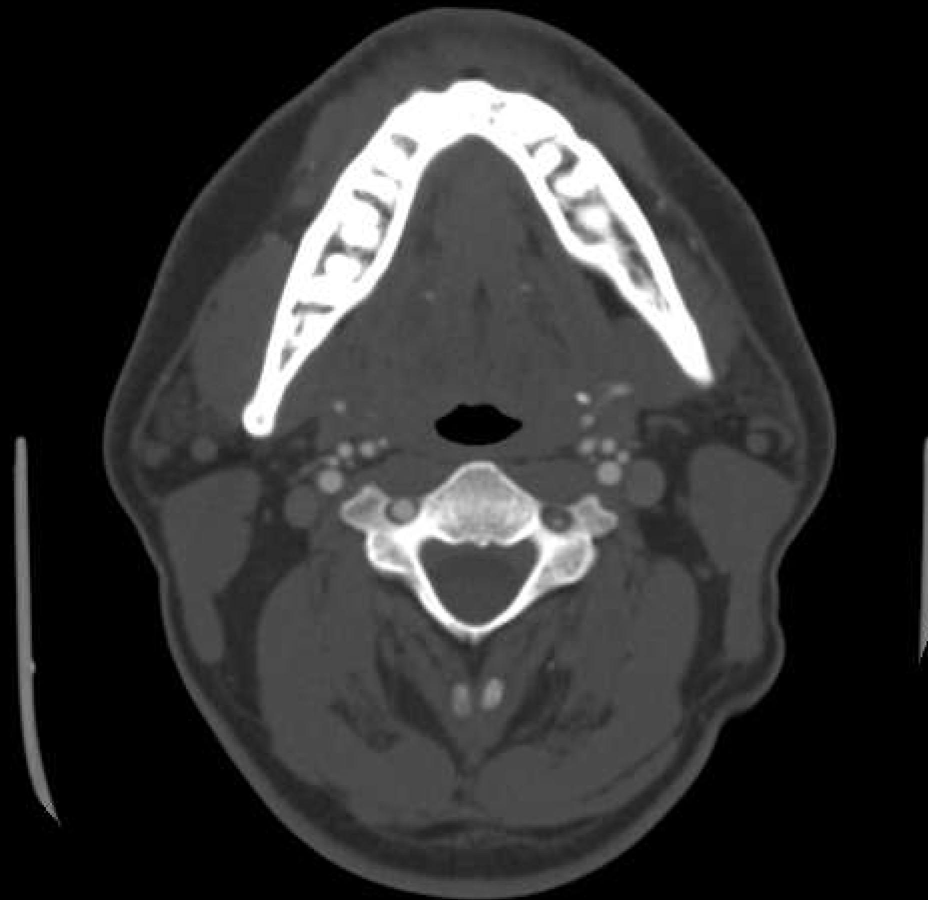
Case 1 (JP Mc, 33yoM)



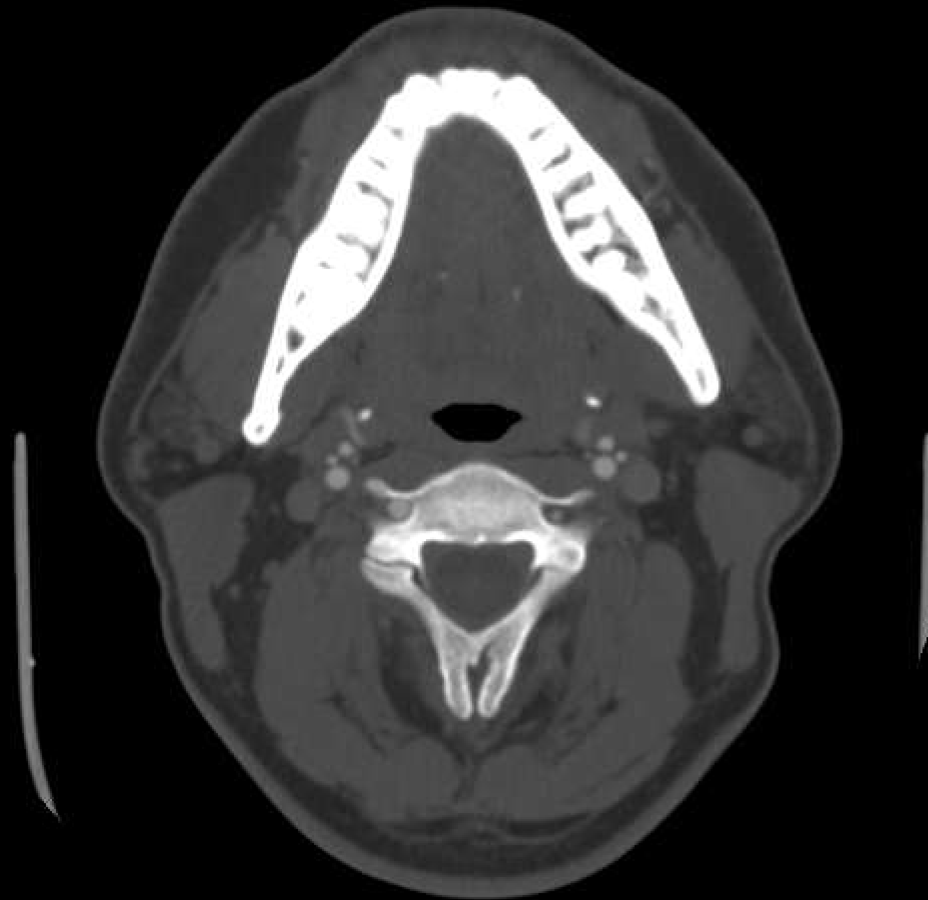
Case 1 (JP Mc, 33yoM)



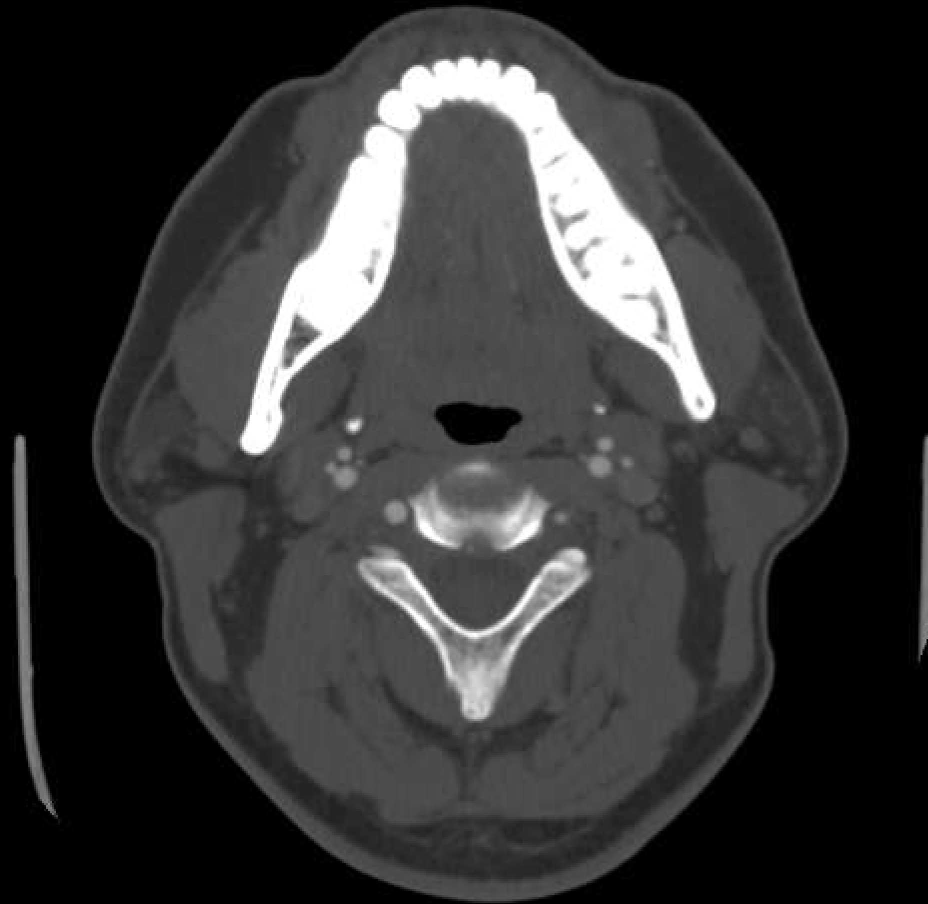
Case 1 (JP Mc, 33yoM)



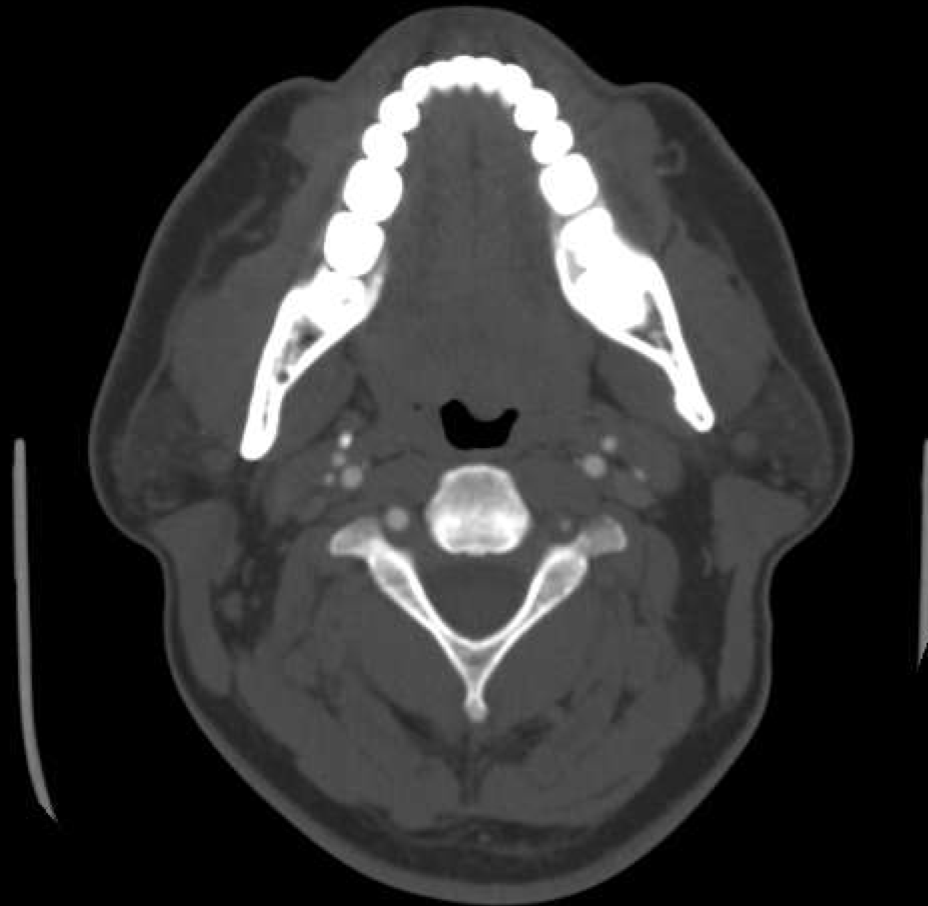
Case 1 (JP Mc, 33yoM)



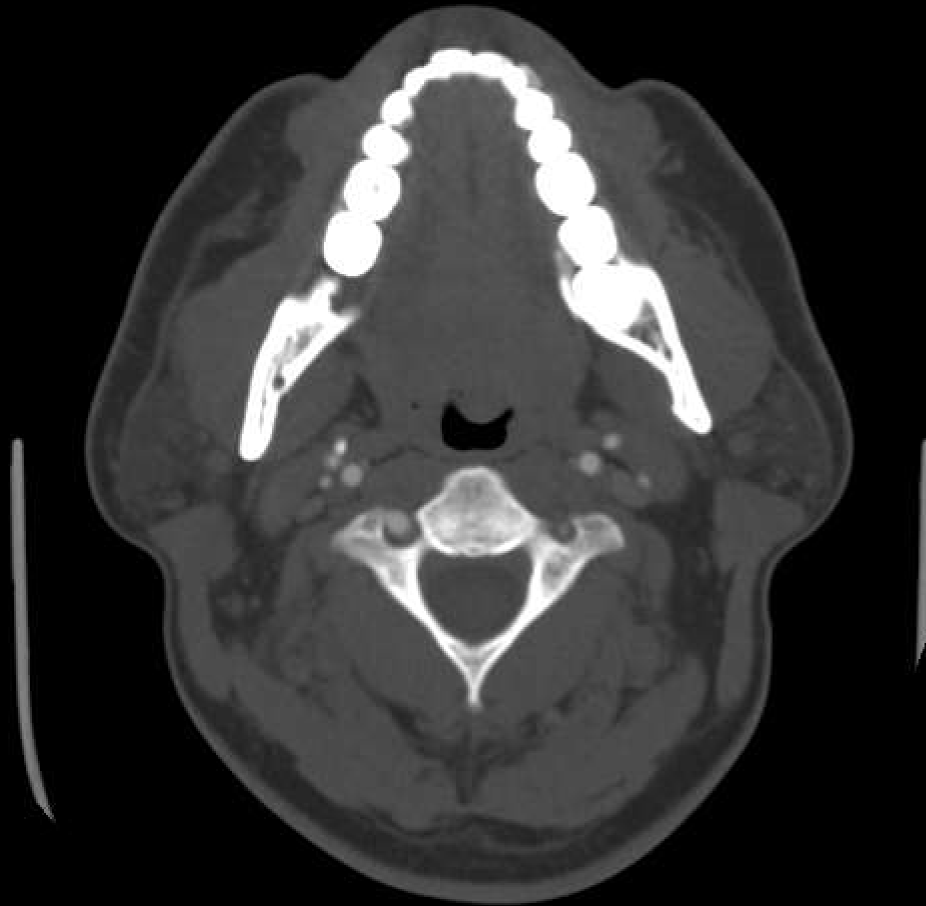
Case 1 (JP Mc, 33yoM)



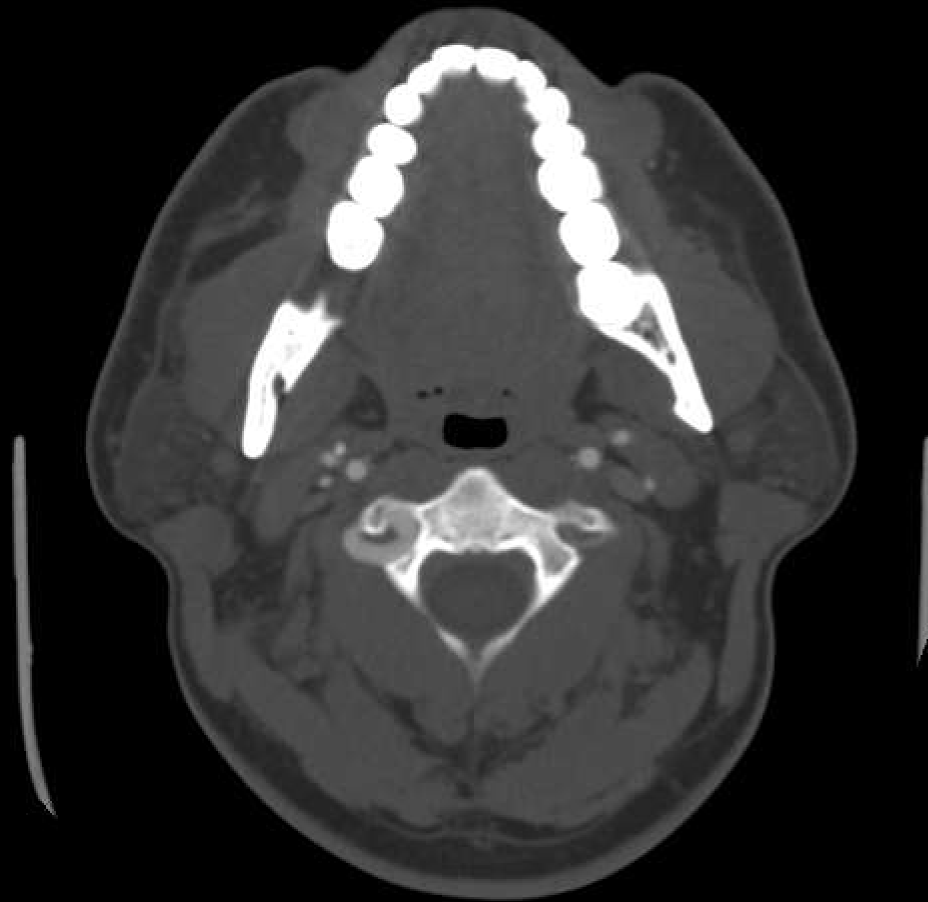
Case 1 (JP Mc, 33yoM)



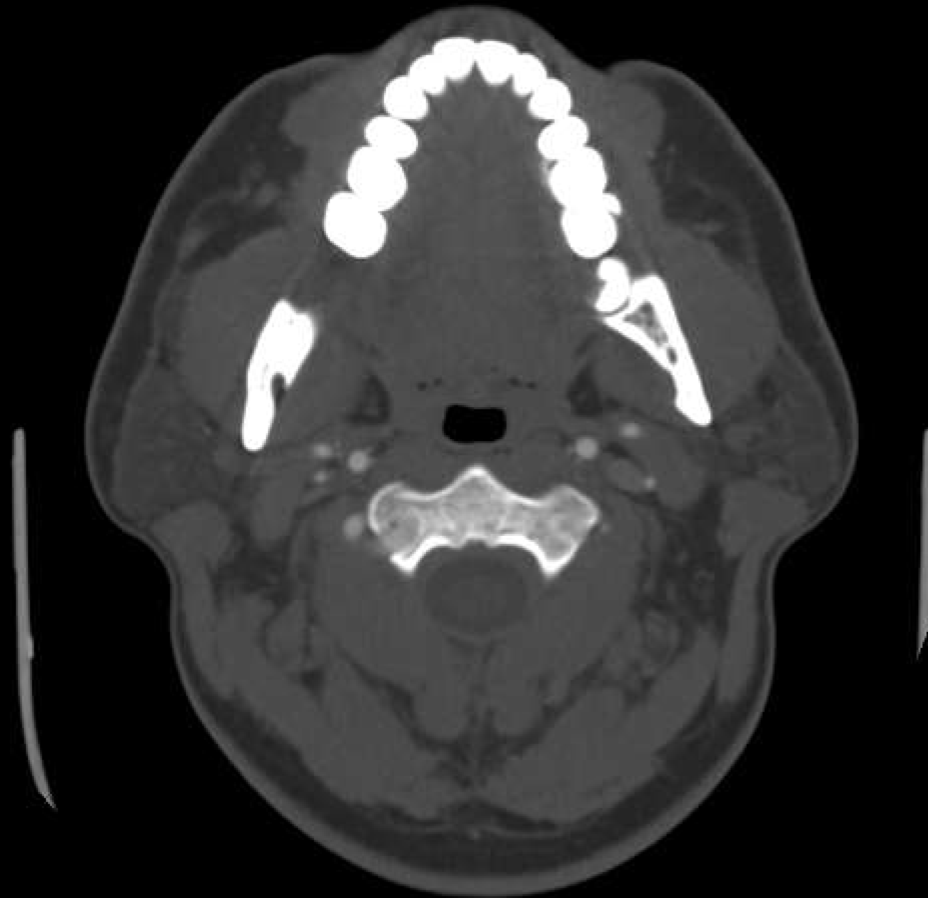
Case 1 (JP Mc, 33yoM)



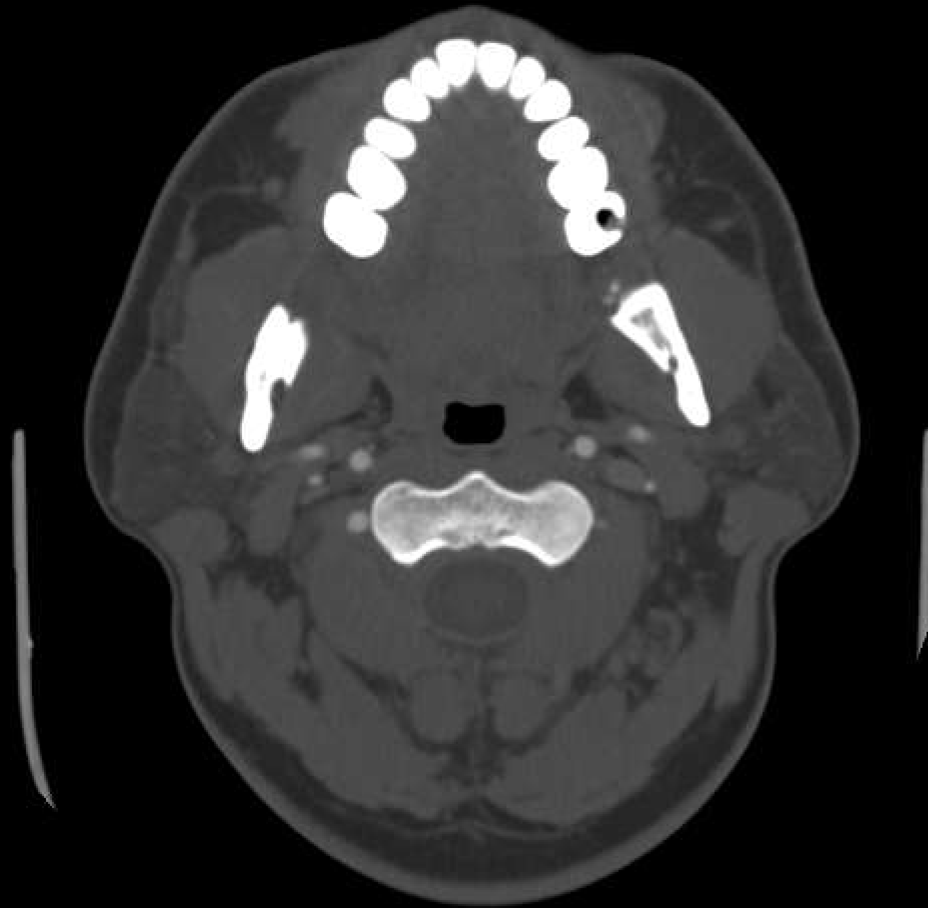
Case 1 (JP Mc, 33yoM)



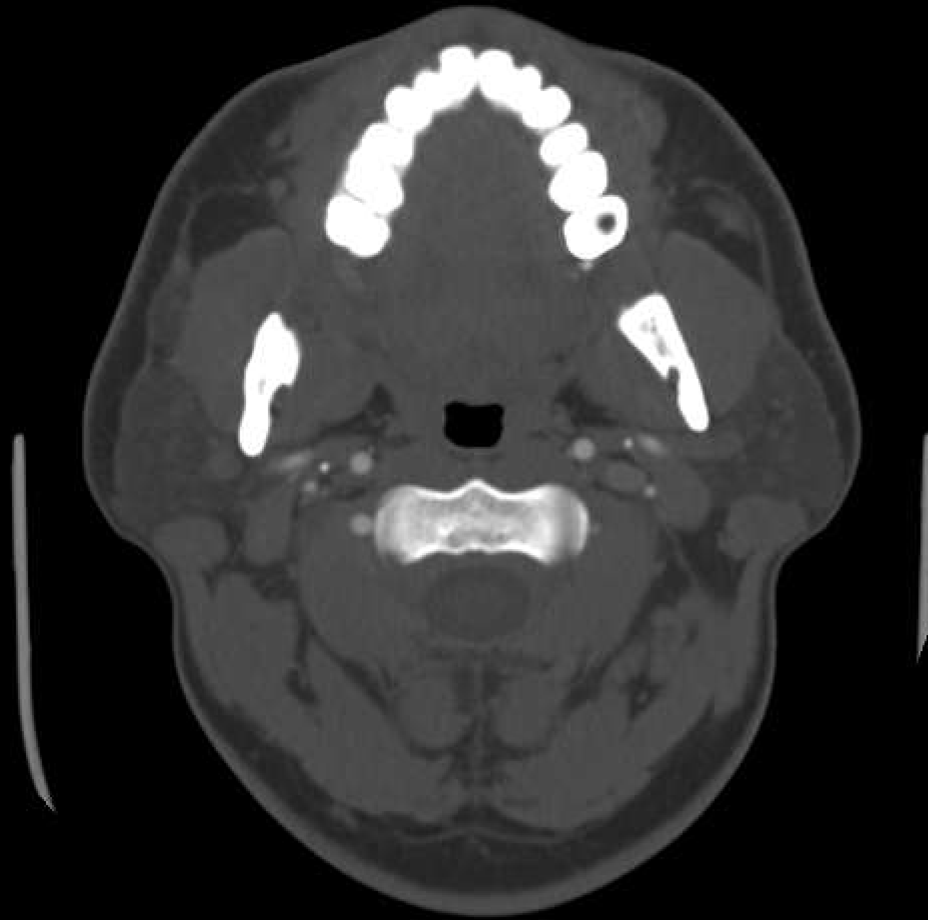
Case 1 (JP Mc, 33yoM)



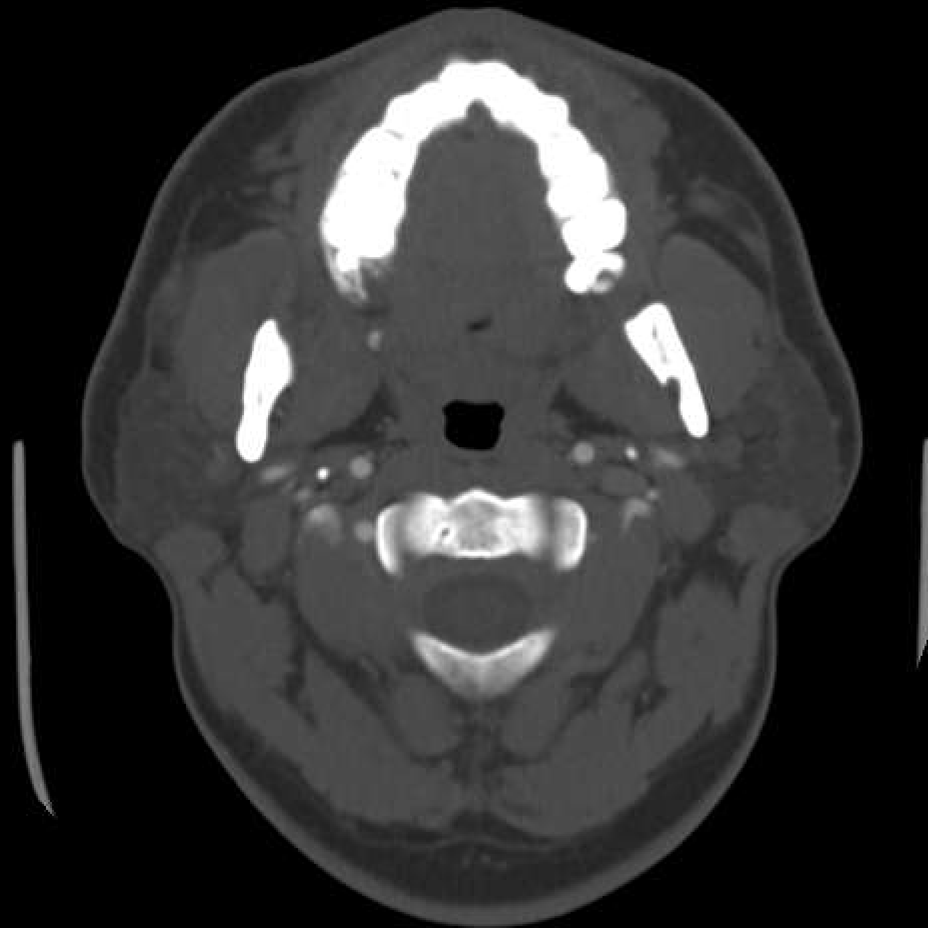
Case 1 (JP Mc, 33yoM)



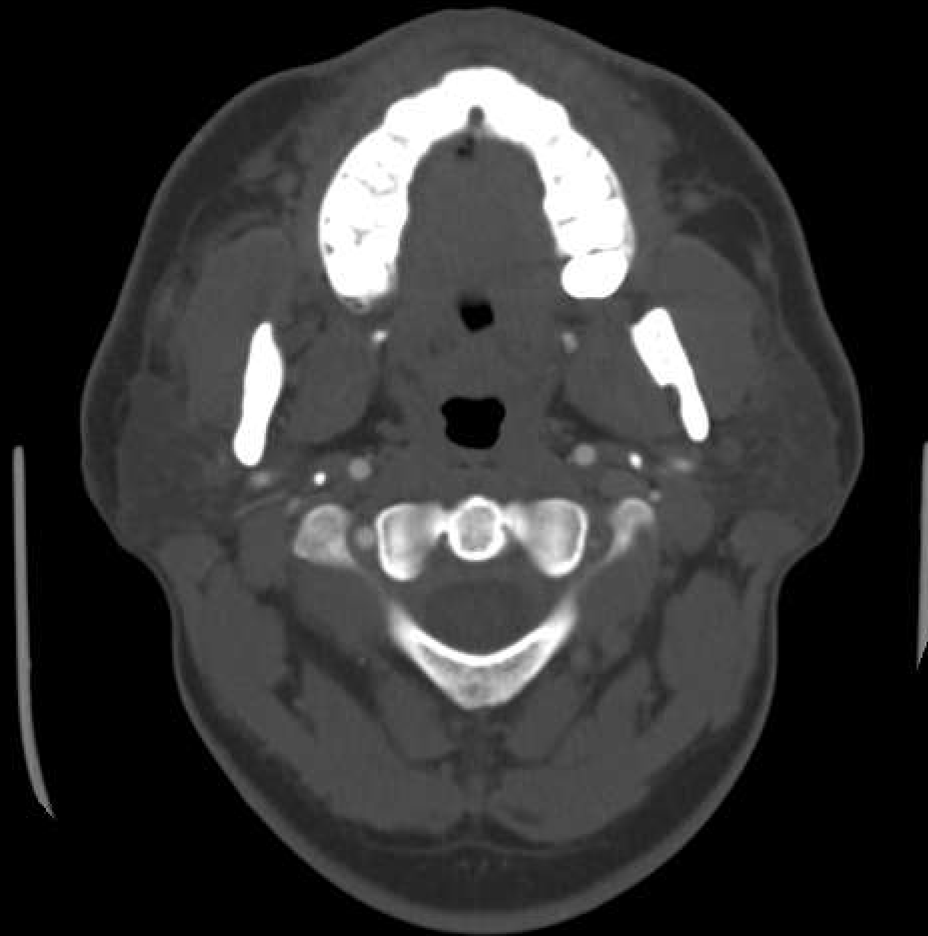
Case 1 (JP Mc, 33yoM)



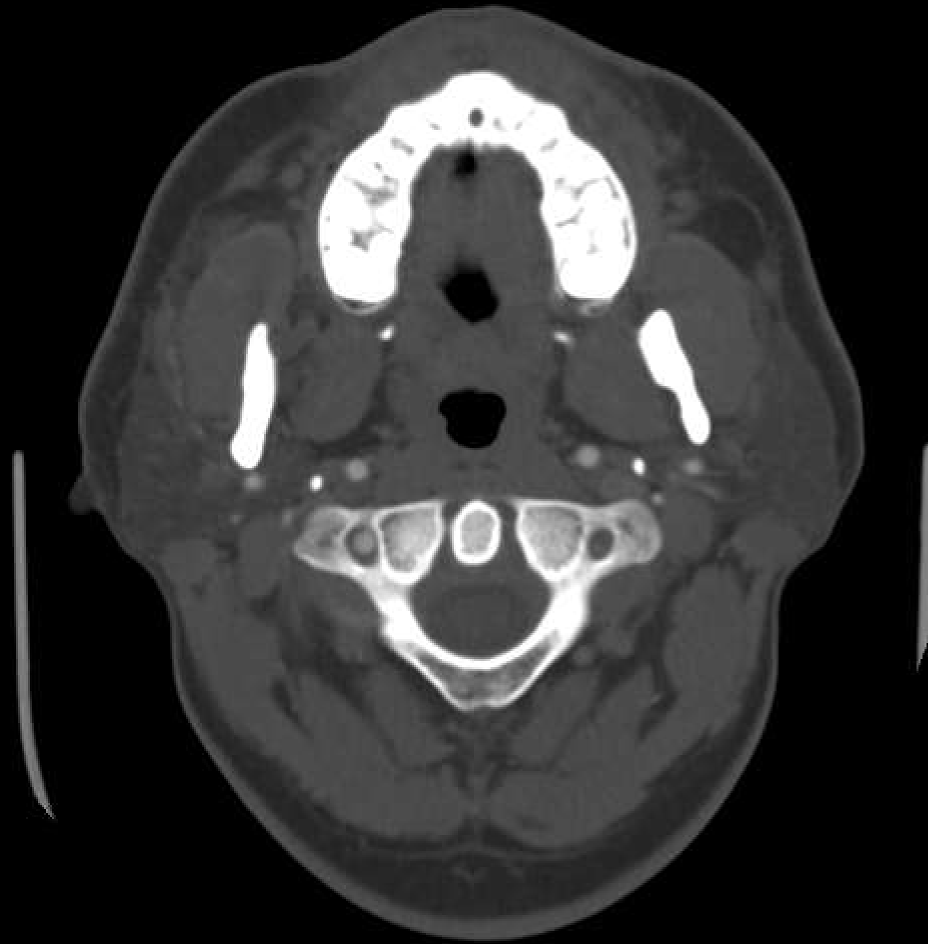
Case 1 (JP Mc, 33yoM)



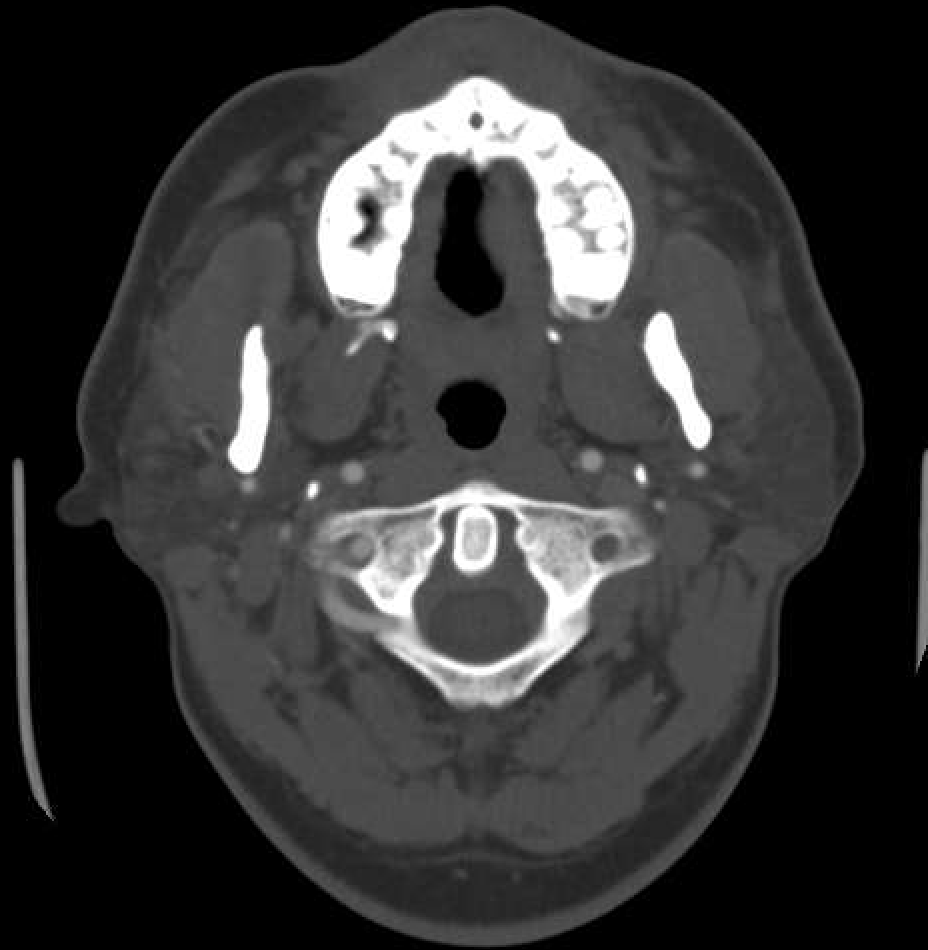
Case 1 (JP Mc, 33yoM)



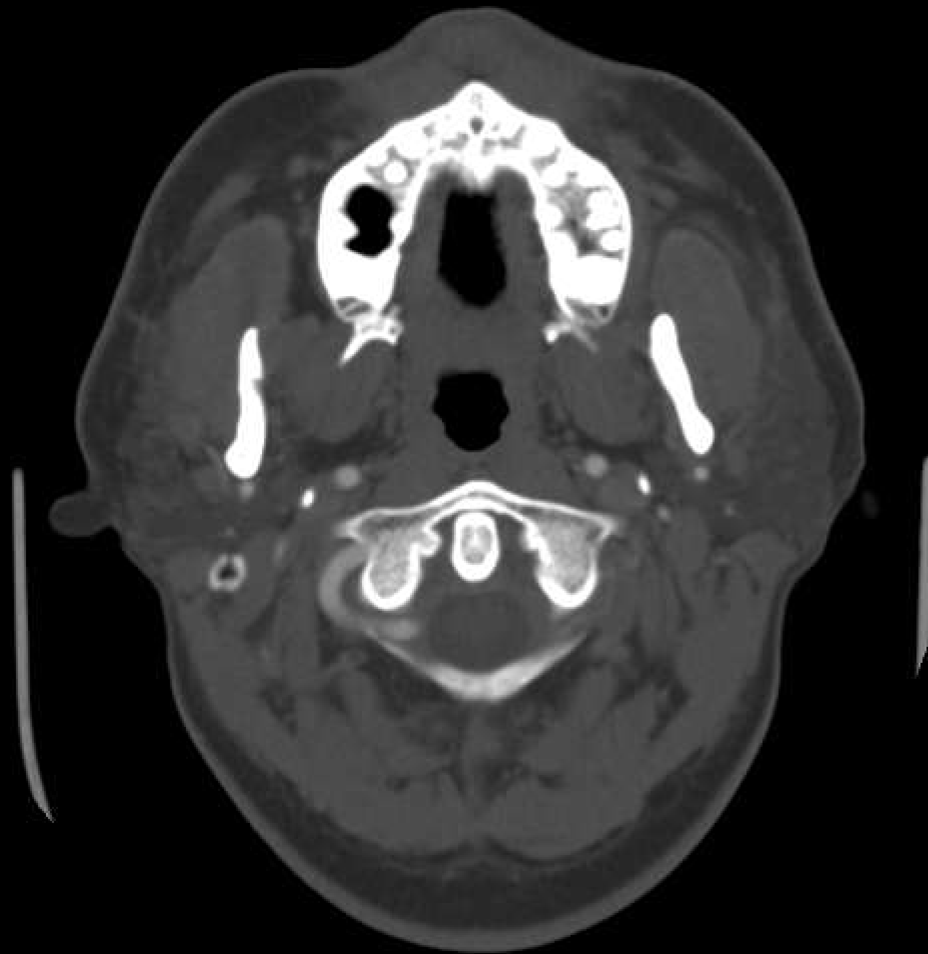
Case 1 (JP Mc, 33yoM)



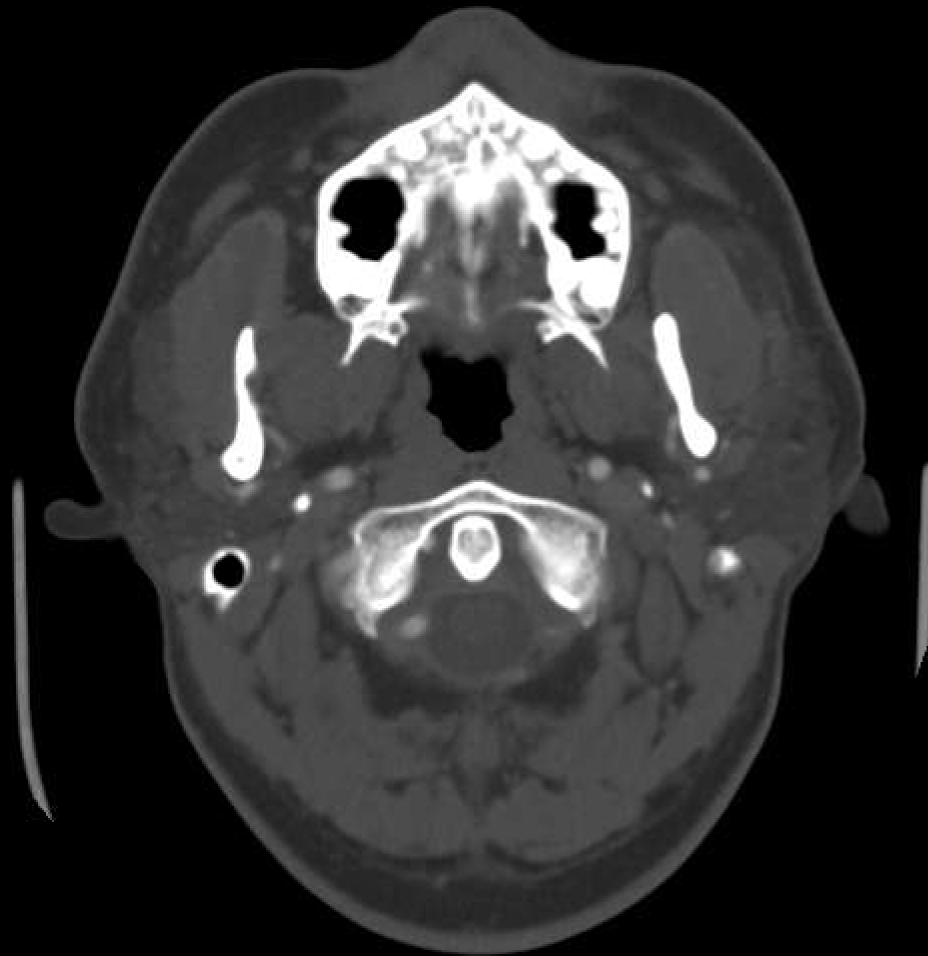
Case 1 (JP Mc, 33yoM)



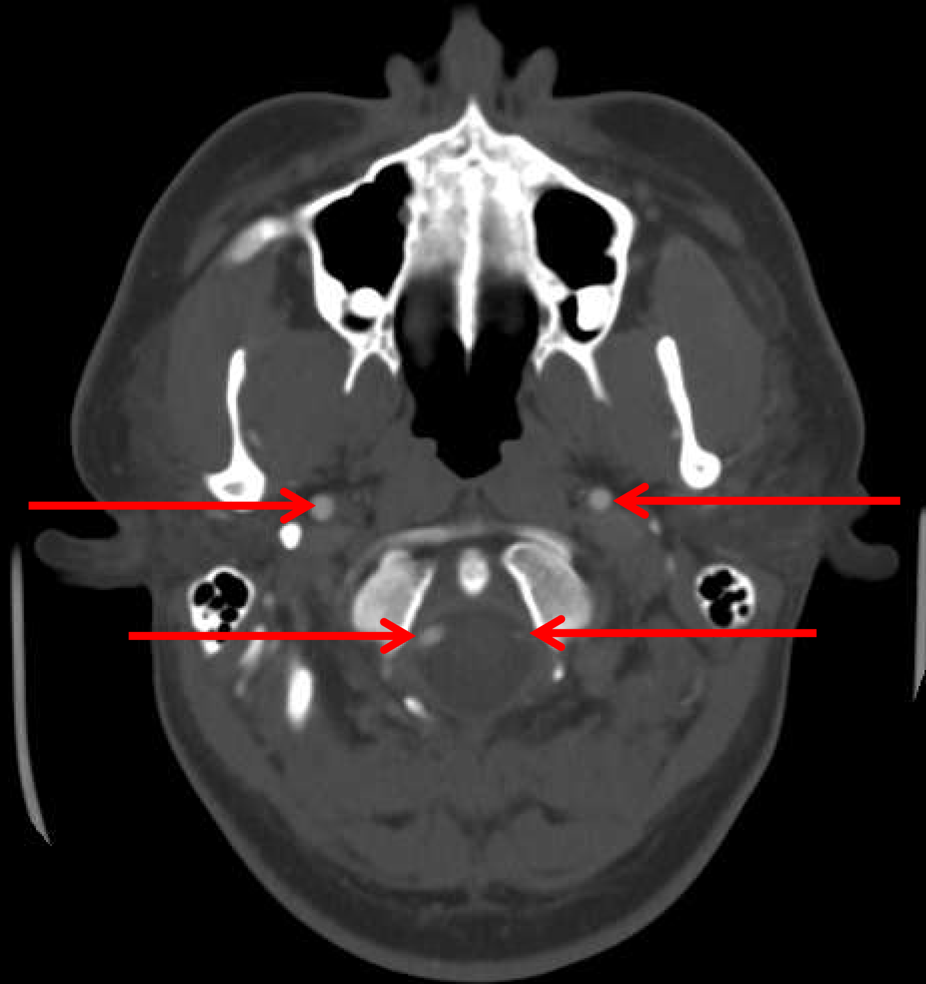
Case 1 (JP Mc, 33yoM)



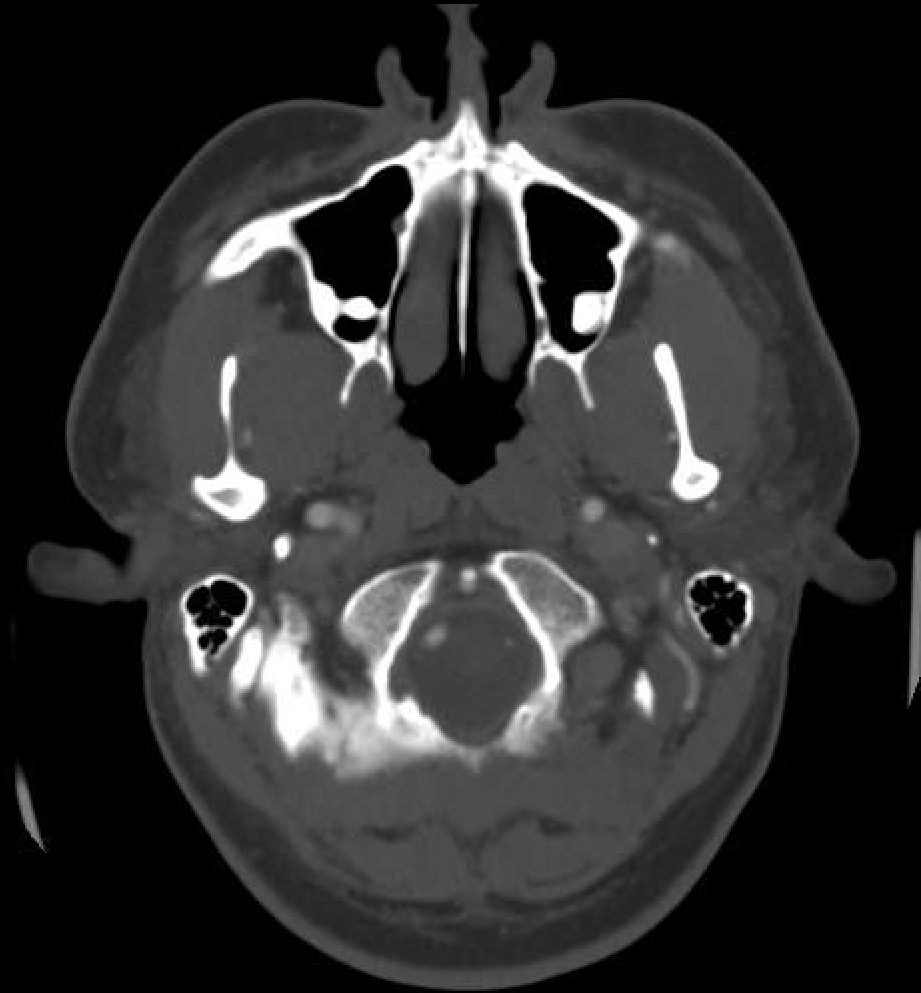
Case 1 (JP Mc, 33yoM)



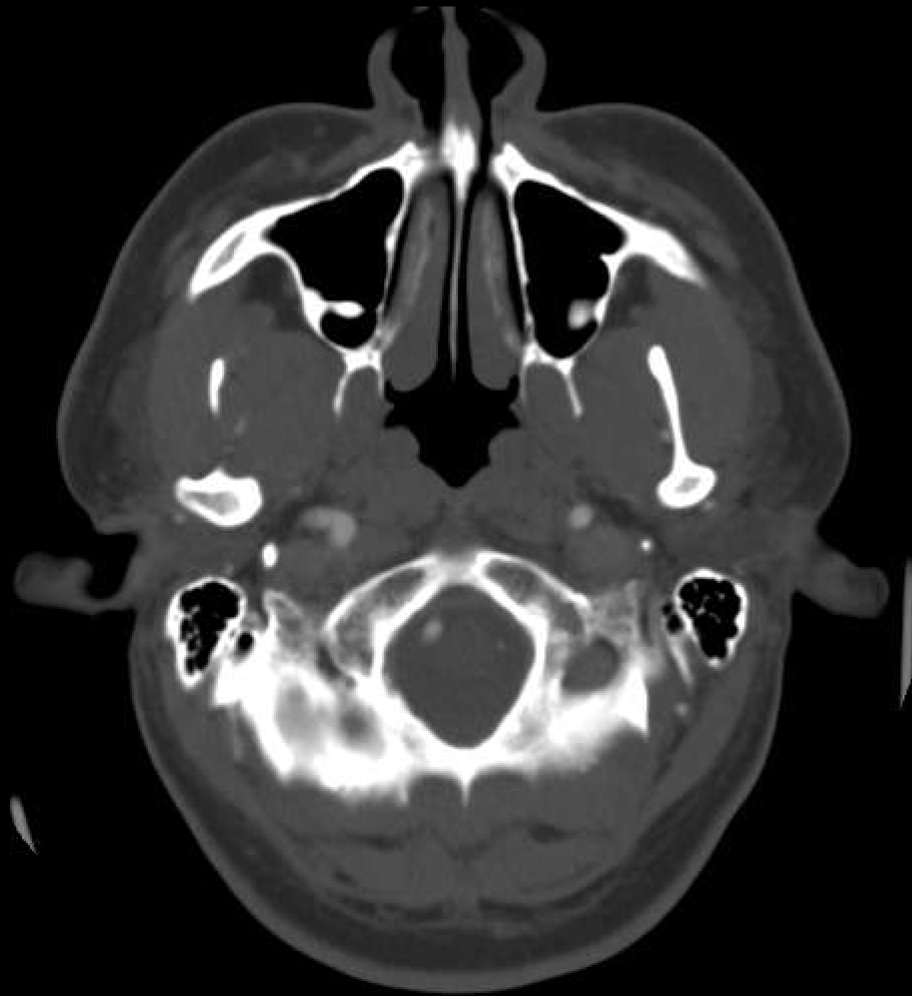
Case 1 (JP Mc, 33yoM)



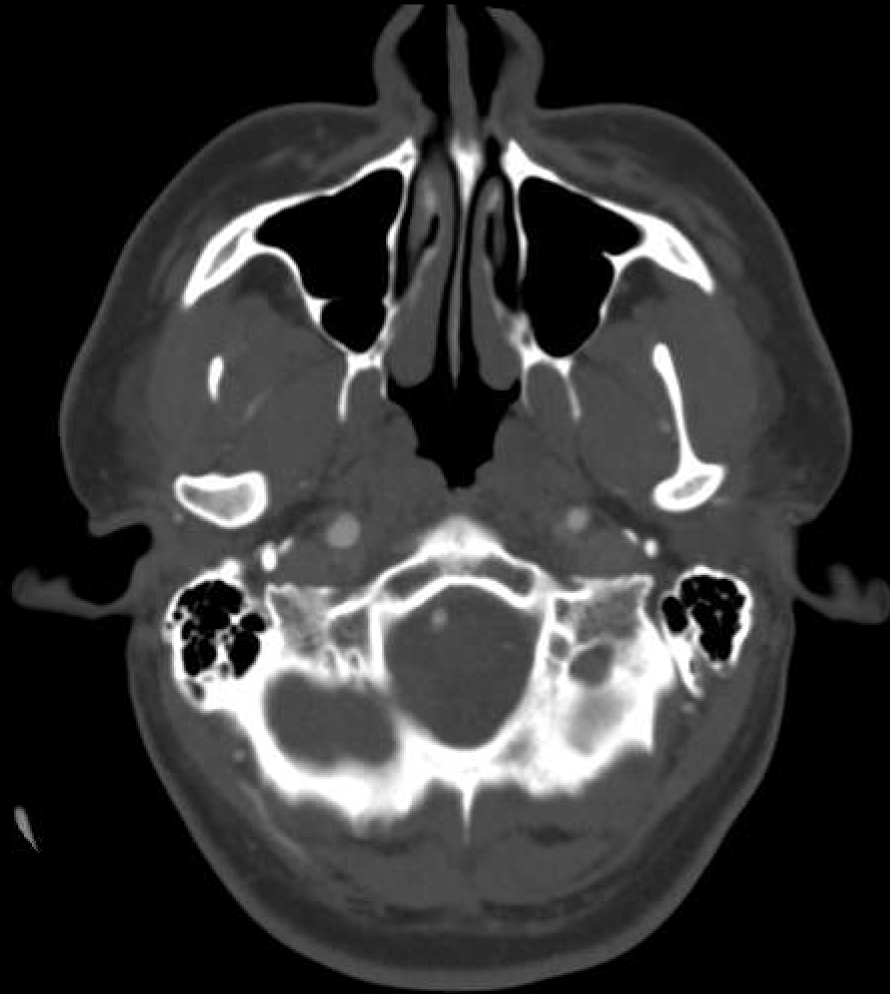
Case 1 (JP Mc, 33yoM)



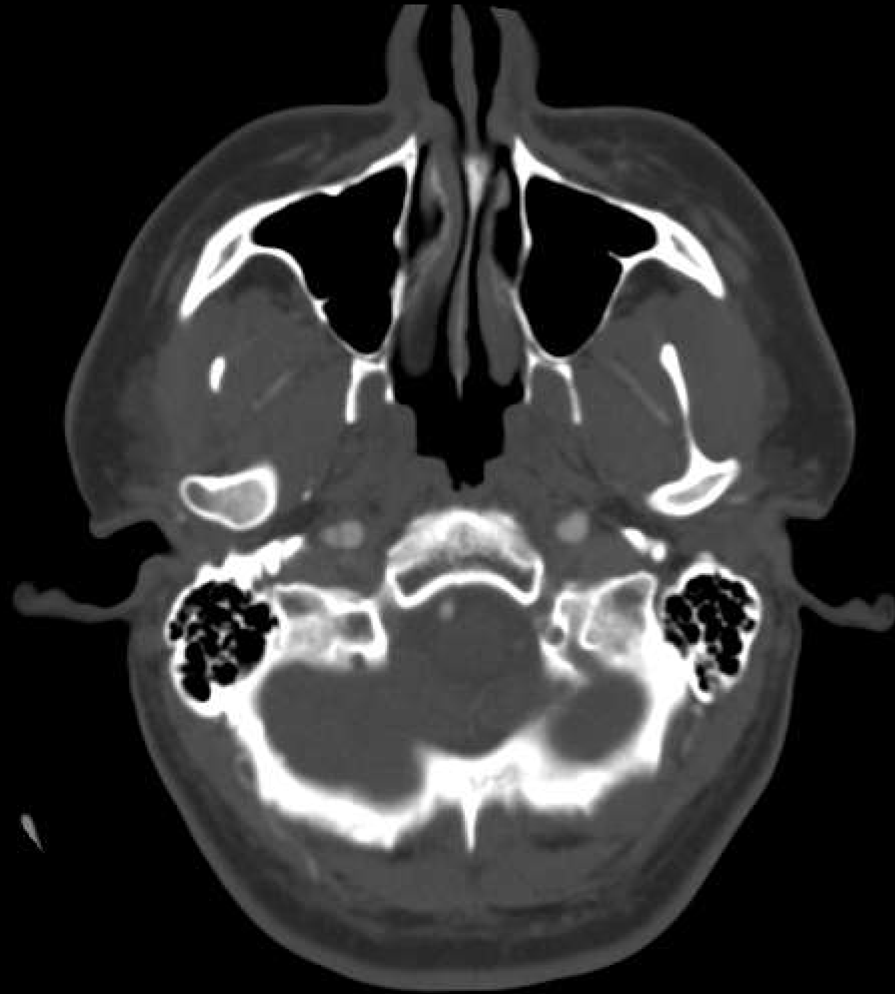
Case 1 (JP Mc, 33yoM)



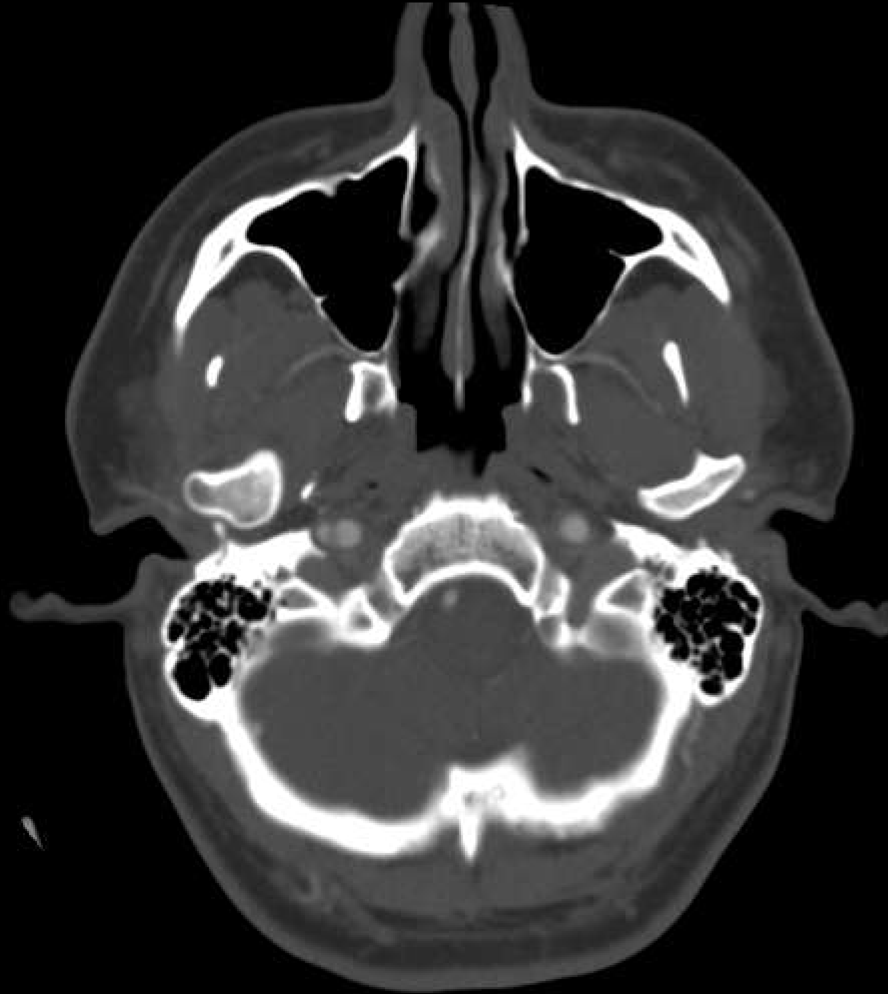
Case 1 (JP Mc, 33yoM)



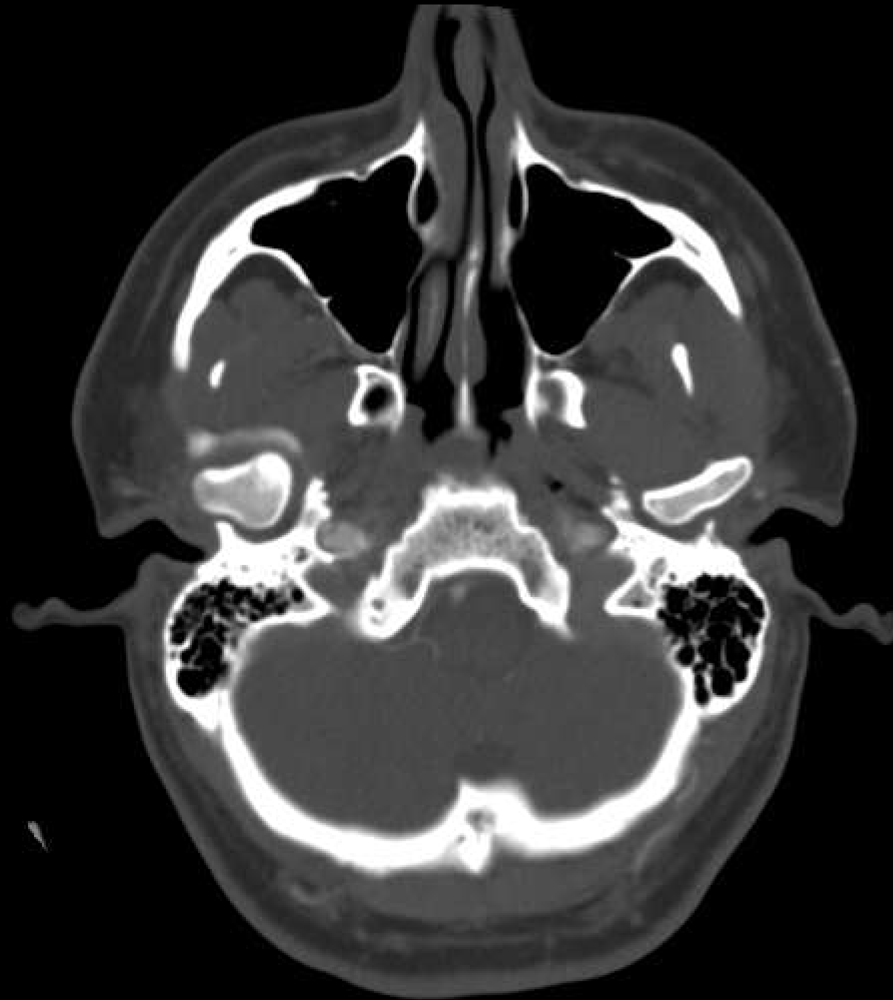
Case 1 (JP Mc, 33yoM)



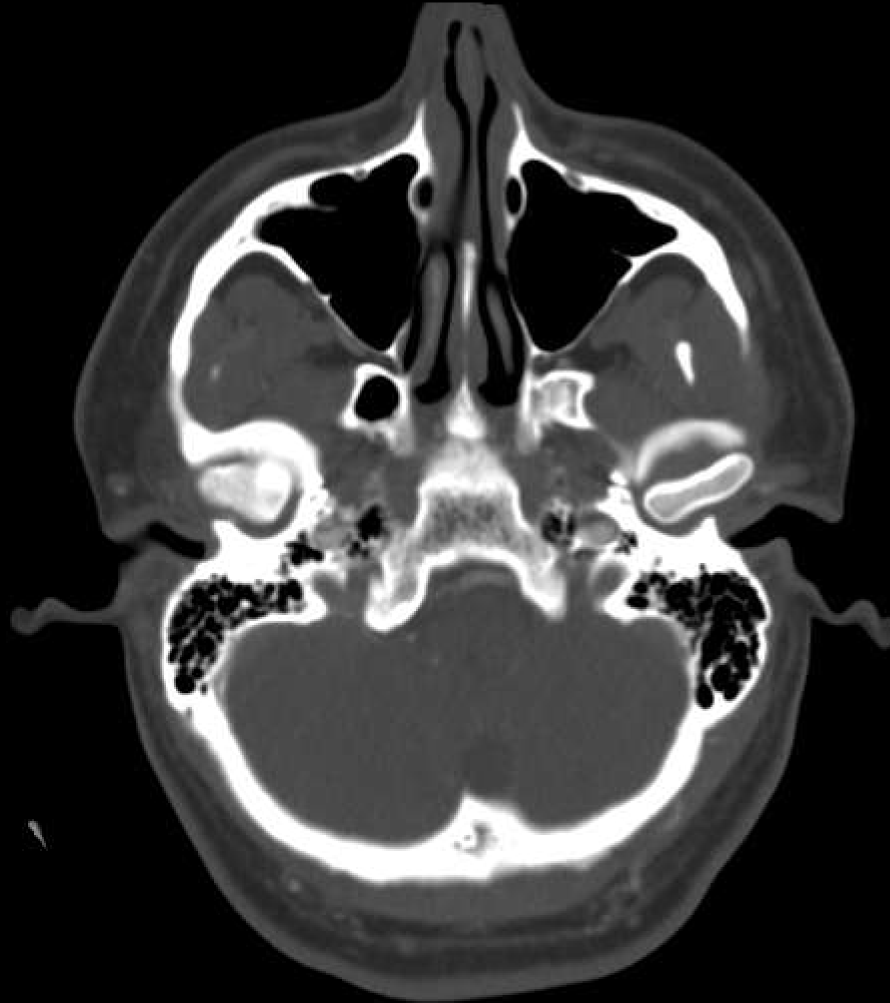
Case 1 (JP Mc, 33yoM)



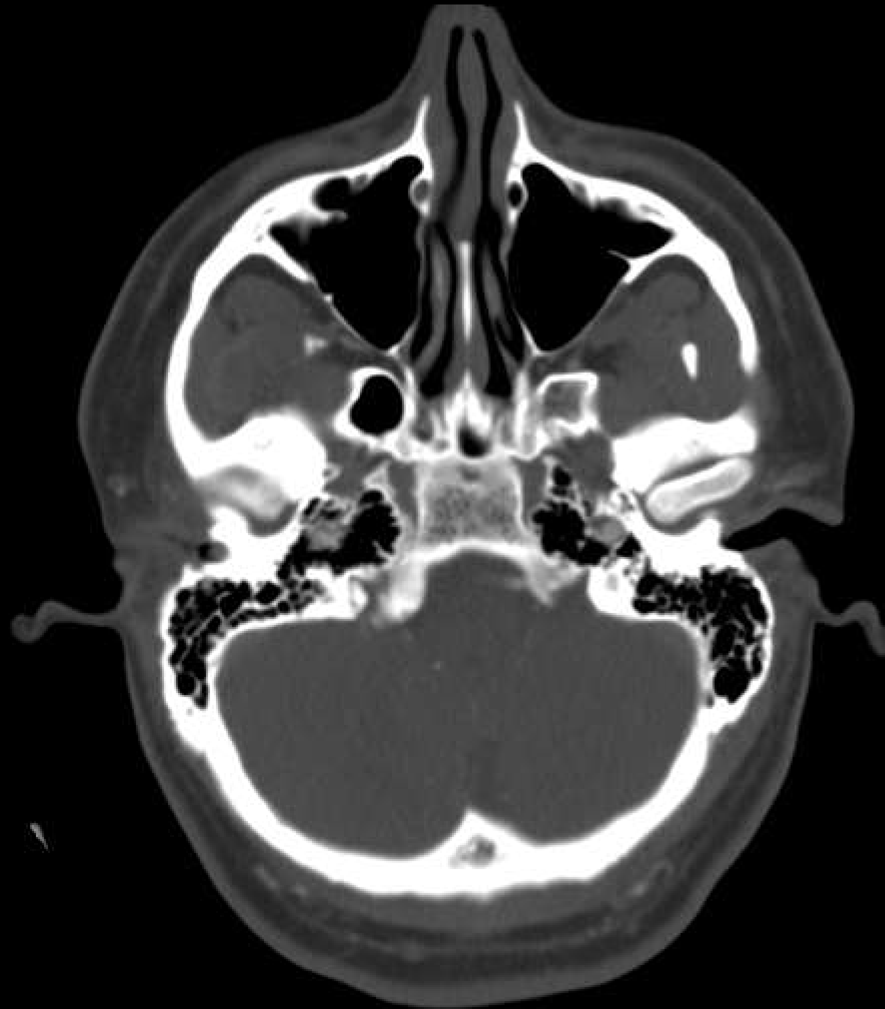
Case 1 (JP Mc, 33yoM)



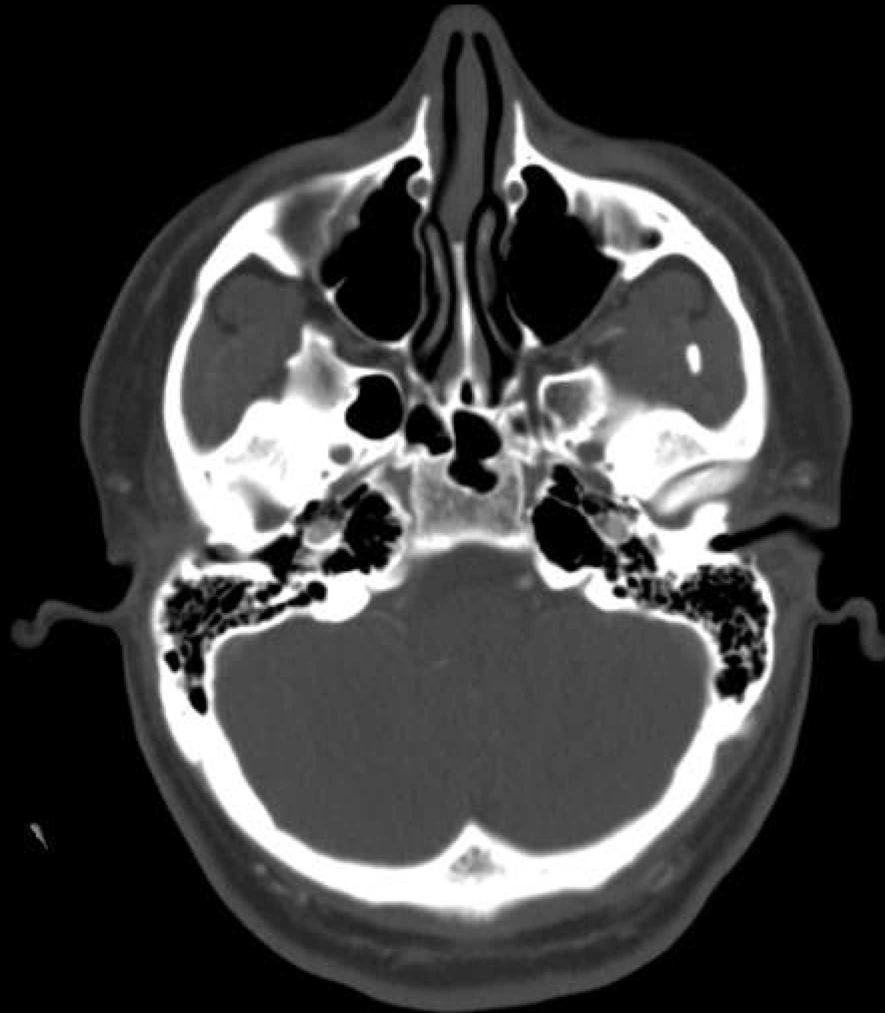
Case 1 (JP Mc, 33yoM)



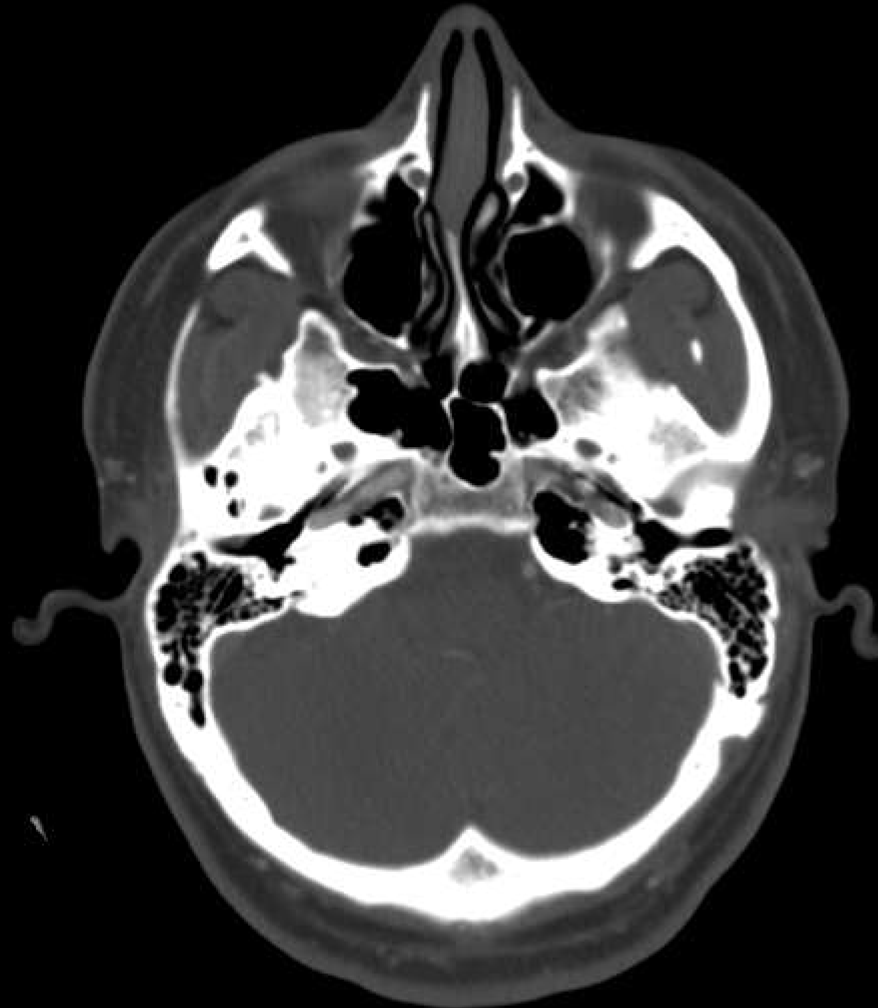
Case 1 (JP Mc, 33yoM)



Case 1 (JP Mc, 33yoM)



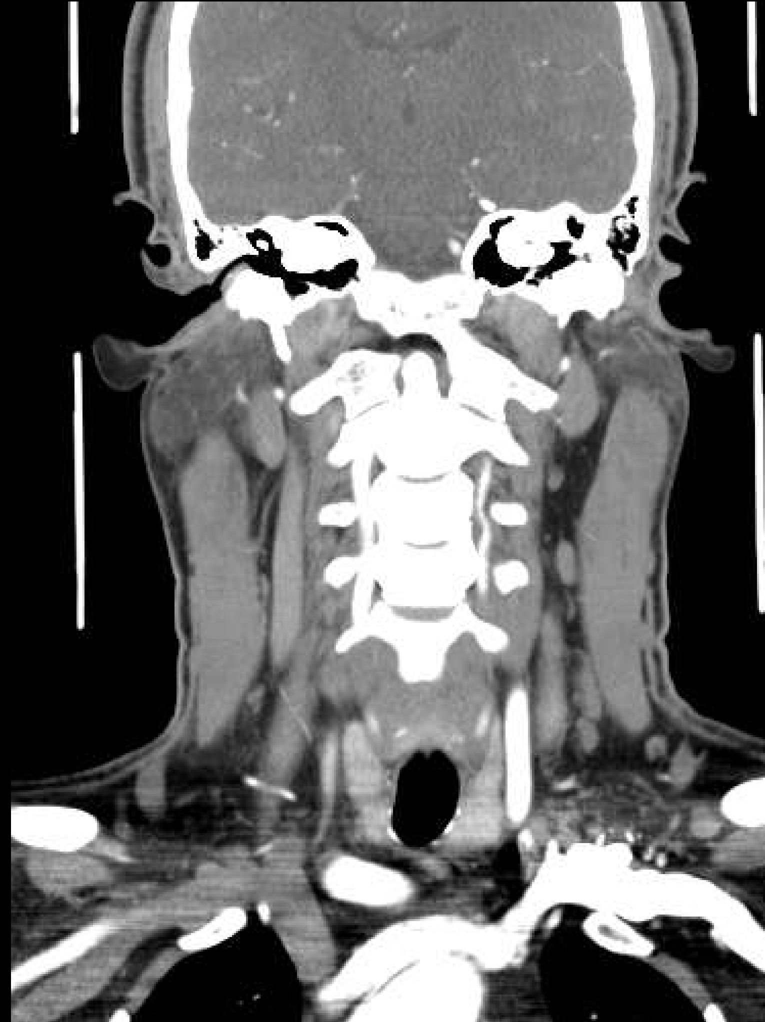
Case 1 (JP Mc, 33yoM)



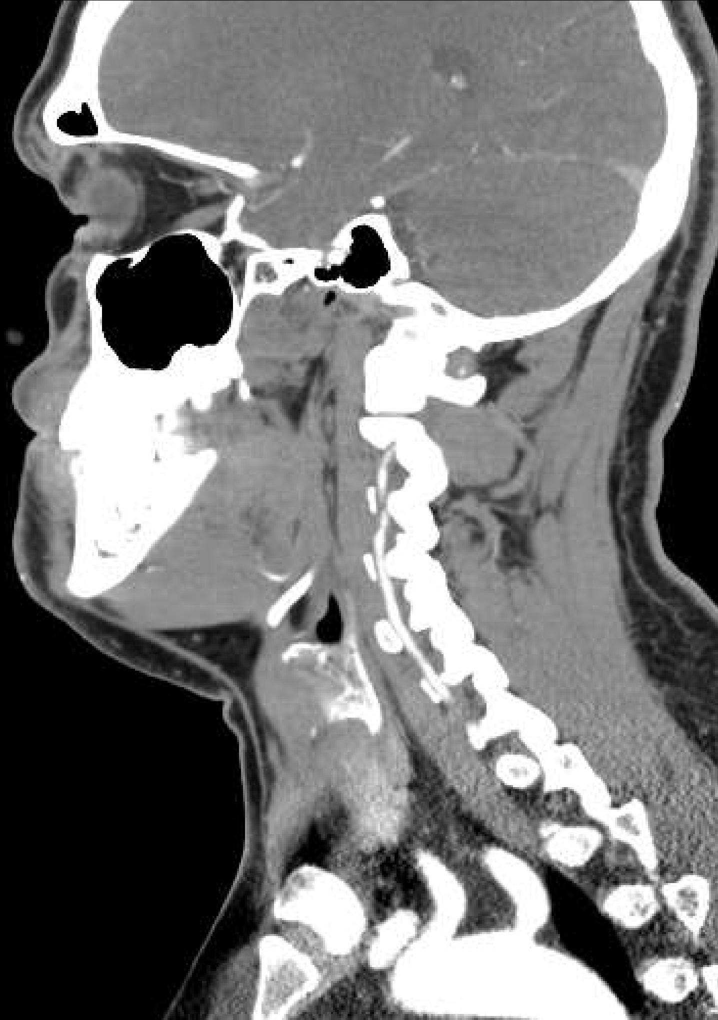
Case 1 (JP Mc, 33yoM)

- The lower cervical portion of the left vertebral artery is regular in calibre, however at around the C3-C4 level, multiple irregularities are noted within the artery, and there is decrease in arterial calibre to the level of the basilar, raising the possibility of a dissection.
- The right internal carotid artery, at the origin of the petrous segment appears to demonstrate a short segment dissection flap, without definite extension to the cavernous portion.
- Further evaluation with MRI and MRA recommended.

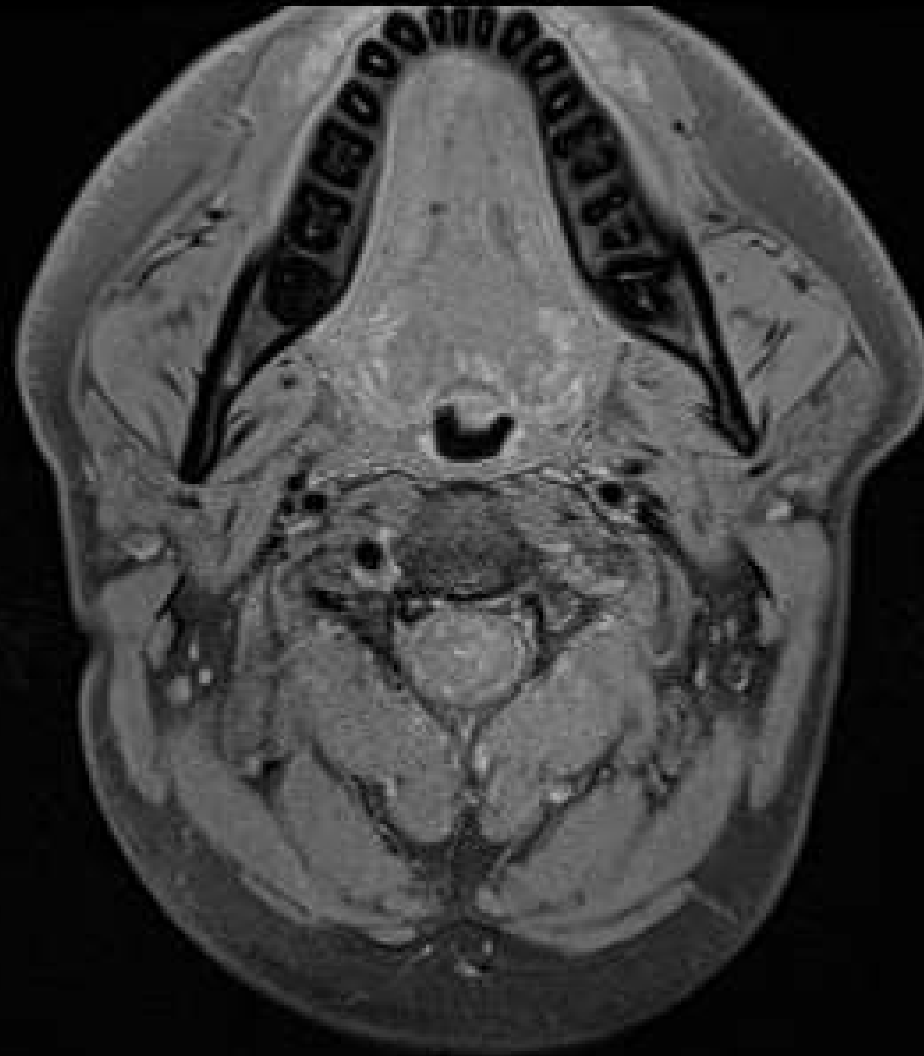
Case 1 (JP Mc, 33yoM)



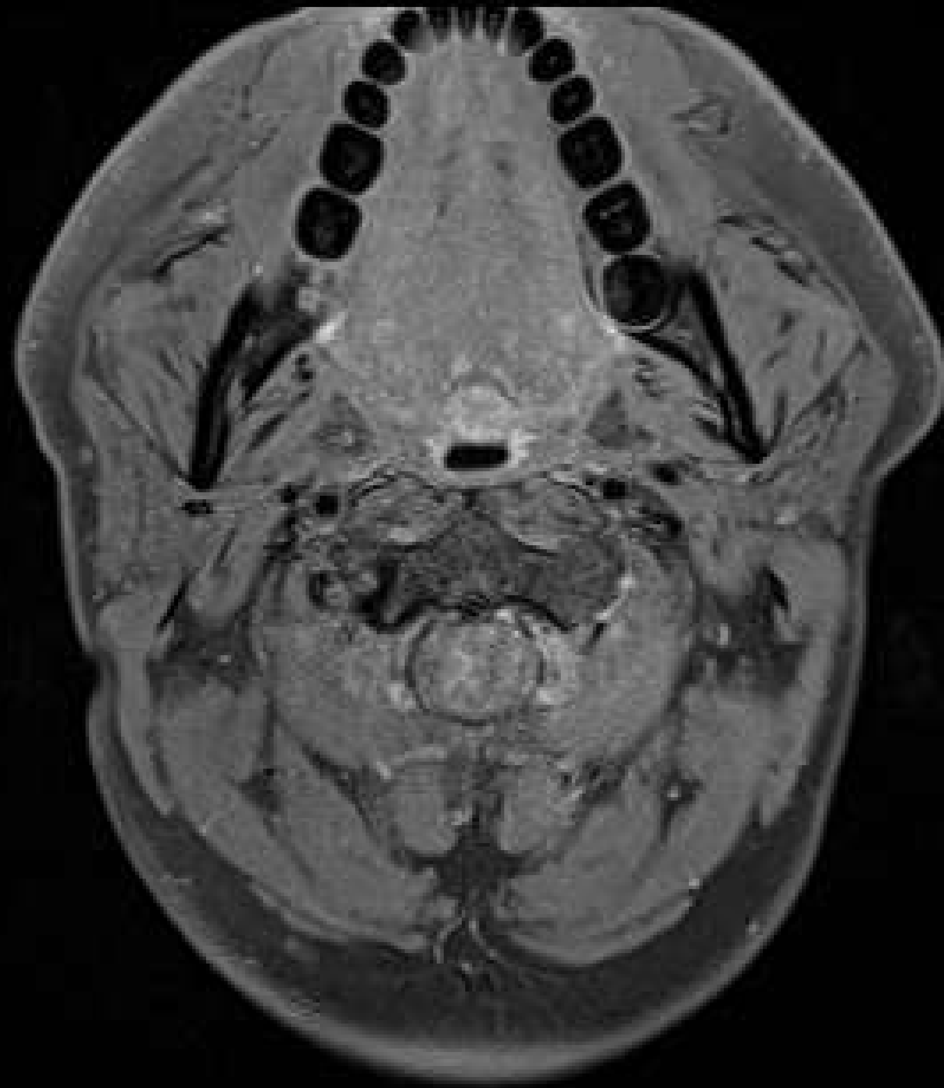
Case 1 (JP Mc, 33yoM)



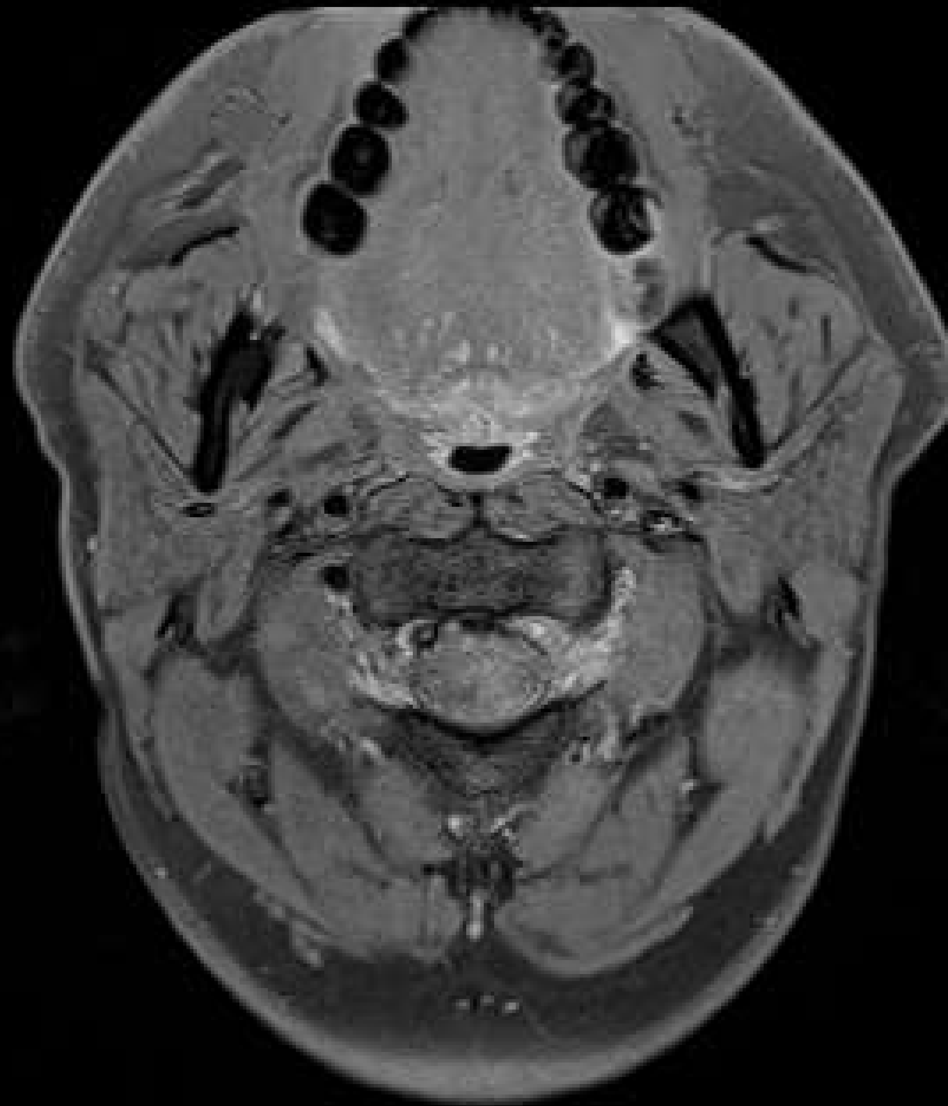
Case 1 (JP Mc, 33yoM)



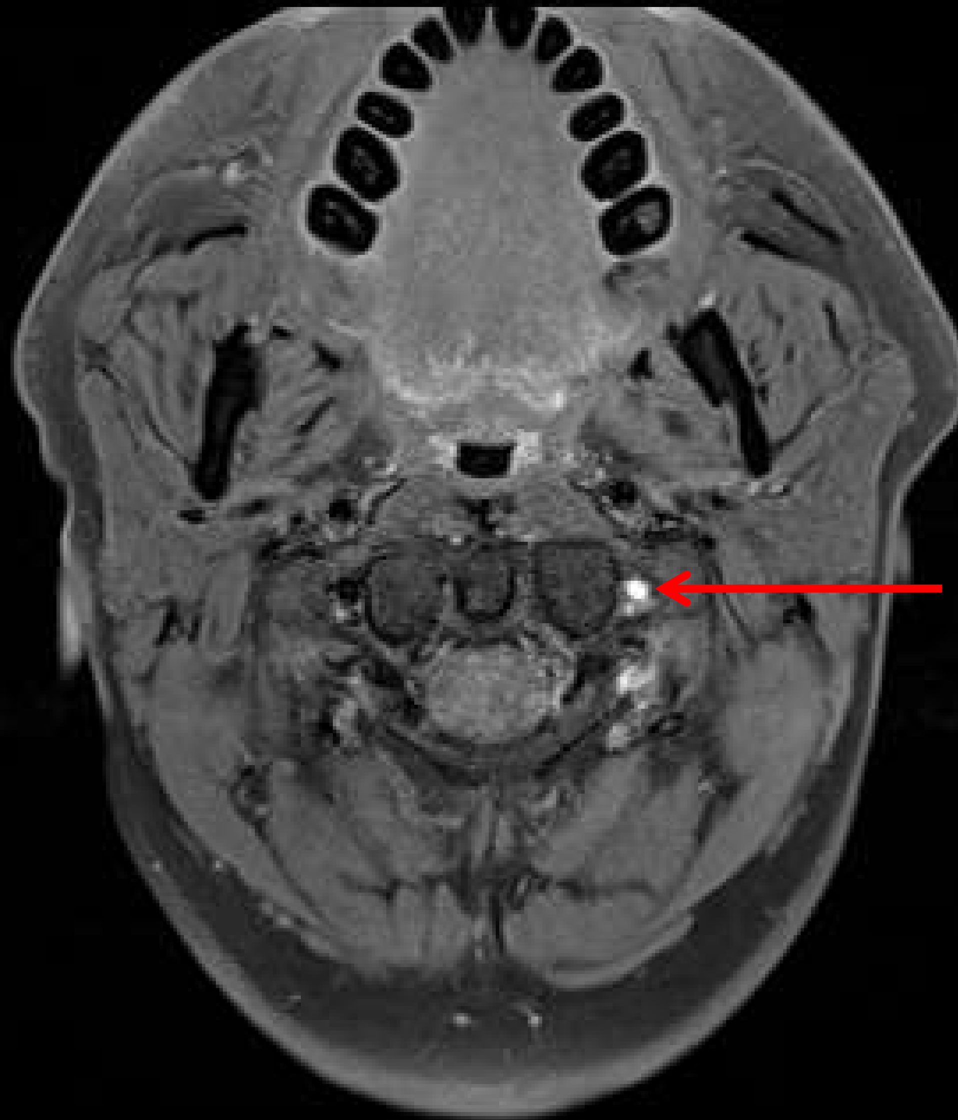
Case 1 (JP Mc, 33yoM)



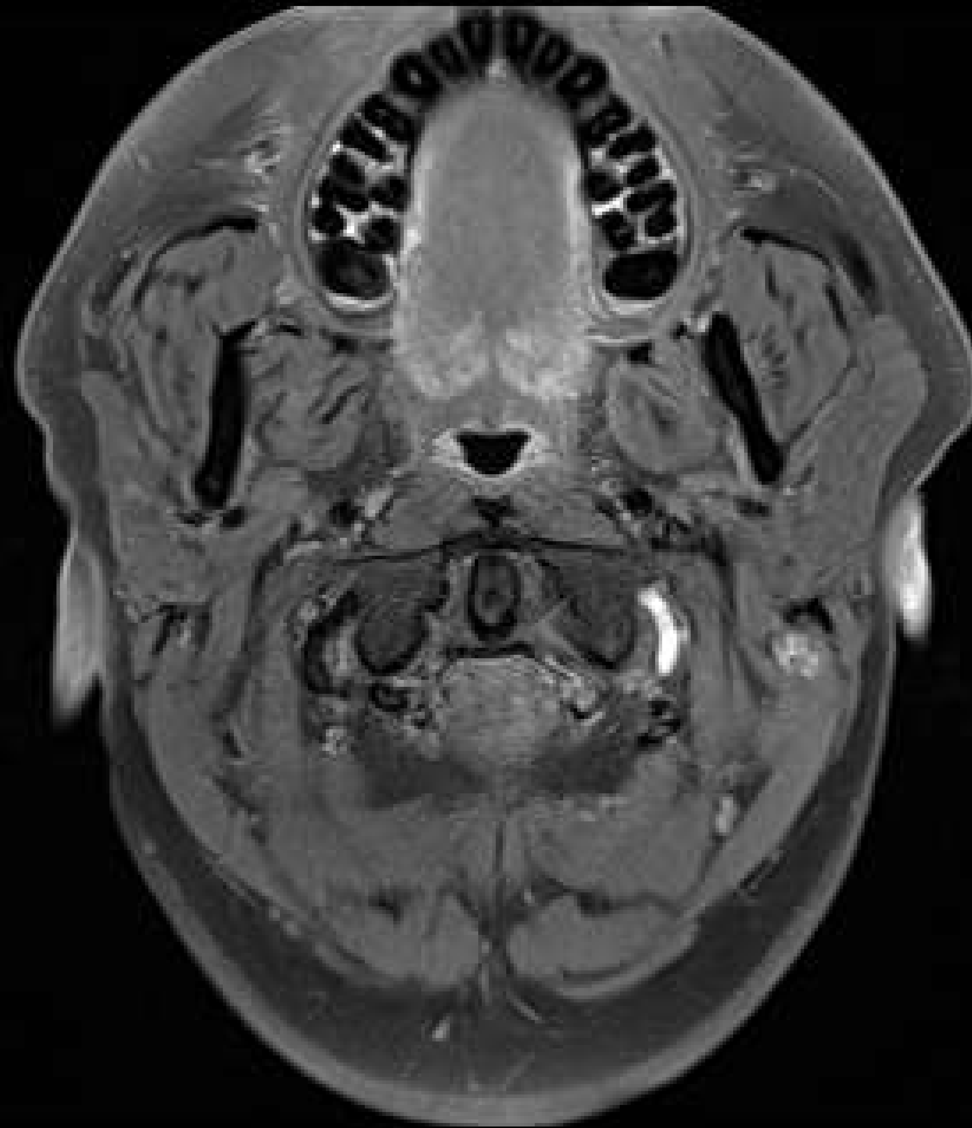
Case 1 (JP Mc, 33yoM)



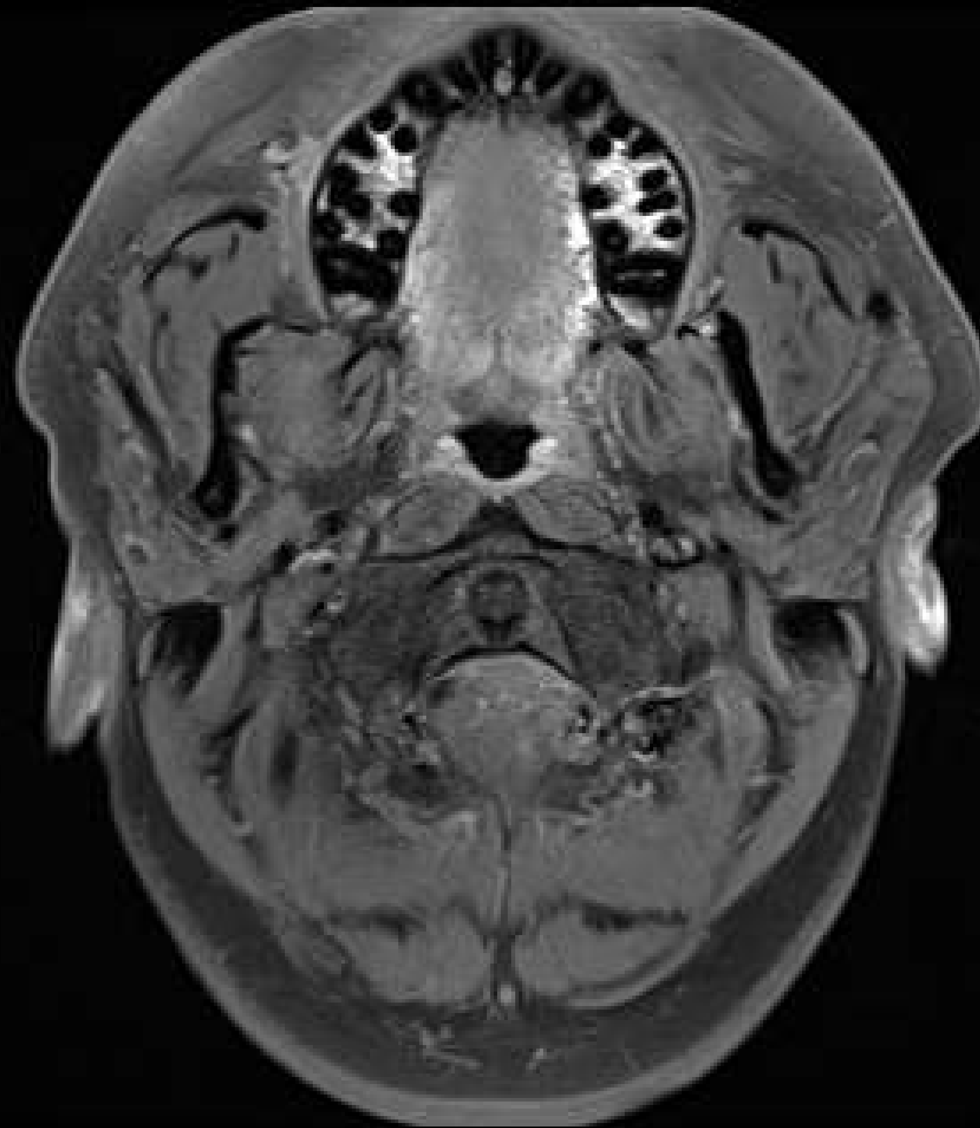
Case 1 (JP Mc, 33yoM)



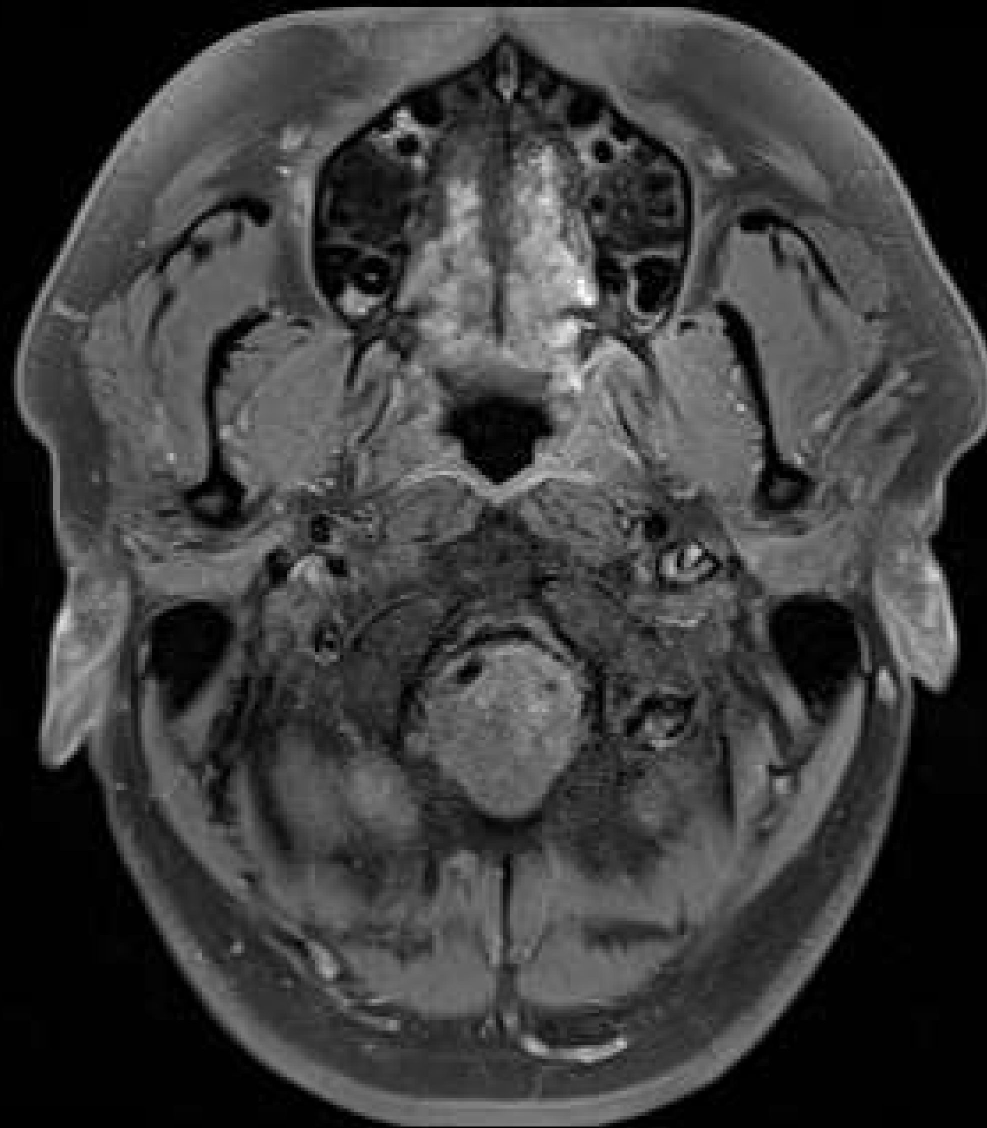
Case 1 (JP Mc, 33yoM)



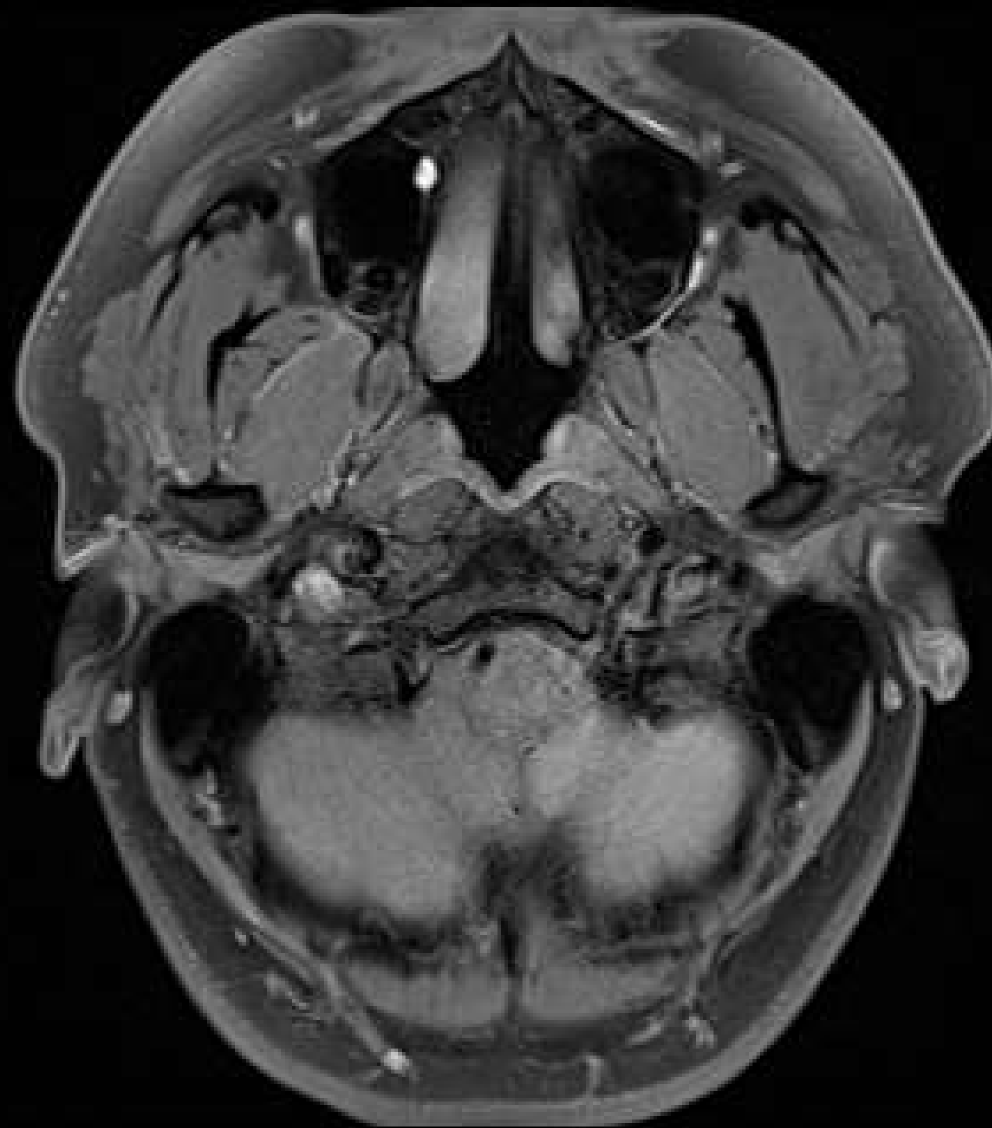
Case 1 (JP Mc, 33yoM)



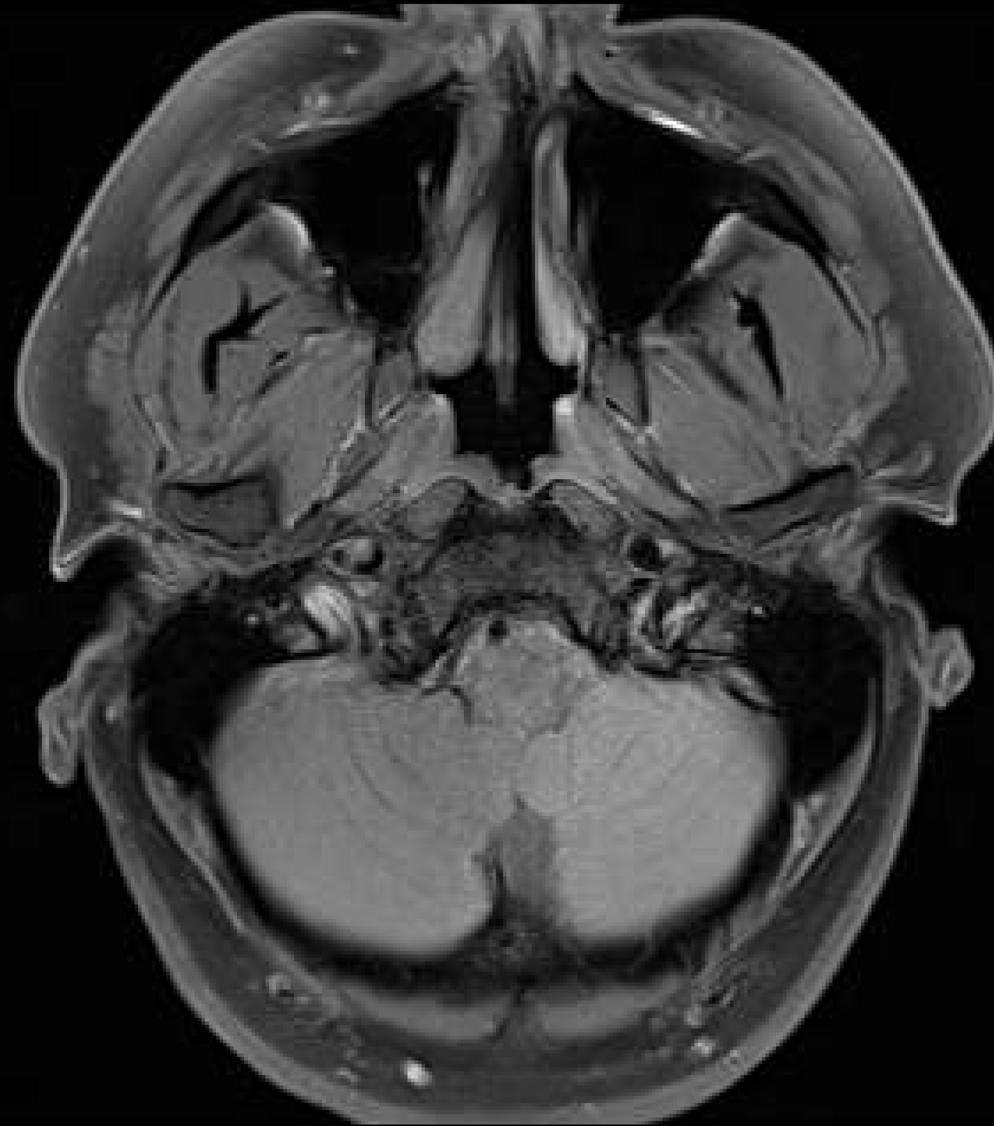
Case 1 (JP Mc, 33yoM)



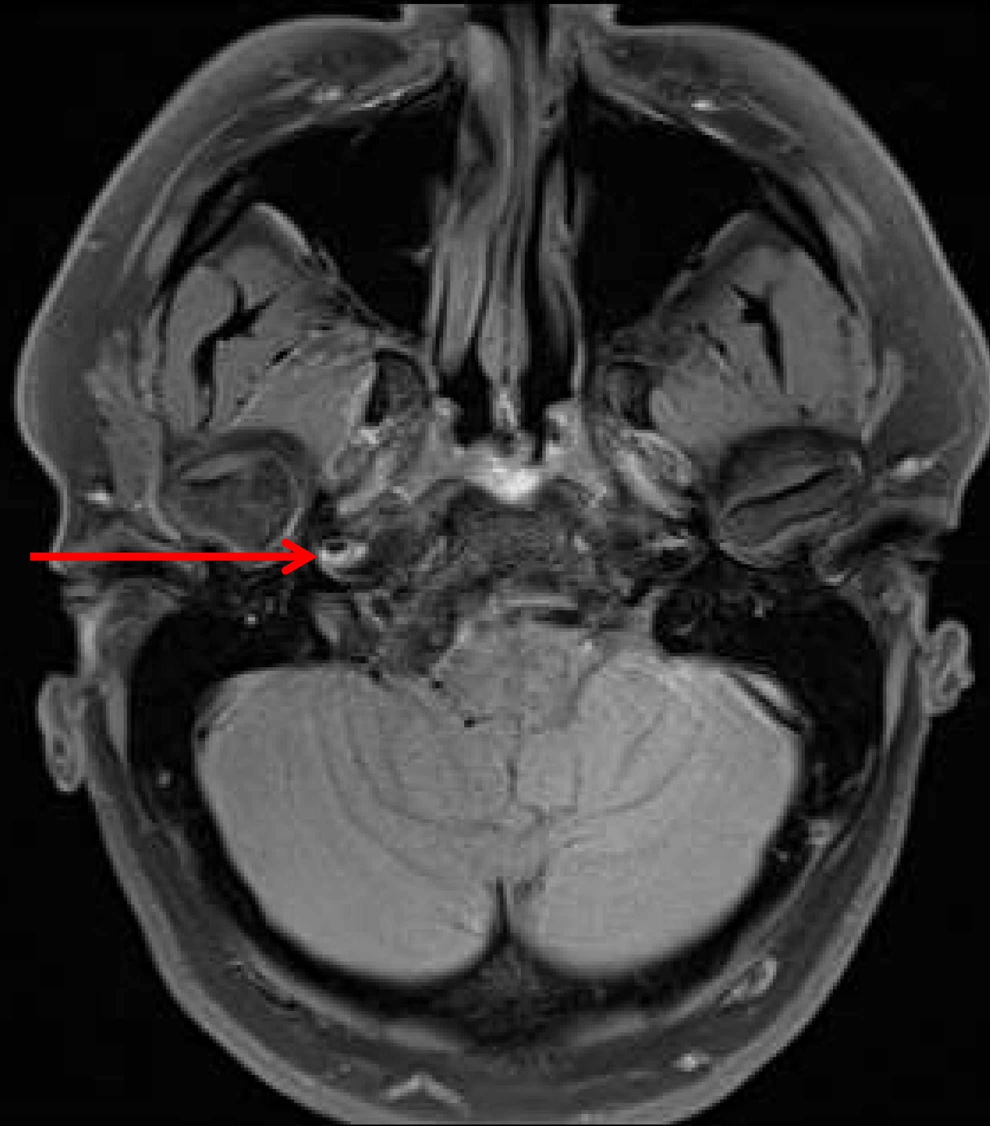
Case 1 (JP Mc, 33yoM)



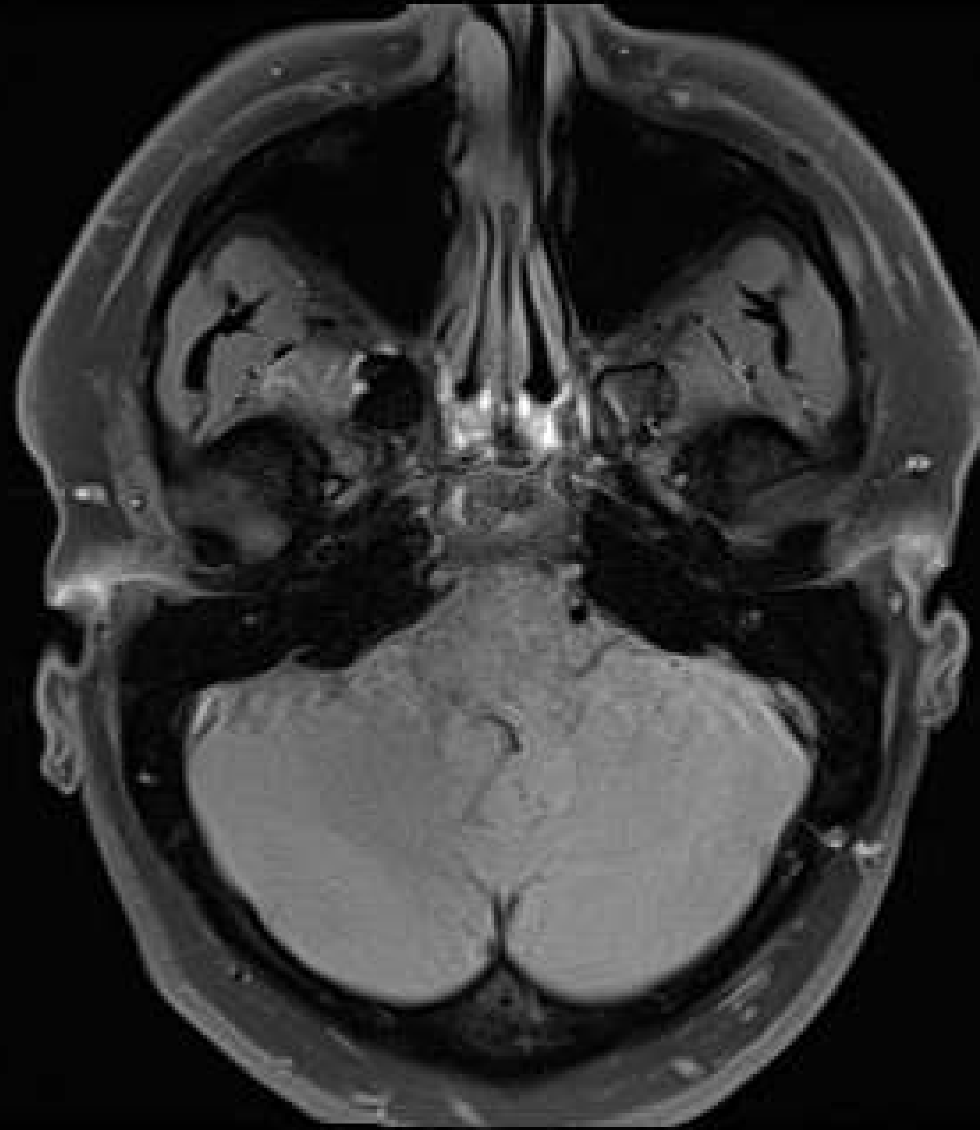
Case 1 (JP Mc, 33yoM)



Case 1 (JP Mc, 33yoM)



Case 1 (JP Mc, 33yoM)



Case 1 (JP Mc, 33yoM)

- There is a definite dissection in the distal right internal carotid at the level of C1. Flow voids are present on both sides of the dissection flap.
- There is also a dissection involving the left vertebral artery as it passes over the lateral mass of C1. This correlates to the extremely thinned and regular component laterally. The dissection extends inferiorly to approximately the mid neck consistent with the CT study.

Carotid / Vertebral Artery Dissection

- Incidence ~3 /100000 /year
  - Carotid ~2 /100000 /year
  - Vertebral ~1 /100000 /year
  - Possibly greater in autumn or winter
    - ? association with infection, blood pressure changes, physical activity
  - Rare but major cause of stroke in young adults

Debette S, Leys D. Cervical-artery dissections: predisposing factors, diagnosis, and outcome. Lancet Neurol 2009 Jul; 8(7): 668-78.

Carotid / Vertebral Artery Dissection

- Mechanism
  - Non-traumatic causes unclear
    - (minor trauma)
  - ? vasculopathy
  - connective tissue disorder

Carotid / Vertebral Artery Dissection

- Symptoms and Signs
  - Carotid
    - Headache, neck pain, facial pain
    - Amaurosis fugax
    - Neck swelling
    - Pulsatile tinnitus
    - Limb weakness
    - Migraine
  - Vertebral
    - Facial pain
    - Voice change
    - Loss of taste
    - Vertigo
    - Nausea
    - Dysphagia
    - Hearing loss

Carotid / Vertebral Artery Dissection

- Investigations
  - CT angiography
  - MRI (especially T1 fat saturation)
  - conventional angiography
  - Vascular duplex ultrasound

Carotid / Vertebral Artery Dissection

- Treatment
  - Lacking strong evidence
  - Anticoagulants / antiplatelets
    - presumed to prevent thromboembolic events
    - prevent recurrent ischaemic events
    - allow vessel to heal
  - Endovascular
    - stenting invasive but effective for ongoing symptoms
  - Surgical
    - ligation + bypass (significant risk)

Schievink WI. Spontaneous dissection of the carotid and vertebral arteries.
N Engl J Med. 2001 Mar 22; 344(12): 898-906.

Carotid / Vertebral Artery Dissection

- Prognosis
  - Stayin' Alive[1] > 95%
  - symptom resolution ~75%

1. Gibb B, Gibb R, Gibb M. 1977.

Rao AS, Makaroun MS, Marone LK, Cho JS, Rhee R, Chaer RA. Long-term outcomes of internal carotid artery dissection. J Vasc Surg. 2011 Aug; 54(2): 370-4.

Progress

- JP Mc, 33yoM
  - Forklift driver
  - Syncope with head movement
  - Commenced aspirin
- Jo Al, 40yoM
  - New Zealander
  - Sudden, severe vertigo and right hearing loss
  - Commenced heparin
  - Switched to aspirin and clopidogrel
  - Aim to reduce to single agent after 3 months
- He Da, 42yoF
  - Mother of three
  - Intermittent visual / ophthalmic deficits, dysarthria, left upper limb weakness / ataxia
  - Commenced clopidogrel
  - Recommended consider stenting, but declined

Progress 2

- JP Mc, 33yoM
  - Forklift driver
  - Syncope with head movement
  - Commenced aspirin
  - Returned at 4 weeks with nocturnal convulsions

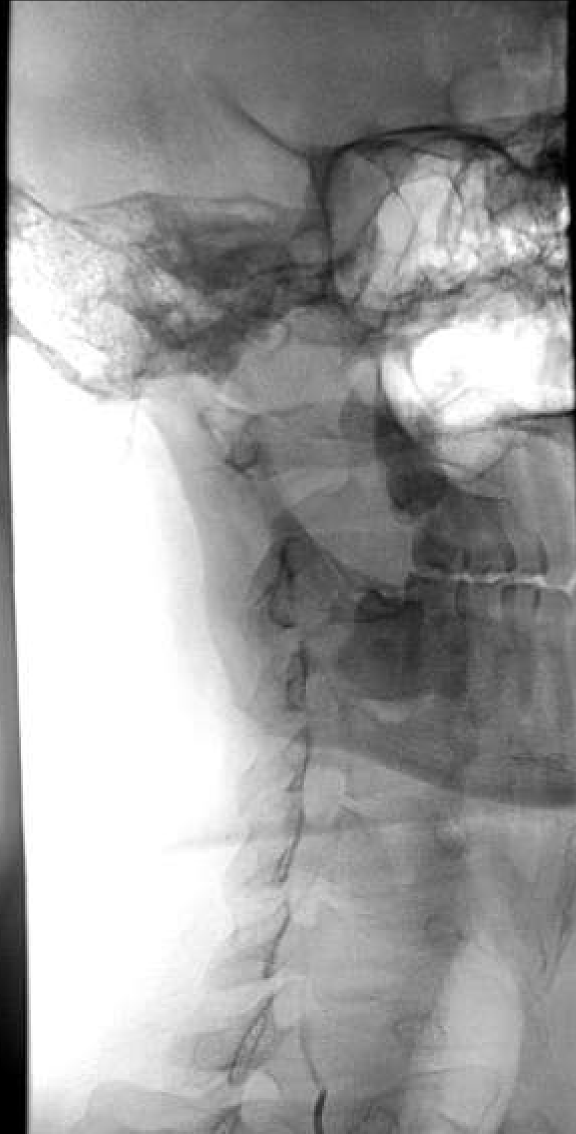
- Jo Al, 40yoM
  - New Zealander
  - Sudden, severe vertigo and right hearing loss
  - Commenced heparin
  - Switched to aspirin and clopidogrel
  - Aim to reduce to single agent after 3 months
  - Developed headache and returned day 13
  - Developed right facial droop day 16
  - ? LMN palsy (!), treated with prednisolone

- He Da, 42yoF
  - Mother of three
  - Intermittent visual / ophthalmic deficits, dysarthria, left upper limb weakness / ataxia
  - Commenced clopidogrel
  - Recommended consider stenting, but declined
  - No new attendances

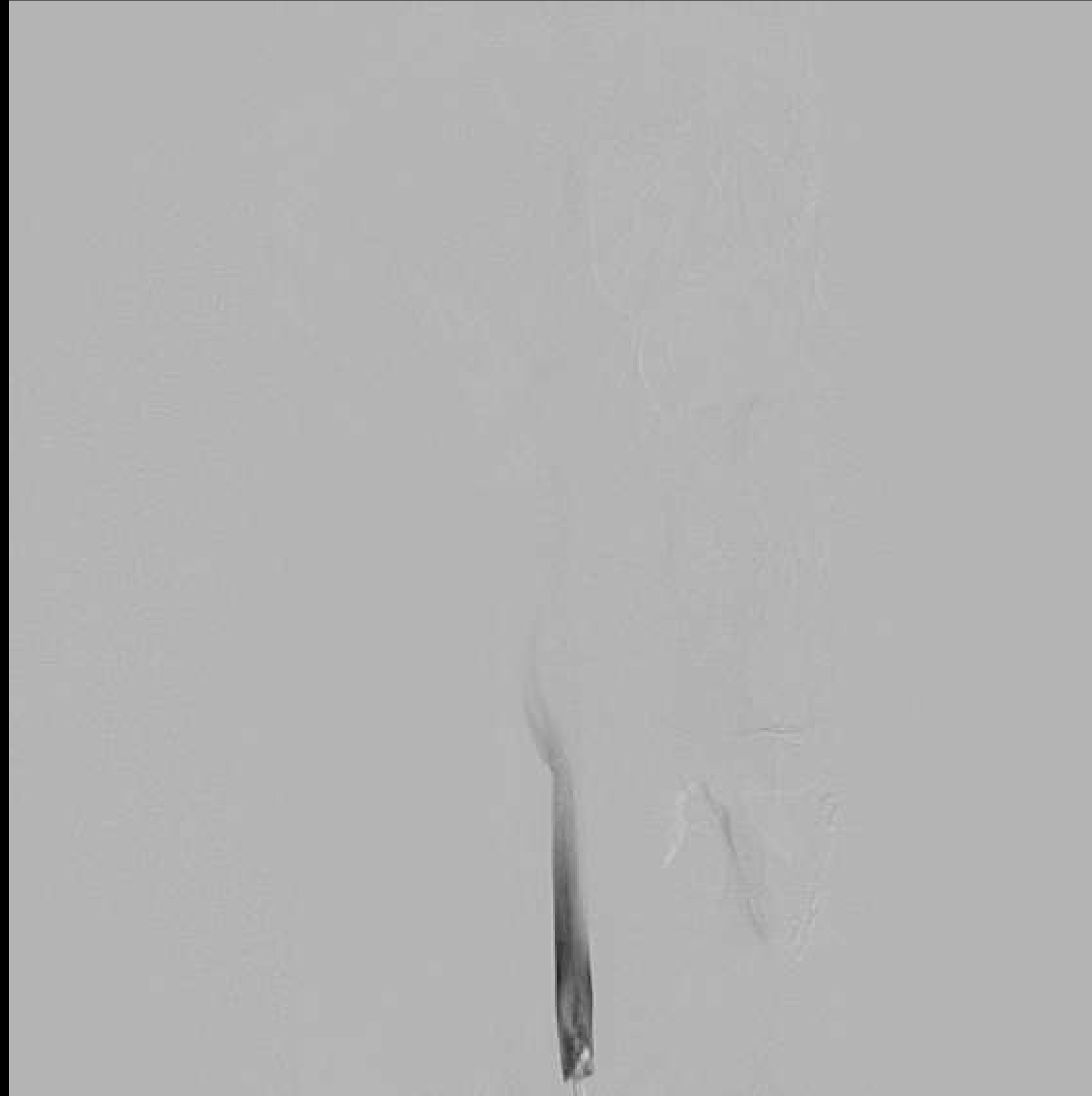
Case 1 (JP Mc, 33yoM)

- Nocturnal convulsions
- Blood tests normal
- ECG normal
- Seen by Neurology
  - probable convulsive syncope
  - ? unknowingly turning head while sleeping

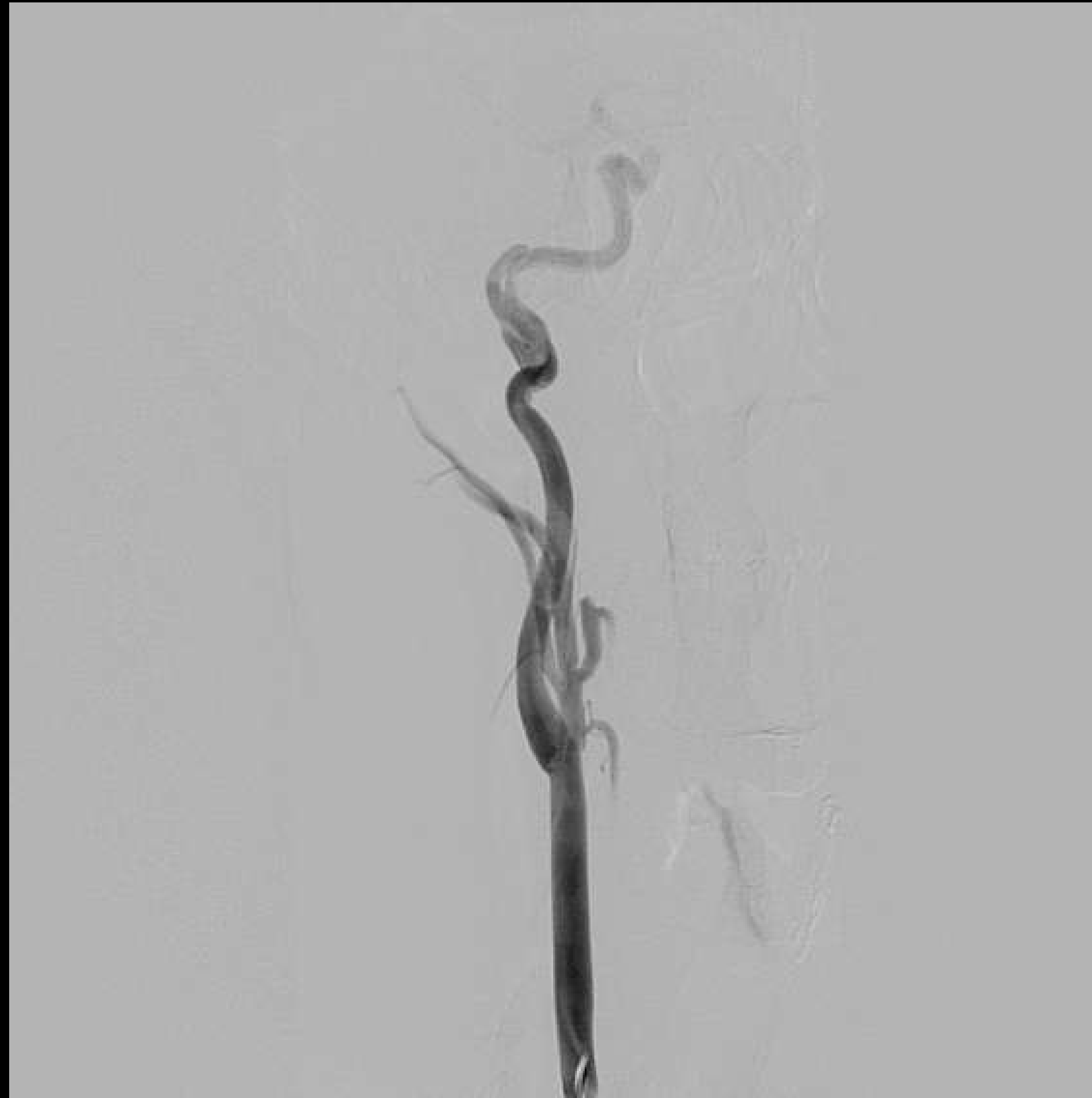
Right Common Carotid, oblique



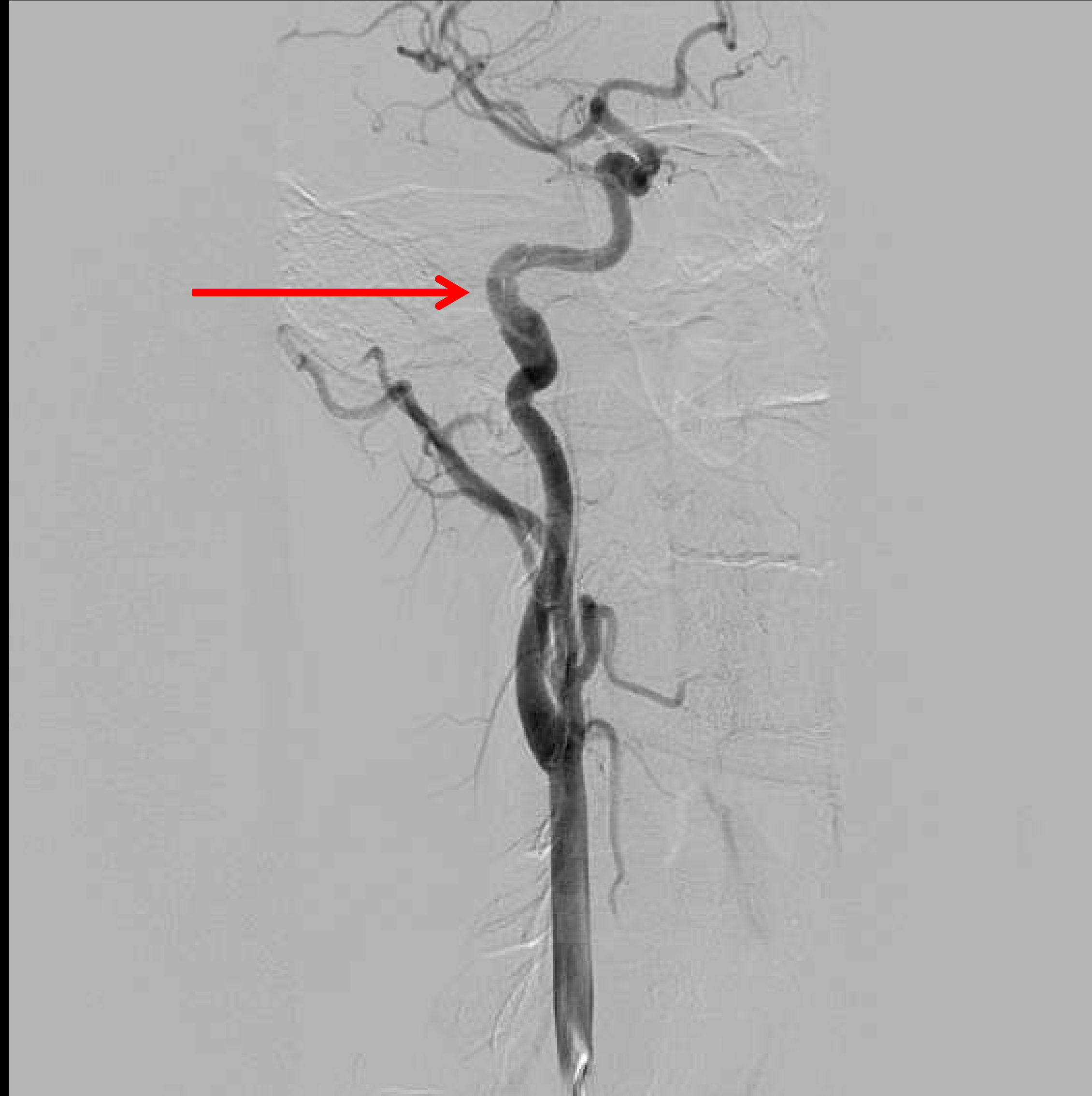
Right Common Carotid, oblique



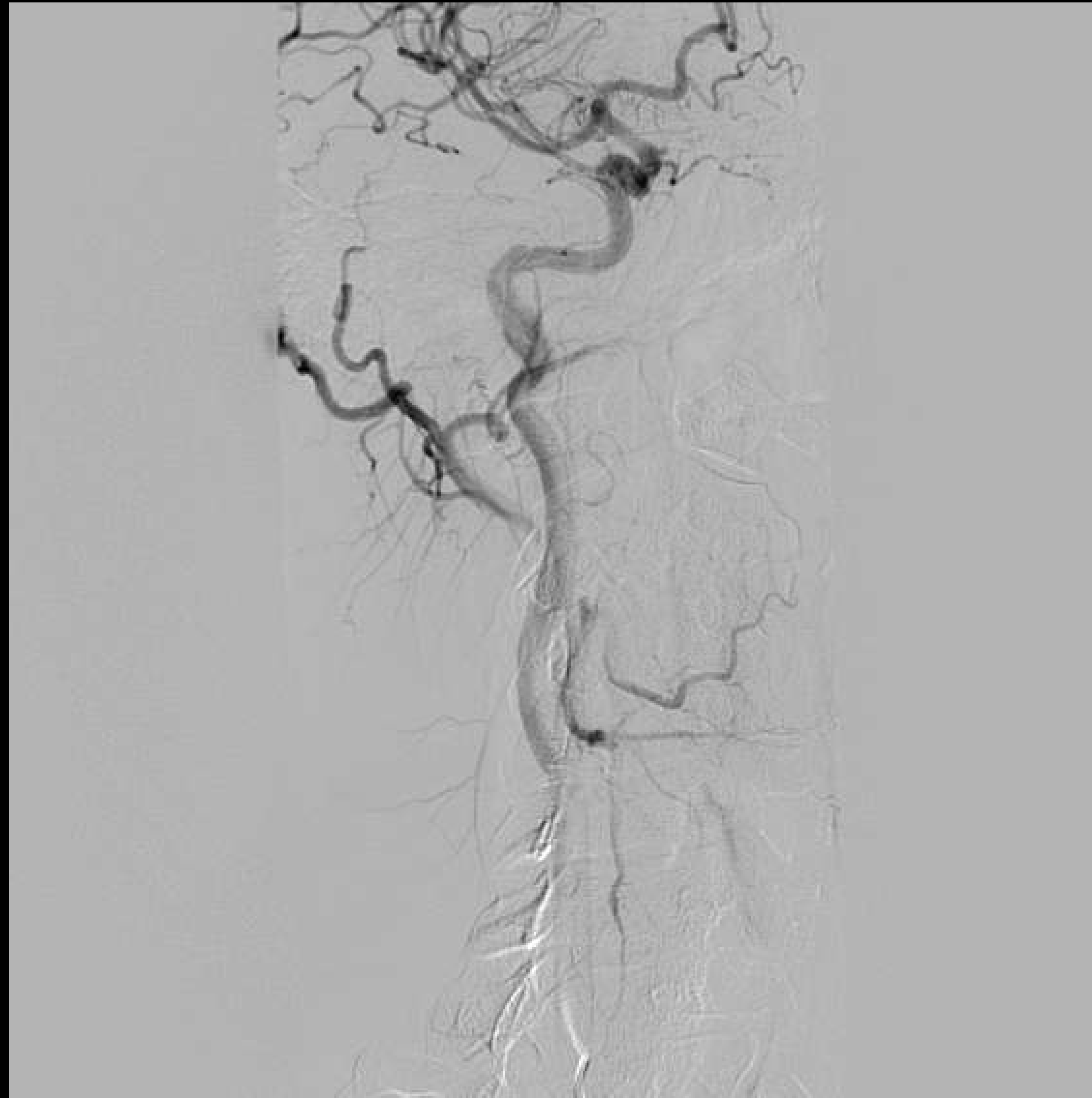
Right Common Carotid, oblique



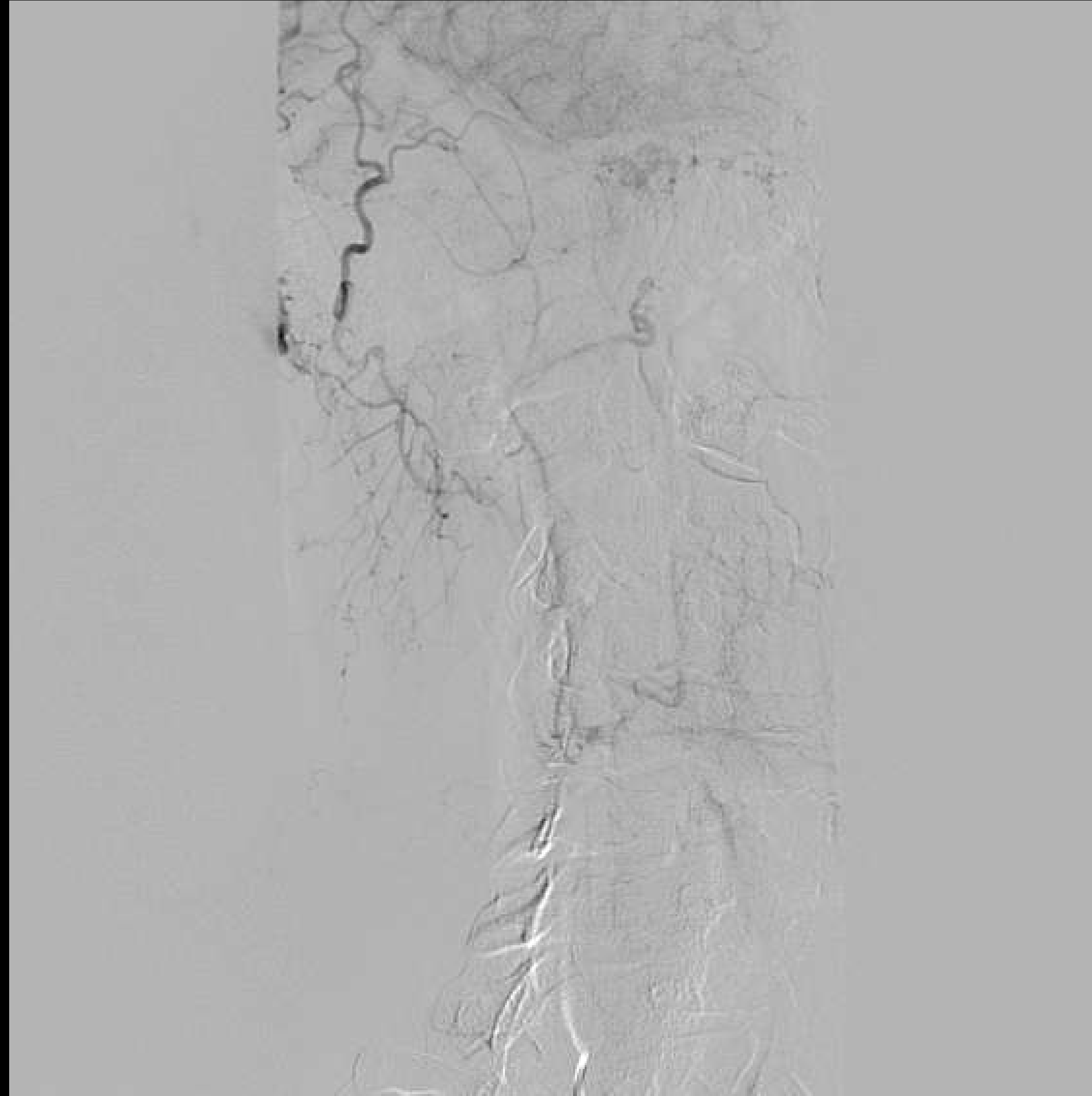
Right Common Carotid, oblique



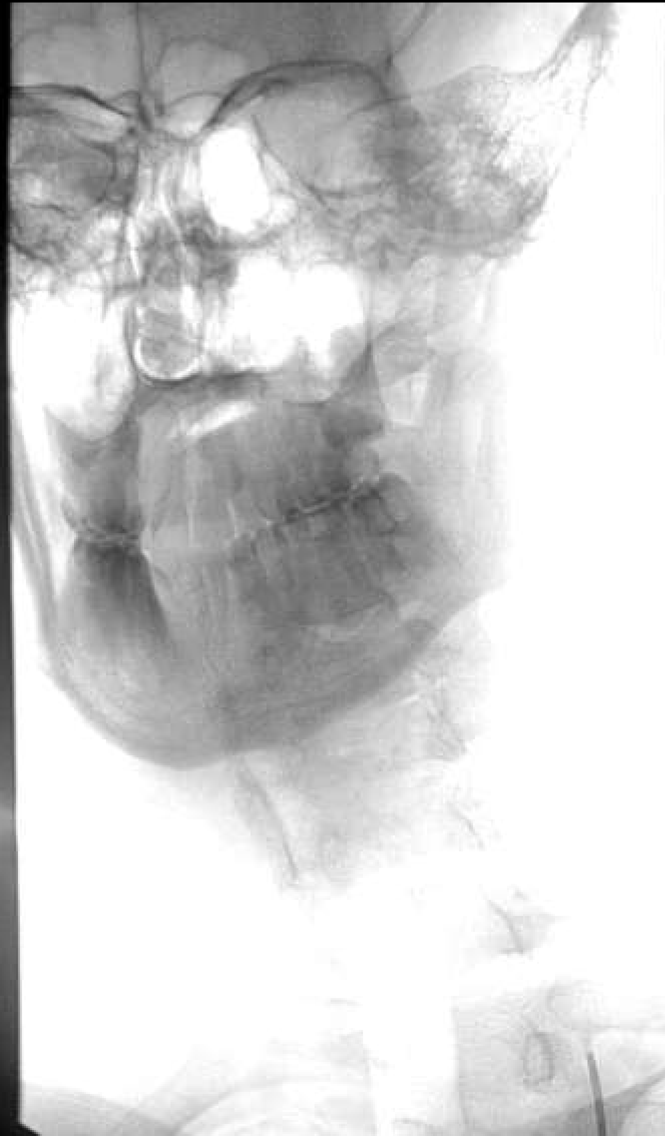
Right Common Carotid, oblique



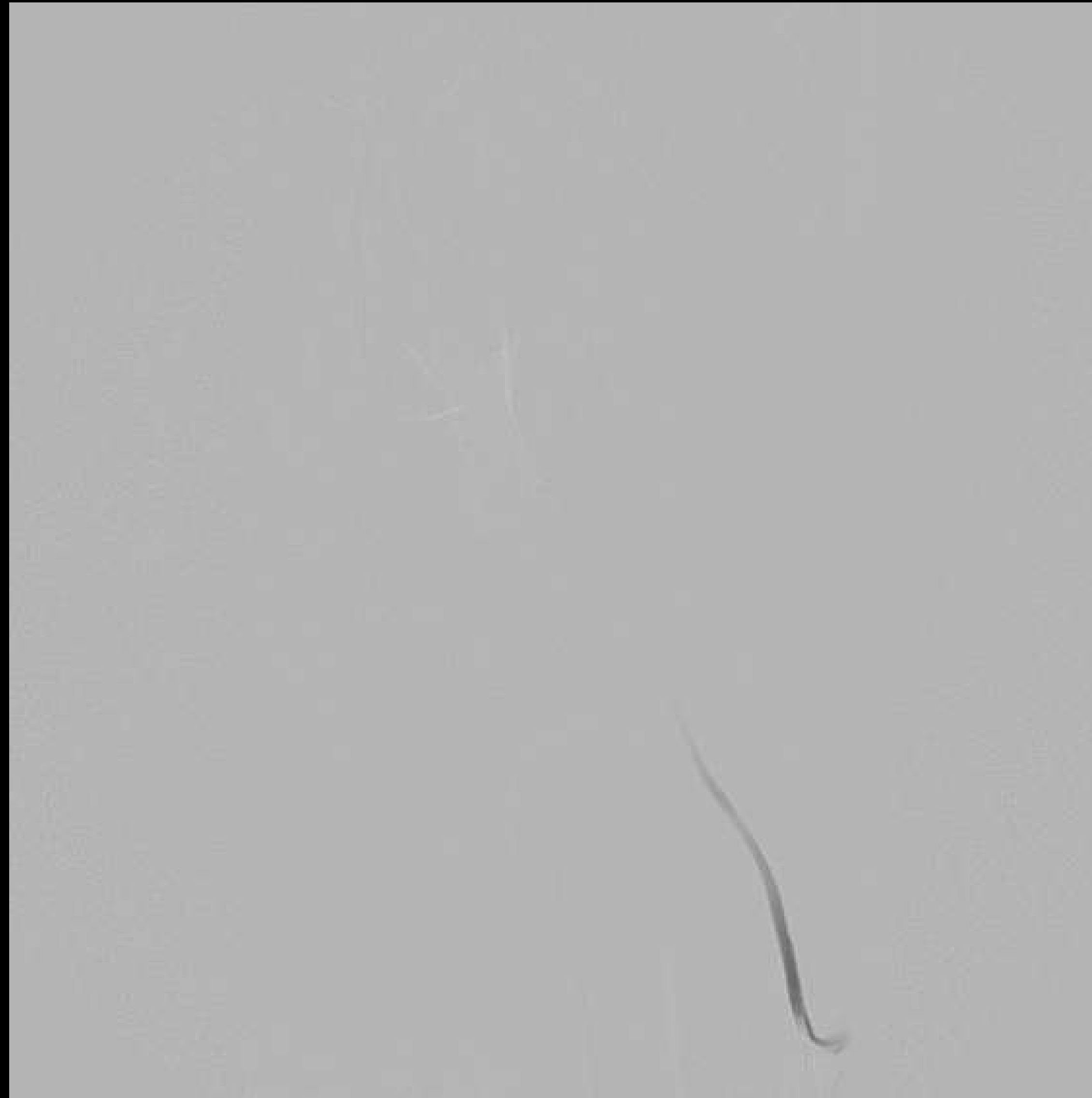
Right Common Carotid, oblique



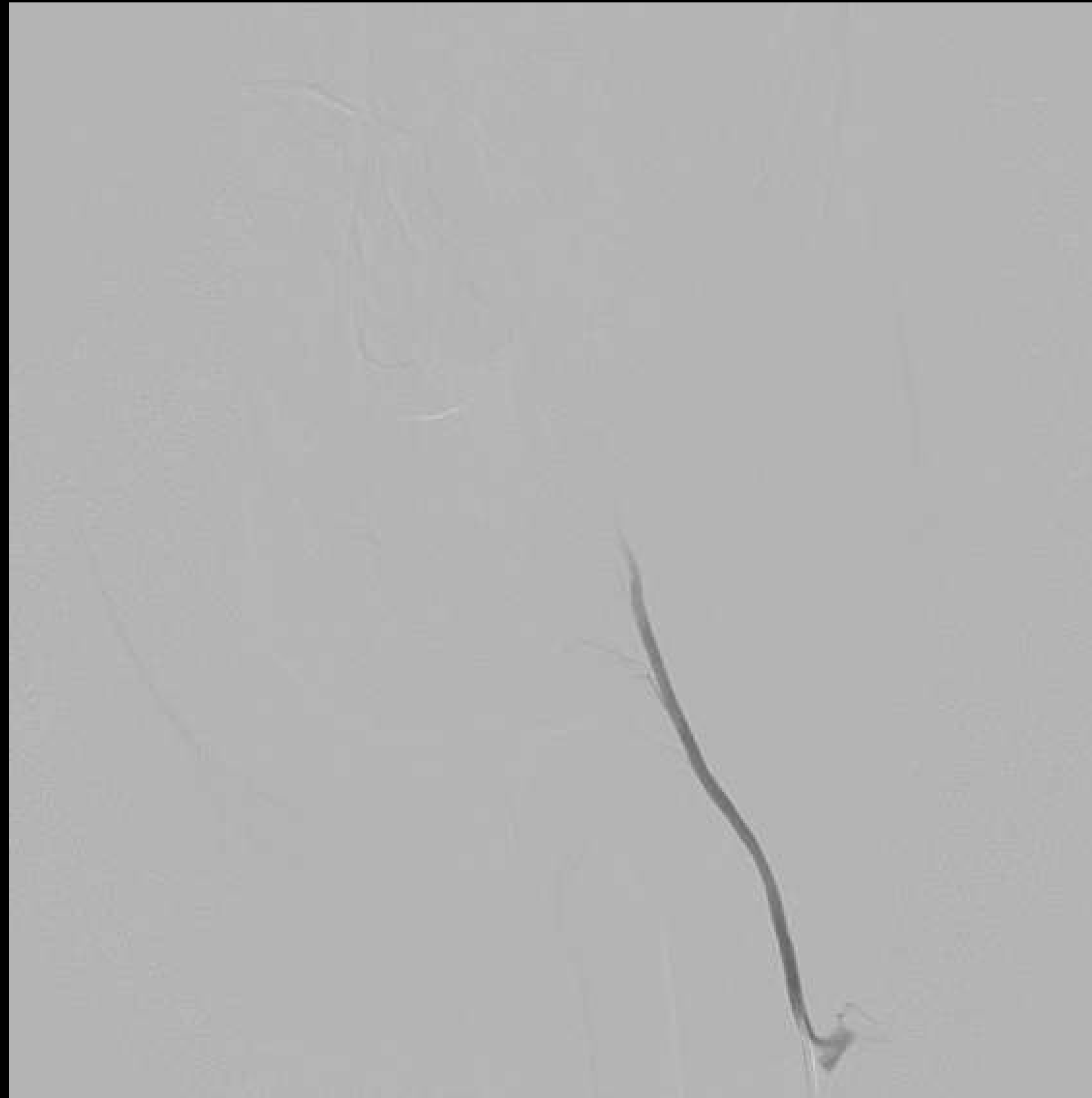
Left Vertebral, AP



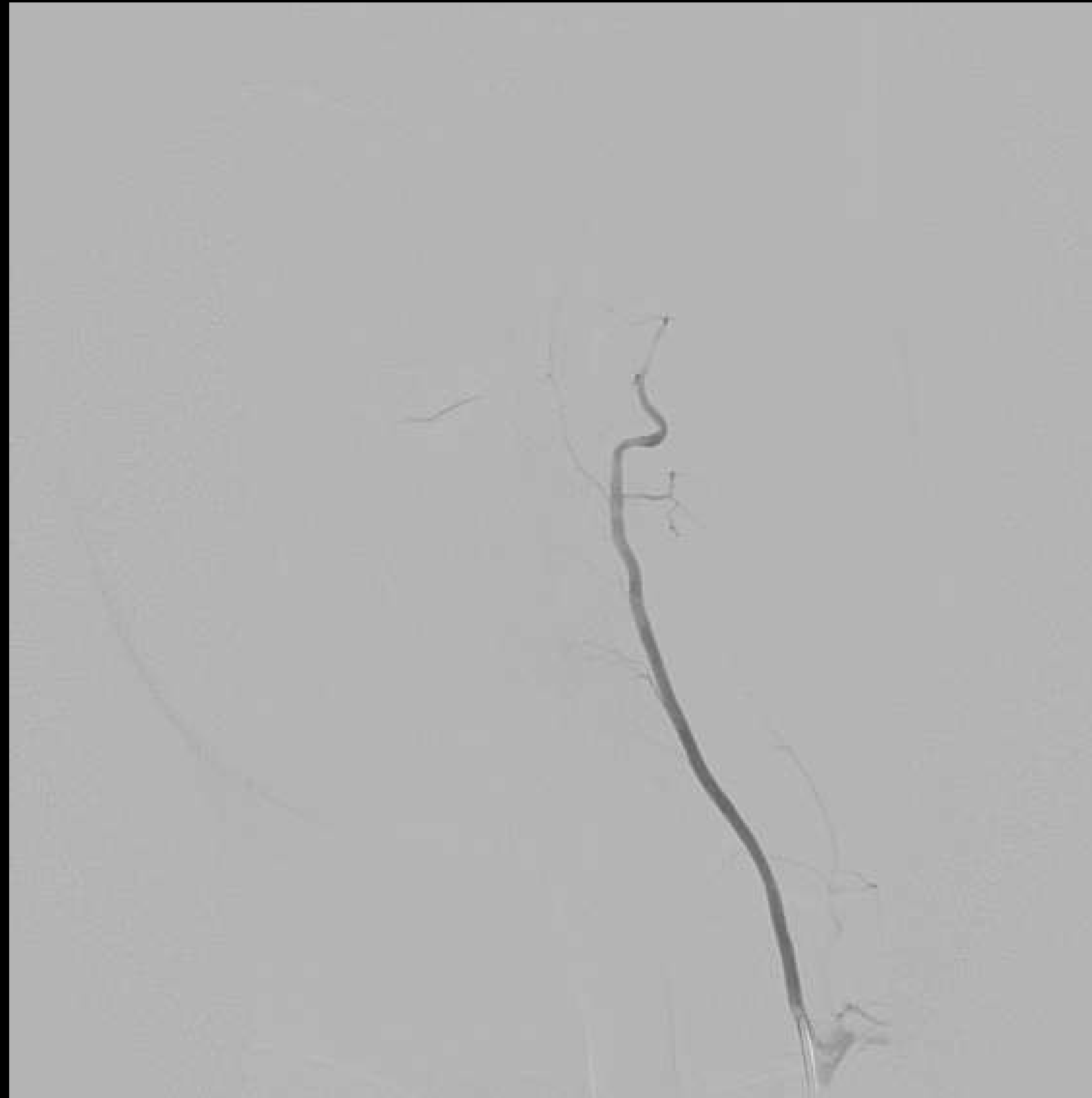
Left Vertebral, AP



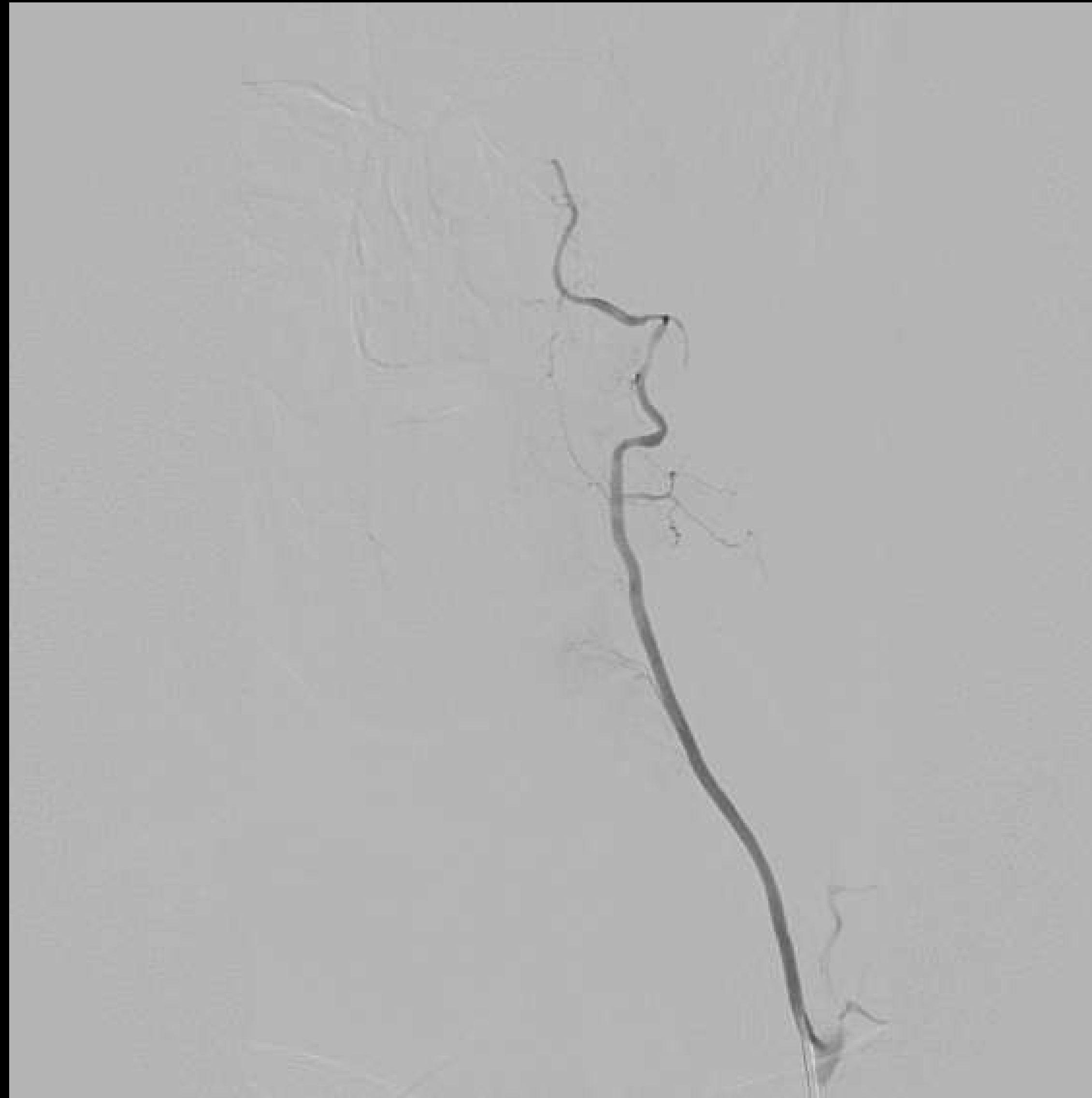
Left Vertebral, AP



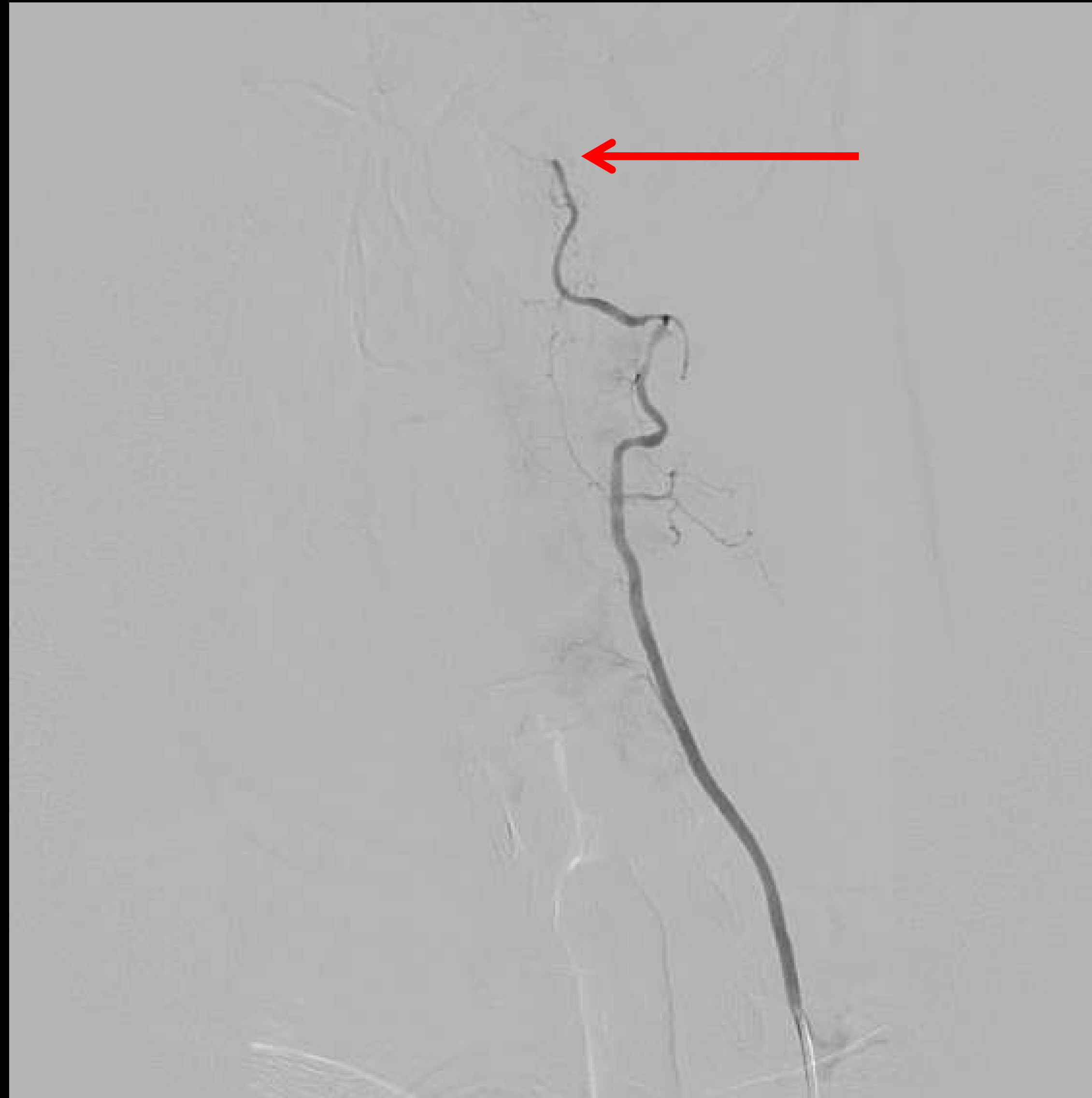
Left Vertebral, AP



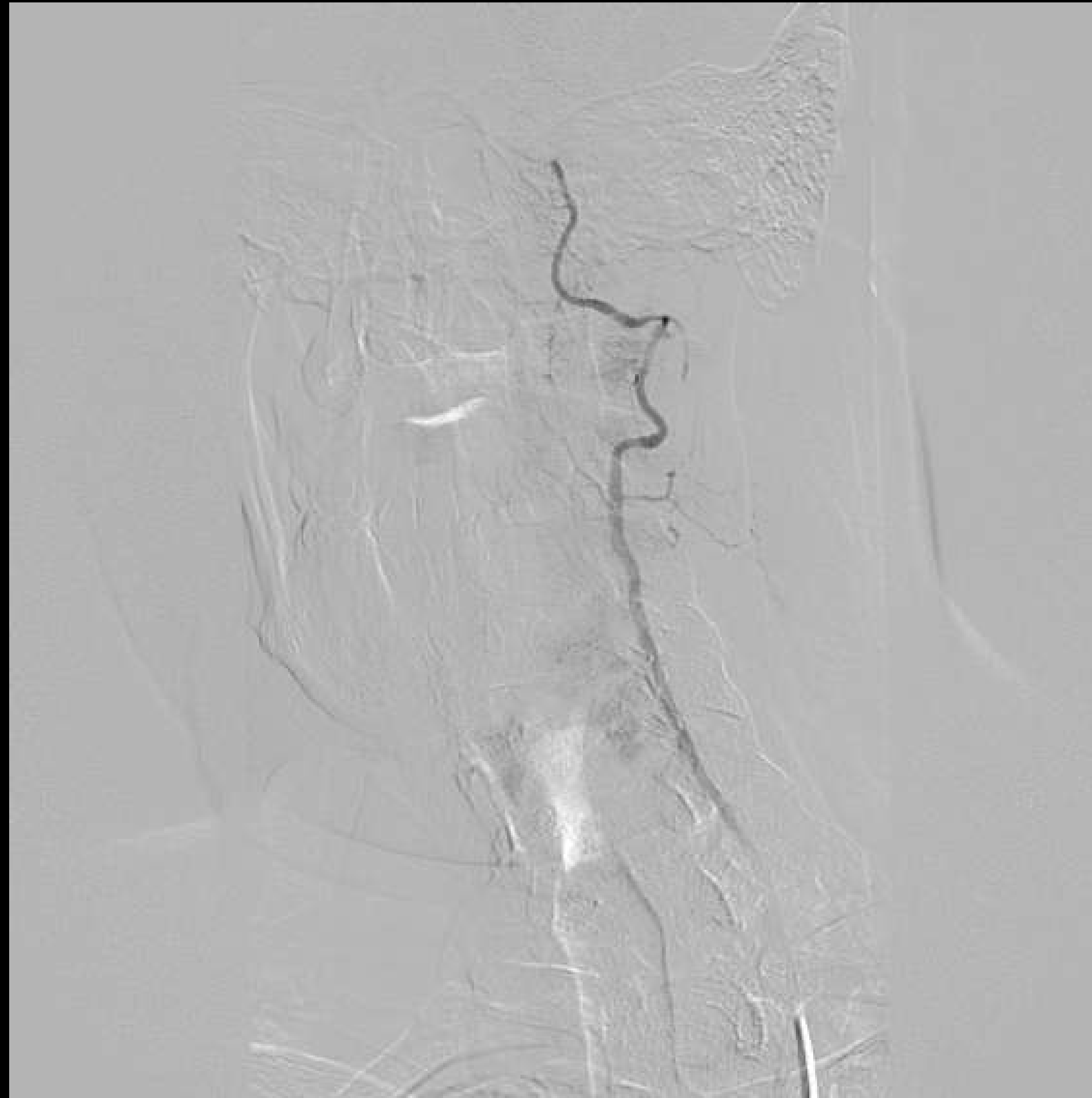
Left Vertebral, AP



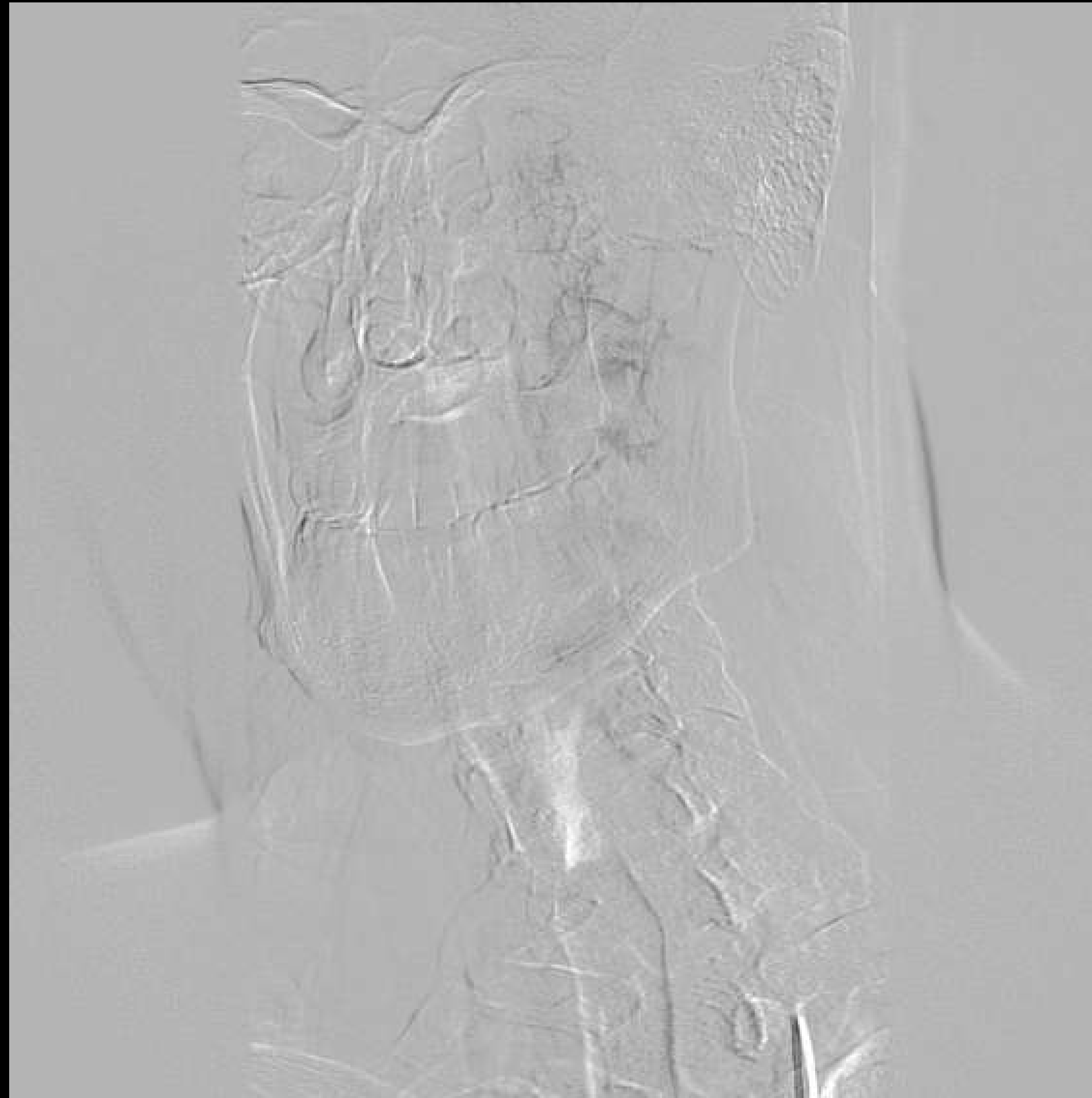
Left Vertebral, AP



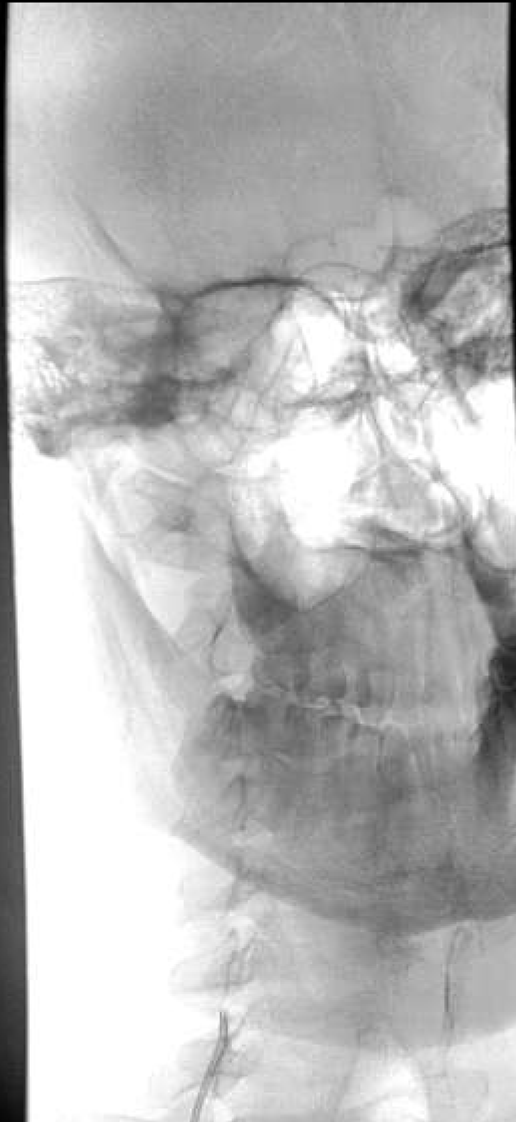
Left Vertebral, AP



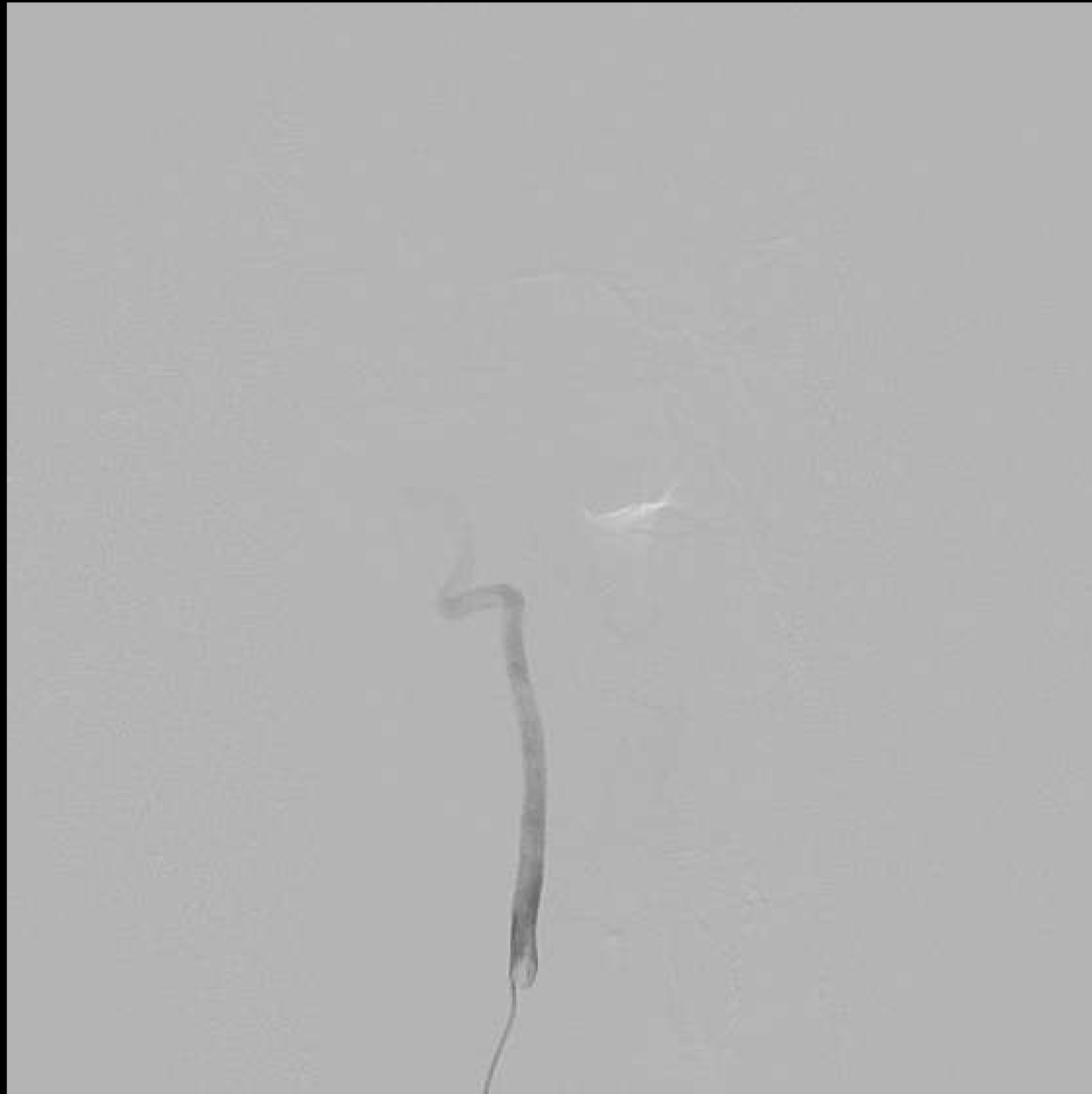
Left Vertebral, AP



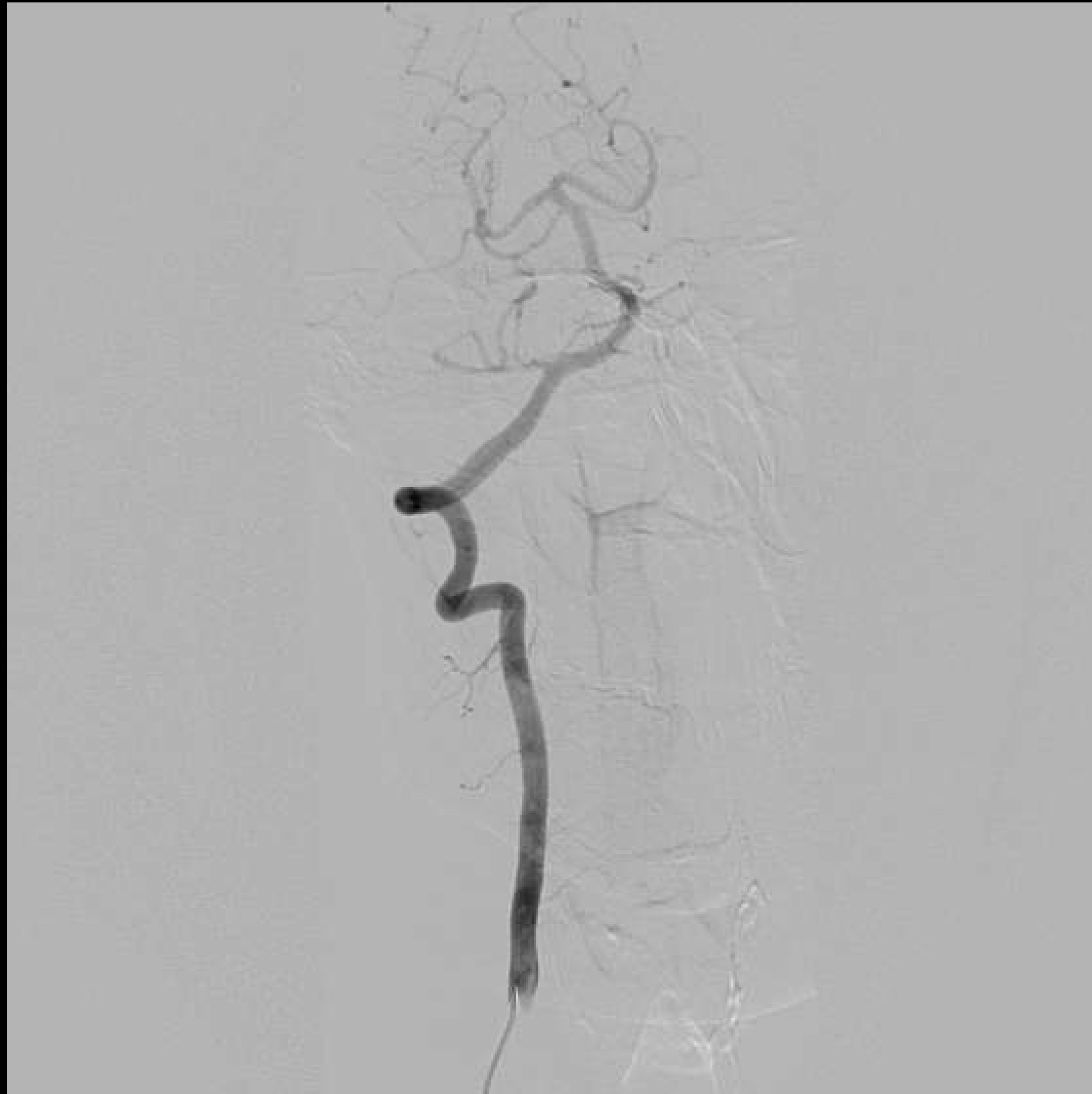
Right Vertebral, AP



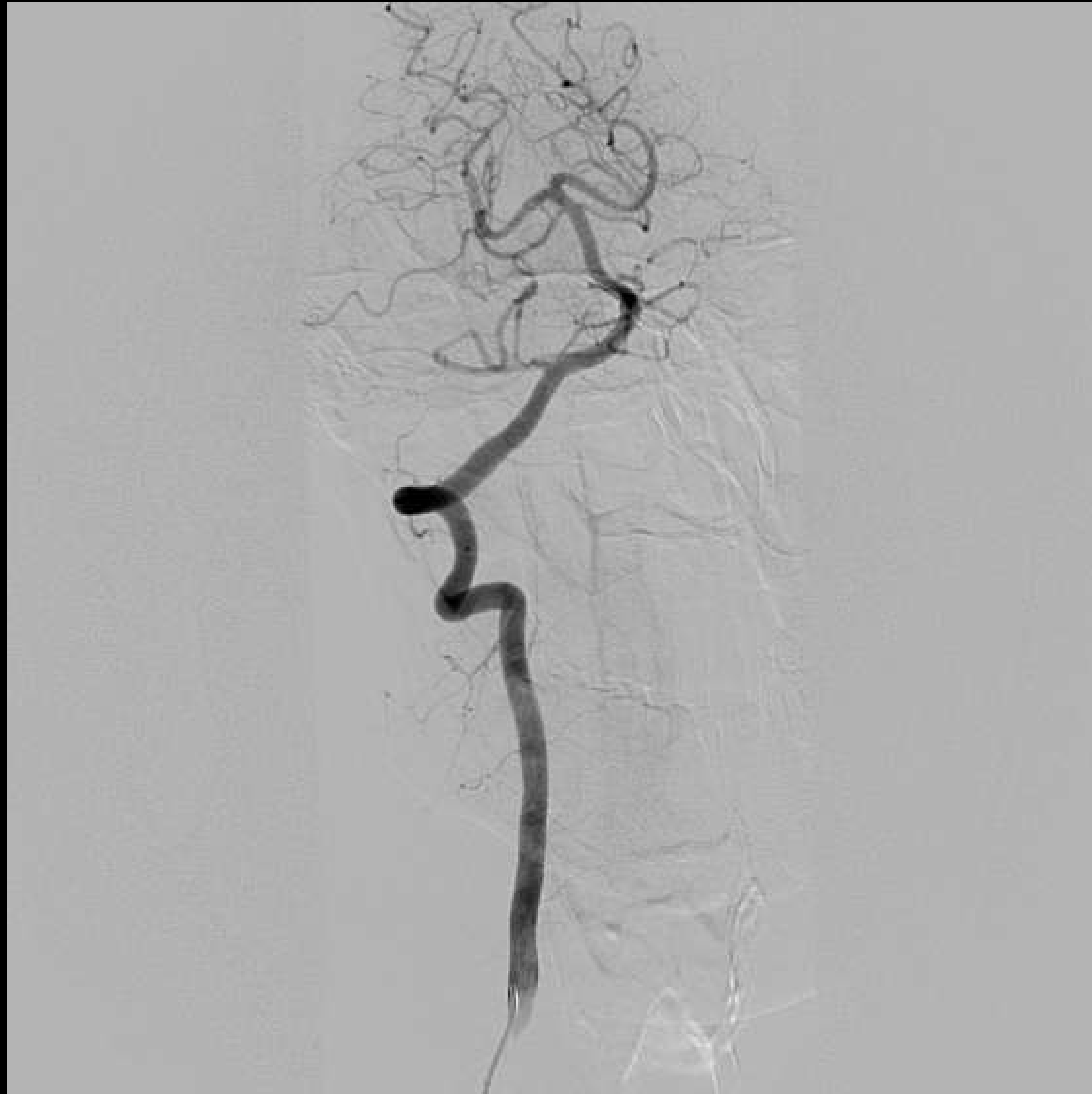
Right Vertebral, AP



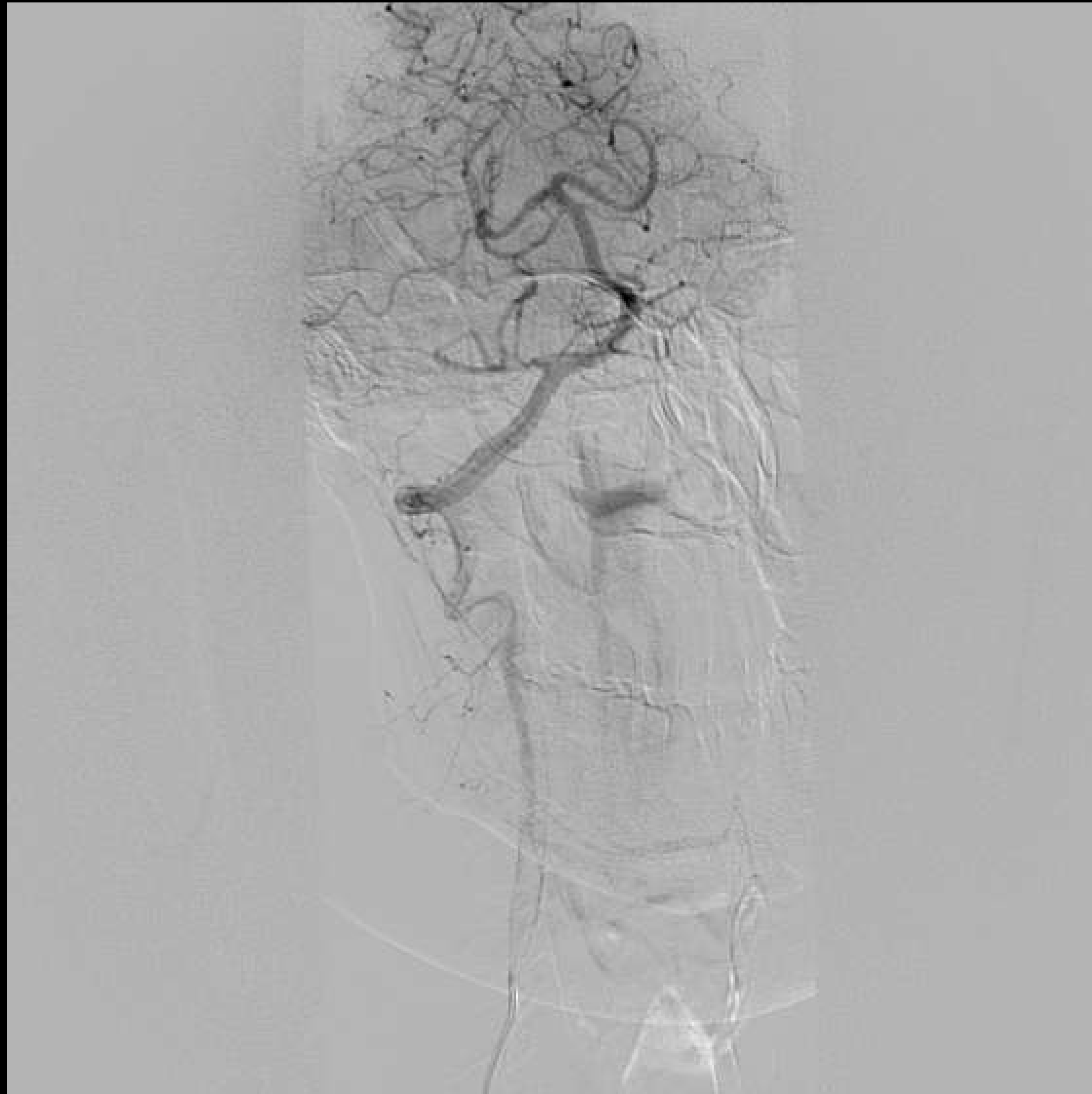
Right Vertebral, AP



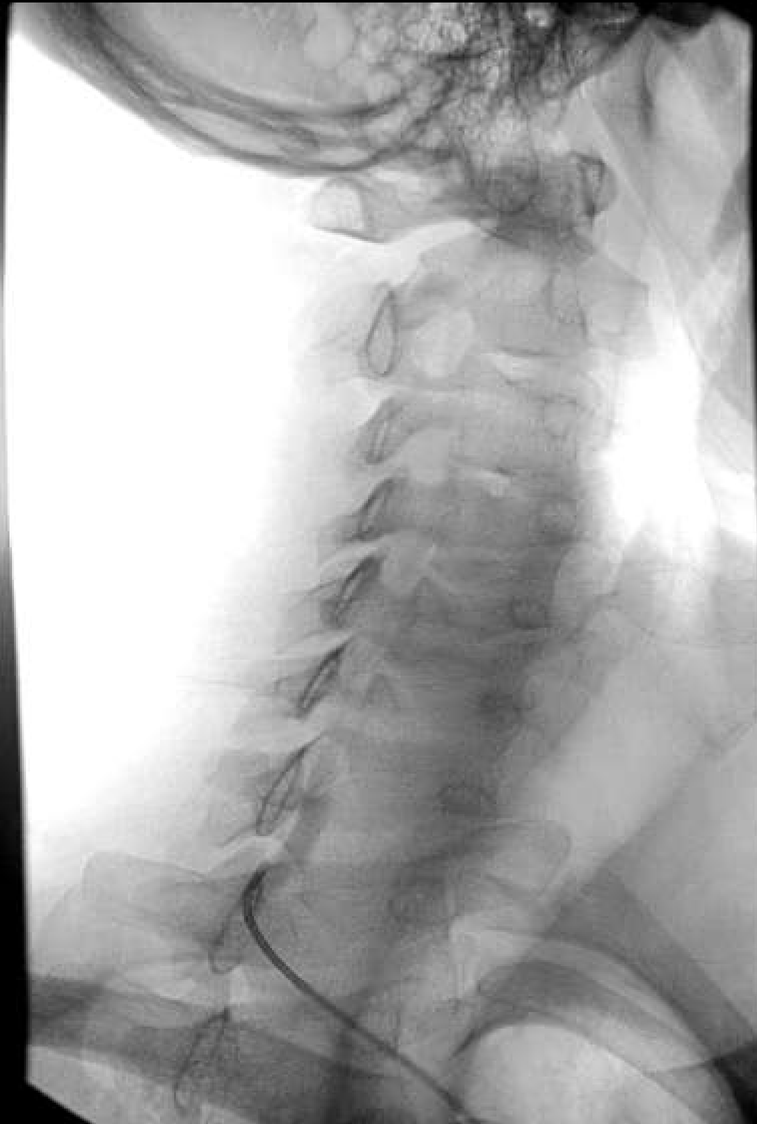
Right Vertebral, AP



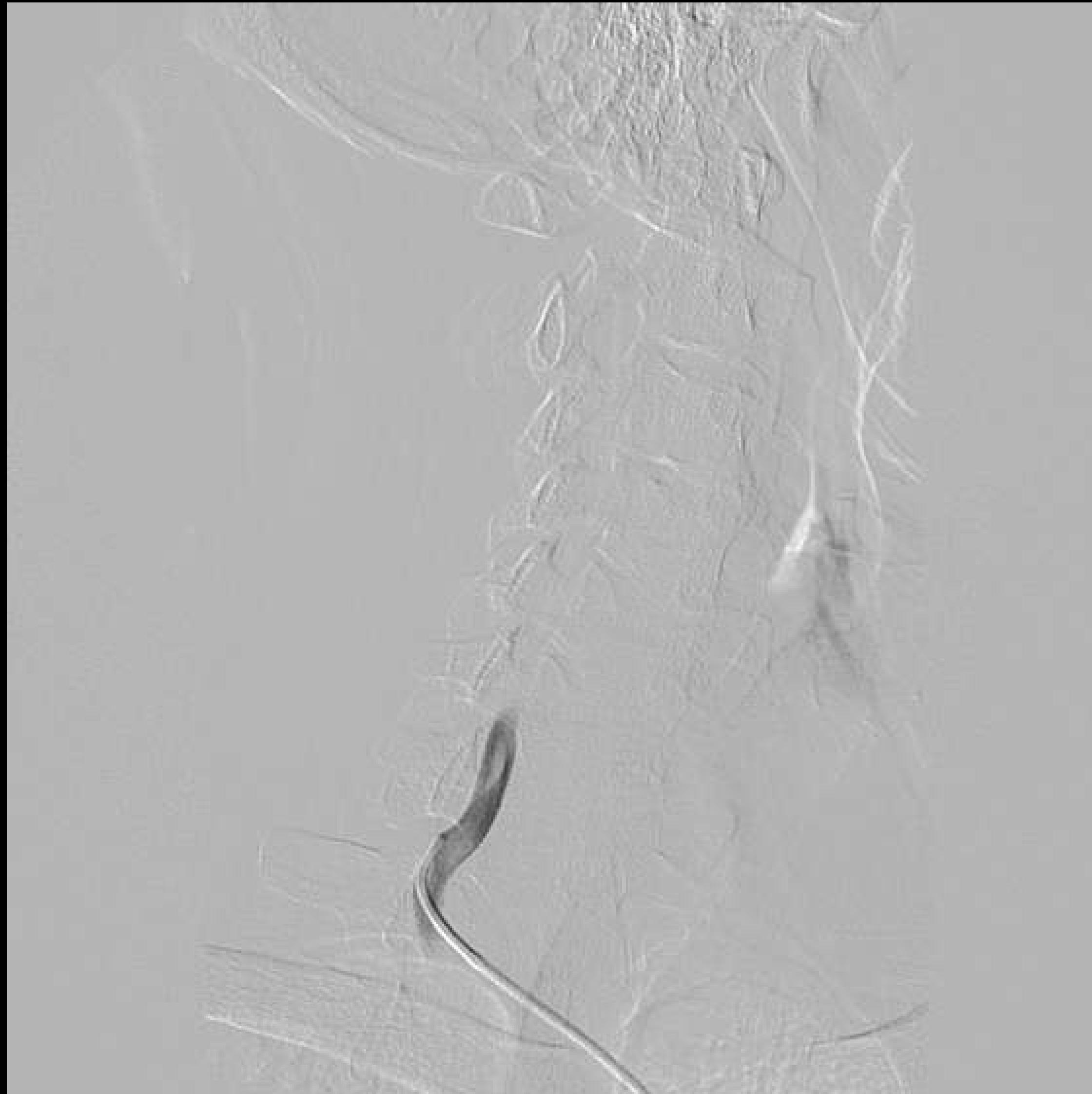
Right Vertebral, AP



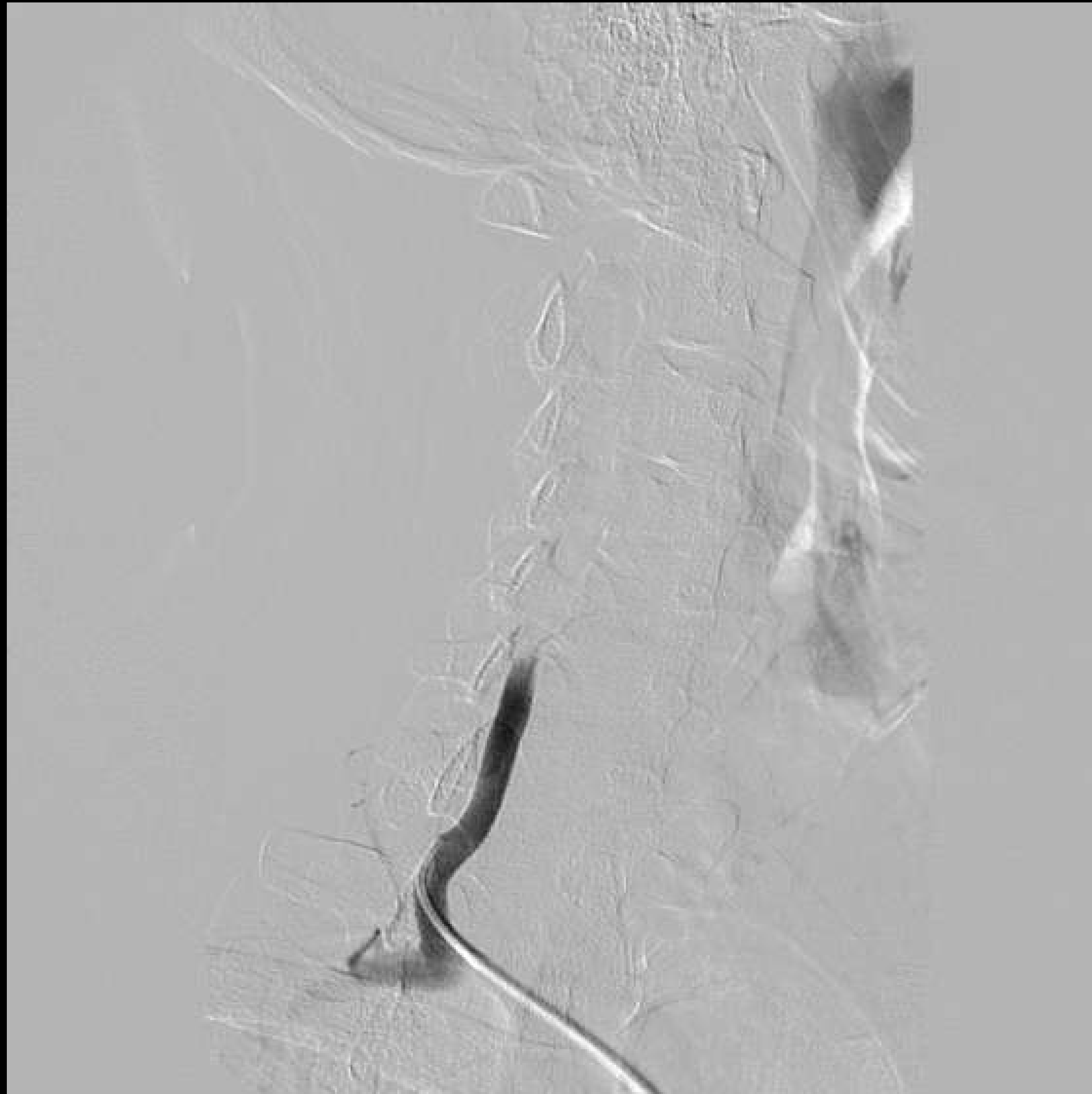
Right Vertebral, head turn



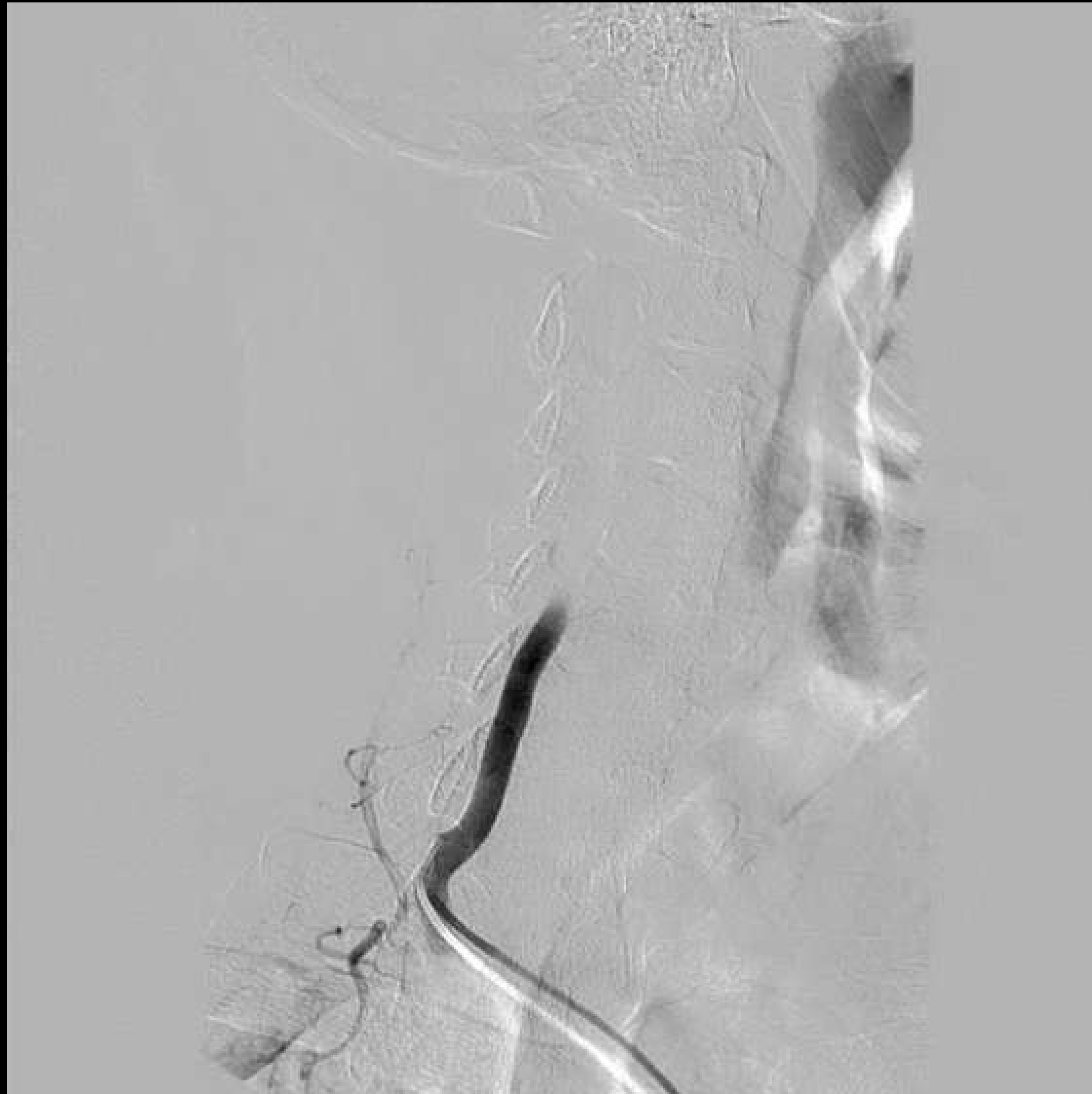
Right Vertebral, head turn



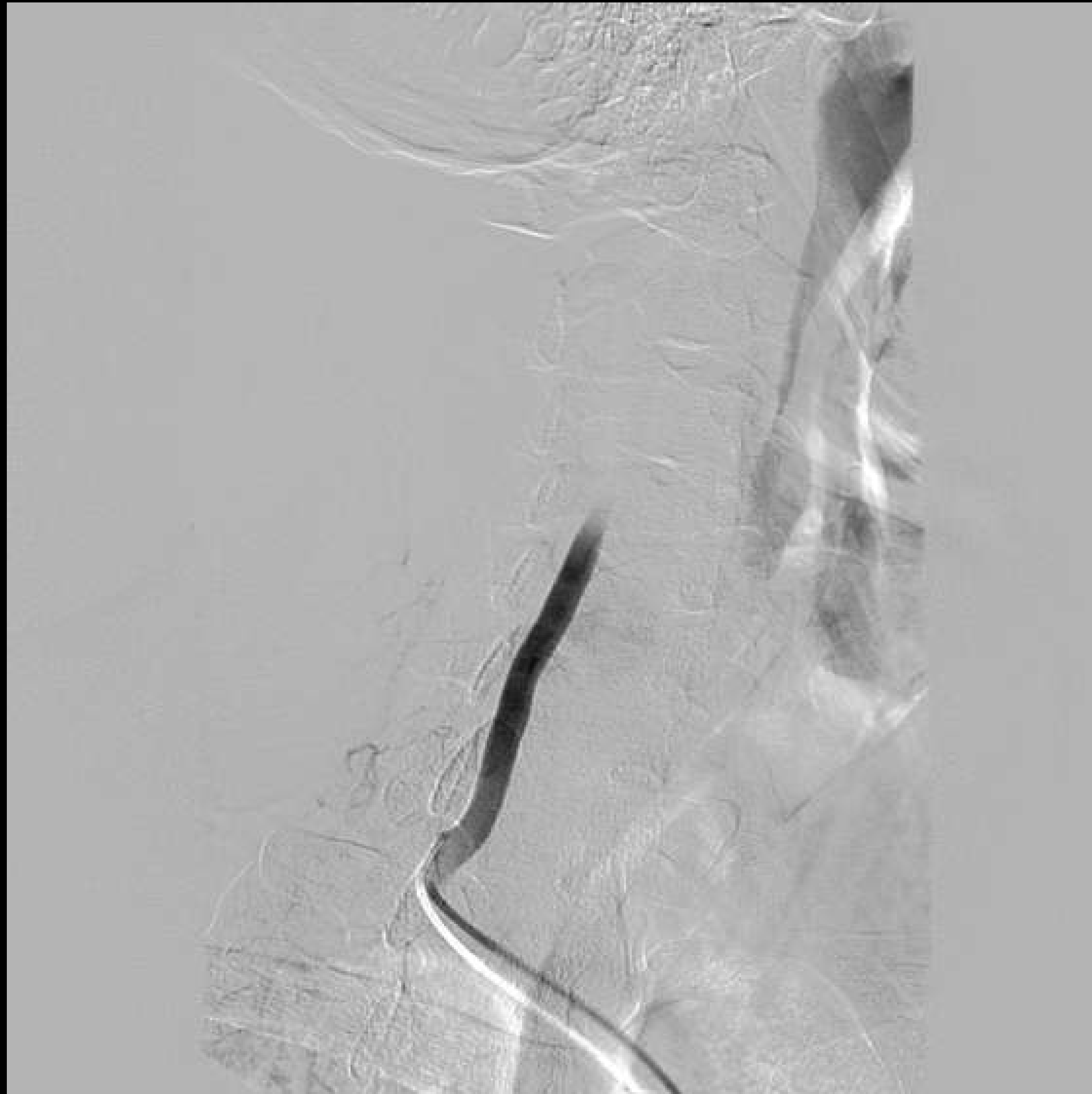
Right Vertebral, head turn



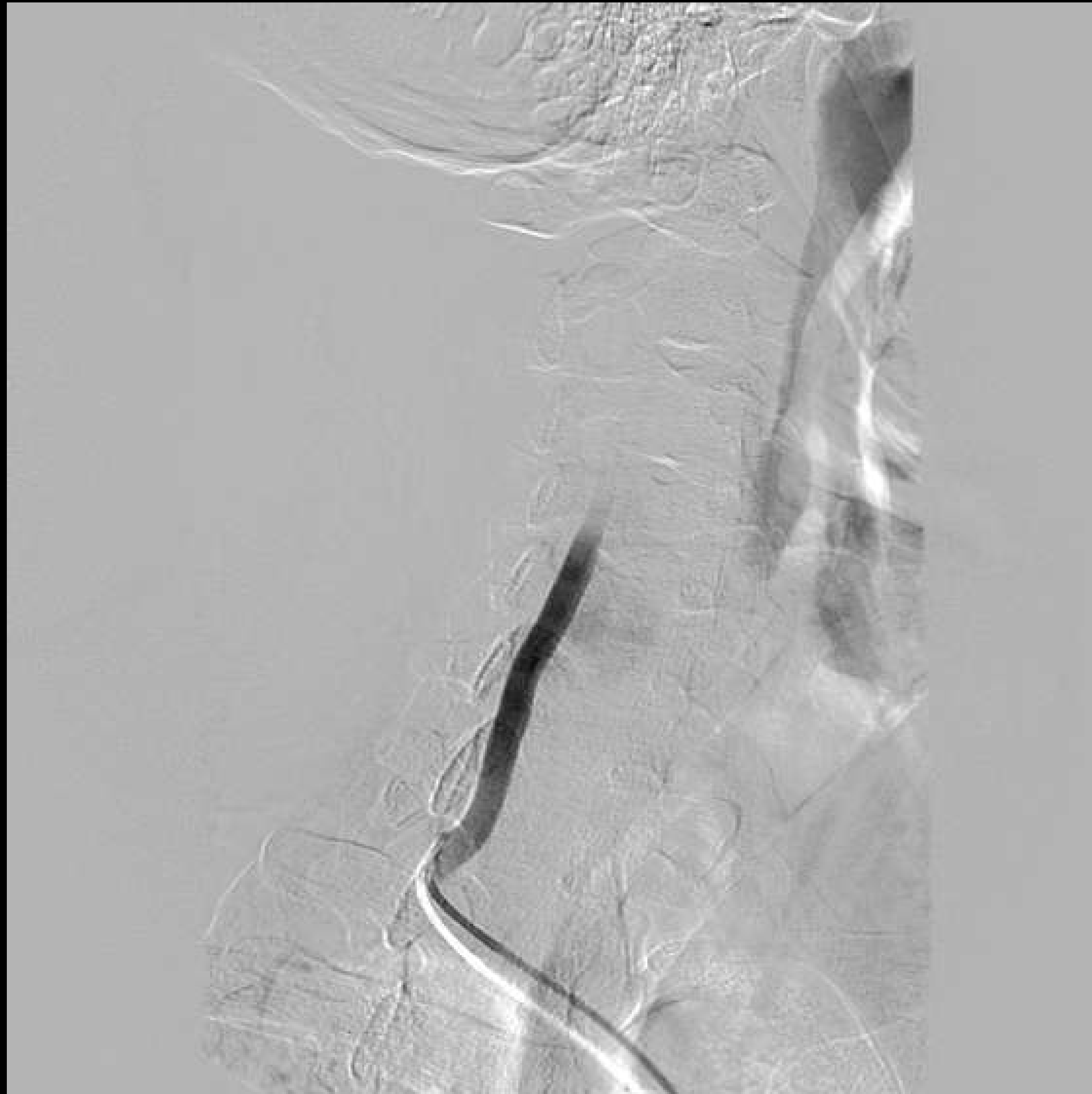
Right Vertebral, head turn



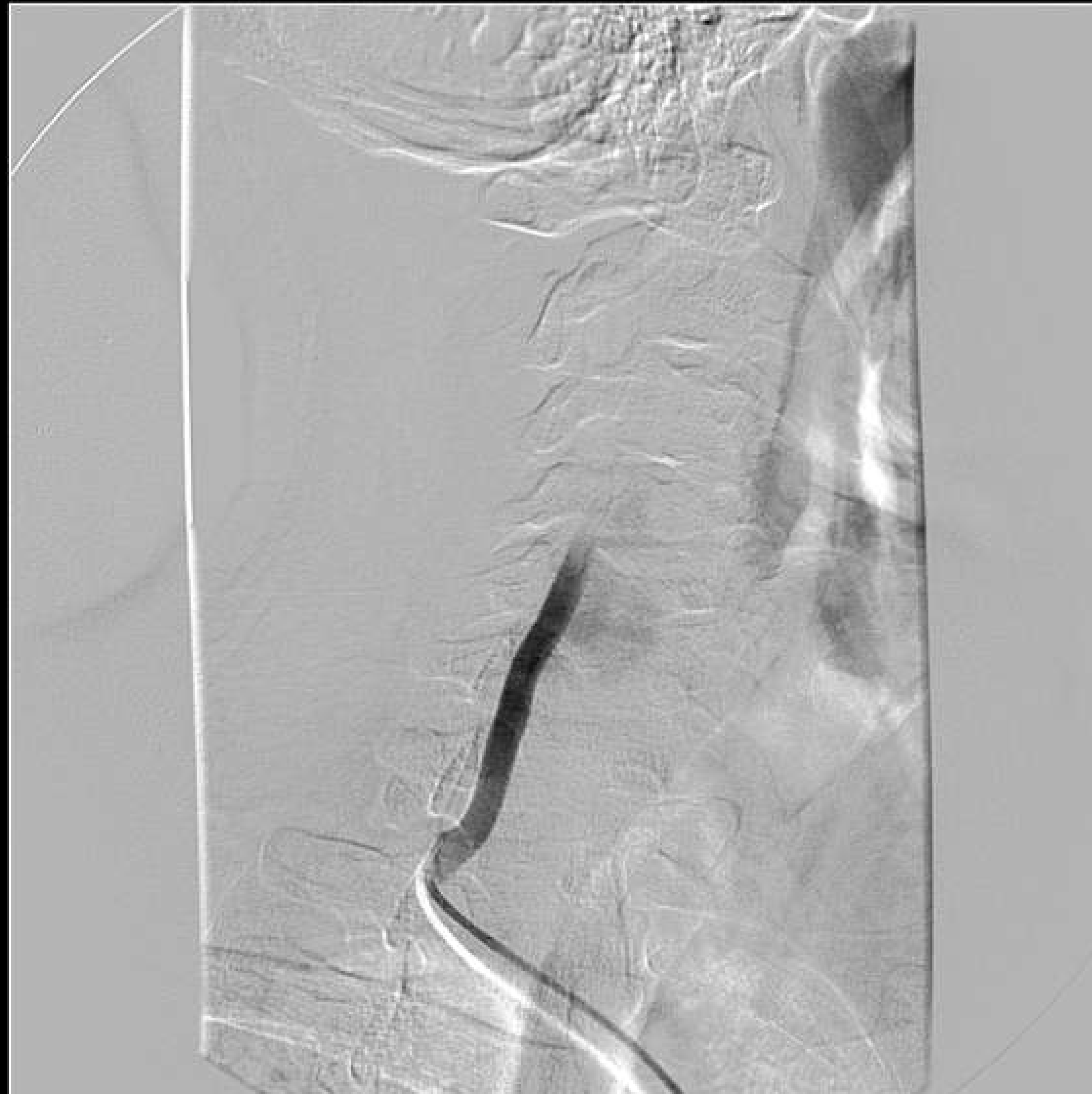
Right Vertebral, head turn



Right Vertebral, head turn



Right Vertebral, head turn



Bowhunter Syndrome

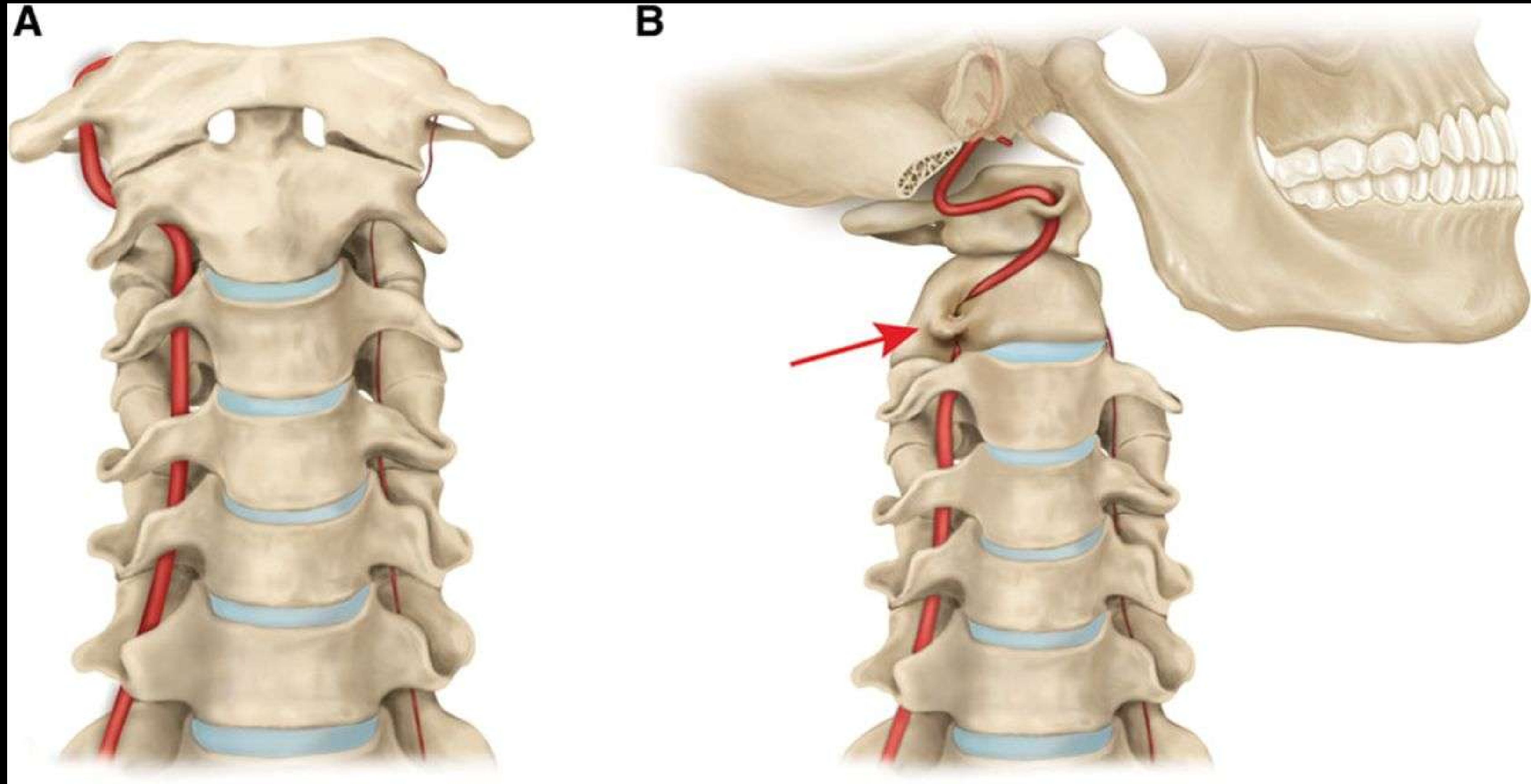
- Rotational vertebral artery occlusion
- May be due to osteophytes, bands of soft tissue, variant course
- Symptoms of diplopia, dysarthria, visual disturbances, vertigo
- Treated conservatively, or with endovascular or surgical intervention

Kuether TA, Nesbit GM, Clark WM, Barnwell SL. Rotational vertebral artery occlusion: a mechanism of vertebrobasilar insufficiency. Neurosurgery. 1997 Aug; 41(2): 427-32.

Bowhunter Syndrome

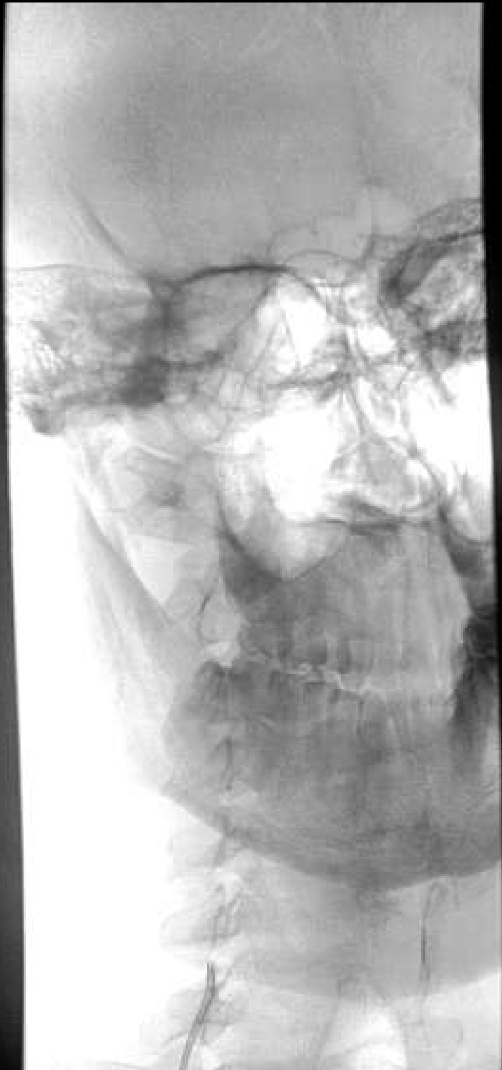
- Course of vertebral artery
  - Origin: subclavian artery
  - Enters foramina of transverse processes of C6 to C2, or occasionally from C7 to C2
    - Osteophyte compression most likely here
  - Obliquely passes to C1 foramen
    - Soft tissue compression most likely here
  - Travels posteriorly then pierces dura, enters foramen magnum
  - Vertebral arteries unite to form basilar artery

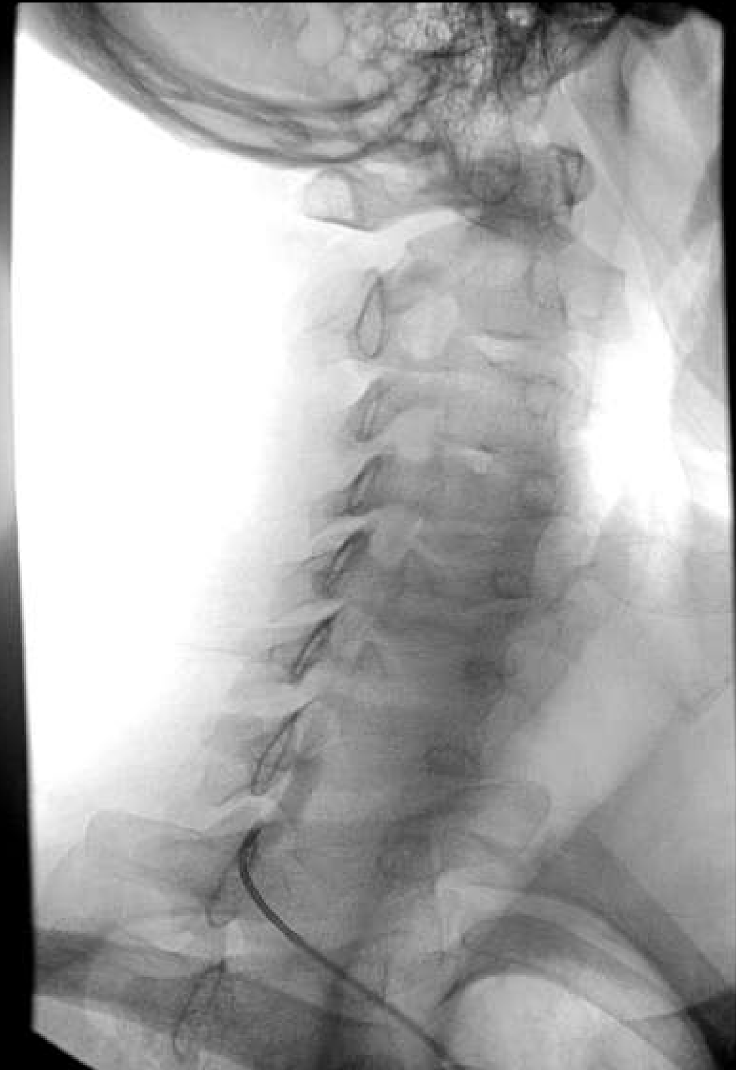
Bowhunter Syndrome



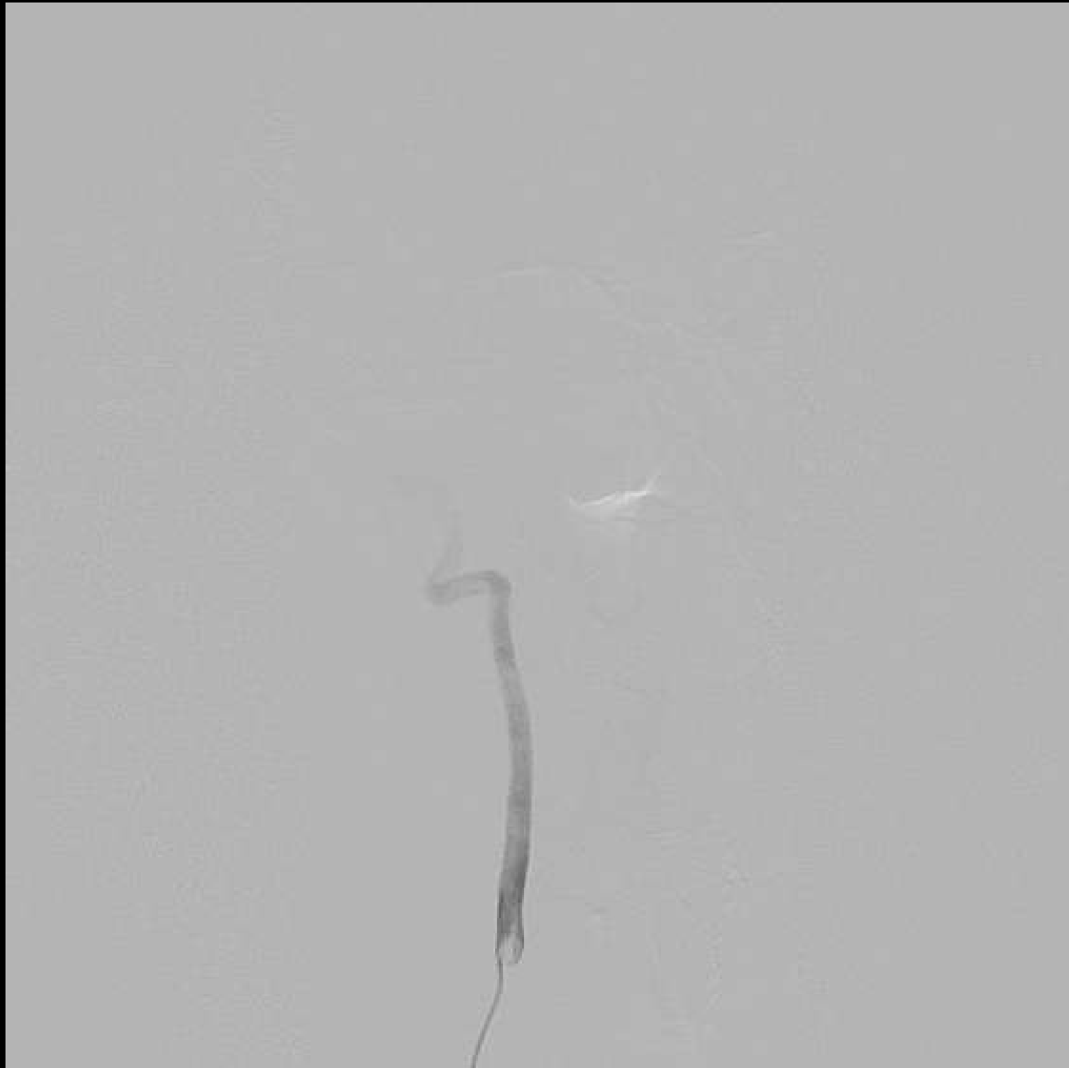
Choi KD, Choi JH, Kim JS, Kim HJ, Kim MJ, Lee TH, Lee H, Moon IS, Oh HJ, Kim JI. Rotational vertebral artery occlusion: mechanisms and long-term outcome. Stroke. 2013 Jul; 44(7): 1817-24.

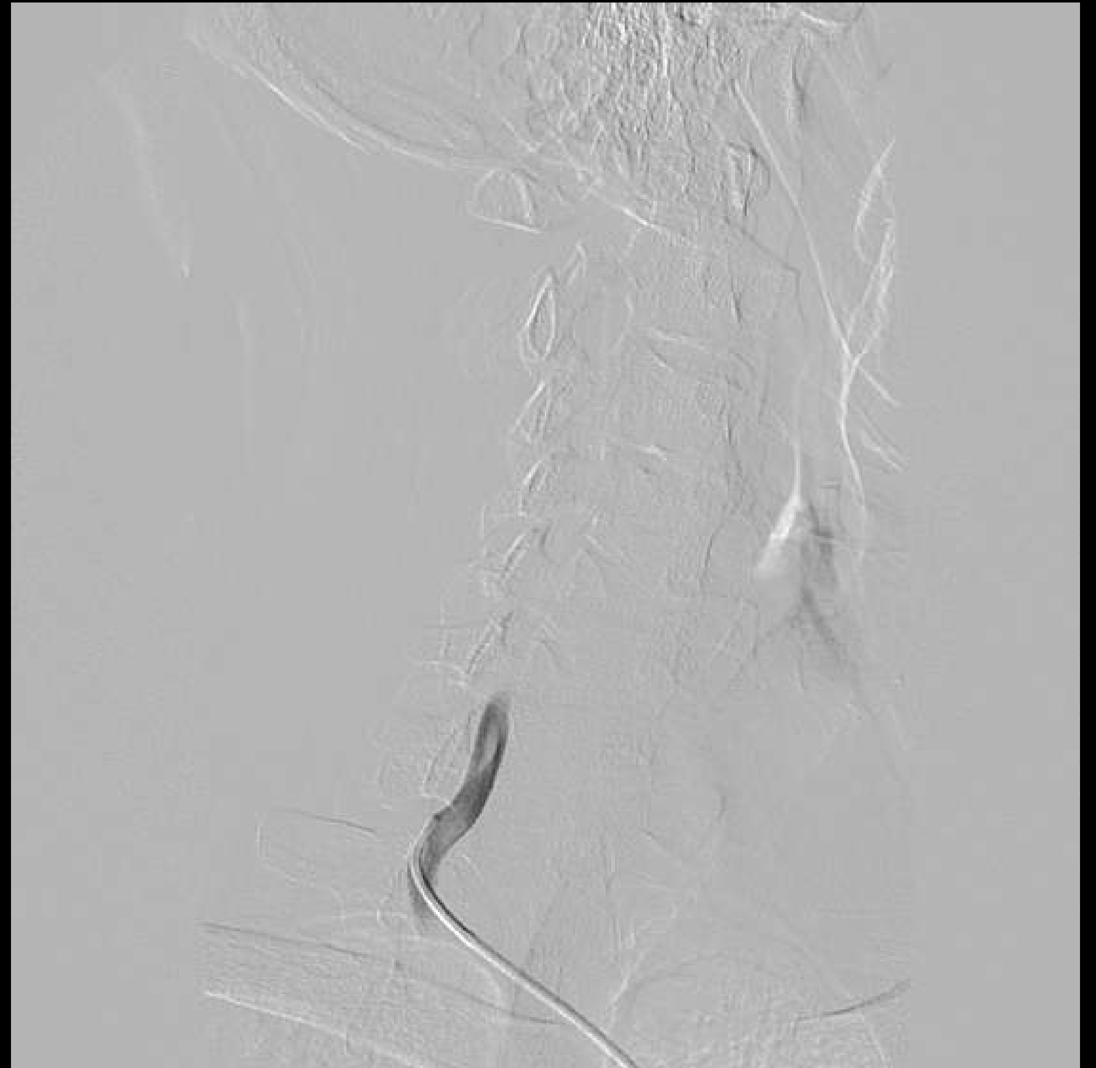
Don't Look Back in Angio



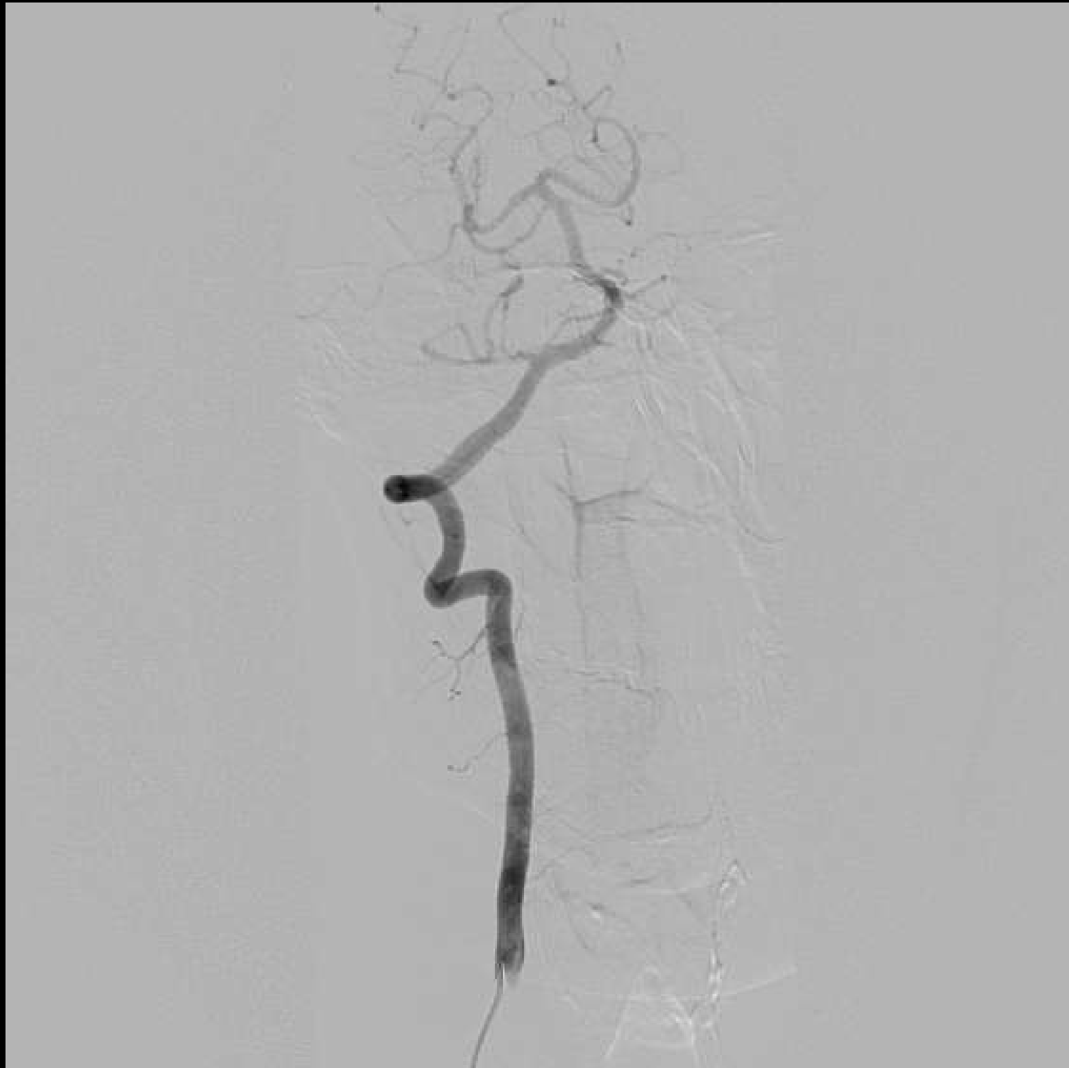


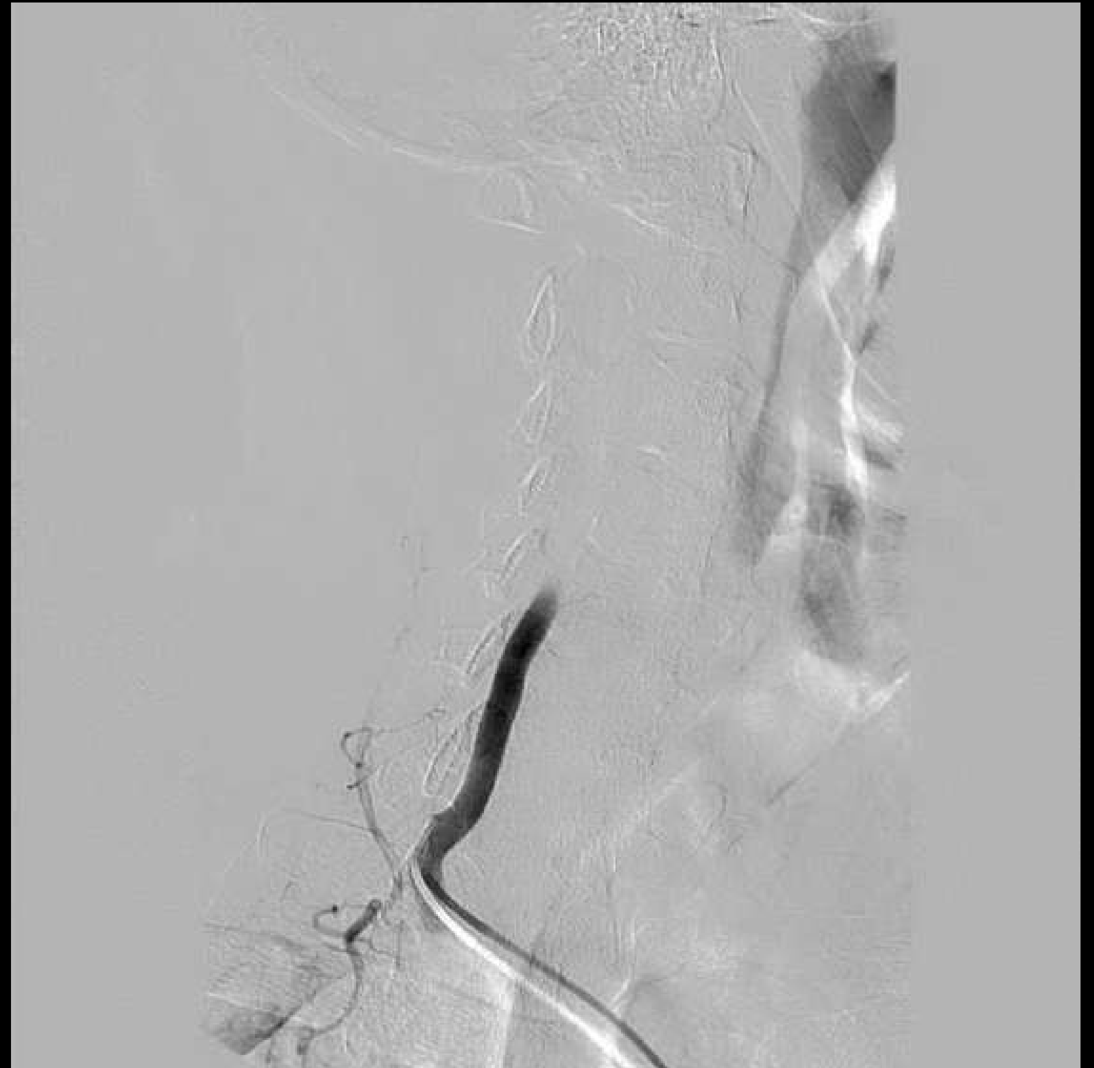
Don’t Look Back in Angio



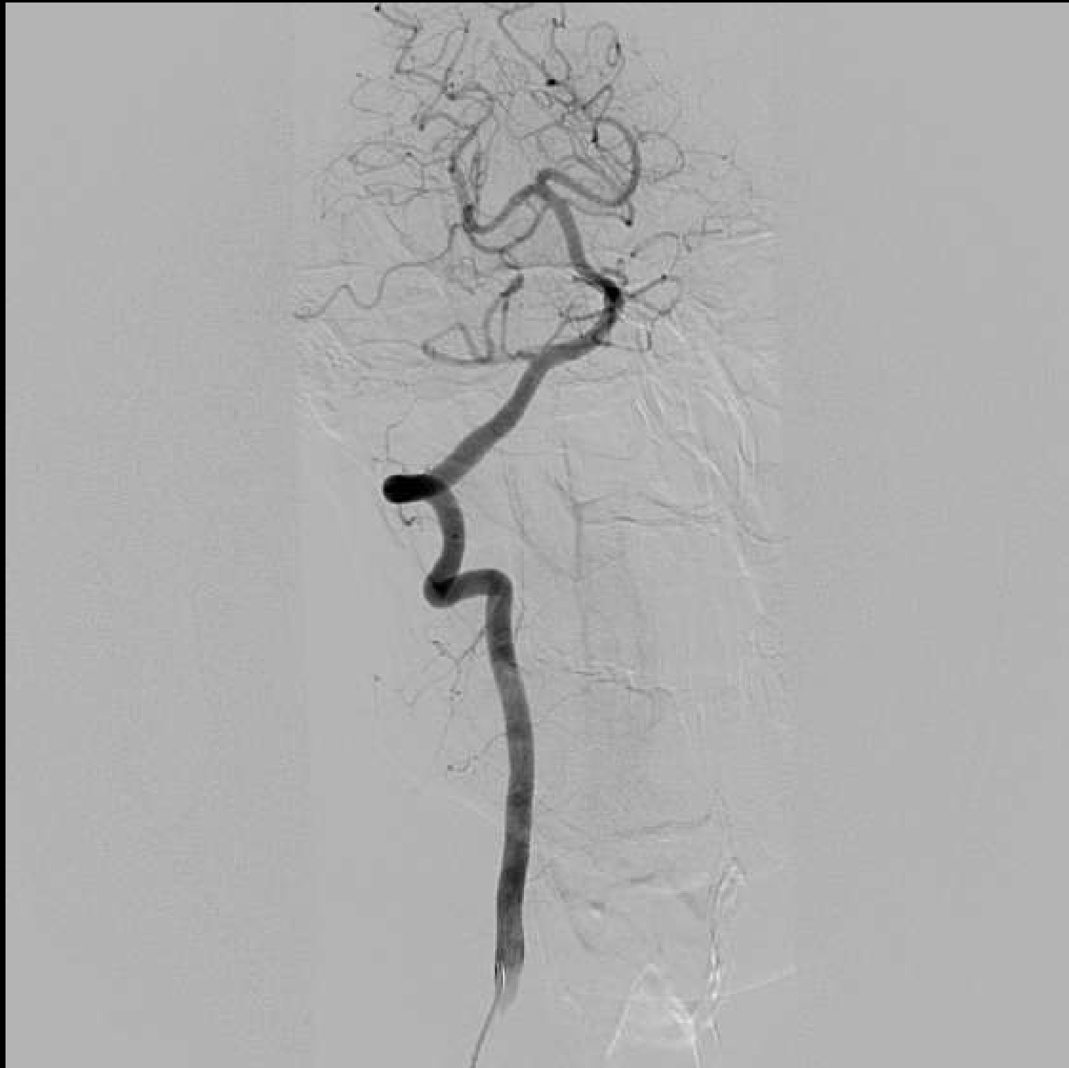


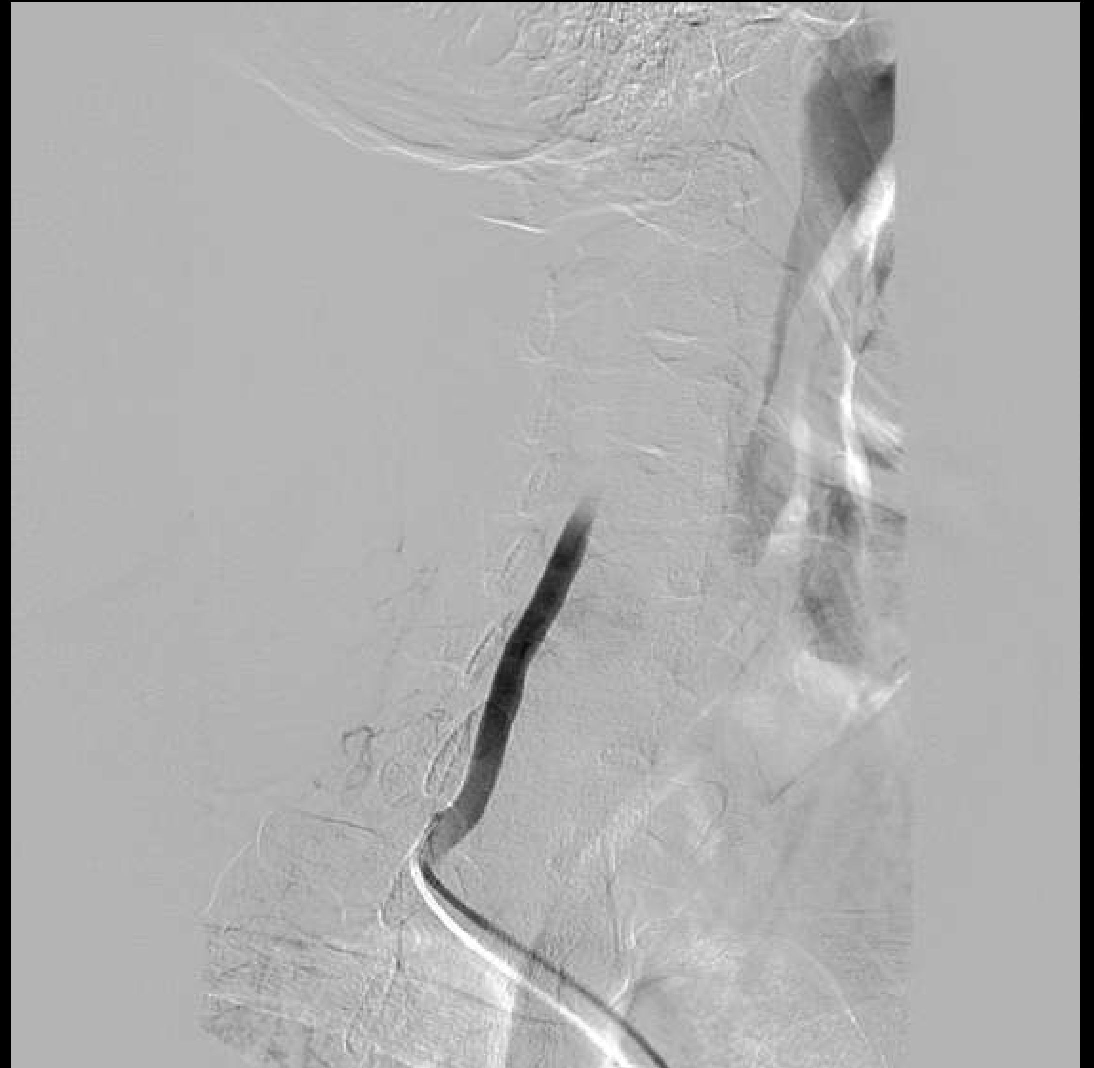
Don’t Look Back in Angio



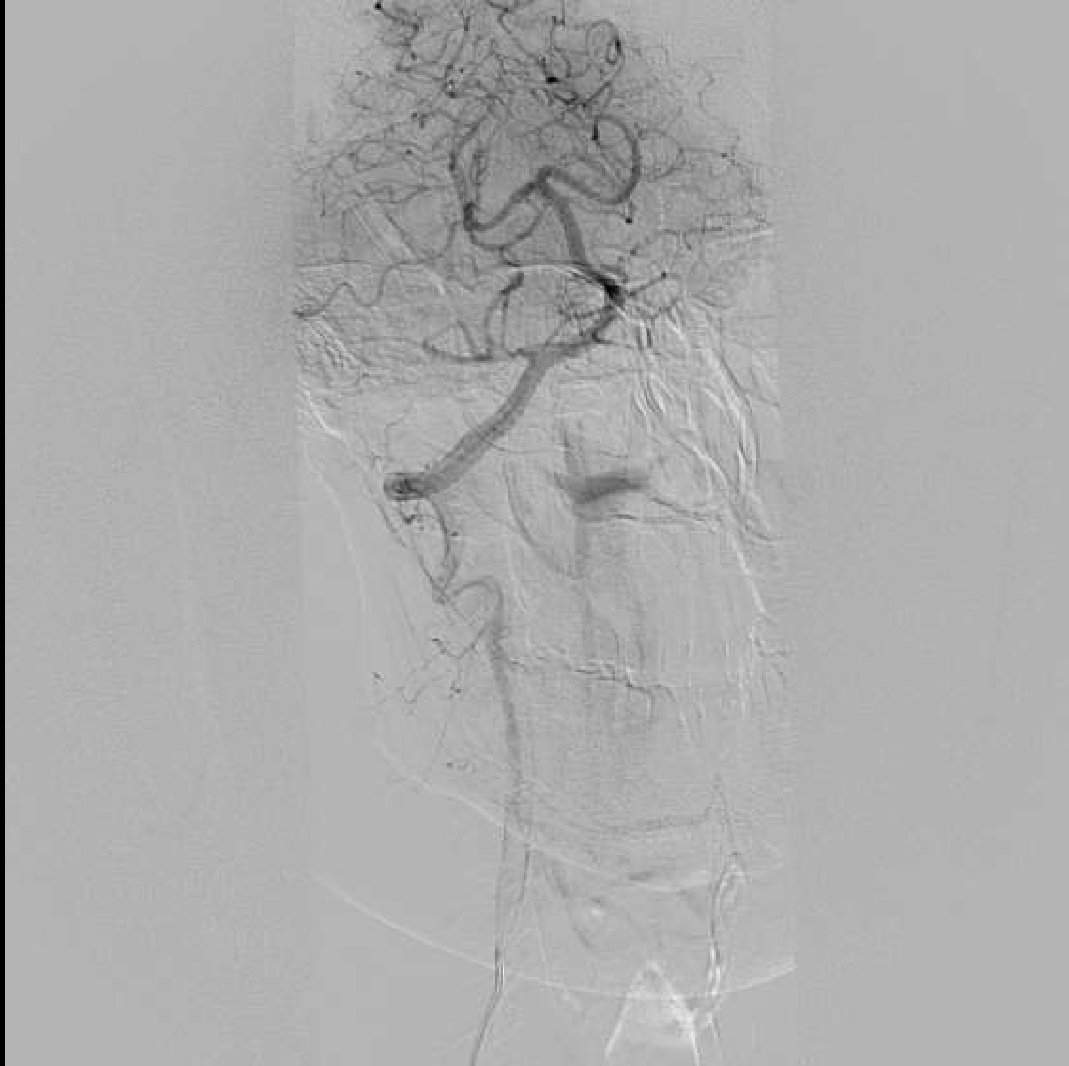


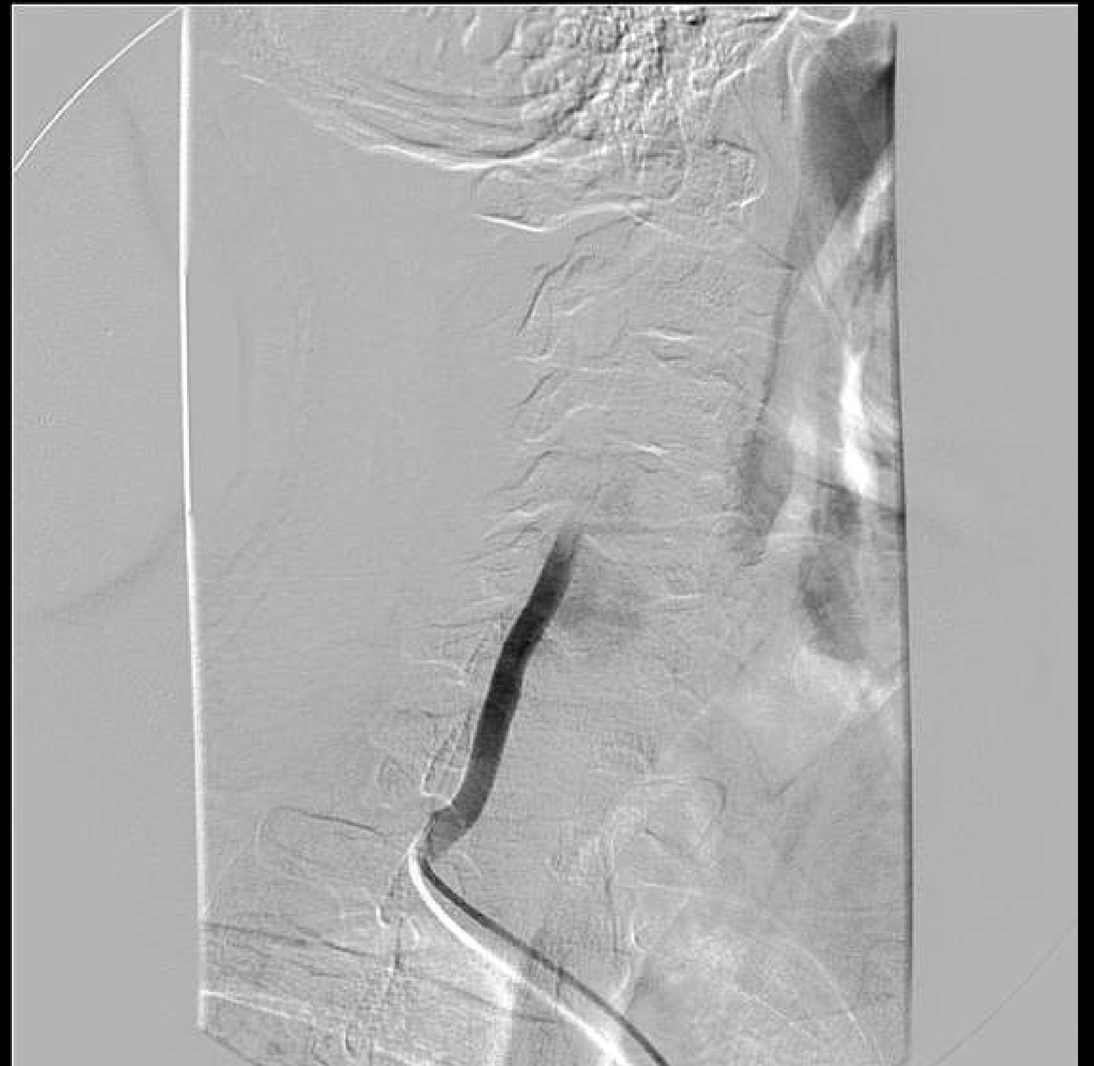
Don’t Look Back in Angio





Don’t Look Back in Angio





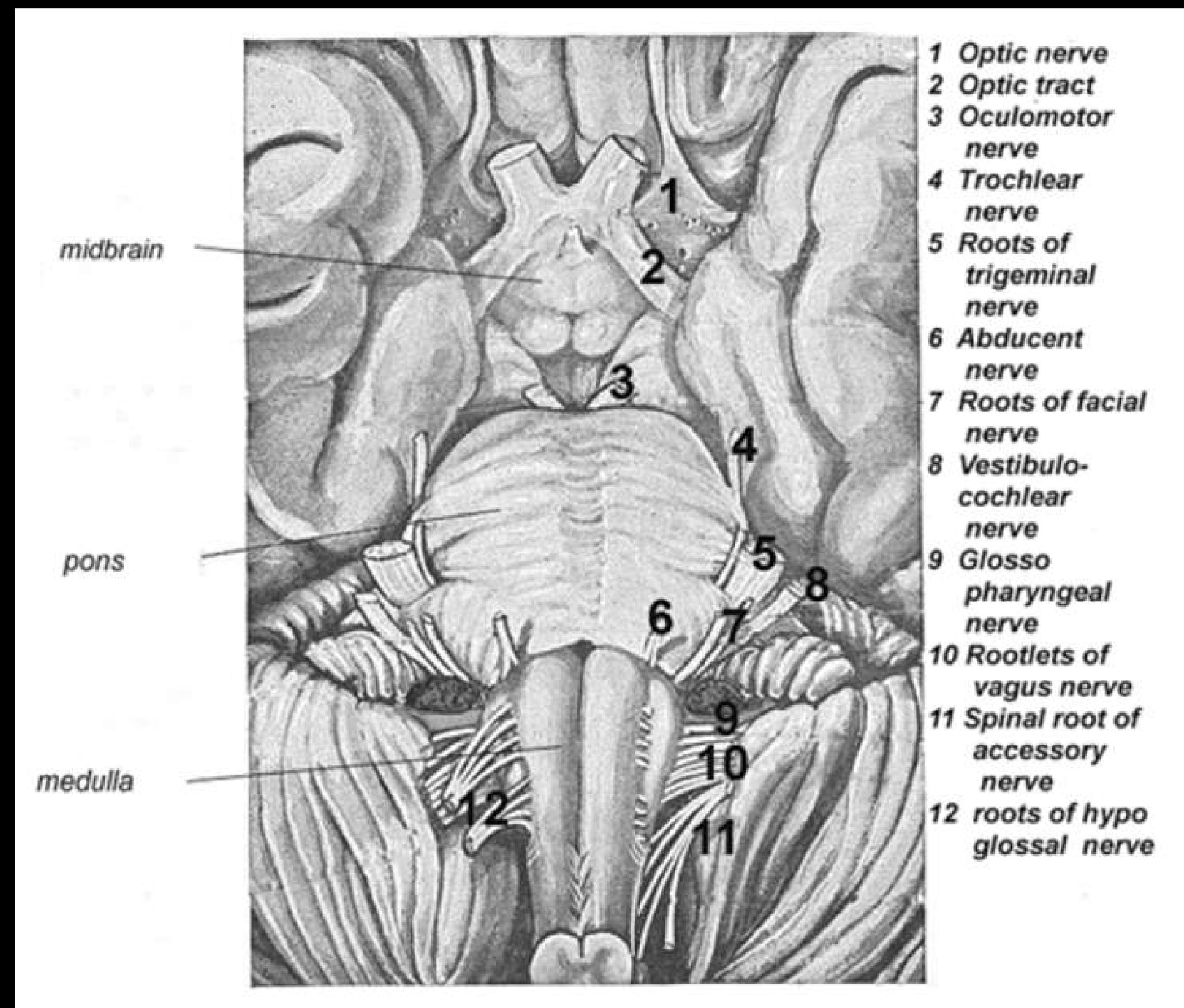
Brainstem Simplified

- Recent trainee teaching

(thanks to Ittimani M)

Brainstem Simplified

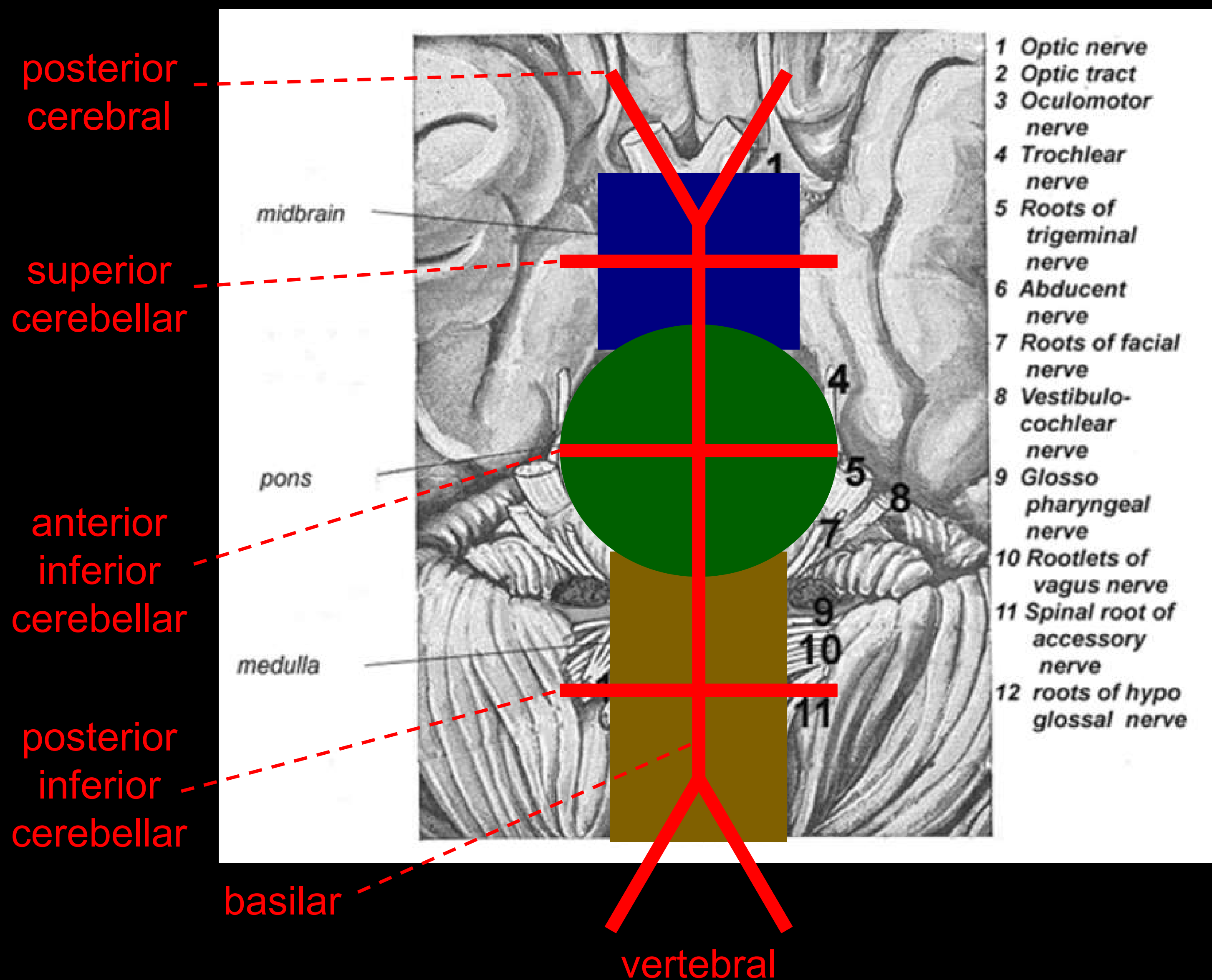
- Overview



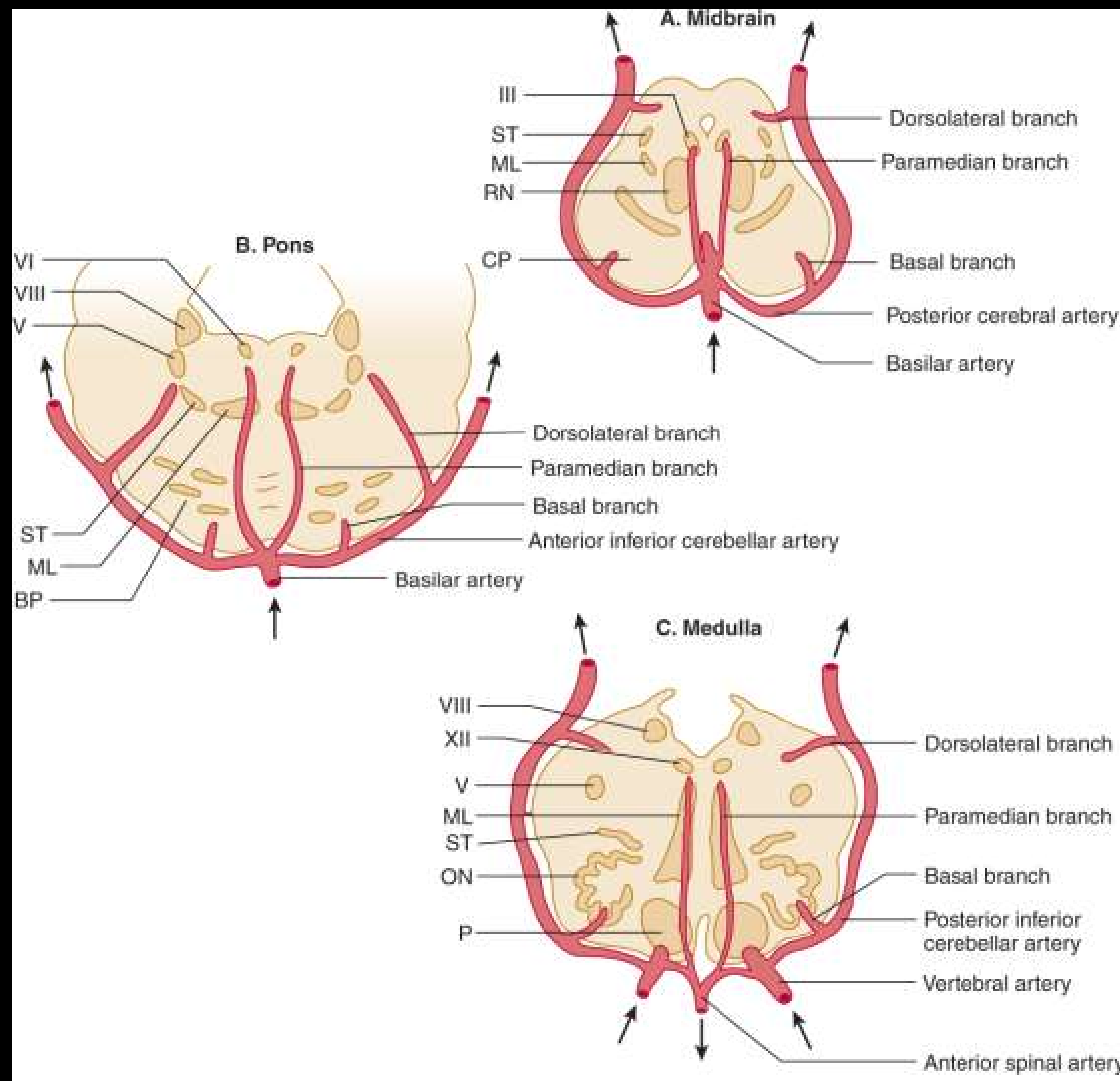
Gates P. The rule of 4 of the brainstem: a simplified method for understanding brainstem anatomy and brainstem vascular syndromes for the non-neurologist. Intern Med J. 2005 Apr; 35(4): 263-6.

Brainstem Simplified

- Overview and vascular supply



Brainstem Detail



Waxman SG: *Clinical Neuroanatomy: Twenty-Seventh Edition:* www.accessmedicine.com

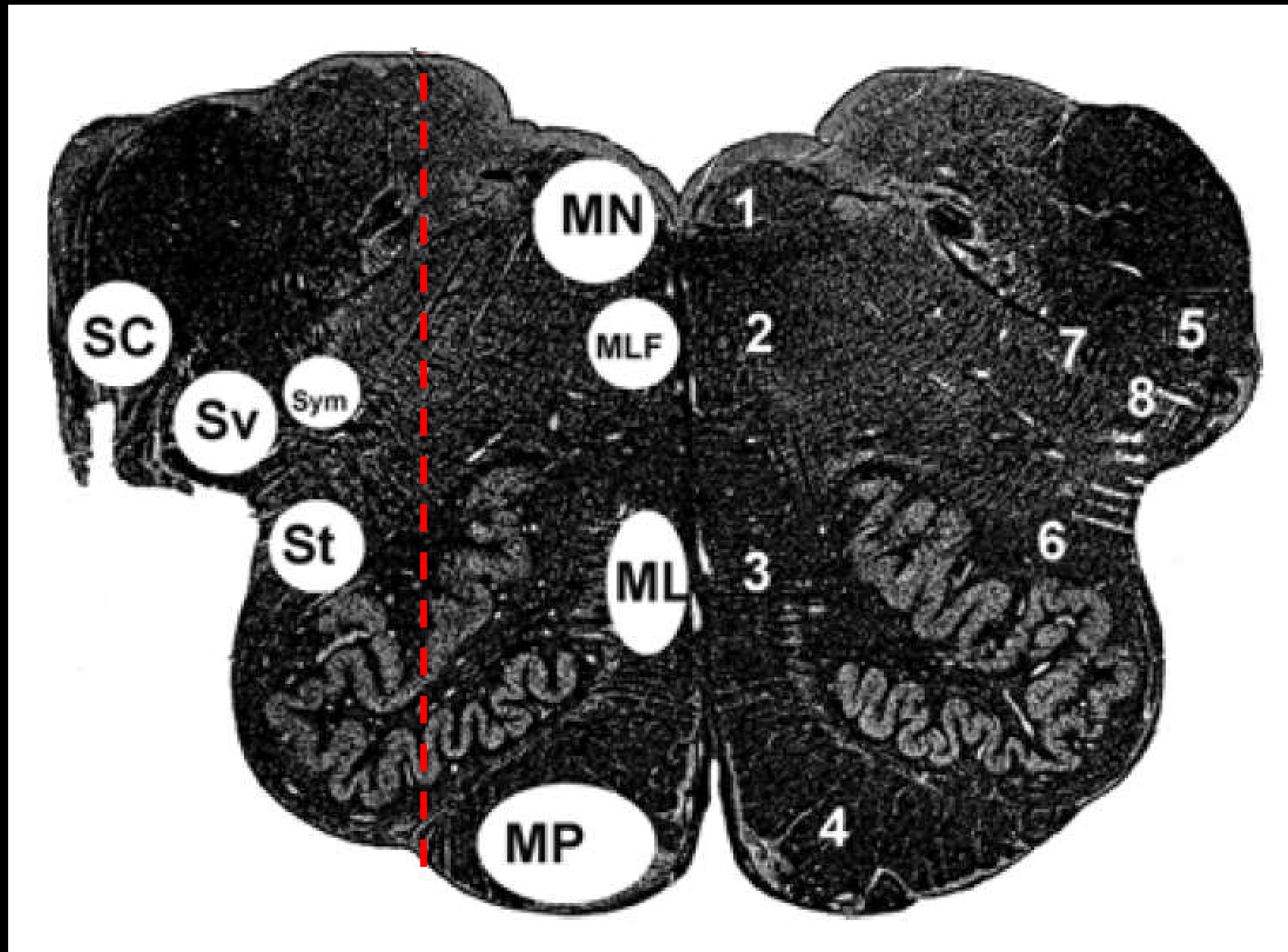
Brainstem Simplified

- “Rule of 4” ×4
  - 4 midline structures (‘m’)
  - 4 side structures (‘s’)
  - 4 cranial nerves in each of midbrain, pons, medulla
  - 4 midline motor nuclei: 3, 4, 6, 12 (factors of 12)

- Use midline / side to establish longitude
- Use cranial nerves to establish latitude

Gates P. The rule of 4 of the brainstem: a simplified method for understanding brainstem anatomy and brainstem vascular syndromes for the non-neurologist. Intern Med J. 2005 Apr; 35(4): 263-6.

Midline and Side Structures



Midline and Side Structures

- 4 midline structures (‘m’)
  - Motor pathway (corticospinal tract)
    - contralateral weakness of limbs
  - Medial lemniscus
    - contralateral loss of vibration / proprioception sense
  - Medial longitudinal fasciculus
    - disruption of conjugate gaze, ipsilateral eye fails to adduct
  - Motor nucleus and nerve (3, 4, 6, 12)
    - ipsilateral loss of motor functions (eye and tongue movements)

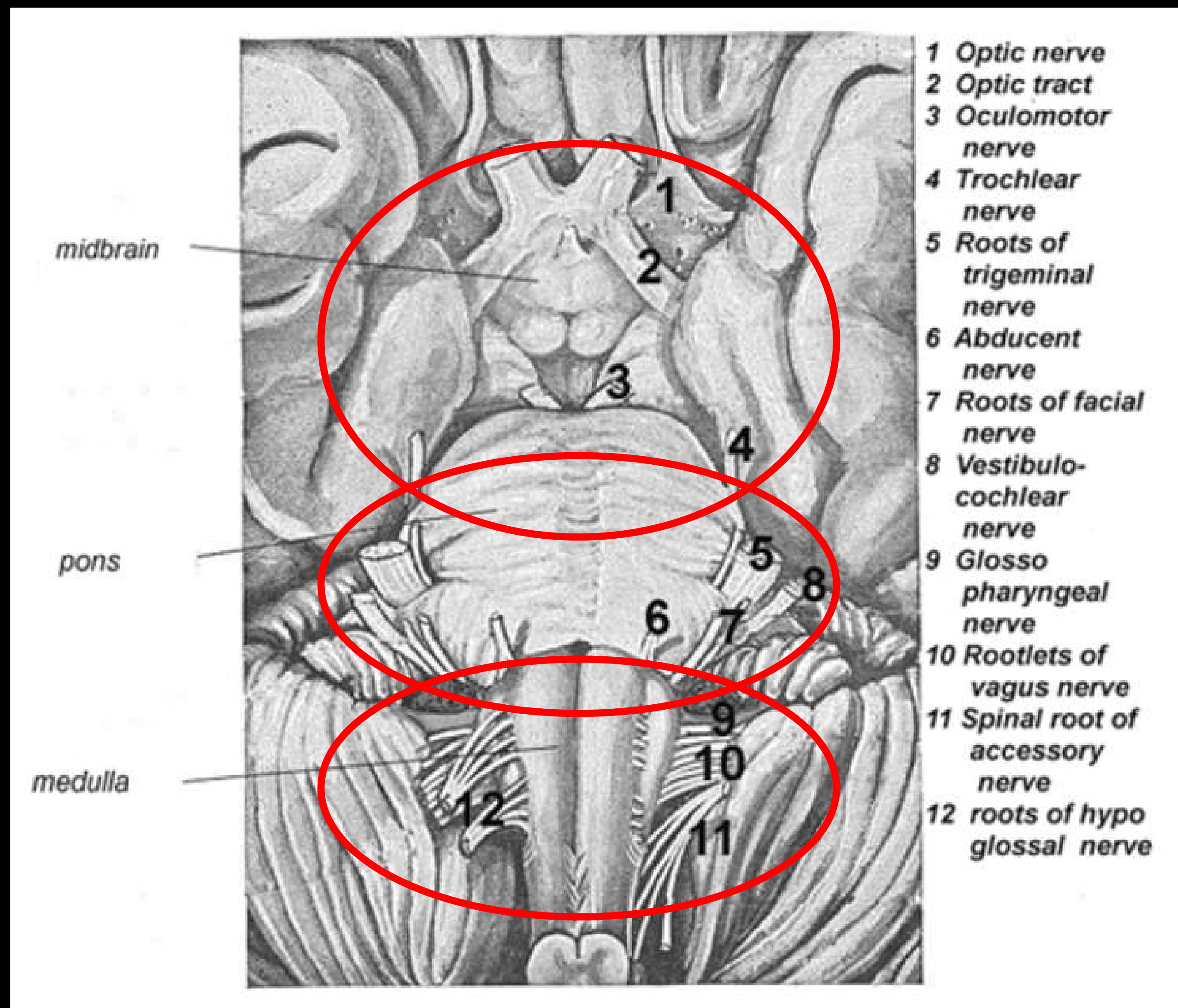
Midline and Side Structures

- 4 side structures ('s')
  - Spinocerebellar pathways
    - ipsilateral ataxia of limbs
  - Spinothalamic pathway
    - contralateral altered pain / temperature sensation of limbs
  - Sensory nucleus of trigeminal nerve
    - ipsilateral altered pain / temperature sensation of face
  - Sympathetic pathway
    - ipsilateral ptosis and miosis (Horner syndrome)

Without extrinsic mnemonics...

- Simplified principle to remember ipsilateral, contralateral, midline motor nuclei
  - most features are ipsilateral
    - cranial nerve dysfunction
    - cerebellar limb ataxia
    - sympathetic outflow
  - conscious limb movements and sensation are contralateral
- Midline motor nuclei
  - eye movements (3, 4, 6)
  - tongue movements (12)

Cranial Nerve Origins



(but note that relevant to our cases, vestibular part of 8th nerve relates more to lateral medulla)

Review

- JP Mc, 33yoM
  - Forklift driver
  - Syncope with head movement
  - Mild headache
  - Mild dizziness
  - Appeared well
  - Vertebral and carotid artery dissections
  - Rotational vertebral artery occlusion
  - No infarct
- Jo Al, 40yoM
  - New Zealander
  - Sudden, severe vertigo and right hearing loss
  - Diaphoretic and looking unwell
  - Basilar artery dissection
  - Inferior pontine infarct
- He Da, 42yoF
  - Mother of three
  - Intermittent visual / ophthalmic deficits, dysarthria, left upper limb weakness / ataxia
  - Appeared well
  - Carotid artery dissection
  - No infarct

Differential Diagnoses

- Syncope *with head movement*
  - Cardiac
  - Vasovagal
  - Orthostatic
  - *Cerebral arterial insufficiency*
  - *Carotid sinus syndrome (tight collar syndrome)*

(consider but contrast to)

- Seizure

... as seen earlier!

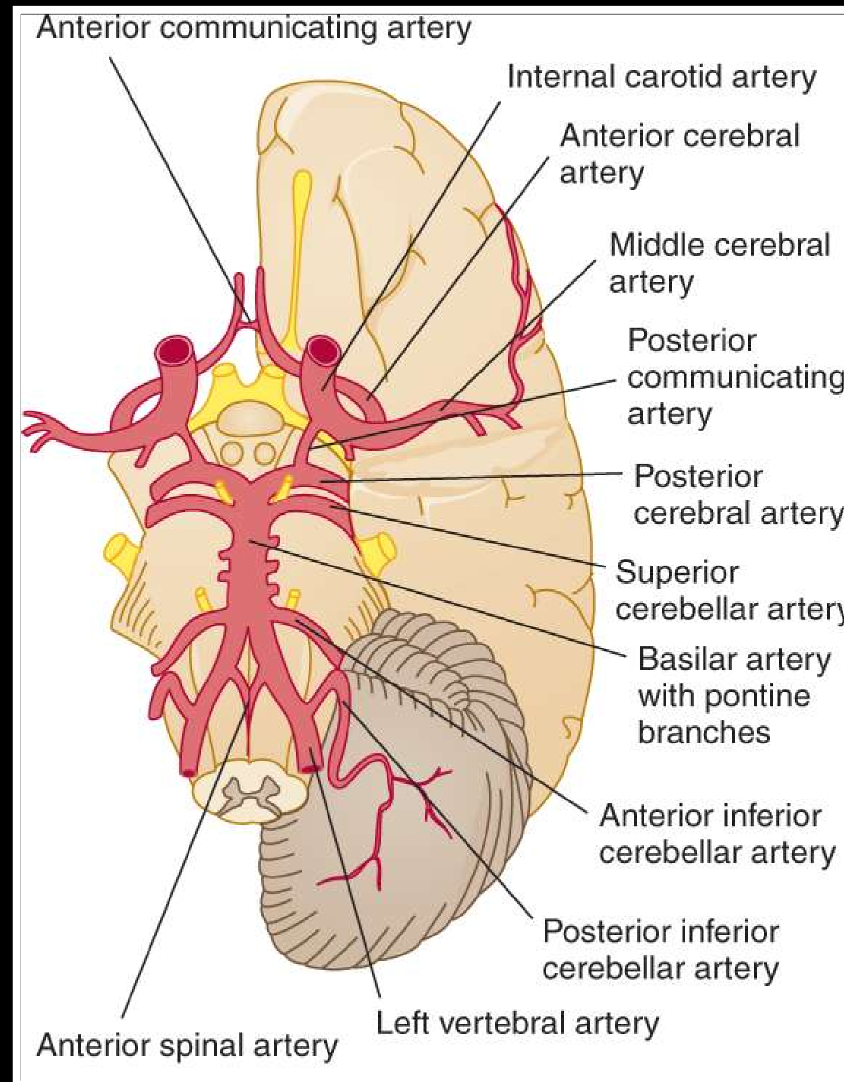
Differential Diagnoses

- Vertigo and/or hearing loss
  - Peripheral
    - benign paroxysmal positional vertigo (no effect on hearing)
    - Meniere disease (hearing loss, tinnitus)
    - labrynthitis (hearing loss, tinnitus)
  - Central
    - vestibular migraine
    - epilepsy
    - vestibular neuritis
    - multiple sclerosis
    - brainstem tumour
    - brainstem ischaemia

Differential Diagnoses

- Dysarthria and limb weakness
  - Stroke
    - cerebral ischaemia
    - haemorrhagic
  - Seizure
  - Sepsis / Delirium
  - Brain tumour
  - Metabolic disturbance

Circle of Life[1,2]



1. John E. 1994.
2. or Willis

Waxman SG: *Clinical Neuroanatomy: Twenty-Seventh Edition:* www.accessmedicine.com

Carotid / Vertebral Artery Dissection

- Incidence ~3 /100000 /year
  - Carotid ~2 /100000 /year
  - Vertebral ~1 /100000 /year
  - Possibly greater in autumn or winter
    - ? association with infection, blood pressure changes, physical activity
  - Rare but major cause of stroke in young adults

Debette S, Leys D. Cervical-artery dissections: predisposing factors, diagnosis, and outcome. Lancet Neurol 2009 Jul; 8(7): 668-78.

Carotid / Vertebral Artery Dissection

- Symptoms and Signs
  - Carotid
    - Headache, neck pain, facial pain
    - Amaurosis fugax
    - Neck swelling
    - Pulsatile tinnitus
    - Limb weakness
    - Migraine
  - Vertebral
    - Facial pain
    - Voice change
    - Loss of taste
    - Vertigo
    - Nausea
    - Dysphagia
    - Hearing loss

Carotid / Vertebral Artery Dissection

- Treatment
  - Lacking strong evidence
  - Anticoagulants / antiplatelets
    - presumed to prevent thromboembolic events
    - prevent recurrent ischaemic events
    - allow vessel to heal
  - Endovascular
    - stenting invasive but effective for ongoing symptoms
  - Surgical
    - ligation + bypass (significant risk)

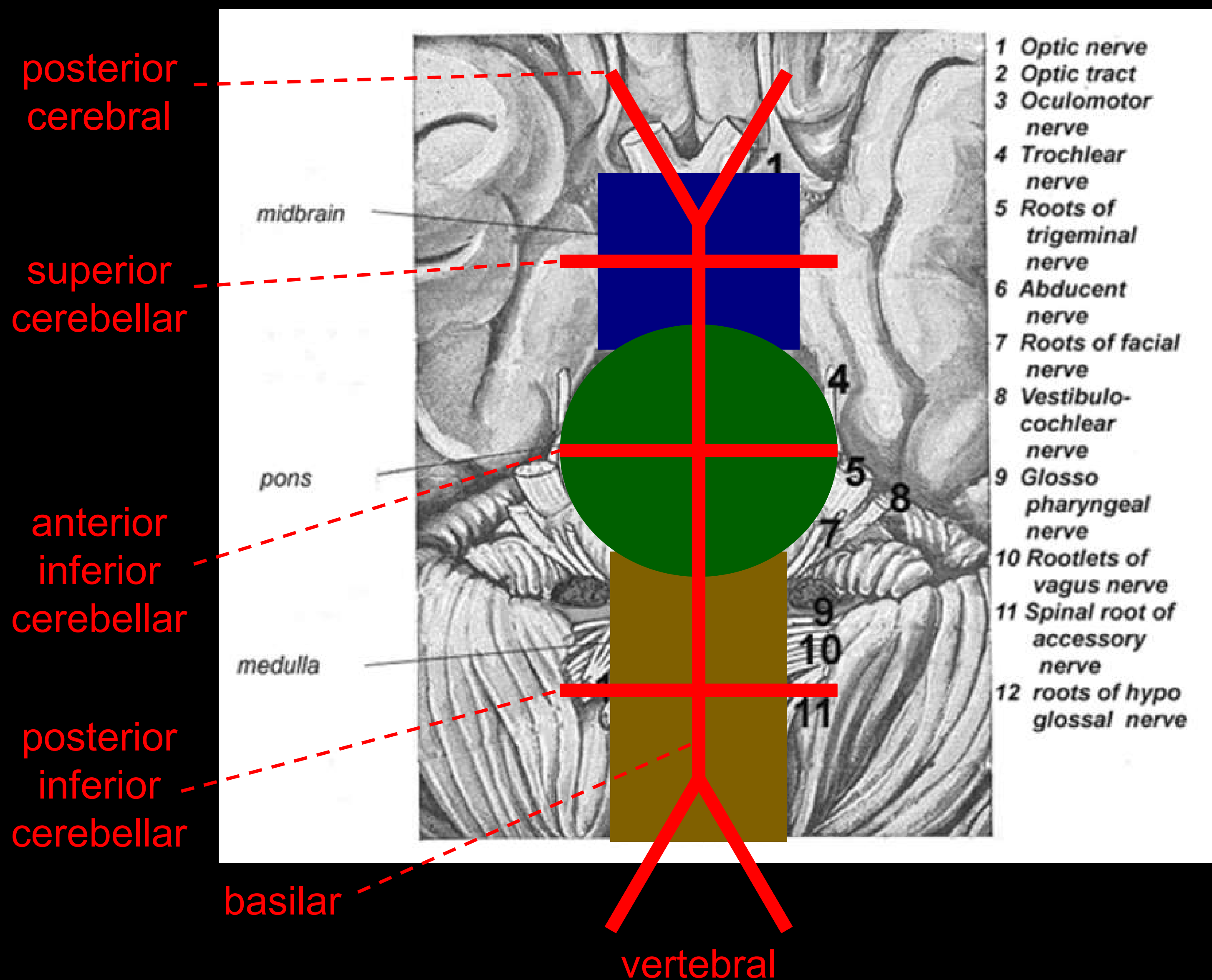
Schievink WI. Spontaneous dissection of the carotid and vertebral arteries.
N Engl J Med. 2001 Mar 22; 344(12): 898-906.

Bowhunter Syndrome

- Course of vertebral artery
  - Origin: subclavian artery
  - Enters foramina of transverse processes of C6 to C2, or occasionally from C7 to C2
    - Osteophyte compression most likely here
  - Obliquely passes to C1 foramen
    - Soft tissue compression most likely here
  - Travels posteriorly then pierces dura, enters foramen magnum
  - Vertebral arteries unite to form basilar artery

Brainstem Simplified

- Overview and vascular supply



Brainstem Simplified

- "Rule of 4" ×4
  - 4 midline structures ('m')
  - 4 side structures ('s')
  - 4 cranial nerves in each of midbrain, pons, medulla
  - 4 midline motor nuclei: 3, 4, 6, 12 (factors of 12)

- Use midline / side to establish longitude
- Use cranial nerves to establish latitude

Gates P. The rule of 4 of the brainstem: a simplified method for understanding brainstem anatomy and brainstem vascular syndromes for the non-neurologist. Intern Med J. 2005 Apr; 35(4): 263-6.

What else?

- Clinical judgements
  - Patient looking diaphoretic and unwell had permanent disease (pontine infarct)
  - Patient with multiple dissections showed significant apprehension to head turning

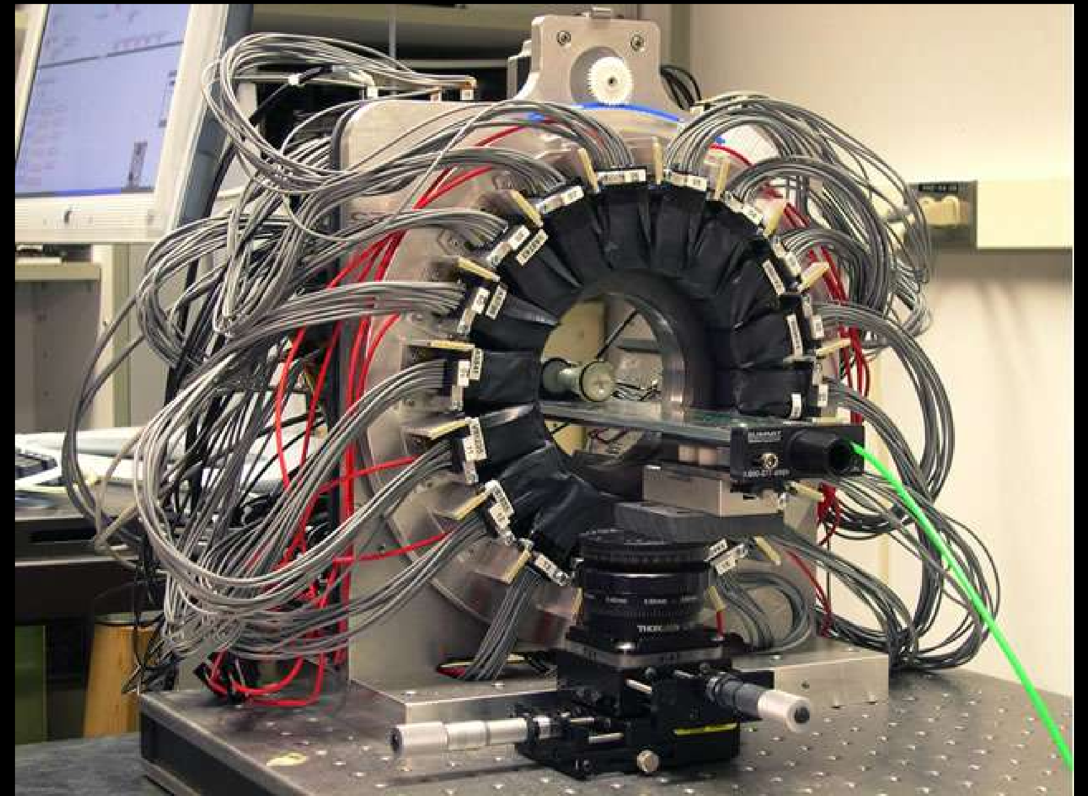
- Sleep ≠ syncope

Don’t Look Back in Angio

With apologies to Gallagher L, Gallagher N, White A, McGuigan P, Arthurs P, McCarroll T. 1996.

Don’t Look Back in Angio

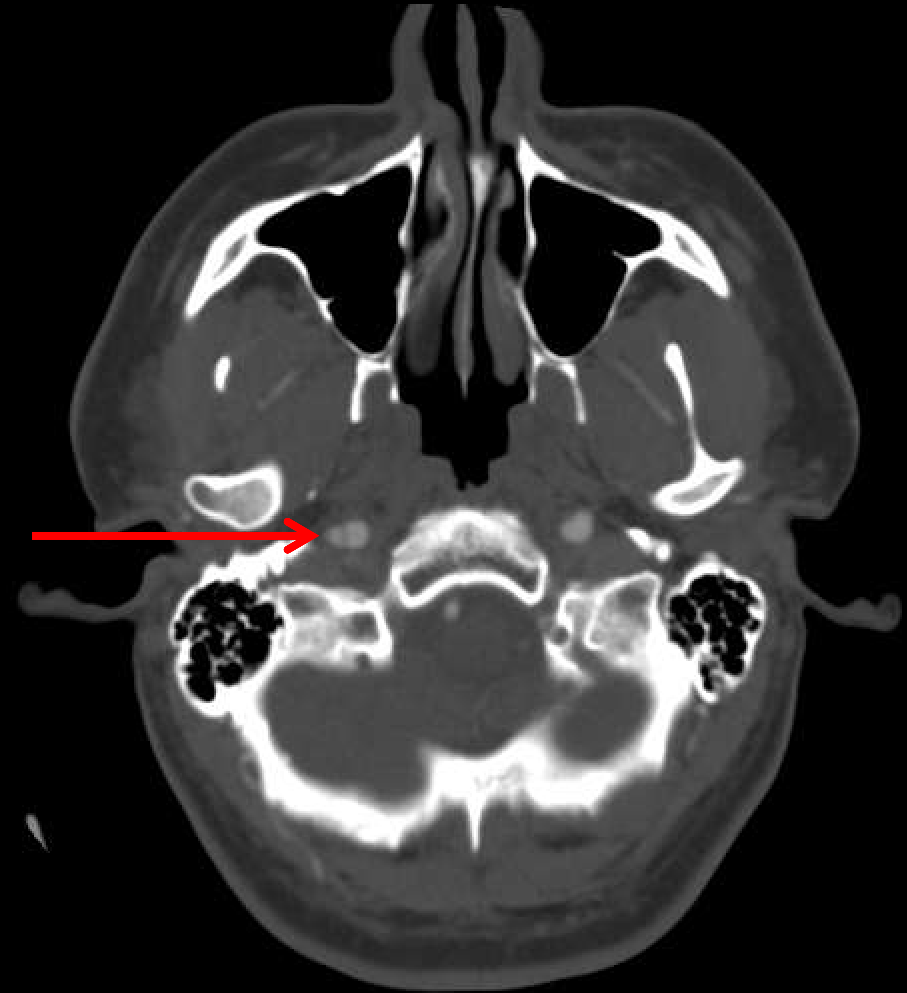
Slip inside the eye of your mind



http://depts.washington.edu/imreslab/from%20old%20SITE/physimages/fig4_quick.jpg

Don’t Look Back in Angio

Slip inside the eye of your mind
Don’t you know you might find
An extramural layer



Don’t Look Back in Angio

Slip inside the eye of your mind
Don’t you know you might find
An extramural layer

You said that you’d never been

http://blogs.uw.edu/radwblog/files/2015/03/Revolution-CT-scanner.jpg

Don’t Look Back in Angio

Slip inside the eye of your mind
Don’t you know you might find
An extramural layer

You said that you’d never been
But all the things that you’ve seen

Don’t Look Back in Angio

Slip inside the eye of your mind
Don’t you know you might find
An extramural layer

You said that you’d never been
But all the things that you’ve seen
Will slowly fade away

- “recurrent episodes of syncope and presyncope when turning head”
  - “darkening of vision and rushing noise”

Don’t Look Back in Angio

Slip inside the eye of your mind
Don’t you know you might find
An extramural layer

You said that you’d never been
But all the things that you’ve seen
Will slowly fade away

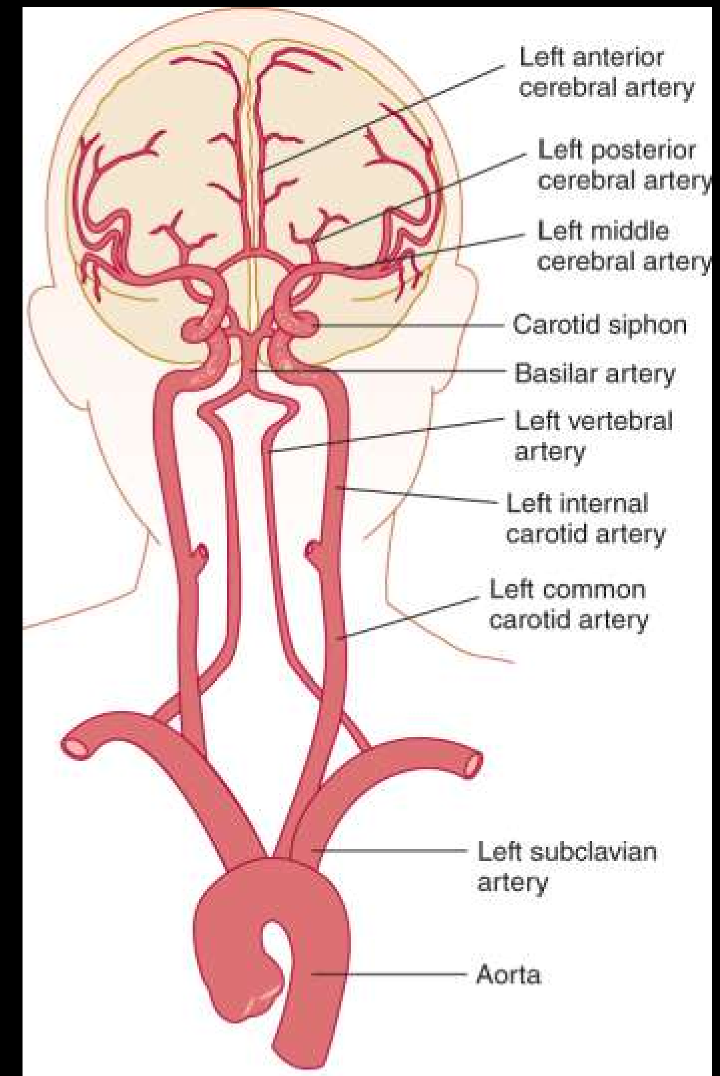
So I get investigated from my bed

Don’t Look Back in Angio

Slip inside the eye of your mind
Don’t you know you might find
An extramural layer

You said that you’d never been
But all the things that you’ve seen
Will slowly fade away

So I get investigated from my bed
The supply to brain I have inside
my head



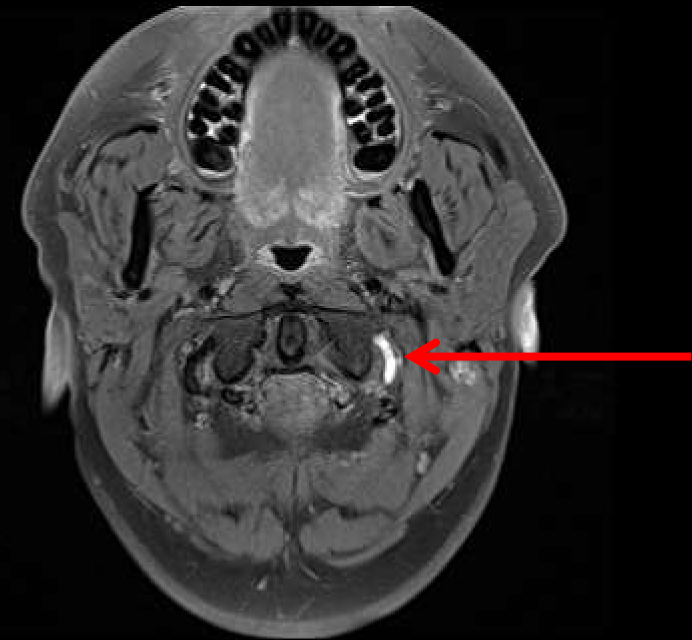
Waxman SG: *Clinical Neuroanatomy: Twenty-Seventh Edition:* www.accessmedicine.com

Don’t Look Back in Angio

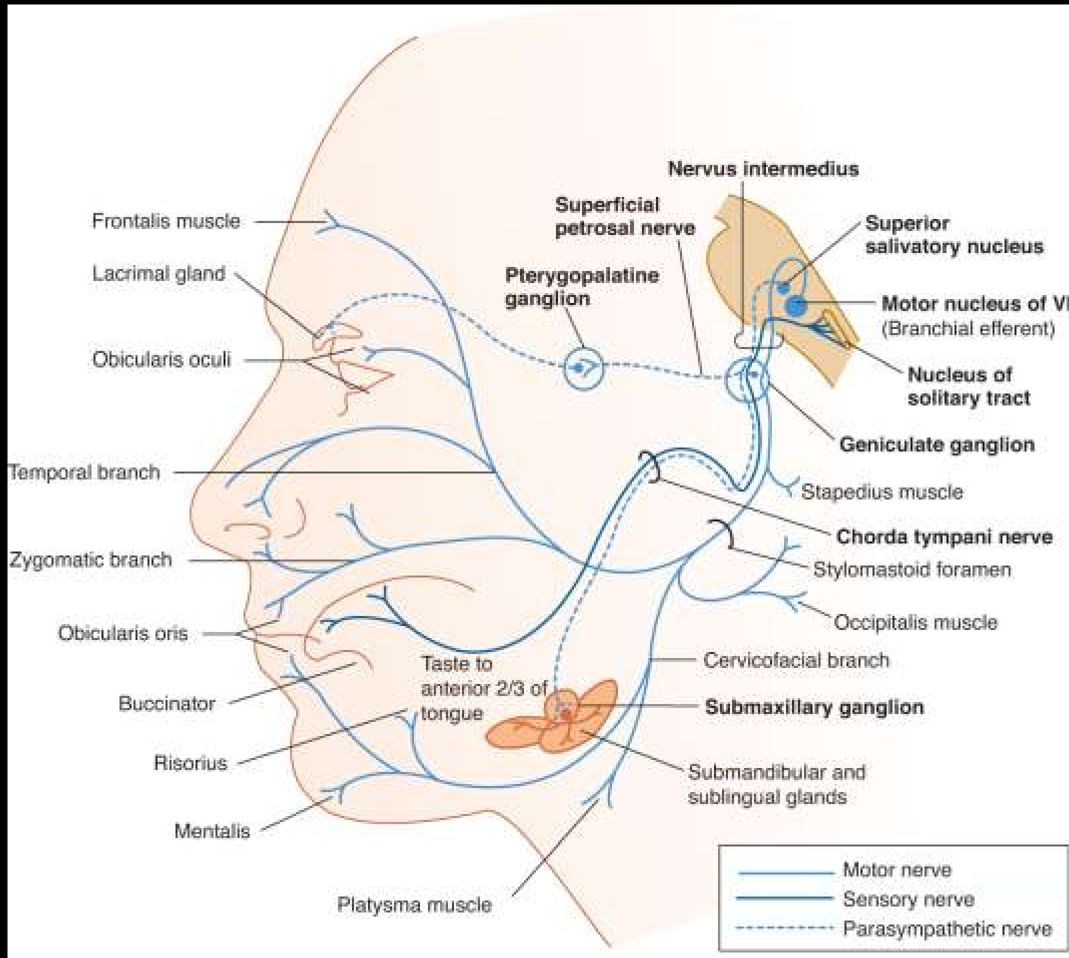
Slip inside the eye of your mind
Don’t you know you might find
An extramural layer

You said that you’d never been
But all the things that you’ve seen
Will slowly fade away

So I get investigated from my bed
The supply to brain I have inside my head
Blood outside, false luminal bloom



Don't Look Back in Angio



Palsy of nerve that carries taste

Waxman SG: *Clinical Neuroanatomy: Twenty-Seventh Edition:* www.accessmedicine.com

Don’t Look Back in Angio

Palsy of nerve that carries taste
Takes that look from off your face

Waxman SG: *Clinical Neuroanatomy: Twenty-Seventh Edition:* www.accessmedicine.com

Don’t Look Back in Angio

Palsy of nerve that carries taste

Takes that look from off your face

Neuro will never figure this strange patient out

https://www.bookstore.umn.edu/images/system/product/9568.gif

Don’t Look Back in Angio

#88811

Palsy of nerve that carries taste

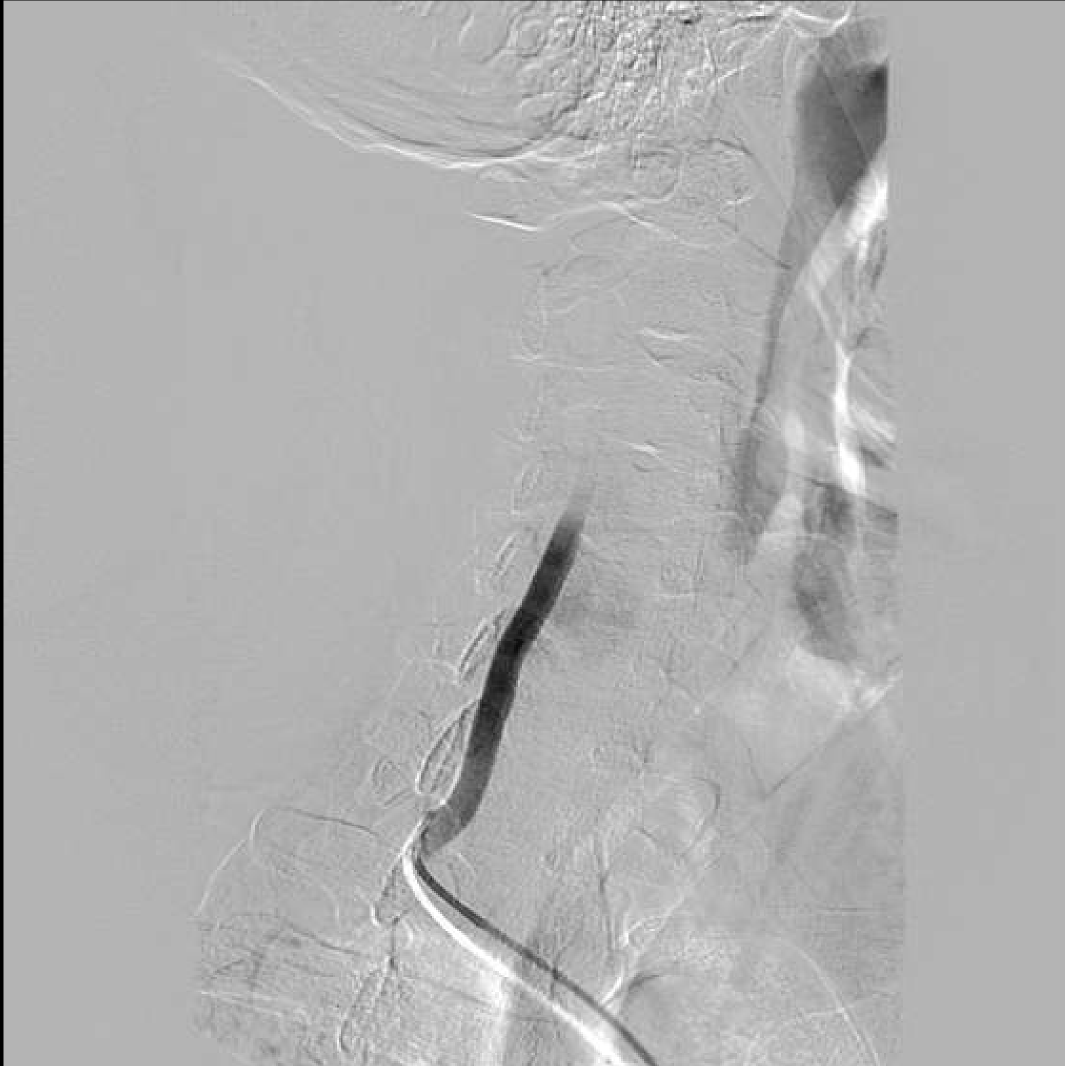
Takes that look from off your face

Neuro will never figure this strange patient out

And so Sally gets paged, it's getting too late to request an MRI

http://news.vanderbilt.edu/files/nec-sv8100-telephone-system.jpg

Don’t Look Back in Angio



Palsy of nerve that carries taste

Takes that look from off your face

Neuro will never figure this strange patient out

And so Sally gets paged, it's getting too late to request an MRI

They’ll scan anyway, but don’t look back in angio I heard you say

It turns out that one of the radiology registrars at the hospital was Ayesa S, the most friendly radiology registrar I have ever met (would actually stop and have a chat, and never raged).

Thanks

- also to Nham B, neurology registrar for helping to locate the recent cases