AMSER Case of the Month
April 2025

21-year-old male with sudden-onset cervical neck pain and upper extremity weakness

Chelsea Levi, M3, Virginia Commonwealth University School of Medicine

Melissa Kang, MD, Clinical Associate Professor Neuroradiology, Virginia Commonwealth University School of Medicine

VCU Health

AMSER

Patient Presentation

- HPI: A 21-year-old male presents to the ED with sudden onset severe posterior cervical neck pain and bilateral upper extremity weakness and numbness which he noticed while packing to return to college. On arrival to the ED, he was noted to have no movement of the bilateral upper arms with the exception weak handgrip (L>R) and some finger wiggling with associated mild sensory loss over the upper extremities. He denied any recent trauma to the head or neck, illness, or recent travel.

Patient Presentation

- Medical history: Generalized anxiety disorder, Hyperlipidemia
- Surgical History: None
- Social History : Social beer use, no history of illicit drug or tobacco use
- Medications: Fluoxetine 10 mg daily, OTC caffeine 200 tablets mg PRN
- Vitals: Hypertensive to 168/107 mmHg otherwise within normal limits
- Physical Exam: Cranial nerves 2-12 intact, 0/5 motor strength in bilateral upper extremities which lay flaccid on bed, 5/5 motor strength in bilateral lower extremities. Decreased sensation in bilateral upper extremities, anterior trunk, and bilateral lower extremities.

Pertinent Labs

- CBC: Within normal limits
- CMP: Within normal limits
- Lipid panel: LDL 164 mg/dL, total cholesterol 237 mg/dL, otherwise within normal limits
- Troponin I: Within normal limits
- Coagulation: Within normal limits
- Urine Drug screen: Negative

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

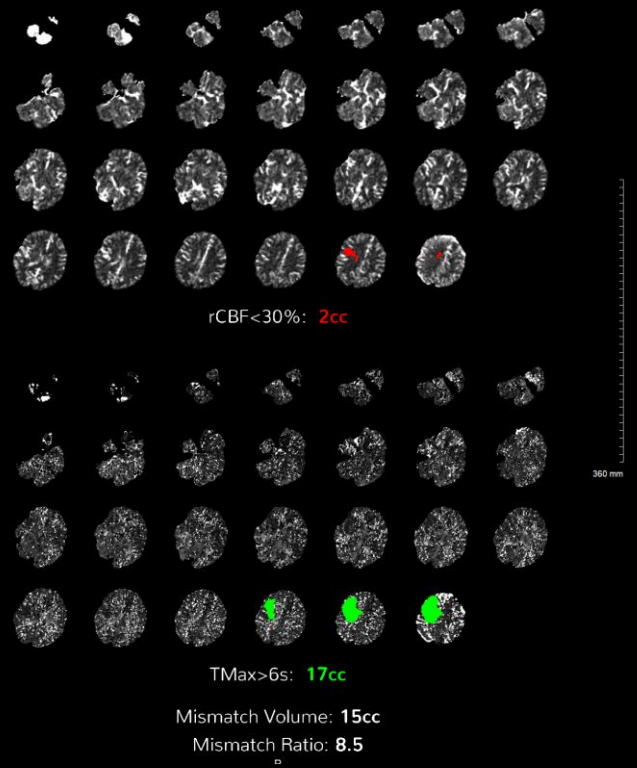
Variant 3: **New focal neurologic defect, fixed or worsening. Less than 6 hours. Suspected stroke.**

Radiologic Procedure	Rating	Comments	RRL*
CT head without IV contrast	9	Parenchymal brain imaging and CT or MR vascular imaging of the head and neck should be considered. Noncontrast head CT is often obtained first to assess for hemorrhage or large infarct. MRI is more sensitive than CT for acute infarct.	☢☢☢
MRI head without IV contrast	8	Parenchymal brain imaging and CT or MR vascular imaging of the head and neck should be considered. Can be useful if there is a contraindication to contrast. Noncontrast head CT is often obtained first to assess for hemorrhage or large infarct. MRI is more sensitive than CT for acute infarct.	O
MRI head without and with IV contrast	8	Noncontrast head CT is often obtained first to assess for hemorrhage or large infarct. MRI head with contrast can be helpful to determine the age of infarct and to evaluate for other causes of symptoms such as tumor or infection.	O
MRA head and neck without IV contrast	8	Can be obtained in conjunction with MRI head. Preferred MR vascular imaging of the head and neck includes noncontrast head MRA and contrast-enhanced neck MRA. Can be useful in patients with renal failure or contrast allergies.	O
MRA head and neck without and with IV contrast	8	Can be obtained in conjunction with MRI head. Preferred MR vascular imaging of the head and neck includes noncontrast head MRA and contrast-enhanced neck MRA.	O
CTA head and neck with IV contrast	8	CTA can be obtained after NCCT.	☢☢☢
CT head perfusion with IV contrast	6		☢☢☢
MRI head perfusion with IV contrast	5		O
Arteriography cervicocerebral	5		☢☢☢
CT head with IV contrast	3		☢☢☢
CT head without and with IV contrast	3		☢☢☢
US duplex Doppler carotid	2		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

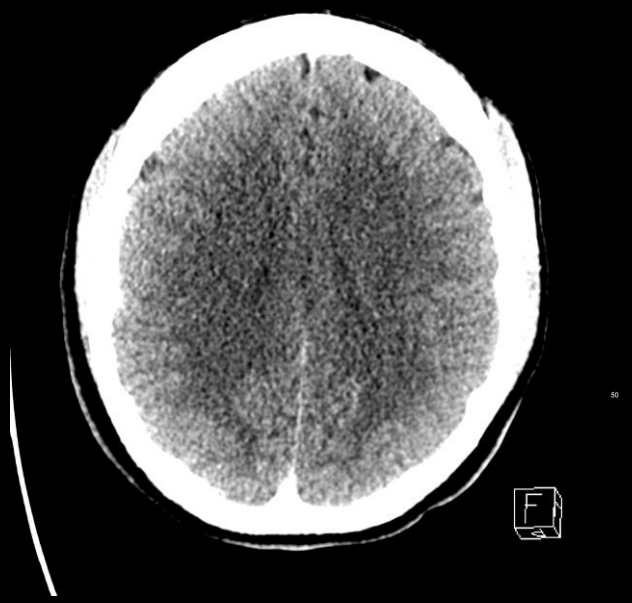
Although the patient's clinical presentation of bilateral hemiparalysis was more consistent with spinal cord pathology, the neurological deficit prompted a stroke workup which included CT head without contrast, CT angiogram head and neck and CT perfusion with Viz. AI software analysis.

AMSER

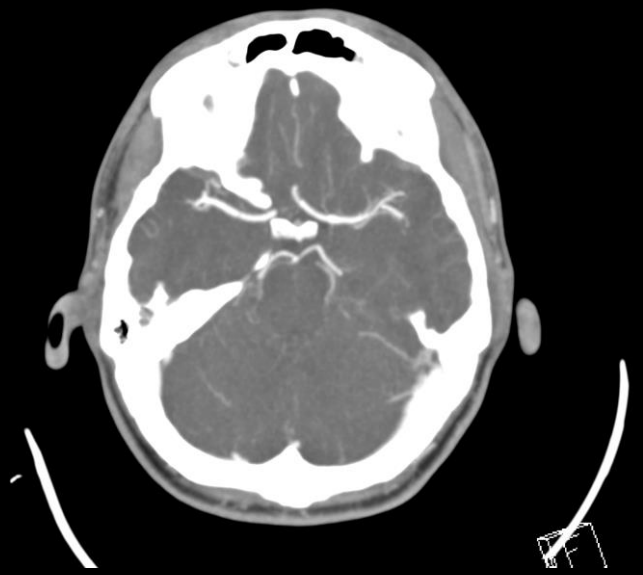
Findings (unlabeled)



Viz.AI summary sheet for cerebral perfusion.

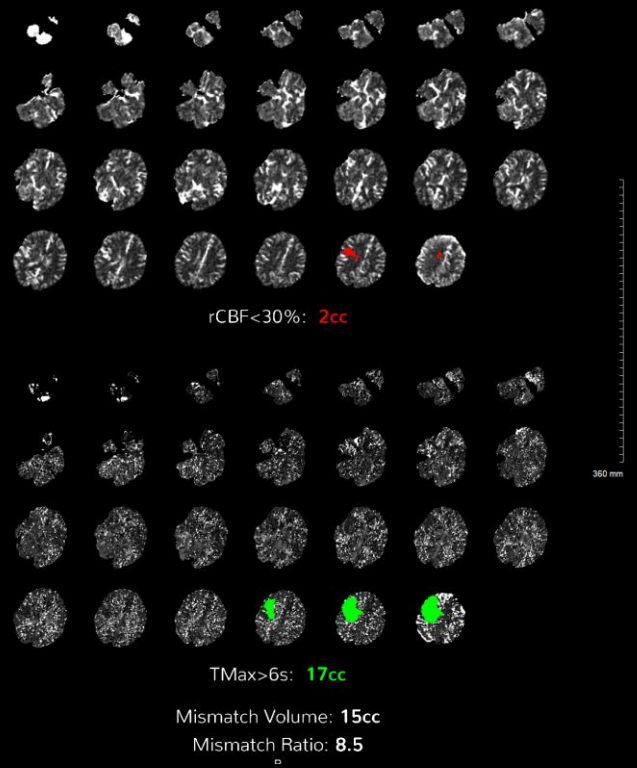


Axial image of CT stroke head without contrast.

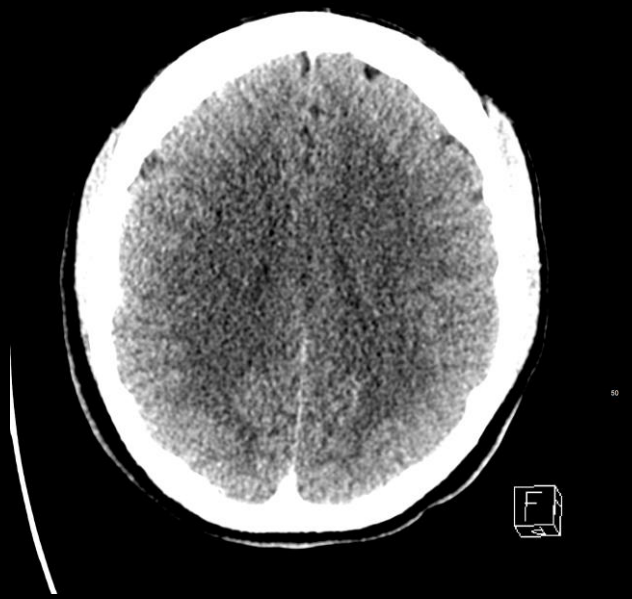


Axial image of CT head neck angio with contrast.

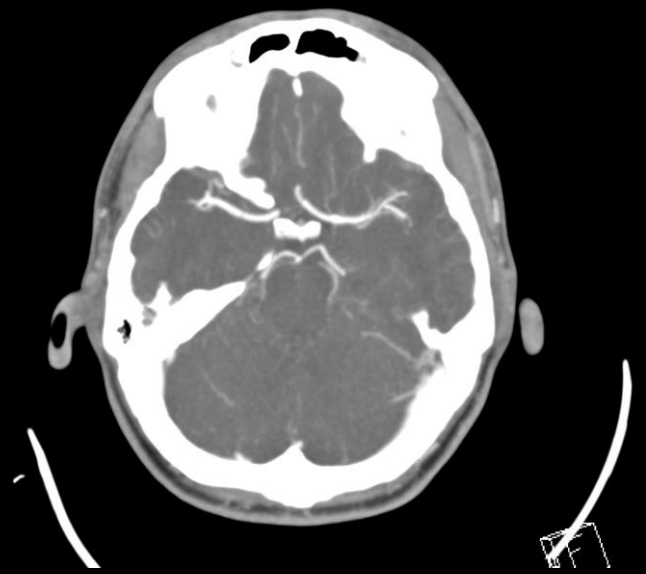
Findings (labeled)



Viz.AI summary sheet for cerebral perfusion. Viz.AI calculates CBF< 30% indicating core infarct volume of 2 ccs. The prolonged Tmax of >6 seconds indicates delay in blood flow to tissue. Mismatch volume of 15 cc corresponds to the amount of cerebral penumbra or tissue at risk.



Head CT without contrast demonstrating no loss of grey-white differentiation and no acute hemorrhage. Image is taken at same cross-sectional level as angiogram.



Axial MIP of CTA head was normal, demonstrating no large vessel occlusion.

Interval History

- Given this patient's perfusion abnormalities and his neurological deficits, TNK was administered. Unfortunately, patient did not have symptomatic or clinical improvement. Given that there was no large vessel this patient was not a thrombectomy candidate.

- Shortly thereafter, the patient’s mental status declined, and he was briefly unconscious. As a result, he was subsequently intubated by the medical team.

What Imaging Should We Order Next?

Select the applicable ACR Appropriateness Criteria

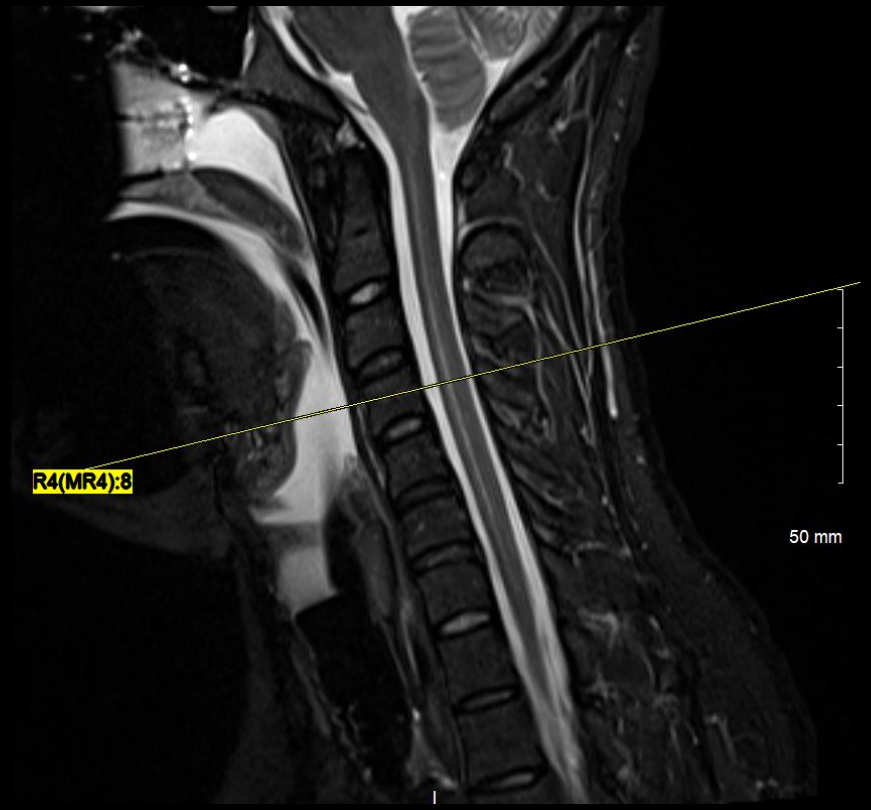
Variant 3: **New focal neurologic defect, fixed or worsening. Less than 6 hours. Suspected stroke.**

Radiologic Procedure	Rating	Comments	RRL*
CT head without IV contrast	9	Parenchymal brain imaging and CT or MR vascular imaging of the head and neck should be considered. Noncontrast head CT is often obtained first to assess for hemorrhage or large infarct. MRI is more sensitive than CT for acute infarct.	☢☢☢
MRI head without IV contrast	8	Parenchymal brain imaging and CT or MR vascular imaging of the head and neck should be considered. Can be useful if there is a contraindication to contrast. Noncontrast head CT is often obtained first to assess for hemorrhage or large infarct. MRI is more sensitive than CT for acute infarct.	O
MRI head without and with IV contrast	8	Noncontrast head CT is often obtained first to assess for hemorrhage or large infarct. MRI head with contrast can be helpful to determine the age of infarct and to evaluate for other causes of symptoms such as tumor or infection.	O
MRA head and neck without IV contrast	8	Can be obtained in conjunction with MRI head. Preferred MR vascular imaging of the head and neck includes noncontrast head MRA and contrast-enhanced neck MRA. Can be useful in patients with renal failure or contrast allergies.	O
MRA head and neck without and with IV contrast	8	Can be obtained in conjunction with MRI head. Preferred MR vascular imaging of the head and neck includes noncontrast head MRA and contrast-enhanced neck MRA.	O
~~CTA head and neck with IV contrast~~	~~8~~	~~CTA can be obtained after NCCT.~~	~~☢☢☢~~
CT head perfusion with IV contrast	6		☢☢☢
MRI head perfusion with IV contrast	5		O
Arteriography cervicocerebral	5		☢☢☢
CT head with IV contrast	3		☢☢☢
CT head without and with IV contrast	3		☢☢☢
US duplex Doppler carotid	2		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

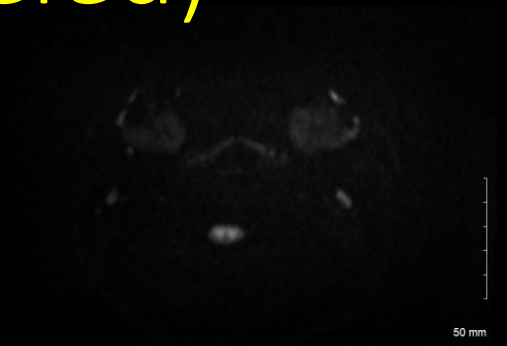
MRI with diffusion weighted imaging was ordered in combination with MRI Cervical spine to work up concern for spinal cord pathology and infarction

AMSER

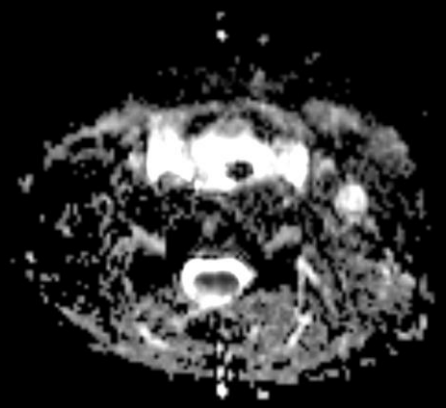
Findings (unlabeled)



Sagittal STIR image of the cervical spine

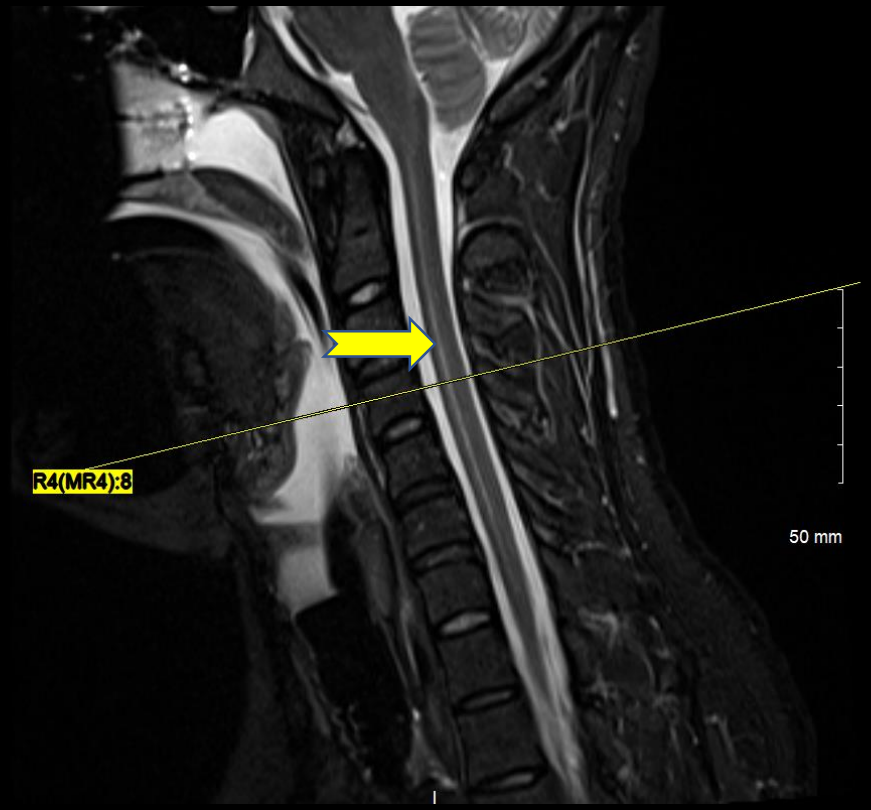


Axial DWI of cervical spine.

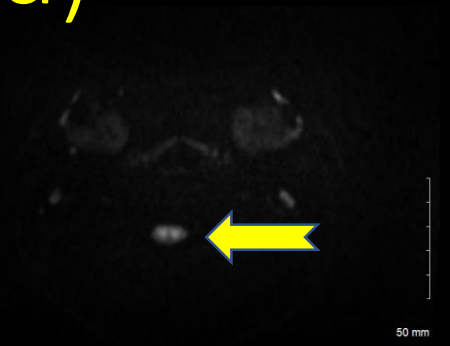


Axial ADC map of cervical spine.

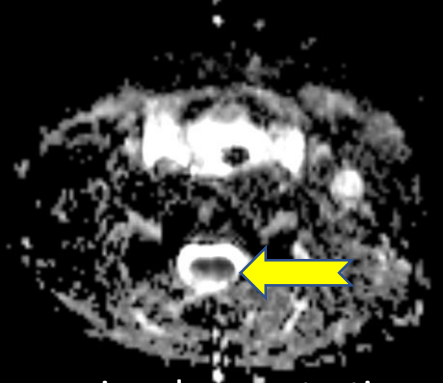
Findings (labeled)



High T2 intensity signal anteriorly in the spinal cord with diffusion restriction extending from C1-C2 to C6-C7 level.

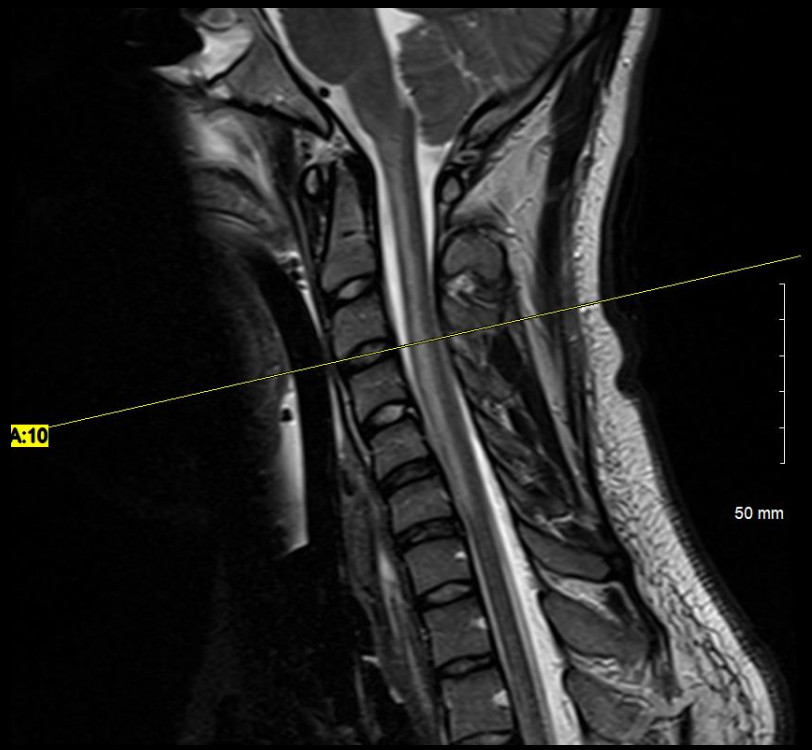


Axial DWI shows diffusion restriction in the grey matter region in “snake eyes” compatible with cervical cord infarct.

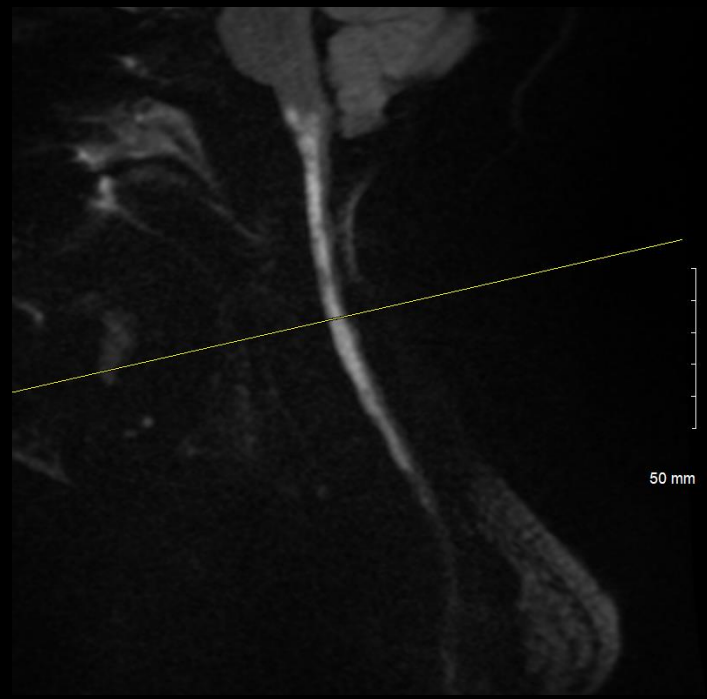


Axial ADC mapping demonstrating hypointense lesion in central spinal cord corresponding to regions of increased DWI signal.

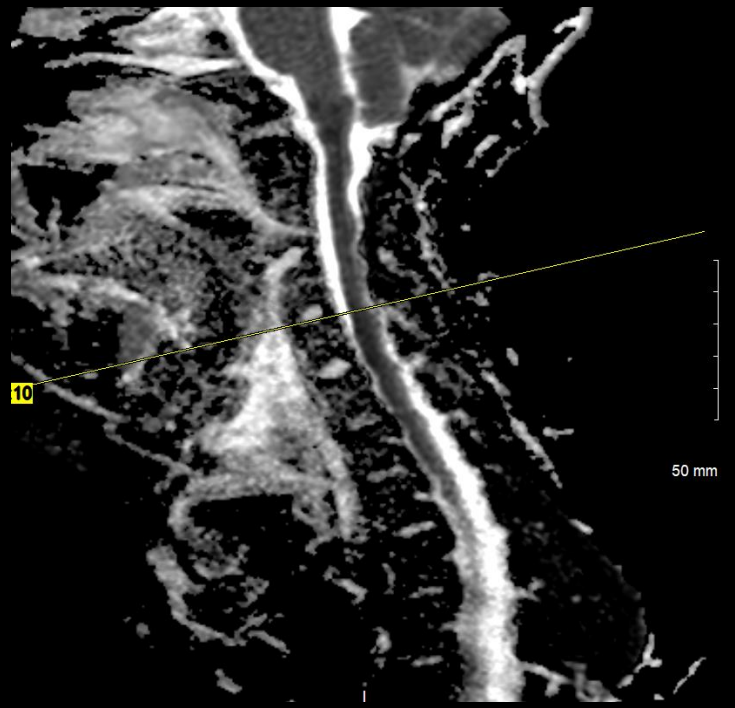
Findings (unlabeled)



Sagittal STIR of head and neck.

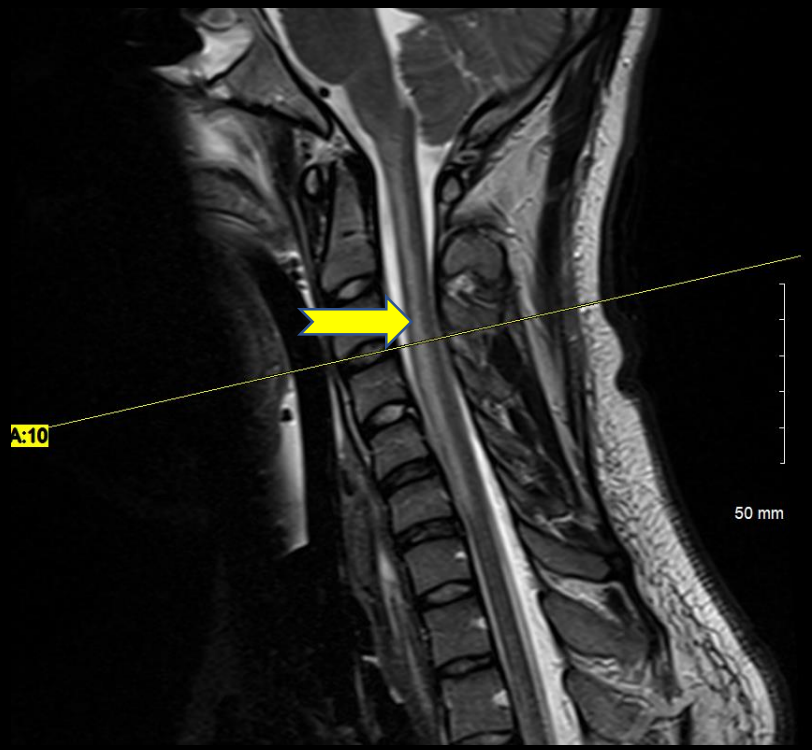


Sagittal DWI of head and neck.

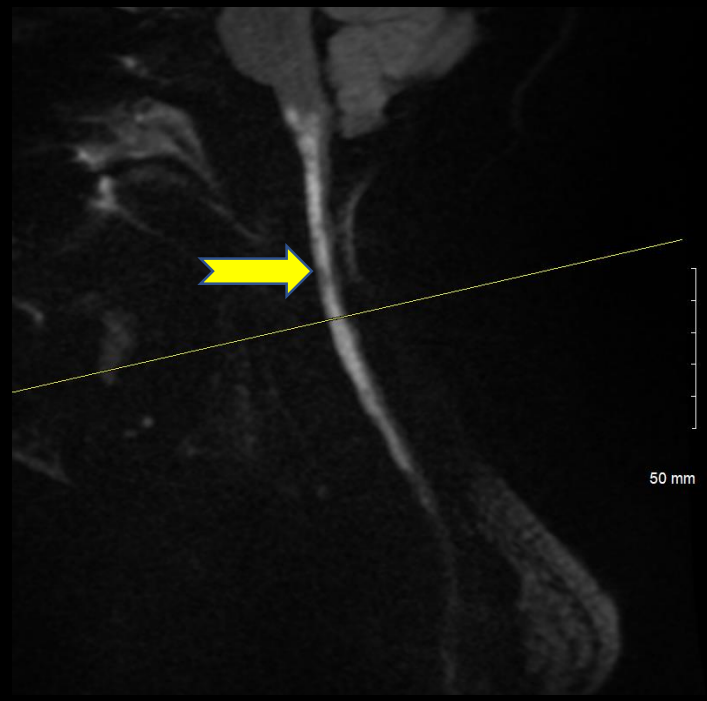


Sagittal ADC map of head and neck.

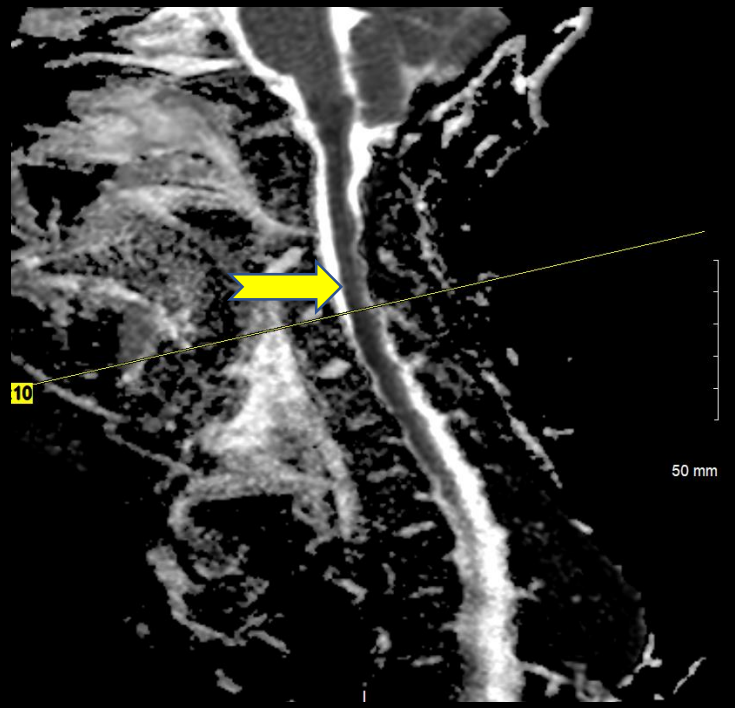
Findings (unlabeled), taken two days after initial presentation



Sagittal STIR of head and neck demonstrates high intensity signal infarct has progressed to involve ventral two-thirds of the cervical spinal cord.



High T2 intensity signal in the central spinal cord with diffusion restriction extending from medulla to C7 level.



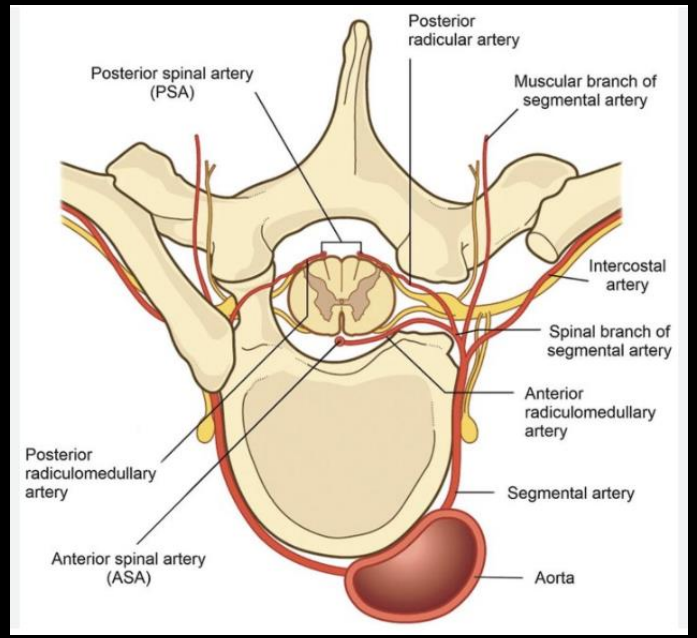
ADC image demonstrating corresponding hypointense lesion in the central spinal cord.

Final Dx:

Acute Anterior Spinal Artery Infarct

Case Discussion: Etiology and pathophysiology of spinal cord infarction

- Spinal artery infarcts (SCI) are relatively rare, accounting for an estimated 0.3- 1% of ischemic strokes. SCI occur most commonly in the sixth and seventh decades of life, common risk factors include HTN, DM, HLD as well as aortic surgery.
- Vascular supply to the spinal cord consists of 2 main arteries
  - Anterior spinal artery (ASA) arises from the vertebral arteries and supplies the anterior 2/3^{rds} of the spinal cord along with radiculomedullary arteries which arise from the descending aorta.
  - 2 Posterolateral spinal artery (PSA) arise from the vertebral arteries or posterior inferior cerebellar arteries (PICA) and supply the posterior 1/3rd of the spinal cord.
  - The artery of Adamkiewicz supplies the lower segments of the ASA.
- Little vascular redundancy exists in this region, making infarct potentially catastrophic.



Case Discussion: Imaging of spinal cord infarction

- DWI imaging is the gold standard for diagnosis of spinal cord infarction as it is the most sensitive and specific imaging modality.
- ADC imaging in conjunction with DWI is critical for diagnosis: To be proven as a true infarct, a lesion that is hyperintense on DWI must appear hypointense on ADC. This finding proves that true diffusion restriction exists as opposed to T2-shine through.
- Evolution of the cord infarction: as time progresses the infarcted region "blooms" as NMDA-induced excitotoxicity and subsequent neuronal apoptosis peaks at 48 hours.

Case Discussion: Clinical Presentation and Treatment

- Wide span of clinical presentations depending on what region of the cord are affected by the infarction.
  - ASA infarct classically presents with anterior cord syndrome which results in bilateral motor paralysis at the level of the lesion and loss of pain and temperature sensation below the lesion due to damage of the corticospinal and spinothalamic tracts, respectively.
  - PSA infarct classically presents posterior cord syndrome which results in ataxia, decreased proprioception and vibration sense below the lesion due to damage to the posterior column.
  - Injury to the lower cervical regions (C3-C5) may result in diaphragmatic paralysis while lesions in the mid thoracic region can result in autonomic dysfunction.
- Treatment:
  - Little data exists on acute treatment as presentation is often heterogenous and definitive diagnosis is often delayed. If there are no underlying causes (aortic dissection, systemic hypoperfusion etc.) thrombolytic therapy may be administered if no contraindications exist.
  - Long term therapy includes supportive care with psychical therapy, multidisciplinary rehabilitation, and antispasmodics, along with low dose aspirin and high intensity statins if indicated.

References:

1. Caton MT, Huff JS. Spinal Cord Ischemia. PubMed. Published 2020. https://www.ncbi.nlm.nih.gov/books/NBK539870/

2. Hanna Al-Shaikh R, Czervionke L, Eidelman B, Dredla BK. Spinal Cord Infarction. PubMed. Published 2023. https://www.ncbi.nlm.nih.gov/books/NBK545185/

3. Pavel J, Kellerova E, Snopkova J. Spinal Cord Vasculature: General Anatomy and Physiology. *Springer eBooks*. Published online January 1, 2023:121-149. doi:https://doi.org/10.1007/978-3-031-39558-1_6

4. Sandoval JI, De Jesus O. Anterior Spinal Artery Syndrome. PubMed. Published 2022. https://pubmed.ncbi.nlm.nih.gov/32809566/

5. Lindeire S, Hauser JM. Anatomy, Back, Artery Of Adamkiewicz. PubMed. Published 2022. https://www.ncbi.nlm.nih.gov/books/NBK532971/

6. Mullen MT, McGarvey ML. Spinal Cord Infraction: Treatmetnt and Prognosis. UptoDate. Published 2025. Accessed February 9, 2025. https://www-uptodate-com.proxy.library.vcu.edu/contents/spinal-cord-infarction-treatmentandprognosis?search=Spinal%20cord%20infarction%3A%20Treatment%20and%20prognosis&source=search_result&selectedTitle=1%7E88&usage_type=default&display_rank=1#H3849419966