

CT Angiography of Vertebral Artery Dissection in Children

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Vertebral Artery Dissection in Children

How common is vertebral artery dissection (VAD)?

MRA, CTA or DSA for diagnosis?

What findings are most common?

How common is recurrent stroke in VAD?

Should a provocative DSA be performed?

How should VAD be treated?

How common is vertebral artery dissection in children?

Simonetti et al. 2019 (IPSS)

- **Vertebral Artery Dissection accounts for 20% of PCAIS, but . . .**
- ***No centralized imaging review***
- ***No detailed information on imaging modalities***

Wintermark et al. 2017 (VIPS)

- **Vertebral Artery Dissection accounts for ≈25% of PCAIS, but . . .**
- ***Only 53% had cervical vascular imaging of any kind***
- ***Up to 30% of arteriopathies ‘challenging to classify’***

Consensus Imaging Recommendations (IPSS and AHA)*

Initial workup protocol (*time for imaging NOT limited*)

Time window: 6 hours-10 days from last known asymptomatic

First choice: MRI

Order	Series	Pulse Sequence	FOV (mm)	Slice Thickness (mm)	Matrix
9a OR	MRA Neck	2D Time-of-Flight	220-240	2.0	256x192
9b	Gad MRA neck	SPGR	220-240	1.2-1.8	418x256

Backup choice: CT

Order	Series	Scan Type	FOV (mm)	Slice Thickness (mm)	Matrix
2 OPTIONAL	CTA head and neck	Helical	220-240	0.5-1.0	512x512

Missing vertebral artery dissection

Tan 2009

- Initial time-of-flight magnetic resonance angiography ***missed dissection*** in 8 patients (61.5%) . . .

McCrea 2016

- In those with VAD, diagnosis was made on initial magnetic resonance angiography (TOF MRA) in six (40%)

Bernard (IPSS) 2016

- . . . ***lack of substantial agreement*** in the aortic/cervical arteriopathy and FCA categories (CASCADE)
- . . . when raters were provided CTA imaging, they ***agreed in 4 out of 5 cases*** . . .

Purpose:

- To examine the ability of CT angiography (CTA) to identify and characterize vertebral artery dissection (VAD) in children
- To compare CTA and various MRA techniques for the diagnosis of VAD in children

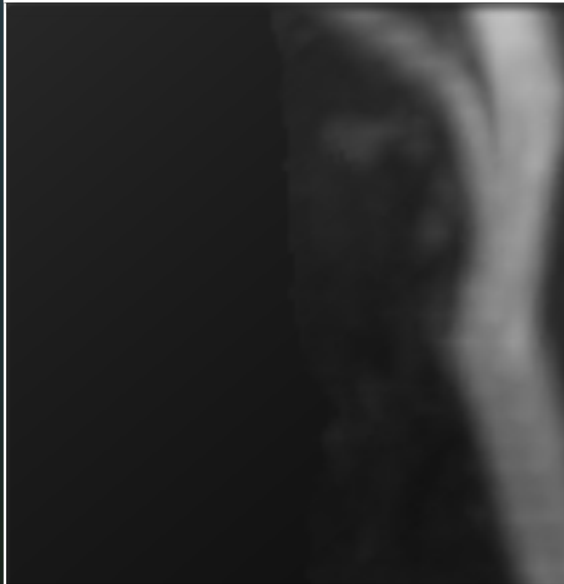
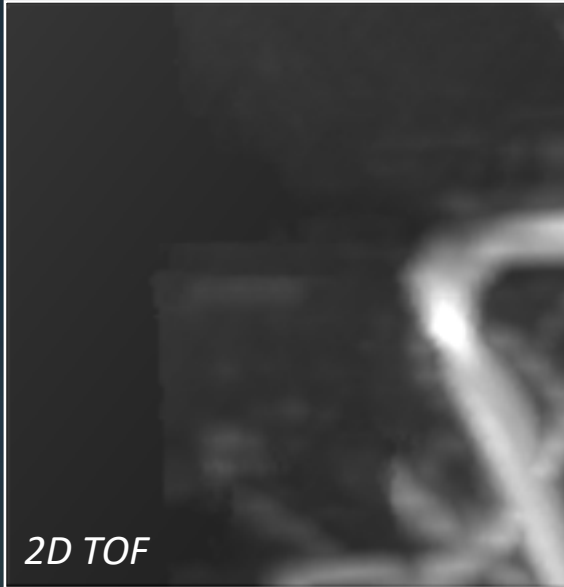
Material and Methods:

- IRB-approved retrospective analysis of childhood VAD from two tertiary pediatric centers
- CTA and MRA examinations were independently evaluated at each site utilizing CASCADE criteria for stroke classification
- Each study rated based on whether the *extracranial vascular imaging findings* were more clearly displayed with CTA, MRA or were equally apparent

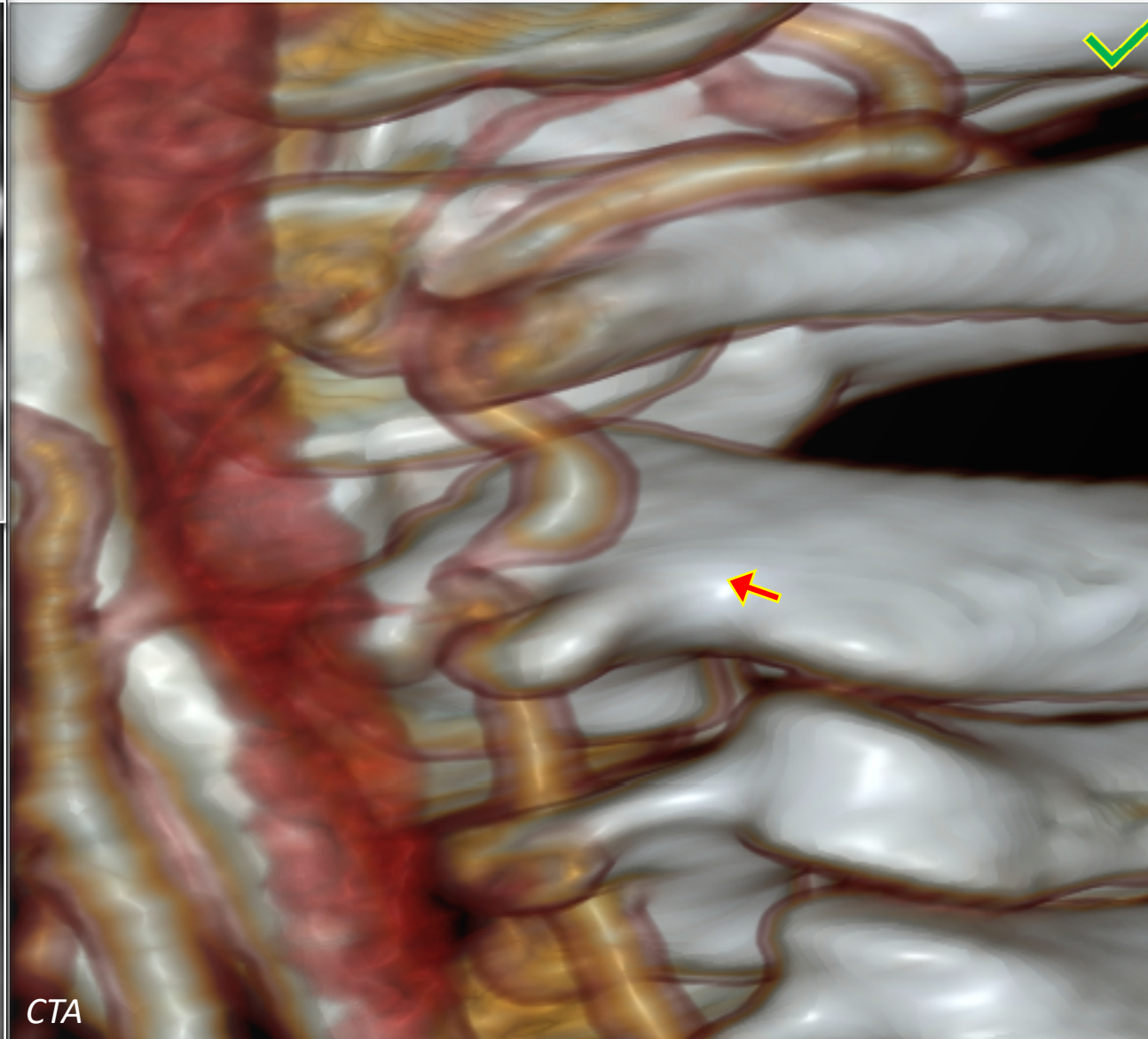
Preliminary Results:

- 21 children (14 male, 7 female) with vertebral artery dissection
- Age: median 7.2 years, mean 8.3 years, range 1.2-17.3 years
- CTA (n=17), 2D TOF (n=13), 3D TOF (n=3), CE-MRA (n=4)
- CTA identified more stenoses, pseudoaneurysms and intimal flaps than 2D TOF or CE-MRA
- 3D TOF was the preferred cervical MRA technique
- Osseous anomalies were well seen on CTA

Stair Step Artifact

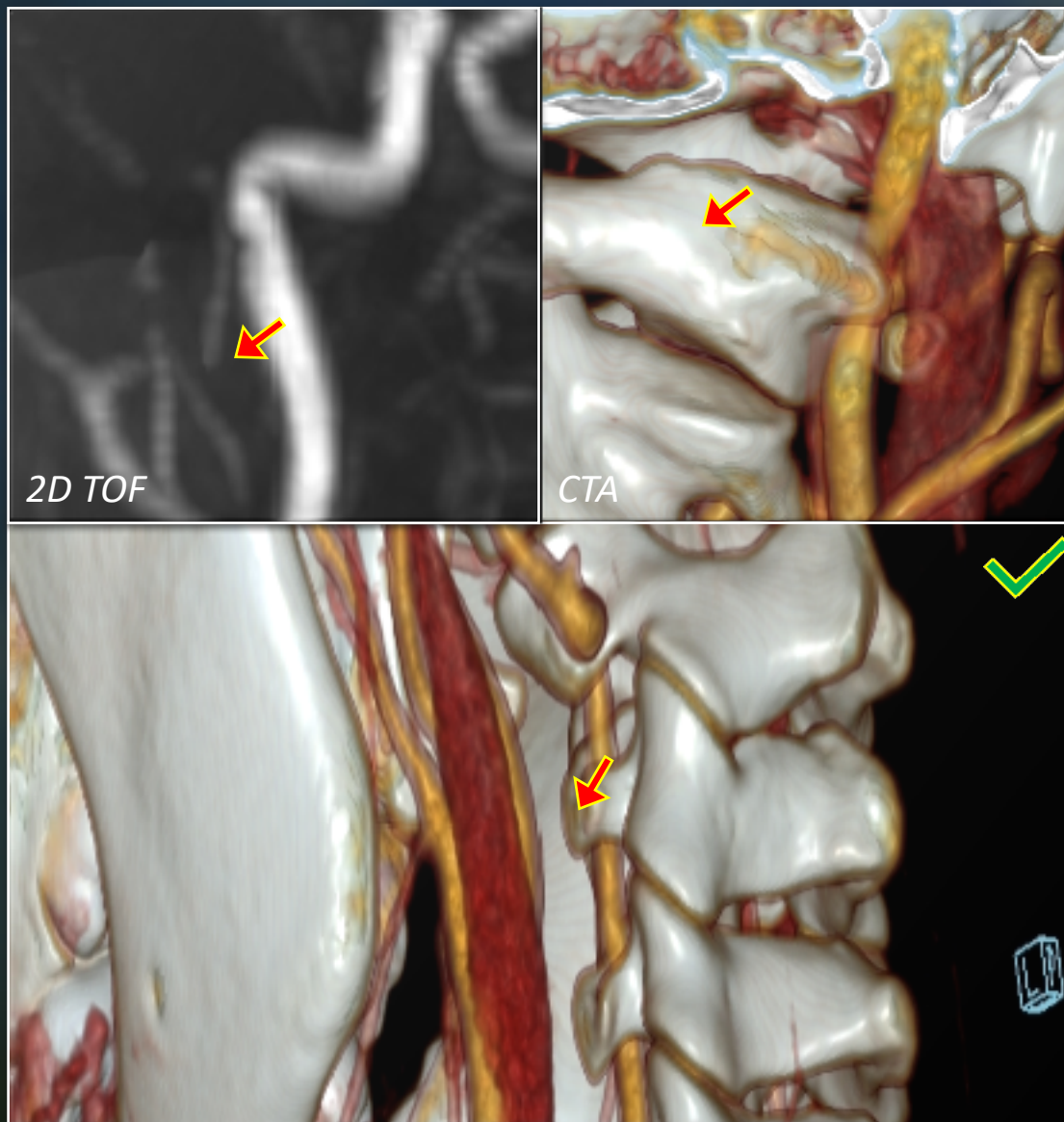


Segmental Stenosis at C2 (CASCADE 4a-3)



1 year old male with multifocal cerebellar infarcts, including left PICA

Bilateral VAD – CASCADE 4a-3 (right) 4a-1 (left)



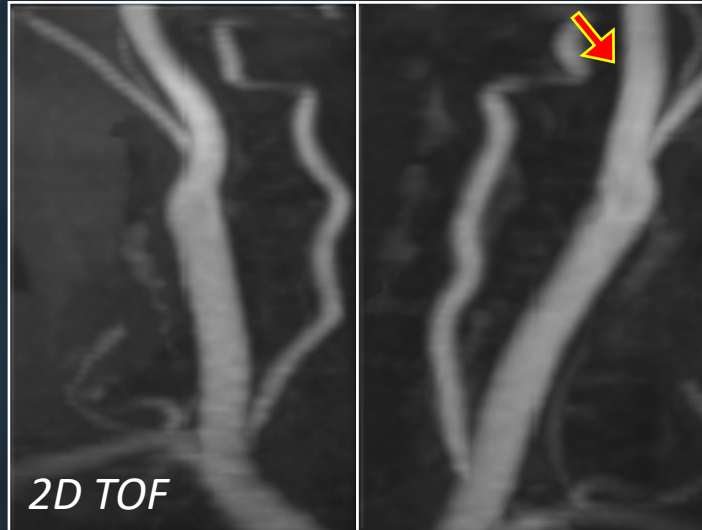
10 year old female with multifocal PCAIS

Osseous Anomaly – potentially pathogenic

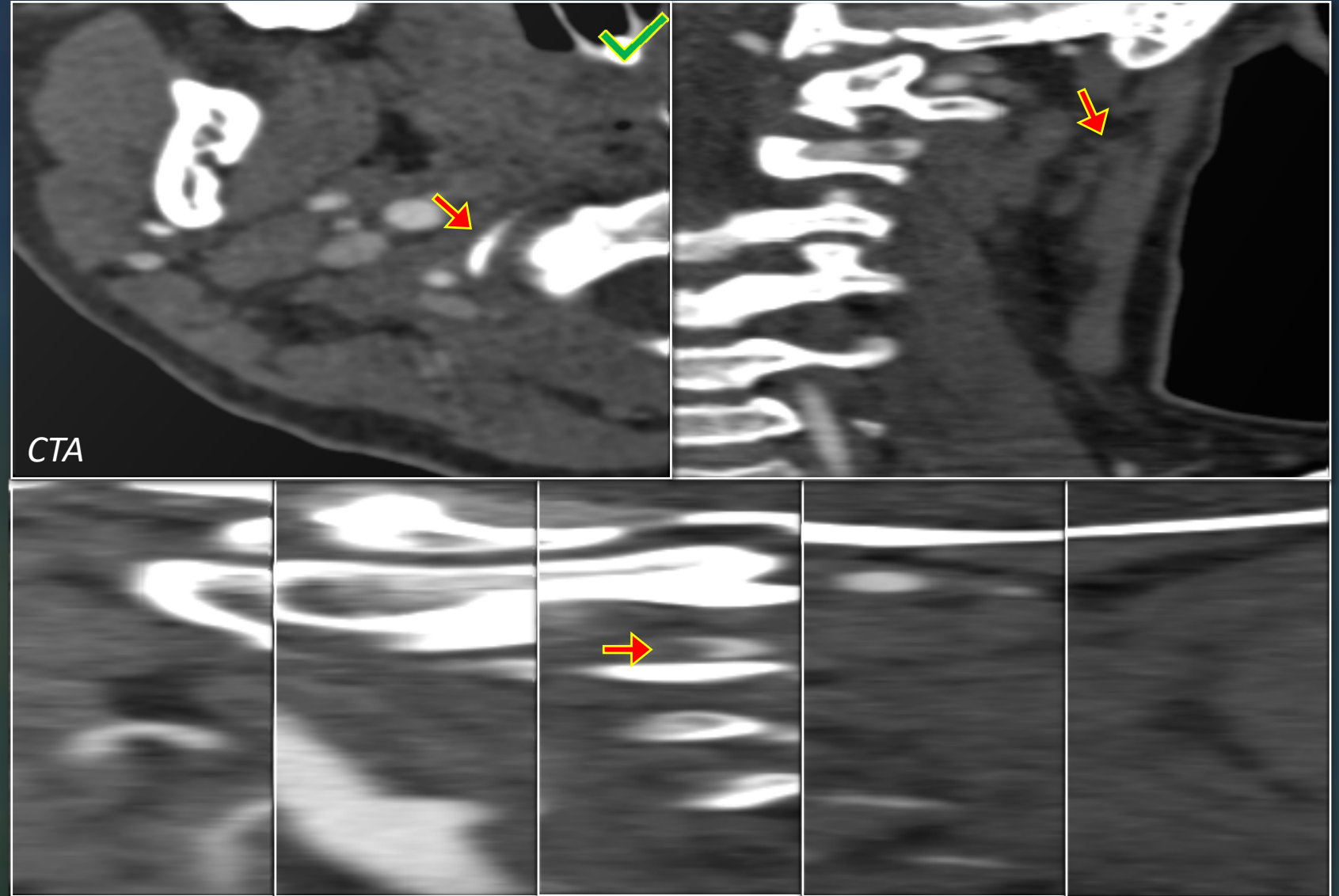


PCAIS = Posterior Circulation Arterial Ischemic Stroke

Segmental Stenosis/Irregularity?

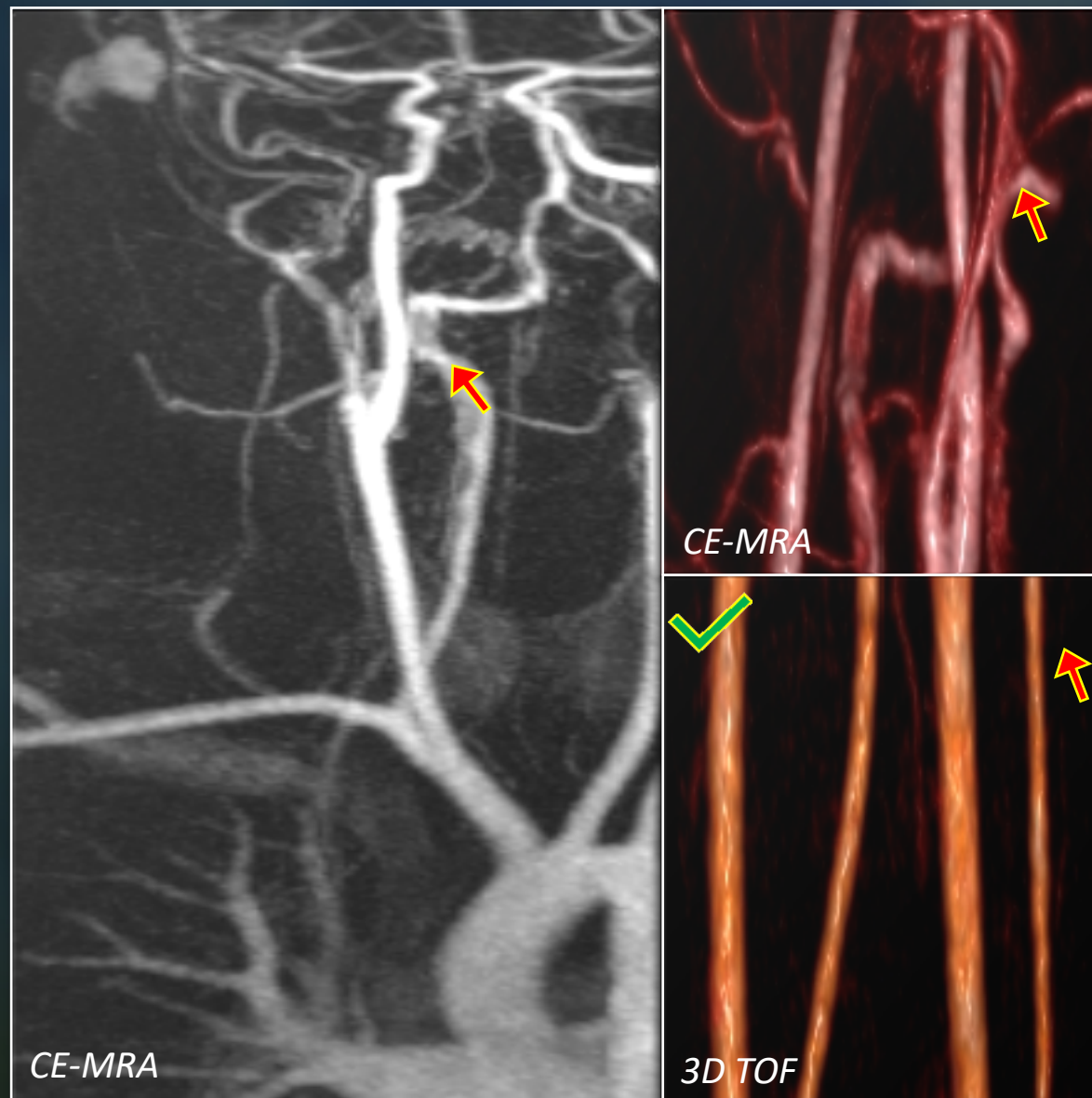


Eccentric Mural Thickening – CASCADE 4a-1



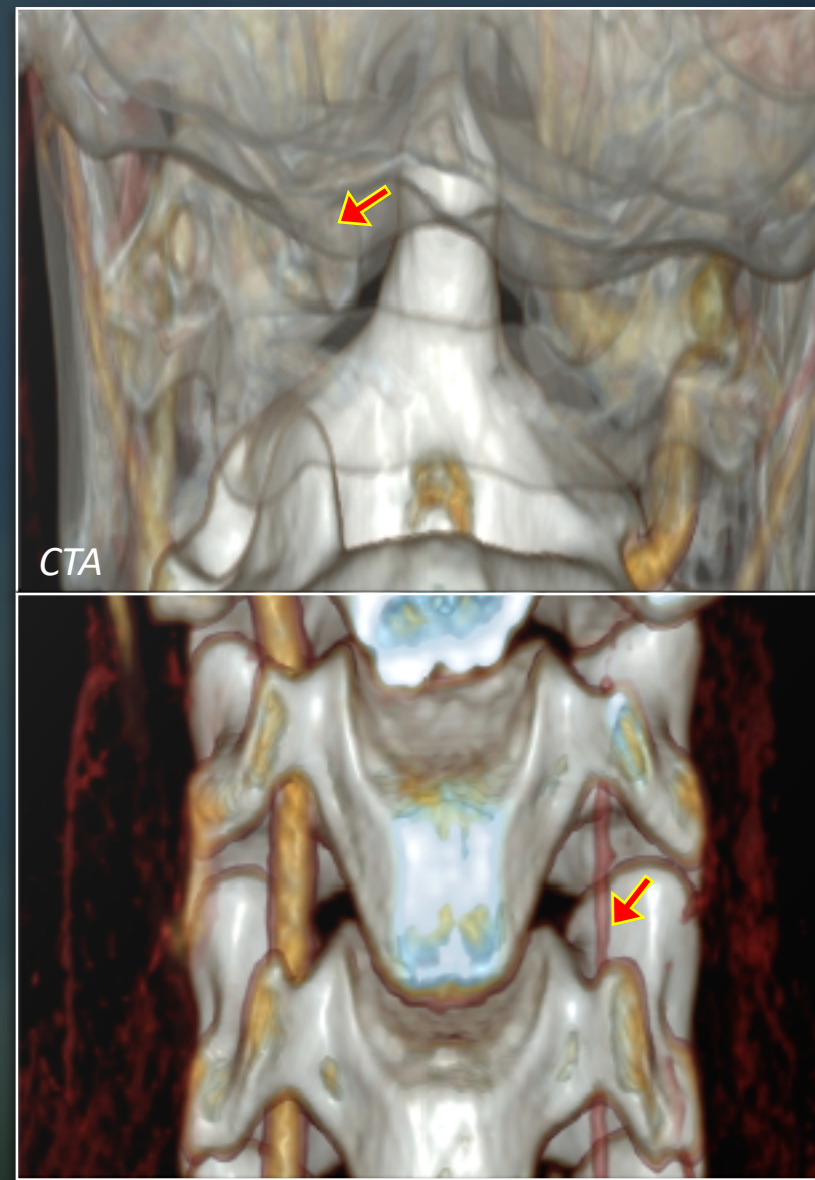
10 year old male with multifocal PCAIS and vessel-to-vessel thromboembolism

Pseudoaneurysm at Presentation – CASCADE 4a-1



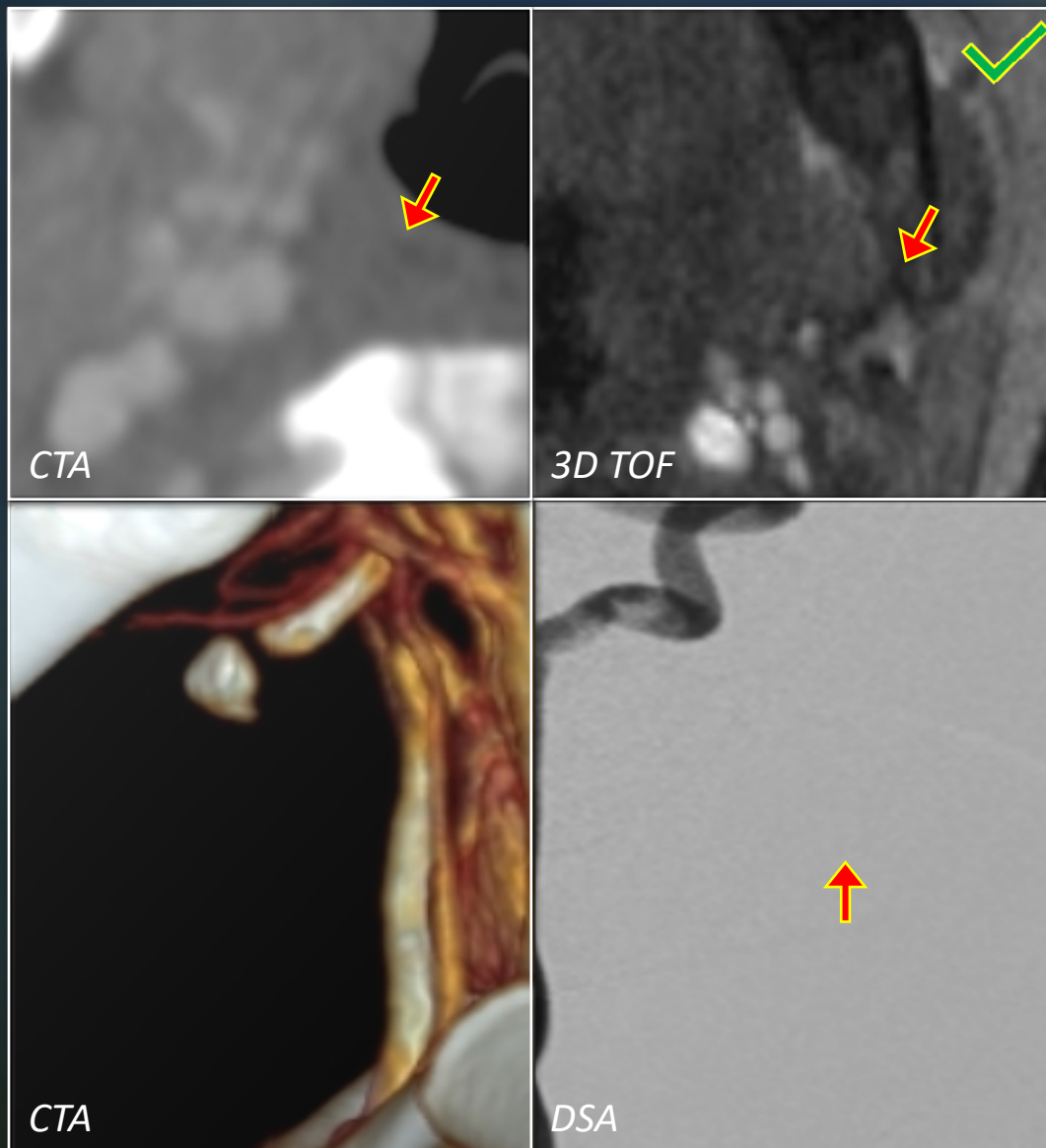
12 year old female with multifocal PCAIS

Osseous Anomaly

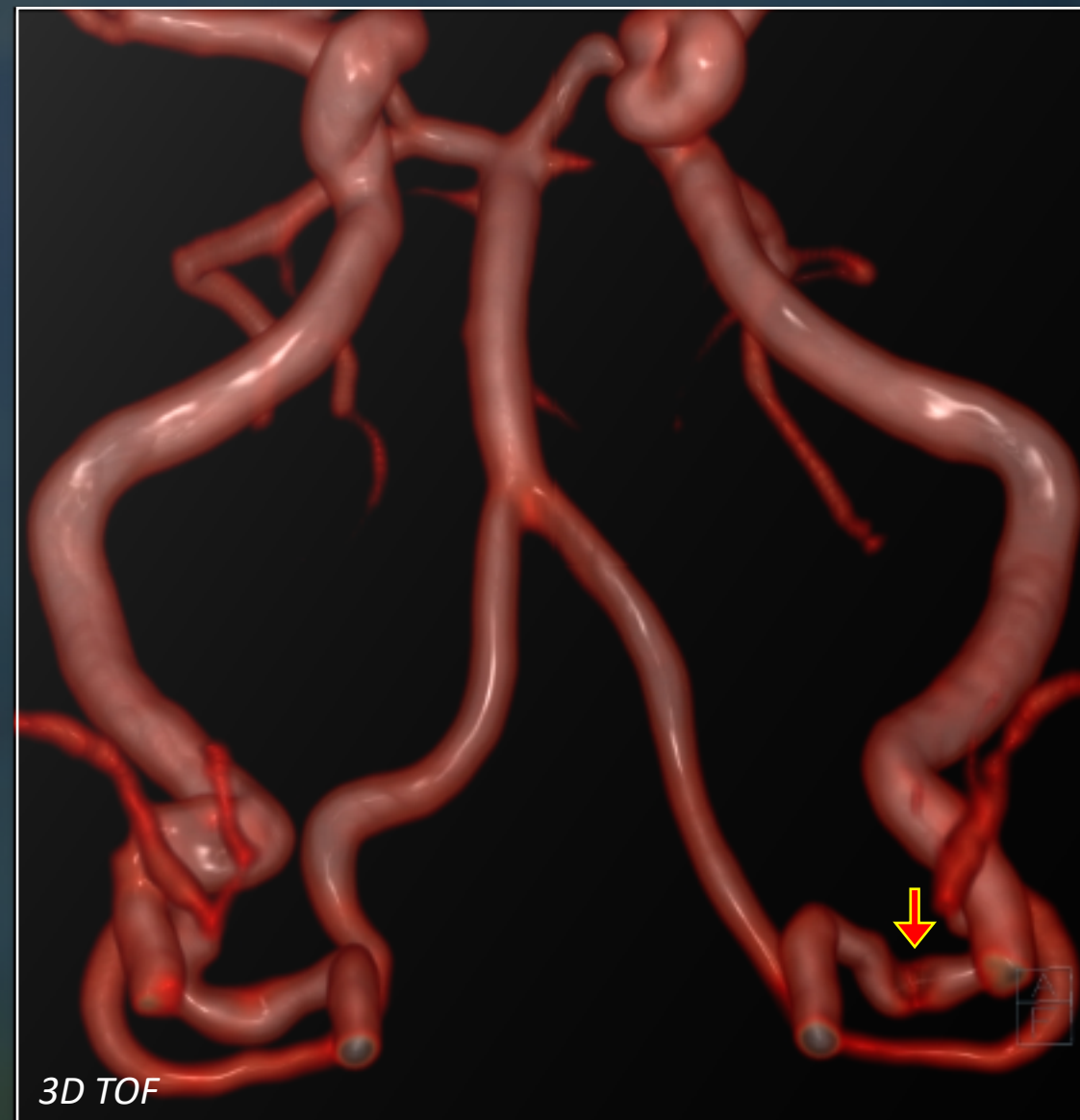


Arterial occlusion on follow-up

Indeterminate CTA

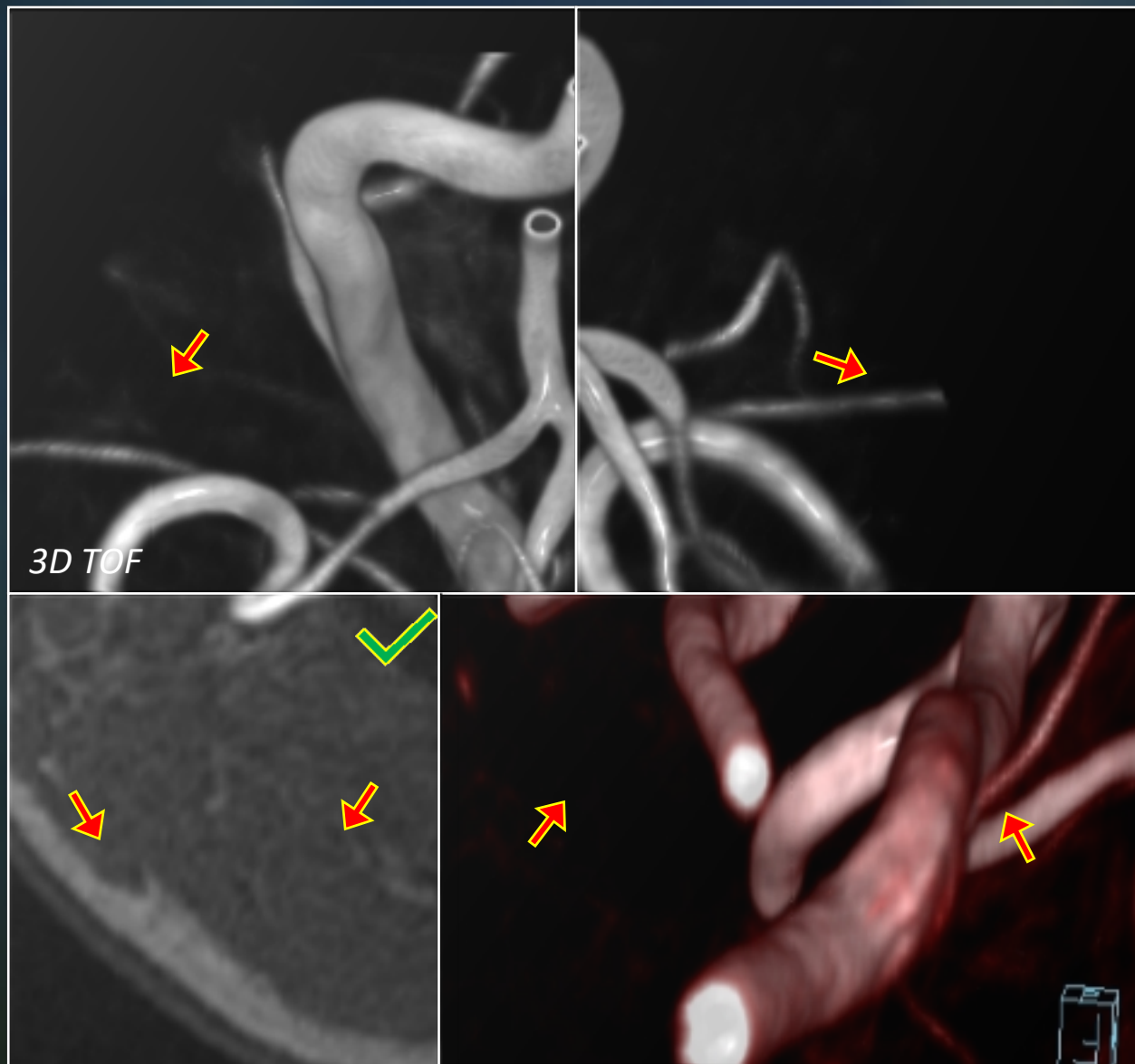


Segmental Stenosis at C2 – CASCADE 4a-3



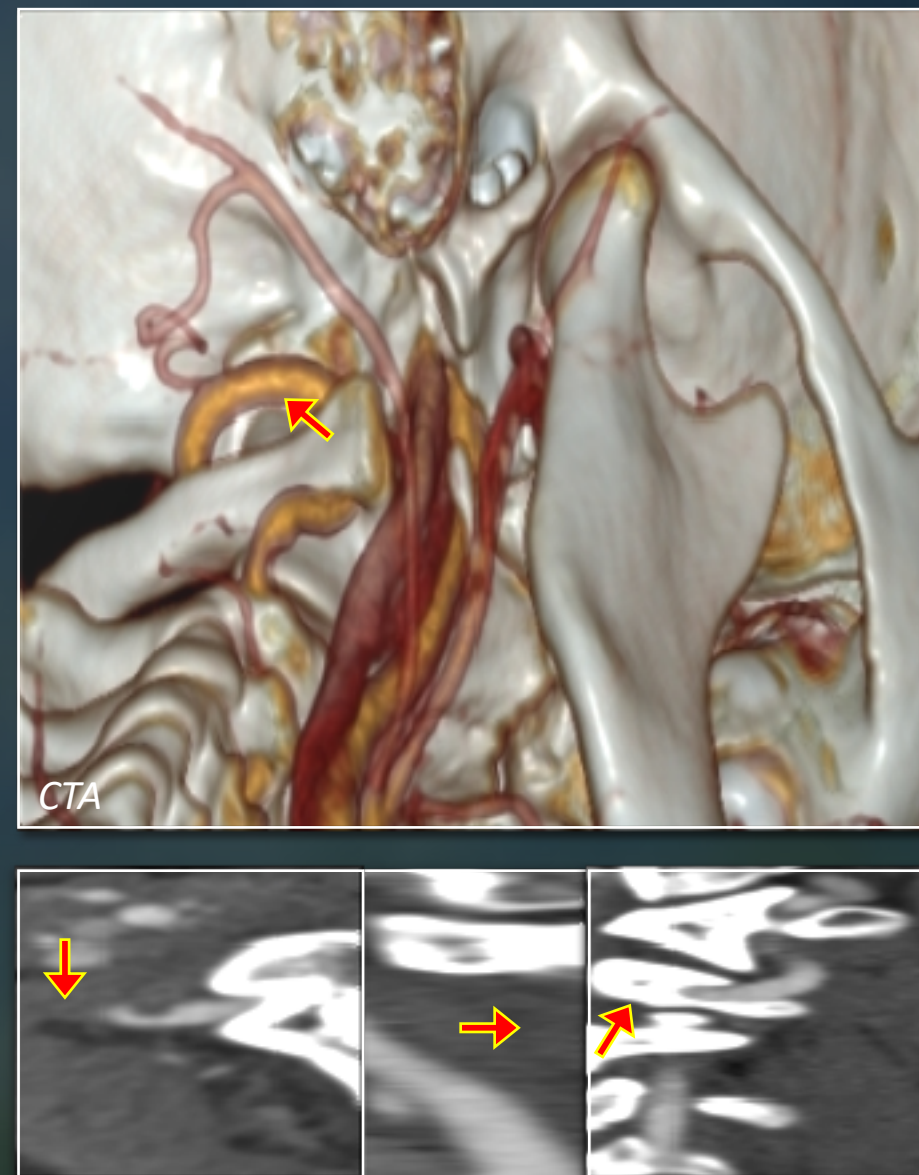
1 year old female with multifocal PCAIS, including left PICA

Bilateral VAD

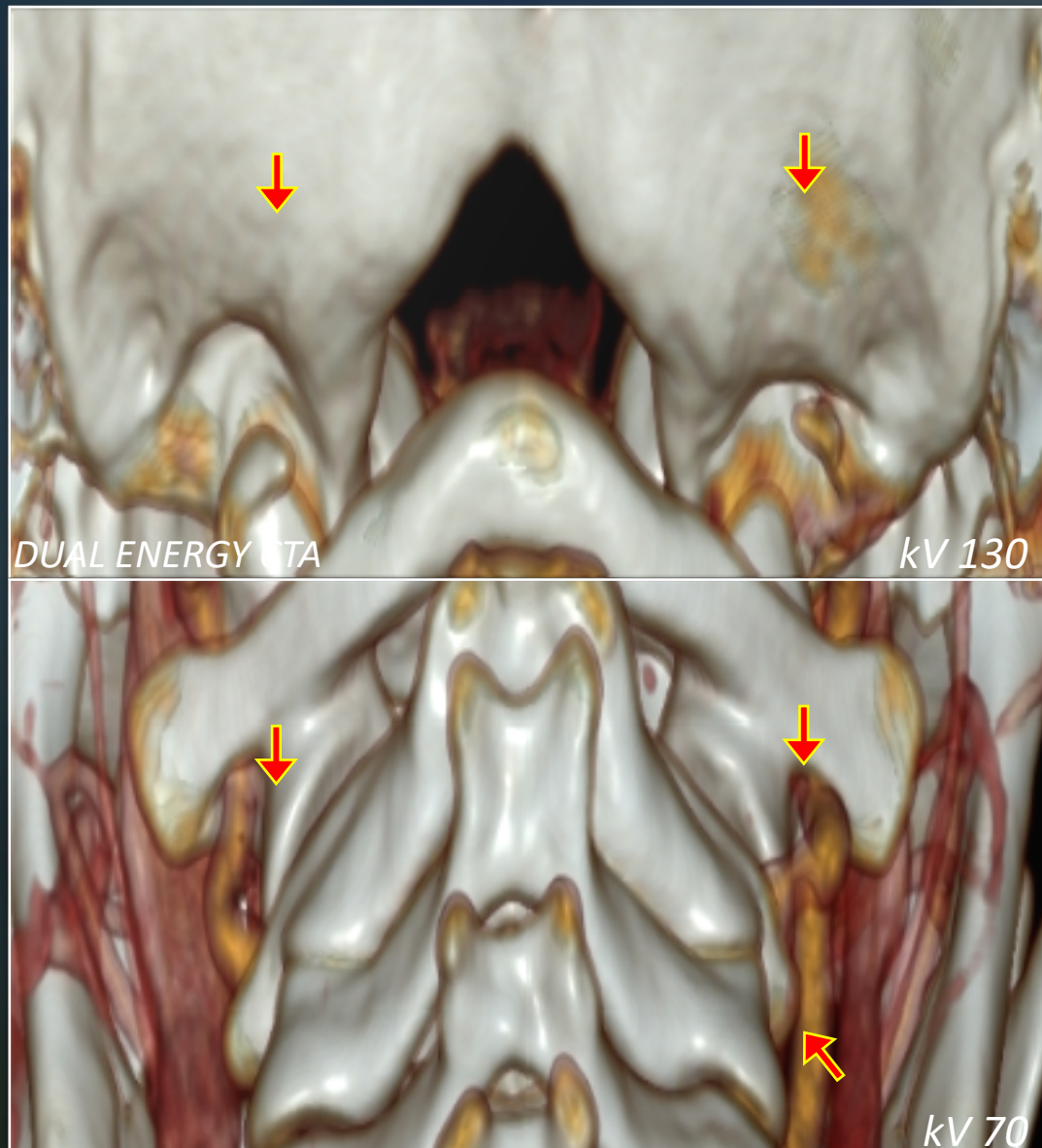


11 year old male with left cerebellar infarct

Eccentric Mural Thickening – CASCADE 4a-1

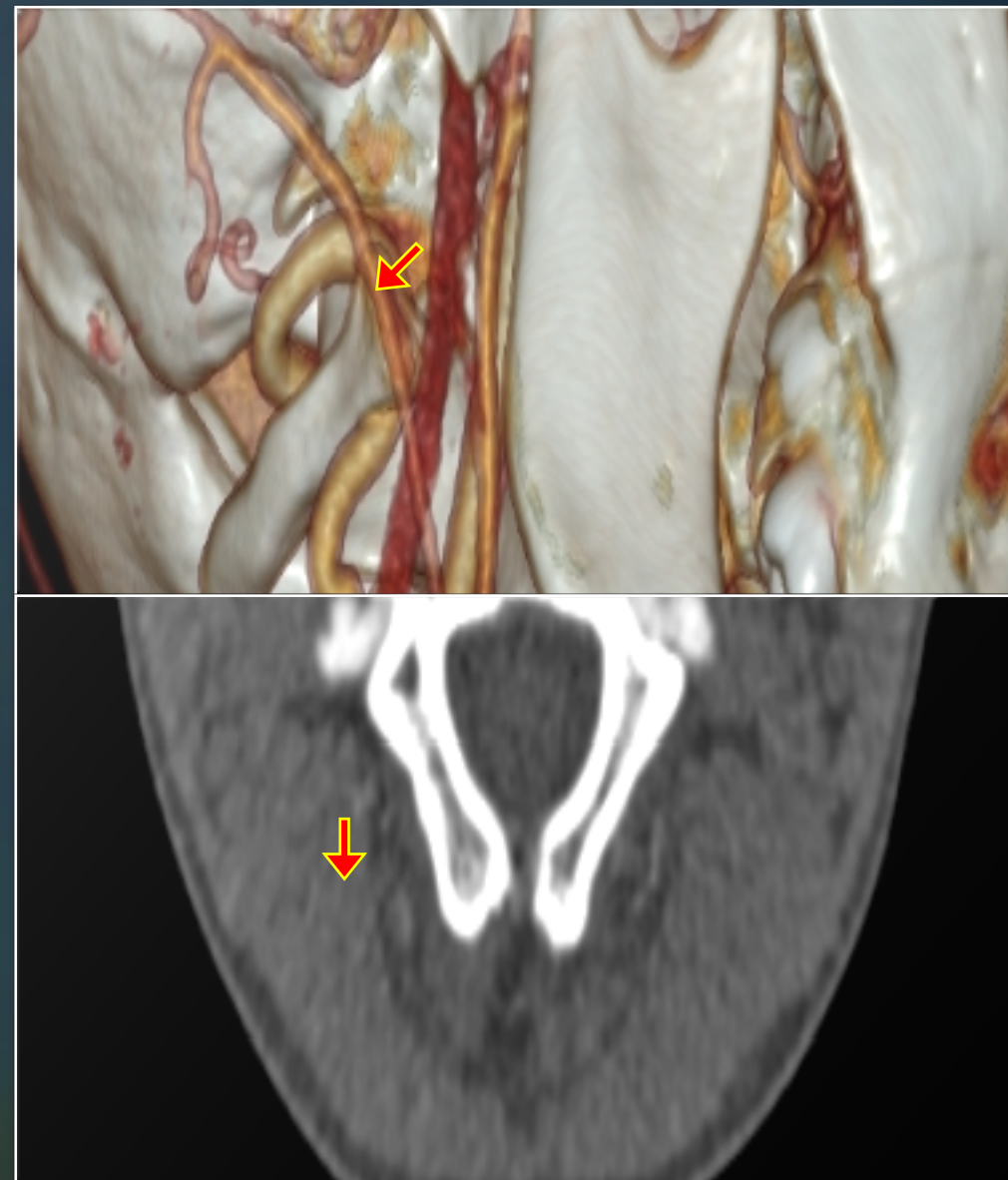


Osseous Anomalies – likely non-pathogenic

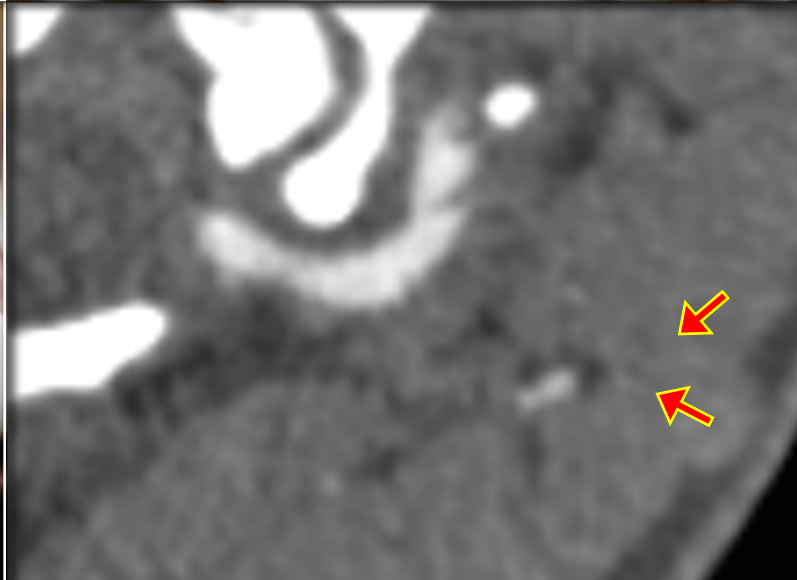
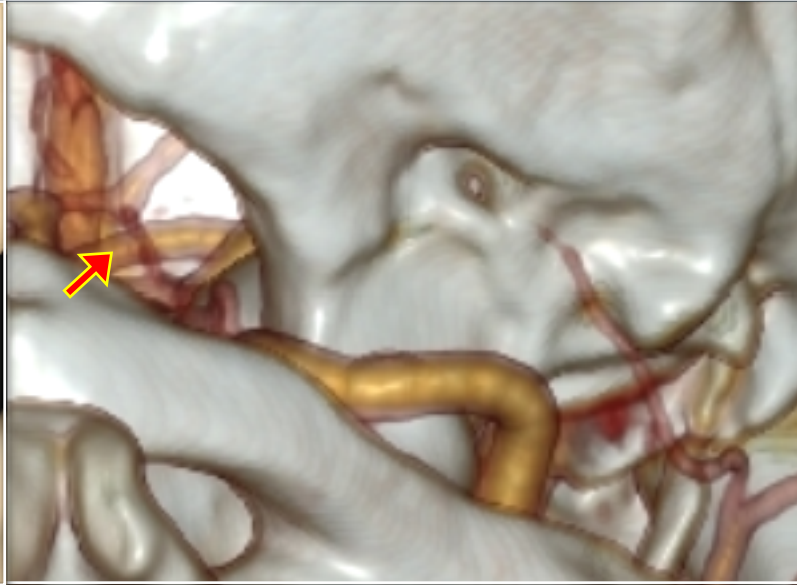
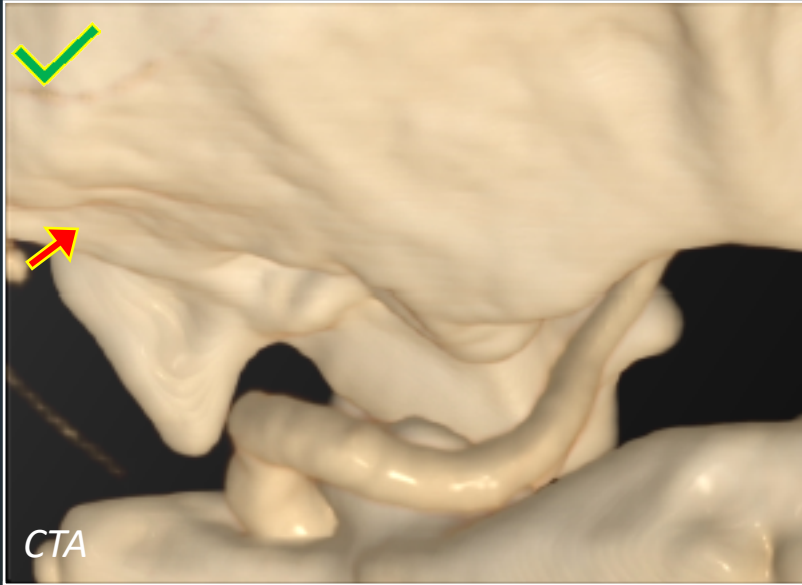


11 year old male with left cerebellar infarct

Pseudoaneurysm on follow-up



Distal V3 Pseudoaneurysm, Intimal flap and Potentially Pathogenic Osseous Anomaly



16 year old male with multifocal PCAIS

Conclusions:

- *CTA* clearly displays features of VAD in children
- Potentially pathogenic osseous anomalies are best demonstrated on *CTA*
- *3D TOF* is the preferred MRA technique for the diagnosis of VAD in children
- Current IPSS and AHA recommendations for stroke neuroimaging may result in *underdiagnosis* of VAD in children

