

**12th Nordic Course in Trauma
Radiology**

Stockholm, Sweden

11 June 2024, 1040-1100

Penetrating Neck Trauma

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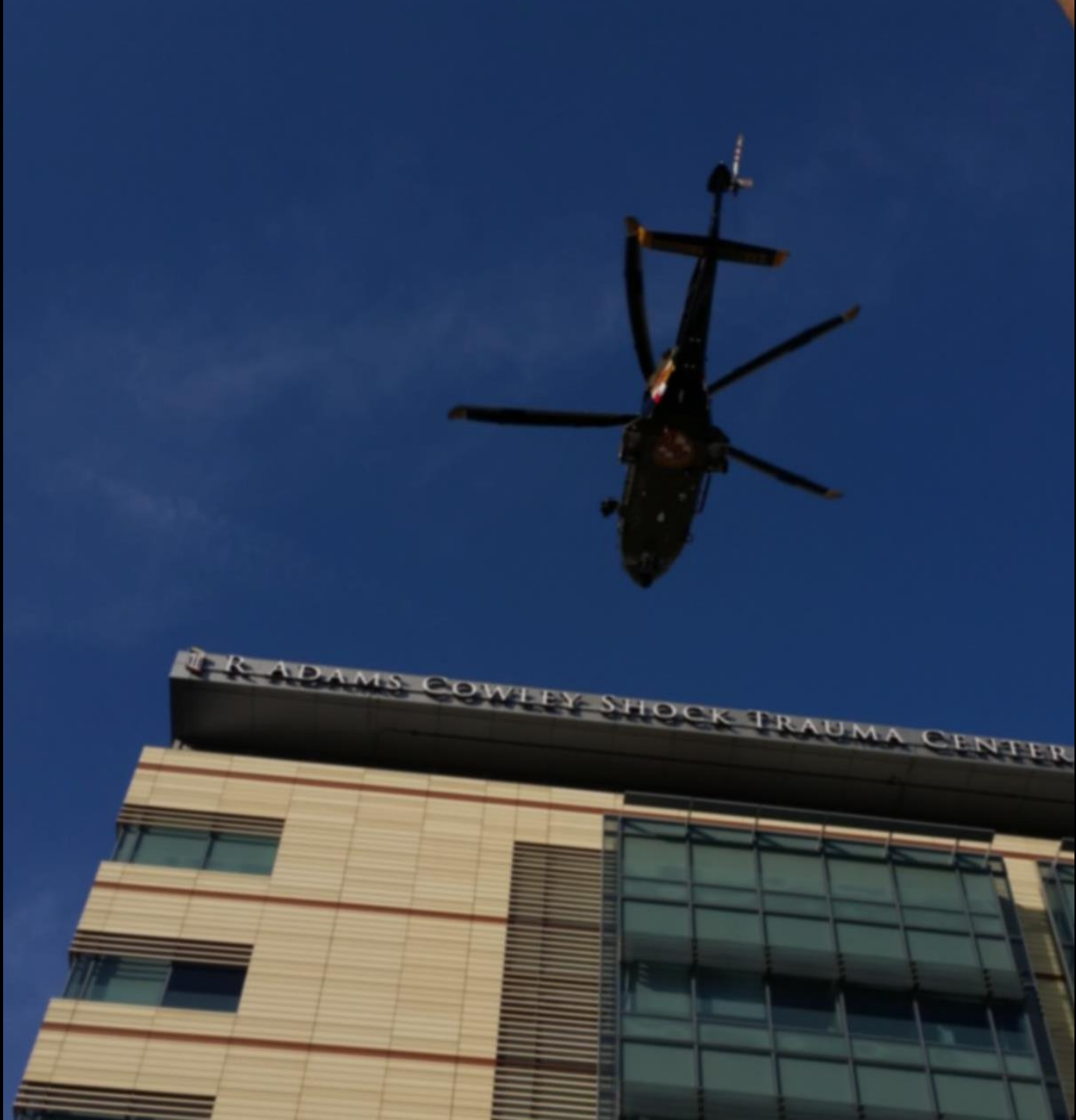
University of Maryland School of Medicine

R Adams Cowley Shock Trauma Center

University of Maryland Medical Center



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I have no conflicts of interest to disclose.



Overview

- Discuss the role diagnostic imaging in the setting of penetrating neck trauma.
- Emphasize the importance of CTA and how it has positive impact on patient care.
- Discuss when diagnostic modalities other than CTA are required.

Penetrating Neck Trauma

- Platysma violated
- Significant injury more common with gunshot wounds
- “Vital structure” injury 10%-50%
 - Vascular 15%-25%
 - Aerodigestive 1%-7%
 - Spine, spinal cord
 - Thyroid, salivary glands

Clinical Signs of Injury

Hard Signs

- Active bleeding
- Expanding or pulsatile hematoma
- Bruit or thrill
- Shock refractory to fluids
- Massive hemoptysis or hematemesis
- Air bubbling at wound

Soft Signs

- Venous oozing
- Non-expanding, non-pulsatile hematoma
- Minor hemoptysis
- Dysphonia
- Dysphagia
- Subcutaneous emphysema

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Management

- Immediate surgery
 - Aerodigestive
 - Vascular
- CTA
 - No clinical signs
 - Soft clinical signs
 - Simultaneous evaluation
 - Aerodigestive
 - Vascular
 - Spinal
- 2nd line diagnostic tools
 - Endoscopy
 - Esophagography
 - DSA

Management

Hard signs
of major
injury?

Surgical
exploration

Treat
injury

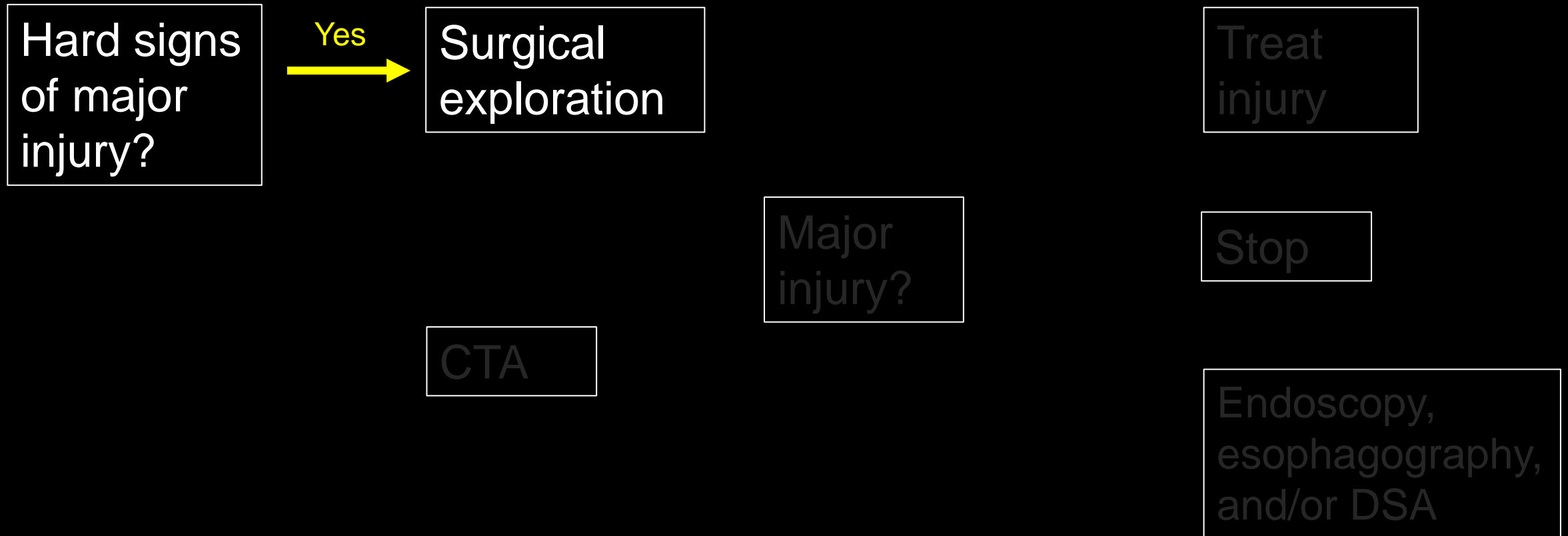
Major
injury?

Stop

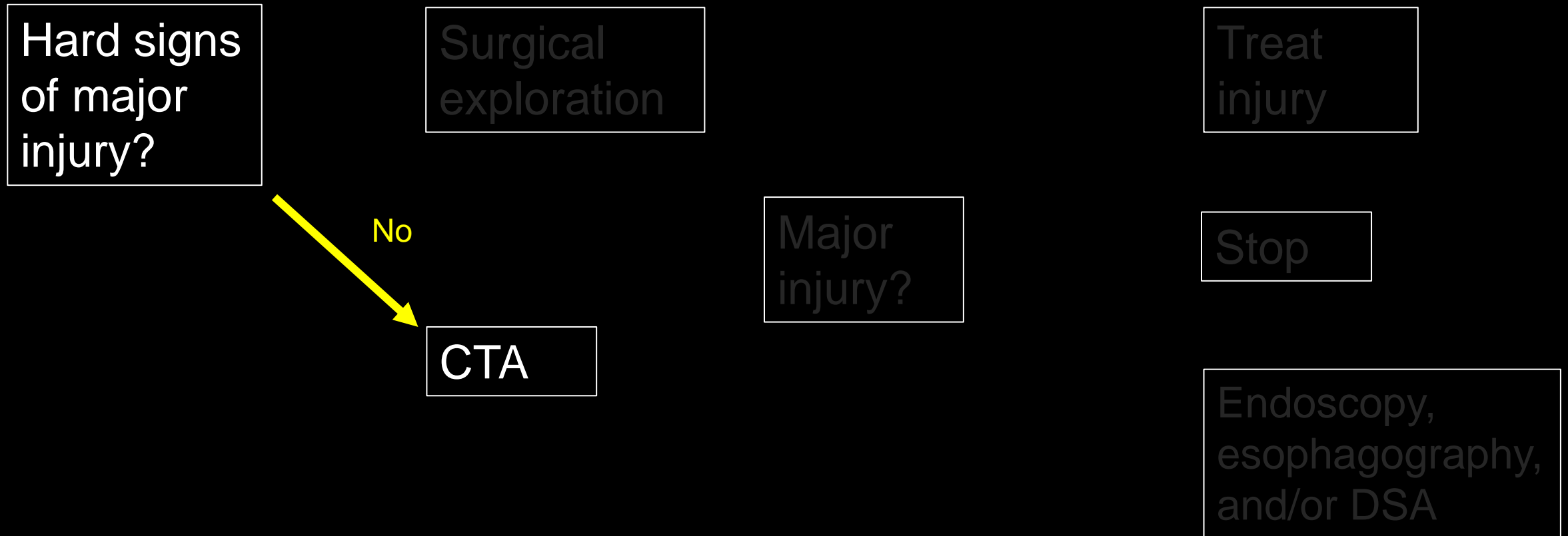
CTA

Endoscopy,
esophagography,
and/or DSA

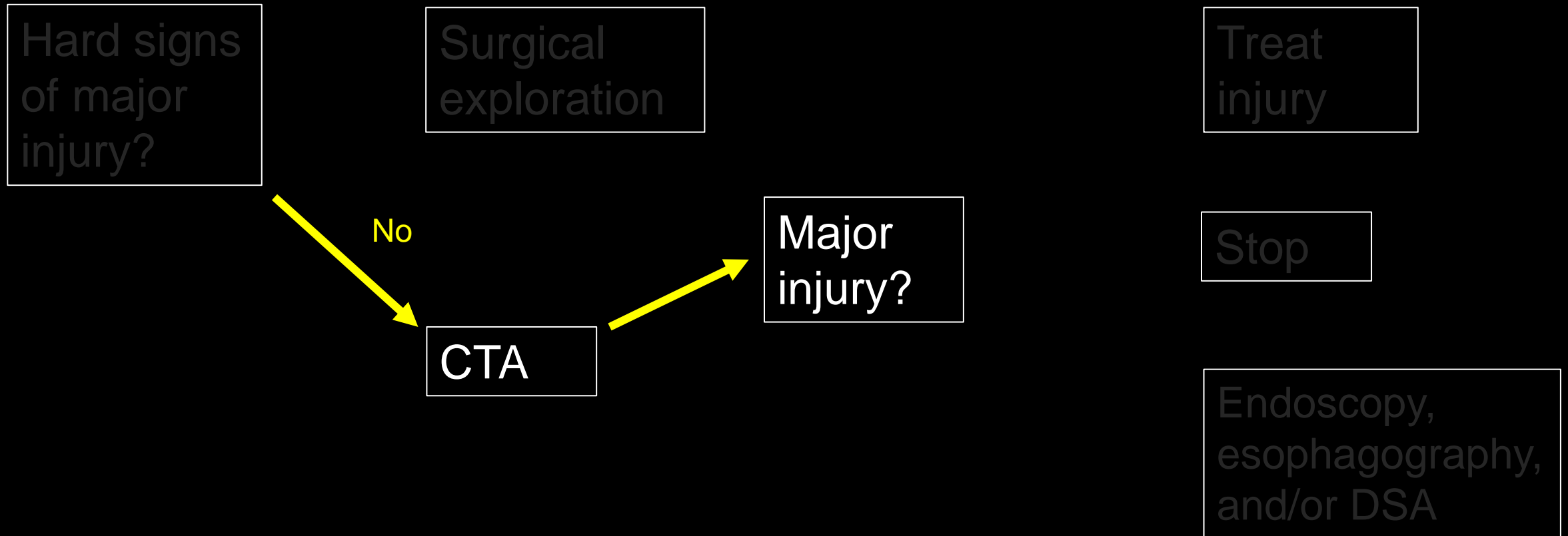
Management



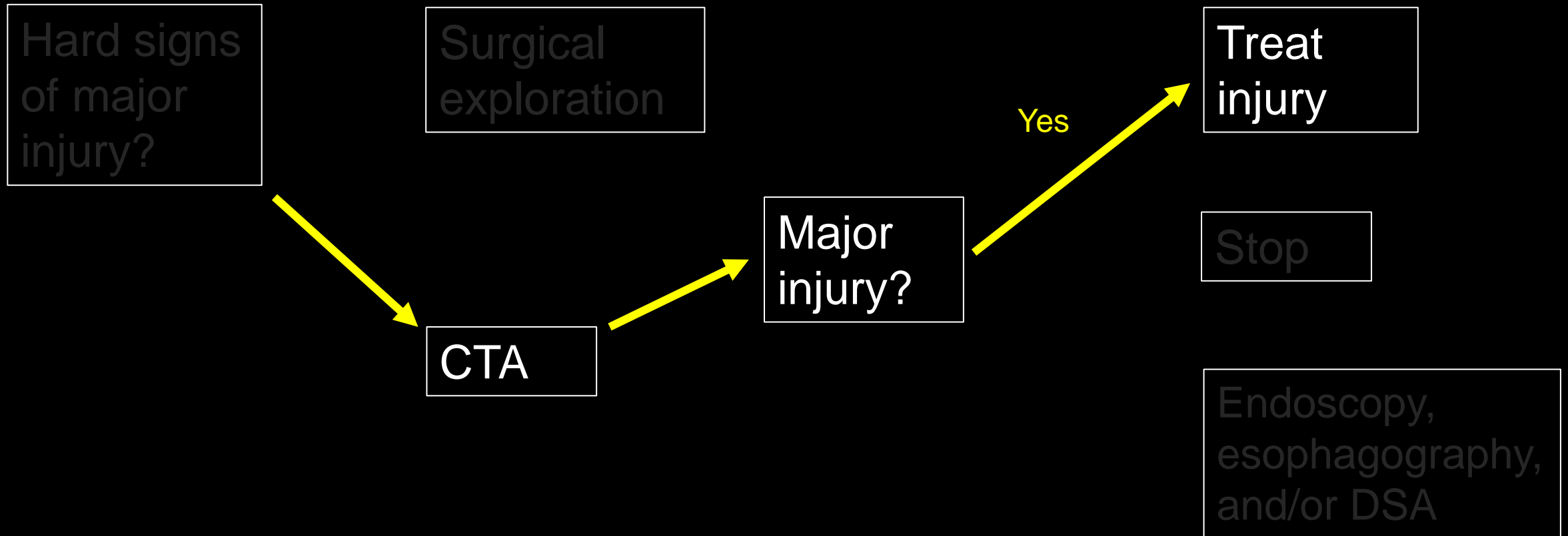
Management



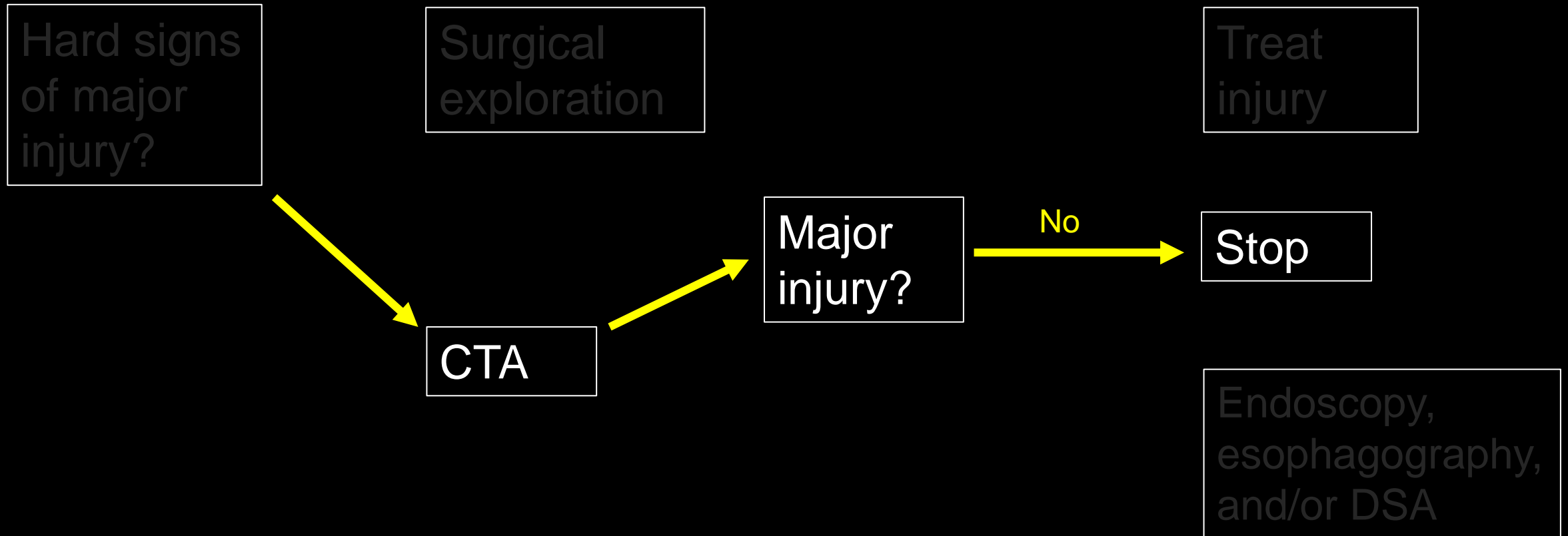
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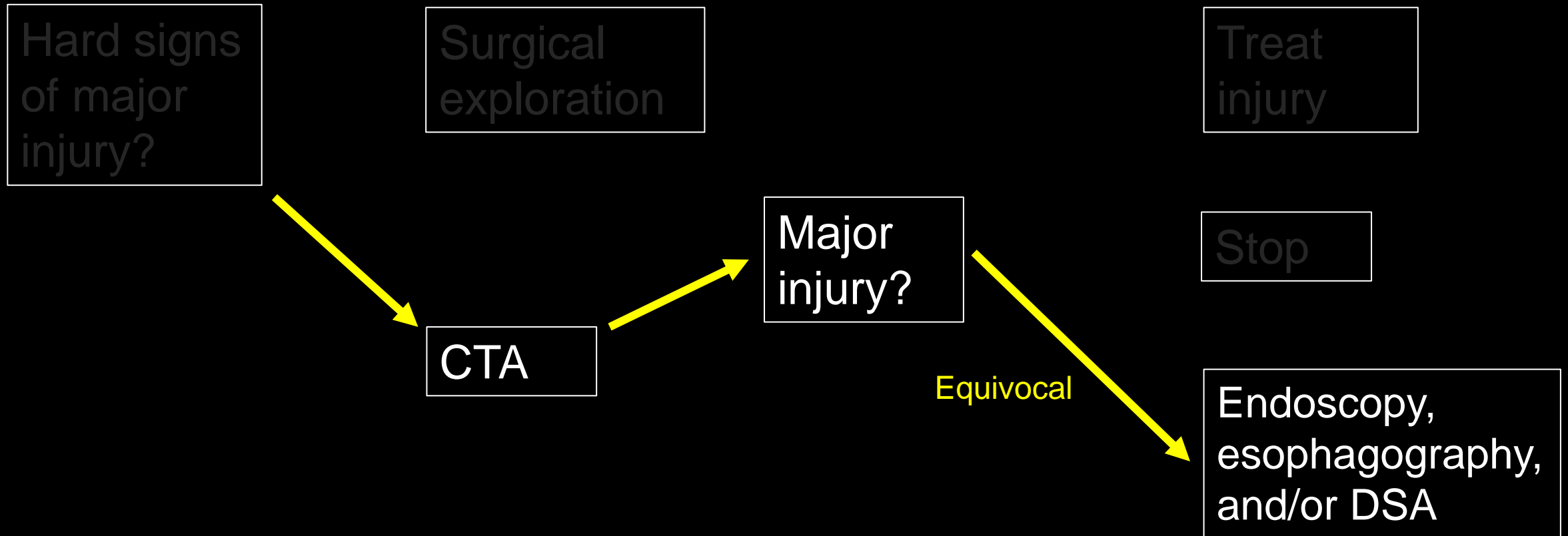
Management



Management



Management



CTA-Guided Management

Soft signs of injury

- Minimize non-therapeutic surgery
 - “Negative neck explorations”
- Target surgical exploration
- Eliminate or reduce additional diagnostic tests
 - Streamline and shorten work-up
 - Reduce costs

No clinical signs

- Eliminate or reduce need for observation
 - Reduce costs

CTA-Guided Management

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No clinical signs

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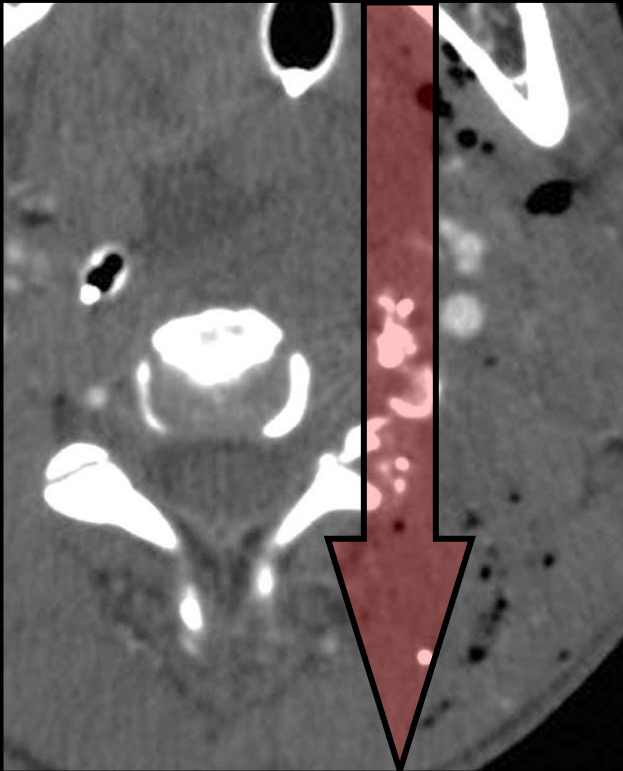
Accuracy of CTA

Accuracy

- Cerebrovascular
 - ICA's, CCA's, VA's
- Aerodigestive
- Sensitivity 89%-100%
- Specificity 97.5%-100%

Wound Tract

- Key to accuracy
- May be subtle
- May be complex
 - Multiple wounds
 - Secondary missiles

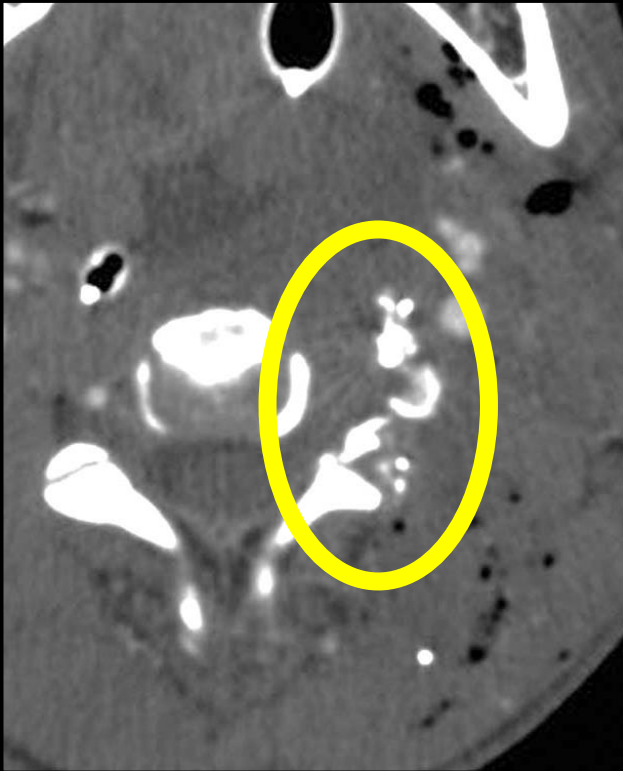


- Gas
- Hemorrhage or edema

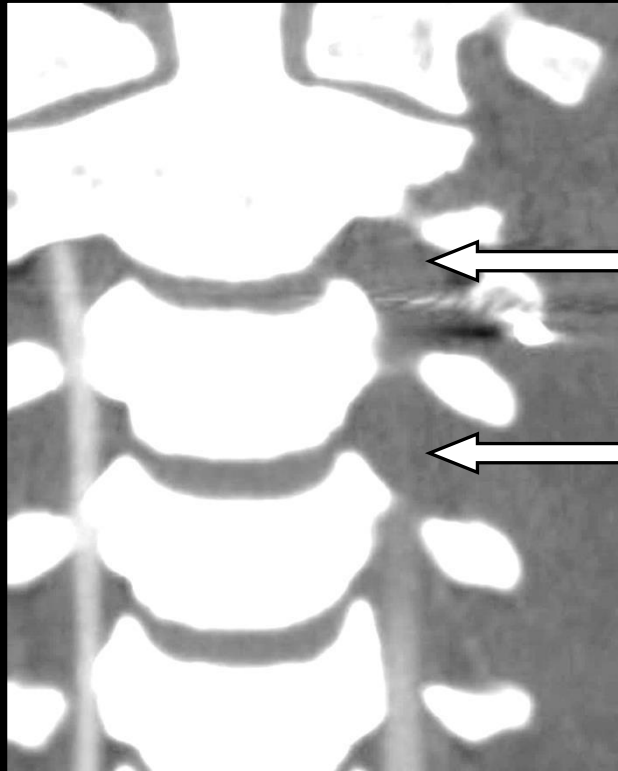


- Missile fragments
- Fractures

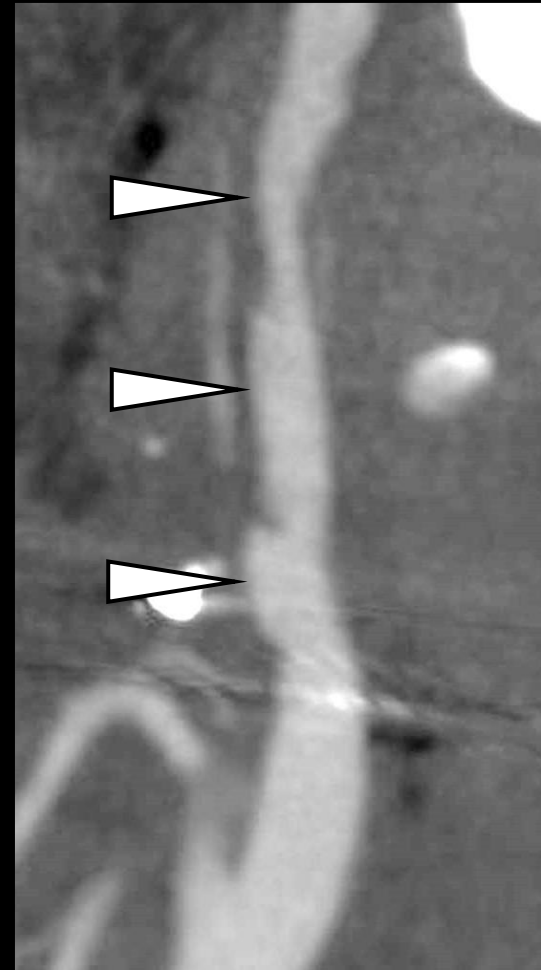


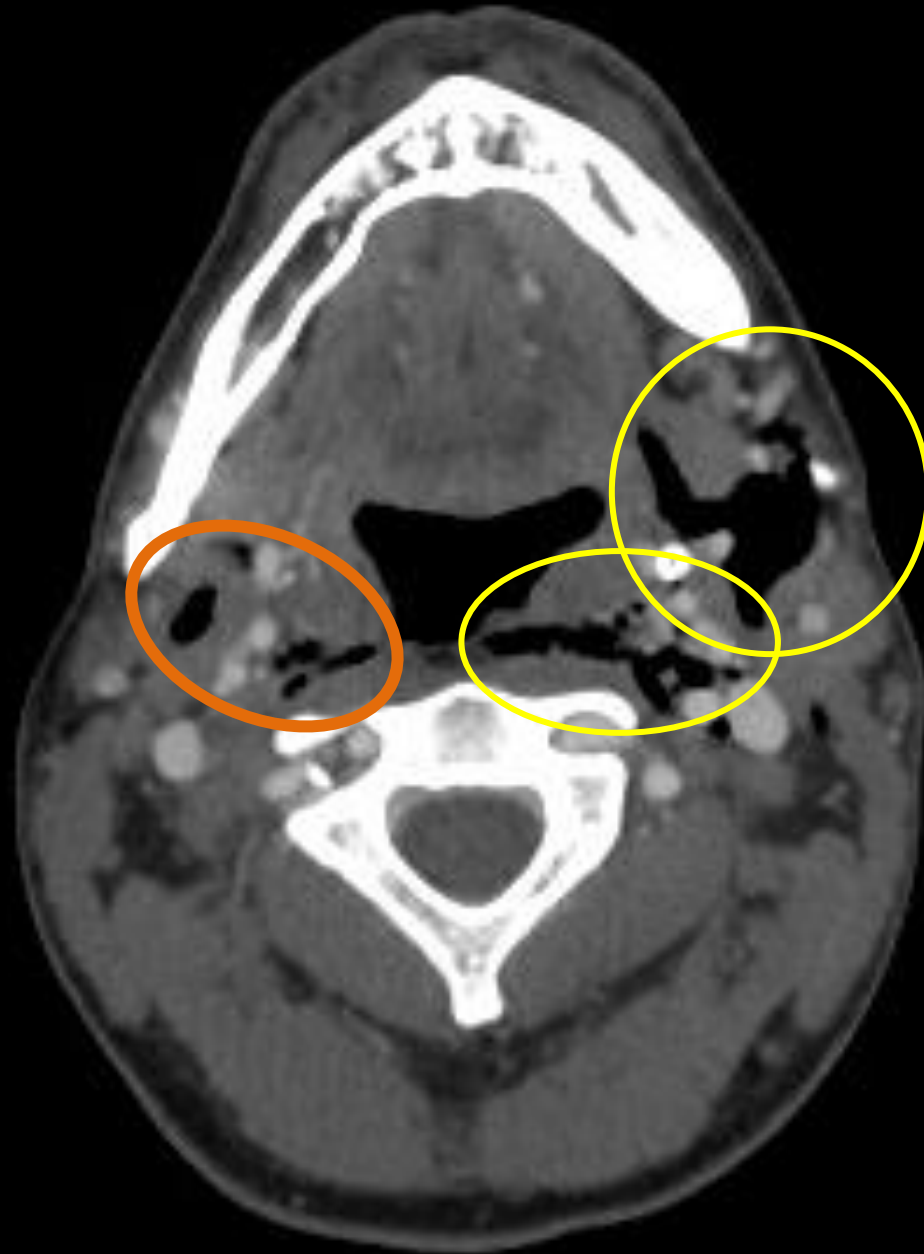


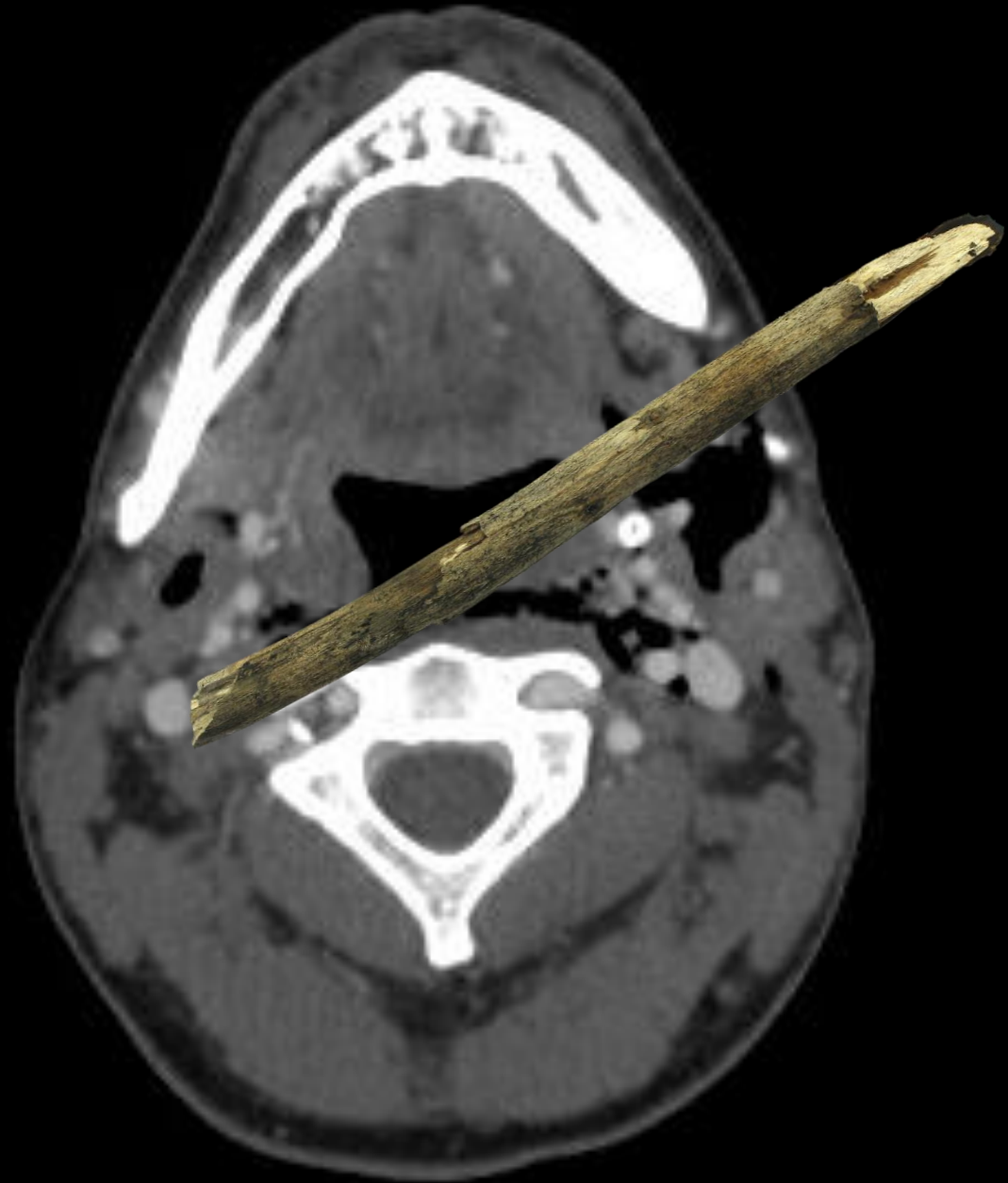
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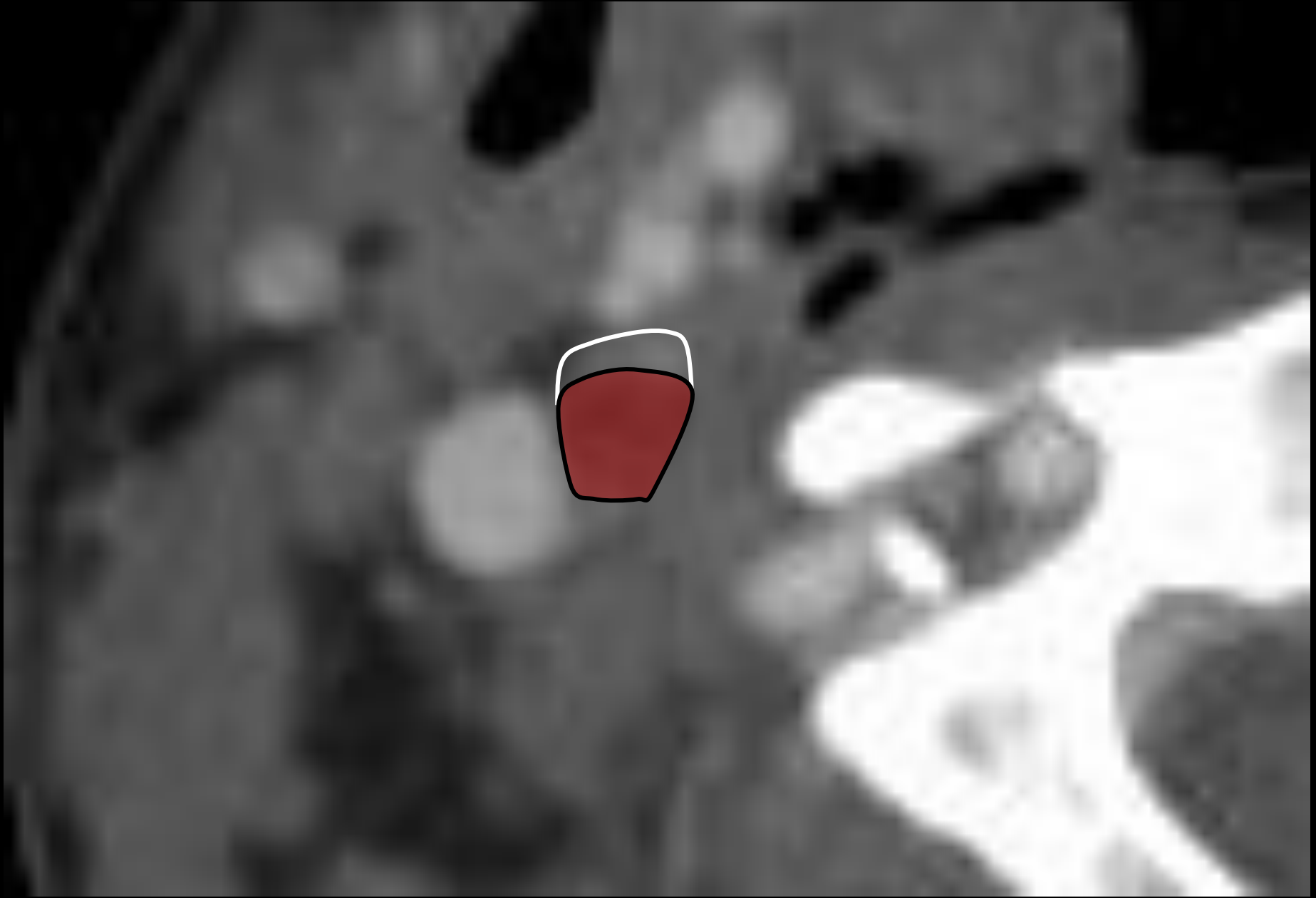


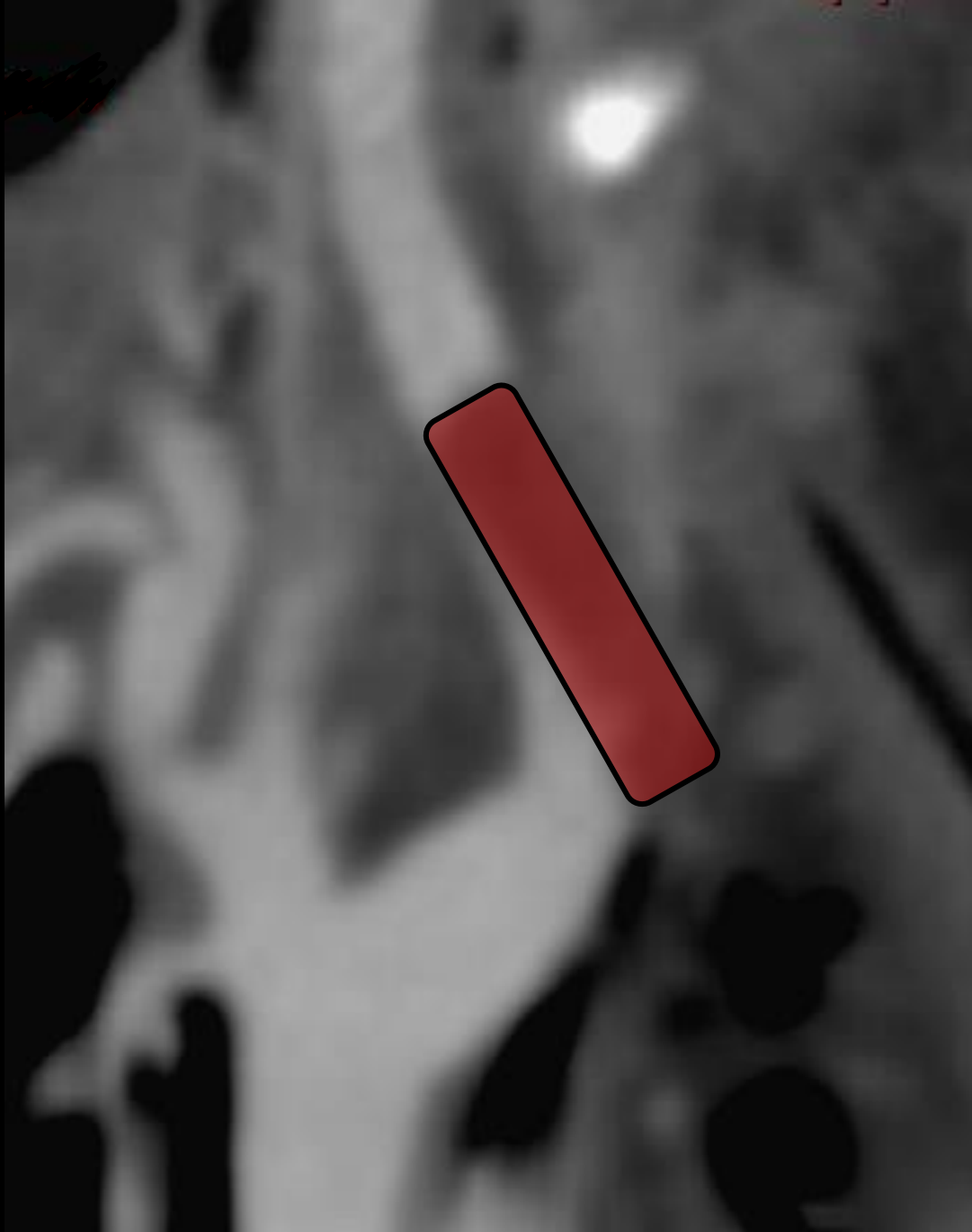
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- Fractures

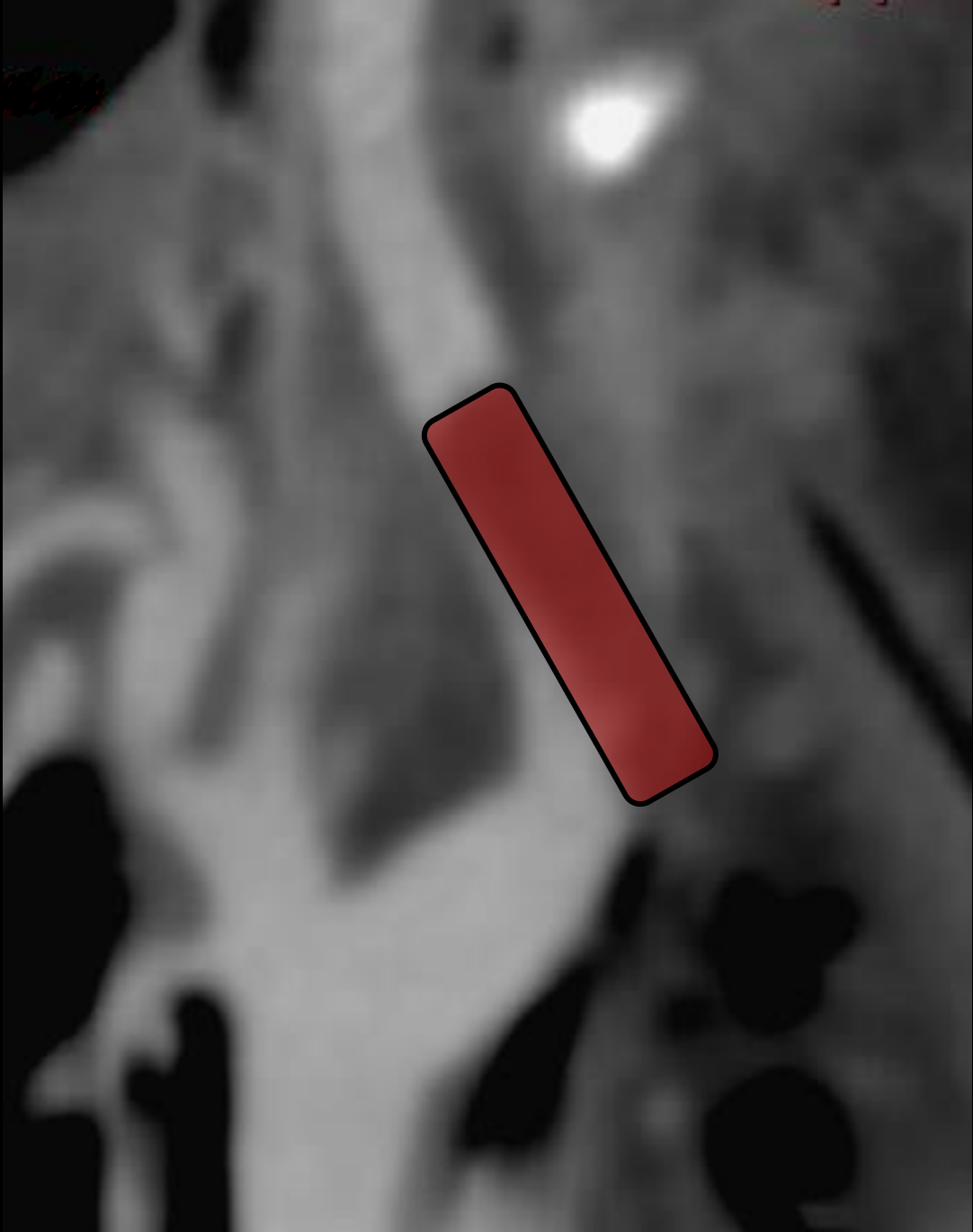








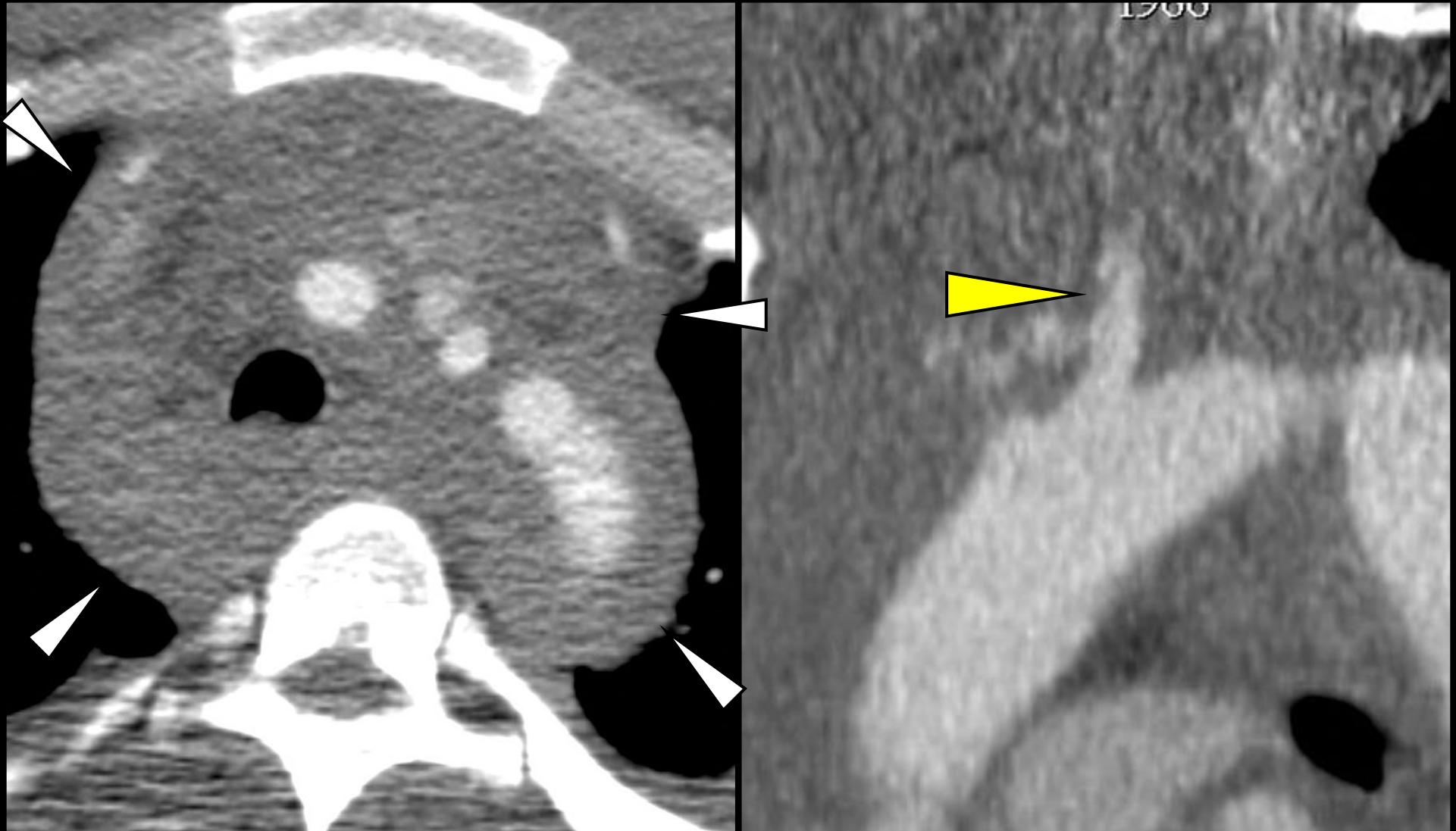




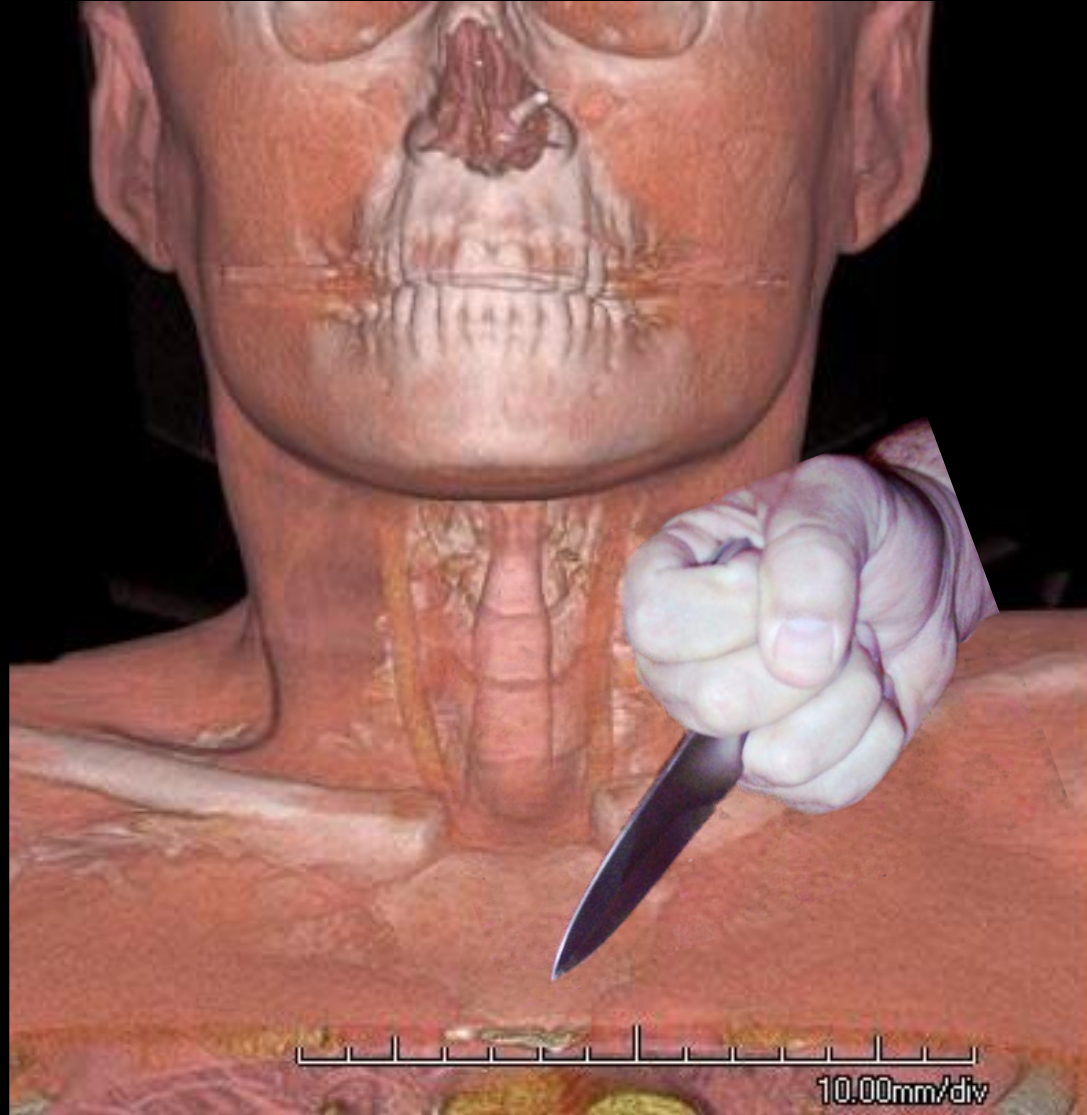
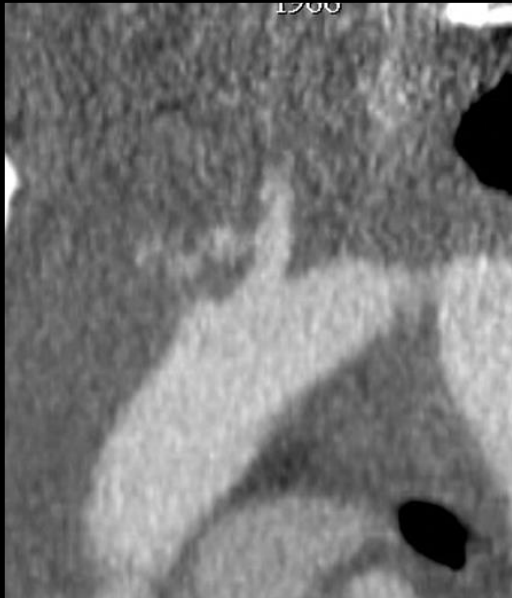
CTA with Hard Clinical Signs?

- Schroll et al. JTrauma 2015
 - Observational study
- Hemodynamically stable
 - CTA may have role
 - Streamline work-up
 - Influence surgical approach
- **Not current standard of care**
 - Not validated by other studies









Digital Subtraction Angiography

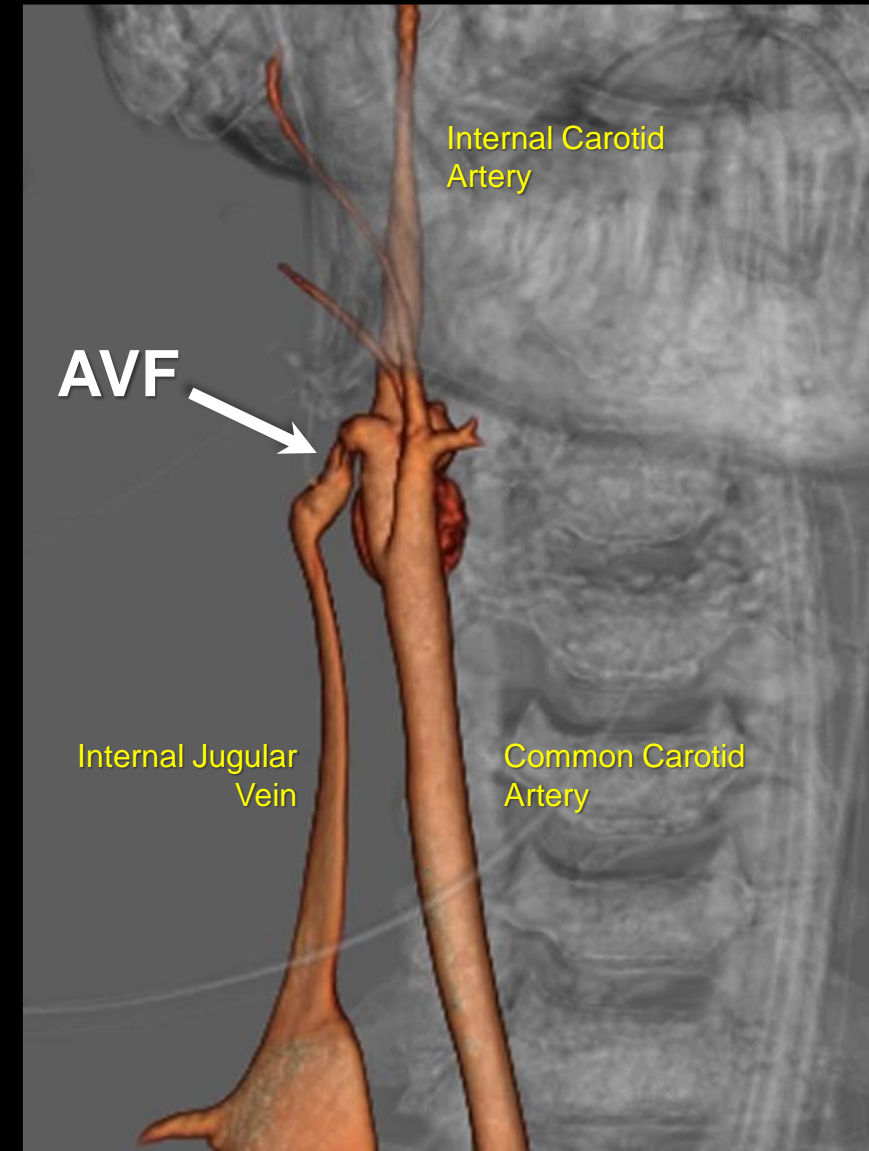
- Cerebrovascular supply
- Normal artery in wound tract
- Artery near wound tract is obscured by artifact



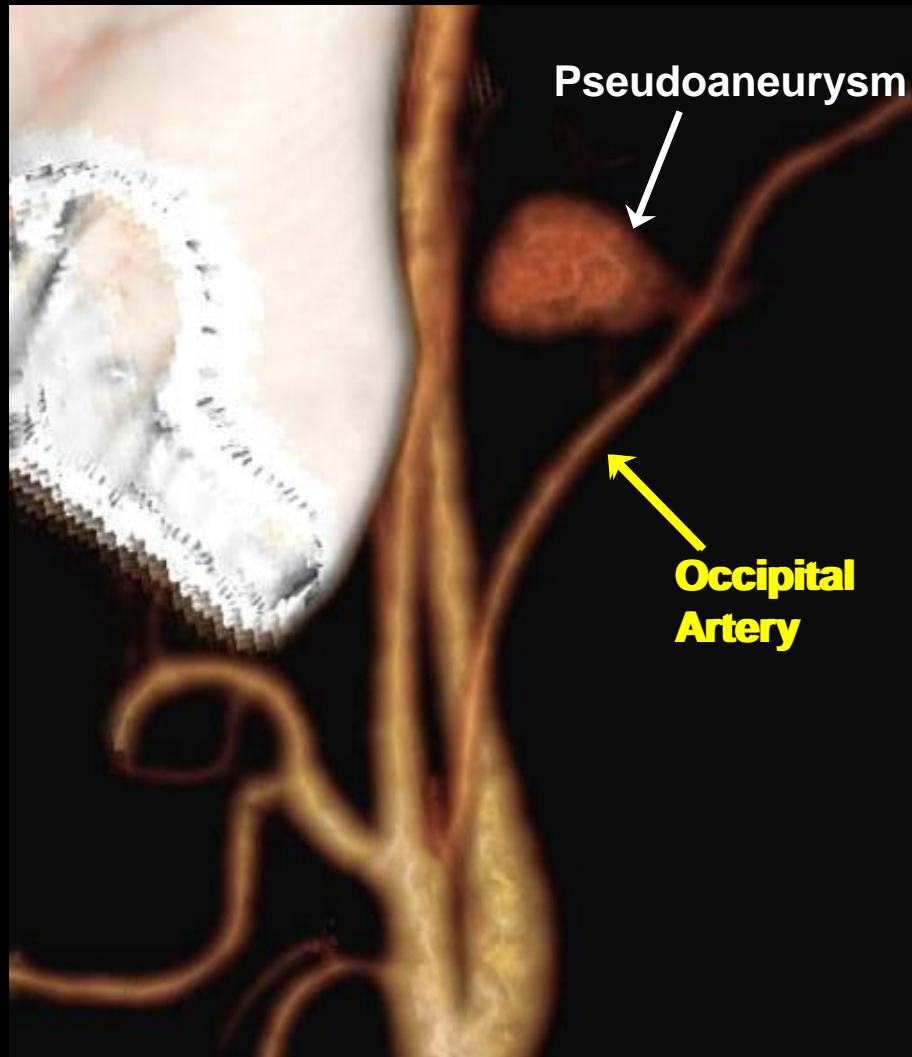


Cerebrovascular Injuries

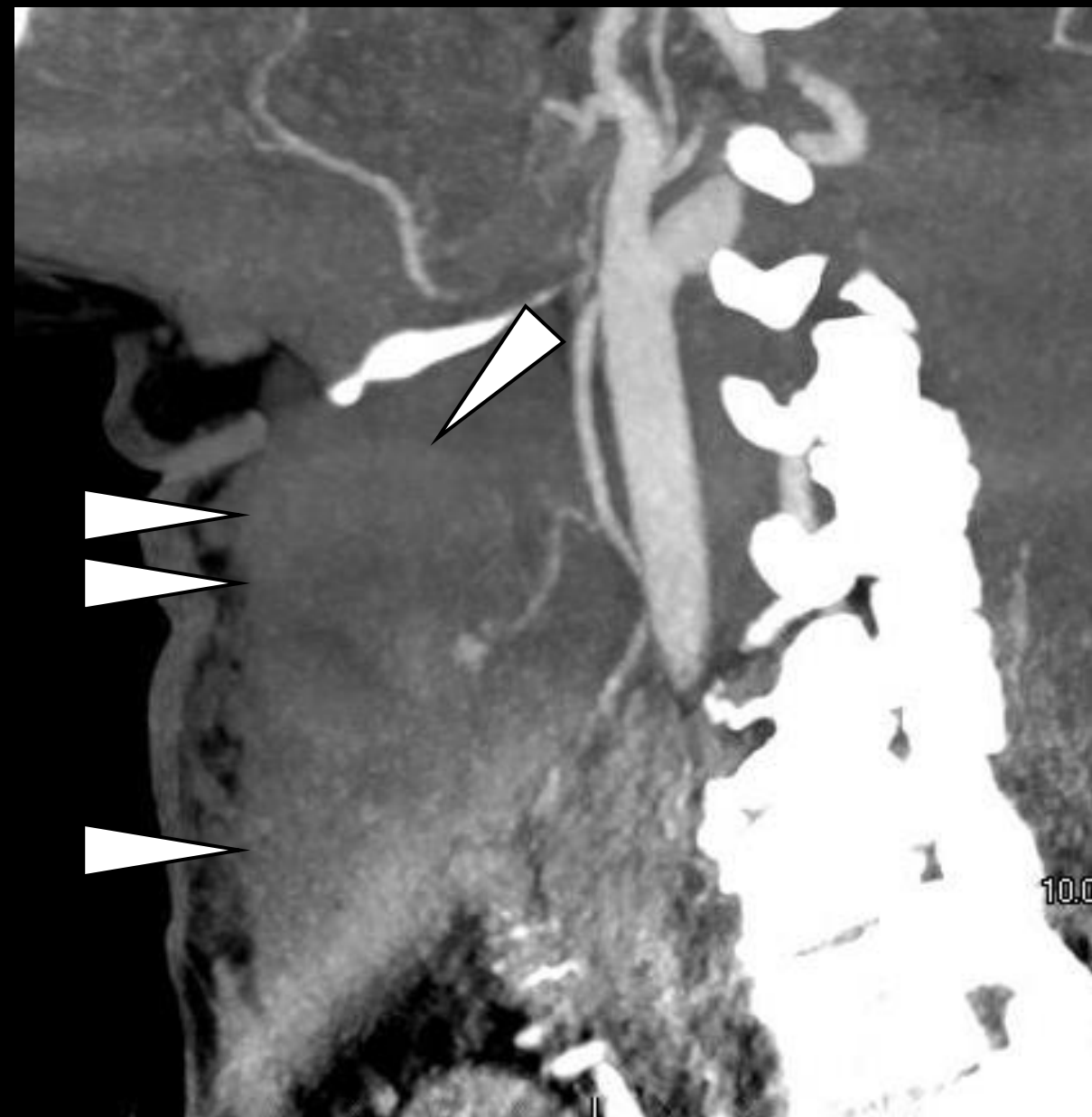
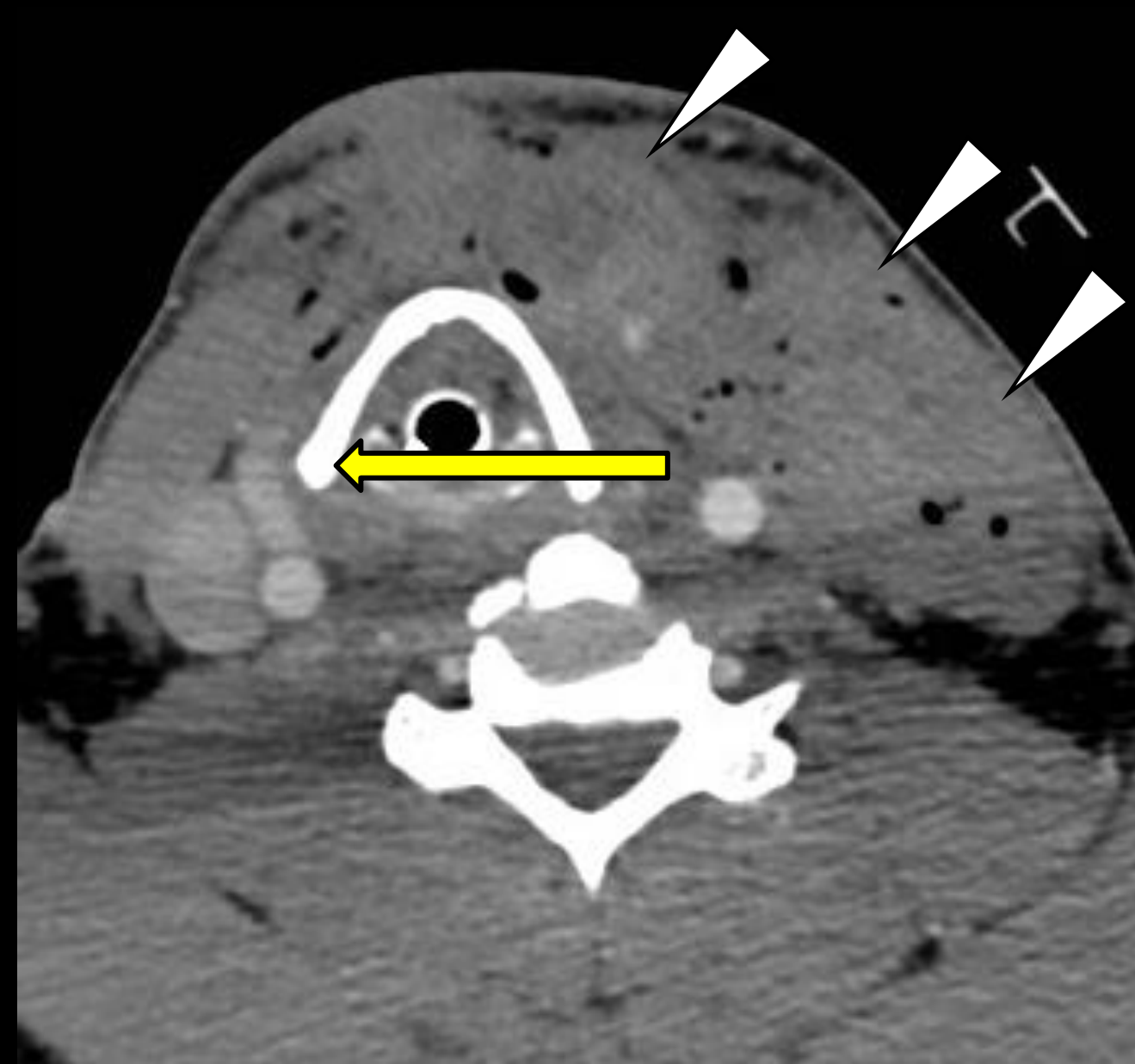
- Arterial inflow to brain
 - Common carotid arteries
 - Internal carotid arteries
 - Vertebral arteries
- Historical outcomes
 - Stroke 15%
 - Mortality 22%
 - Stroke
 - Airway compromise
 - Exsanguination

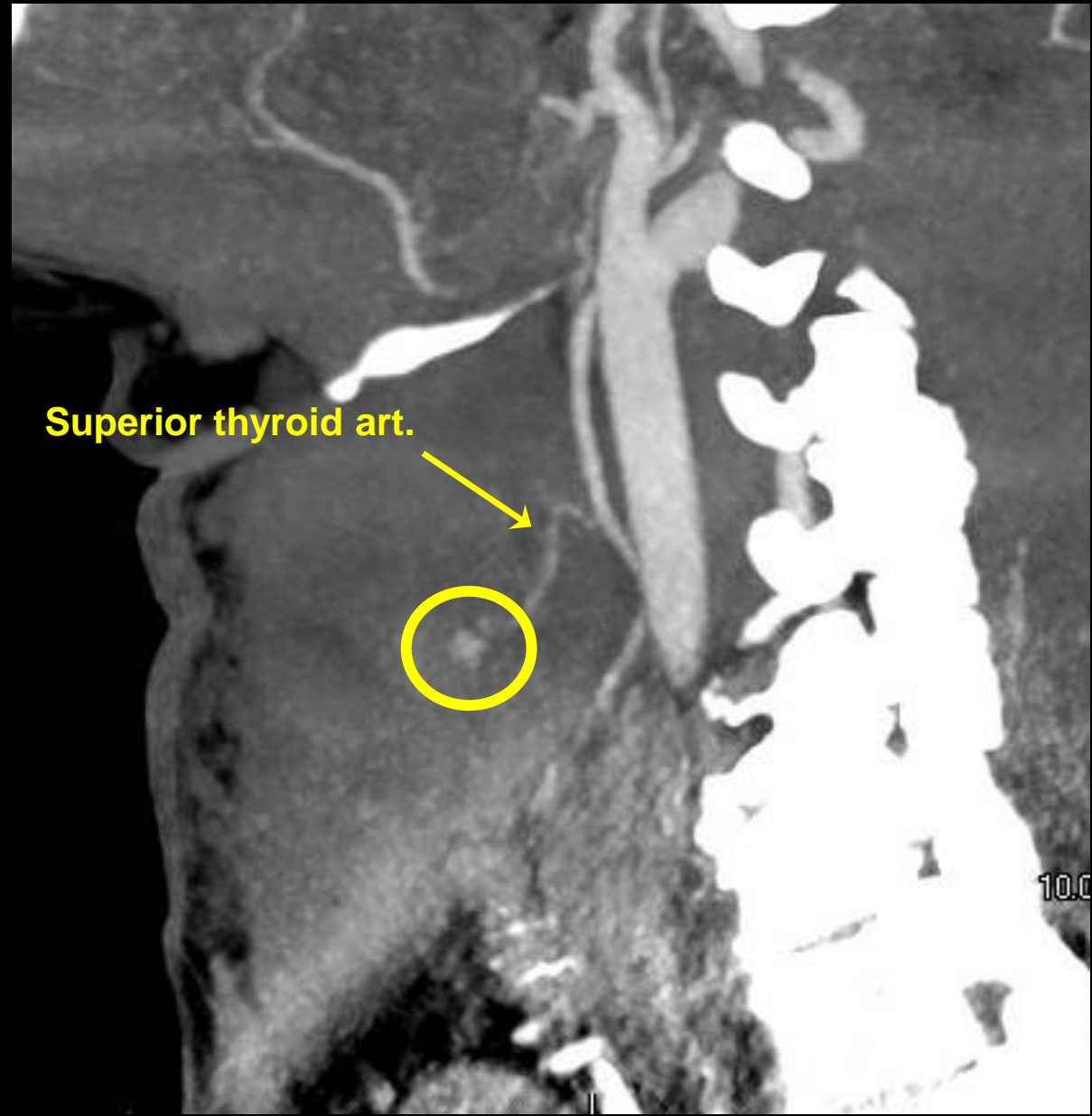
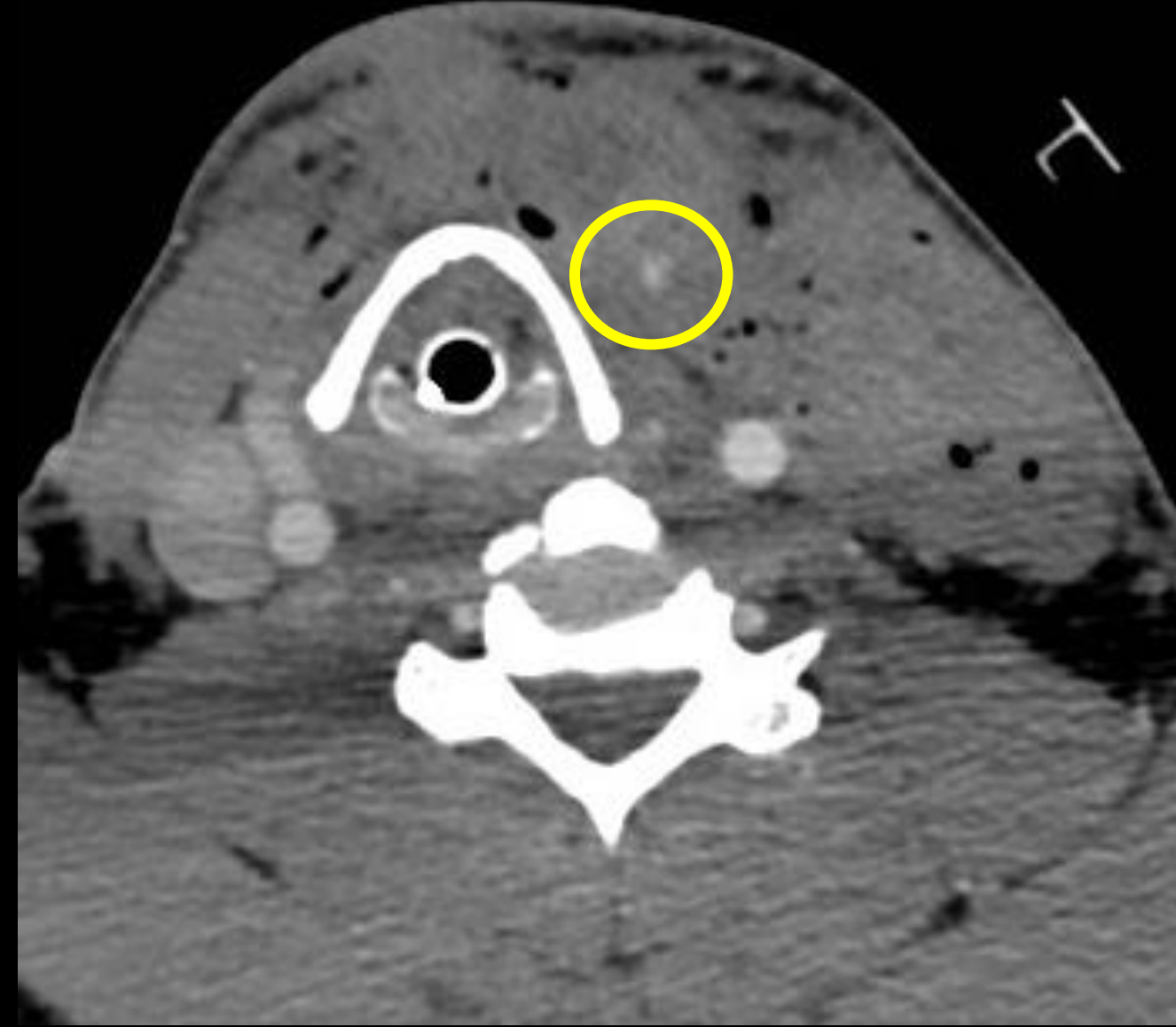


External Carotid Artery Injuries



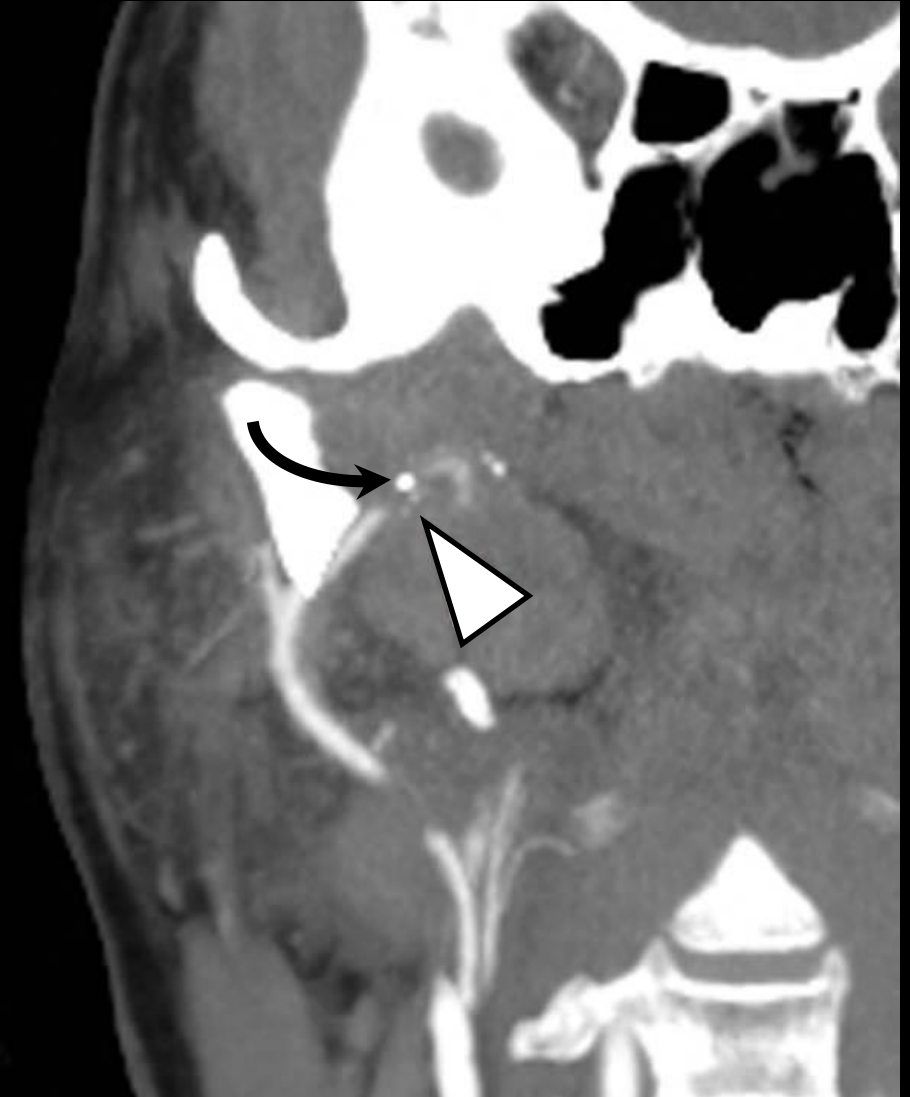
- Morbidity and mortality
 - Exsanguination
 - Airway occlusion
- MDCTA
 - Sensitivity 63.4%-70%
- Easily missed
 - Arteries small
 - Oblique or tortuous

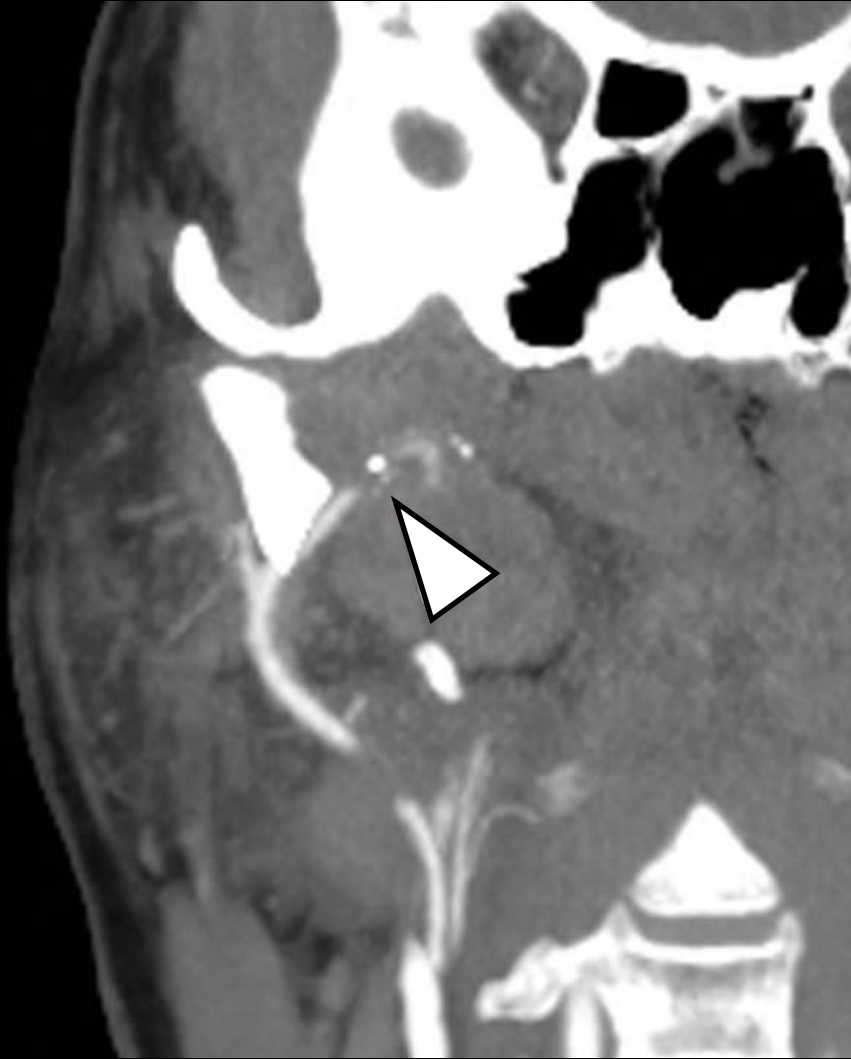




ECA Occlusion

- Occlusions may recanalize
 - Hours to days
 - Develop pseudoaneurysm
 - Rupture
- Shock Trauma
 - 5-7 day follow-up CTA of occlusion





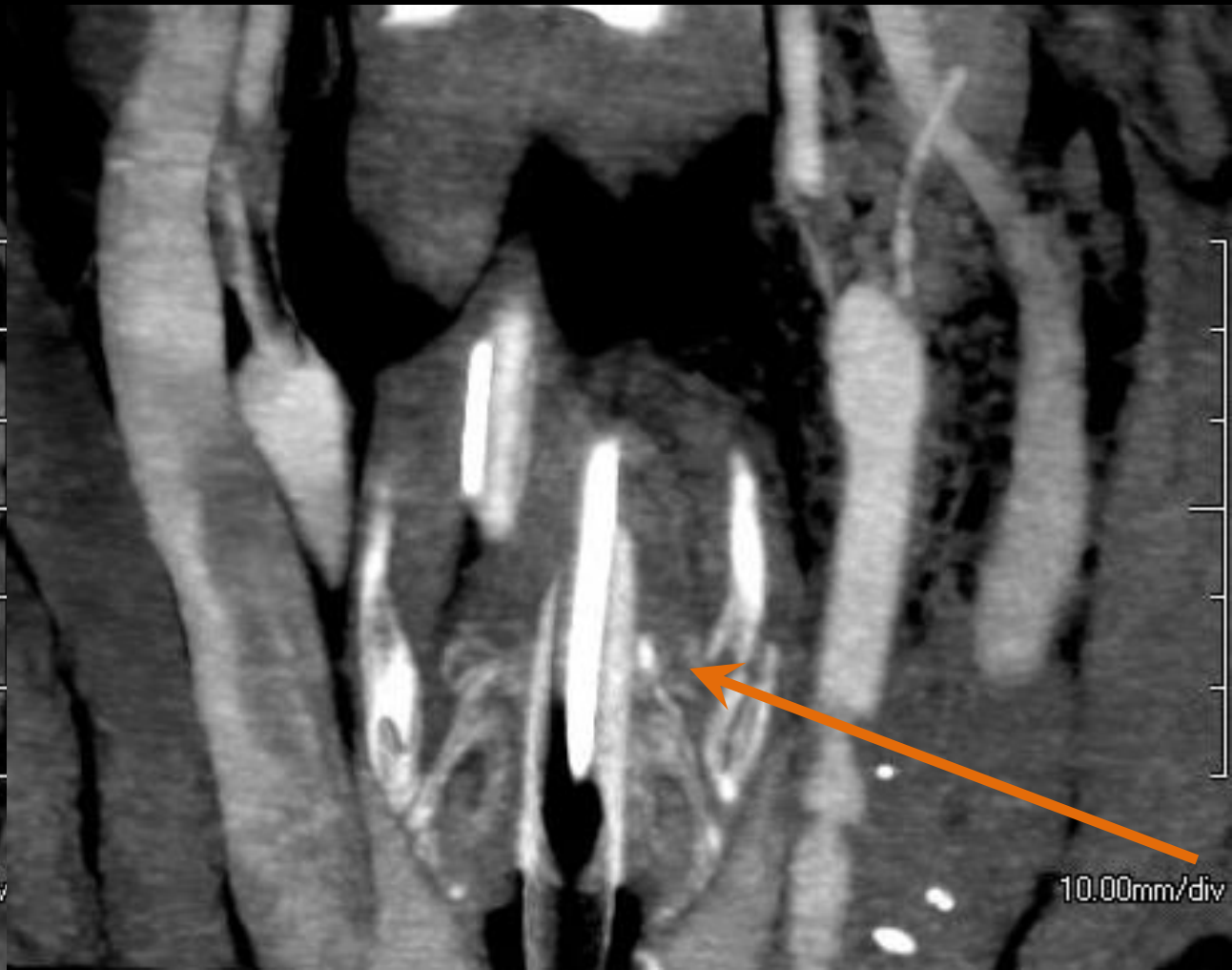
Admission

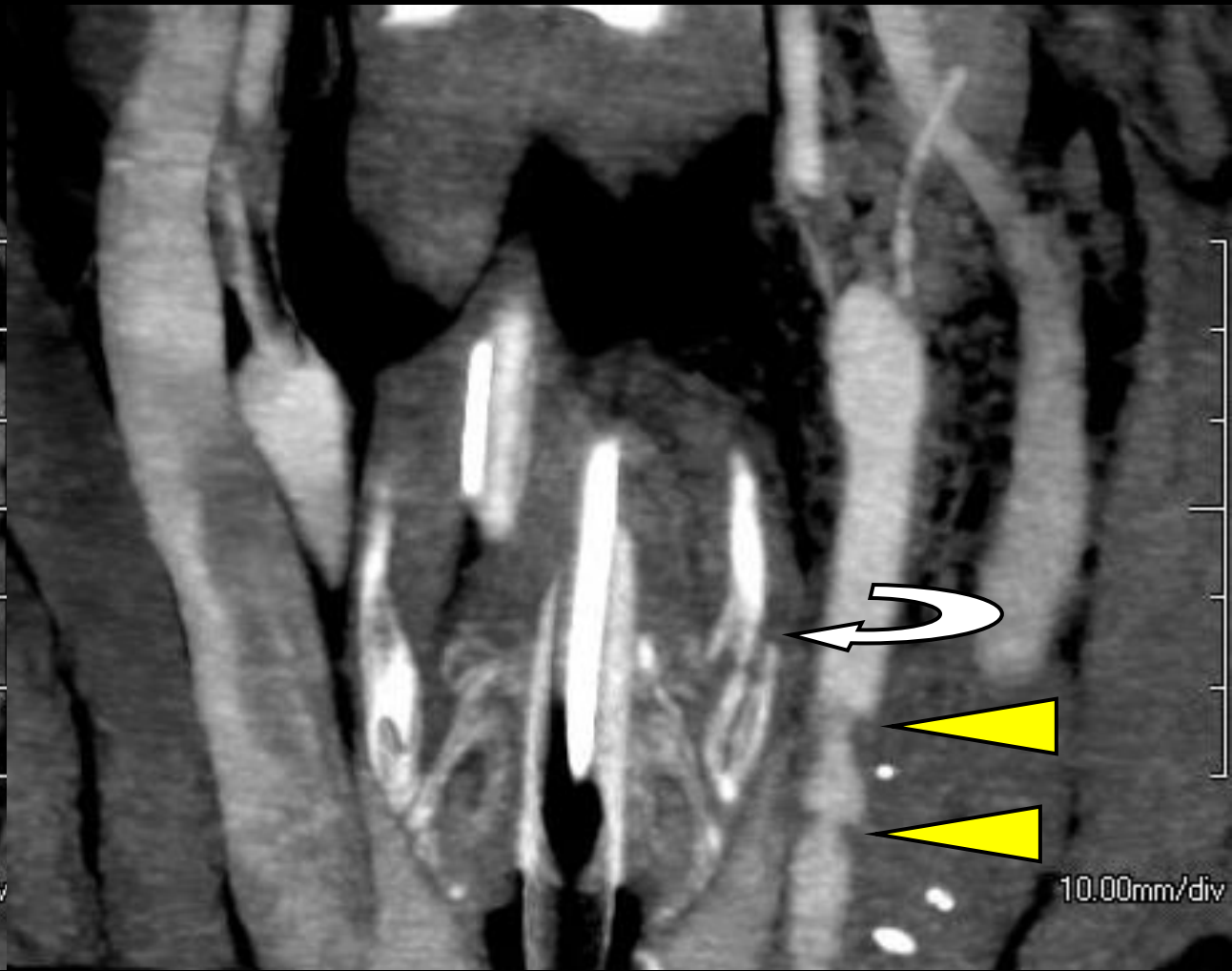
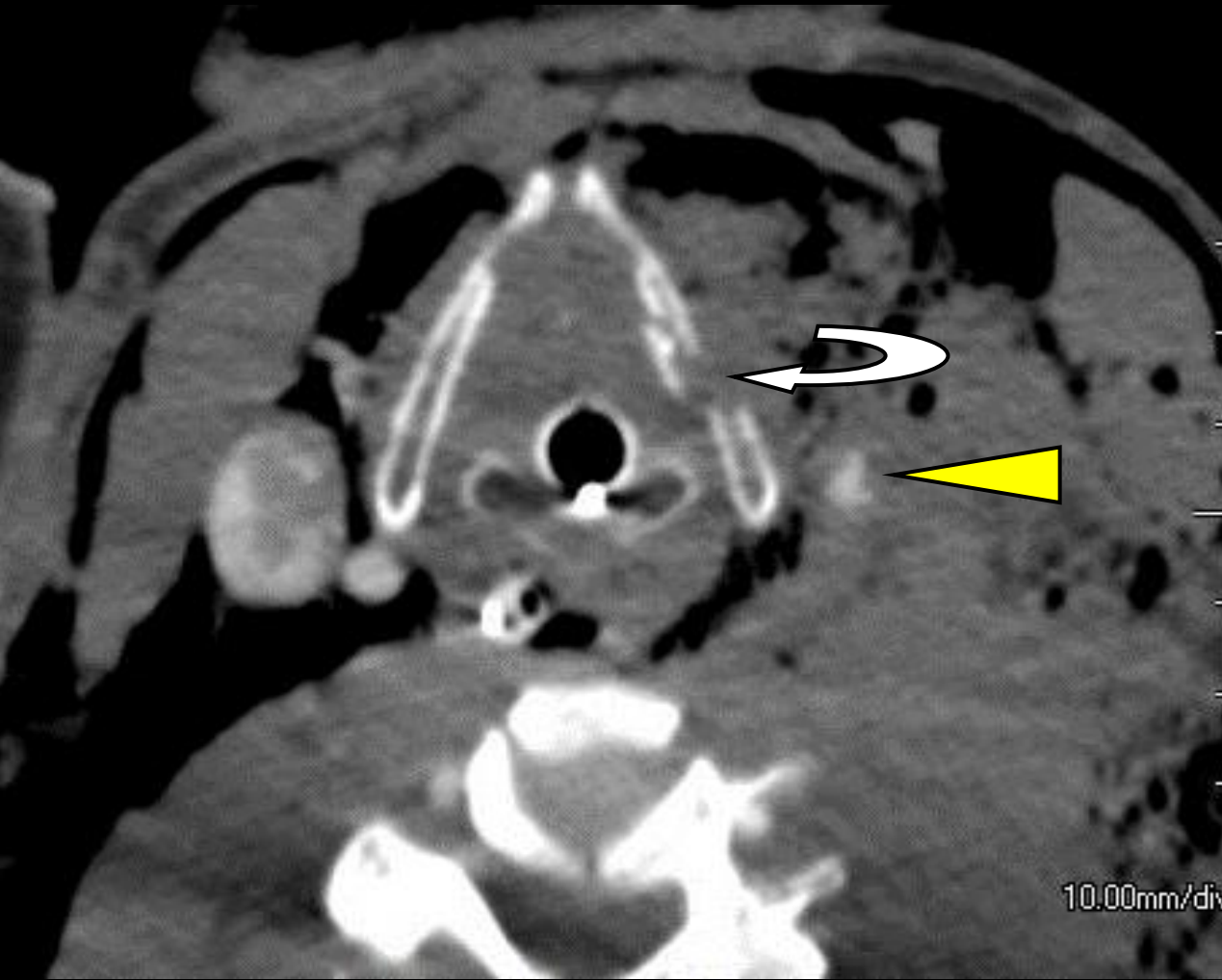


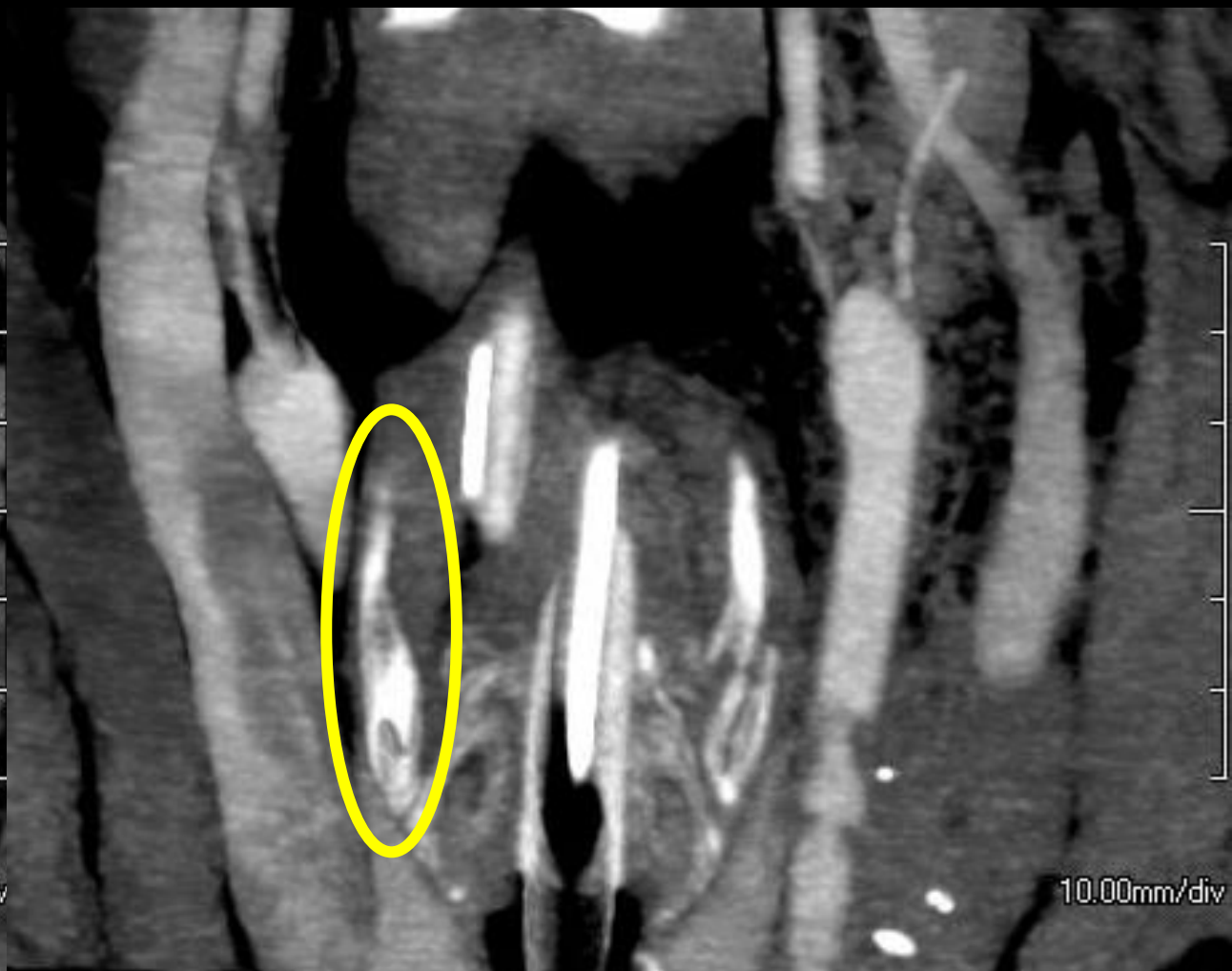
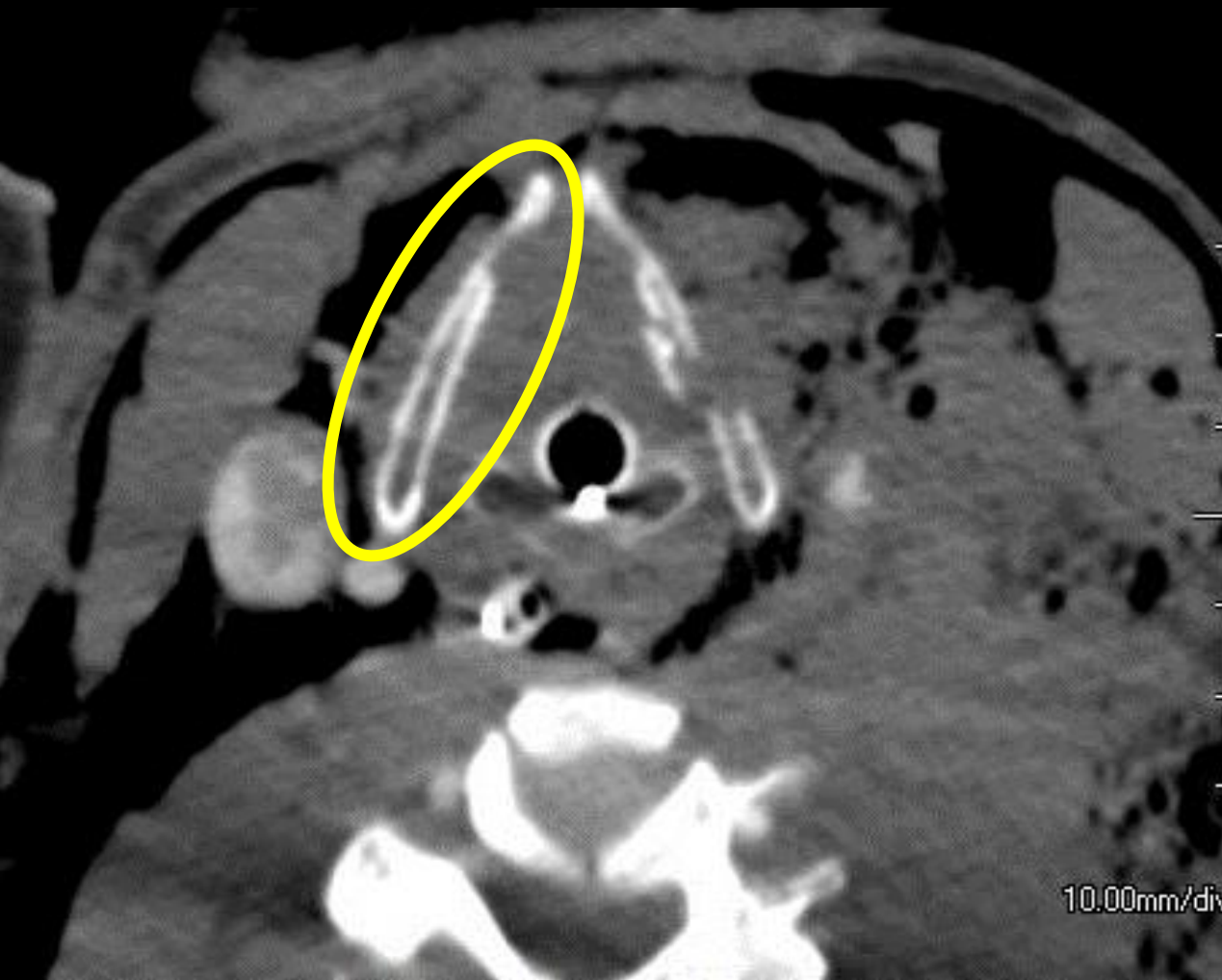
Day #5

Aerodigestive Injuries

- 5%-7% neck PT
- Laryngotracheal mortality
 - Prehospital 40%-80%
 - Secured airway 8%
- Esophageal mortality
- 12.5%-20%
 - Infra-arytenoid hypopharynx



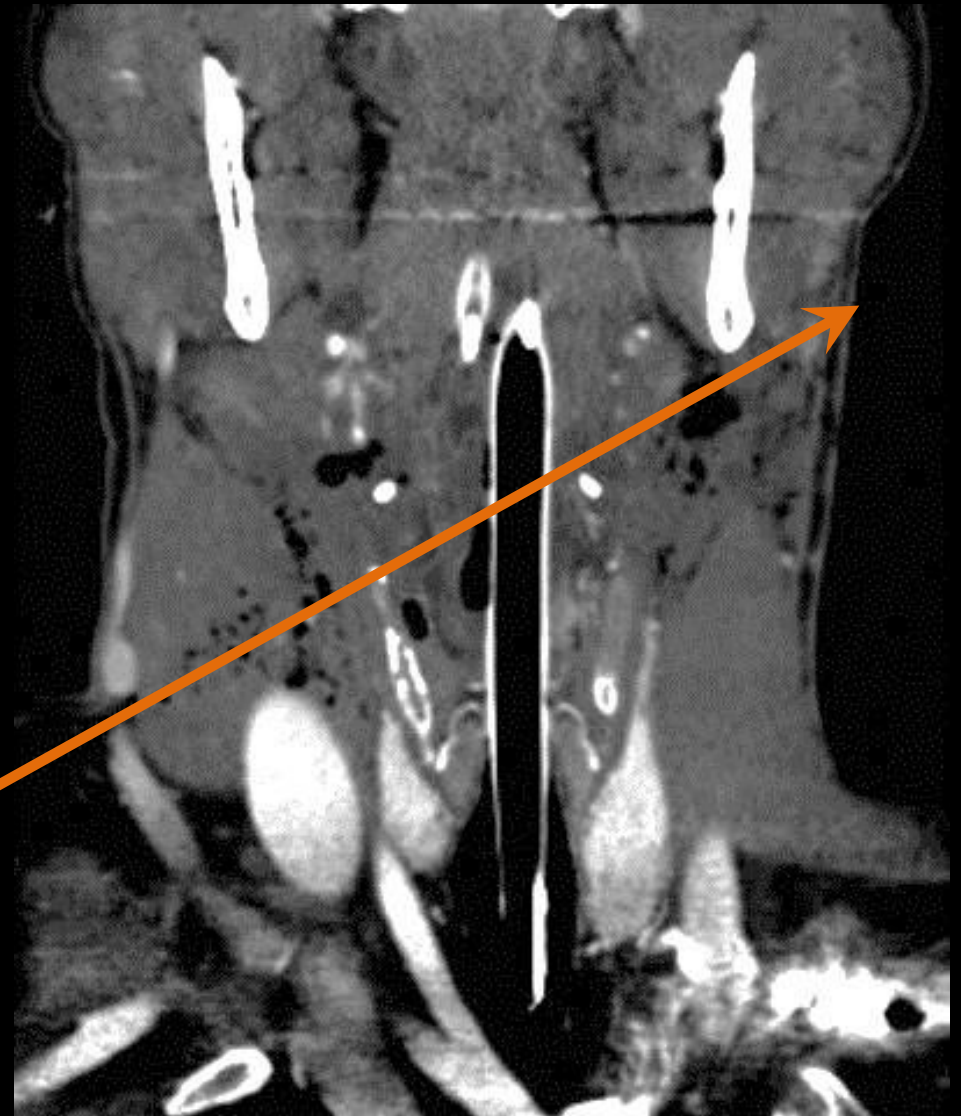






Wound Tract & Aerodigestive Injury

- Sensitivity 97%
- Tract through structure is *diagnostic of injury*
 - Usually deep soft tissue emphysema
 - Discrete defect does not need to be visualized



Wound Tract & Aerodigestive Injury

- Equivocal for injury
 - Wound track to margin
 - Deep fascial gas
 - Usually esophagus or pharynx
- Additional work-up
 - Surgical exploration
 - Endoscopy
 - Esophagography





Figure courtesy of Scott Steenburg, MD: Steenburg SD, Leatherwood, D. Penetrating neck trauma: A review of image-based evaluation and management. *Applied Radiology*. Jan 2016: 17-26.

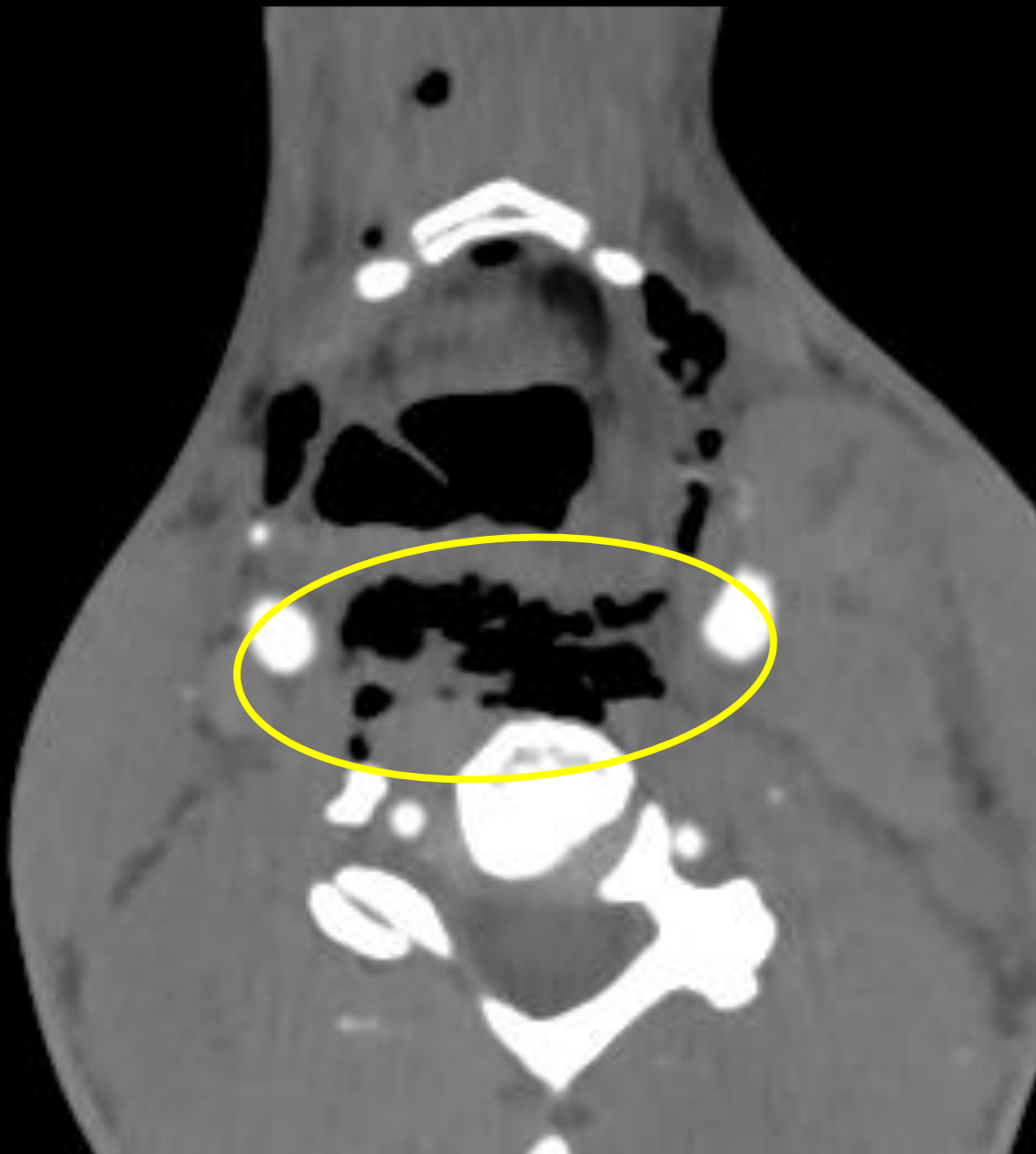
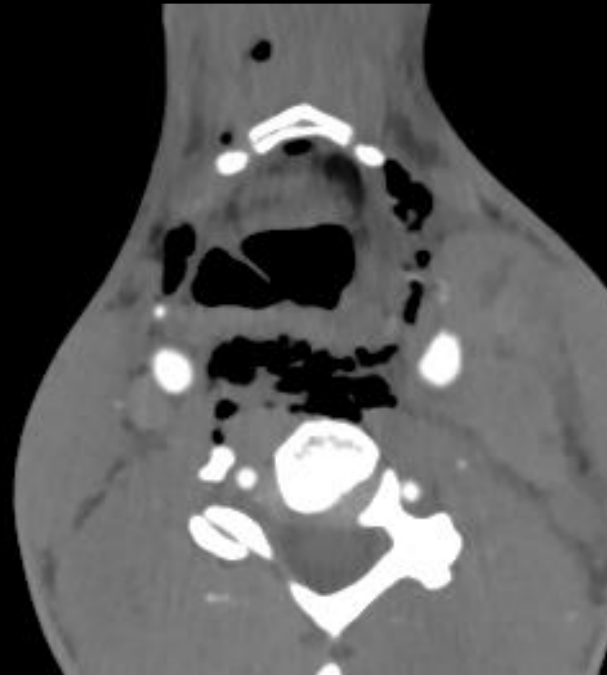


Figure courtesy of Scott Steenburg, MD: Steenburg SD, Leatherwood, D. Penetrating neck trauma: A review of image-based evaluation and management. Applied Radiology. Jan 2016: 17-26.

Pharyngoesophageal Injuries

- CTA equivocal
 - Esophagography
 - Endoscopy
 - Combination 90%-100% sensitive
- Esophagography
 - Less sensitive for pharyngeal injuries
 - Difficult or impossible with intubated patient



Soft Tissue Emphysema

- Sensitivity & NPV ~100%
- Nonspecific finding
 - Aerodigestive injury
 - Introduced through tract
 - Facial or thoracic injuries



Summary

- Contemporary management based on combination of clinical findings and diagnostic imaging.
- In patients without hard signs of injury, CTA is instrumental in directing patient care.
- DSA and esophagography play secondary but important roles.



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Thank you for your attention.