‘NEURO IMAGING OF ACUTE STROKE’

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DISCLOSURES

Alicia Richardson: Stryker Neurovascular Consultant

Wendy Smith: None

Lynn Hundley: Medtronic: Speaker Bureau, modest; Arbor Pharmaceuticals: Speaker Bureau, modest

NCCT

<table>
<thead>
<tr>
<th></th>
<th>Color</th>
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<tbody>
<tr>
<td>Bone</td>
<td>Very White</td>
</tr>
<tr>
<td>Acute Blood</td>
<td>Very White</td>
</tr>
<tr>
<td>Enhanced tumor</td>
<td>Very White</td>
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<tr>
<td>Subacute Blood</td>
<td>Light Grey</td>
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<tr>
<td>Muscle</td>
<td>Light Grey</td>
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<tr>
<td>Grey Matter</td>
<td>Light Grey</td>
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<tr>
<td>White Matter</td>
<td>Medium Grey</td>
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<tr>
<td>CSF</td>
<td>Medium Grey to Black</td>
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<tr>
<td>Air, Fat</td>
<td>Very Black</td>
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WHAT DO THESE WORDS MEAN?

- **Diffuse**: It’s everywhere
- **Mass effect**: Stuff is pressing on stuff
- **Sulcal Effacement**: Now you can’t see the difference between the sulci & gyri
- **Cytotoxic**: Swelling of white and grey matter
- **Midline shift**: Stuff is pressing really hard, into the other hemisphere hard
WHAT DO THESE WORDS MEAN?

- **Encephalomalacia**: Loss of brain tissue, dark area
- **Hypointense**: Dark
- **Hypodense**: Dark area
- **Isointense**: Neutral or same as other tissues
- **Hyperintense**: Bright
- **Hyperdense**: Bright area
**NCCT CHECKLIST**

1. **EVIDENCE OF HEMORRHAGE?**
   - a) Ventricular
   - b) Subdural
   - c) Subarachnoid
   - d) Epidural

   Is it intra-axial?
   - a) Follow the distribution of an arterial branch?
   - b) Align itself with the anatomical location of the perforating arteries?

2. **IS THERE FRANK HYPODENSITY?**

3. **IS THERE MASS EFFECT WITH A SHIFT CROSS MIDLINE?**

4. **EARLY INFARCT SIGNS?**
   - A) SULCAL EFFACEMENT
   - B) BLURRING OF THE GRAY-WHITE INTERFACE
   - C) HYPERDENSE ARTERY

5. **DIFFUSE BRAIN EDEMA?**
   - A) OVERALL FLATTENING OF SULCI
   - B) SMALL CISTERNAL SPACES
   - C) SMALL VENTRICLES
   - D) DIFFUSE LOSS OF GRAY-WHITE DIFFERENTIATION
NCCT CHECKLIST

6. IS THERE HYDROCEPHALUS?
   a) Opening of the temporal horns
   b) Localized enlargement of the lateral ventricles suggesting non-communicating hydrocephalus

7. IS THERE EVIDENCE OF CALCIFICATION AND IS IT IN AREAS THAT DO BECOME CALCIFIED?

8. DO YOUR CT FINDINGS MATCH THE CLINICAL PICTURE?!

“JEWEL PATHOLOGY”

MUST FOCUS, MUST FOCUS

......OH LOOK SOMETHING SHINY
ISCHEMIC CHANGES ON CT

HYPERDENSE MCA SIGN
Cortical penetrating branches of ACA, MCA, or PCA (~20-30%)

Basal Ganglia - lenticulostriate perforators (~40-50%)

Thalamus - thalmogeniculate perforators (~20-30%)

Pons - pontine perforators (~8%)

Cerebellum - AICA, PICA, or SCA penetrating branches (~8%)

CT ANGIOGRAPHY

CTA
- VESSEL IMAGING
  - Occlusions
  - Stenosis
  - Aneurysms
- SHOULD PERFORM HEAD AND NECK
  - Carotid/vertebral arteries
  - Dissection
  - “Road map” for intervention
CT PERFUSION

CTP

- CEREBRAL BLOOD FLOW/VOLUME
  - Helps with timing - Unknown onset, late window
  - Infarct vs penumbra to show at risk tissue

MRI – T1 AND T2

<table>
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<tr>
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<th>T1</th>
<th>T2</th>
<th>T2 Flair</th>
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<tbody>
<tr>
<td>Bone</td>
<td>Very Black</td>
<td>Very Black</td>
<td>Very Black</td>
</tr>
<tr>
<td>Air</td>
<td>Very Black</td>
<td>Very Black</td>
<td>Very Black</td>
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<td>Grey</td>
<td>Grey</td>
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<tr>
<td>Fat</td>
<td>White</td>
<td>Grey</td>
<td>Grey</td>
</tr>
<tr>
<td>CSF</td>
<td>Very Black</td>
<td>Very White</td>
<td>Very Black</td>
</tr>
<tr>
<td>Acute Ischemia</td>
<td>Dark Grey</td>
<td>Light Grey to White</td>
<td>Good for Anatomical Definition</td>
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STROKE MRI SEQUENCES

**GRE**
- Highly sensitive to blood
  - Blood: Black
  - CSF: White
- Must be done with ADC/DWI otherwise hemorrhage can be missed

**SWI**
- Also highly sensitive to blood
  - Blood: Black
  - CSF: Grey

**ADC**
- Ischemic tissue: Dark grey/Black
- CSF: White
- Normalizes by 5-10 days, good for lesion age

**DWI**
- Highly sensitive to infarcted tissue
  - Ischemic tissue: White
  - CSF: Dark grey/Black
- May be positive in up to 50% of TIA patients with full symptom resolution
- Can be used to select tPA candidates outside window

**Flair**
- Benefit: Suppresses CSF signal to enhance older infarcts
  - Bright white: old
MR Imaging in Acute Stroke

**DWI:** Bright at 30 min – 7-10 days, isointense thereafter

**ADC:** Dark at 30 min with maximum at 4 days, isointense at 7-10 days and bright thereafter

**T2/FLAIR:** Bright at 6 hours and thereafter

**T1+Gad:** Enhancement begins at 2 days, peak enhancement at 2 weeks and no enhancement after 2 months

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**DWI-FLAIR-mismatch**

![Images showing DWI and FLAIR comparisons with and without mismatch](image_url_1)

**No DWI-FLAIR-mismatch**

![Images showing DWI and FLAIR comparisons without mismatch](image_url_2)
THANK YOU!

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