Rady 401 Case Presentation

Travis Corriher MS4
June 2018

Ed. John Lilly, MD
Ms. NT is a 16 yo female with a hx of sickle cell trait who presents to the ED with 2 weeks of headache with acute worsening over the past 2 hours associated with right-sided numbness and weakness

Symptoms began while swimming. Denies LOC, trauma, seizures, OCP use, blood clots. Family Hx of stroke at age 50+.

Vitals unremarkable (Except RR 25)

Neuro Exam: A&O x 3, EOMs intact, R facial numbness V1-3, R facial droop, tongue midline. RUE 2, LUE 5, RLE 1, LLE 5; Sensation diminished in right hemibody

ED Labs: Negative CBC/BMP/coags, Utox, tylenol/ethanol
List of imaging studies

- MRI Brain with and without contrast
- MRA Head
- MRA Neck (Unremarkable)
- MRI C-Spine with and without contrast (Unremarkable)
- IR Cerebral Arteriogram
Findings?

Hint:
1. DWI is based upon fast MRI to detect a signal related to the movement of water molecules
2. DWI is bright where there is restricted water diffusion
3. Hard to distinguish vasogenic and cytotoxic edema

DWI (Diffusion Weighted Image), Axial (3:60)
Findings?

DWI signal bright at left thalamus and posterior limb internal capsule showing restricted diffusion
DWI (Diffusion Weighted Imaging) is based upon the capacity of fast MRI to detect a signal related to the movement of water molecules between two closely spaced radiofrequency pulses. This technique can detect abnormalities due to ischemia within 3 to 30 minutes of onset, when conventional MRI and CT images would still appear normal. In acute stroke, swelling of the ischemic brain parenchymal cells follows failure of the energy-dependent Na-K-ATPase pumps and is believed to increase the ratio of intracellular to extracellular volume fractions. DWI contains an additional component of T2 effect, and increased T2 signal due to vasogenic edema can "shine through" on DWI images, making it difficult to distinguish vasogenic from cytotoxic edema on these images. This problem can be overcome by use of the apparent diffusion coefficient (ADC). The ADC provides a quantitative measure of the water diffusion. In acute ischemic stroke with cytotoxic edema, decreased water diffusion in infarcted tissue causes increased (hyperintense) DWI signal and a decreased ADC, visualized as hypointense signal on ADC maps of the brain. In contrast, vasogenic edema may cause increased DWI signal may occur due to T2 shine through, but water diffusion is increased, and increased ADC is seen as hyperintense signal on ADC maps.
ADC (Apparent Diffusion Coefficient), Axial (4:12)

Findings?

Hint:
1. ADC is based upon MRI to measure magnitude of water diffusion within tissue
2. ADC is hypointense where there is no water diffusion
3. Vasogenic is hyperintense whereas cytotoxic edema is hypointense

\[1\]
Findings?

Hypointense signal at left thalamus and posterior limb of internal capsule
Head MRA w/ contrast, axial (32:116)

Findings?
Findings?

0.7 cm, possibly bilobular aneurysm arising from the left posterior cerebral artery, likely at the junction of P2 and P3.
Findings?

Hint:
1. FLAIR is similar to T2 except it suppresses free-moving fluid (CSF).²
Findings?

Hyperintense region in quadrigeminal cistern and at the roof of the fourth ventricle (not shown)
Findings?
Findings?

Left PCA aneurysm at P2/P3 junction. Left vertebral artery shows opacification of the basilar artery and branches. Good retrograde opacification of R vertebral artery.
Bright DWI at left thalamus and posterior limb of internal capsule - suggests acute vs subacute infarct, infection/abscess, or tumor. Cannot differentiate vasogenic vs cytotoxic edema. ADC hypointensity at left thalamus and posterior limb of internal capsule. DWI and ADC results suggest acute ischemic infarct with cytotoxic edema. Head MRA indicates 0.7cm bilobular PCA aneurysm at P2/P3 junction. FLAIR shows evidence of small SAH in quadrigeminal cistern.
IR Cerebral Arteriogram showed left PCA aneurysm.
Underwent coil embolization with VIR for treatment
Leading hypothesis at this point: Small L PCA aneurysm rupture with subsequent vasospasm of L thalamogeniculate branches off PCA. This caused sensory motor stroke – primary sensory symptoms with paresis of same limbs.
VIR Coil Embolization
On presentation, the patient had a focal neurologic deficit:

Angiogram was appropriate after discovering aneurysm.

Could argue MRI C-spine w/o contrast was unnecessary.
Pediatric Ischemic Stroke

- Differential is extensive for this patient but includes: subarachnoid hemorrhage with subsequent vasospasm, polycystic kidney disease, cardiac, vasculitis, connective tissue disorder, fibromuscular dysplasia, hypercoagulable state, infectious, drug use
- Only 0.63-6.4 strokes per 100,000 children per year\(^5\)
**Ischemic Stroke Work-up**

- <4.5 hours, can use Alteplase
- 4.5-24 hours, candidate for only mechanical thrombectomy
- >24 hours, not a candidate for either

- Our patient was not eligible for alteplase from inclusion criteria (<18 years old) and not mechanical thrombectomy from exclusion criteria (aneurysm present, SAH present)
Ischemic Stroke Imaging

- DWI was a sensitive and specific indicator of ischemic stroke in patients presenting within six hours of symptom onset compared to CT or standard MRI\(^6\).

- CT is still preferred for possible hemorrhagic stroke due to time of scan.

- MRI should be used rather than CT only if it does not delay treatment with intravenous alteplase in an eligible patient.
C) Early DWI scan shows right-sided hyperintensity in frontal lobe. D) Hypointensity in same area on ADC map.
### Sensitivity, Specificity, and Radiation

<table>
<thead>
<tr>
<th></th>
<th>DWI (ordered as Brain MRI non-contrast)</th>
<th>CT (non-contrast)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity(^8)</td>
<td>91%</td>
<td>61%</td>
</tr>
<tr>
<td>Specificity(^8)</td>
<td>95%</td>
<td>65%</td>
</tr>
<tr>
<td>Radiation(^9)</td>
<td>0 mSv</td>
<td>2 mSv</td>
</tr>
<tr>
<td>Cost(^10)</td>
<td>$675-$2,975</td>
<td>$304-$1,873</td>
</tr>
</tbody>
</table>
Pediatric ischemic stroke is incredibly rare with a wide differential diagnosis.

- DWI is a more sensitive and specific test compared to CT or standard MRI for ischemic stroke.
- Ischemic stroke is bright on DWI and hypointense on ADC.
- Thus, MRI (DWI) should be used when it does not affect alteplase timing.
References

1) UpToDate: Neuroimaging of acute ischemic stroke [Accessed 15 June 2018].