Acute Ischemic stroke diagnosis

Computerized axial tomography (CAT)

Findings at various times after ischemic stroke

NB: These principles do not apply to small lacunar infarcts, nor to hemorrhagic strokes (ICH). NB: CT is normal in 8–69% of MCA strokes in the first 24 hours [1].

▶ Hyperacute (< 6 hours after stroke). Early signs of infarction involving large areas of the Middle Cerebral Artery Territory correlate with poor outcome [2].

Early findings may include [3]:

1. hyperdense artery sign: low sensitivity, but helpful if present

2. focal low attenuation within the gray matter*

3. loss of the gray-white interface*

4. attenuation of the lentiform nucleus

5. mass effect*

a) early: effacement of the cerebral sulci (often subtle) [4]

b) late: midline shift in large territory infarction

6. loss of the insular ribbon sign (hypodensity involving the insular cortex, susceptible to ischemia due to poor collaterals)

7. enhancement with IV contrast: occurs in only 33%. Stroke becomes isodense (called “masking” effect) or hyperdense with normal brain, and, rarely, may be the only indication of infarction9 *These findings are probably due to increased water content resulting from the following: cellular edema arising from altered cell permeability, which produces a shift of sodium and water from the extracellular to the intracellular compartment, which also increases the extracellular osmotic pressure causing transudation of water from capillaries into the interstitium [5].

▶ 24 hrs. Most strokes can be identified as low density by this time.

▶ 1–2 wks. Strokes are sharply demarcated. In 5–10% there may be a short window (at around day 7–10) where the stroke becomes isodense, called “fogging effect.” IV contrast will usually demonstrate these.

▶ 3 wks. Stroke approaches CSF density.

▶ Mass effect. Common between day 1 to 25. Then atrophy is usually seen by ≈ 5 wks (2 wks at the earliest). Serial CT scans have shown that midline shift increases after ischemic stroke and reaches a maximum 2–4 days after the insult.

▶ Calcifications. Over a long period of time (months to years) ≈ 1–2% of strokes calcify (in adults, it is probably a much smaller fraction than this; and in peds it is higher).

CT

globus pallidus(low density on CT):

CT perfusion

CT perfusion for acute Ischemic stroke diagnosis.

Multiphase CT angiography in acute ischemic stroke

Multiphase CT angiography in acute ischemic stroke.

Diffusion-weighted magnetic resonance imaging (DWI)

Diffusion-weighted magnetic resonance imaging for acute ischemic stroke diagnosis.

Diffusion-weighted imaging in stimulated echo acquisition mode

Compared to standard EPI-DWI, STEAM-DWI offers a more robust alternative for diagnosing subacute strokes in areas affected by susceptibility artifacts [6).].

see Diffusion-weighted imaging in stimulated echo acquisition mode

Arterial spin labeling

Determining the occlusion site and collateral blood flow is important in acute ischemic stroke. The purpose of the current study was to test whether arterial spin labeling (ASL) magnetic resonance imaging (MRI) could be used to identify the occlusion site and collateral perfusion, using digital subtraction angiography (DSA) as a gold standard.

Data from 521 consecutive patients who presented with acute ischemic stroke at our institution from January 2012 to September 2014 were retrospectively reviewed. Image data were included in this study if: (1) the patient presented symptoms of acute ischemic stroke; (2) MRI was performed within 24 h of symptom onset; and (3) DSA following MRI was performed (n = 32 patients). We defined proximal intra-arterial sign (IAS) on ASL as enlarged circular or linear bright hyperintense signal within the occluded artery and distal IAS as enlarged circular or linear bright hyperintense signals within arteries inside or surrounding the affected region. The presence or absence of the proximal IAS and distal IAS were assessed, along with their inter-rater agreement and consistency with the presence of occlusion site and collateral flow on DSA images.

The sensitivity and specificity for identifying occlusion site with ASL were 82.8 and 100%, respectively. Those for identifying collateral flow with ASL were 96.7 and 50%, respectively. The inter-rater reliability was excellent for proximal IAS (κ = 0.92; 95% CI 0.76-1.00) and substantial for distal IAS detection (κ = 0.78; 95% CI 0.38-1.00).

Proximal IAS and distal IAS on ASL imaging can provide important diagnostic clues for the detection of arterial occlusion sites and collateral perfusion in patients with acute ischemic stroke [7].

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