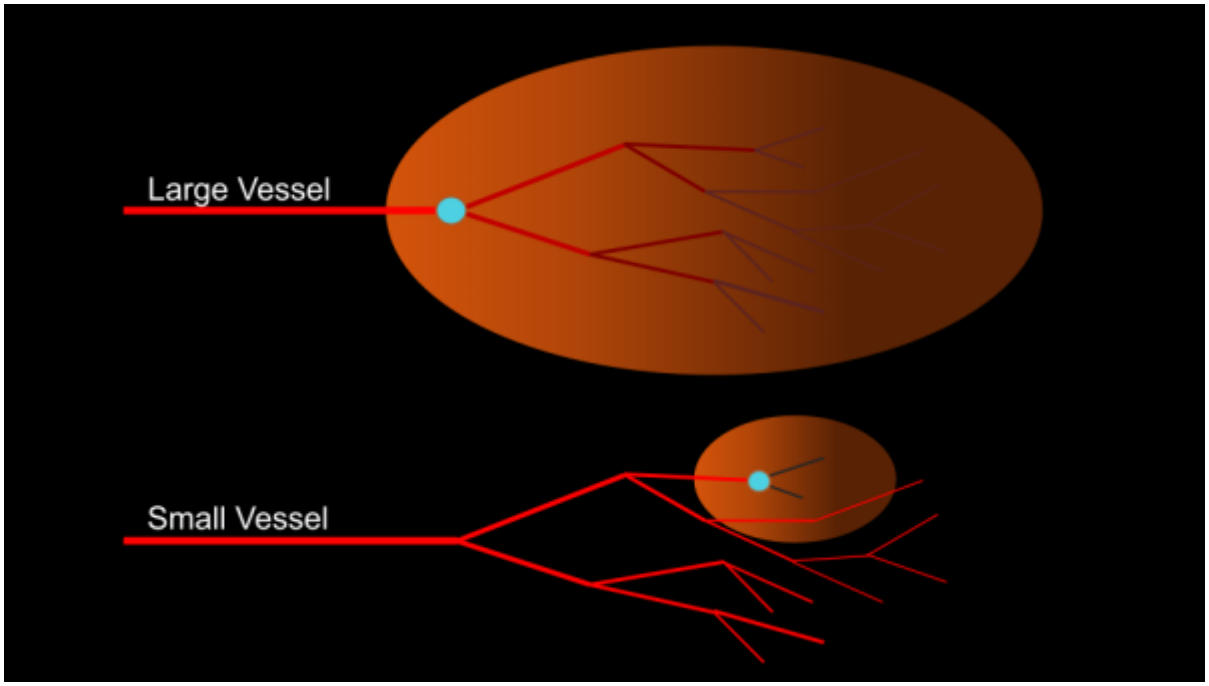
Ischemia

Ischemia

Ischemia is reduced perfusion to an area of tissue due to an occlusion of a vessel. The occlusion of a vessel reduces or prevents downstream cells from getting fresh oxygenated blood resulting in a state of hypoxia. If severe enough, cell death and infarction can occur. Most occlusions are due to a thrombus, embolism, or thromboembolism.

Any area downstream from the occlusion will be affected, so the location and area of effect will be determined by the location of the occlusion. If a proximal/large vessel is occluded, an entire vascular territory may be involved.

Symptoms of ischemia typically present as acute and non-progressive, and will vary depending on the location of the occlusion.



Important Sequences for Identifying Ischemia

Diffusion Weighted Imaging (DWI)

DWI sequences are critical for identifying ischemia, and virtually the only sequence that can directly demonstrate the pathophysiologic changes due to hypoxia. While the mechanisms are not fully understood, when neural tissues experience hypoxia they tend to swell and water tends to move from extracellular to intracellular spaces, reducing the overall free diffusion of water. This physiologic change can be seen with DWI ONLY.

The DWI sequence will produce 3 image series: a b0, b1000, and an Apparent Diffusion Coefficient (ADC) map. The 'b' represents a parameter known as the 'b value' which controls the strength and duration of the diffusion weighting gradients; higher b values means diffusion effects will have a

stronger influence on image contrast.

Most commonly, EPI sequences with relatively long TE's are used to acquire diffusion weighted images; this means that a significant amount of T2 weighting will influence the image contrast. Therefore, any hyperintensity seen on the b0 or b1000 may represent edema, or edema + restricted diffusion. Truly restricted diffusion will appear as DARK on the ADC Map and is the only way to ensure that the hyperintensity is not just due to edema.

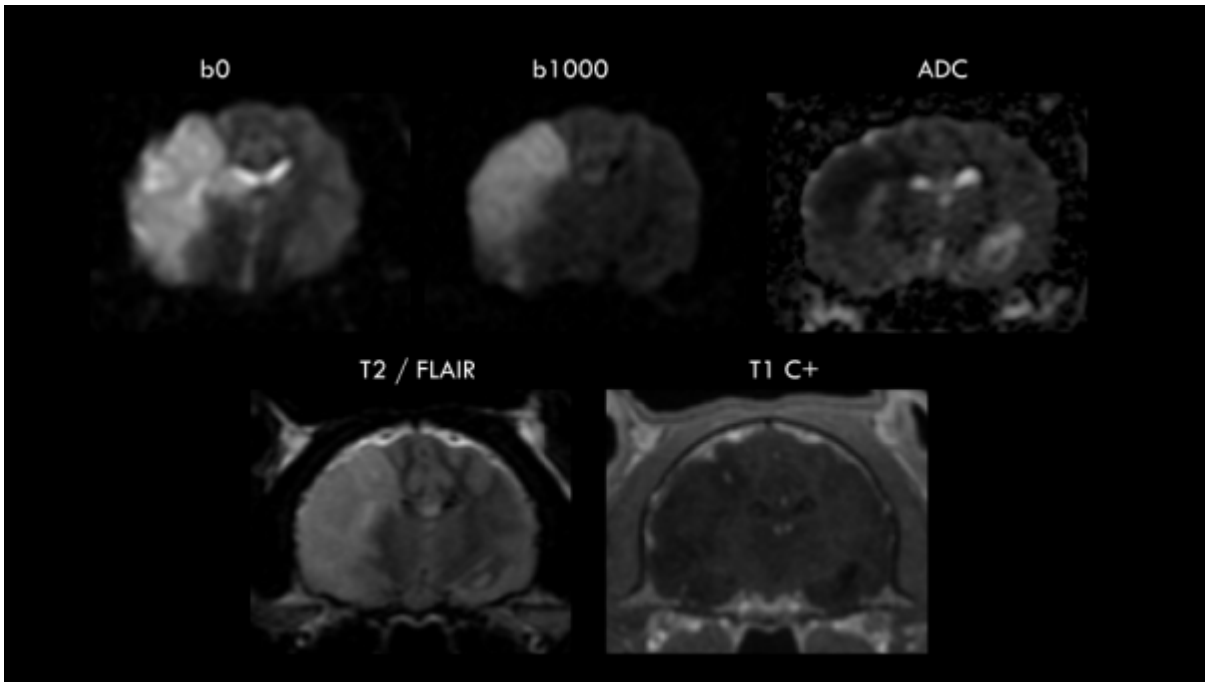
True ischemia will have this imaging relationship: BRIGHT b1000 and DARK ADC

Case Examples

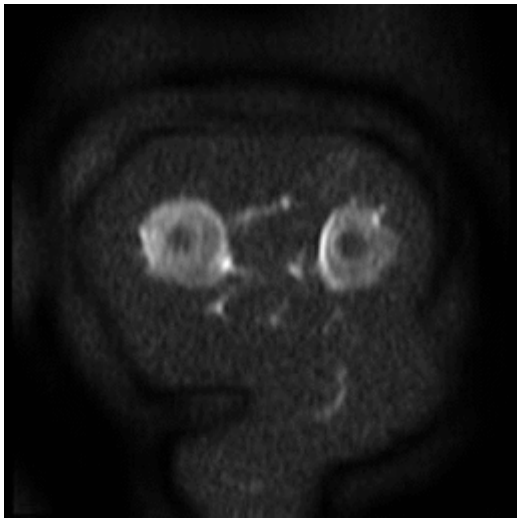
Ischemia has a few characteristics, aside from it's appearance on DWI's:

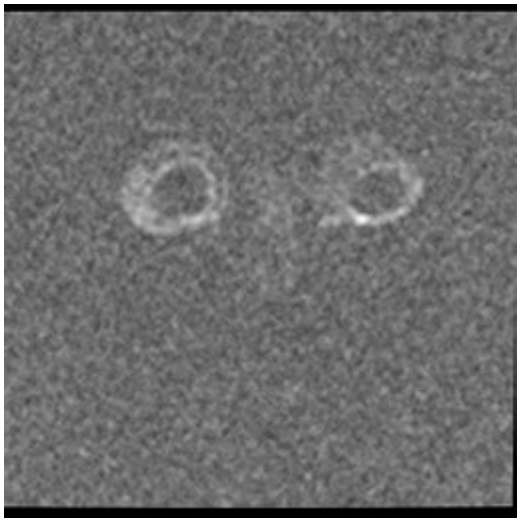
- Sharp margins of affected areas
- Corresponds to known vascular territory
- Edema on T2 and T2 FLAIR
- If severe, T1 hypointensity, especially T1 GREs

MCA Ischemia



Another MCA Ischemia





Lacunar Infarct aka Small Vessel Ischemia