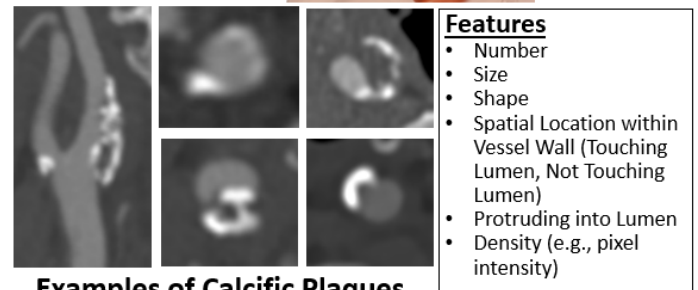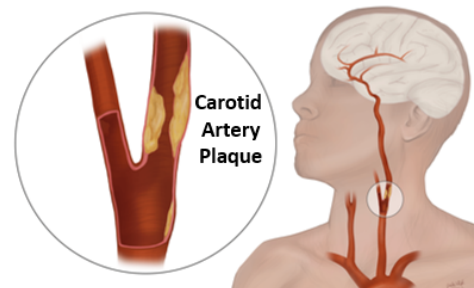# Phenotyping Carotid Artery Calcific Atherosclerotic Plaque

Team Description: We are an interdisciplinary research group passionate about taking care of patients with stroke. Using noninvasive diagnostic neuroimaging exams such as computed tomographic angiography (CTA) to image the blood vessels, we identify patients with diseased vessels with atherosclerotic plaque. Our core team includes neuroradiologists, vascular neurologists, and vascular surgeons at the University of Pennsylvania.

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Vascular Surgery

Project Description:

First, calculate morphologic features of atherosclerotic calcifications in the carotid artery. Specific morphologic features of interest include: size (e.g., volume measurements, maximum transverse and sagittal measurements), number of discrete calcifications, density (e.g., pixel signal intensity), and spatial information relative to the carotid artery vessel wall. Second, train machine learning classifiers to identify plaque in CTA scans using manual labels as training data and, if possible, identify symptomatic vs. asymptomatic plaque.

Carotid Artery Plaque

Features
- Number
- Size
- Shape
- Spatial Location within Vessel Wall (Touching Lumen, Not Touching Lumen)
- Protruding into Lumen
- Density (e.g., pixel intensity)

Examples of Calcific Plaques

Clinical Significance:

Carotid atherosclerotic plaque in the neck is a common cause of ischemic stroke in the brain. Atherosclerosis is the deposition of inflamed fat in the vessel walls that lead to hardening of the arteries. Hardened arteries with inflammation can lead to unstable plaque, which can break into pieces and travel and obstruct blood vessels in the brain and cause a stroke. Understanding features of plaque that lead to instability are therefore absolutely critical for doctors to identify patients at risk for stroke.

Calcific plaque is fascinating as it may have dual roles in both plaque stability and instability. This project will involve a characterizing qualitative and quantitative morphologic features of calcific plaque.

Keywords: Atherosclerosis, Calcifications, Stroke

Reading Reference:

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2. Shi X et al. Calcification in Atherosclerotic Plaque Vulnerability: Friend or Foe? Frontiers in Physiology. 2020. PMID 32116766

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