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CEREBRAL AMYLOID ANGIOPATHY

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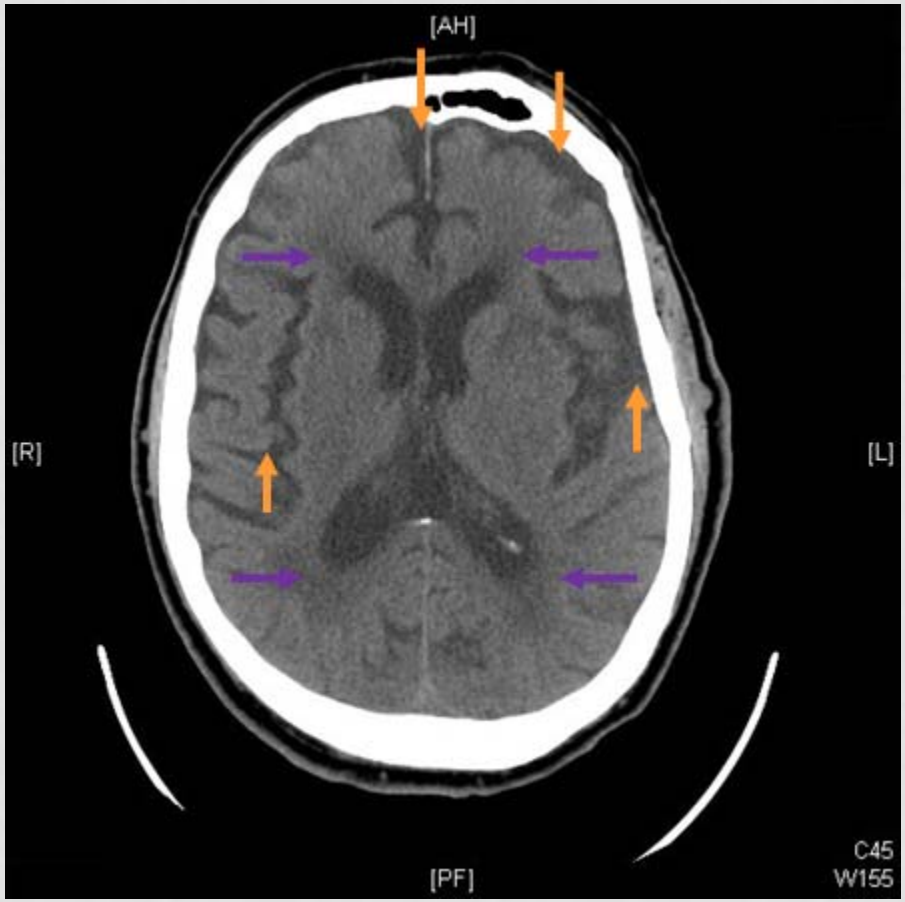
AGENDA

- Patient presentation
- Initial imaging
- Cerebral amyloid angiopathy
  - Clinical presentation
  - Histology
  - Boston Criteria
  - Imaging modalities, imaging findings
  - Management
- Patient follow-up
- Summary

OUR PATIENT: CLINICAL PRESENTATION

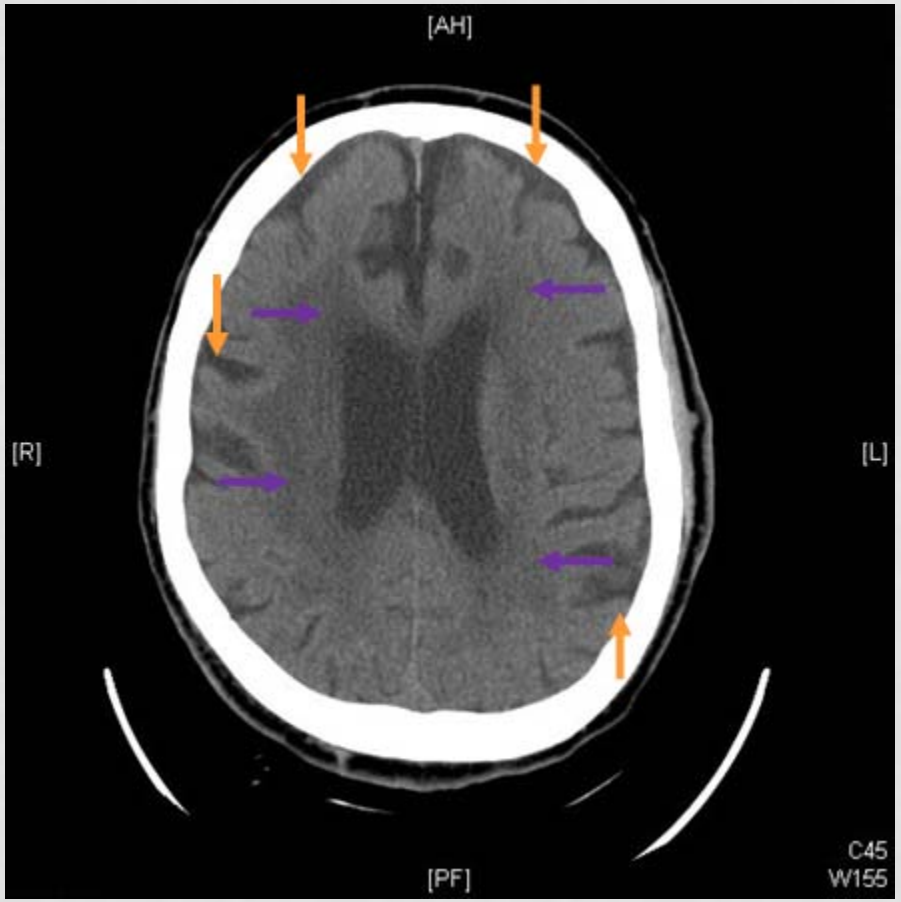
- **86 yo M** with HTN, A fib who presents after being **found down and unresponsive at home while watching TV**. Also with **urinary incontinence**, **blood in his oropharynx**, and **altered mental status**.
- No history of stroke, trauma, infections, seizures, masses, fevers / chills, no prior neurologic deficits.
- Exam: sedated, intubated, withdraws to pain in all extremities. Difficult exam.
- **What is the differential? What imaging modalities are indicated?**

OUR PATIENT: HEAD CT WITHOUT CONTRAST (1 OF 2)



C- Axial head CT

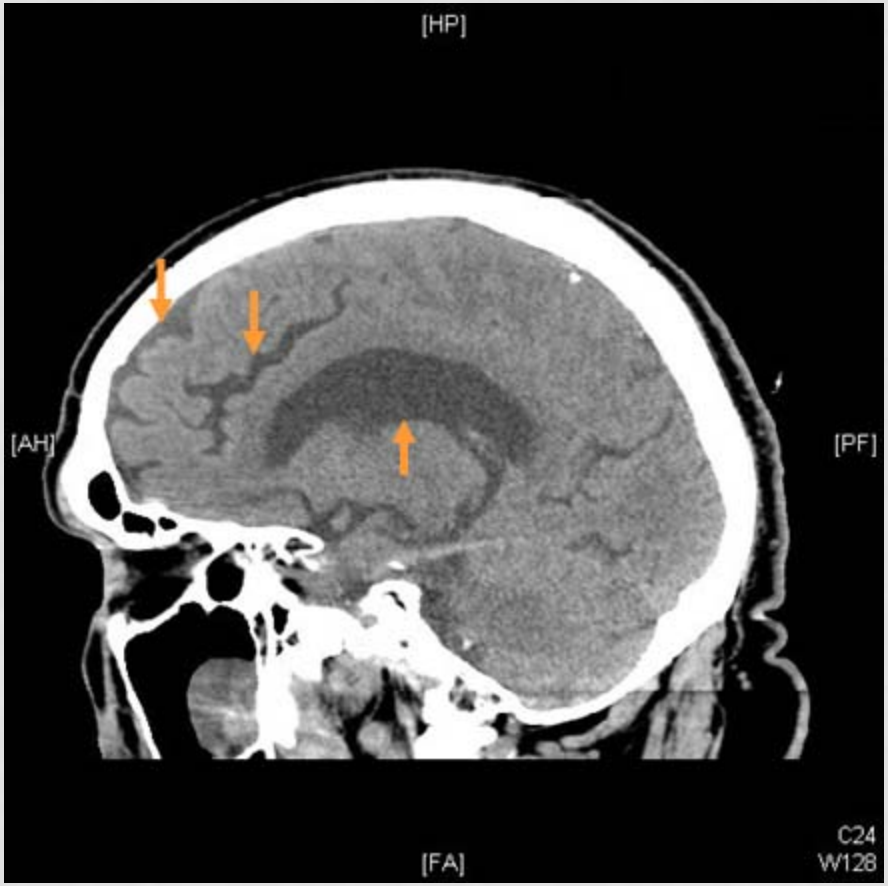
Age-related atrophy



C- Axial head CT

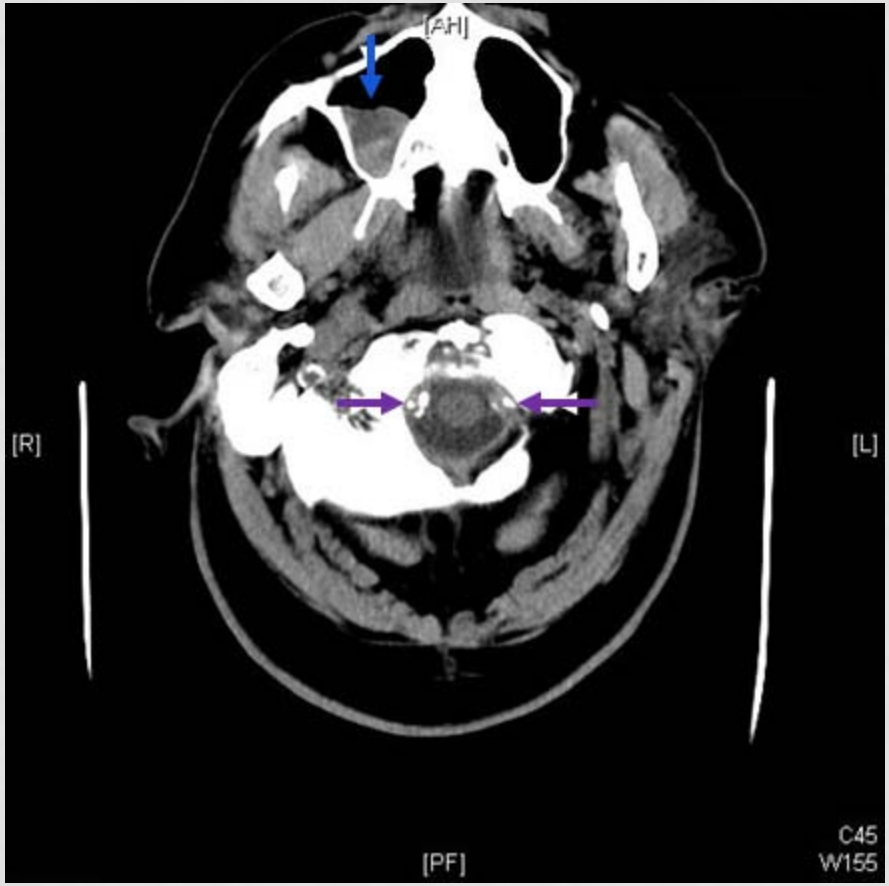
Periventricular white matter hypodensities

OUR PATIENT: HEAD CT WITHOUT CONTRAST (2 OF 2)



C- Sagittal head CT

Age-related atrophy



C- Axial head CT

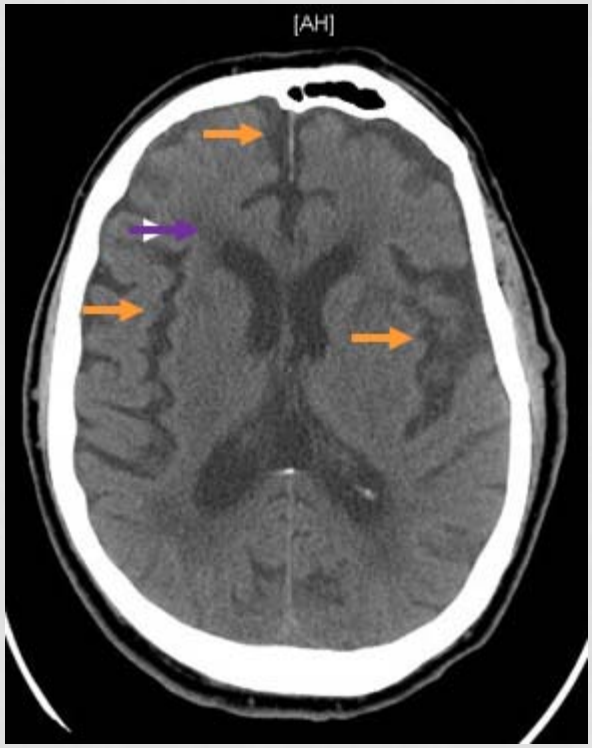
Vertebral artery calcifications

Sinus opacifications

OUR PATIENT: INTERVAL SUMMARY

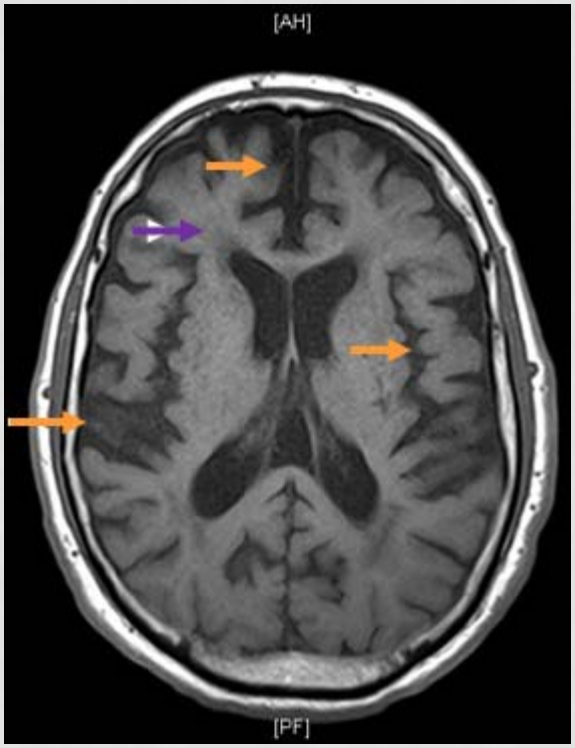
- Head CT: no acute process, extensive chronic periventricular ischemic changes, age-related atrophy.
- EEG: diffusely slow changes (non-specifc encephalopathy), no epileptiform changes.
- The patient became more alert but was still confused. Antiepileptic medications were not given.
- What's the next step in (radiologic) diagnosis?

OUR PATIENT: AXIAL HEAD MRI (FLAIR AND GRE)



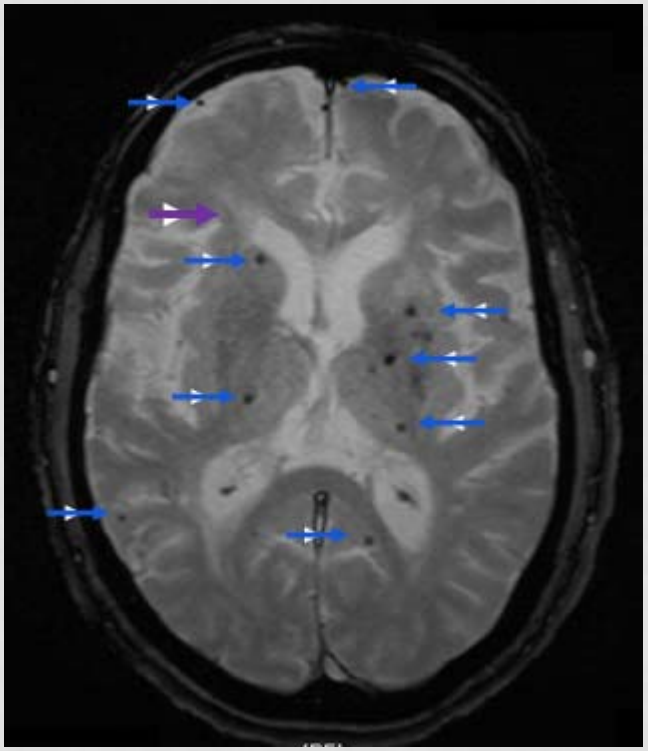
C- Axial CT (comparison)

Diffuse atrophic changes



Axial MRI FLAIR

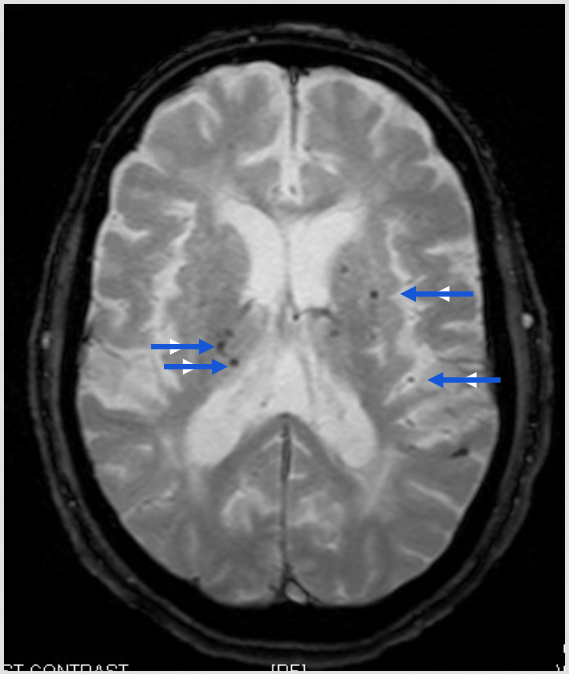
Periventricular ischemic changes (hypodensities on CT, hyperintensities on GRE)

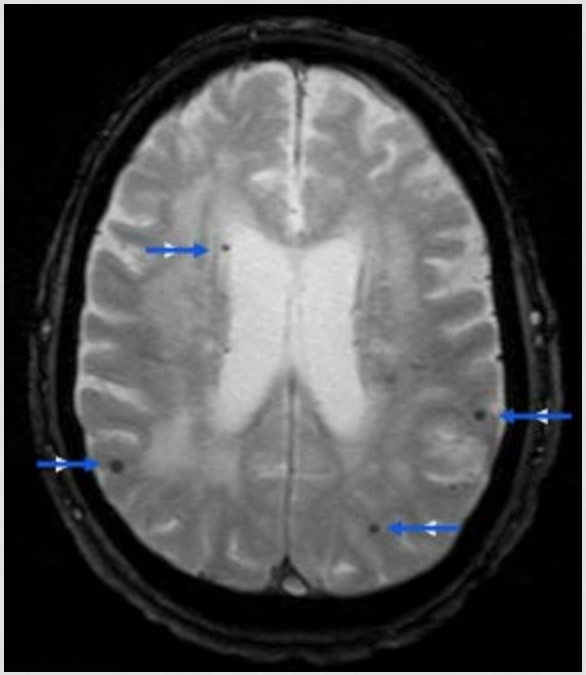


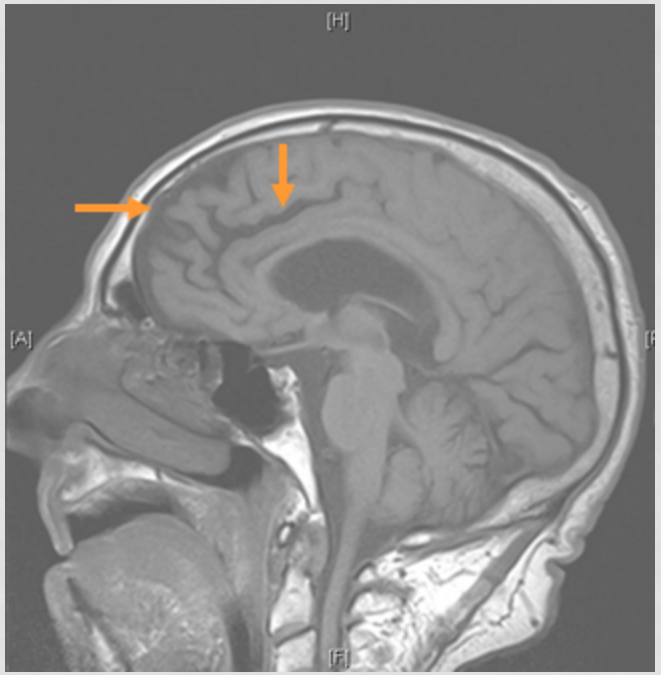
Axial MRI Gradient Echo (GRE)

Punctate abnormalities in Cerebral Amyloid Angiopathy

OUR PATIENT: GRE MRI DEMONSTRATES CAA







MRI Gradient Echo (GRE)

Punctate abnormalities in cortical-subcortical locations consistent with CAA

Sagittal T1

Diffuse atrophic changes

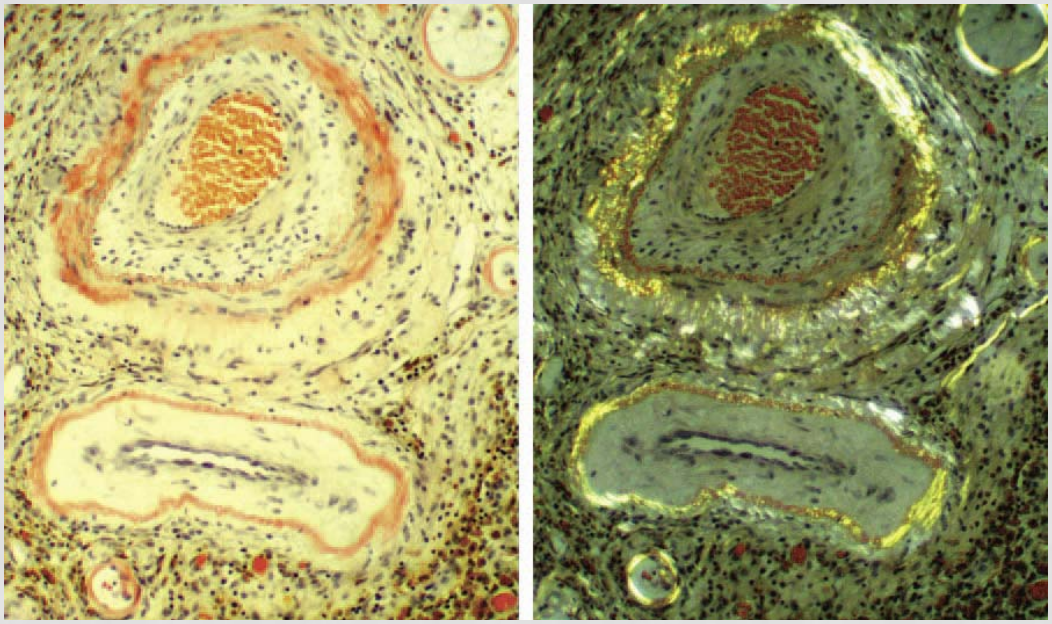
CAA: CLINICAL PRESENTATION AND PATHOPHYSIOLOGY

- Pathophysiology: deposition of **β-amyloid** protein in **small and medium sized vessels** of cerebral cortex and subcortex that predispose vessels to repeated leakage. Associated with **APO-E2/E4 genotypes.**
- Prevalence: 33% in 60-70 yo, 75% in > 90yo.
- Presentation (nonspecific):
  - Sudden neurologic deficit from **acute ICH** without HTN.
  - **TIA**, smooth spread from one body part to another
  - Slowly progressive **Dementia** (presents before ICH in 25-40%).
- Associations: 90% of Alzheimer's pts have CAA at autopsy. *Not related to systemic amyloidosis.*

CAA: HISTOLOGIC FINDINGS

Photomicrograph:

- Left: congo red stain shows **β-amyloid deposition** in cerebral cortical vessels.
- Right: polarized light shows classic **yellow-green birefringence** of the β-amyloid deposits.



Chao C et al. Cerebral Amyloid Angiopathy: CT and MR Imaging Findings. Radiographs 2006; 26, 1517-1531

CAA: THE BOSTON DIAGNOSTIC CRITERIA

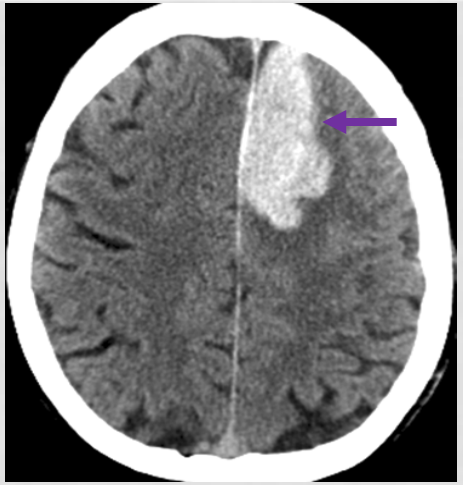
- Categorization developed in 1990s to standardize diagnosis of CAA related hemorrhage (**lobar / cortical / corticosubcortical pattern**)

1. Definite CAA
   - **Post-mortem** demonstration of severe CAA with vasculopathy.
2. Probable CAA with supporting pathology
   - **Some CAA on biopsy specimen** (hematoma evacuation).
3. Probable CAA
   - **Multiple hemorrhages**. Age > 55. Absence of other causes.
4. Possible CAA
   - **Single hemorrhage.** Age > 55. Absence of other causes.

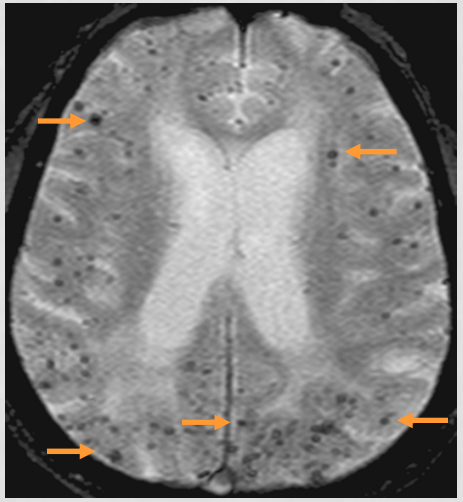
- Knudsen et al. showed that 100% of "probably CAA" and 62% of "possible CAA" cases demonstrate CAA on pathology.

CAA: IMAGING MODALITIES COMPANION PATIENTS #1 & #2

- Acute neurologic deficit:
  - Initial modality is **head CT without contrast** for possible **intracranial hemorrhage in cortical-subcortical regions**.

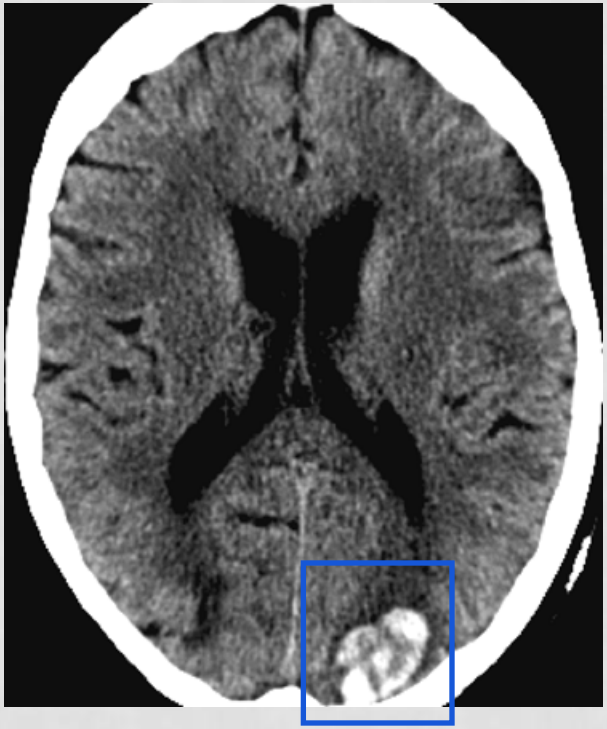


- If ICH is in cortical-subcortical region, or presentation includes dementia:
  - **MRI with gradient-echo (GRE) sequence** is most sensitive for hemosiderin from **chronic microhemorrhages in CAA**.

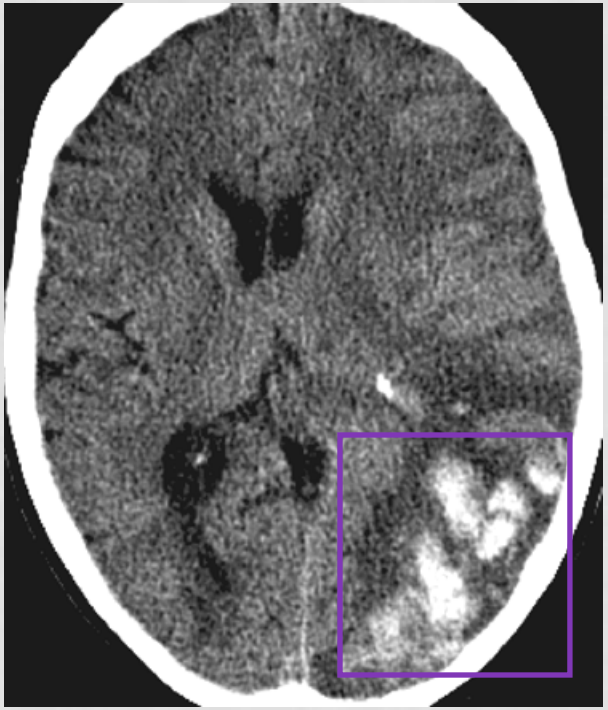


Images courtesy of Chao C et al. Cerebral Amyloid Angiopathy. Radiographs 2006; 26, 1517-1531

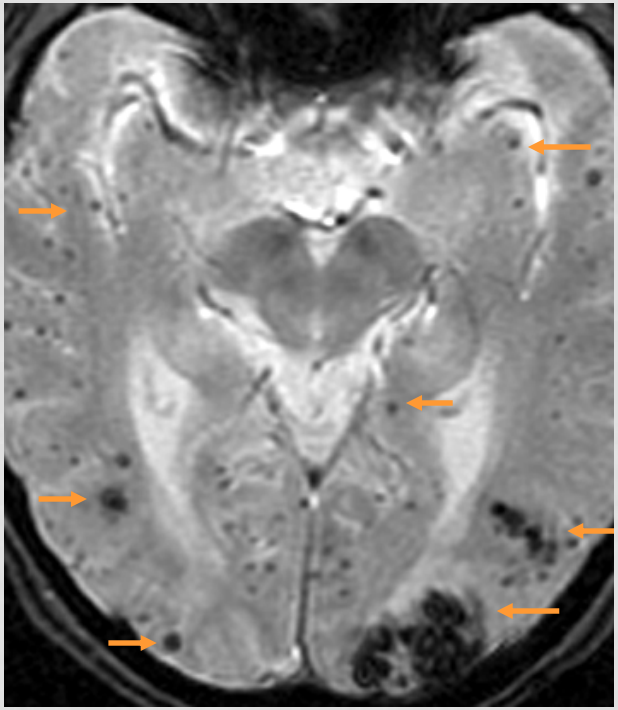
CAA: RADIOLOGIC FINDINGS COMPANION PATIENT #3



C- Axial head CT
Lobar cortical-subcortical hemorrhage



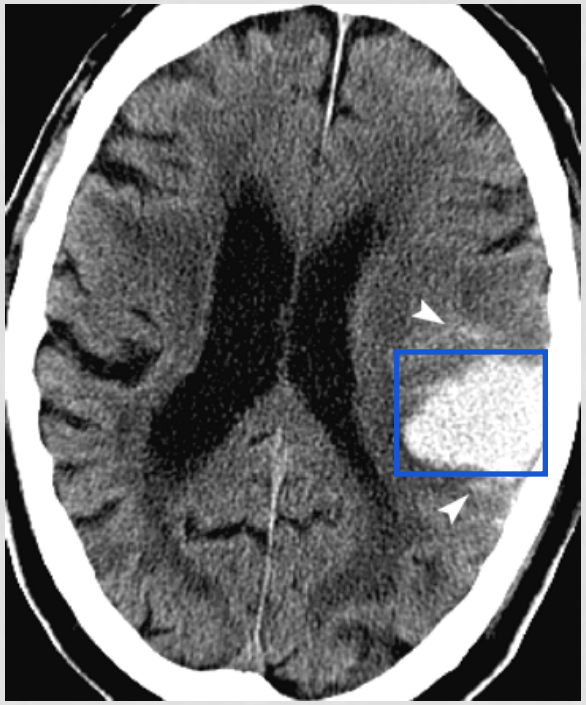
C- axial head CT
Multiple, recurrent sites of hemorrhage



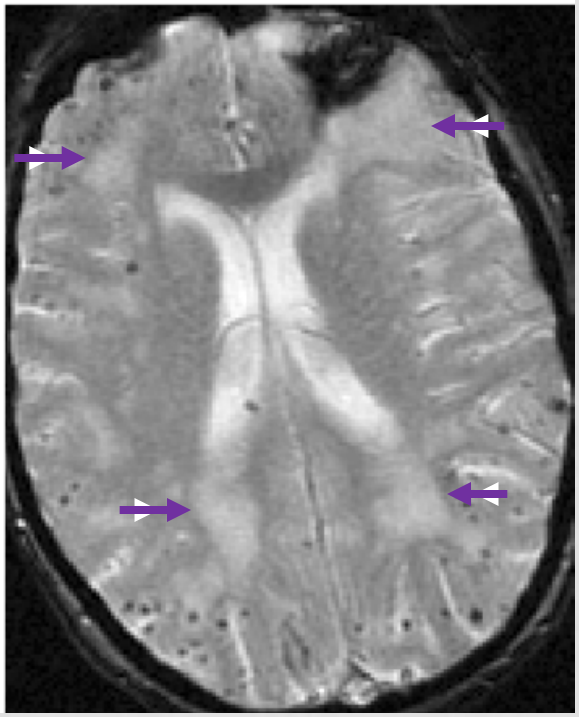
Axial GRE MRI
Many punctate microhemorrhages

Images courtesy of Chao C et al. Cerebral Amyloid Angiopathy. Radiographs 2006; 26, 1517-1531

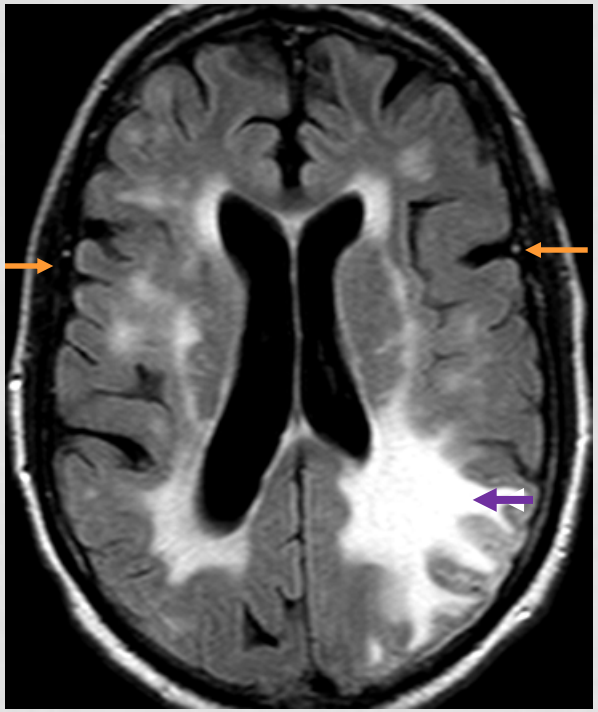
CAA: RADIOLOGIC FINDINGS COMPANION PATIENTS #4 - #6



C- axial head CT
Macrohemorrhage (with subarachnoid hemorrhage)



Axial GRE MRI
Leukoencephalopathy



Axial FLAIR MRI
Cortical atrophy

Images courtesy of Chao C et al. Cerebral Amyloid Angiopathy. Radiographs 2006; 26, 1517-1531

CAA: MEDICAL AND SURGICAL MANAGEMENT

- **Medical management**: prevent recurrence / progressive dementia. No therapies for stopping / reversing β-amyloid deposition.
  - Consider discontinuing anticoagulation / antiplatelets.
  - Control blood pressure
  - Avoid statins (atorvastatin increases risk for CAA)
  - Immunosuppressive agents for inflammatory CAA.

- **Surgical management**: resection of hematoma for ICH in patients < 75yo, non-parietal lobe ICH, and without associated intraventricular hemorrhage.

OUR PATIENT: FOLLOW-UP

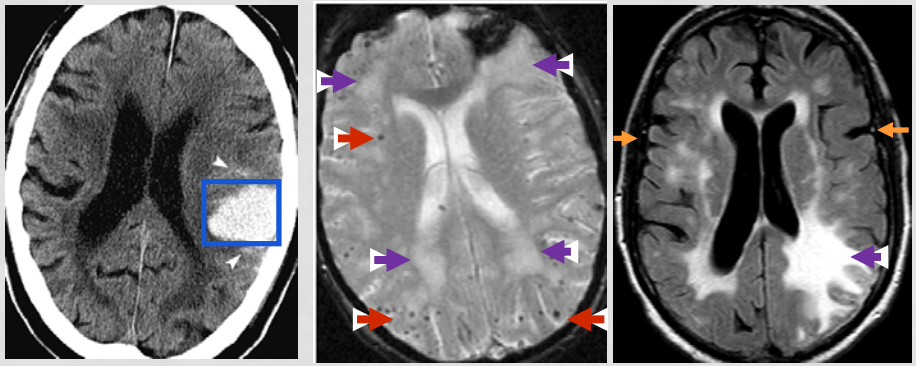
- Diagnosis: unprovoked seizure, multifactorial in the context of CAA, diffuse atrophy, and microangiopathic changes.

- Hospital course: He was extubated on hospital day 2, with improving mental status, and treated for aspiration pneumonia. He was alert and sometimes confused, and was discharged on hospital day 5 without antiepileptic medications.

- Follow-up: Instructed to not drive for 6 months, and to follow-up with PCP and neurologist.

CAA: SUMMARY

- Presentation: TIA / dementia / mental status changes in elderly (> 60), spontaneous ICH without history of HTN. Associated with Alzheimer's.
- Radiologic studies: **head CT**, **MRI** with and without contrast (especially **GRE**).
- Radiologic findings: multiple, lobar hemorrhages at cortical-subcortical interface, microhemorrhages on GRE, atrophy, leukoencephalopathy.



Images courtesy of Chao C et al. Cerebral Amyloid Angiopathy. Radiographs 2006; 26, 1517-1531

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