НЕТРАВМАТИЧЕСКИЕ ВНУТРИЧЕРЕПНЫЕ КРОВОИЗЛИЯНИЯ

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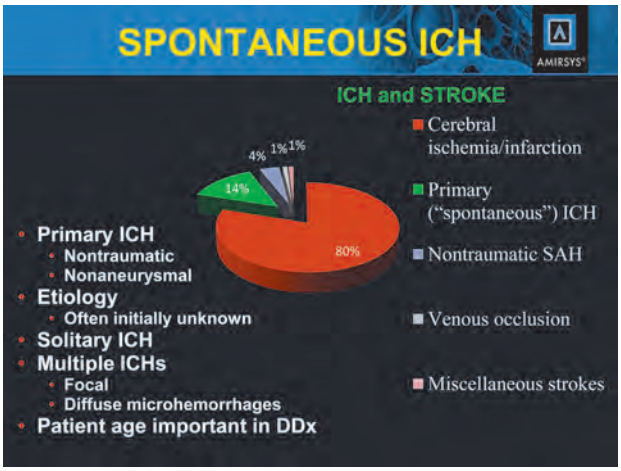
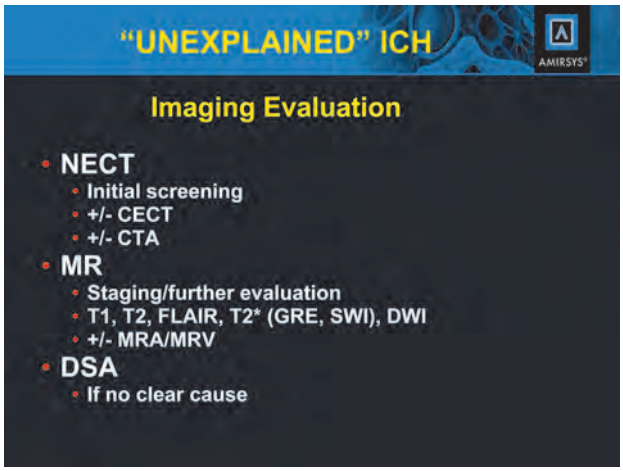
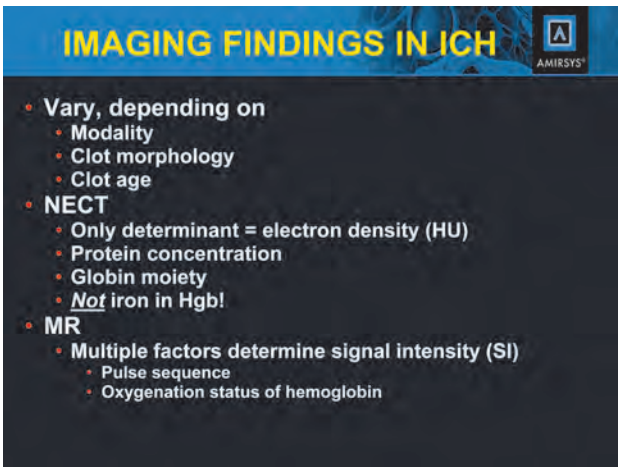
Университет штата Юта, США

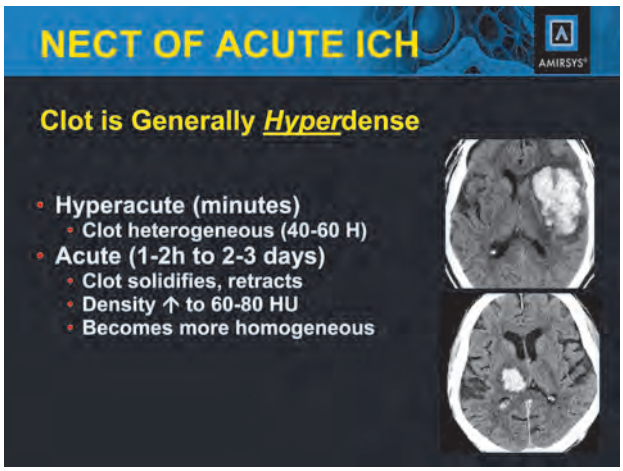
UNDERSTANDING NONTRAUMATIC INTRACRANIAL HEMORRHAGE

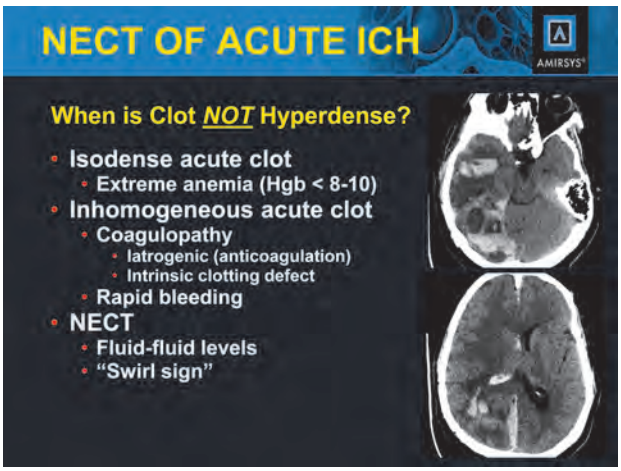
Anne G. Osborn
Universsity of Utah, USA

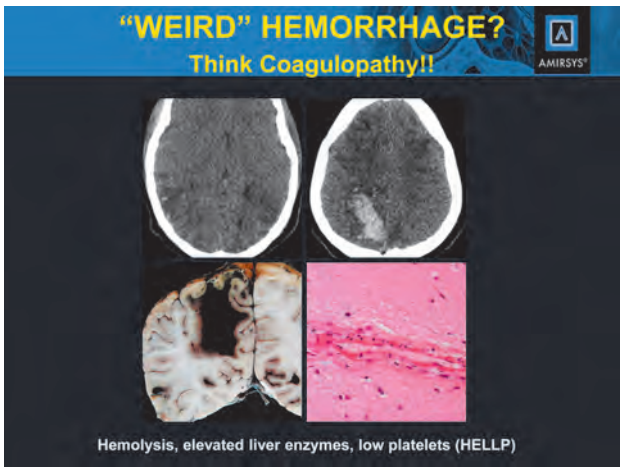








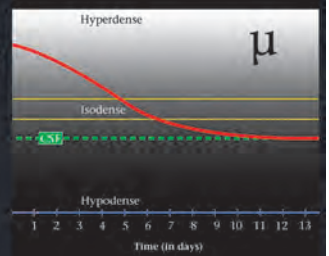




NECT OF EVOLVING ICH

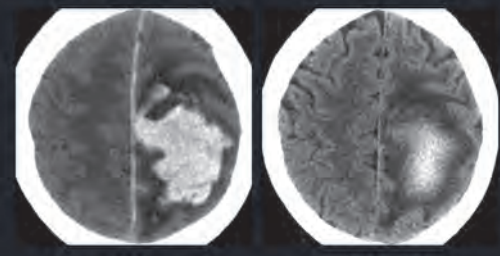
Time vs. Density (Relative to Gray Matter)

- Subacute ICH (3-10d)
  - Progressive ↓ density
  - Decreases 1.5H/day
- Becomes isodense
  - 7-10 days



NECT OF SUBACUTE ICH

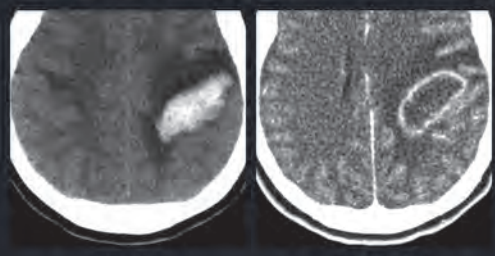
Density Gradually Decreases (Outside/In)



Initial 10 days later

CECT OF SUBACUTE ICH

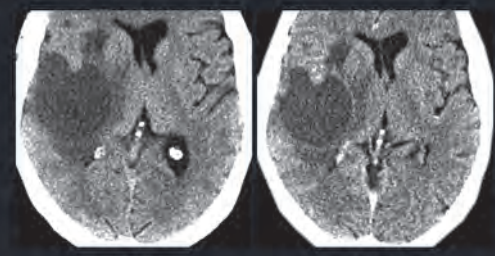
Ring Enhancement



Acute 10 days later

NECT OF CHRONIC ICH

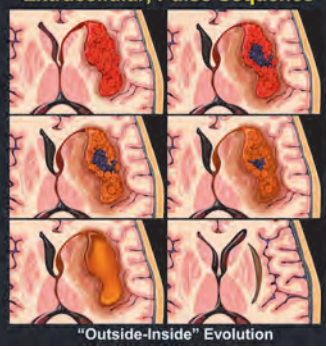
Generally Hypodense After 10days-2 Weeks



NECT CECT

MR OF ICH

Clot Age, Oxygenation Status of Hgb, Intra vs. Extracellular, Pulse Sequence



"Outside-Inside" Evolution

HEMOGLOBIN vs. S.I.

HEMOGLOBIN

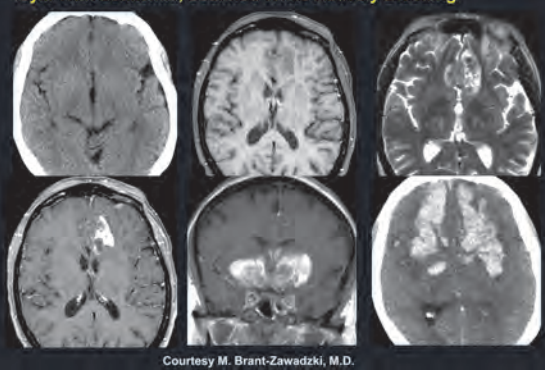
- Hyperacute (minutes to few hours)
  - Oxyhemoglobin
- Acute (6h-3days)
  - Deoxyhemoglobin
- Early subacute (3-7 days)
  - DeoxyHgb center
  - Intracellular metHgb rim
- Late subacute/early chronic (week)
  - Intracellular metHgb
- Late chronic (weeks to months)
  - Extracellular metHgb

SIGNAL INTENSITY

- Hyperacute
  - T1 ≅; T2 inhomogeneously ↑
- Acute
  - T1 iso/mildly hypo; T2 ↓↓
- Early subacute
  - T1 ≅ center, ↑ rim
  - T2 hypointensity decreases
- Late subacute/early chronic
  - Both T1, T2
- Late chronic
  - T1 iso/hypo, T2 hyper
  - Hypointense rim

MR OF EXTREMELY HYPERACUTE ICH

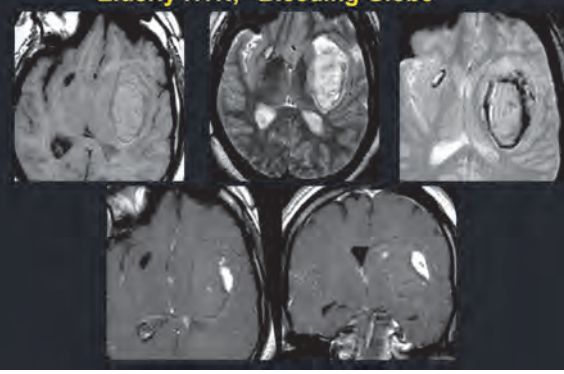
15yM With Leukemia, Scanned While Actively Bleeding

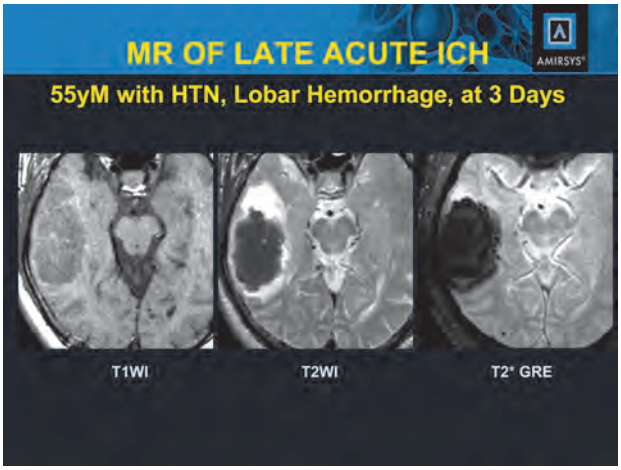


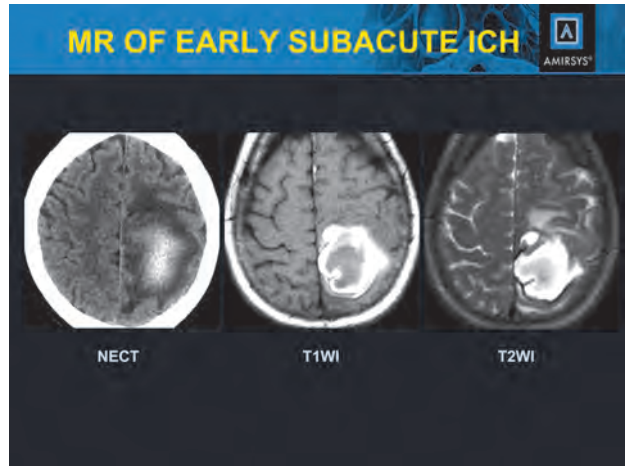
Courtesy M. Brant-Zawadzki, M.D.

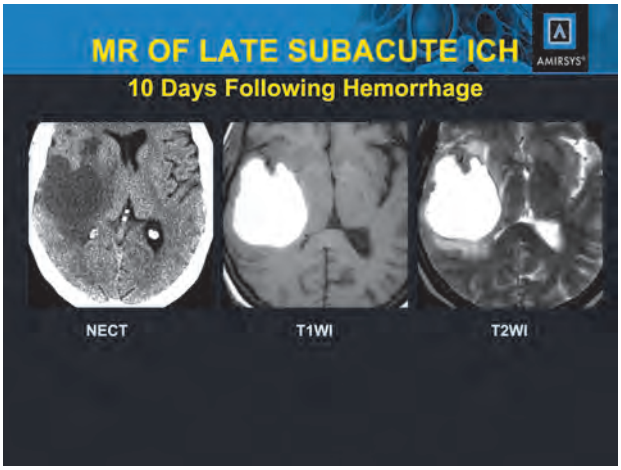
MR OF HYPERACUTE ICH

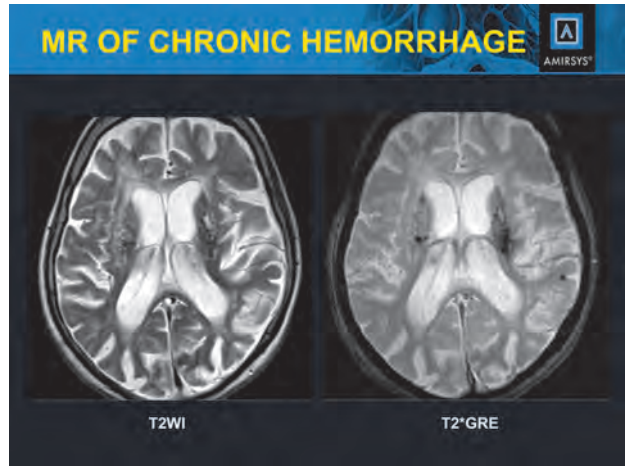
Elderly HTN, "Bleeding Globe"

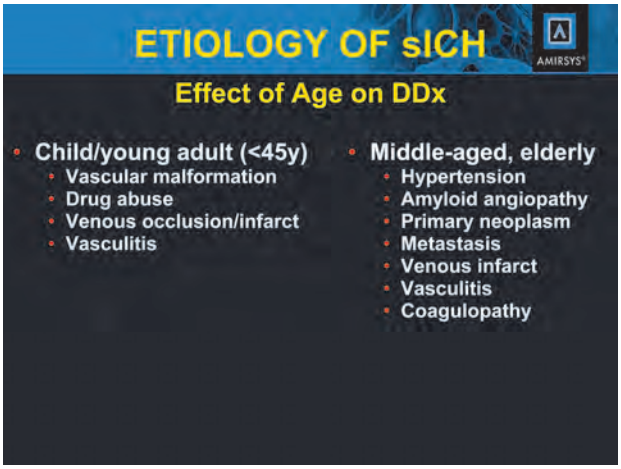


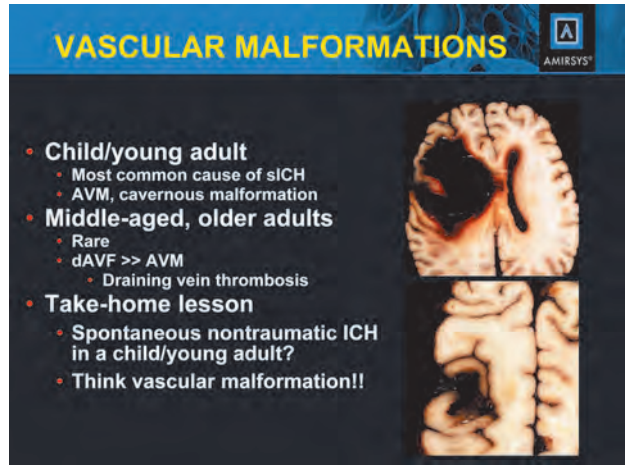

MR OF LATE ACUTE ICH
55yM with HTN, Lobar Hemorrhage, at 3 Days
T1WI
T2WI
T2* GRE

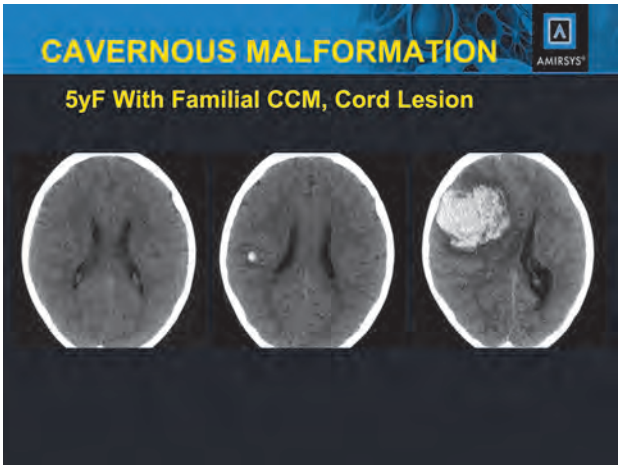

MR OF EARLY SUBACUTE ICH
NECT
T1WI
T2WI

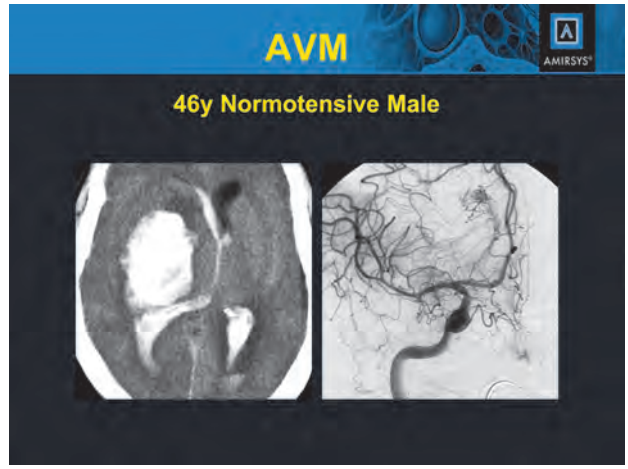

MR OF LATE SUBACUTE ICH
10 Days Following Hemorrhage
NECT
T1WI
T2WI


MR OF CHRONIC HEMORRHAGE
T2WI
T2*GRE


ETIOLOGY OF sICH
Effect of Age on DDx
Child/young adult (<45y)
Vascular malformation
Drug abuse
Venous occlusion/infarct
Vasculitis
Middle-aged, elderly
Hypertension
Amyloid angiopathy
Primary neoplasm
Metastasis
Venous infarct
Vasculitis
Coagulopathy

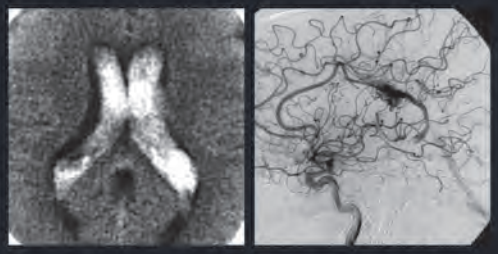

VASCULAR MALFORMATIONS
Child/young adult
Most common cause of sICH
AVM, cavernous malformation
Middle-aged, older adults
Rare
dAVF >> AVM
Draining vein thrombosis
Take-home lesson
Spontaneous nontraumatic ICH in a child/young adult?
Think vascular malformation!!


CAVERNOUS MALFORMATION
5yF With Familial CCM, Cord Lesion


AVM
46y Normotensive Male

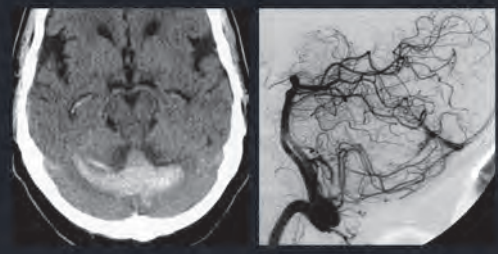
AVM

36yM, Sudden Severe H/A



dAVF

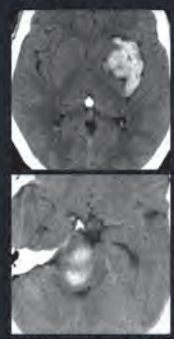
76yM, Normotensive



DRUG ABUSE

- Teenagers, young adults
  - 2nd most common cause of ICH
  - Cocaine
    - Causes extreme HTN
  - Methanol
    - Causes BG necrosis
- Take-home message
  - Unexplained ICH in young patients?
  - Do drug screen!

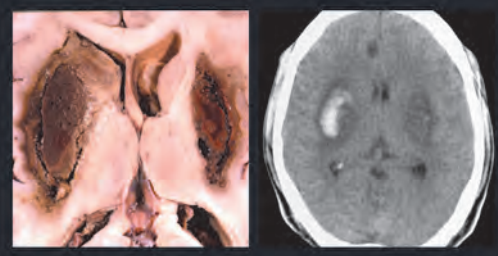
24y M, Cocaine O/D



26yM, Cocaine, 260/120

DRUG ABUSE

Methanol, BG Hemorrhagic Necrosis



VENOUS OCCLUSION

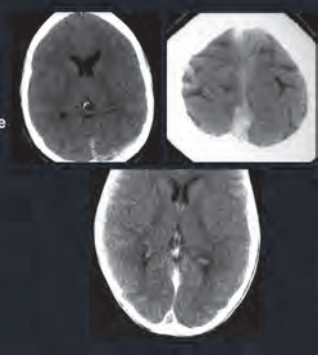
- 1% of "strokes"
- Clinical dx often difficult, elusive
  - Variable clinical presentation
  - Common: H/A, nausea, ↓ MS
- Early imaging findings often subtle
- Etiology
  - Genetic (resistance to activated protein C)
  - Trauma, infection/inflammation
  - Pregnancy, oral contraceptives
  - Metabolic (dehydration, thyrotoxocosis, etc)
  - Coagulopathy
  - Collagen-vascular, vasculitis (APLA, Behcet)

DURAL SINUS OCCLUSION: Pathology

- Dural sinus +/- cortical veins
  - SSS>TS>SS>CS
- Adjacent cortex
  - Edema
  - Early hemorrhage
- ≅ 50% progress to frank venous infarct

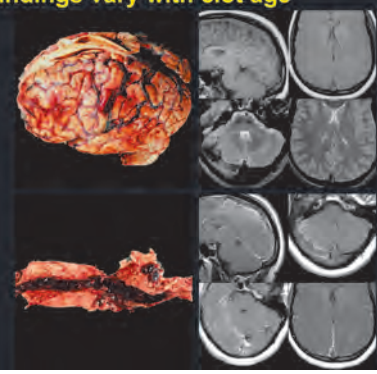
CT OF DURAL SINUS OCCLUSION

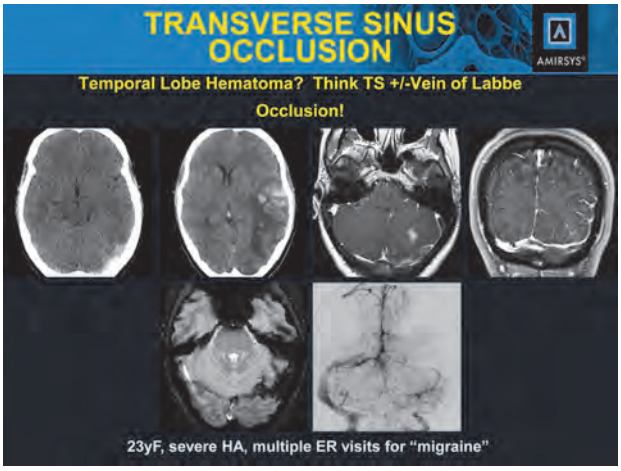
- NECT
  - Hyperdense dural sinus
  - Hyperdense vein ("cord sign")
  - Cortical/subcortical hemorrhage
  - Variable edema
- CECT
  - "Empty delta" sign
  - "Shaggy" falx or tentorium
  - Irregular veins

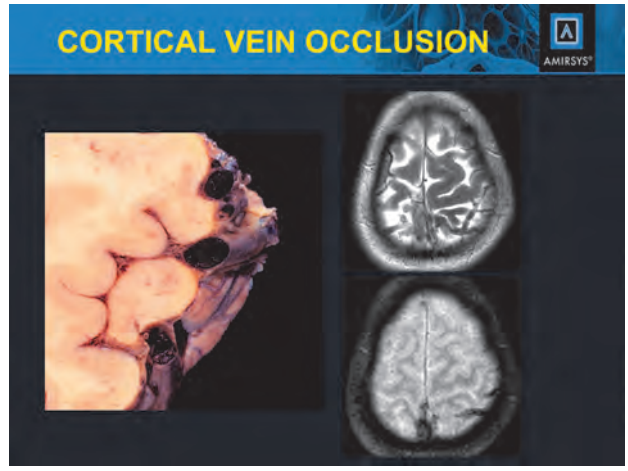


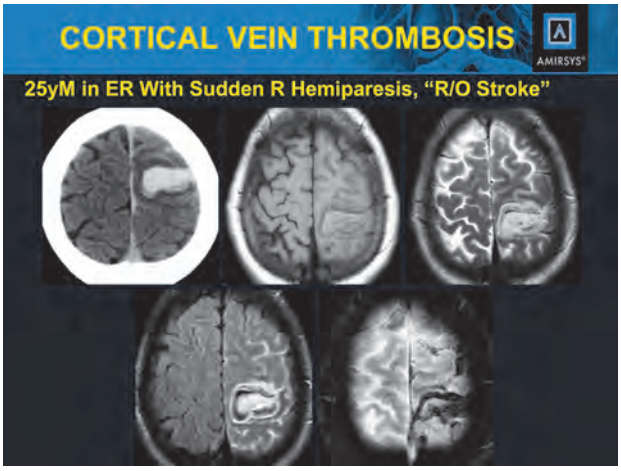
MR OF DURAL SINUS OCCLUSION

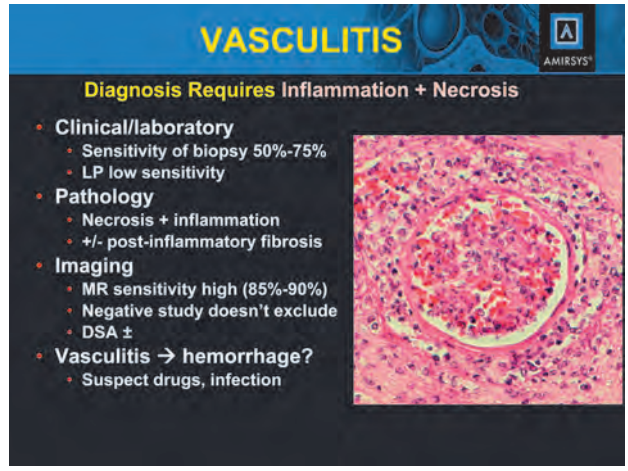
Findings vary with clot age

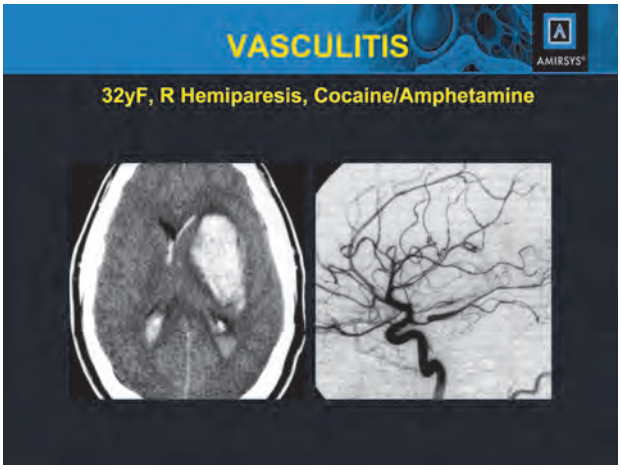


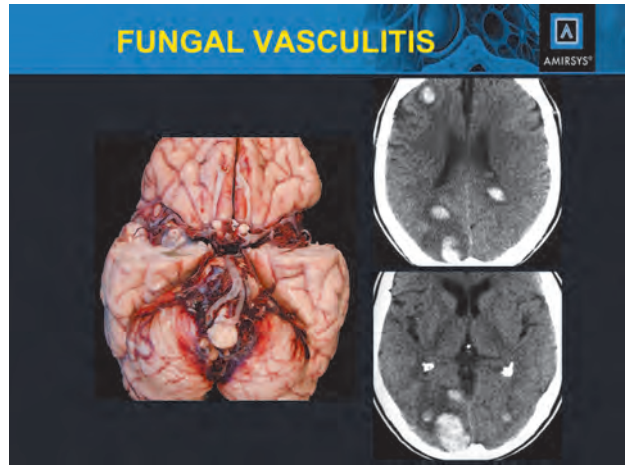

TRANSVERSE SINUS OCCLUSION
AMIRSYS
Temporal Lobe Hematoma? Think TS +/-Vein of Labbe Occlusion!
23yF, severe HA, multiple ER visits for "migraine"

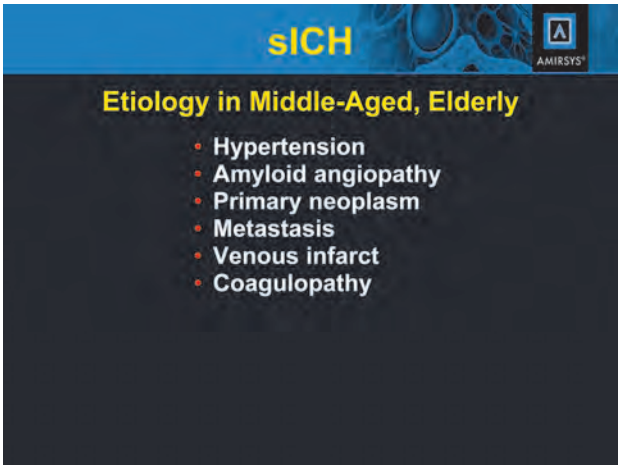

CORTICAL VEIN OCCLUSION
AMIRSYS

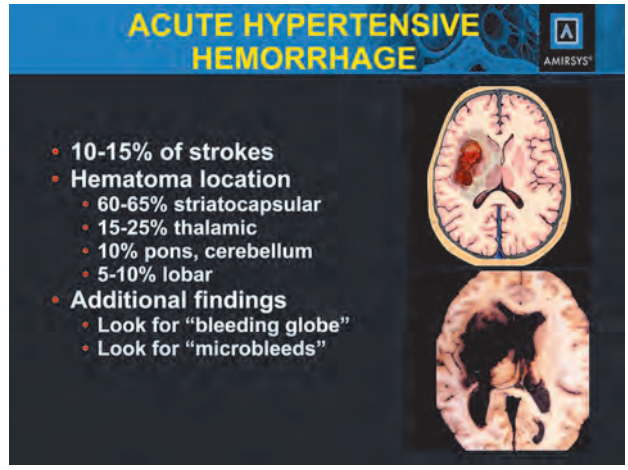

CORTICAL VEIN THROMBOSIS
AMIRSYS
25yM in ER With Sudden R Hemiparesis, "R/O Stroke"

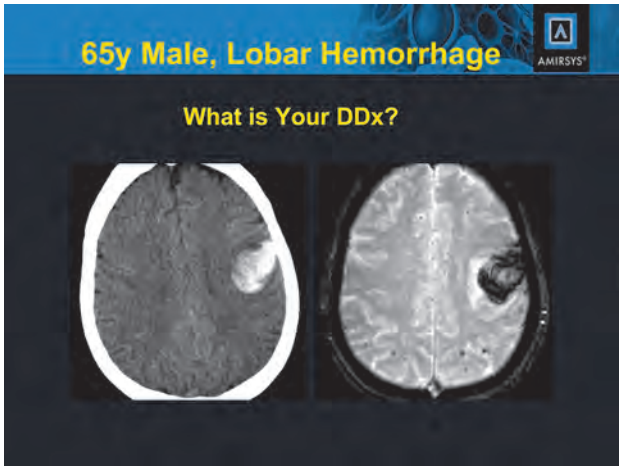

VASCULITIS
AMIRSYS
Diagnosis Requires Inflammation + Necrosis
Clinical/laboratory
Sensitivity of biopsy 50%-75%
LP low sensitivity
Pathology
Necrosis + inflammation
+/- post-inflammatory fibrosis
Imaging
MR sensitivity high (85%-90%)
Negative study doesn't exclude
DSA ±
Vasculitis → hemorrhage?
Suspect drugs, infection

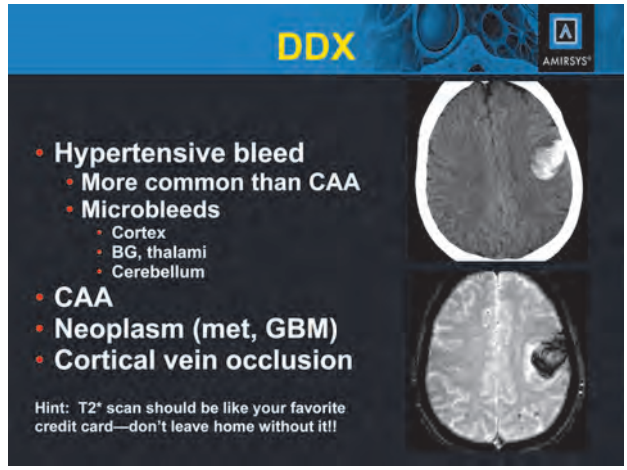

VASCULITIS
AMIRSYS
32yF, R Hemiparesis, Cocaine/Amphetamine

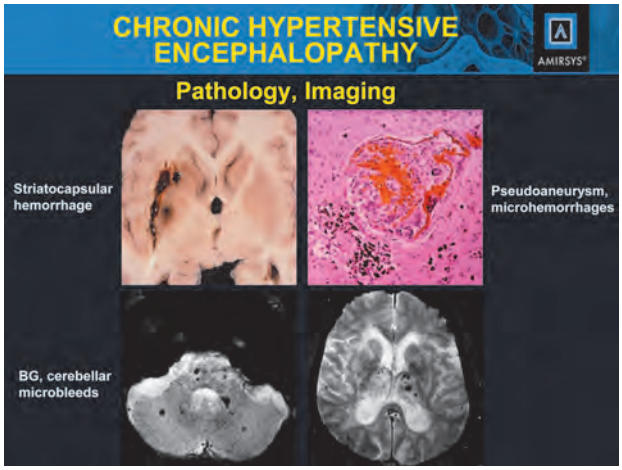

FUNGAL VASCULITIS
AMIRSYS

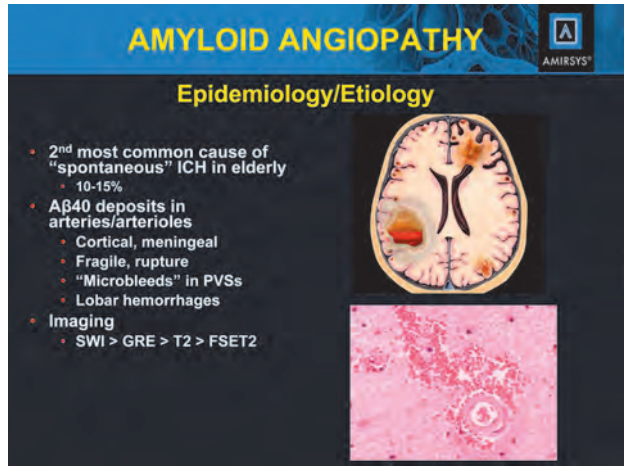

sICH
AMIRSYS
Etiology in Middle-Aged, Elderly
Hypertension
Amyloid angiopathy
Primary neoplasm
Metastasis
Venous infarct
Coagulopathy

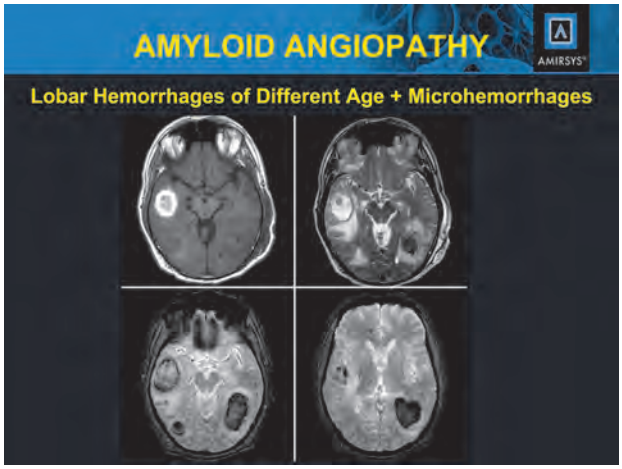

ACUTE HYPERTENSIVE HEMORRHAGE
AMIRSYS
10-15% of strokes
Hematoma location
60-65% striatocapsular
15-25% thalamic
10% pons, cerebellum
5-10% lobar
Additional findings
Look for "bleeding globe"
Look for "microbleeds"

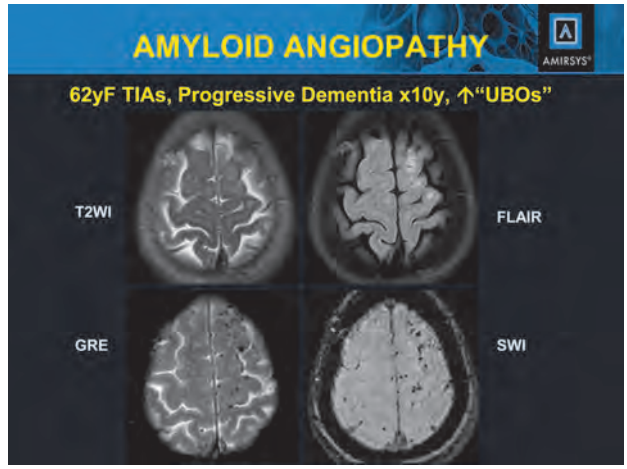

65y Male, Lobar Hemorrhage
What is Your DDx?

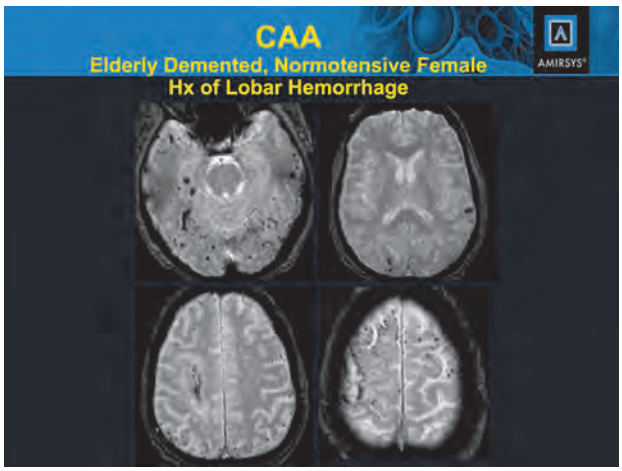

DDX
Hypertensive bleed
More common than CAA
Microbleeds
Cortex
BG, thalami
Cerebellum
CAA
Neoplasm (met, GBM)
Cortical vein occlusion
Hint: T2* scan should be like your favorite credit card—don't leave home without it!!

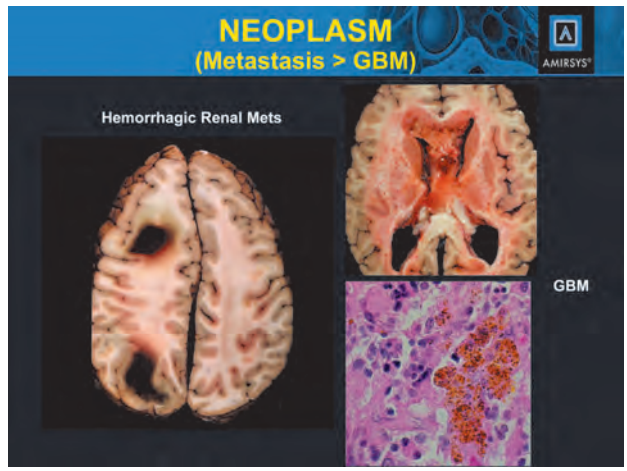

CHRONIC HYPERTENSIVE ENCEPHALOPATHY
Pathology, Imaging
Striatocapsular hemorrhage
Pseudoaneurysm, microhemorrhages
BG, cerebellar microbleeds

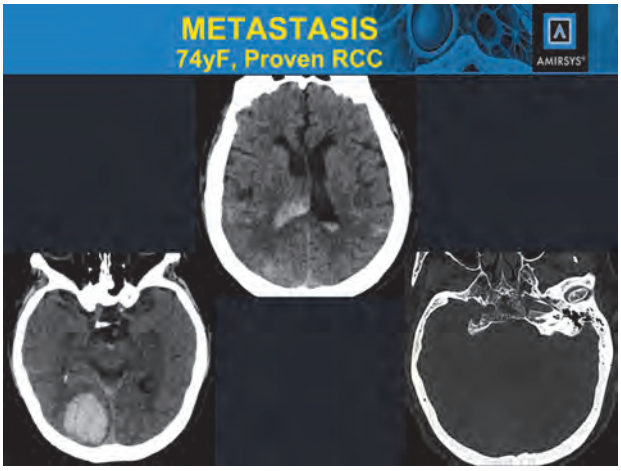

AMYLOID ANGIOPATHY
Epidemiology/Etiology
2nd most common cause of "spontaneous" ICH in elderly
10-15%
Aβ40 deposits in arteries/arterioles
Cortical, meningeal
Fragile, rupture
"Microbleeds" in PVSs
Lobar hemorrhages
Imaging
SWI > GRE > T2 > FSET2

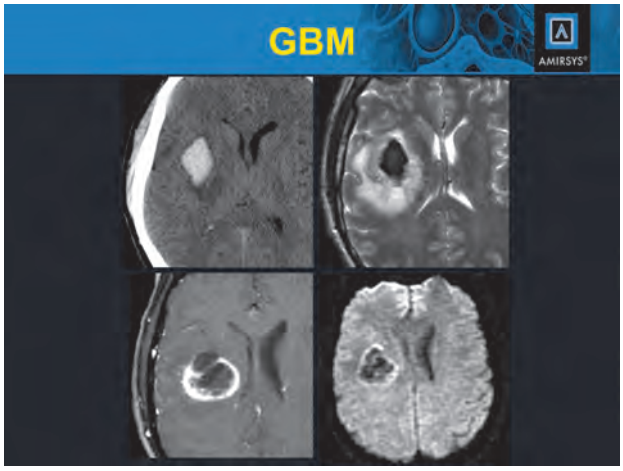

AMYLOID ANGIOPATHY
Lobar Hemorrhages of Different Age + Microhemorrhages

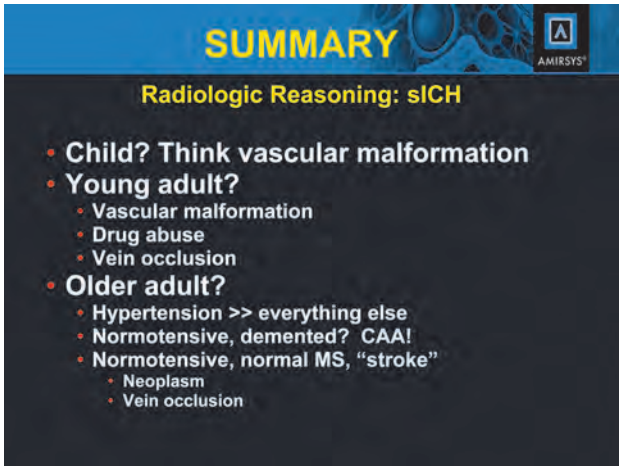

AMYLOID ANGIOPATHY
62yF TIAs, Progressive Dementia x10y, ↑"UBOs"
T2WI
FLAIR
GRE
SWI


CAA
Elderly Demented, Normotensive Female
Hx of Lobar Hemorrhage


NEOPLASM
(Metastasis > GBM)
Hemorrhagic Renal Mets
GBM







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It was a real pleasure to be with you at the recent Radiology International Conference in St. Petersburg. During my lectures I presented images that included a lot of essential diagnostic information and differential diagnoses from STATdx. Many of you requested information about how to access this key online information. Beatty suggested I send you a brief email including information about STATdx, so here 'tis.

I always find the Radiology International experience to be rewarding and extremely beneficial in our mutual quest to keep in the forefront of medical imaging. As you know, I join you in attending all the other faculty presentations so I can learn from the experts about other body parts (yes, there is actually life outside the skull and neural foramina!). Beatty has kindly invited me to participate as part of the 2015 Northern Ireland faculty. I have been to Northern Ireland just once—and all too briefly. It was so enchanting I have longed to return for another visit. I hope to see you there. It should be a wonderful course in a spectacular location.

Best personal regards,

Anne Osborn, MD