



Neurodiagnostics and the Stroke Patient

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Disclosures

- I have no disclosures

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Objectives

1. Discuss stroke facts and prevalence
2. Discuss goals of care for the stroke patient
3. Discuss guideline-based recommendations for the use of Neurodiagnostics in:
 1. Ischemic stroke
 2. ICH
 3. SAH

Stroke By The Numbers

795,000 Americans each year suffer a new or recurrent stroke



Stroke is the #5 leading cause of death in the U.S.A.



37% of all Americans cannot accurately identify even one warning sign for stroke



36 Billion dollars are spent every year in direct and indirect care



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Goals of care

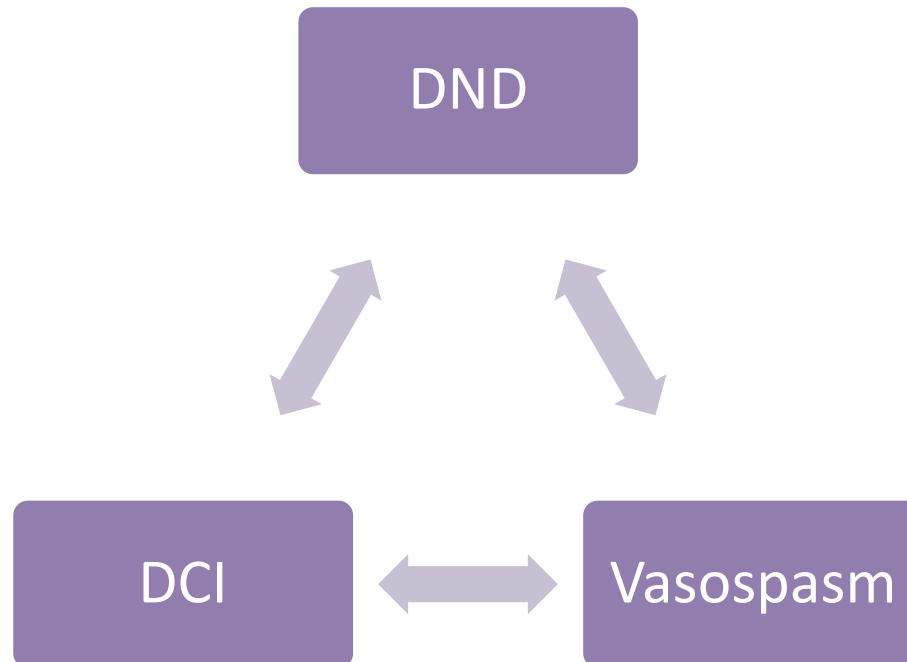
“A fundamental goal in the critical care management of patients with neurological disorders is identification, prevention, and treatment of secondary cerebral insults that are known to exacerbate outcome”

Roux et al (2014)

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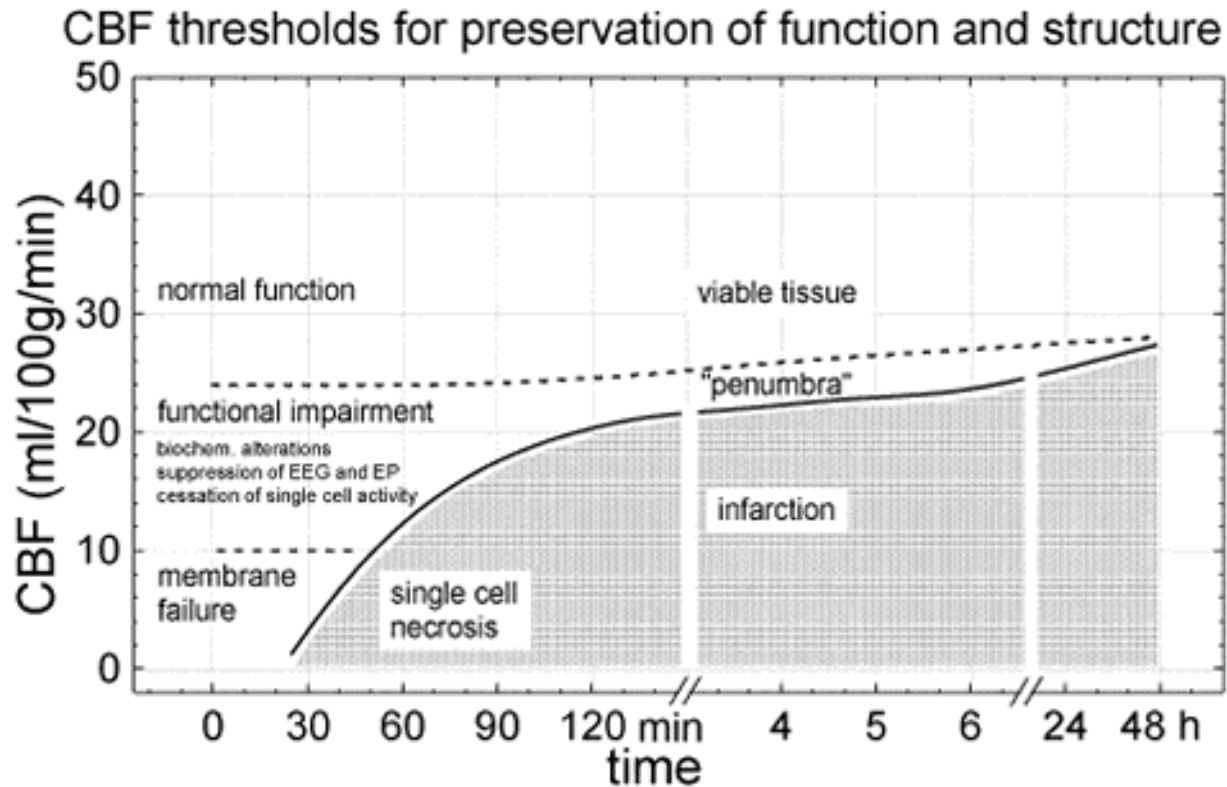
Definitions of key terms

- DND – Delayed Neurological Deterioration
- DCI – Delayed Cerebral Ischemia
- Vasospasm



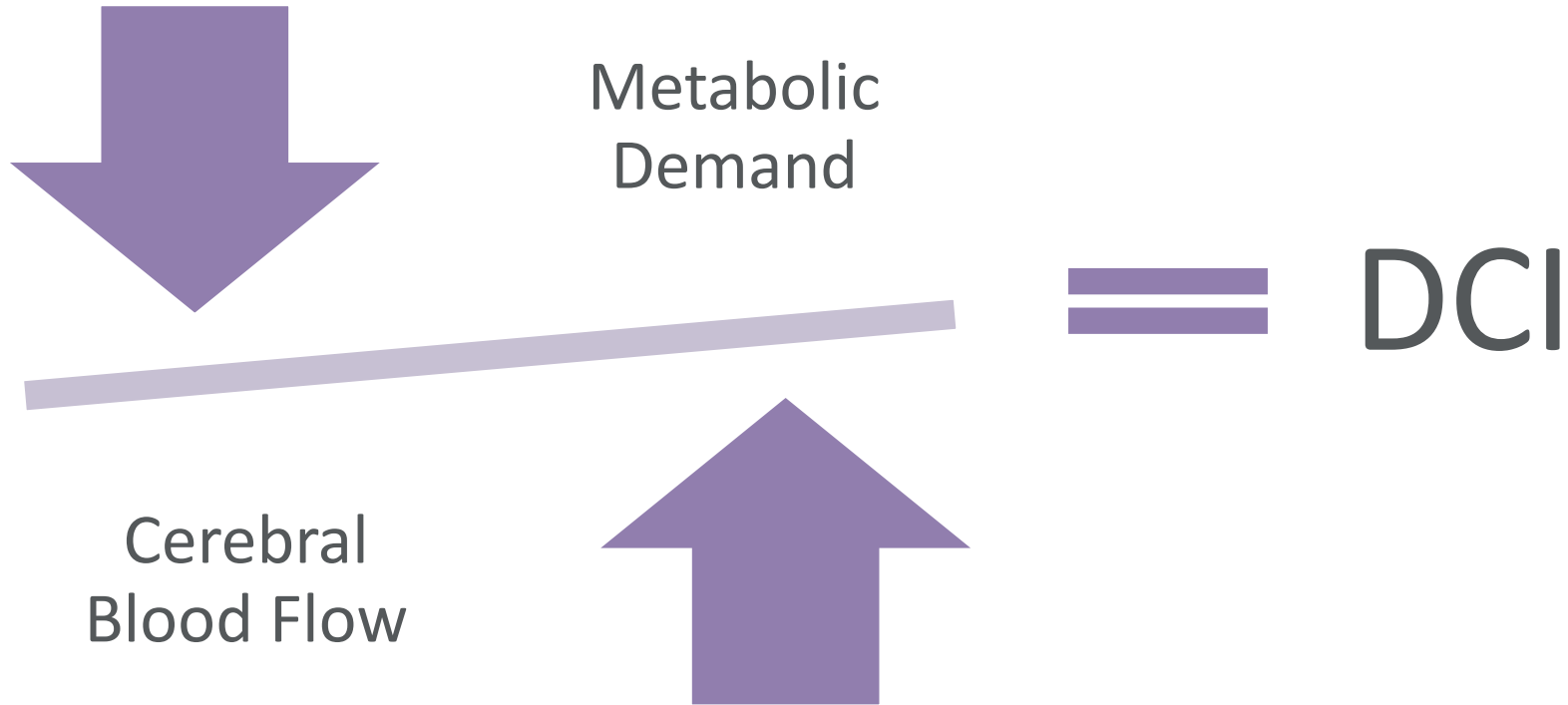
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Cerebral Blood Flow and Cerebral Metabolic Demand



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Cerebral Blood Flow and Cerebral Metabolic Demand



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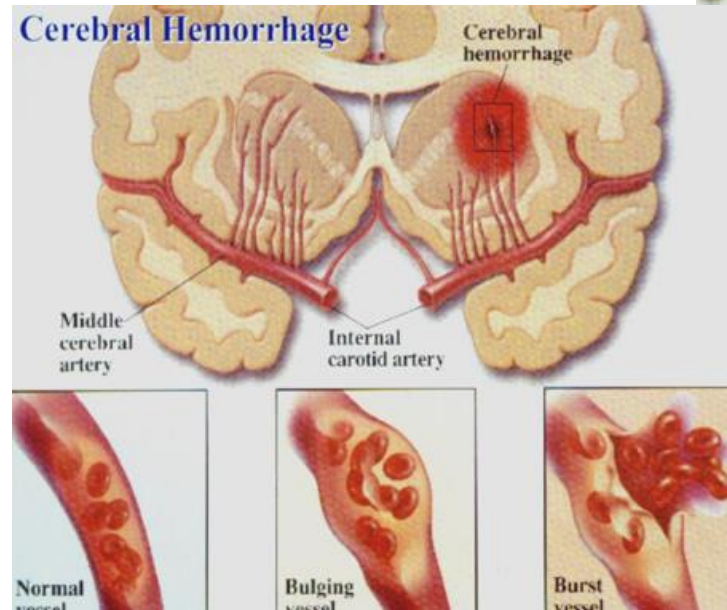
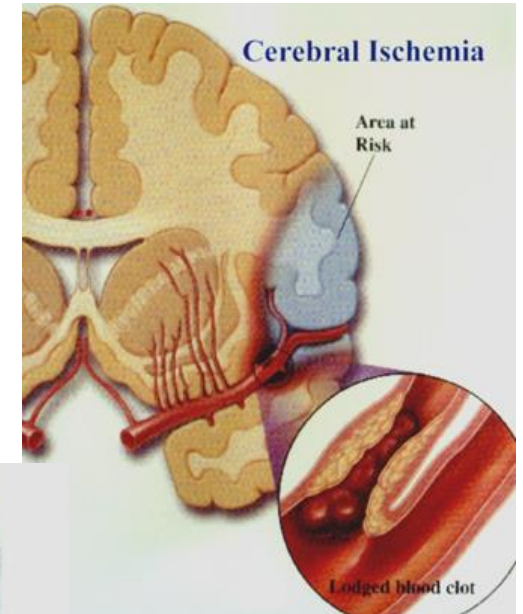
Stroke Types and Incidence

1. Ischemic (87%)

- Thrombotic (large vessel occlusive) (~35%)
- Embolic (~30%)
- Lacunar (~20%)
- Vasculitic (~4%)

2. Hemorrhagic (13%)

- ICH (10%)
- SAH (3%)



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How does stroke relate to seizure activity?

Early post-stroke seizures – occur within the first 14 days

Late post-stroke seizures – occur after 14 days

Facts:

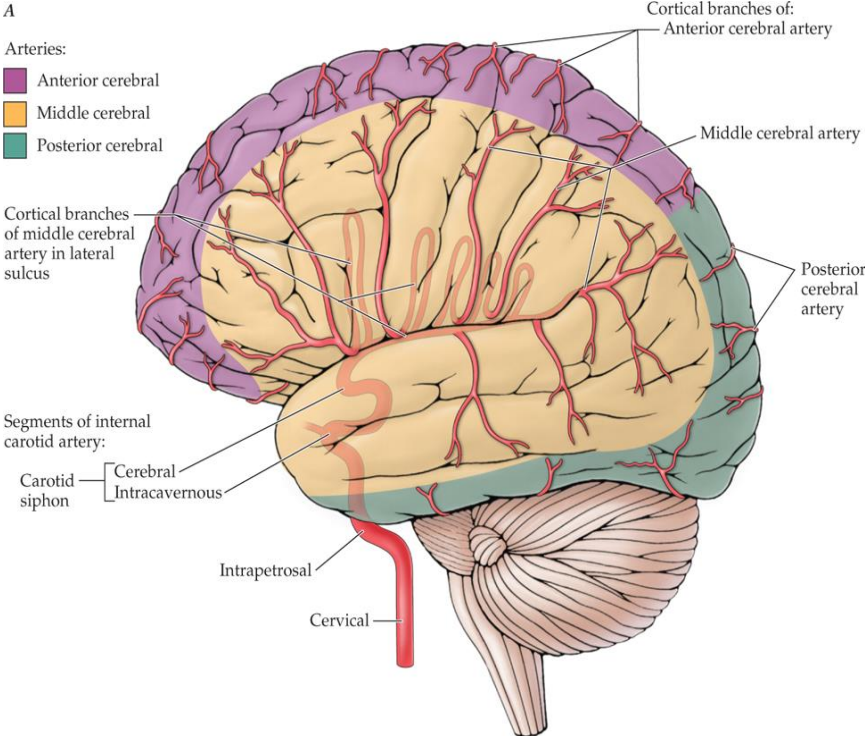
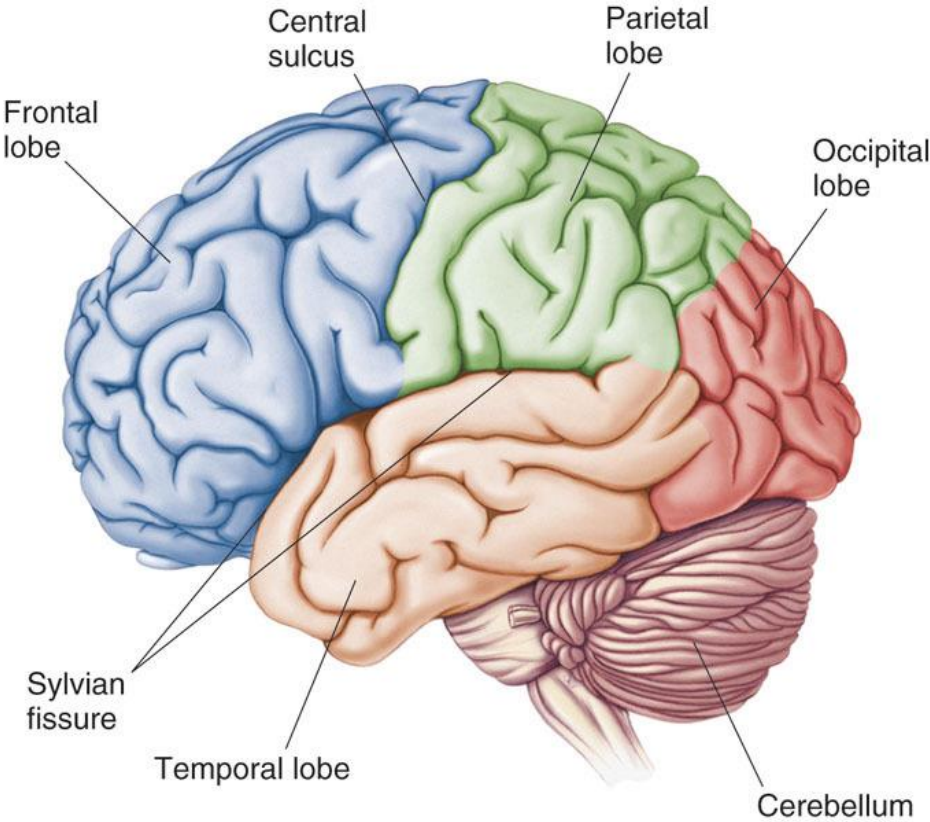
- Stroke is the most common risk factor for new onset epilepsy
 - Up to 12% of post-stroke patients will experience new onset seizures
 - New onset seizures put a post-stroke patient at a higher risk of mortality and morbidity
- Previous stroke accounts for 30-40% of epilepsy in the elderly

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Risk factors for post-stroke seizures

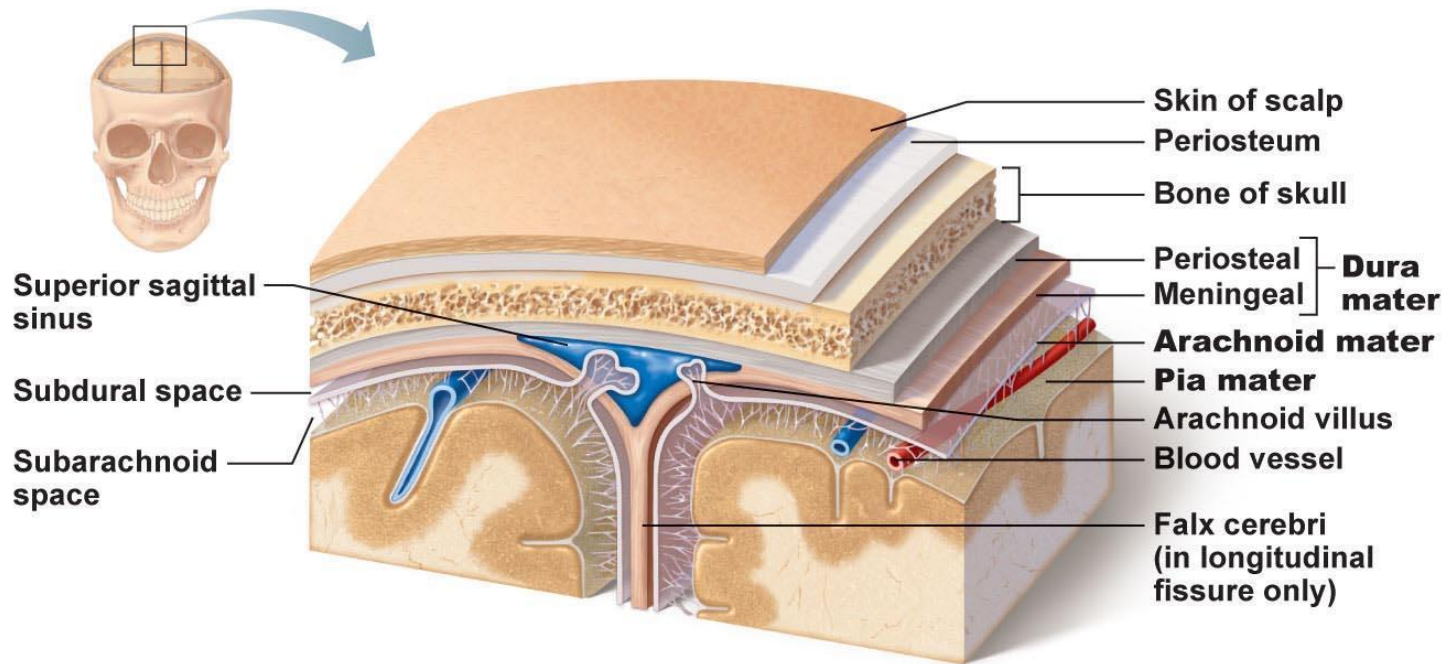
- Supratentorial lobar ICH
- SAH
- Ischemic stroke in the MCA territory

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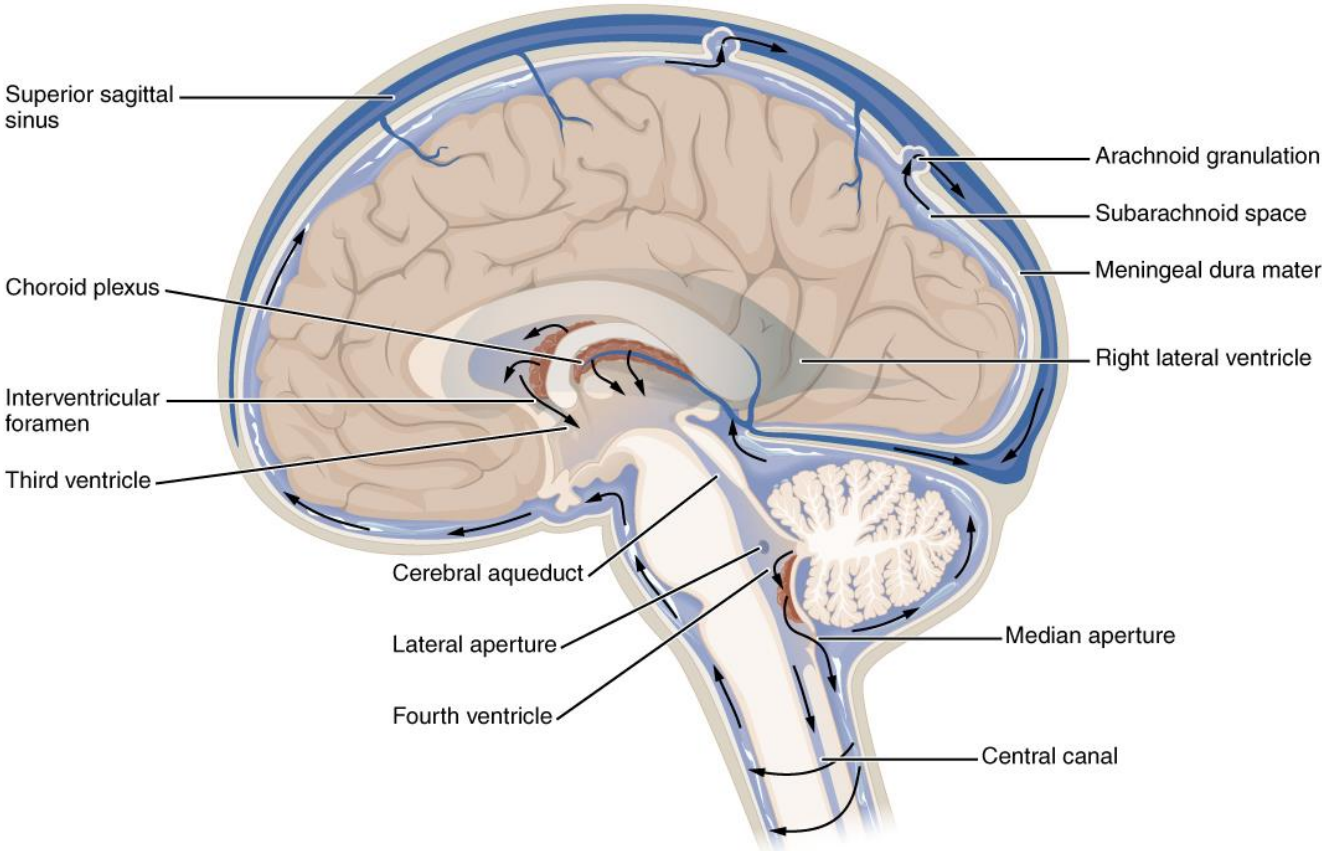
Source: John H. Martin: Neuroanatomy Text and Atlas, Fourth Edition, <http://neurology.mhmedical.com> Copyright © McGraw-Hill Education. All rights reserved.

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Recommendations for ICH Patients

Facts:

- Incidence of clinical seizures within first 14 days ranges from 2.7-17%
- Most occur at or near the onset of the hemorrhage
- cEEG has demonstrated that in certain cohorts subclinical seizure activity may be evident in approximately 30% of patients, even those on prophylactic AEDs

Recommendations from the AHA/ASA:

- “cEEG monitoring is indicated in ICH patients with depressed mental status out of proportion to the degree of brain injury”

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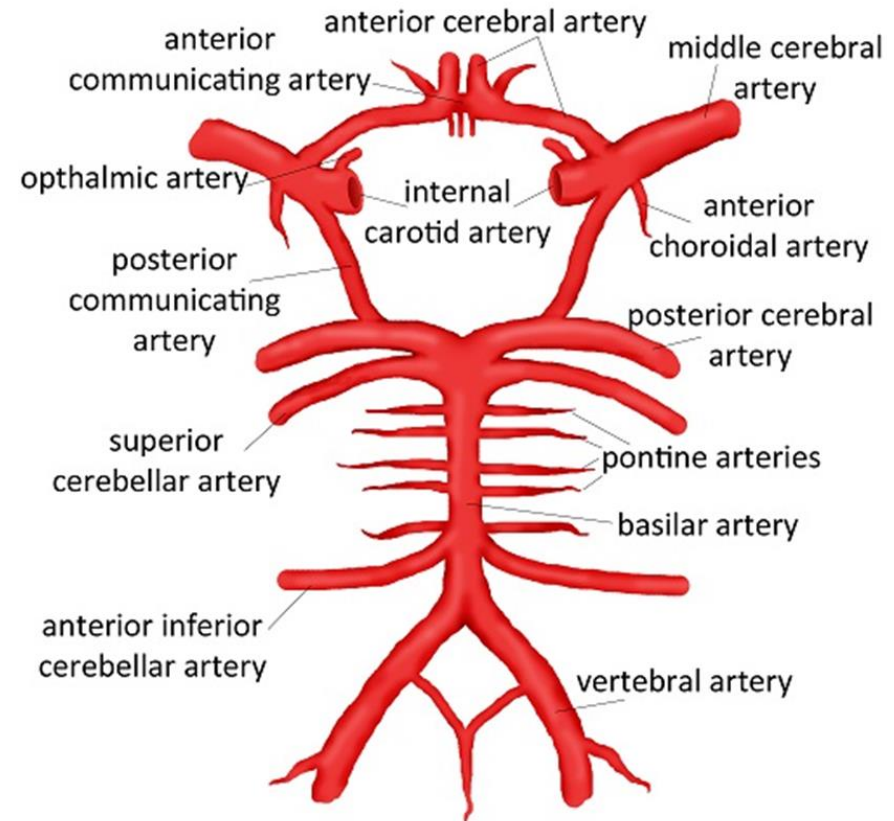
Recommendations for Ischemic Stroke Patients

Facts:

- Cortex involvement puts patients at the highest risk
- Strokes in the MCA territory are also highest risk
 - The majority of ischemic strokes take place within the MCA territory

Recommendation from the AHA/ASA:

- “cEEG or rEEG not recommended for routine use. If cortical involvement or clinical deterioration without other identifiable cause then cEEG and treatment of seizures as in any other population is recommended.”



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Recommendations for SAH Patients - EEG

Facts:

- The incidence of seizure at SAH onset is lower than ICH at around 1-7% and some abnormal movements may be posturing at the time of aneurysmal rupture
- When they occur in patients with an unsecured aneurysm they would represent re-rupture

Risk factors specific to SAH:

- Surgical aneurysm repair in patients > 65
- Thick Subarachnoid clot
- Intraparenchymal hematoma or infarction

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Recommendation for SAH Patients - EEG

EEG

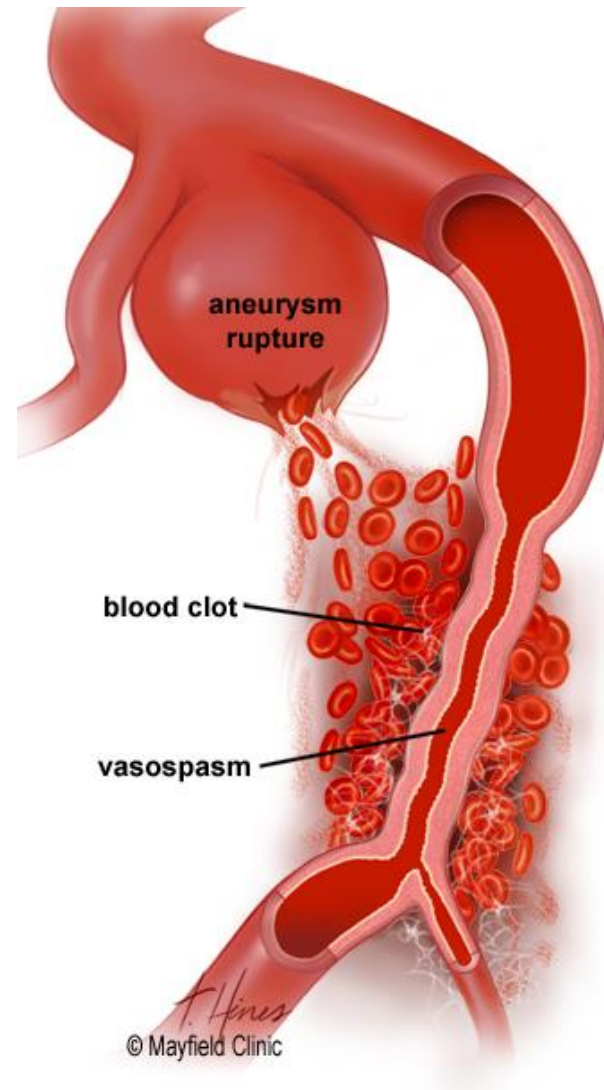
- “cEEG monitoring should be considered in patients with poor-grade SAH who fail to improve or who have neurological deterioration of unknown etiology.”

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Recommendations for SAH Patients - TCD

Definitions:

- Vasospasm – arterial narrowing after SAH demonstrated by radiographic images or sonography
- Delayed Cerebral Ischemia (DCI) – any neurological deterioration presumably related to ischemia that persists for more than an hour
- The highest risk period for DCI is 3-14 days after the SAH
 - High risk patients have a larger SAH and a poorer clinical grade



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Recommendations for SAH Patients - TCD

Recommendations:

- Thresholds to be used for determining large artery vasospasm
 - Mean blood flow velocity < 120 cm/s for absence of vasospasm
 - Mean blood flow velocity > 200 cm/s and or MCA/ICA ratio > 6 for presence of vasospasm

Key point: TCD should not be taken as a single snapshot but should be utilized in conjunction with clinical and radiographic studies to monitor for and intervene on vasospasm

Questions?

Thank You

References

Diringer MN, Bleck TP, Claude Hemphill J 3rd, Menon D, Shutter L, Vespa P, ... Tseng MY. (2011). Critical care management of patients following aneurysmal subarachnoid hemorrhage: recommendations from the Neurocritical Care Society's Multidisciplinary Consensus Conference. *Neurocritical Care*, 15(2), 211–240. <https://doi.org/10.1007/s12028-011-9605-9>

Gilad, R. (2012). Management of Seizures following a Stroke. *Drugs & Aging*, 29(7), 533–538. <https://doi.org/10.2165/11631540-000000000-00000>

Hemphill 3rd, J. C., Greenberg, S. M., Anderson, C. S., Becker, K., Bendok, B. R., Cushman, M., ... Hemphill, J. C., 3rd. (2015). Guidelines for the Management of Spontaneous Intracerebral Hemorrhage: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke (00392499)*, 46(7), 2032–2060. <https://doi.org/10.1161/STR.0000000000000069>

Koome, M., Churilov, L., Chen, Z., Chen, Z., Naylor, J., Thevathasan, A., ... Kwan, P. (2016). Computed tomography perfusion as a diagnostic tool for seizures after ischemic stroke. *Neuroradiology*, 58(6), 577–584. <https://doi.org/10.1007/s00234-016-1670-5>

Le Roux, P., Menon, D. K., Citerio, G., Vespa, P., Bader, M. K., Brophy, G. M., ... Helbok, R. (2014). Consensus summary statement of the International Multidisciplinary Consensus Conference on Multimodality Monitoring in Neurocritical Care: a statement for healthcare professionals from the Neurocritical Care Society and the European Society of Intensive Care Medicine. *Neurocritical Care*, 21, 1–26. <https://doi.org/10.1007/s12028-014-0041-5>

Wang, G., Jia, H., Chen, C., Lang, S., Liu, X., Xia, C., ... Zhang, J. (2013). Analysis of risk factors for first seizure after stroke in chinese patients. *BioMed Research International*, 2013, 702871. <https://doi.org/2013/702871>