



Medical School
BROWN UNIVERSITY

Rhode Island STROKE SYMPOSIUM

Stroke in Pregnancy
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Columbia University

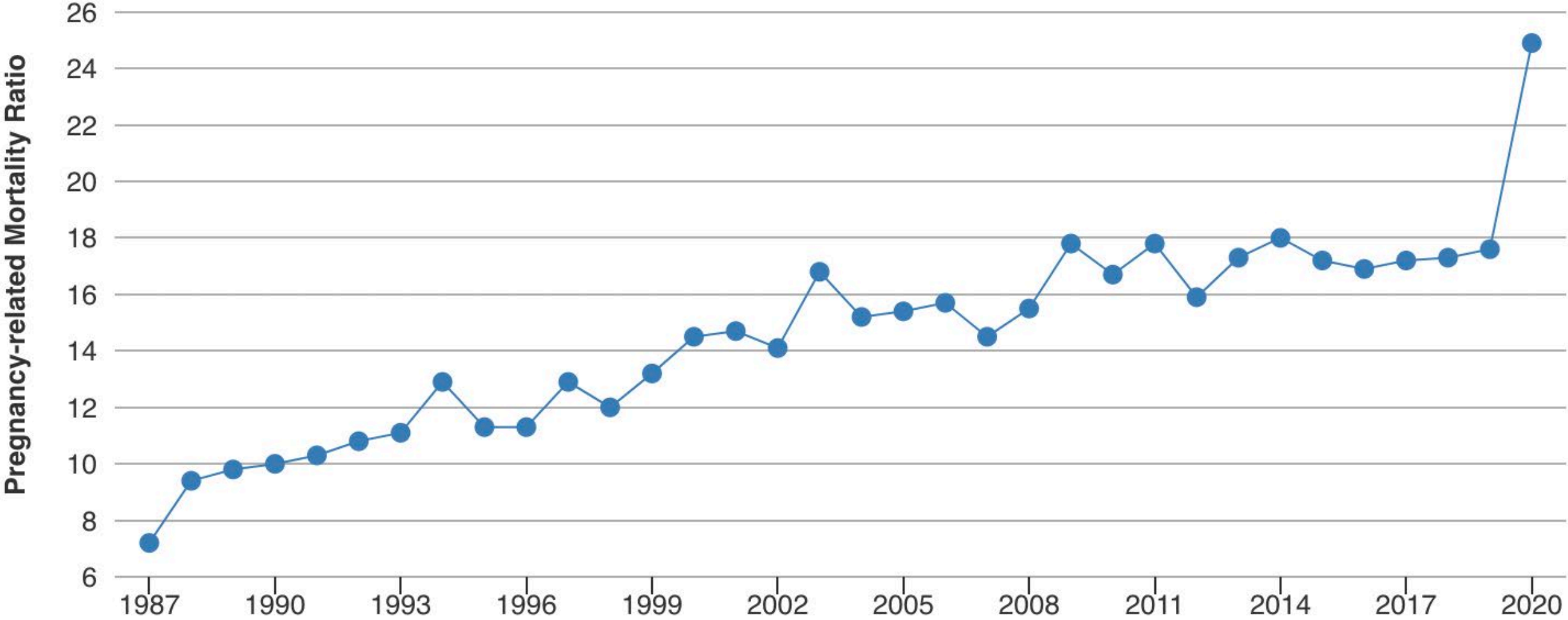
DISCLOSURE

- I have the following financial relationships to disclose: medicolegal consulting; NIH funding (NINDS R01NS122815, NIA R01AG085475, NICHD R21HD110992)
- My talk will include off-label discussion of use of thrombolytics for acute stroke in pregnancy.

Maternal mortality, US

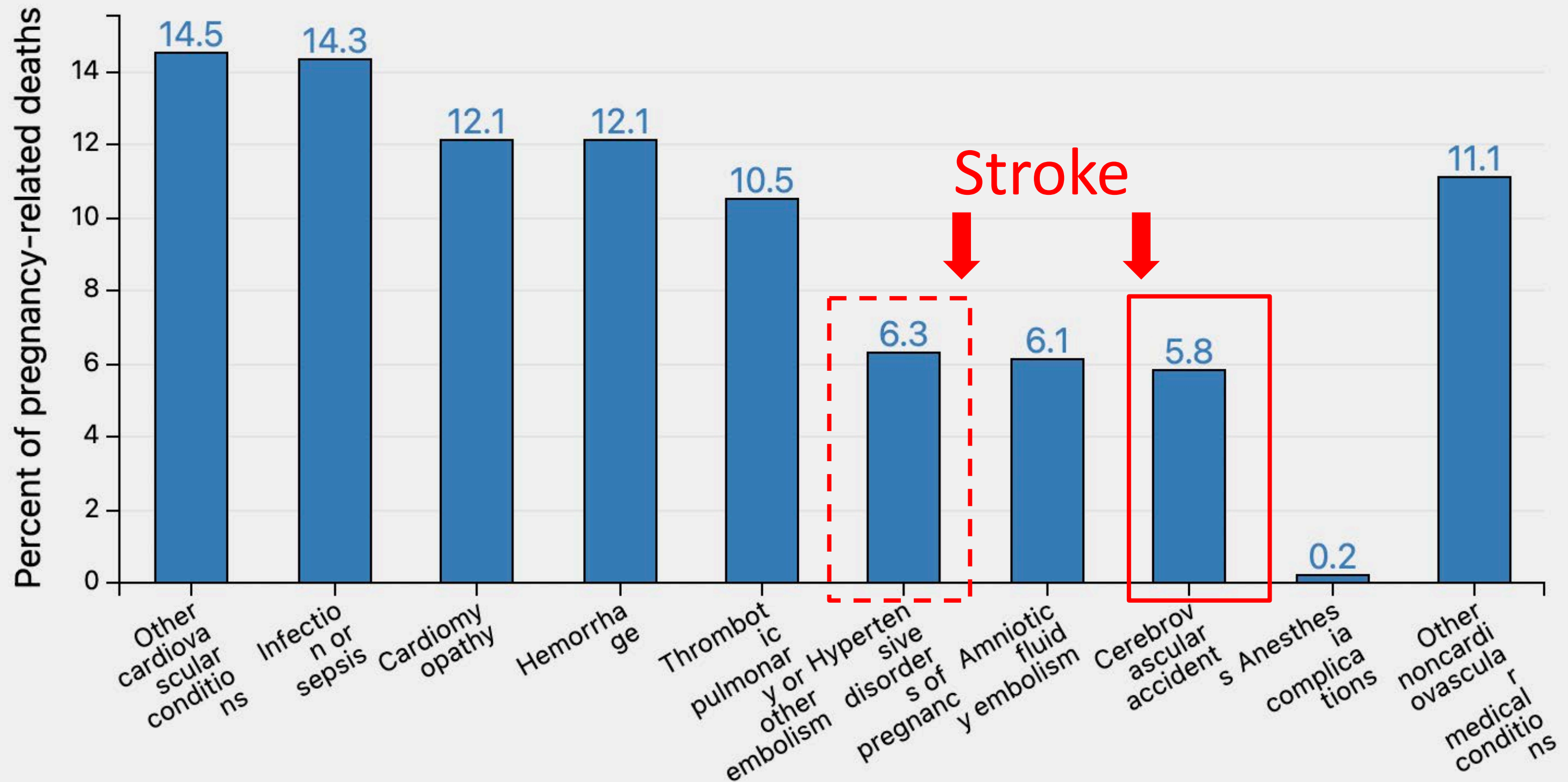
Figure 1. Pregnancy-related mortality ratio in the United States: 1987-2020

Approximately half (55%) of the increased number of pregnancy-related deaths between 2019 and 2020 had an underlying cause of COVID-19.



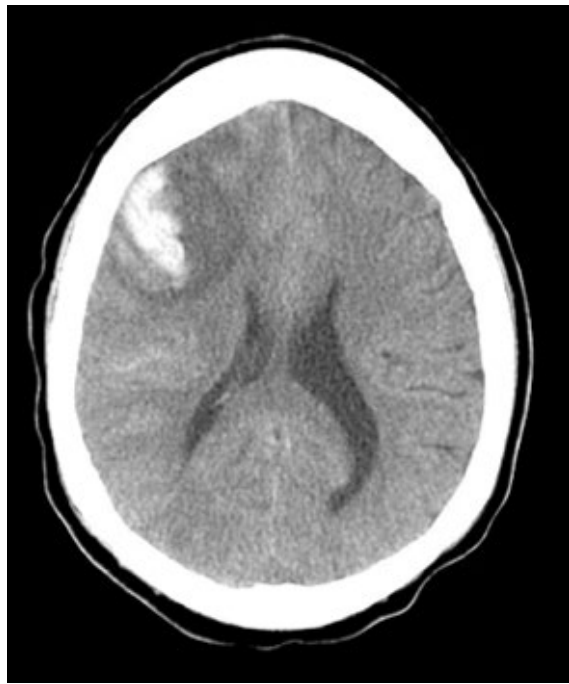
Source: Centers for Disease Control, Pregnancy Mortality Surveillance System

Causes of pregnancy-related death in the United States: 2017-2019

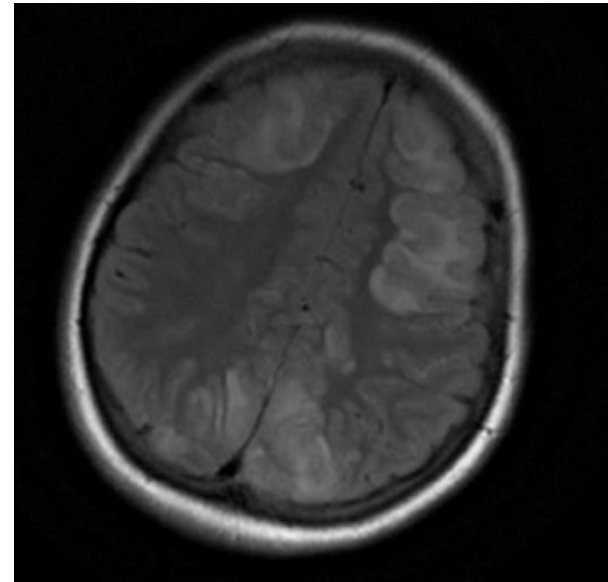


Source: Centers for Disease Control, Pregnancy Mortality Surveillance System

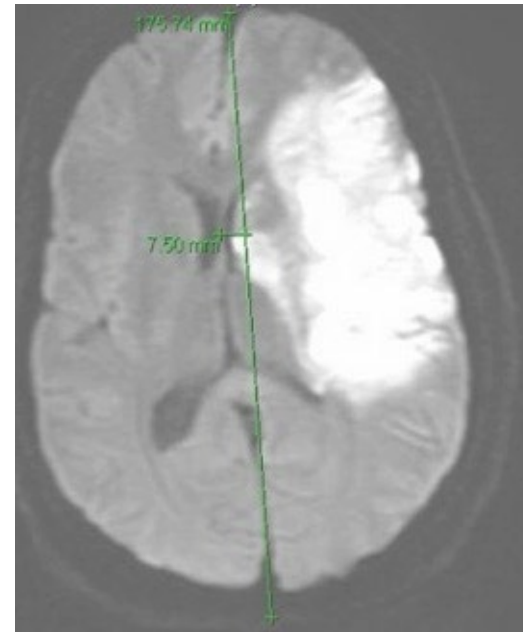
Some examples



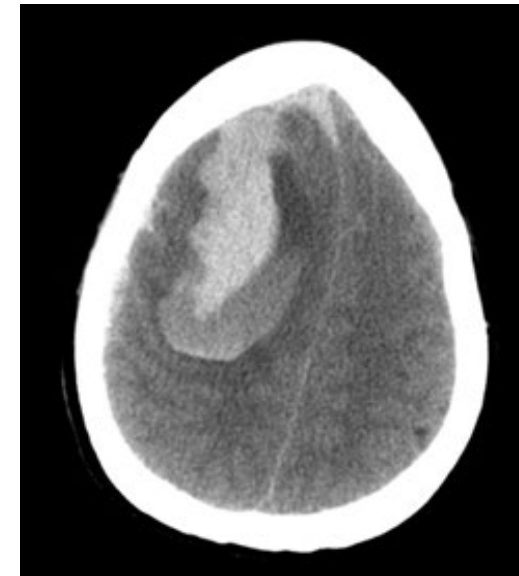
21y/o,
postpartum day 1



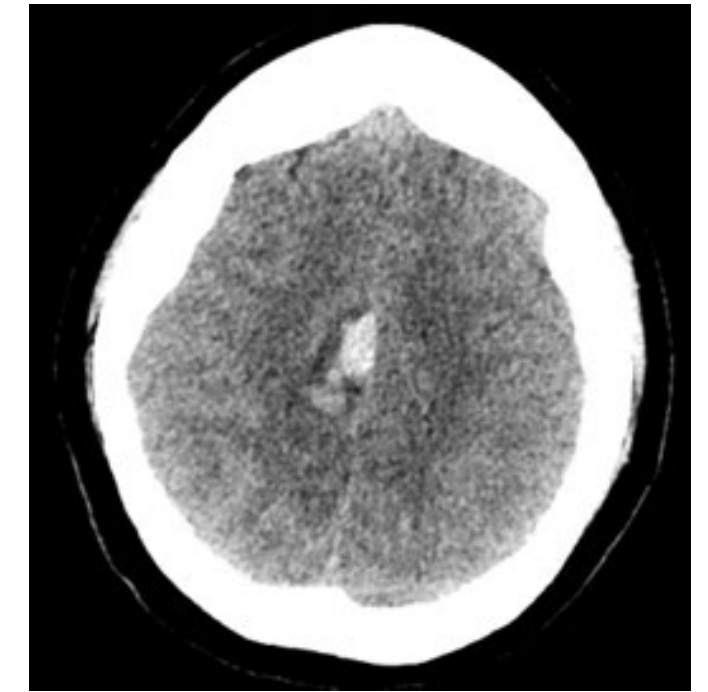
18 y/o, postpartum
day 5



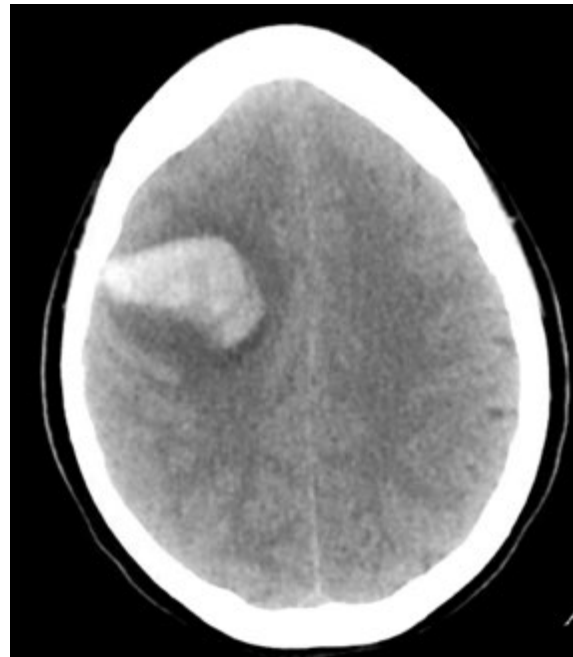
33 y/o, postpartum
day 30



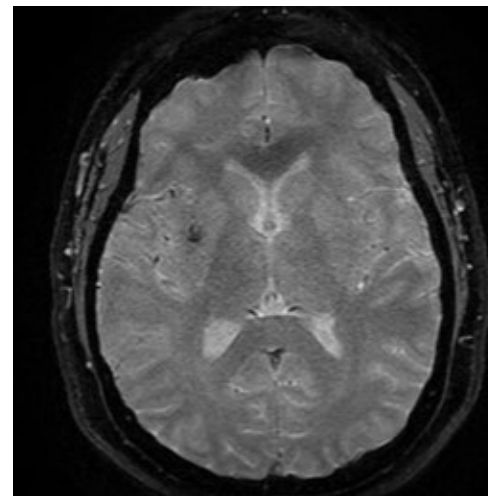
36 y/o, postpartum
day 7



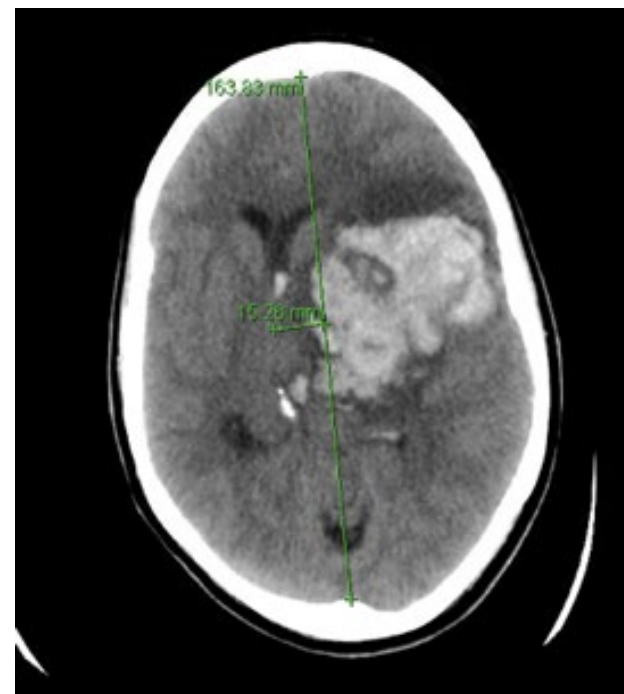
34 y/o, 33 weeks



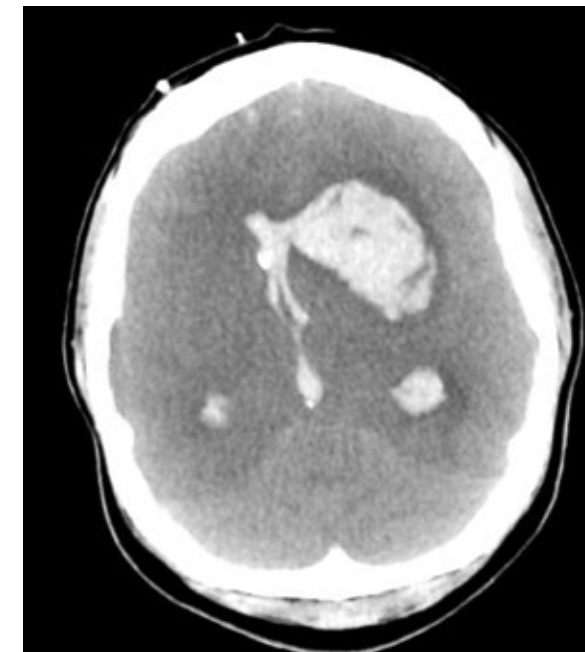
28 y/o, postpartum
day 7



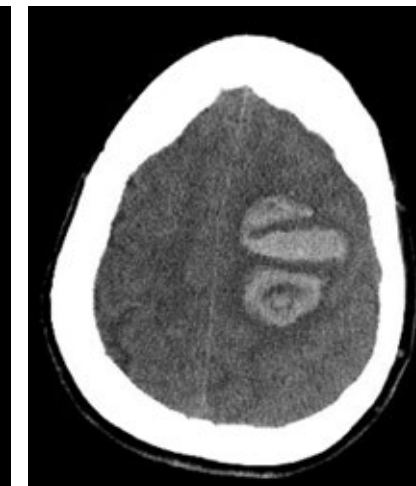
33 y/o, 29 weeks



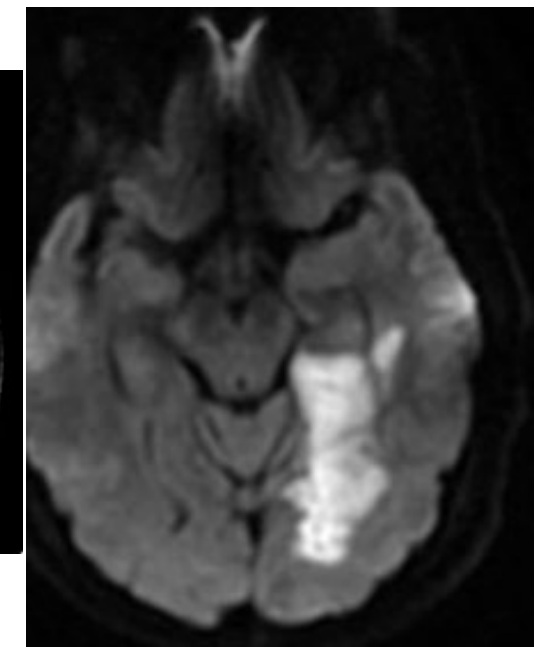
32 y/o, postpartum
day 4



36 y/o, 33 weeks



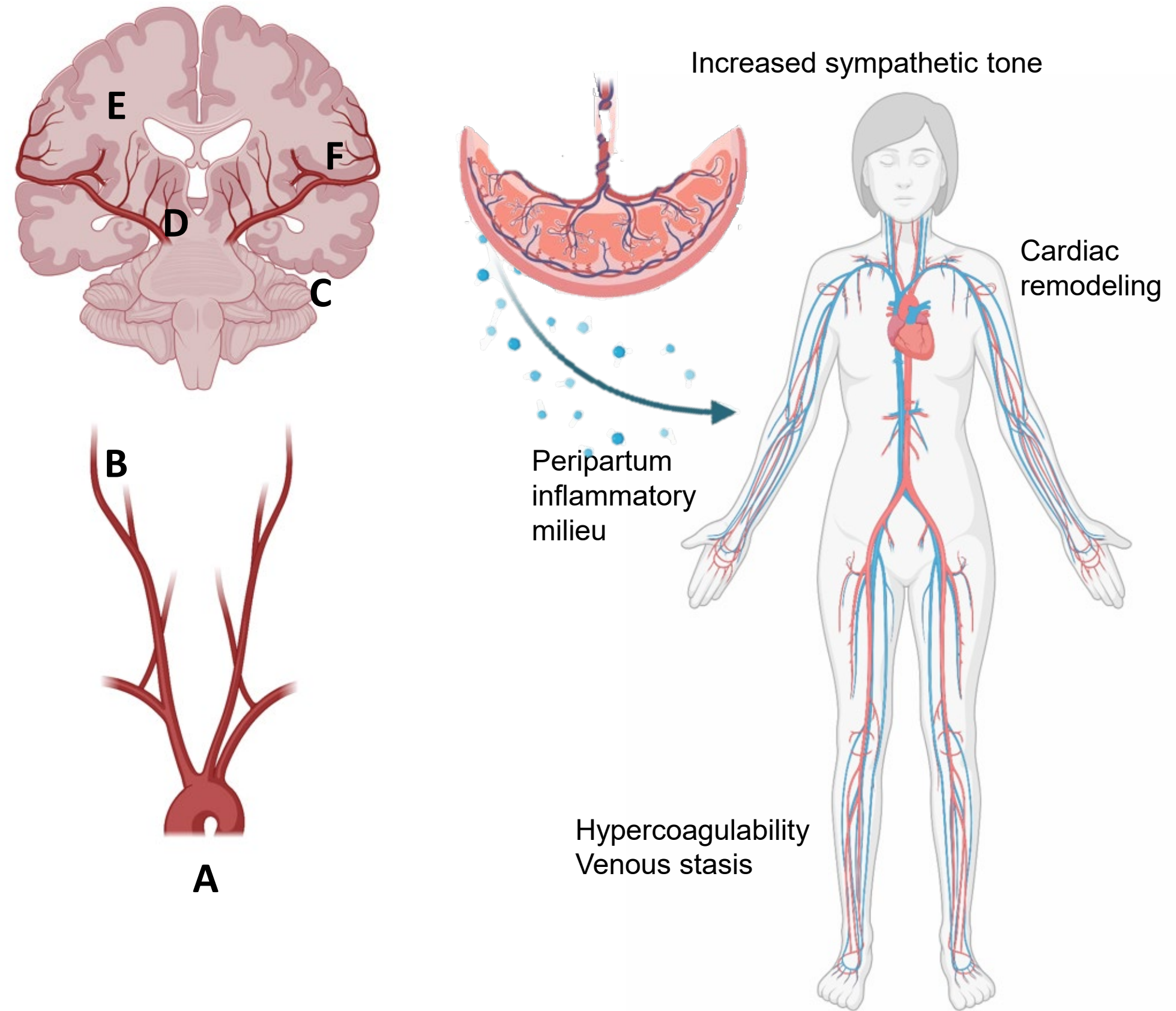
41 y/o,
postpartum
day 8



26 y/o,
postpartum
day 14

Circulation Research

- Maternal stroke can occur throughout the cerebrovascular tree by multiple mechanisms
 - ✓ Venous sinus thrombosis
 - ✓ Cardioembolism
 - ✓ Dissection
 - ✓ AVM or aneurysm rupture
 - ✓ RCVS
 - ✓ Hypertensive hemorrhage
- Physiological changes of pregnancy increase stroke risk



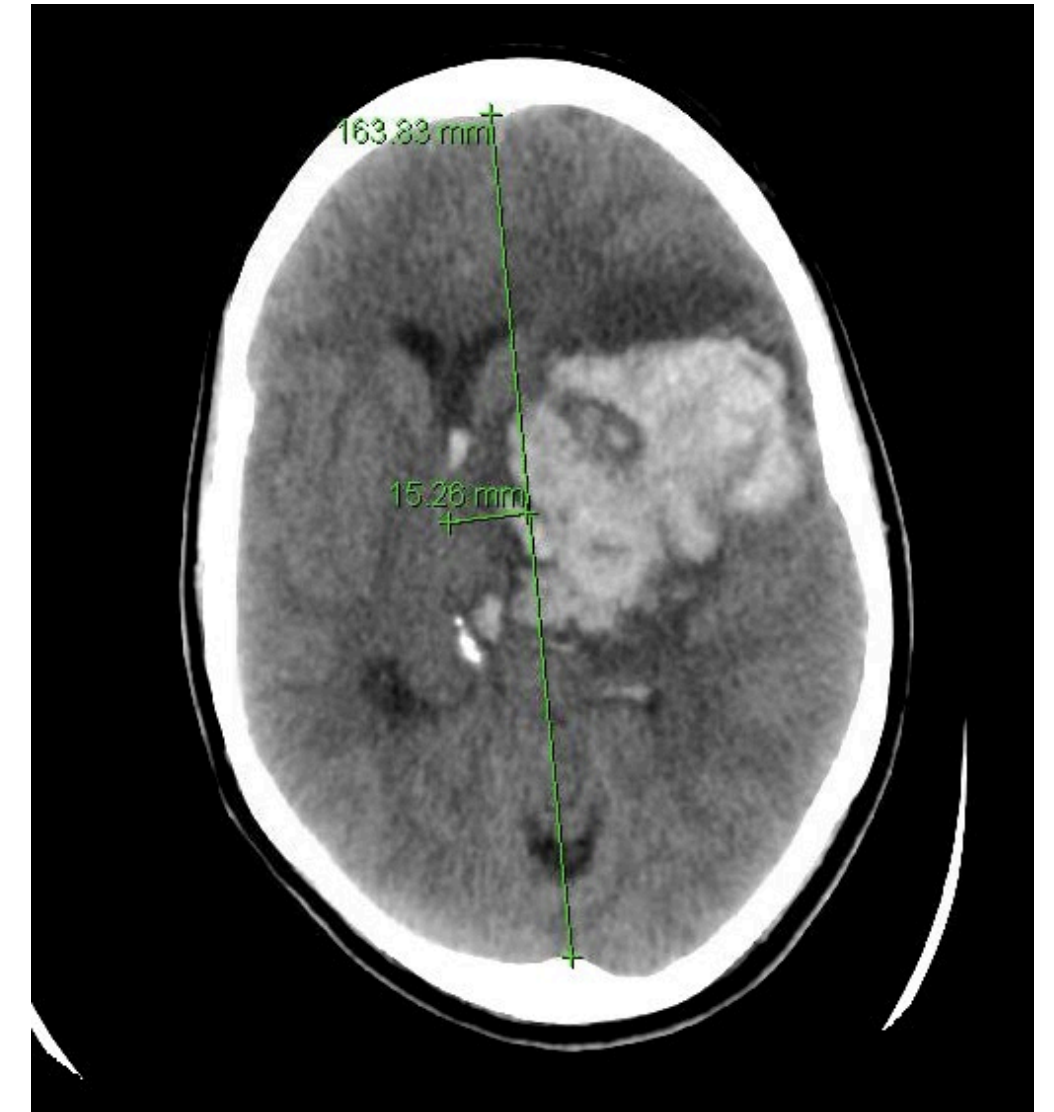
Risk factors for maternal stroke

- HYPERTENSION
- Cesarean section
- Chronic kidney disease
- Older age
- Migraine
- Gestational diabetes
- Smoking
- Infections
- Hematological disorders
- Heart disease
- Exposure to racism



Maternal stroke is under-recognized and under-treated

- Most occur postpartum
- 40% of pregnant or postpartum patients with acute stroke had missed diagnosis or diagnostic delays
- Among those with ICH, **50% had delayed diagnosis**



Miller EC et al. Diagnostic Delays Or Errors In Maternal Stroke: A Retrospective Study. Late Breaking Science poster presentation, International Stroke Conference, February 2023 (Dallas, TX).

How can we do better?

- **Recognize** neurological red flags (eg **HEADACHE**)
- **Identify** and immediately **evaluate** stroke symptoms
- Make use of **existing stroke systems** of care
- **Engage** community and patient advocacy groups in **education** and **prevention** efforts



Recognize and identify “red flags”



Sudden/Severe/Seizure

Change in position or quality

Altered mental status

Neurological deficits/Nausea and vomiting

Medications without relief

Elevated blood pressure or temperature

Evaluating maternal stroke: Neuroimaging in pregnancy and lactation

- ▶ CT/CTA: fetal radiation dose negligible
- ▶ Conventional angiography: less data, but likely similar based on cardiac cath literature
- ▶ Iodinated contrast: ok in pregnancy when benefits outweigh risks; theoretical risk of neonatal hypothyroidism; **SAFE IN LACTATION**
- ▶ Gadolinium contrast: not recommended in pregnancy; **SAFE IN LACTATION**

Treating maternal stroke: Thrombolysis in pregnancy and postpartum

- ▶ Alteplase and tenecteplase **do not cross placenta**
- ▶ AHA: “may be considered” in pregnancy, less evidence postpartum
- ▶ Canadian consensus statement: “it is reasonable”
- ▶ Outcomes appear similar to non-pregnant individuals
- ▶ Should always be discussed with OB!



Demaerschalck BM et al. Stroke. 2016 Feb;47(2):584-591. doi: 10.1161/STR.0000000000000086.

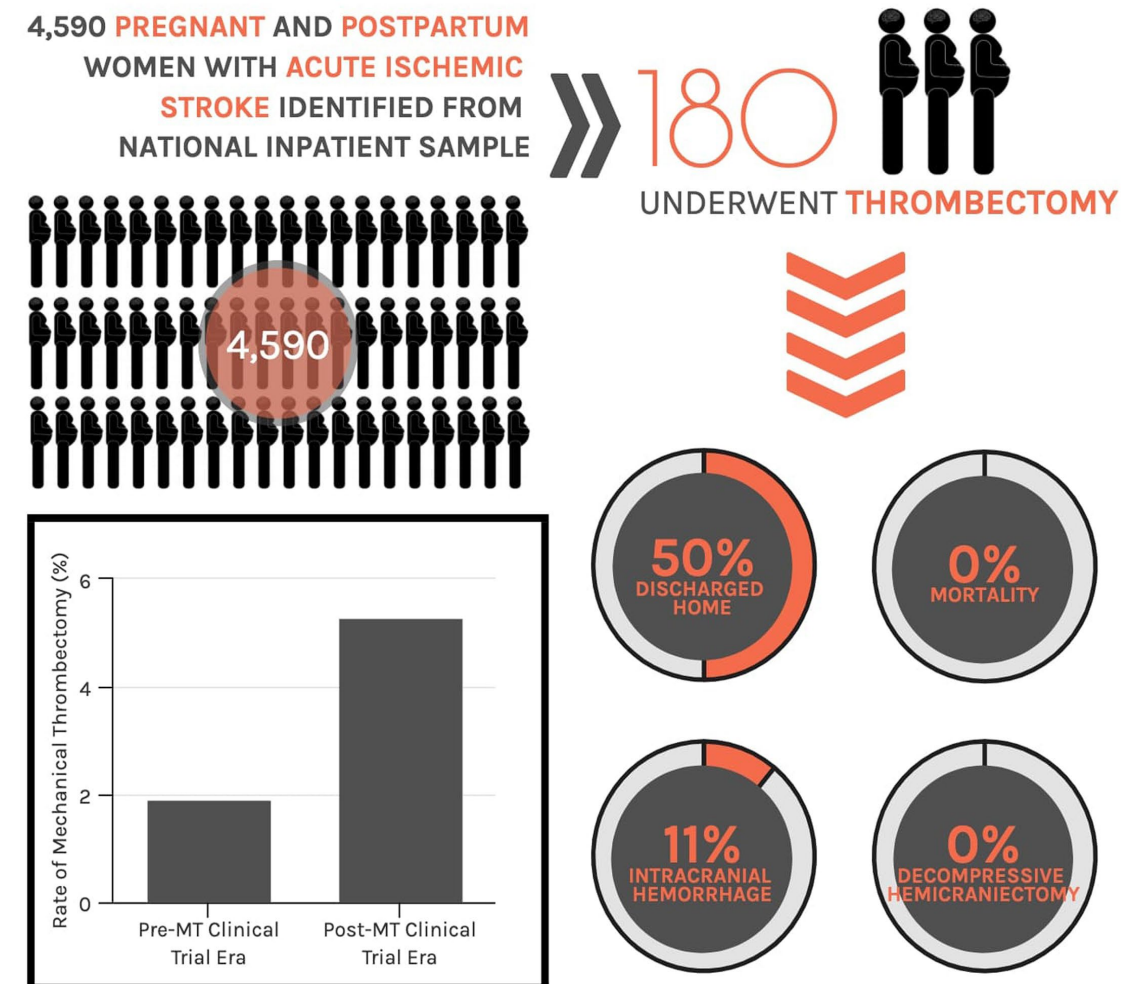
Ladhan NNN et al. Int J Stroke. 2018 Oct;13(7):748-758. doi: 10.1177/1747493018786617

Mechanical thrombectomy in pregnancy and postpartum

- ▶ Similarly safe and effective as in non-pregnant patients; outcomes were actually better
- ▶ Higher frequency of thromboembolic complications compared to medical management

Alis J. Dicipinigaitis. Stroke. Endovascular Thrombectomy for Treatment of Acute Ischemic Stroke During Pregnancy and the Early Postpartum Period, Volume: 52, Issue: 12, Pages: 3796-3804, DOI: (10.1161/STROKEAHA.121.034303)

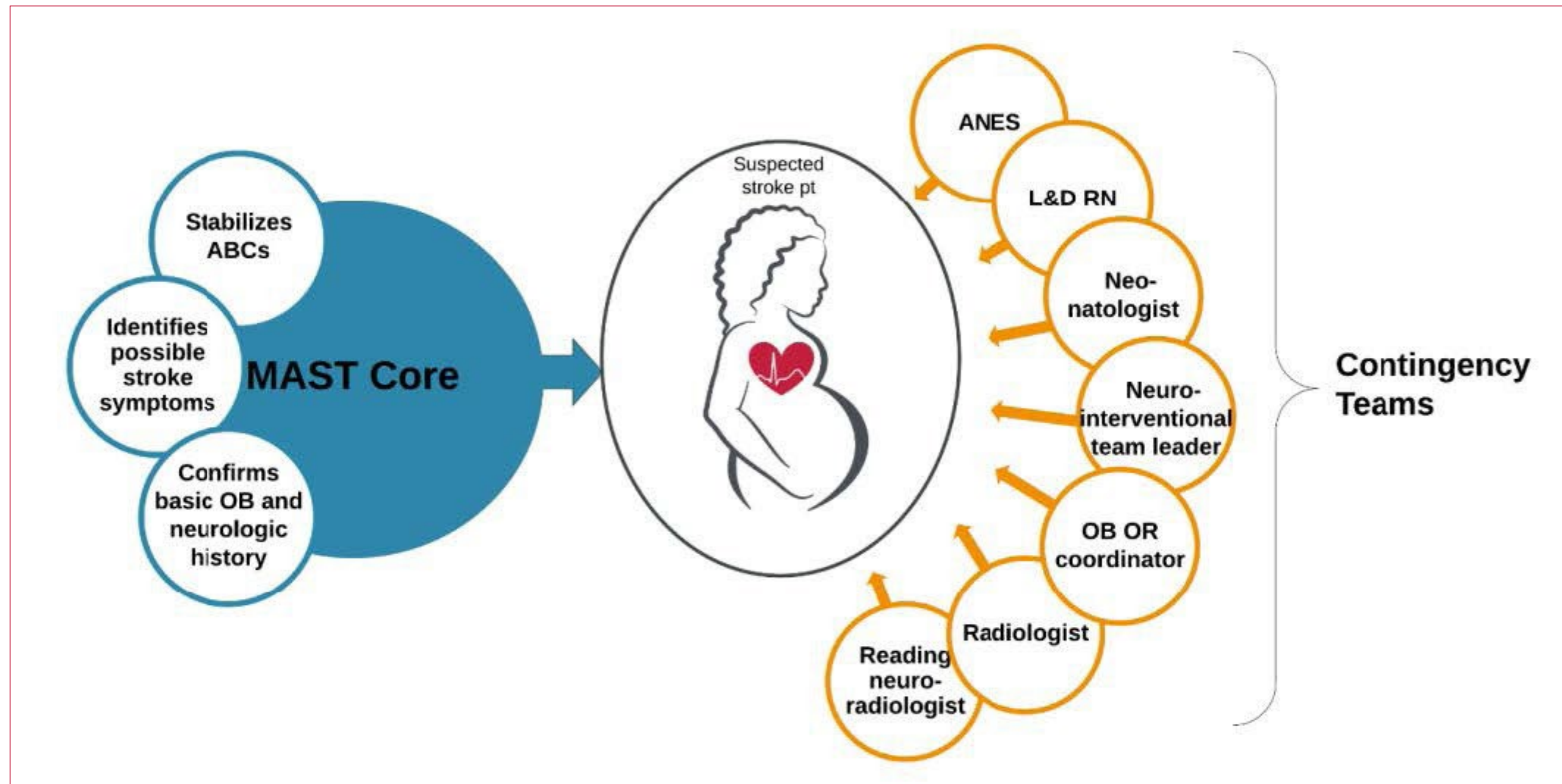
Endovascular Thrombectomy for Treatment of Acute Ischemic Stroke During Pregnancy and the Early Postpartum Period



Mechanical thrombectomy: technical considerations

- ▶ Hypercoagulability?
- ▶ Possible higher risk of vasospasm and dissection
- ▶ Intubation: airway may be more difficult
- ▶ If possible, involve OB anesthesiology
- ▶ Positioning: ideally tilt left
- ▶ Radial approach if possible
- ▶ Fetal monitoring during procedure

Systems of care: The Maternal Stroke Team (MAST)



AFTER THE STROKE

- ▶ Blood pressure targets and treatment during pregnancy differ (consult MFM and OB anesthesia!)
- ▶ Pregnant patients should be at a center with Level 3 or 4 capabilities (ICU, MFM)
- ▶ If patient is lactating, offer support (OT, lactation specialist)
- ▶ Postpartum patients: facilitate neonatal visitation if possible
- ▶ Be sensitive to patient's situation (no "congratulations!")
- ▶ Don't forget to do the stroke workup!!!

Neuro-OB Resources

Acute stroke management during pregnancy:

<https://www.strokebestpractices.ca/recommendations/acute-stroke-management-during-pregnancy>

Maternal Stroke Associated With Pregnancy

By Eliza C. Miller, MD, MS

REVIEW ARTICLE



CONTINUUM AUDIO
INTERVIEW AVAILABLE
ONLINE



VIDEO CONTENT
AVAILABLE ONLINE

