Evaluation

For the **Provincial Stroke Rounds Planning Committee**:

- To plan future programs
- For quality assurance and improvement

- For **You**: Reflecting on what you've learned and how you plan to apply it can help you enact change as you return to your professional duties

- For **Speakers**: The responses help understand participant learning needs, teaching outcomes and opportunities for improvement.

https://forms.office.com/r/mZPspu1V9d

Please take 2 minutes to fill the evaluation form out. Thank you!

BABY "SHOWER"

A Stroke Rounds on Pregnancy and Stroke

Robert Joseph C. Sarmiento, MD, FPNA, FCSC(S)
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Stroke Neurologist, Kingston Health Sciences Centre
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2 April 2025

Queen's UNIVERSITY

DISCLOSURES

- None

HISTORY

JS

Right-handed

37F

HISTORY

JS

30’s

Right-handed

ONE HOUR PRIOR TO ADMISSION

NO

HEADACHE

SEIZURE-LIKE MOVEMENTS

NAUSEA

2100H

IN TRANSIT

LAMS SCORE OF 5

Facial droop
Arm drift
Grip strength

TWO EPISODES OF VOMITING

NORMAL blood sugar

NORMAL blood pressure

2100H ~2120H

REVIEW OF SYSTEMS

GENERAL	No weight loss
HEENT	No **gum bleeding**, oral ulcers
PULMO	**No easy fatigability**
CVS	No chest pain, **palpitations**, **orthopnea, paroxysmal nocturnal dyspnea**, edema
GIT	No abdominal discomfort, no constipation, diarrhea, **melena, hematemesis, hematochezia**
GUT	No dysuria, polyuria, pyuria, nocturia, urgency, frequency, discharges
MSK	**No leg pain,** joint pains, cramps
HEMA	**No easy bruisability, spontaneous bleeding**

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PAST MEDICAL HISTORY

- **Gestational Diabetes**
- No HTN, PTB, bronchial asthma, thyroid diseases
- No history of migraine
- No seizures or epilepsy

MENSTRUAL AND OBSTETRIC HISTORY

- Menarche at 13 years old, occurring a regular monthly interval, lasting for 3-5 days consuming 3 pads per day
- **G3P2 2002**

G1	**2010**	**No feto-maternal complications**
G2	**2016**	**Gestational diabetes**
G3	**Current pregnancy @ 8 weeks GA**	

FAMILY MEDICAL HISTORY

- No strokes or premature atherosclerosis
- No early cardiac death
- No seizures or epilepsy
- No clotting disorders in the family

PERSONAL SOCIAL HISTORY

- No smoking, alcoholic beverage drinking
- No recreational drug use
- No history of previous travel
- She drives to work daily
- Healthcare aide for three years, husband is a truck driver
- Good family support

PHYSICAL EXAMINATION

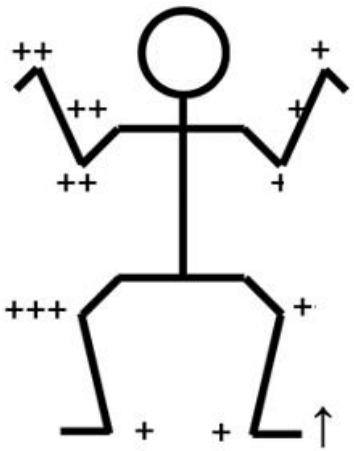
- **BP 237/ 106 HR 70 RR 18 O2 99% T 36.2**
- **Drowsy, easily arousable**, oriented to name, follows commands

SYSTEMIC PHYSICAL EXAM

HEENT	anicteric sclera, pink palpebral conjunctivae, no nasal discharge, **no carotid bruit**, no cervical lymphadenopathies, **no neck vein engorgement**
CHEST	symmetrical chest expansion, good air entry, no wheezing, adynamic precordium, apex beat not displaced**, distinct heart sounds, normal rate, regular cardiac rhythm**, **no murmurs**
ABD	**protuberant abdomen**, no scars or lesions. normoactive bowel sounds, soft, no palpable masses. No hepatosplenomegaly.
EXT	full and equal pulses, pink nail beds CRT < 2 seconds, no edema, no non healing wounds, no puncture wounds or scars, fair skinned with no rashes nor notable lesions

NEUROLOGIC EXAM

SENSORIUM	**Drowsy, easily arousable** with sustained wakefulness, oriented, follows commands
CRANIAL NERVES	**left hemianopia to threat, 3mm isocoric**, no RAPD distinct disc borders, no papilledema no ptosis, **primary gaze was midline but limited conjugate gaze to the left** **left central facial palsy, left trapezius lag**
MOTOR	Fair muscle bulk with no atrophy nor fasciculation. **Flaccid left extremities.**
REFLEXES	**Left side were hyporeflexic.** **(+) Extensor toe sign** by Babinski maneuver on the left
COORDI-NATION	No nystagmus
SENSORY	**Localized to pain on both sides, R > L**
MENINGEAL	Negative for Kernig's, Brudzinski's, supple neck
HCF	**Tactile inattention**



(-) clonus

5/5	**0/5**
5/5	**0/5**

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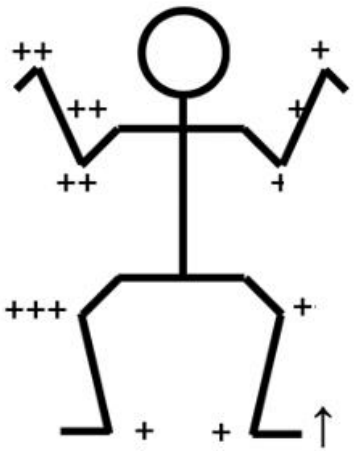

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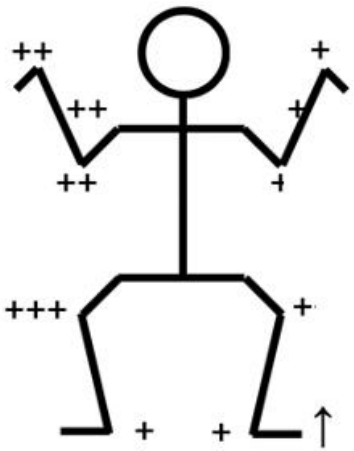

(-) clonus

5/5	**0/5**
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1A	Not alert but easily arousable	**2**
1B	Answers both questions correctly	**0**
1C	Performs both tasks correctly	**0**
2	Partial gaze palsy	**1**
3	Complete hemianopia	**2**
4	Partial paralysis	**1**
5A	No movement	**4**
5B	No drift	**0**
6A	No movement	**4**
6B	No drift	**0**
7	Absent limb ataxia	**0**
8	Mild to moderate sensory loss	**1**
9	No aphasia	**0**
10	Mild to moderate dysarthria	**1**
11	Visual, tactile, auditory inattention	**2**

NIHSS=17

CASE SUMMARY

- **37** year old **pregnant lady** with no known comorbidities presenting with **sudden onset left- sided weakness, vomiting, elevated blood pressure, and slightly depressed sensorium**.
- Pertinent neuro exam revealed left hemiplegia, right correctible preferential gaze, left facial droop, left hemianopia and left extensor toe sign consistent with **a right MCA syndrome stroke**.
- **NIHSS= 17**.

VASCULAR | INFECTIOUS | TRAUMA

DIFFERENTIAL DIAGNOSES

37/F with a left sided weakness

AUTOIMMUNE | METABOLIC | IATROGENIC

VASCULAR | INFECTIOUS | TRAUMA

DIFFERENTIAL DIAGNOSES

37/F with a **sudden** left sided weakness

AUTOIMMUNE | METABOLIC | IATROGENIC

DIFFERENTIAL DIAGNOSES

37/F Pregnant

Left sided weakness

Vomiting

Depressed sensorium

High blood pressure

Left hemiplegia

Left CFP

Left Hemianopia

Limited Gaze to the L

Left Babinski

Supple neck

VASCULAR

- Intracerebral Hemorrhage

DIFFERENTIAL DIAGNOSES

37/F Pregnant

Left sided weakness

Vomiting

Depressed sensorium

High blood pressure

Left hemiplegia

Left CFP

Left Hemianopia

Limited Gaze to the L

Left Babinski

Supple neck

VASCULAR

- Intracerebral Hemorrhage
- **Ischemia- Hypercoagulable**

DIFFERENTIAL DIAGNOSES

37/F Pregnant

Left sided weakness

Vomiting

Depressed sensorium

High blood pressure

Left hemiplegia

Left CFP

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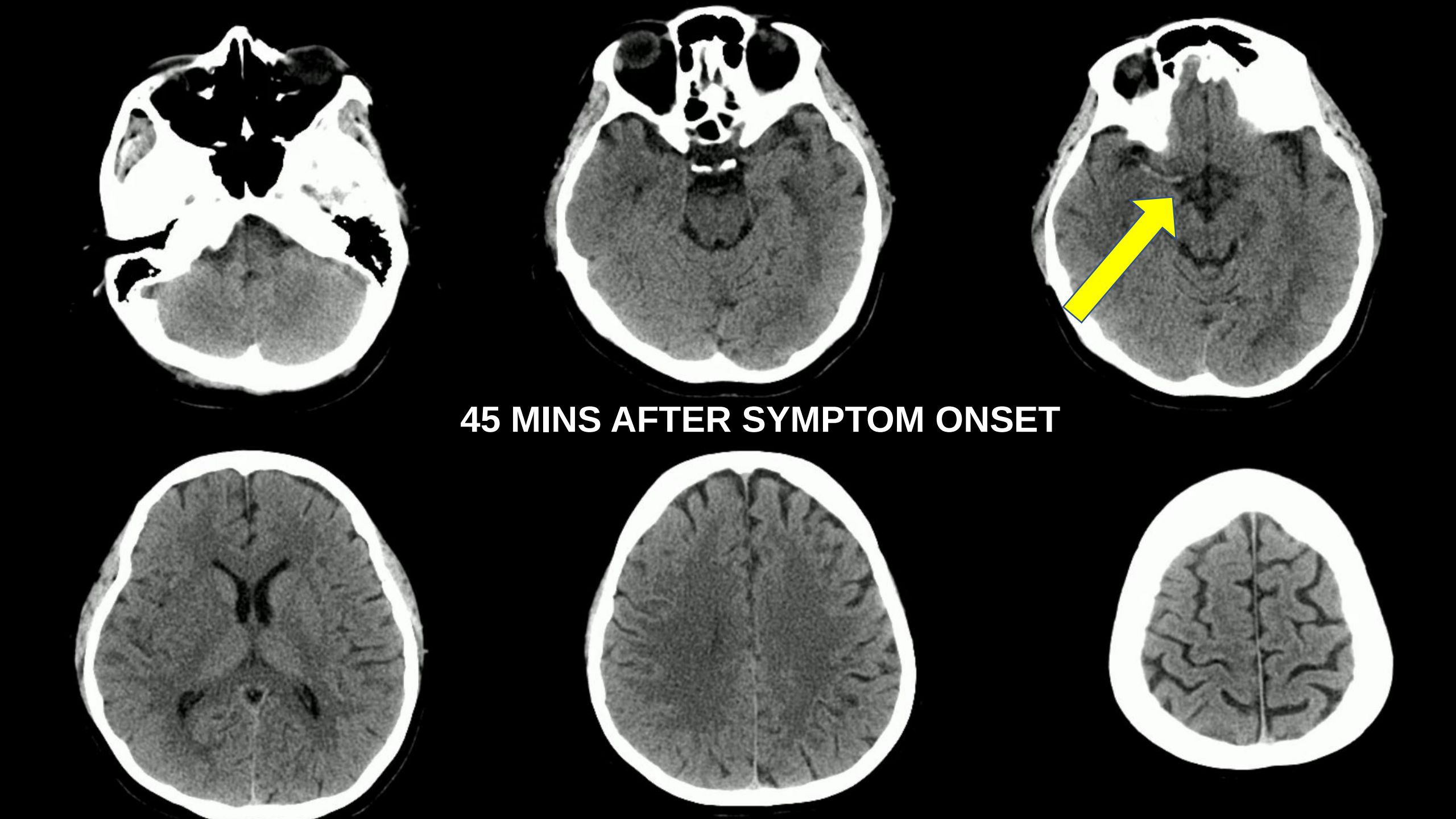
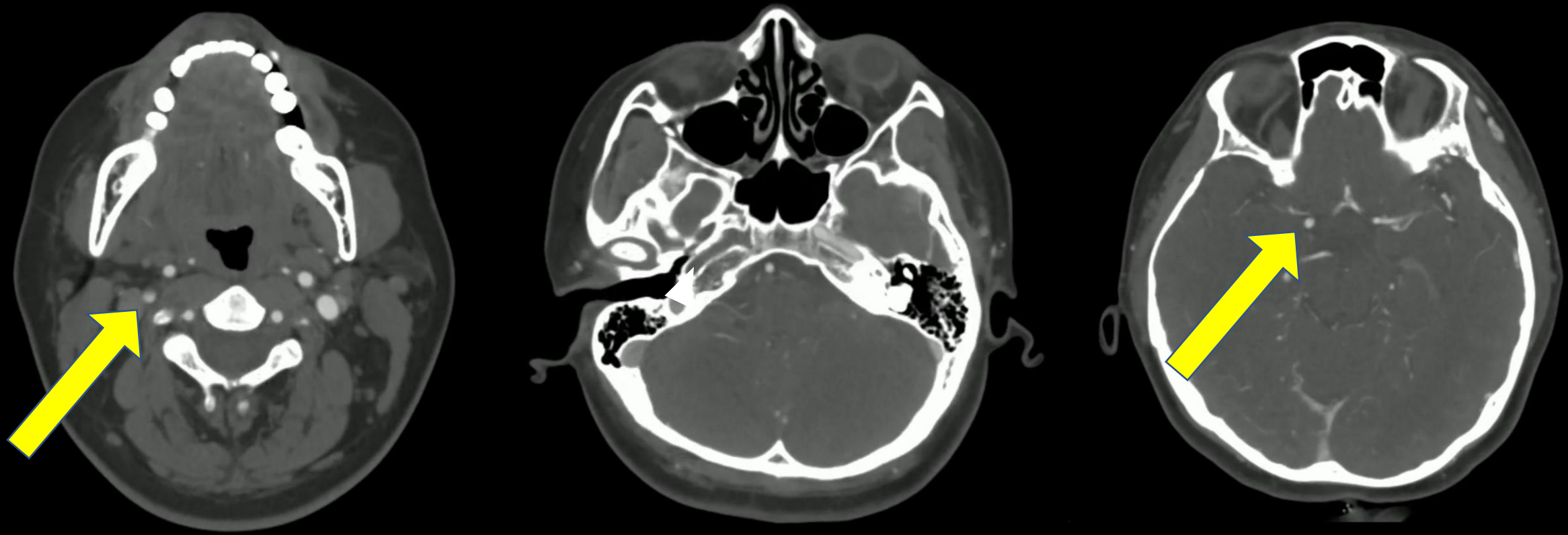
Left Babinski

Supple neck

VASCULAR

- Intracerebral Hemorrhage
- Ischemia- Hypercoagulable
- **Ischemia- Cardioembolic**


45 MINS AFTER SYMPTOM ONSET



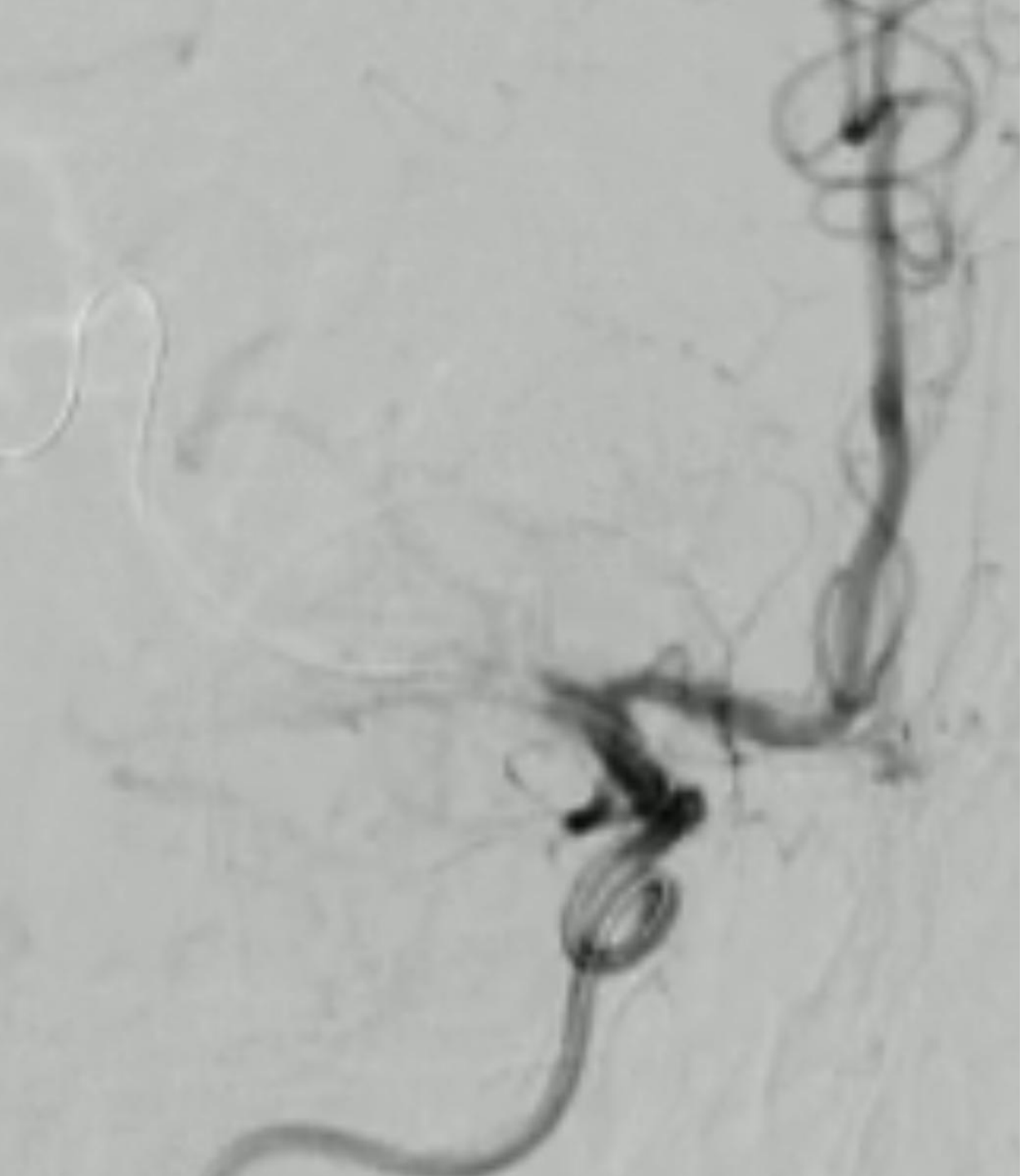
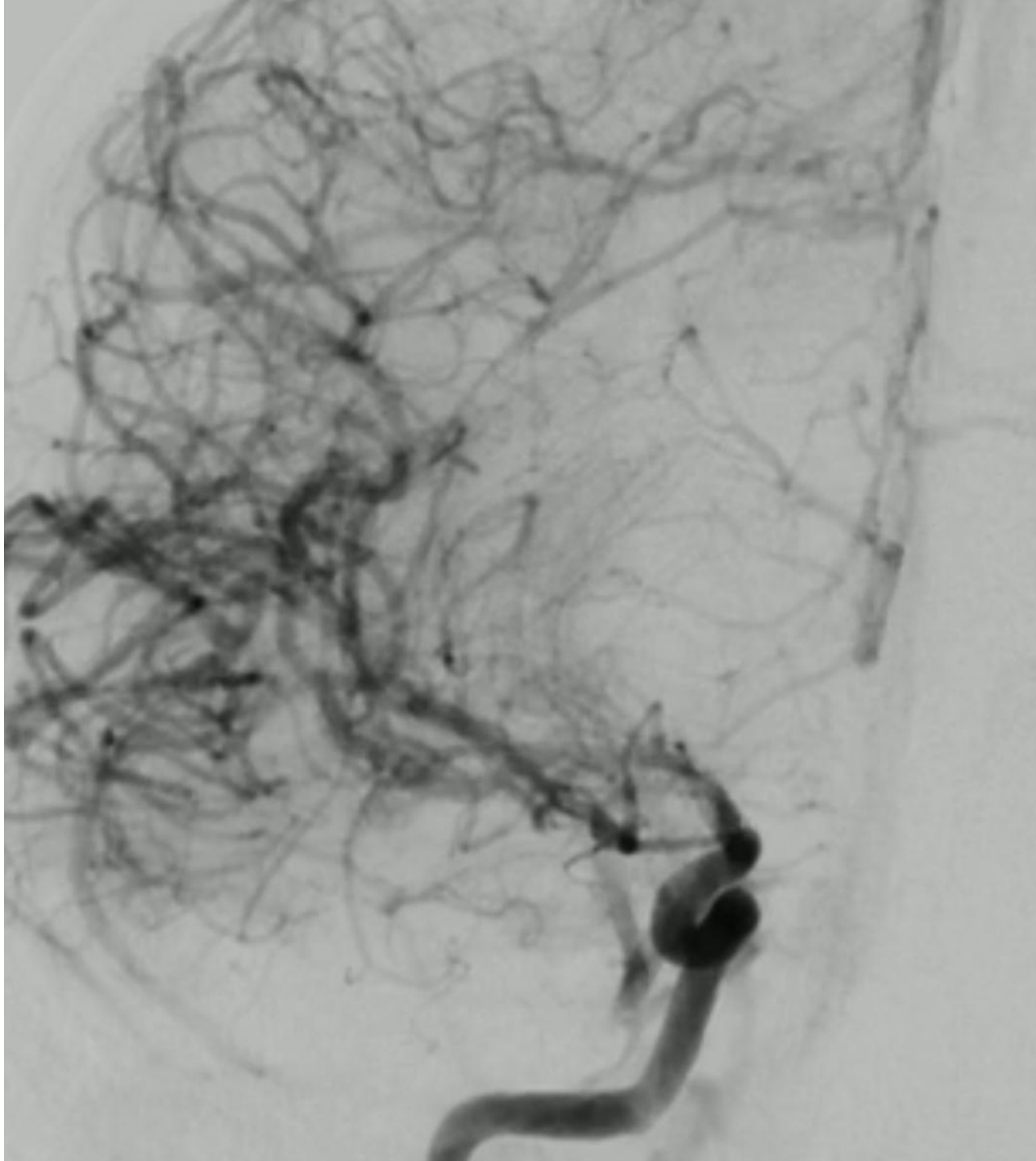
50 MINS AFTER SYMPTOM ONSET


30°
45°
60°
sin
1/2
√2/2
√3/2
cos
√3/2
√2/2
1/2
tan
√3/3
1
√3
2x
60°
30°
x√3
45°
x√2
x
45°

THROMBOLYSE?

MANAGEMENT

- After control of blood pressure and careful discussion with husband
- Given **0.9mg/kg Alteplase**
- Brought to Angio suite for EVT

1ST HOSPITAL DAY: STROKE OBSERVATION UNIT

R MCA SYNDROME

- Visual neglect, facial droop
- **L hand movement**

Acute CVD infarct R MCA

Cardioembolic Stroke

Hypercoagulable State

Stroke In the Young Work-up

- Hep B, Hep C, syphilis
- ANA, ENA, APAS, Lupus, TTE
- **Aspirin**

HD 1

HB	**101**
HCT	**0.32**
WBC	14.9
PT	302
NEUT	13.5
MCV	**70**
MCHC	313

Na	133
K	3.7
Cl	104
CO2	18
AG	11
CRP	5.8
CBG	6.2

HbA1C	5.5
Crea	52
eGFR	118

INR	0.9
APTT	24
LUPUS AC	**NEG**
B2 GCP	**NEG**
ANTI-CAR	**<15**
ANA	**NEG**
ANTI-CEN	**NEG**
HSV 1,2	**NEG**
SYP	**NR**

1ST HOSPITAL DAY

R MCA SYNDROME

- Visual neglect, facial droop
- L hand movement

Acute CVD infarct R MCA

Cardioembolic Stroke

Hypercoagulable State

Stroke In the Young Work-up

- Hep B, Hep C, syphilis
- ANA, ENA, APAS, Lupus, TTE
- Aspirin

Transesophageal Echo

- **PFO, moderate size, with no atrial septal aneurysm**
- Reversal of flow on agitated saline bubble study and Valsalva maneuver
- LV EF: 60-65%

CARDIOLOGY INPUTS

- No sufficient evidence to start LMWH
- Continue **Aspirin**
- Second trimester: appropriate time to intervene with defect

6TH- 7TH HOSPITAL DAY

R MCA SYNDROME

- Visual neglect, facial droop
- 4/+5 muscle movement

Acute CVD infarct R MCA

Cardioembolic Stroke

Stroke In the Young Work-up

- PFO
- **For closure on second trimester**

HD 9

DISCUSSION

QUESTIONS:

1. Why are pregnant patients at risk for stroke?
2. What are the differentials mechanisms of stroke in a pregnant patient?
3. How safe is thrombolysis and thrombectomy in pregnant patients with stroke?

OUTLINE

I. Case Presentation
II. Burden of Disease
III. Physiological Changes in Pregnancy
IV. Differential diagnoses
V. Thrombolysis and Thrombectomy in Pregnant Patients with Stroke
VI. Patient follow up and advice

BURDEN OF DISEASE

30 per 100,000 births

3x higher than rates for stroke in young adults overall

R. H. Swartz *et al.*, “The incidence of pregnancy-related stroke: A systematic review and meta-analysis,” *Int. J. Stroke*, vol. 12, no. 7, pp. 687–697, Oct. 2017.

10.8 per 100,000 → ⬆️ 16.6 per 100,000

2004 vs 2016

S. Liu, W.-S. Chan, J. G. Ray, M. S. Kramer, and K. S. Joseph, “Stroke and Cerebrovascular Disease in Pregnancy,” *Stroke*, vol. 50, no. 1, pp. 13–20, Jan. 2019.

BURDEN OF DISEASE

- Unit of **3300 deliveries per year**
  - Likely to encounter such a case every 9 months to 2 years

A. H. James, “Pregnancy and thrombotic risk,” *Crit. Care Med.*, vol. 38, pp. S57–S63, Feb. 2010.

BURDEN OF DISEASE

- The Nationwide Inpatient Sample (United States) 2000-2001
- 34.2 per 100,000 deliveries.
  - There were 117 deaths, a **mortality rate of 1.4 per 100,000**
  - Both the mortality and disability rates were higher than previously reported

A. H. James, “Pregnancy and thrombotic risk,” *Crit. Care Med.*, vol. 38, pp. S57–S63, Feb. 2010.

BURDEN OF DISEASE

- Japan
- Stroke is the **second leading cause** of maternal mortality
  - 90% of maternal strokes being hemorrhage

A. H. James, “Pregnancy and thrombotic risk,” *Crit. Care Med.*, vol. 38, pp. S57–S63, Feb. 2010.

HYPERTENSION

DIABETES

OBESITY

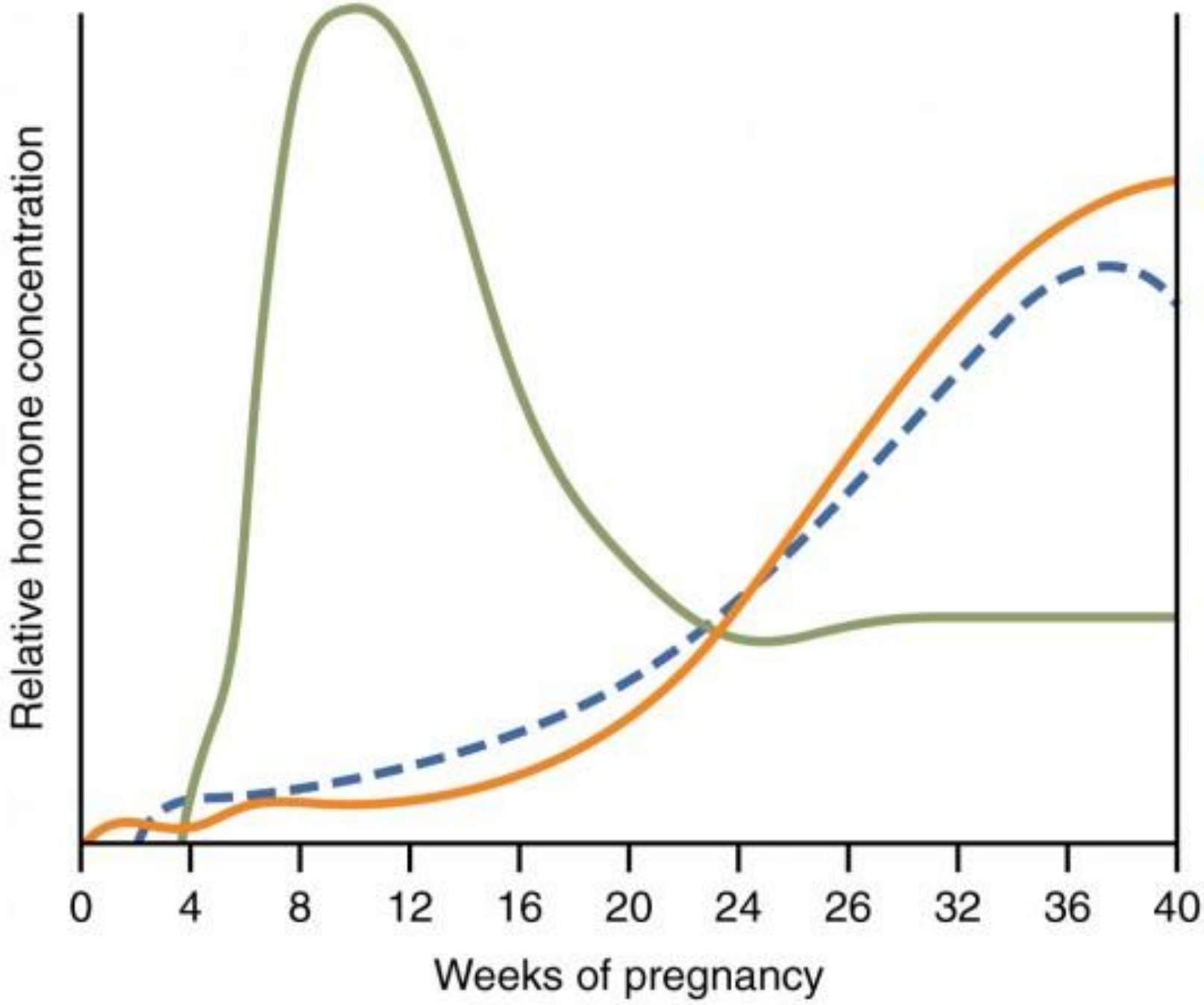
ADVANCING MATERNAL AGE

R. H. Swartz *et al.*, “The incidence of pregnancy-related stroke: A systematic review and meta-analysis,” *Int. J. Stroke*, vol. 12, no. 7, pp. 687–697, Oct. 2017.

Like other thrombo-embolic disease, stroke is essentially a disease of **puerperium**.

Z. Moatti, M. Gupta, R. Yadava, and S. Thamban, “A review of stroke and pregnancy: Incidence, management and prevention,” *Eur. J. Obstet. Gynecol. Reprod. Biol.*, vol. 181, pp. 20–27, 2014.


BLADDER



Estrogens

⬆️ clotting factors

Progesterone

Promotes venous dilatation

Vasoconstriction during ⬇️

Human chorionic gonadotropin

Pregnancy increases the risk of thrombosis

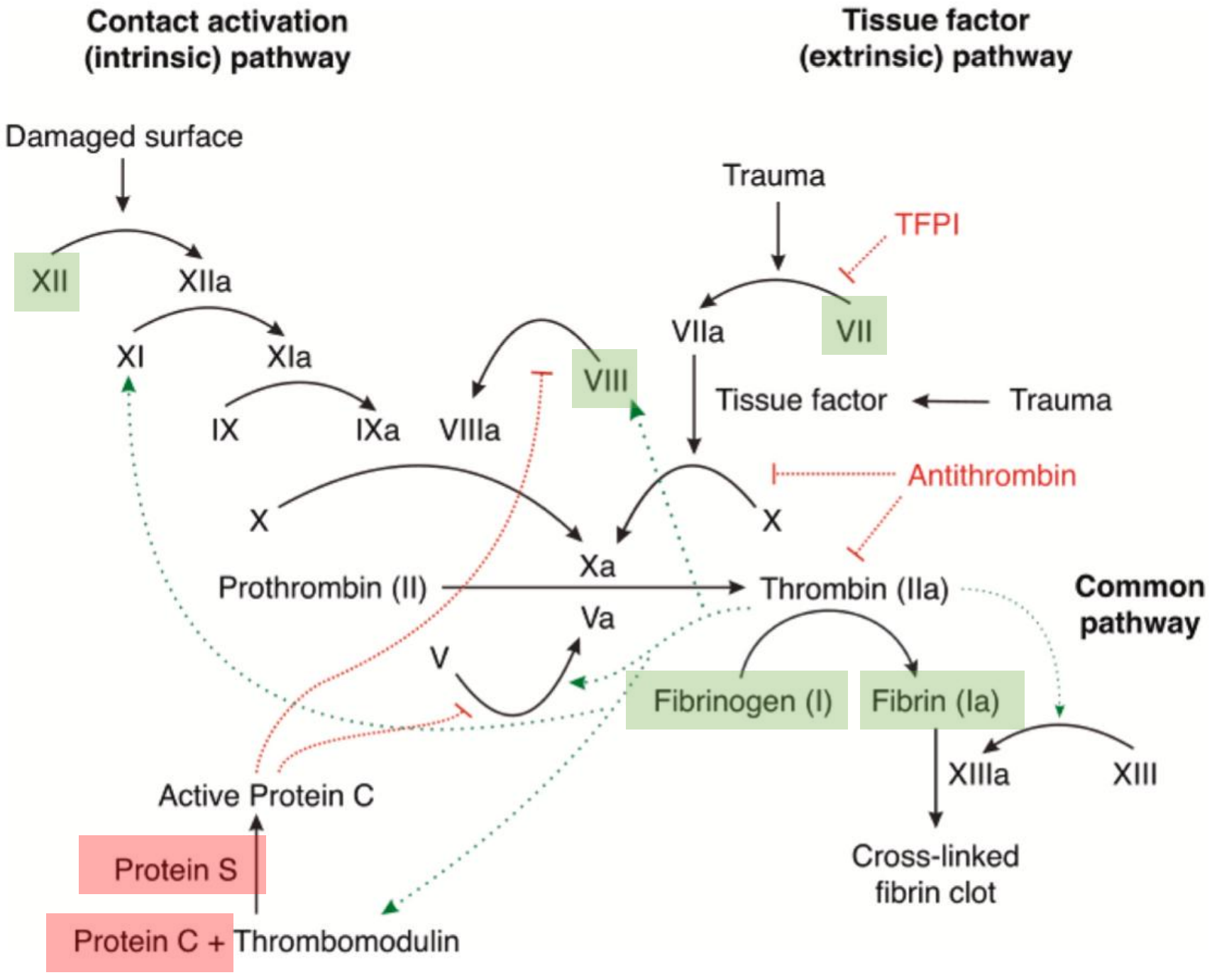
3-4x as early **as the first trimester**

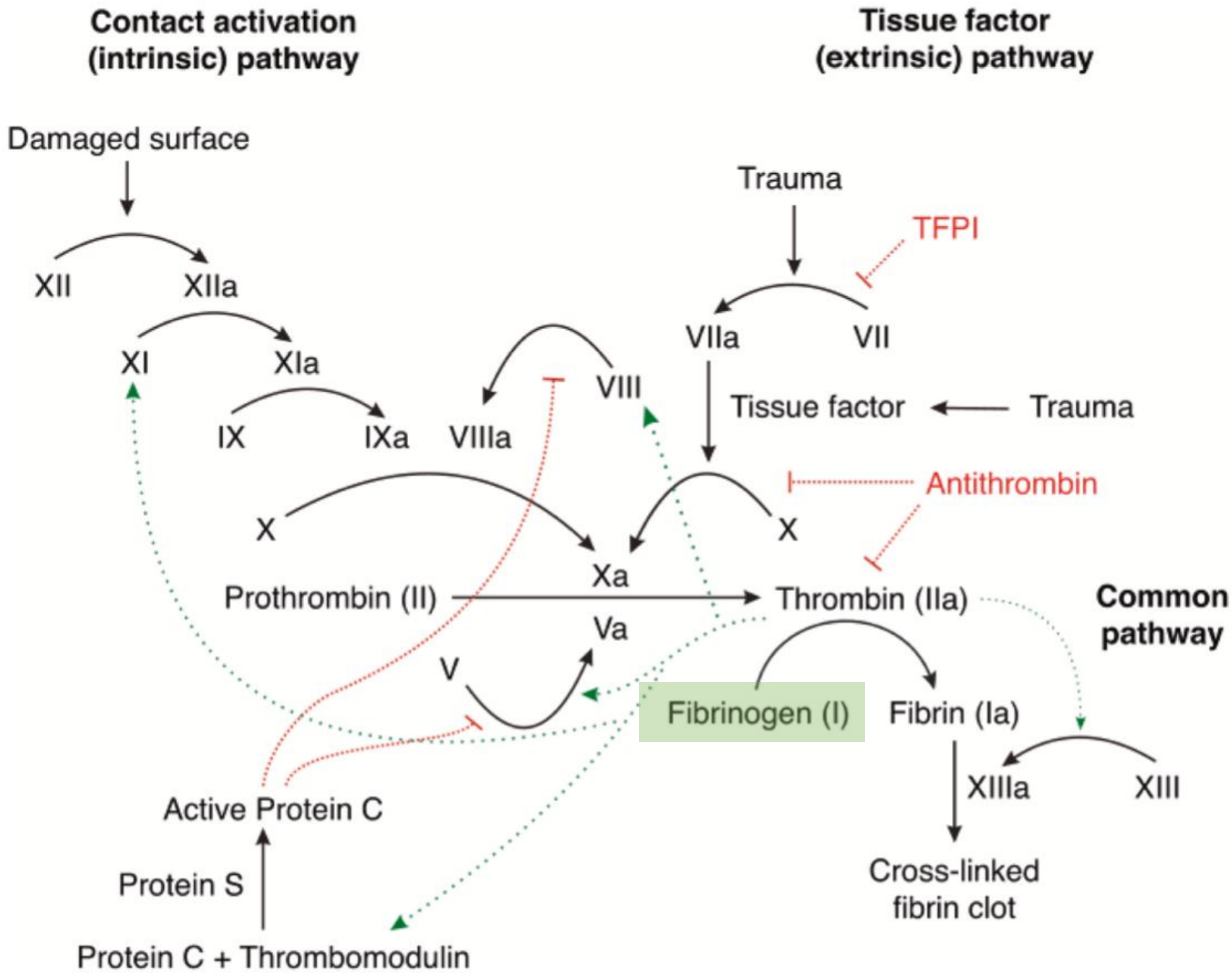
A. H. James, “Pregnancy and thrombotic risk,” *Crit. Care Med.*, vol. 38, pp. S57–S63, Feb. 2010.

BURDEN OF DISEASE

- Swedish Cohort
- Cerebral infarction **33x more** in three days surrounding delivery
- **8.3x** in the subsequent 6 weeks delivery.

A. H. James, “Pregnancy and thrombotic risk,” *Crit. Care Med.*, vol. 38, pp. S57–S63, Feb. 2010.


Contact activation
(intrinsic) pathway
Tissue factor
(extrinsic) pathway
Damaged surface
XII
XIIa
XI
XIa
IX
IXa
VIIIa
VIII
Trauma
TFPI
VIIa
VII
Tissue factor
Trauma
Antithrombin
X
X
Xa
Prothrombin (II)
Thrombin (IIa)
Common
pathway
Va
V
Fibrinogen (I)
Fibrin (Ia)
XIIIa
XIII
Cross-linked
fibrin clot
Active Protein C
Protein S
Protein C +
Thrombomodulin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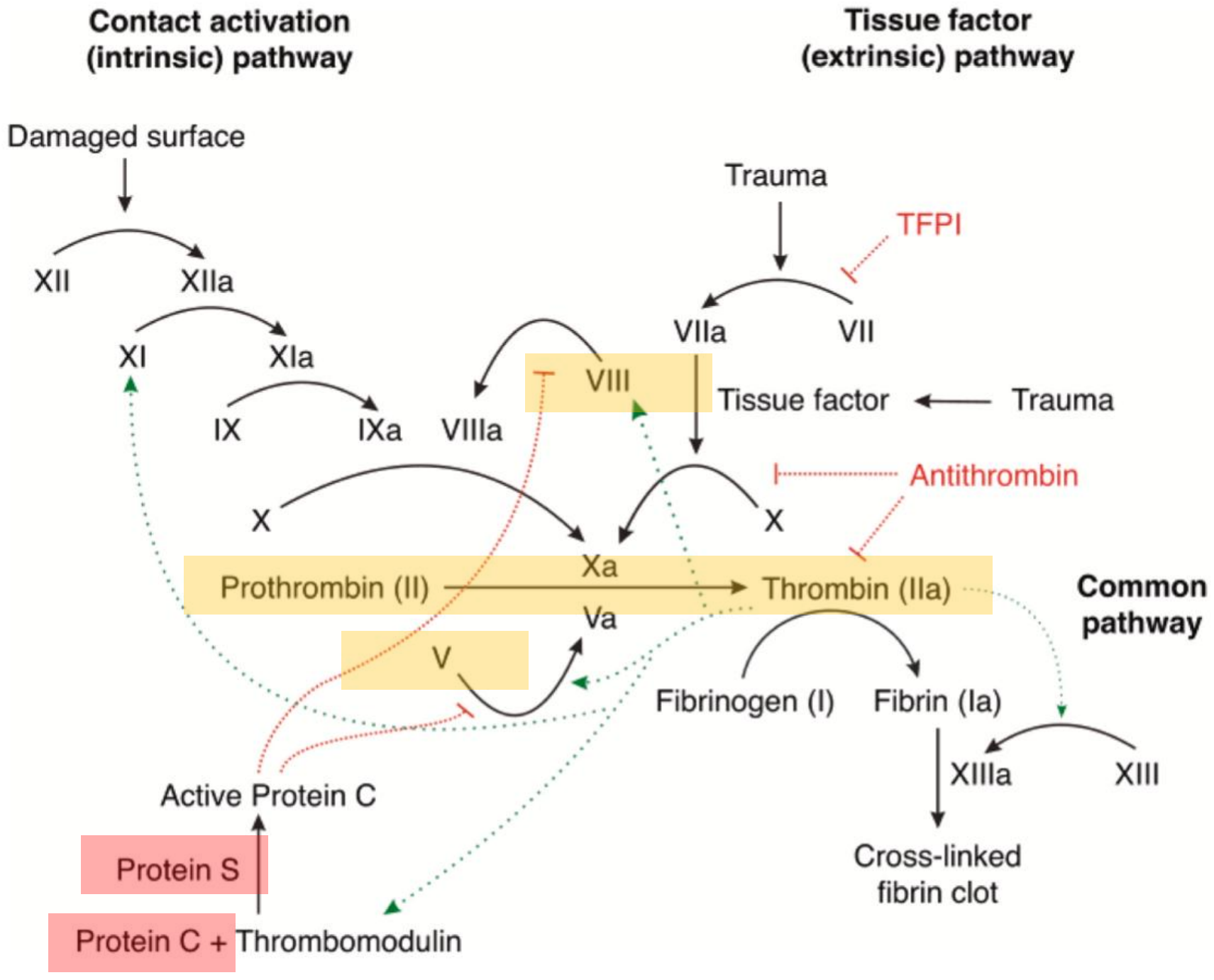
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Protein S
Protein C +
Thrombomodulin

In the vast majority of pregnancies, these levels are **not altered enough to cause a problem.**

They could have devastating consequences for women with underlying or undiagnosed thrombophiliia.

A. H. James, “Pregnancy and thrombotic risk,” *Crit. Care Med.*, vol. 38, pp. S57–S63, Feb. 2010.

BODY AND METABOLIC CHANGES

- Increased retention of water
  - Associated with an increased elaboration of estrogen and adrenocorticoids
- Lipotrophic effect of estrogen
  - Increase in total neutral fat, serum phospholipids and circulating cholesterol
- Steroid hormone
  - Causes changes in carbohydrate metabolism, increasing level of plasma glucose

B. Tettenborn, “Stroke and Pregnancy,” *Neurol. Clin.*, vol. 30, no. 3, pp. 913–924, 2012.

BODY AND METABOLIC CHANGES

- Increased retention of water → **HYPERTENSION**
  - Associated with an increased elaboration of estrogen and adrenocorticoids
- Lipotrophic effect of estrogen → **HYPERLIPIDEMIA**
  - Increase in total neutral fat, serum phospholipids and circulating cholesterol
- Steroid hormone → **GLUCOSE INTOLERANCE**
  - Causes changes in carbohydrate metabolism, increasing level of plasma glucose

B. Tettenborn, “Stroke and Pregnancy,” *Neurol. Clin.*, vol. 30, no. 3, pp. 913–924, 2012.

CARDIOVASCULAR CHANGES

- **Increase venous distensibility**
  - Caused by progesterone increase
  - Accommodate higher volumes + compromised venous return → dependent edema, varicose veins

B. Tettenborn, “Stroke and Pregnancy,” *Neurol. Clin.*, vol. 30, no. 3, pp. 913–924, 2012.

CARDIOVASCULAR CHANGES

- **Increase venous distensibility→ ⬆️ VENOUS THROMBOEMBOLISM**
  - Caused by progesterone increase
  - Accommodate higher volumes + compromised venous return → dependent edema, varicose veins

D. L. H. Koelman *et al.*, “Acute disseminated encephalomyelitis in 228 patients,” *Neurology*, vol. 86, no. 22, pp. 2085–2093, 2016.

… the inability to adapt to changes can put a patient with cardiac disease at risk of cardiovascular complications…

can also reveal a previously unknown underlying cardiac disease.

R. Ashrafi and S. L. Curtis, “Heart Disease and Pregnancy,” *Cardiol. Ther.*, vol. 6, no. 2, pp. 157–173, Dec. 2017.

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37/F

1HR history of sudden L sided weakness

G3P2 2002 **8 weeks pregnant**

PHx: no known risk factors

FHx: unremarkable

PSHx: no vices

Patent foramen ovale (PFO), stroke and pregnancy

Lei Chen,[1,2] Wenjun Deng,[1] Igor Palacios,[3] Ignacio Inglessis-Azuaje,[3] David McMullin,[1] Dong Zhou,[2] Eng H Lo,[1] Ferdinando Buonanno,[1] MingMing Ning[1]

BMJ

PFO-related stroke peaks **during early pregnancy** (first and second trimester—60%).

L. Chen *et al.*, “Patent foramen ovale (PFO), stroke and pregnancy,” *J. Investig. Med.*, vol. 64, no. 5, pp. 992–1000, 2016.

PREGNANCY AND PFO

- **7 out of 13 patients had additional risk factors**
  - Additional right-to-left shunting (from pulmonary AVM)
  - Hypercoagulable state
  - Migraine with aura

L. Chen *et al.*, “Patent foramen ovale (PFO), stroke and pregnancy,” *J. Investig. Med.*, vol. 64, no. 5, pp. 992–1000, 2016.

RISK FACTOR FOR RECURRENT STROKE

- high- risk PFO morphology (atrial septal aneurysm)
- larger right-to-left shunt
- multiple gestation and
- concurrent hypercoagulability
- Smoking
- Use of OCPs

L. Chen *et al.*, “Patent foramen ovale (PFO), stroke and pregnancy,” *J. Investig. Med.*, vol. 64, no. 5, pp. 992–1000, 2016.

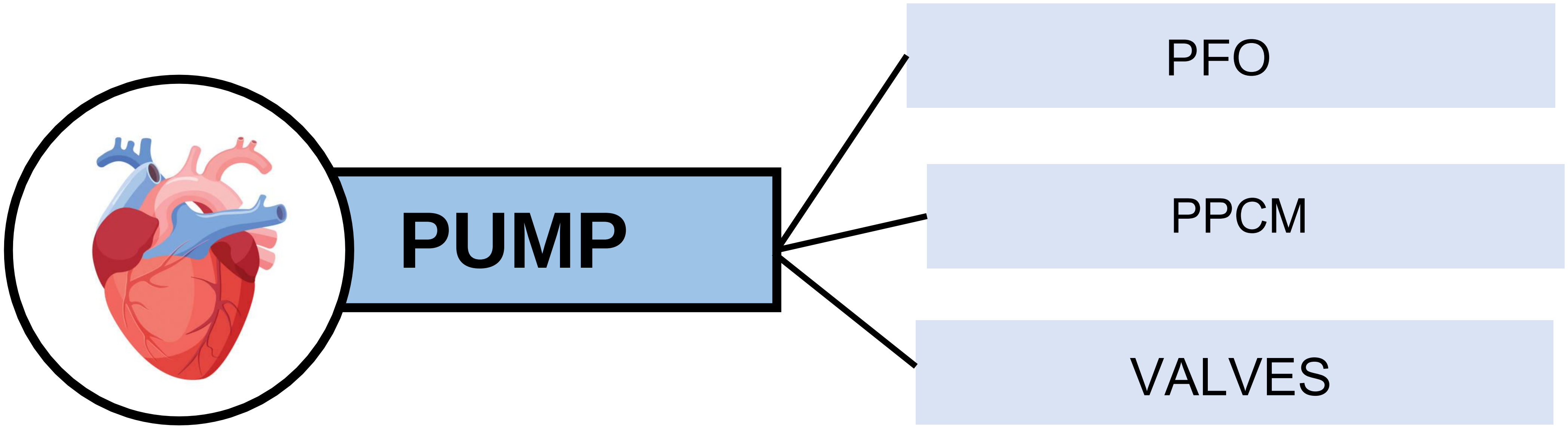
HYPERCOAGULABLE STATE OF PREGNANCY

CARDIOVASCULAR CHANGES

SUSCEPTIBILITY OF EMBOLI FROM R TO L ATRIA

Z. Moatti, M. Gupta, R. Yadava, and S. Thamban, “A review of stroke and pregnancy: Incidence, management and prevention,” *Eur. J. Obstet. Gynecol. Reprod. Biol.*, vol. 181, pp. 20–27, 2014.

DIFFERENTIALS

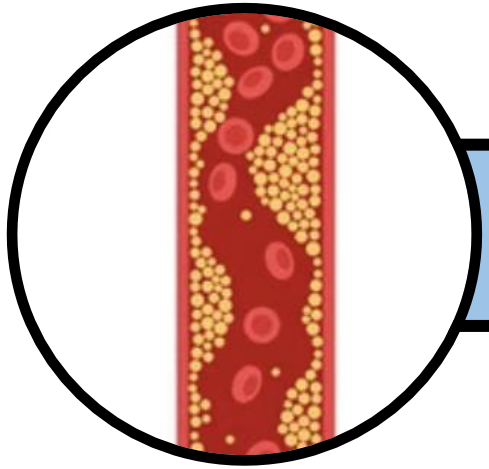


Peripartum Cardiomyopathy
Think of the Valves as well!

LV dysfunction + heart failure in previously healthy women

Bacterial and Non-bacterial endocarditis

Sinus rhythm, with depressed EF, 4% rate of embolic events (Mischie 2013)



PIPES

CVT

RCVS

DISSECTION

Reversible Cerebral Vasoconstriction Syndrome

Cerebral Venous Thrombosis

Headaches, papilledema

1% of all strokes in adults

Associated with Valsalva and hemodynamic changes

Vasoconstriction, often triggered by vasoactive substances

Resolution after several weeks (Decros, 2012)

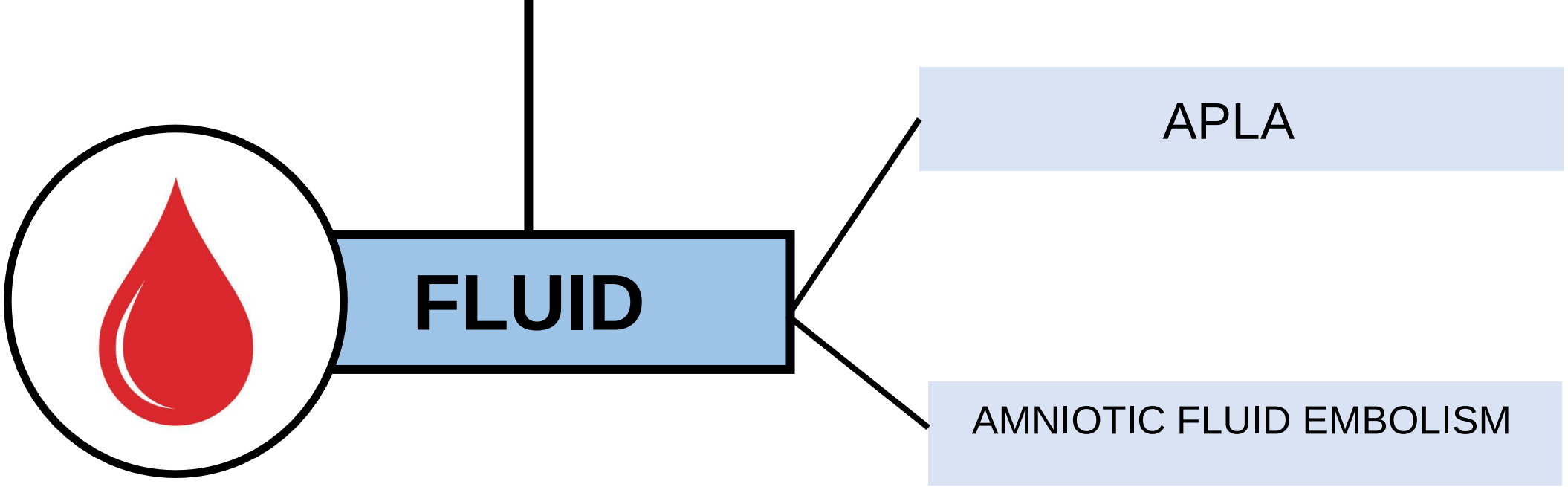
Cervical Artery Dissection

Headaches, “coat hanger pain”

2.6- 3 per 100,000

Thunderclap headaches

9.1 per 100,000 in young adults (Schwarz, 2017)



Anti- Phospholipid Antibody Syndrome

Amniotic Fluid Embolism

Allergic-type reaction to amniotic fluid introduced

10.7% recurrence in pregnancy despite aspirin and LMWH thrombophylaxis

+ PFO allowing a venous system amniotic fluid embolus to the arterial circulation

ICH IN PREGNANCY

- Tend to be more common in Eastern studies
  - Taiwanese cohorts, Japanese cohorts
- **43- 69% in Asian population vs 33- 52% in Western countries**
- Associated with poorest outcomes
  - In 32 cases out of 67,000 deliveries
    - Mortality rate 17.8%
    - 77% were due to ICH

Z. Moatti, M. Gupta, R. Yadava, and S. Thamban, “A review of stroke and pregnancy: Incidence, management and prevention,” *Eur. J. Obstet. Gynecol. Reprod. Biol.*, vol. 181, pp. 20–27, 2014.

HEMORRHAGIC STROKES

- Jaigobin (2000)
  - 50,700 admissions for delivery, 13 had hemorrhages
  - 1/3 ruptured aneurysms
  - 1/2 ruptured AVMs
  - Disseminated intravascular coagulation
- Liang (2006)
  - **SAH and ICH:** three days surrounding delivery or during the puerperium

Z. Moatti, M. Gupta, R. Yadava, and S. Thamban, “A review of stroke and pregnancy: Incidence, management and prevention,” *Eur. J. Obstet. Gynecol. Reprod. Biol.*, vol. 181, pp. 20–27, 2014.

PREECLAMPSIA

- complex multi-system disorder, conferring risks for both ischemic and hemorrhagic stroke.
- Pre- eclampsia is **present as a risk factor in 25 to 45%** of cases of stroke in pregnancy
- associated with a 3–12 fold risk of stroke

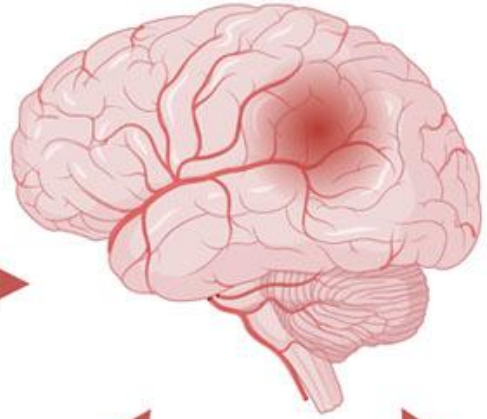
Z. Moatti, M. Gupta, R. Yadava, and S. Thamban, “A review of stroke and pregnancy: Incidence, management and prevention,” *Eur. J. Obstet. Gynecol. Reprod. Biol.*, vol. 181, pp. 20–27, 2014.

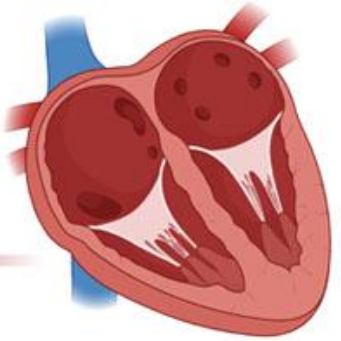
PREECLAMPSIA

- Many factors increase the risk of stroke:
  - raised blood pressure,
  - endothelial dysfunction,
  - hemolysis,
  - elevated liver enzymes and low platelets (HELLP syndrome) leading to fibrin deposition and platelet aggregation,
  - hemoconcentration
  - activation of the coagulation cascade.

Z. Moatti, M. Gupta, R. Yadava, and S. Thamban, “A review of stroke and pregnancy: Incidence, management and prevention,” *Eur. J. Obstet. Gynecol. Reprod. Biol.*, vol. 181, pp. 20–27, 2014.

Mechanisms of Pregnancy-Associated Stroke



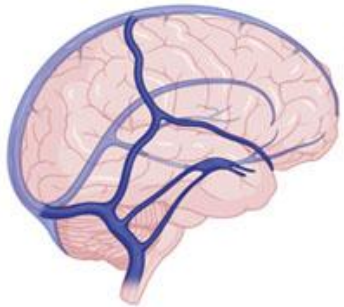


Hypertensive Disorders of Pregnancy

Hypertensive intracerebral hemorrhage

Cardioembolic

Valvular heart disease
Atrial Fibrillation
Peripartum cardiomyopathy
PFO



Intracranial Venous Disease

Dural sinus thrombosis
Cerebral venous thrombosis

Extracranial and Intracranial Arterial Disease

Dissection
Arteritis
RCVS

Aneurysm
Arterio-venous malformation

STROKE, PREGNANCY AND IVT


CAREFUL.

NEUROIMAGING

- The typical dose threshold for fetal radiation is in the **range of 50–100 mGy.**
- A plain CT head dose to the uterus is measured at **<1 mGy**
- Lead shielding, pulsed vs continuous fluoroscopy, selective magnification
  - reduce radiation scatter.
- No significant risk with using **iodine contrast**.

S. Kular *et al.*, “Mechanical thrombectomy for acute stroke in pregnancy,” *Neuroradiol. J.*, vol. 33, no. 2, pp. 134–139, Apr. 2020.

Pregnant or postpartum women **were less likely** to receive IV tPA monotherapy (4.4% vs 7.9%) primarily due to “pregnancy” and ”recent surgery”.

L. R. Leffert *et al.*, *Treatment patterns and short-term outcomes in ischemic stroke in pregnancy or postpartum period Presented at the American Heart Association/American Stroke Association 2015 International Stroke Conference, Nashville, TN, February 11 - 12, 2014.*, vol. 214, no. 6. Elsevier Ltd, 2016.

PREGNANCY AND THROMBOLYSIS

- **Pregnancy** and **first week post-partum** are **not** contra-indications for treatment
- Pregnant women were **not** included in Phase II and Phase III trials
  - Thorough risk assessment of bleeding risks

Z. Moatti, M. Gupta, R. Yadava, and S. Thamban, “A review of stroke and pregnancy: Incidence, management and prevention,” *Eur. J. Obstet. Gynecol. Reprod. Biol.*, vol. 181, pp. 20–27, 2014.

PREGNANCY AND THROMBOLYSIS

- Recombinant tissue plasminogen activator (Alteplase)
  - **Not known to be teratogenic**
  - 72 000 kD
    - Large molecule to cross the placenta
  - Will take **twice** or **thrice** for it to be teratogenic

Z. Moatti, M. Gupta, R. Yadava, and S. Thamban, “A review of stroke and pregnancy: Incidence, management and prevention,” *Eur. J. Obstet. Gynecol. Reprod. Biol.*, vol. 181, pp. 20–27, 2014.

Thrombolytic therapy in pregnancy

Georg Leonhardt, Charly Gaul, Hubert H Nietsch, Michael Buerke, and Ekkehard Schleussner

Martin-Luther-University Halle-Wittenberg

G. Leonhardt, C. Gaul, H. H. Nietsch, M. Buerke, and E. Schleussner, “Thrombolytic therapy in pregnancy,” *J. Thromb. Thrombolysis*, vol. 21, no. 3, pp. 271–276, 2006.

Leonhardt, et al.

- 28 cases of systemic thrombolysis in pregnancy
- **10 Stroke patients**
- Optimal outcomes in 7/10 patients
  - 1 dense hemiparesis
  - 1 mortality due to arterial dissection
  - 1 treated by a second thrombolytic treatment

G. Leonhardt, C. Gaul, H. H. Nietsch, M. Buerke, and E. Schleussner, “Thrombolytic therapy in pregnancy,” *J. Thromb. Thrombolysis*, vol. 21, no. 3, pp. 271–276, 2006.

Leonhardt, et al.

- **None** of the live-born children suffered a permanent deficit.

G. Leonhardt, C. Gaul, H. H. Nietsch, M. Buerke, and E. Schleussner, “Thrombolytic therapy in pregnancy,” *J. Thromb. Thrombolysis*, vol. 21, no. 3, pp. 271–276, 2006.

Use of thrombolytics for the treatment of thromboembolic disease during pregnancy

M A Turrentine [1], G Braems, M M Ramirez

Affiliations + expand

PMID: 7566831 DOI: 10.1097/00006254-199507000-00020

8% maternal hemorrhages

Hemorrhagic complications after off-label thrombolysis for ischemic stroke

Aitziber Aleu [1], Patricio Mellado, Christoph Lichy, Martin Köhrmann, Peter D Schellinger

Affiliations + expand

PMID: 17185641 DOI: 10.1161/01.STR.0000254504.71955.05

1 out of 11 pregnant women

Turrentine MA, Braems G, Ramirez MM. Use of thrombolytics for the treatment of thromboembolic disease during pregnancy. Obstet Gynecol Surv 1995;50: 534–41
Aleu A, Mellado P, Lichy C, et al. Hemorrhagic complications after off-label throm- bolysis for ischemic stroke. Stroke 2007;38:417–22

CEREBROVASCULAR DISEASE AND INTERVENTIONAL NEUROLOGY: ACUTE MANAGEMENT AND INTERVENTIONAL TECHNIQUES

April 9, 2024 |

Check for updates

First Reported Case of Tenecteplase for Treatment of Acute Ischemic Stroke in Pregnancy (P1-5.011)

Jacob Sambursky, Ali Payan, Patrick Brown, and Sishir Mannava | AUTHORS INFO & AFFILIATIONS

April 9, 2024 issue • 102 (17_supplement_1) • https://doi.org/10.1212/WNL.0000000000208233

30year old G3P2, 6weeks AOG
Midbrain infarction
Received TNK

EFFICACY AND SAFETY OF IVT IN PREGNANCY

- Get with the Guidelines Stroke Registry
  - *Reperfusion therapy* was associated with **similar favorable outcomes and reperfusion rates**
    - among pregnant or postpartum women compared to nonpregnant women

[L. R. Leffert *et al.*, *Treatment patterns and short-term outcomes in ischemic stroke in pregnancy or postpartum period Presented at the American Heart Association/American Stroke Association 2015 International Stroke Conference, Nashville, TN, February 11 - 12, 2014.*, vol. 214, no. 6. Elsevier Ltd, 2016.

STROKE, PREGNANCY AND EVT

STROKE, PREGNANCY AND EVT

- Mechanical thrombectomy
  - Proven to be effective in patients with acute ischemic stroke with proximal LVO
  - **Pregnant women were excluded from the trial**

M. E. Van Alebeek, R. De Heus, A. M. Tuladhar, and F. E. De Leeuw, “Pregnancy and ischemic stroke: A practical guide to management,” *Curr. Opin. Neurol.*, vol. 31, no. 1, pp. 44–51, 2018.

STROKE, PREGNANCY AND EVT

- Multiple cases have been reported of pregnant women who underwent successful thrombectomy for acute ischemic stroke
- Subsequently had an uneventful recovery with **good functional outcomes**
- **No subsequent delivery or infant complications**

M. D. Zambrano and E. C. Miller, “Maternal Stroke: an Update,” *Curr. Atheroscler. Rep.*, vol. 21, no. 9, 2019.

Canadian Stroke Best Practices

CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Stroke in Pregnancy

A Consensus Statement by the Canadian Stroke Best Practices Stroke in Pregnancy Writing Group.

Part Two: Acute Stroke Management during Pregnancy

These reperfusion therapies **could be offered to pregnant and post- partum women who otherwise meet criteria**.

Ladhani NNN, Swartz RH, Foley N, et al. Canadian stroke best practice consensus statement: acute stroke management during pregnancy. Int J Stroke 2018;13:743–58.

FOLLOW-UP

A WORD ON THROMBOPHYLAXIS

- **Aspirin** is recommended for patients with a history of ischemic stroke.
- Low-molecular heparin (LMWH) should be considered in certain cases.
- For patient with no prior history of stroke, anticoagulation with LMWH is required in certain circumstances, e.g. thrombophilia disorders or prosthetic heart valve.

Z. Moatti, M. Gupta, R. Yadava, and S. Thamban, “A review of stroke and pregnancy: Incidence, management and prevention,” *Eur. J. Obstet. Gynecol. Reprod. Biol.*, vol. 181, pp. 20–27, 2014.

Table 3. Ischemic stroke treatment: recommendations during pregnancy, delivery, and lactation period

Medication	Period		
	Pregnancy	Delivery	Lactation
Recombinant tissue plasminogen activator (rt-PA)	Relative contra-indication, however individual decision, benefit should outweigh risk (level of evidence C)	Limited evidence: within 48 h after delivery considerable risk of fetal and maternal bleeding (level of evidence C)	Limited evidence: temporarily discontinuation advised (level of evidence C)
Aspirin	Safe up to 150 mg in second and third trimester, in first trimester no consensus[a] (level of evidence B)	Discontinue at 36th week or 1 week prior to a scheduled delivery (level of evidence C)	Safe up to 150 mg (level of evidence C)
Other antiplatelet agents (dipyridamole, ticagrelor, clopidogrel)	Limited evidence, do not use (level of evidence C)	Limited evidence, do not use (level of evidence C)	Limited evidence, do not use (level of evidence C)
Heparin (LMWH, UFH)	Safe, LMWH preferred over UFH (level of evidence B)	Discontinue 24 h prior to delivery, or as soon as possible in case of contractions/spontaneous rupture of membranes. Restart within 12–24 h after delivery (level of evidence B)	Safe, not secreted in breast milk (level of evidence UFH: A, level of evidence LMWH: B)
Vitamin K antagonists (warfarin, acenocoumarol)	Teratogenic, convert to LMWH/UFH especially in first and third trimester (level of evidence B) In case of high cardioembolic risk (mechanical heart valves): adjusted-dose UFH/bid LMWH or UFH/LMWH until 13th week, then vitamin K antagonists until close to term, then resume UFH/LMWH. [60,67] (level of evidence A)	Discontinue close to delivery (in case of high cardioembolic risk), restart 1–3 days after delivery (level of evidence C)	Safe (level of evidence A)
Direct oral anticoagulants	Limited evidence, do not use (level of	Limited evidence, do not use (level of	Evidence of secretion in breast milk, do not

Heparin (LMWH, UFH)	Safe, LMWH preferred over UFH (level of evidence B)	Discontinue 24 h prior to delivery, or as soon as possible in case of contractions/spontaneous rupture of membranes. Restart within 12–24 h after delivery (level of evidence B)	Safe, not secreted in breast milk (level of evidence UFH: A, level of evidence LMWH: B)
Vitamin K antagonists (warfarin, acenocoumarol)	Teratogenic, convert to LMWH/UFH especially in first and third trimester (level of evidence B) In case of high cardioembolic risk (mechanical heart valves): adjusted-dose UFH/bid LMWH or UFH/LMWH until 13th week, then vitamin K antagonists until close to term, then resume UFH/ LMWH. [60,67] (level of evidence A)	Discontinue close to delivery (in case of high cardioembolic risk), restart 1–3 days after delivery (level of evidence C)	Safe (level of evidence A)
Direct oral anticoagulants (DOAC) (apixaban, rivaroxaban, dabigatran)	Limited evidence, do not use (level of evidence C)	Limited evidence, do not use (level of evidence C)	Evidence of secretion in breast milk, do not use (level of evidence C)

Aspirin	Safe up to 150 mg in second and third trimester, in first trimester no consensus[a] (level of evidence B)	Discontinue at 36th week or 1 week prior to a scheduled delivery (level of evidence C)	Safe up to 150 mg (level of evidence C)
Other antiplatelet agents (dipyridamole, ticagrelor, clopidogrel)	Limited evidence, do not use (level of evidence C)	Limited evidence, do not use (level of evidence C)	Limited evidence, do not use (level of evidence C)
Heparin (LMWH, UFH)	Safe, LMWH preferred over UFH (level of evidence B)	Discontinue 24 h prior to delivery, or as soon as possible in case of contractions/spontaneous rupture of membranes. Restart within 12–24 h after delivery (level of evidence B)	Safe, not secreted in breast milk (level of evidence UFH: A, level of evidence LMWH: B)
Vitamin K antagonists (warfarin, acenocoumarol)	Teratogenic, convert to LMWH/UFH especially in first and third trimester (level of evidence B) In case of high cardioembolic risk (mechanical heart valves): adjusted-dose UFH/bid LMWH or UFH/LMWH until 13th week, then vitamin K antagonists until close to term, then resume UFH/ LMWH. [60,67] (level of evidence A)	Discontinue close to delivery (in case of high cardioembolic risk), restart 1–3 days after delivery (level of evidence C)	Safe (level of evidence A)
Direct oral anticoagulants (DOAC) (apixaban, rivaroxaban, dabigatran)	Limited evidence, do not use (level of evidence C)	Limited evidence, do not use (level of evidence C)	Evidence of secretion in breast milk, do not use (level of evidence C)
Statins	Discontinue. Limited evidence, therapy not essential during pregnancy (level of evidence C)		Limited evidence, do not use (level of evidence C)
Antihypertensive treatment	(Intravenous) Labetalol, nifedipine and methyldopa well tolerated and effective (level of evidence A) Avoid Atenolol, angiotensin receptor blockers and direct renin inhibitors (level of evidence C)		Widely used and compatible with breastfeeding (consult Lactmed[b] for complete summary): -Beta blockers: propranolol, labetalol, metoprolol; -

PSYCHOLOGICAL CARE

- Multi-disciplinary neuro-rehabilitation and referral to specialist perinatal mental health services.
- The evidence of stroke recurrence is low– between **1.8% and 2.7%.**
- Recurrence in the next pregnancy?
  - N= 441 women with early onset ischemic stroke
  - 187 subsequent pregnancies, 3 had repeat stroke

Z. Moatti, M. Gupta, R. Yadava, and S. Thamban, “A review of stroke and pregnancy: Incidence, management and prevention,” *Eur. J. Obstet. Gynecol. Reprod. Biol.*, vol. 181, pp. 20–27, 2014.

PSYCHOLOGICAL CARE

- After the initial stroke, about **34% of women** indicated that they would have wanted more pregnancies
- but avoided due to risk of recurrence of stroke, or had residual handicap.

Z. Moatti, M. Gupta, R. Yadava, and S. Thamban, “A review of stroke and pregnancy: Incidence, management and prevention,” *Eur. J. Obstet. Gynecol. Reprod. Biol.*, vol. 181, pp. 20–27, 2014.

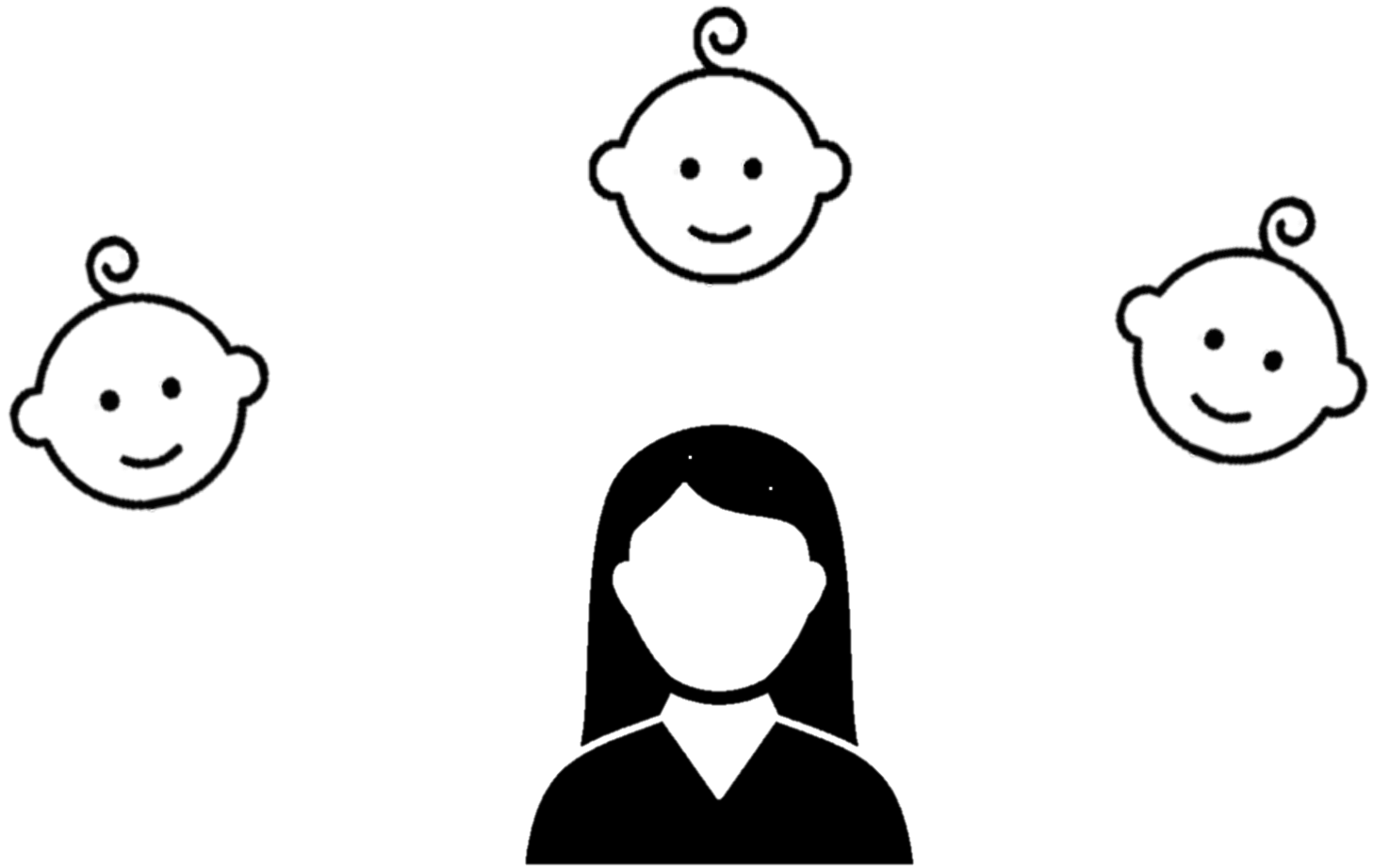
QUESTIONS:

1. Why are pregnant patients at risk for stroke?
2. What are the differentials mechanisms of stroke in a pregnant patient?
3. How safe is thrombolysis and thrombectomy in pregnant patients with stroke?

TAKE HOME POINTS

1. Stroke during pregnancy is rare but has **significant** maternal morbidity and mortality.
2. Etiology differs to the non-pregnant population due to **physiologic changes.** Unique pathomechanisms exist.
3. Thrombolysis and thrombectomy **could be offered to selected patients, though paucity of evidence exists.**
4. Multi-disciplinary management and family involvement are utmost importance in making future plans for the patient.

CASE DENOUMENT



THANK YOU!

Maraming Salamat!

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G. Leonhardt, C. Gaul, H. H. Nietsch, M. Buerke, and E. Schleussner, “Thrombolytic therapy in pregnancy,” *J. Thromb. Thrombolysis*, vol. 21, no. 3, pp. 271–276, 2006.
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BABY "SHOWER"

A Stroke Rounds on Pregnancy and Stroke

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2 April 2025

Queen's UNIVERSITY

Evaluation

For the **Provincial Stroke Rounds Planning Committee**:

- To plan future programs
- For quality assurance and improvement

- For **You**: Reflecting on what you've learned and how you plan to apply it can help you enact change as you return to your professional duties

- For **Speakers**: The responses help understand participant learning needs, teaching outcomes and opportunities for improvement.

https://forms.office.com/r/mZPspu1V9d

Please take 2 minutes to fill the evaluation form out. Thank you!