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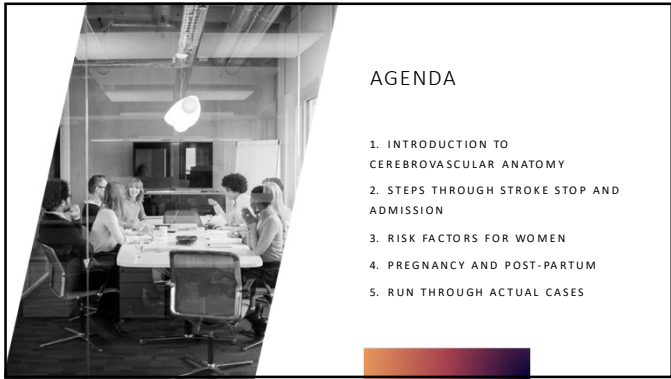
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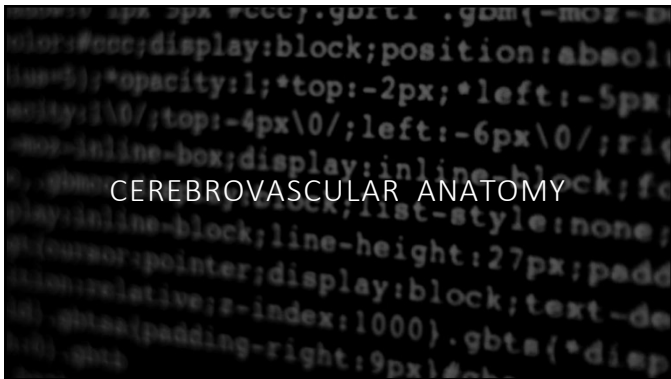
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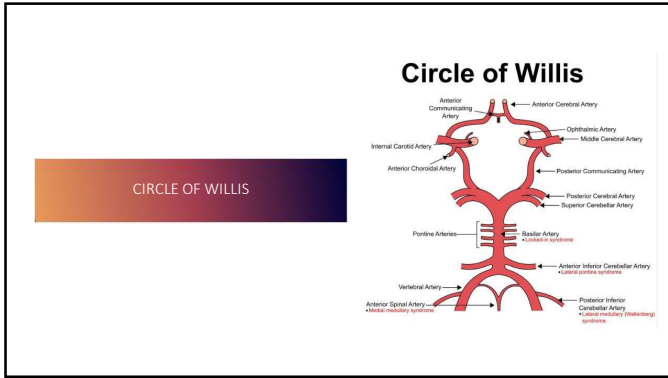
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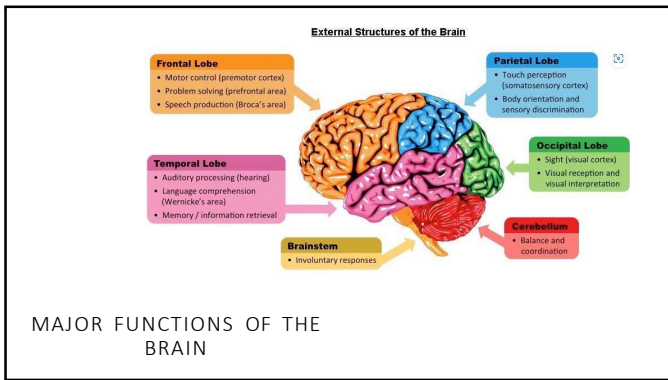
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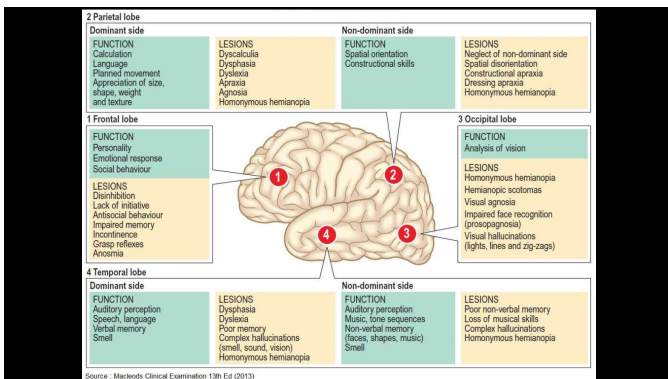
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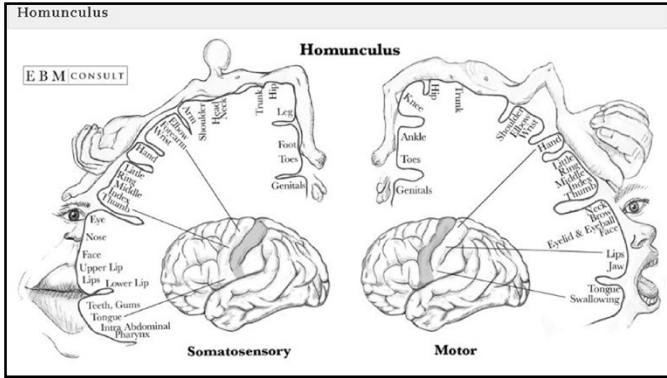
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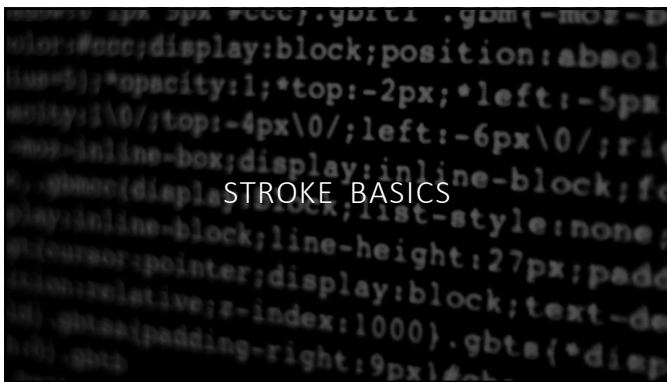
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**A blood clot block the blood flow**

**Ischemic Stroke**

The diagram shows a cross-section of the brain with a red blood clot blocking an artery, leading to a stroke. The affected area is shaded in red, while the rest of the brain is in shades of blue and purple.

**Thrombotic**  
A blood clot forms locally in the brain consequently blocking the blood flow

**Embolic**  
A blood clot formed in the body travels through the bloodstream until it reaches the brain, where it blocks the artery

**ISCHEMIC STROKE**

- Occlusion of an artery causing lack of blood flow to an area of the brain

Major Mechanisms:

- Cardioembolic
- Large Artery Atherosclerosis (Carotid vs ICAD)
- Small Vessel Disease
- ESUS

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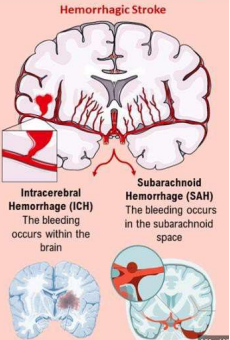
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**A blood vessel rupture and bleeds**

### Hemorrhagic Stroke



**Intracerebral Hemorrhage (ICH)**  
The bleeding occurs within the brain

**Subarachnoid Hemorrhage (SAH)**  
The bleeding occurs in the subarachnoid space

## HEMORRHAGIC STROKE

- Bleeding in the parenchyma or spaces of the brain

Major Mechanisms:

- Uncontrolled Hypertension
- Ruptured Aneurysm
- Cerebral Amyloid Angiopathy
- Underlying Mass or Vascular Malformation

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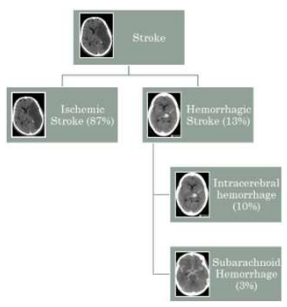
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**Stroke**

- Ischemic Stroke (67%)
- Hemorrhagic Stroke (13%)
  - Intracerebral Hemorrhage (10%)
  - Subarachnoid Hemorrhage (3%)

- Of all strokes, 87% are ischemic, 10% are ICHs, and 3% are SAHs

Circulation. 2023;147:e93–e621

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## CEREBRAL VENOUS SINUS THROMBOSIS

- Women are at risk of suffering this rare form of stroke → CVST
- Thrombosis of the sinuses that drain the brain

Major Mechanism:

- Hypercoagulability – inherited or situational
  - Coagulopathy – APA, FVL, MTHFR
  - Pregnancy, OCP, Trauma, Infection
- Can cause ischemic or hemorrhagic strokes



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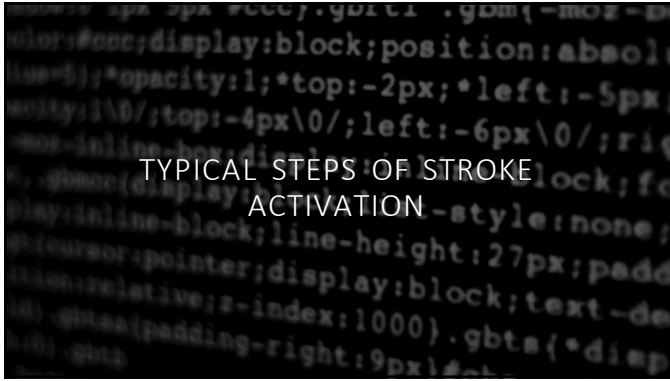
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STROKE STOP

- Stroke page activated
- NIH Stroke Scale Performed at Stroke Stop
- Try to get patient to CT scanner in 5 minutes
- CTH w/o + CTA + CTP
- Decide quickly if patient is a tPA candidate or Mechanical Thrombectomy Candidate
- They go back to the ER room to either get tPA or for further evaluation
- Or they go to the angio suite for thrombectomy

NebraskaMed.com/Stroke

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NIH STROKE SCALE

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**NATIONAL INSTITUTES OF HEALTH STROKE SCALE (NIHSS)**

Item	Title	Responses and Scores	Item	Title	Responses and Scores
1a.	Level of consciousness	0—alert 1—obtuseness 2—obtunded 3—coma/unresponsive	6.	Motor function (arm)	0—no drift 1—drift before 5 seconds a. Left b. Right 2—drift before 5 seconds 3—no effort against gravity 4—no movement
1b.	Orientation questions (2)	0—answers both correctly 1—answers one correctly 2—answers neither correctly	7.	Motor function (leg)	0—no ataxia 1—ataxia in 1 test 2—ataxia in 2 tests
1c.	Response to commands (2)	0—performs both tasks correctly 1—performs one task correctly 2—performs neither	8.	Sensory	0—no sensory loss 1—mild sensory loss 2—severe sensory loss
2.	Gaze	0—several horizontal movements 1—partial gaze palsy 2—complete gaze palsy	9.	Language	0—normal 1—mild aphasia 2—severe aphasia 3—mute or global aphasia
3.	Visual fields	0—no visual field defect 1—partial hemianopia 2—complete hemianopia 3—obscure hemianopia	10.	Attention	0—normal 1—mild dyscalculia 2—severe dyscalculia
4.	Facial movement	0—normal 1—mild facial weakness 2—partial facial weakness 3—complete unilateral palsy	11.	Extinction or interference	0—absent 1—mild loss (1 sensory modality lost) 2—severe loss (2 modalities lost)
5.	Motor function (arm)	0—no drift 1—drift before 10 seconds a. Left b. Right 2—drift before 10 seconds 3—no effort against gravity 4—no movement			

Scoring range is 0-42 points. The higher the number, the greater the severity.

Score	Stroke Severity
0	No stroke symptoms
1-4	Minor stroke
5-15	Moderate stroke
16-20	Moderate to severe stroke
21-42	Severe stroke



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**WOMEN AND STROKE**



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**American Stroke Association**  
Division of the National Heart, Lung, and Blood Institute

**Together to End Stroke®**

**How Common is Stroke?**

Stroke has a large impact on society, with **more than 9 million stroke survivors in the U.S.**

Every year, about **800,000 people** in the U.S. have a stroke, with about **185,000 being recurrent strokes.**


Stroke is the **5<sup>th</sup> leading cause of death** in the U.S. *(3<sup>rd</sup> leading cause of death in women)*

About **55,000 more women than men** have a stroke each year.

Black people are **twice as likely** as white people to have a first-time stroke.

Treatment may **reduce the effects of stroke** if administered soon after the onset of symptoms.

**Up to 80% of strokes may be prevented with lifestyle changes.**



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### EPIDEMIOLOGY

Age < 45; stroke incidence and mortality are similar in both sexes	Age 45-74; males have higher incidence and mortality	Age >74; women have higher incidence and mortality	On average women live longer than men... One in 5 Women will have a stroke
Proportion of deaths caused by stroke is higher in females than in males	In 2019, stroke was the third leading cause of death in females, 6.2% - fifth leading cause of death in males, 4.4% of all deaths	That means Stroke kills 90,000 women a year	Rates of CVST among women of reproductive age are consistently 2 times higher than men of similar age

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### STROKE SYMPTOMS: WOMEN VS. MEN

Men and women share a common set of stroke symptoms. But women also can experience more subtle warning signs.

WOMEN	MEN
Face drooping	Face drooping
Arm weakness	Arm weakness
Speech difficulty	Speech difficulty
Vision problems	Vision problems
Trouble walking or loss of coordination	Trouble walking or loss of coordination
Severe headache without a known cause	Severe headache without a known cause
General weakness	
Disorientation & confusion or memory problems	
Fatigue	
Nausea or vomiting	

**Stroke in Women:**

- Stroke is a leading cause of death and disability in the U.S., **and women make up nearly 60% of all stroke deaths**

**Women may have atypical symptoms**

- Fatigue or general weakness
- Severe headache ~ bad migraine
- Confusion, behavior change
- Persistent hiccups
- Nausea or vomiting
- Neck pain, unilateral
- Seizures, fainting or LOC

<https://www.hearst.org/news/2019/05/31/is-it-fatigue-or-a-stroke-women-shouldnt-ignore-these-warning-signs>

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### NON-MODIFIABLE STROKE RISK FACTORS



- Age: specifically, an age > 55
- Family History of Stroke
- Race and Ethnicity
  - Black and Hispanic people have a higher prevalence of stroke and death rates
- Gender → women have higher risk of dying from a stroke
- Prior Stroke or TIA



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WHAT EXPLAINS THE DIFFERENCE BETWEEN MEN AND WOMEN'S STROKE SEVERITY, FUNCTIONAL OUTCOME, AND MORTALITY?

- Age
- Pre-stroke functional status
- Comorbidities, especially Atrial Fibrillation
- Women are more likely to have a stroke mimics/not as easily identifiable symptoms
- Risks as previously listed

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LIFE'S ESSENTIAL 8

1. Eat a healthy diet
2. Get at least 150 minutes of moderate physical activity
3. Don't smoke or vape
4. Sleep 7 to 9 hours
5. Maintain a healthy body weight
6. Get your cholesterol checked
7. Keep fasting blood sugar < 100 mg/dL
8. Keep blood pressure below 120/80 mmHg

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WHAT CAN WE DO?

**B**ALANCE: Loss of balance, headachy/dizziness, "funny" or blurry vision

**E**YES: Blurred vision

**F**ACE: One side of the face is drooping

**A**RM(S): Arm or leg weakness

**S**PEECH: Speech difficulty

**T**IME: Time to call for professional help immediately

RECOGNIZE SYMPTOMS & ACTIVATE EMS → CHELSEY EMS RESPONSE → TRANSPORT TO & NOTIFY STROKE CENTER → GUIDELINE-BASED STROKE CARE → QUALITY POST-STROKE CARE

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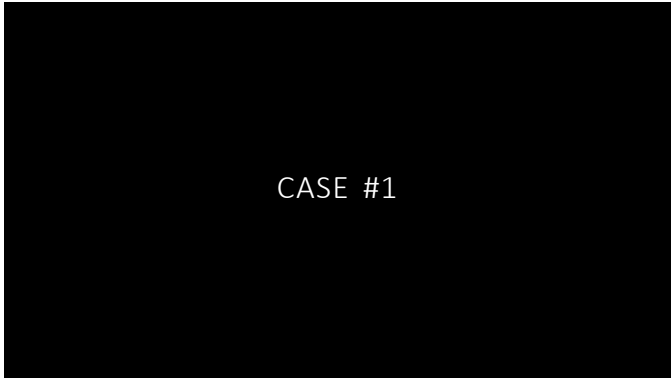
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**PRESENTATION**

<ul style="list-style-type: none"> <li>▪ LKW around 3 a.m. on 6/20/24</li> <li>▪ Acted weird around 3 a.m., then went back to sleep</li> <li>▪ Woke up and suddenly lost consciousness around 12 p.m. and became unresponsive → EMS called and taken to local ER</li> <li>▪ Intubated and sedated due to lack of airway protection</li> <li>▪ In OSH ED found to have Bilateral PE's and started on Heparin gtt</li> </ul>	<p>PMHx: 56-year-old female</p> <ul style="list-style-type: none"> <li>▪ On oral contraceptives</li> <li>▪ No other medical history – otherwise healthy</li> </ul> <p>Family Hx:</p> <ul style="list-style-type: none"> <li>▪ Grandparent with lymphoma, no other history known</li> </ul> <p>Social Hx:</p> <ul style="list-style-type: none"> <li>▪ Never Smoker</li> </ul>
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WHAT WORK UPDO YOU WANT TO DO NEXT?



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(CTA OF THE HEAD AND NECK)

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WHAT SYMPTOMS DO YOU  
EXPECT WITH BASILAR  
OCCLUSION?

KEARNEY CAMPUS

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BROUGHT HER TO UNMC FOR MECHANICAL  
THROMBECTOMY  
(ANGIOGRAM)

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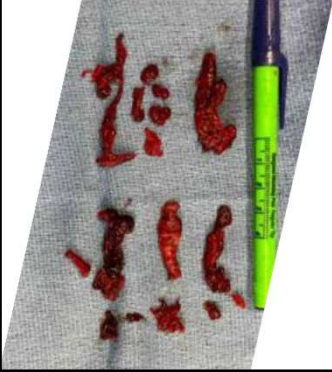
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**HOSPITAL COURSE CONTINUED**

- ADMITTED TO THE ICU POST THROMBECTOMY, TICI 3
- STARTED ON ASPIRIN 81 MG AND HIGH INTENSITY STATIN (ATORVASTATIN 80 MG) AFTER MT (HD#2)
- FOUND TO HAVE HYPODENSITIES OF LIVER/KIDNEY + SEVERAL DVTS
- HD#2 WENT FOR THROMBECTOMY OF BILATERAL PE'S
- LATER THAT EVENING STARTED ON CUSTOM HEPARIN GTT

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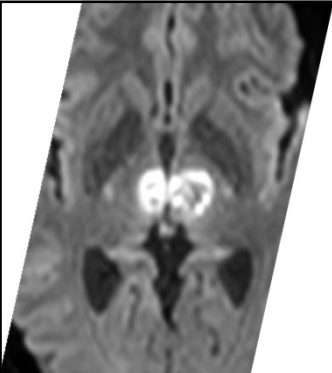
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**HOSPITAL COURSE CONTINUED**

- UNDERWENT IVC FILTER PLACEMENT HD#3
- MRI BRAIN SHOWING BILATERAL THALAMIC, LEFT MIDBRAIN, LEFT PONS, MULTIFOCAL CEREBELLAR, OCCIPITAL, LEFT TEMPO-PARIETAL INFARCTS
- PFO PRESENT ON ECHOCARDIOGRAM

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**WHAT CAUSED THE STROKE?  
WHAT'S YOUR DIFFERENTIAL?**

NORFOLK CAMPUS

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WOULD YOU DO ANYTHING ELSE FOR WORK UP?

SCOTTS BLUFF CAMPUS

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HYPERCOAGULABILITY WORK UP

- Upon further questioning, found to have significant family history of factor V Leiden (suspected in 2 maternal aunts and her father); however, no other significant family history of VTE
- Tested for Paroxysmal nocturnal hemoglobinuria, Factor V Leiden, APA, Lupus anticoagulant, cardiolipin antibody, inflammatory markers, Beta-2-glycoprotein, etc.
- CT C/A/P

Results:

- Factor V Leiden Negative
- Antiphospholipid Antibody Testing Negative
- PNH testing negative
- CT C/A/P → Similar under distention versus wall thickening along the lateral cecal wall potentially neoplasm
- PET Scan → Intense focal activity localizing to the lateral wall of the cecum which appears eccentrically mildly thickened on CT

Eventually....

- Found to have tubulovillous adenoma with high grade dysplasia + tubular adenomas → can eventually turn into high grade adenocarcinoma

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CASE #2

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### PRESENTATION

- LKW 1245 on 11/22/23
  - Was at the airport when suddenly she had acute onset inability speak + right arm weakness
  - NIHSS originally 8 for aphasia and right sided deficits
  - CTA Head and Neck without bleed; evidence of partially occlusive L ICA thrombus
- PMHx: 29-year-old female
- No other medical history – healthy
  - Not on any medications, including OCP
- Family Hx:
- Significant for HTN, a few still births
- Social Hx:
- Former Smoker

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(CTA HEAD AND NECK 11/22)

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WOULD SHE QUALIFY FOR ANY INTERVENTION?

OMAHA CAMPUS

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HOSPITAL COURSE

-  Was given tPA and admitted to the ICU
-  Went from global aphasia, significant right sided weakness, lethargy to...
-  Being awake, alert, with improved R side weakness, R arm 4/5, R leg 5/5. She was able to say some words (yes or no, one, two) but still was having difficulty following complex commands.
-  Unfortunately, had worsening of her exam again → but improved back to the prior exam with blood pressure augmentation

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HOSPITAL COURSE

- CTA with now what appeared to be complete occlusion of the left ICA; but still irregular and concerning for dissection
- Kept in the ICU to continue to augment blood pressure, systolic goal 150-170 mmHg
- Decided to pursue MRI brain as it was negative for hemorrhage – she was started on aspirin antiplatelet therapy

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(MRI BRAIN)

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SIGNIFICANT EVENT

- Overnight on HD#3 patient had worsening expressive aphasia
- Code Stroke Called
- Went to CT Scanner and this revealed

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(CTA 11/26)

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WHAT WOULD YOU LIKE TO DO?

KEARNEY CAMPUS

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### MEDICAL MANAGEMENT

- Started on heparin gtt without bolus
- Continued on aspirin antiplatelet therapy
- Continue blood pressure augmentation with same systolic goal of 150-170 mmHg
- Continue hourly neuro checks
- Discussed possibility of vascular intervention or even DSA, but neurosurgery very cautious due to her risk for vascular injury and dissection
- Again planned to hold off on any intervention at this time – planning for medical management
- Planned for weaning of vasopressors, since further dissections occurred after admission while she had been augmented

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### WORKUP/RESULTS

- Hypercoagulability Work Up: Negative
- SPEP, ANCA, Lyme, Cardiolipin, Lupus, Syphilis, Hepatitis, HIV, West Nile, VZV, Complement, RF, ANA → all within normal limits
- A1c, lipid panel, FA, B12, UA, UDS → WNL
- No family history of connective tissue disorders, no uterine rupture history with her personal history of deliveries of her children
- Continued to have intermittent worsening exams → found to have mostly occluded the vessels that were dissected
- Transitioned to DAPT and since then improved
- Discharged to AR
- In the end:
  - had L ICA dissection → occlusion
  - R ICA dissection, pseudoaneurysm, partial thrombus
  - L V2 and V3 dissections; R V3 dissection
  - Multifocal L ACA/MCA infarcts; R Corona Radiata + Multifocal infarcts
- Symptoms:
  - Partial Gerstman Syndrome
  - Left Horner's Syndrome
  - RUE Weakness + Apathy/Abulia

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### CASE #3

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### PRESENTATION

- Had 24 hours of nausea/vomiting + diarrhea on 3/10/21
  - Subsequently developed worsening headache over the next several days
  - Associated with photophobia, phonophobia
  - Specifically located in the Right Posterior Region
  - OTC medications didn't help and it continued to progress
  - Presented to the ED in Council Bluffs for Evaluation on 3/15
- PMHx: 29-year-old female
- PCOS
  - Obesity
  - Negative for Migraines
- Family Hx:
- No significant family hx (HTN)
- Social Hx:
- Current Smoker ~ 5 cigarettes daily, smoking since she was around 18
  - Currently using NuvaRing for contraception

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WHAT TOP DIFFERENTIAL DO YOU THINK OF WITH NEW ONSET, SEVERE HEADACHE

NORFOLK CAMPUS

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WHAT IMAGING WOULD YOU LIKE TO DO?

SCOTTSBLUFF CAMPUS

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(MRV 3/15/21)

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HOSPITAL COURSE

- After finding CVST – transferred to UNMC
- Started on heparin infusion and IV fluids prior to transfer
- Total burden of thrombus → right sided transverse sinus, sigmoid sinus, and proximal internal jugular vein
- No associated hemorrhage or stroke, no signs of hydrocephalus
- NIHSS was 0
- Found to have low B12 and started on supplementation
- Iron studies WNL
- hypercoagulable work-up done in March 2021 that included ANA, cardiolipin antibodies, lupus anticoagulant panel, beta-2 microglobulin, blood protein electrophoresis, ESR and Antithrombin activity were not suggestive of an acquired thrombophilia.
- Admitted for a total of 3 days and received heparin during this time, with improvement in headache
- Evaluated and okay'd to discharge home with support
- Transitioned to oral anticoagulation with Eliquis on discharge

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(REPEAT MRV 9/28/21)

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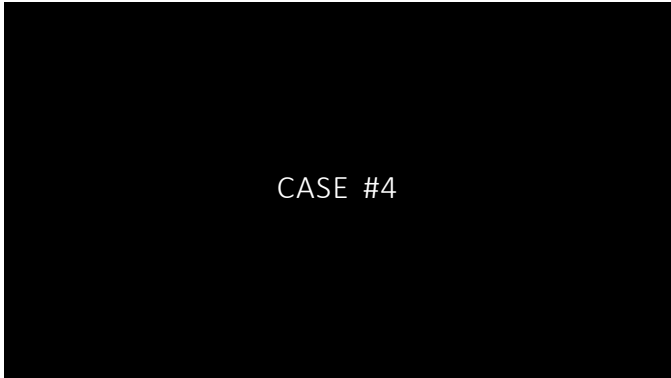
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CASE #4

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**PRESENTATION**

- LKW 1230 on 8/6/24 when she started vomiting, experiencing diplopia, decreased facial sensation on the right side, and imbalance
- Had been having a few days of neck pain and headache that started on 8/2 for which she laid in bed and had pain relief with Tylenol
- Presented to OSH for the above symptom changes, and then increased lethargy
- CTA Head and Neck with evidence of R Vertebral Dissection and Basilar Occlusion
- Declined at OSH and intubated --> transferred to UNMC for MT

PMHx: 30-year-old female

- anemia during pregnancy
- 5 months post-partum

Family Hx:

- No family hx

Social Hx:

- Never Smoker

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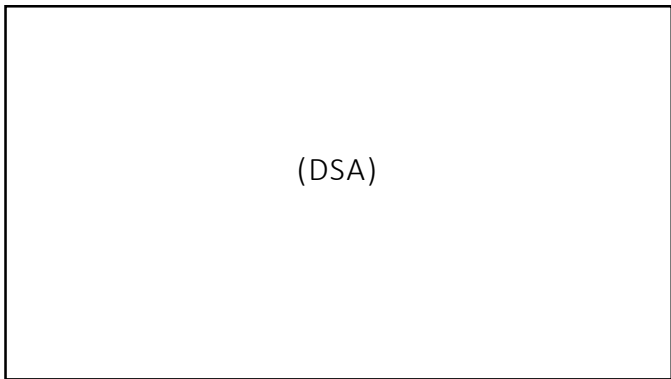
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(DSA)

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WHAT ARE SYMPTOMS OF  
BASILAR OCCLUSION AGAIN?

OMAHA CAMPUS

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IS ANY INTERVENTION  
INDICATED?

KEARNEY CAMPUS

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(DSA POST MT)

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### HOSPITAL COURSE

- Underwent MT of basilar occlusion, TICI 3 and admitted to the ICU, remained intubated
- Started on Heparin gtt and ASA (for vertebral stent)
- Initially unable to move LUE, intermittently following commands
- Proceeded with MRI for quantification of stroke, and she was found to have bilateral cerebellar infarcts and right pontine infarct
- Also had hydrocephalus developing (comparing CTH from day prior)
- Went for urgent suboccipital craniectomy and C1 laminectomy + EVD placement HD#2

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### (MRI BRAIN)

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### HOSPITAL COURSE

- Found to have R Frontal Tract Hemorrhage on follow up imaging
- Extubated on HD#4
- Remained in ICU while EVD in place, but developed no signs of hydrocephalus
- EVD removed on HD#6
- Loaded with Plavix on HD#9, heparin infusion stopped HD#10
- Stayed in ICU for several days, but deemed safe to transfer to the floor on HD#11 – off heparin and on DAPT

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MECHANISM

- Believed to have artery to artery embolism from her right vertebral dissection
- Unsure why she originally had a right vertebral dissection
- Pregnancy Testing was negative; A1c, lipid panel, echocardiogram, telemetry all within normal limits
- Fortunately, continues to improve – mostly just suffering from axial and appendicular ataxia, but improving daily

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QUESTIONS?

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