PREGNANCY & STROKE

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Grady
Endovascular Management of Acute Ischemic Stroke from Carotid Dissection

DISCLOSURES:
Stryker Neurovascular / Concentric Medical
- DAWN Trial Site PI
- SELECT Study Site PI
- Consultant
Medtronic / Covidien / ev3 Neurovascular
- STRATIS registry Site PI
Codman / Johnson & Johnson
- Consultant (unpaid)
Vesalio

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“STROKE”
STROKE AND PREGNANCY

• US: incidence of stroke in pregnancy is increasing.
  • Nationwide Inpatient Sample
  • Between 1994–1995 to 2006–2007,
  • Rates of antenatal and postpartum hospitalizations for stroke increased by 47% and 83%, respectively.

  Kuklina et al. 2011

• Rate of stroke: 25–34 cases per 100,000 deliveries
• While stroke in non-pregnant woman aged 15–44 years of age is 11 per 100,000 women
• Small percentage of pregnant women are diagnosed with stroke, BUT accounts for 12% of maternal deaths and contributes to significant fetal morbidity and mortality.

Grear K et al. Clin Obstet Gynecol. 2013 56
Aneurysm

• Definition:
  • Acquired lesions of the major arteries.
  • Commonly at branching points

• Mechanism:
  • Hemodynamic stress
  • Inflammation
  • Genetic predisposition

• Prevalence:
  • 3.2% in adults

• Age:
  • Peak 60-79yo

Hashimoto et al. Neur Res 2006;28
Theodotou CB. Asian J Neuros 2017; 12
Krings et al. Neuroradiology 2004;47
Vlak M. Lancet Neurology 2011;10
Rinkel G. Stroke 1998; 29
Microscopy

- **Histopathology:**
  - **Intracranial arteries:** No Elastica Externa
  - **Discontinuation of media and internal elastica**
  - **More frequently acellular**

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Kondo et al. Stroke. 1997;28

Why Are We Discussing Aneurysms?
Why Are We Discussing Aneurysms?
Aneurysms

**PREGNANCY**

- Plasma volume
  - Increases by 50%
  - Plateau at 30-34w

**POSTPARTUM**

- Body prepared for event (birth) that requires rapid coagulation
- Coagulation activated / fibrinogen increased
- Coagulation inhibitors decreased
Aneurysms During Pregnancy

- SAH: pregnant 5x of nonpregnant (of same age).
- 0.01-0.05% of all pregnancies
- Risk of rupture increases as gestation progresses (peak 30-34w)
- Valid to treat the aneurysm prior to pregnancy

Harrigan M and Deveikis J. Humana Press. 2nd ed.
Aneurysm Treatment: Surgery

**Advantages:**
- Duration
- Hematoma Evacuation

**Disadvantages:**
- Invasive
- Retraction Injury
- Perforating vessels
- Seizures
Aneurysm Treatment: Endov Coiling

**Advantages:**
- Less invasive

**Disadvantages:**
- Coil compaction with need for retreatment
Wide-Necked Aneurysms:

- Neck > 4 mm

- Dome: Neck Ratio < 2:1
Balloon Remodeling
Wide-Necked Aneurysms

Wide-Necked Aneurysm:

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- Dome: Neck Ratio < 2:1
NEW TECHNOLOGIES

The WEB™ Aneurysm Embolization Device
Deployment Illustration of the WEB™ System
FLOW DIVERGING STENTS

Surpass Streamline

SILK stent

p64 Flow Modulation Device
How does the PED Work?
Case Example – Pre Treatment
Case Example – Follow-Up
ARTERIOVENOUS MALFORMATION

- Congenital vascular lesion
- Direct connection between arteries and veins without intervening capillary bed
- 0.005-0.6% of population
- Men 55%
- Presentation:
  - Hemorrhage
  - Seizures
  - Headaches
ARTERIOVENOUS MALFORMATION

- Congenital vascular lesion
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- 0.005-0.6%
- Men 55%
- Presentation:
  - Hemorrhage
  - Seizures
  - Headaches
- Diagnosis: NCCT, MRI, Angio
Medical management with or without interventional therapy for unruptured brain arteriovenous malformations (ARUBA): a multicentre, non-blinded, randomised trial


Mohr JP. Lancet 2011
ARTERIOVENOUS MALFORMATION

- 27yo developed headaches during pregnancy
- First pregnancy; 26 weeks
ARTERIOVENOUS MALFORMATION

- 32 weeks
- Acute neurological deterioration
- GCS 11 / NIHSS 15
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CEREBRAL VENOUS THROMBOSIS

- 0.5-1% of all strokes
- Stasis of the blood, changes in the vessel wall, changes in the blood composition.
- Clotting of the venous sinuses

Saposnik G et al. Stroke 2011
CEREBRAL VENOUS THROMBOSIS

- Prior medical conditions
  - eg, thrombophilias, inflammatory bowel disease

- Transient situations
  - eg, pregnancy, dehydration, infection

- Selected medications
  - eg, oral contraceptives, substance abuse

- Unpredictable events
  - eg, head trauma

Saposnik G et al. Stroke 2011
CEREBRAL VENOUS THROMBOSIS

Pregnancy and Puerperium

• Causes of transient prothrombotic states.
• Approximately 2% of pregnancy-associated strokes are attributable to CVT.
• 50% of CVT occur during pregnancy (most in 3\textsuperscript{rd} trimester) or puerperium (6-8w / 80%).

Oral Contraceptives

• 96% of CVT cases were using oral contraceptives
CEREBRAL VENOUS THROMBOSIS

- Diagnostic Challenge
- Increased intracranial pressure
- Headaches (90%)
- Seizures
- Focal neurology changes
- Hemorrhages
CEREBRAL VENOUS THROMBOSIS

• Diagnostic Challenge
• Increased intracranial pressure
• Headaches (90%)
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CEREBRAL VENOUS THROMBOSIS

- IMAGING
CEREBRAL VENOUS THROMBOSIS

• IMAGING
CEREBRAL VENOUS THROMBOSIS

TREATMENT

• Symptomatic treatment
• Anticoagulation
• Catheter therapy
CEREBRAL VENOUS THROMBOSIS

- 44yo
- On OCP
- Developed headache which progressed to hemiparesis
- Admitted to OSH
- Diagnosed with SSS thrombosis
- Started on anticoagulation
- Called 2/2 worsening edema
- Hemicraniectomy with significant
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ARTERIAL STROKE

- Highest risk in post partum period
- Pregnancy specific causes
- Eclampsia
- Choriocarcinoma
- Amniotic fluid embolism
- Post partum angiopathy
- Post-partum cardiomyopathy

\[
\text{LARGE VESSEL OCCLUSION}
\]
Retriever with Balloon Guide (only)
2015

MR CLEAN

2015 AHA/ASA Focused Update of the 2013 Guidelines for the Early Management of Patients with Acute Ischemic Stroke Regarding Endovascular Treatment

REVASCAT
39 yo 2 months pregnant, with acute onset of right weakness, left gaze, and aphasia upon awakening at 4pm. Last known well unknown. OSH: DWI: infarct in left basal ganglia and temp lobe. On arrival at MSNC patient has NIHSS of 17
39 yo 2 months pregnant, with acute onset of right hemiplegia, left gaze, and aphasia upon awakening at 4pm. Last known well unknown. OSH: DWI: infarct in left basal ganglia and temp lobe. On arrival at MSNC patient has NIHSS of 17.
2018 - EXTENDED WINDOW

DAWN

Thrombectomy 6 to 24 Hours after Stroke with a Mismatch between Deficit and Infarct

DEFUSE 3

Thrombectomy for Stroke at 6 to 16 Hours with Selection by Perfusion Imaging

NNT for 90-day independence = 2.8
Arterial Access 22:35 - Left M1 Occlusion
Post Trevo 4x20: Residual Distal M2-M3 Occlusion
Baby Trevo (3x20) in M2-M3
TICI 2B but Full Reperfusion of the Target Territory
Penumbral Area Completed Spared

Pre-Treatment DWI

Post-Treatment DWI

Raul Nogueira, MD
She was able to hold her baby!
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Kuklina et al. 2011
STROKE AND PREGNANCY

• Women with concomitant diagnoses of hypertension and heart disease are more likely to also be diagnosed with a stroke of any type.

• This association was so strong, that when the authors corrected for hypertension and heart disease in a logistic regression model, the increase in stroke rates from 1994–1995 to 2006–2007 dissipated.

Kuklina et al. 2011
CONCLUSIONS

• Prenatal care / Primary Care: Critical to improve maternal outcomes

• When strokes occur (hemorrhage from aneurysm or malformation / infarct from arterial or venous disease) can be treated in comprehensive stroke centers
THANK YOU

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