Predictors of Stroke and Stroke Mimics During Pregnancy

Chelsea Meyer, DO MA
Jennifer Majersik, MD
Jennifer Murrilo
Adam De Havenon, MD
University of Utah
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No Disclosures
Stroke in Pregnancy

• Ischemic and hemorrhagic strokes are more common in the peripartum period

• According to a study in 2011 by Kuklina EV, Tong X, al.
  • 71 per 100,000 pregnancy-related stroke hospitalizations in US per year
    • 3 times the prevalence of non-pregnant women
    • Increased by 43% when comparing 1994-95 to 2006-07
  • Includes cerebral venous sinus thrombosis, PRES, RCVS
    • Eclampsia is a clear risk factor
    • Increased prevalence of hypertension and heart disease

Complications of Treating Acute Strokes in Pregnancy

– Radiation
  • Head/neck radiation has less risk than thoracic and abdominal

– Risk of systemic thrombolysis in pregnancy
  • 8% hemorrhagic complications in pregnant patients (2)
  • Not a contraindication
  • Does not cross placenta

HYPOTHESIS

Using readily available clinical data, we could accurately predict vascular versus non-vascular causes of neurologic symptoms in pregnancy.
Methods

• ICD-9 codes for pregnancy and stroke within the same year
  – 30,000 patients identified as pregnant in 2009-2014 at the University of Utah
  – 112 of those had ICD-9 code for stroke or other cerebrovascular disorders

• Excluded if:
  – Stroke or stroke mimic occurred postpartum
  – Stroke prior to pregnancy but established care for pregnancy
  – Not seen by a neurologist or neurosurgeon

• 39 total patients meeting criteria
Comprehensive Review of Risk Factors

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Obstetrics History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social History</td>
<td>Antepartum Labs</td>
</tr>
<tr>
<td>Family History</td>
<td>Delivery Information</td>
</tr>
<tr>
<td>Past Medical History</td>
<td>Post partum Complications</td>
</tr>
<tr>
<td>Medications</td>
<td>Stroke Evaluation</td>
</tr>
</tbody>
</table>
Methods

• Logistic regression models to compare predictive ability of different covariates
  – Evaluated area under the curve to establish most predictive model
• Two outcomes in regression models
  – Ischemic strokes compared to mimics
  – Mimics compared to all vascular disease
## Results - Etiology

<table>
<thead>
<tr>
<th>Etiology</th>
<th># of Patients</th>
<th>% of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischemic Stroke</td>
<td>12</td>
<td>30.8%</td>
</tr>
<tr>
<td>Venous Sinus Thrombosis</td>
<td>8</td>
<td>20.5%</td>
</tr>
<tr>
<td>Intracerebral Hemorrhage</td>
<td>3</td>
<td>7.6%</td>
</tr>
<tr>
<td>Transient Ischemic Attack</td>
<td>2</td>
<td>5.1%</td>
</tr>
<tr>
<td>Complicated Migraine</td>
<td>7</td>
<td>17.9%</td>
</tr>
<tr>
<td>Non-Epileptic Convulsion</td>
<td>3</td>
<td>7.6%</td>
</tr>
<tr>
<td>Seizure</td>
<td>2</td>
<td>5.1%</td>
</tr>
<tr>
<td>Conversion Disorder</td>
<td>2</td>
<td>5.1%</td>
</tr>
</tbody>
</table>
Predicting Mimics Compared to Vascular Causes

- Model 4
  - History of miscarriage
  - Age<30
  - Migraines
- AUC of 0.85
  - Positive Predictive Value 75%
  - Negative Predictive Value 69%
Predicting Ischemic Strokes Compared to Other Etiologies

- Model 3
  - Age > 30
  - Family history of 1st degree relative with stroke
- AUC of 0.76
  - Positive Predictive Value 100%
  - Negative Predictive Value 74%
Conclusions

• Promising models using clinical risk factors to predict:
  – **Ischemic strokes from other causes** of acute focal neurologic symptoms in pregnant patients
  – **Non-vascular disease (eg. migraine)** from **vascular causes** of acute neurologic symptoms in pregnant patients
Discussion

• Strengths
  – Highly specific models
  – Risk factors can be obtained quickly without additional testing

• Limitations
  – Small, single-center retrospective review
  – Sensitivity could be improved
Future Directions

• Could a scoring system be created to accurately predict vascular versus non-vascular causes of neurologic changes in pregnant patients?
  – Helpful in rapid decision making
  – Reduce risk of potentially harmful testing and treatments
Acknowledgements

- Adam De Havenon, MD
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QUESTIONS?

Thank you!