Uncommon CVA Syndromes: Pregnancy and Post-Op

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Eleventh Annual
Statewide Stroke Conference
Pregnancy and Stroke

• Review in July 2011 from C.D.C. shows marked increase in pre partum strokes and post partum strokes.

• Although absolute numbers remain very low the percentage of prepartum cva increased by 47%, and the percentage of post partum cva increased by 83% in 12 years 1994/95 compared to 2006/07
DIFFERENTIAL DX

• Cerebral venous sinus thrombosis
• Eclampsia with posterior reversible leukoencephalopathy (P.R.E.S.)
• Cardioembolic stroke
• Aneurysmal rupture
• Postpartum cardiomyopathy
• Spontaneous dissection
What about CT scan in pregnancy?

• This causes significant anxiety for patients/caregivers in terms of potential hazard to the developing fetus
• According to guidelines for diagnostic imaging during pregnancy, radiation exposure less than 5 rads has not been associated with an increase in fetal anomalies or pregnancy loss. CT scan of the head gives a fetal exposure of less than 1 rad
• The development of various cancers and childhood is a different concern regarding ionizing radiation in utero. This is unknown but has been estimated not to exceed one in 1000 children per one rad
• Exposure to iodine contrast arguably produces some risk of neonatal hypothyroidism, therefore thyroid function should be checked during the first week post partum after birth if iodinated contrast has been given during pregnancy.
What about MRI in Pregnancy?

- MRI uses no ionizing radiation, making it a more useful tool for evaluation of brain ischemia during pregnancy.
- Although there have been no documented adverse fetal effects reported, the national radiologic protection board arbitrarily advised against the use of MRI during the first trimester.
- More recent data suggests that MRI is safe in any trimester of pregnancy.
- There is no agreement on the safety of gadolinium in pregnancy, Gadolinium is “Category C”.

Perioperative Stroke
(And other things that go bump in the night)
Perioperative/periprocedural strokes are predominantly:

• Embolic
• Thrombotic
• Hemorrhagic
• "Watershed" strokes from hypotension/anoxia/hypoxia
Test question: (This will not go in your permanent record)

Most perioperative strokes occur:

1. During surgery/procedure
2. In the recovery room
3. From the end of procedure to first 24 hours
4. From 24-72 hours post procedure
Figure 1. Mechanisms of Perioperative Stroke.
Data are from Likosky et al.\textsuperscript{12}
Incidence of Perioperative Stroke

Cardiac surgery is highest:

- CABG .......... 1.4% - 3.8%
- One valve replacement ....... 4.8% to 8.8%
- Double valve .................. 9.7%
- Aortic repair .................. 8.7%
- Combined CABG and valve ... 7.4%
Incidence of Perioperative Stroke

Carotid endarterectomy 5.5% to 6.1%  
(nationwide analysis 2004)

Recommendations now from AHA/ASA include a demonstrated peri-operative stroke morbidity less than 6%.
Incidence of Perioperative Stroke

Peripheral vascular surgery
0.8% to 3.0%

Resection of head and neck tumors
4.8%
Incidence of Perioperative Stroke

• All general surgery procedures combined
  0.08% to 0.7%

• How many general surgery procedures were done at
  I BMC in 2011? 16,678

• So what would be the expected number of
  postoperative strokes? 13 to 117
Perioperative Strokes

Only 9% of post cardiac surgery strokes are in a watershed (hypoperfusion) distribution. They are immediately apparent after full recovery from the anesthesia in the recovery room.

Therefore:

**Do Not** send the patient up to the floor and say "oh he is just slow to wake up from the anesthesia."
Perioperative Strokes

Contrary to common belief, most strokes in patients undergoing cardiac surgery, including those with carotid stenosis, are not related to hypoperfusion. Deliberate hypotension induced by anesthesia does not seem to adversely affect cerebral perfusion, nor does it considerably increase the risk of perioperative stroke due to hypoperfusion in patients with carotid stenosis.
Timing of Perioperative/Periprocedural Stroke

Noncardiac surgery..... most often 24-72 hours post procedure
Timing of Perioperative/Periprocedural Stroke

Timing is bimodal in vascular surgery

Within the first day-45% presumably from manipulations of heart or aorta or particulate matter from pump

From second postop day forward 55%

• Atrial fibrillation
• New myocardial infarction
• Coagulopathy
Case #1

29-year old female is in your E.D., two days postpartum develops onset of sudden severe headache, nausea and vomiting, motor weakness bilaterally, legs more involved than arms, right more involved than left. Incomplete right visual field loss, blood pressure 168/96, pulse of 90, CAT scan of the head revealed some petechial hemorrhage.

What is most likely the diagnosis?
Case #1

You are in a 25 bed community Hospital with CAT scan capability, you can get an MRI but you cannot get it today

What do you do next?

[1] Immediate full anticoagulation, transport to nearest tertiary care hospital with neurological services
[2] Avoid anticoagulation, avoid aspirin, transport to nearest tertiary care hospital with neurological services
Cerebral Venous Thrombosis

- Rare disorder with highly variable and nonspecific presentation. Five main clinical presentations;
- HA is most frequent (90%). Fundascopy often shows papilledema. Sz is the presentation 15% of the time. Focal neuro deficits in 40% of patients.
- MRI/MRA is study of choice. Major causes include pregnancy, post partum state, ATIII def., Prot C & S def., Factor V Lyden, iatrogenic causes, otitis media, mastoiditis, sinusitis, meningitis, TBI....... 
- Rx is heparin then oral Rx for 3-6 mo, You must anticoagulate .
- Rarely can put catheter in transverse/saggital sinus and give direct thoromobolytics
Case #2

CC: left hemiparesis

29-year-old female s/p uneventful delivery of twins 1 1/2 weeks ago c/o pain on the R side of her head the evening prior. She woke without defect then developed left sided hemiparesis. Originally taken to ED in a community hospital, Initial brain CT was negative for any acute finding. (lack of blood at 12 hours makes aneurysmal hemorrhage unlikely but possible)
Case #2 cont....

- PMH: none
- FMH: none
- MED: none
- ALL: NKDA
- SOC: No hx. of smoking, EtOH., or drugs. She is a professional in a small town. Married with 2 children.
Case #2 cont...

PE: 120/76  p 75  t 97°  pulse ox 97%

- Gen:  A/Ox3, NAD, WNWF
- HEENT:  PERRLA, EOMI
- Card:  RRR no murmur
- Lungs:  clear
- Abd:  soft, BSx4
- Ext:  no rash, skin w&d, no deformity
- (normal BP takes PRES out of differential)
Case #2 cont....

Neuro: CN intact, Left toe upgoing, left facial droop, left arm and leg paresis, left arm and leg numbness, slight dysarthria No clonus, heal-shin ok, no F.N.F. ataxia some extinction, NIH stroke scale 8
Case #2
PREGNANCY/POST-PARTUM AND STROKE

You plan to transfer this pt. to a stroke center, but what do you do in the meantime?

1) IV TPA 0.9mg/kg 10% bolus the rest over 59 minutes
2) Anticoagulate with Lovenox or Aqueous heparin
3) Anti platelet tx with rectal ASA
4) None of the above
“Careful—it might be a trap!”
Carotid Artery Dissection

- 10-25% of ischemic strokes in very young patients
- High mobility of the extracranial internal carotid and the vertebral A. Hyperextension or rotation of the neck.
- Pregnancy and Postpartum **increase risk.**
- Intimal tear allows an intramural hematoma that decreases downstream flow
- Non-traumatic; Ehlers-Danlos, Marfan’s polycystic kidneys, osteogenesis imperfecta.
- Typical pt. – pain on side of head, face or neck with partial Horner’s followed hrs. or days by ischemia. Triad found in less than 1/3 of pt’s, but the presence of 2 of 3 highly suggests the diagnosis.
Carotid Artery Dissection

• 5-10 % mortality
• 75% who develop CVA recover well
• Recurrence is about 2% in same artery, rare recurrence in unaffected artery
• Rx-until recently was heparin followed by warfarin. More recent data show no convincing superiority to anticoagulation compared to ASA
• Most studies indicate that brain damage is ischemic not hemorrhagic
Case #3

- 18 y/o 10 days post partum presents with “trouble with my eyes” for 1 ½ days and severe HA. Had been to a walk-in clinic earlier today and was treated for migraine. CT scan reported as W.N.L. On exam you find impaired visual fields L worse than R.
Posterior Reversible Leukoencephalopathy (PRES)

- Seen in a number of conditions, including eclampsia / preeclampsia
- Severe hypertension, headache, seizures are frequent
- MRI shows bilateral mostly T2 lesions posteriorly
- Tx is deliver baby and control B.P.
- B.P. **MUST!!** Be kept under 160.
Differential Diagnosis

- Cerebral venous thrombosis
- P.R.E.S.
P.R.E.S.
Postpartum Cardiomyopathy

- Uncommon cardiomyopathy of unknown etiology
- It occurs in the absence of any pre-existing heart disease
- It is more common in older, African American, and multiparous woman
- The incidence of systemic embolism is estimated at 25-40%
- Ischemic strokes are seen approximately 5%
- Often will slowly improve on its own, not infrequently requires cardiac transplantation
- Treatment is with anticoagulation.
Case Presentation #1

History: 47-year-old female presents to the emergency room with an episode of unwitnessed syncope/falling. She relates "I remember working in my garden, my dog flushed a rabbit and took off after it. My feet must have gotten tangled up in his leash." She doesn't think she lost consciousness, if so "only for a moment". She had immediate onset of pain in her right lateral chest wall, discovered a tomato spike protruding from her chest wall. Being from Southwest Oklahoma she of course poured some peroxide on it and pulled it out and put a bandage on the wound. It continued to leak "a little". She then developed a cough productive of blood with progressive shortness of breath, drove herself to the emergency room in an outlying hospital.
Case Presentation #1

In the community Hospital the physician got a chest film and found hemopneumothorax, transferred the patient to the tertiary Hospital. At arrival she was dyspneic, tachypnea, tachycardic hypotensive and cyanotic, with hyperresonance to percussion on the right, the trachea shifted from right to left. The emergency department physician intubated the patient and did an immediate thoracotomy in the ED with immediate improvement in ventilatory status. A large amount of blood eventually was removed through the chest tube. Serial x-ray's showed expansion of the lung but a developing infiltrate right lung base.
Case Presentation #1

Hospital course: She was transfused with improvement in all vital signs. She had a fair amount of pain and required significant narcotic for pain management. The next day she was sleepy but could be easily awakened, complained of pain in the left chest, still some shortness of breath, but was improving. The third hospital day, approximately 40 hours after the event, she developed abrupt onset "slurred speech“, right-sided weakness, agitation and confusion.

Examination revealed a right hemiparesis, right upgoing toe, incomplete expressive aphasia, slight left gaze preference.
Case Presentation #1

CT scan of head was unremarkable
Case Presentation #1

What is the most likely etiology?

1. Thromboembolic stroke
2. Carotid dissection
3. Delayed appearance of watershed infarct due to hypotension/hypoxia
Case Presentation #1

MRI scan reveals:
Case Presentation #1

What is the recommended course of action? You are now 80 minutes status post stroke. T.P.A. is not an option. Therefore, perform a CTA of the cervical vessels and brain.

- Antiplatelet therapy if no major proximal arterial occlusion is found
- If dissection is found, start antiplatelet therapy and get opinion from an interventional neuroradiologist
- If embolus is found in a major vessel, transfer to a hospital capable of neuro interventional treatment
Watershed Stroke
Watershed Stroke
Tissue injury often results in a hypercoagulable state.

Table 34.1 Acquired Deficiencies of Antithrombin III and Proteins C and S

<table>
<thead>
<tr>
<th>Condition</th>
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<tbody>
<tr>
<td>Consumption coagulopathy</td>
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<tr>
<td>Disseminated intravascular coagulation (shock, sepsis)</td>
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<tr>
<td>Surgery</td>
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<tr>
<td>Preeclampsia</td>
</tr>
<tr>
<td>Liver dysfunction</td>
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<tr>
<td>Acute hepatic failure</td>
</tr>
<tr>
<td>Cirrhosis</td>
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<tr>
<td>Renal disease</td>
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<tr>
<td>Nephrotic syndrome</td>
</tr>
<tr>
<td>Hemolytic-uremic syndrome</td>
</tr>
<tr>
<td>Malignancies</td>
</tr>
<tr>
<td>Leukemia (acute promyelocytic leukemia)</td>
</tr>
<tr>
<td>Malnutrition or gastrointestinal loss</td>
</tr>
<tr>
<td>Vascular reconstruction (diabetes, age)</td>
</tr>
<tr>
<td>Protein-calorie deprivation</td>
</tr>
<tr>
<td>Inflammatory bowel disease</td>
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<tr>
<td>Drugs</td>
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<tr>
<td>Estrogens-progestins</td>
</tr>
<tr>
<td>Heparin</td>
</tr>
<tr>
<td>L-Asparaginase</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Vasculitis (? systemic lupus erythematosus)</td>
</tr>
<tr>
<td>Infection—neutropenia</td>
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<tr>
<td>Hemodialysis</td>
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<tr>
<td>Plasmapheresis</td>
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Perioperative Strokes

Further adding to risk often includes the reason for which the surgery is done particularly

**Malignancy**

Most malignancies are likely to induce the hypercoagulable state. Ovarian cancer is probably at the top of that list, as well as myeloproliferative disorders with subsequent elevated platelet count.
Postoperative Strokes

- **Perioperative Hypercoagulable State**
- $\downarrow$ native TPA
- $\uparrow$ increased plasminogen activator inhibitor
- $\uparrow$ fibrinogen degradation products
- $\uparrow$ thrombin-antithrombin complex
- $\uparrow$ thrombin precursor protein
- $\uparrow$ D. dimer

*For 14-21 days post procedure*
Surgery/procedure induced hypercoagulopathy is aggravated by

- Dehydration
- Bedrest
- Stasis/splinting/casting
- Withholding anticoagulant/antithrombotics

(Now for a brief word from our senior neurologist and wise man)
Really stupid things to say to family when the patient is not waking up and coming around as fast/well as expected

• “Oh, he is probably just having a tough time waking up from the anesthesia”
• “We are going to move him to the floor, he should be waking up shortly”
• “He must have had too much anesthesia”
• “Maybe his blood pressure was a little low during part of the procedure”
• “Has he had trouble with anesthetics before?”
<table>
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<tr>
<th>Table 2. Uncommon Causes of Perioperative Stroke.</th>
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<tbody>
<tr>
<td>Air embolism after endoscopic procedures, intravascular interventions, and cardiopulmonary bypass</td>
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<tr>
<td>Fat embolism after orthopedic procedures</td>
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<tr>
<td>Paradoxical embolism from postoperative deep-vein thrombosis in patients with patent foramen ovale</td>
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<tr>
<td>Extracranial carotid- or vertebral-artery dissections resulting from neck manipulations and hyperextension of the neck during induction of anesthesia, neck surgery, or dental procedures</td>
</tr>
<tr>
<td>Dislodgment of arterial atherosclerotic plaques resulting from manipulations of extracranial internal carotid or vertebral arteries during neck surgeries</td>
</tr>
<tr>
<td>Spinal cord infarct after surgery to repair an abdominal aortic aneurysm</td>
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Case Presentation #3

48-year-old physician presents to the emergency department with" I think I have the worst indigestion of my life" rapid evaluation reveals Q waves in 2, 3 and aVF, ST segment elevation

He is taken to the interventional suite. Arteriogram reveals acute occlusion left anterior descending with diffuse disease throughout the coronary arteries. Angioplasty and stent is done on the LAD. The pain resolves. The EKG improves. Troponin trends down. After 2 days he has good myocardial function and is scheduled for a 4 vessel CABG.
Case Presentation #3

CABG is accomplished, postoperatively he develops ARDS, is intubated, sedated, is treated very aggressively in the intensive care unit, gradually has improving pulmonary function. Postop day 2 he has a witnessed seizure right upper and right lower extremity with head and eye deviation to the right. Neurological evaluation is impaired by his being on a ventilator, sedated, but is felt to have some weakness right upper and lower extremity, a right upgoing toe. Initial CT scan unremarkable.
Case Presentation #3

The most likely etiology of the stroke is:

• Hemorrhagic stroke related to heparinization/aggressive antiplatelet therapy
• Embolic stroke from debris at the time of the CABG/angioplasty
• Watershed infarct related to arrhythmia/hypotension during the procedure which was not obvious due to the rapidly developing ARDS
• Thromboembolic stroke due to hypercoagulable state/atherosclerotic risk factors
Case Presentation #3

Scan reveals:
O.T.T.G.B.I.T.N.

- Short-term memory loss
- Decreased executive function
- Psychomotor slowing
- A frontal lobe kind of emotional lack of “censoring”

Occur frequently after successful C.A.B.G.
O.T.T.G.B.I.T.N.

When a patient is admitted for an unrelated diagnosis such as:

• Elective gallbladder surgery
• Pancreatitis
• Pituitary surgery
• Knee replacement

And you are called to see the patient for “the patient is confused and the family is worried that he’s had a stroke”.
If the patient is confused, but really does not have any lateralizing signs, particularly if he is agitated, the most likely cause is:

1. Hypoxia
2. Hypoxia
3. Hypoxia
4. Stroke
5. Drug withdrawal
A patient with a mild/moderate memory loss which he denies, his spouse sort of is aware of but wants to believe “he is just getting older” comes in for an elective knee replacement.

Postoperatively he is confused, worse at night, blood gasses are normal, CAT scan shows mild atrophy, MRI scan shows mild atrophy/minor small vessel ischemic change, labs are unremarkable. Thyroid functions normal, B12 normal.
The daughter from California arrives and is irate. “My daddy has always had a good memory until he came here to get his knee replaced, something went wrong, I want to know what!!!”

This could be prevented if someone had actually interviewed the patient in their office days/weeks preop, after the patient and family filled out their health history. You or your physician extender looks at the health history and sees the patient/family has circled memory loss on the health history. That would be the time to do a Folstein Mini-Mental Status exam and let the patient/spouse know that the patient is almost surely going to be more confused postoperatively in the new enviroment. Failure to do so creates a mess that is just very difficult to deal with.