AWAKE CAROTID ENDARTERECTOMY:
A CASE REVIEW

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REVIEW: CEREBRAL BLOOD SUPPLY

- **Two Sources:**
  - **Internal Carotid Arteries (80-90%)**
    - Arise from the common carotid arteries
    - Branch to form the anterior and middle cerebral arteries
  - **Vertebral Arteries (10-20%)**
    - Arise from subclavian arteries
    - Combine to form the basilar artery

- **Circle of Willis:**
  - Arterial ring that is responsible for distributing blood flow to the various regions of the brain
  - Decreases the risk of ischemia when one of the major arteries becomes occluded
CEREBRAL AUTOREGULATION

• Vasculature Autoregulates to Maintain Constant Cerebral Blood Flow (CBF)
  • MAP must be between 60-160 mmHg
  • Chronic hypertension shifts both upper and lower limit curves right (increases)
  • Autoregulation is inhibited by volatile anesthetics

• Neurons are Extremely Sensitive to Decreased Perfusion
  • High metabolic rate = high oxygen demand + glucose + waste product removal
  • Oxygen demand:
    • 50 mL/min or 20% of basal oxygen consumption
  • Blood Flow:
    • 750 mL/min or 15% of resting cardiac output
PRIMARY DIAGNOSIS

• **Carotid Stenosis:**
  - Narrowing of the Carotid Arteries
  - Typically due to Atherosclerotic Plaque build-up

• **Concerns:**
  - plaque embolization
  - decreased cerebral blood flow

• **Treatment:**
  - Endarterectomy – plaque removal

• **Surgical Indications:**
  - Stenosis > 50-60%
  - Reoccurring TIAs
  - Plaque Associated CVA
## CAROTID ENDARTERECTOMY

<table>
<thead>
<tr>
<th>General</th>
<th>Regional</th>
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<tbody>
<tr>
<td><strong>Advantages:</strong></td>
<td><strong>Advantages:</strong></td>
</tr>
<tr>
<td>• Still Patient</td>
<td>• Continuous Neuro Status Monitoring</td>
</tr>
<tr>
<td>• Quiet Operative Field</td>
<td>• Best modality to monitor cerebral perfusion</td>
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<tr>
<td>• Ability to Control Respirations</td>
<td><strong>Disadvantages:</strong></td>
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<tr>
<td>• normocapnia prevents “steal phenomenon”</td>
<td>• Loss of Patient Cooperation</td>
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<td>• Ability to Provide Ischemic Protection</td>
<td>• Cannot Provide Cerebral Ischemic Protection</td>
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<tr>
<td>• e.g. cooling, barbiturates, volatile agents</td>
<td>• May Have to Convert to General</td>
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<tr>
<td><strong>Disadvantages:</strong></td>
<td><strong>Disadvantages:</strong></td>
</tr>
<tr>
<td>• Unable to Perform Detailed Neurologic Evaluations</td>
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<td>• Requires Neuro Monitoring and/or Cerebral Oximetry</td>
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<td>• High risk of false negative results (EEG)</td>
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PATIENT PRESENTATION

• AGE: Geriatric Adult
• SEX: Female
• HT: 5’ 6” (167cm)
• WT: 66kg (145lbs)
• BMI: 23

• AIRWAY EXAM
  • Mallampati Score: Class II
  • Mouth Opening: > 4 cm
  • Thyro-mental Distance: > 6 cm
  • Upper Lip Bite Test: Class I
  • Full Upper Dentures – Allowed to keep in to optimized speech clarity
MEDICAL HISTORY

• Presented with a minor cerebrovascular accident (CVA): 3 weeks prior with minor residual left lower extremity weakness

• **History of:**
  • Atrial Fibrillation (AFIB)
  • Hypertension (HTN)
  • Congestive Heart Failure (CHF) – improved with treatment of AFIB and HTN
  • Former Smoker – 40 pack years
  • Breast Cancer
  • Depression / Anxiety
PATIENT MEDICATIONS

• Lopressor (metoprolol) 25 mg
• Xanax (alprazolam) 0.25 mg
• Lipitor (atorvastatin) 20mg
• Plavix (clopidogrel) 75 mg – Stopped for 5 days
  • Recommended to stop 5-7 days prior to elective surgery (Johnson, 2010)
• Xarelto (rivaroxaban) 20 mg – Stopped for 3 days
  • Recommended to stop 1-3 days prior to elective surgery (Sunkara et al., 2016)
TEST RESULTS

• CT Angiogram
  • Carotid Stenosis
    • Left Carotid 80-90% Occluded
    • Right Carotid 50% Occluded
    • “Moderately Occluded”
      • Right Vertebral Artery
      • Left Vertebral Artery

• Echocardiogram
  • Left Ventricular Hypertrophy
  • Ejection Fraction: 50-60%
PERTINENT LAB RESULTS

- Hemoglobin – 10.2 g/dL
- Hematocrit – 32.3 %
- Platelets – 355 $10^3$/uL
- INR – 1.4
ANESTHETIC PLAN:
DEEP CERVICAL PLEXUS BLOCK WITH MAC

• Deep Cervical Plexus Block:
  • In the room

• MAC:
  • Awake & Completely Arousable

• Positioning:
  • Supine, arms tucked, head secured with padded tape

• Lines:
  • Left Radial Arterial Line
  • Right Hand 18 gauge IV
  • Right Forearm 18 gauge IV – Hotline Warmer

• Standard Monitors and Simple Facemask 6L O2
REGIONAL ANESTHESIA

- Deep Cervical Plexus Block:
  - 0.5 mg midazolam & 25 mcg Fentanyl
  - 20 mL 0.5% Ropivicaine:
    - Site of injection: C2-C4 nerve roots
    - Time for onset: 10 – 20 minutes
    - Expected duration of action: 6-18 hours
  - Complications:
    - Ipsilateral Phrenic Nerve Blockade – typically will occur
    - Inadvertent Subarachnoid Injection
    - Block Failure
INTRAOPERATIVE COURSE

- 0730 – 0.5 mg Midazolam & 25 mcg Fentanyl
- 0735 – Deep Cervical Block Completed
- 0745 – 4 mcg Dexmedetomidine
- 0755 – Incision made
- 0832 – Carotid Clamp On
  - Talk to Patient and Assess Situation
  - Patient Instructed to Count to 100
  - Slurred Speech and Decreased Arousal
- 0833 – Carotid Clamp Off
  - HR: 70
  - BP: 120/67   MAP: 85
INTRAOPERATIVE COURSE CONT.

- **0835** – Increased BP to Obtain a MAP of 115 per Surgeon Request
  - Increased CPP and CBF to Prevent Cerebral Hypoxia
  - Neosynerpine Boluses and Neosynerpine Drip
  - BP: 157/97   MAP: 117

- **0842** – Carotid Clamp On

- **0842** – Surgeon Passes Out

- **0844** – Surgical Tech Removes Carotid Clamp

- **0844** – Administration:
  - 1 mg midazolam
  - 12 mcg dexmedetomidine
  - 25 mcg fentanyl

- **0845** – Help arrives to escort surgeon to ER and back-up surgeon is called in
• 0915 – Back-up Surgeon Arrives

• 0925 – Carotid Clamp On
  • Talk to Patient and Assess Situation
  • Patient Instructed to Count to 100
  • Slurred Speech and Decreased Arousal

• 0926 – Carotid Clamp Off
  • Decision made to place a shunt

• 0935 – Carotid Clamp On

• 0937 – Carotid Shunt placed
  • Patient has Clear Speech and Appropriate
When to Shunt:
- If there is evidence of ischemia with carotid clamping (e.g. drowsiness & slurred speech)

Advantages:
- Maintains CBF during periods of clamping

Disadvantages:
- Does not guarantee adequate CBF
- Embolization of plaque or air
- Shunt kinking or occluding
- Damage to distal carotid artery
INTRAOPERATIVE COURSE CONT.

- 0950 – Light Sedation provided per surgeon request - restlessness
  - dexmedetomidine and propofol
- 1000 – Maintaining BP with neosynephrine drip
  - 0.8 mcg/kg/min
- 1010 – Shunt Removed
- 1020 – Beginning to close & Sedation turned off
- 1035 – Transport to PACU
PACU

- Transported on 6L Simple Face Mask
- Patient states that she is comfortable

**Vitals:**
- Neosyphrine drip: 1.2 mcg/kg/min
- Goal: SBP – 100
- BP: 104/76
- MAP: 85
- HR: 58

**Totals:**
- EBL – 200 mL
- Crystalloid – 1800 mL
CAROTID GRAFT RUPTURE

• **1122 – STAT Call To PACU**
  - Patient laying in bed, holding her neck, and repeating “my neck, my neck”
  - Begin holding pressure on neck while waiting on surgeon

• **1127 – Neck Hematoma Causes Airway Obstruction**
  - Begin bagging the patient with AMBU Bag with minimal volumes achieved
  - Sat 90-100%
  - Develops a decreased level of consciousness
  - BP – 70/50 & HR – 90’s

• **1130 – Back to OR to Repair the Ruptured Carotid Patch and Evacuate Hematoma**
THE REPAIR

• 1131 – Induction
  • 2 mg midazolam
  • 100 mcg fentanyl
  • 100 mg propofol
  • 100 mg succinylcholine

• 1132 – Patient Intubated on PACU Cart with Glidescope
  • Hematoma caused immense tissue edema and severe tracheal deviation

• 1132 – Moved Patient to OR Bed
  • Prepping and draping while placing monitors

• 1134 – Incision, Clamping, and Repair

• 1135 – Supportive Measures (Pressure Support & Volume Replacement)

• 1210 – Transported to ICU
PATIENT STABILITY

- Maintained BP with a MAP of 60
  - Neosynephrine – 1 mcg/kg/min

- Fluid Resuscitation:
  - 1 unit PRBC
  - 500 mL Albumin
  - 1600 NS

- Medications:
  - 10 mg vecuronium
  - 40 mcg dexmedetomidine
  - Isoflurane 0.5 MAC
  - 1 gram calcium gluconate

- Estimated Blood Loss:
  - 1600 mL conservative

- Hgb – 6.5 g/dL & Hct – 21%
PATIENT OUTCOMES

• Extubated post-op day 1 – allowed neck swelling to regress
• Stayed in ICU 3 days
• Discharged home post-op day 7
  • No cognitive deficits
  • Bilateral lower extremity weakness
    • Left leg weakness pre-existing from CVA
    • Outpatient Physical Therapy
CONTACT INFORMATION

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RESOURCES


