General Anesthetic Considerations for Carotid Endarterectomy

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November 2020
Goals of CEA

• Reduce stroke risk
  • Symptomatic Carotid stenosis
  • Asymptomatic high grade Carotid stenosis
• Remove atheromatous plaque from Carotid artery
• Increase Carotid artery diameter (with patch) to reduce turbulent bloodflow and slow recurrence of plaque.
CEA Surgical Procedure

1) Positioning (beach-chair): 5 min
2) Prep & Drape: 5 min
3) Time Out - 1 min
4) Dissection and exposure: 20-30 min
5) Heparinization: 3-5 min
6) Cross-clamping (common, internal, external)

7) Endarterectomy: 15-20 min
8) Carotid closure, usually with a patch: 20-30 min
9) Unclamping (reperfusion)
10) Drying up (protamine): 10-15 min
11) Closure of fascia and skin: 5-10 min
12) Dressing

Major Vessels and Nerves Exposed in CEA
EEG Neuromonitoring During CEA

An example of unilateral EEG changes after right carotid cross-clamping, showing reduced amplitude and loss of high frequency signals.

Possible interventions include:
- Induced hypertension
- Temporary carotid shunting
- Emergent stroke rescue by NIR after CEA

EEG is also globally affected (slowed) by many general anesthetic drugs.
Temporary Carotid Shunting During CEA

A: Clamps placed; B: Shunt from Common to Internal Carotid artery.
C: Endarterectomy performed with shunt in place.

Risks of carotid shunting:
- Embolism (air, plaque, clot)
- Kinking (can check with doppler)
- Damage to distal artery (dissection)
- Inadequate blood flow
Anesthetic Goals for CEA

Maintain Brain Perfusion
- A-line (opposite surgical side unless MAP 15 mmHg lower)
- Vaso-active drips available (phenylephrine and TNG or other downer)
- Deliberate hypertension during x-clamp or for EEG slowing

Optimize EEG monitoring sensitivity
- Light general anesthesia (0.7-1.0 x age-adjusted MAC)
- Constant anesthetic depth during x-clamp period
- Deep NMB during x-clamp period

Fast Emergence (Neuro check soon after extubation)
- NO BENZODIAZEPINES (low dose propofol if needed for anxiety)
- Light general anesthesia
- Rocuronium/suggamadex
- Avoid NMB after un-clamping

Other
- Hypnosis/Amnesia (0.7-1.0 x age-adjusted MAC)
- No bite block until preparing to extubate
- Remi infusion or low dose fentanyl to ↓ coughing on extubation
- Opioids not needed for post-op pain

Typical General Anesthetic Plan

18g IV contralateral to surgery
Consider 2nd 20g IV for infusions
20g a-line contralateral to surgery
NO BENZO premed (10-20 mg propofol!)
Induction:
  - 2-4 ug/kg fentanyl
  - 0.5 mg/kg propofol, titrate as needed
- Rocuronium

Maintenance: 66% N₂O + 0.3 x MAC
- isoflurane (0.4%) or sevoflurane (0.7%)
- Hypertension using phenylephrine if needed.
- HR 50-80 and SBP 110-140 (MAP 70-95) on emergence.
Additional Details

- NO BENZODIAEPINES!!—this can slow emergence and produce delirium
- Insert all lines on upper extremity of non-operative side if possible
- Check BP in both arms twice (alternating each time) when checking for MAP differences. A-line can be placed ipsilateral if contralateral MAP is 15 or more mmHg lower.
- 18 g IV is adequate, but a 2nd is ideal for infusions. PACU RNs insist on a second IV if a patient arrives on vasoactive drugs
- Inform the EEG tech about all drugs when administered and any changes in anesthetic dose settings
- The EEG tech can tell you if early signs of muscle activity are present—just ask
- 65% N2O + 1/3 MAC of volatile anesthetics ensures adequate hypnosis (probability of awareness about 1:10,000) and rapid wake-up
- TIVA is an option, but note that with continuous propofol infusion, target site concentration rises over time
Regional Anesthesia for CEA

Need cooperative motivated patient

Relatively easy blocks: Deep and Superficial Cervical
Surgeon can add more LA as needed
Avoids coughing due to ETT
Can use patient neuro-checks for monitoring

Risks:
May need to switch to GETA if stroke occurs during surgery!
Surgical field is near airway.
Anticipated Problems During CEA

1) Bradycardia during dissection/retraction around carotid bifurcation (vagal stimulus)
   Prevention with 0.2 to 0.4 mg glycopyrrolate after induction (HR permitting)
   Stop traction if this occurs, treat with glycopyrrolate
   Surgeons can infiltrate carotid bifurcation with lidocaine

2) EEG slowing after x-clamp
   Increase BP (SBP up to 200 mmHg)
   Surgeon may shunt across the endarterectomy incision (re-establishing some blood flow)

3) Bradycardia/Asystole after NMB reversal with neostigmine/glycopyrrolate
   Risk increased with beta-blockers
   If HR < 60, give glycopyrrolate first and neostigmine after HR increases.
   Use Rocuronium/Suggamadex

4) Tachycardia and Hypertension during Emergence
   Avoid neostigmine/glycopyrrolate administration—use rocuronium/suggamadex
   Have labetolol available

5) Persistent post-op hypotension
   Phenylephrine usually adequate—need second post-op IV in PACU
   Occasionally requires overnight PACU monitoring
References


