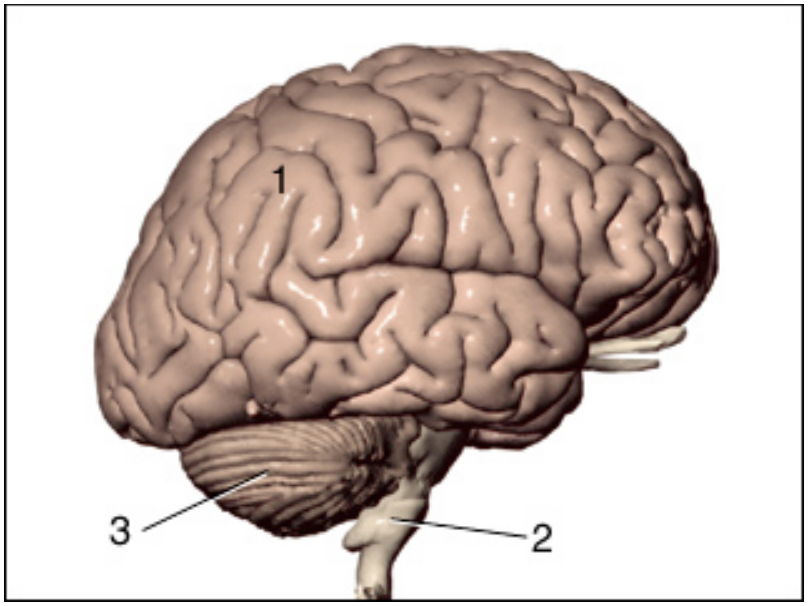
Clinical (Cookbook) Neuroanesthesia



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Neuroanesthesia

- Anesthesia and craniotomy for mass lesions
- Anesthesia and craniotomy for aneurysm
- Posterior fossa craniotomy
- Carotid endarterectomy
- GDC
- Trigeminal Decompression
- Brain Biopsy
- Not covered: spine surgery, transphenoidal procedures, awake cranis, closed head injury

Neuroanesthesia

- Anesthesia for (intracranial) neuroanesthesia requires understanding of relationships between CeBF, CMRO2, and ICP
- We use techniques and drugs that manipulate these relationships to make surgery and anesthesia successful and safe
- We do make a difference; when problems occur, the basics are usually violated

Anesthesia and craniotomy for mass lesions

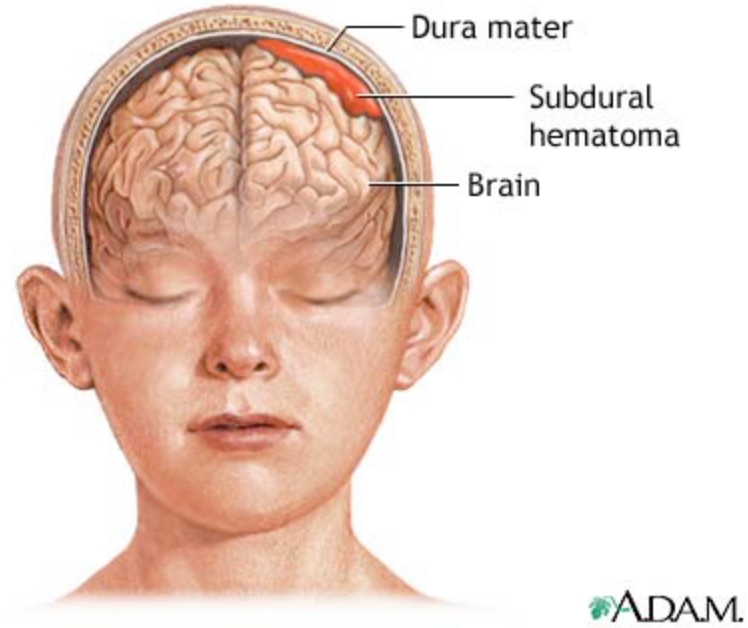
- Intracranial masses may be congenital, infectious, neoplastic or vascular (ie: clots)
- Signs of high ICP present(N/V, HTN, bradycardia, personality changes, consciousness level, papilledema, seizures)
- Growth rate of mass can be guessed from rapidity of symptoms
- Intracranial compliance curve; effect of slow versus fast volume expansion

Anesthesia and craniotomy for mass lesions
Preoperative evaluation

- Typical history and physical
- Obtain neurological history
- Ascertain presence of high ICP
- SMA[7] to look of corticosteroid induced hyperglycemia, diuretic induce electrolyte abnormalities; anticonvulsant levels
- CT/MRI for presence of edema, midline shift, location of mass (deep or superficial)

Anesthesia and craniotomy for mass lesions
Premedication

- Premeds include benzodiazepines, corticosteroids, anticonvulsants, diuretics and whatever else is needed to make the patient ready for surgery
- Watch for signs of hypoxia and hypoventilation



Anesthesia and craniotomy for mass lesions
Intraopertative Management
Monitoring

- ASA monitors
- A-line: Positioning, rapid changes in BP, access for electrolytes and PaO_2 and $PaCO_2$
- Central Access
  - Where and why?
  - When and why?
- Foley Monitor: Yes
- NMB Monitor: Yes; No MOVEMENT ALLOWED W/ HEAD CLAMPS OR NOT
- Neurologic Monitors as needed: EPs, EEGs, ICP Monitor* (Zero the ICP monitor at the EAM)

Anesthesia and craniotomy for mass lesions
Induction

- A critical part of the case
- Goals: Minimize raising ICP and maintaining CeBF
- Technique:
  - Hyperventilate
  - Thiopental 1-6 mg/kg
  - Fentanyl 3-10 mcg/kg
  - Lidocaine 1-2 mg/kg
  - Hyperventilate
  - NMB
  - Intubate efficiently
- Bad Airway: AWAKE is an option
- Have other drugs ready: esmolol, NTP, NTG, hydralazine

Anesthesia and craniotomy for mass lesions
Positioning

- Supine Position for frontal/parietal/temporal cranis
- Head is inadvertently turned to one side
- Head Clamp is often placed. AVOID PATIENT MOVEMENT
- Poor positioning can lead to problems during the entire case
- Secure your lines before draping
- Put drips close to vein

Anesthesia and craniotomy for mass lesions
Maintenance of Anesthesia

- **2 overall techniques: Nitrous-narcotic-relaxant and balance anesthesia with volatile agent**
- **Nitrous-narcotic-relaxant technique: 70% nitrous, 30% oxygen, narcotics (fentanyl 2-5 mcg/kg/min), pancuronium 0.02-0.05 mg/kg/hr**
- **Balanced: 50-70% nitrous, muscle relaxant, volatile agent usually isoflurane 0.5-1 MAC**
- **TIVA (propofol, NMB, narcs, dex)**
- **Hyperventilate to $PaCO_2$ of 25-30**
- **No PEEP unless needed**
- **IVF= 0.9% NaCl; avoid dextrose containing and hypoosmolar solutions**
- **Can use hetastarch and albumin; remember fluid shifts are minimal**
- **Goals wrt to fluids in neuro: keep them dry but maintain CePP**

Anesthesia and craniotomy for mass lesions
Emergence

- Emergence is as important as induction
- Extubation is important to allow for neurological examination of patient
- Sloppy emergence may result in sloppy outcome
- Sloppy emergence---> Cerebral edema and hemorrhage among other things
- Extubate patients if normal criteria are met + if High ICP is not out of control
- Reverse NMB, control BP carefully with drugs and wake patient up once head clamp is off

Anesthesia for Posterior Fossa Craniotomy
Introduction

- 3 main problems exist here
- Unusual Positioning
- Potential for brainstem injury
- Obstructive hydrocephalus

Anesthesia for Posterior Fossa Craniotomy
Obstructive Hydrocephalus

- Small lesions can have a significant effect on ICP as obstruction to CSF outflow can occur at the level of 4th ventricle and cerebral aqueduct
- Patient will probably get ventriculostomy prior to induction of anesthesia

Anesthesia for Posterior Fossa Craniotomy Brainstem Injury

- Vital respiratory and circulatory centers can be injured by tumor, aneurysms and surgery itself
- Injury take the form of ischemia or infarction
- Clinical sequel include: postop apnea, aspiration, hypotension and bradycardia (and other rhythm disturbances)

Anesthesia for Posterior Fossa Craniotomy Positioning

- Most cases done in prone or lateral positions
- Rarely done in sitting positions (on exams)
- Most of the time, the head is above the heart regardless of position
- Head clamp and associated problems still present
- Advantage of sitting position: Less blood loss and better exposure
- Avoid injuries to peripheral nerves, ischial spine and head and eyes when positioning

Anesthesia for Posterior Fossa Craniotomy
Premedication

- Same as for supine tumors

Anesthesia for Posterior Fossa Craniotomy Maintenance

- Same as supine crani's
- Can avoid nitrous if sitting position or if the patient has pneumocephalus
- As always, turn off nitrous once dura is close in any crani case
- Use of nitrous oxide is very controversial in anesthesia

Anesthesia for Posterior Fossa Craniotomy Problems

- Positioning: covered already
- Pneumocephalus: just mentioned
- Postural hypotension
- Venous air embolism

Anesthesia for Posterior Fossa Craniotomy Problems: Postural Hypotension

- Why does this happen:
  - Fluid restriction and diuresis
  - Position itself
  - Lower sympathetic tone with venous pooling in the presence of volatile agents
- Treat with vasopressors carefully rather than large amounts of fluid; perhaps lighten anesthesia too, compression stocking on

Anesthesia for Posterior Fossa Craniotomy Problems:Venous Air embolism

- Occurs when pressure within a vein is sub-atmospheric
- Incidence is about 40%
- Contributory factors: low CVP, poor surgical techniques
- Physiological consequences: F(rate and amount of air); small bubbles are well tolerated and are exhaled; if the lungs is overwhelmed then PAP increases, cardiac output decreases as RV after load increases
- $PaCO_2$ slight increase, PaO_2 decrease if amount small
- Full hemodynamic compromise if large amounts of air
- Paradoxical Air Embolus: Can lead to CVA or coronary artery occlusion. PAE occurs when RAP exceeds LAP in the presence of a patent foramen ovale

Anesthesia for Posterior Fossa Craniotomy Problems:VAE; Monitoring

- TEE
- Precordial Doppler
- ETN_2, $ETCO_2$, Etvolatile agent
- Changes in PAP and CVP
- Changes in ECG and Blood Pressure (very late)

Anesthesia for Posterior Fossa Craniotomy Problems:VAE; Placement of CVP

- Place multiorificed CVP at the junction of RA and SVC
- Easiest done with Fluoroscopy
- Also done with ECG looking for a biphasic p wave and then pulling back

Anesthesia for Posterior Fossa Craniotomy Problems:VAE: Treatment

- Surgeon flood area
- 100% O2 and turn off nitrous
- Aspirate CVP
- Fluids
- Vasopressors to correct hypotentsion
- Bilateral jugular compression
- PEEP (?); this may cause paradoxical embolism
- If all else fails: turn the patient to LLD position
- Finally start CPR in the supine position and prepare for Wednesday morning

Anesthesia for Aneurysms and AVMs
Preoperative Management

- Same goals as patients with tumors
- Most patients have normal ICP unless the aneurysm is ruptured

O.K. YOUR PICTURES ARE A ROADMAP

Anesthesia for Aneurysms and AVMs
Intraop Management

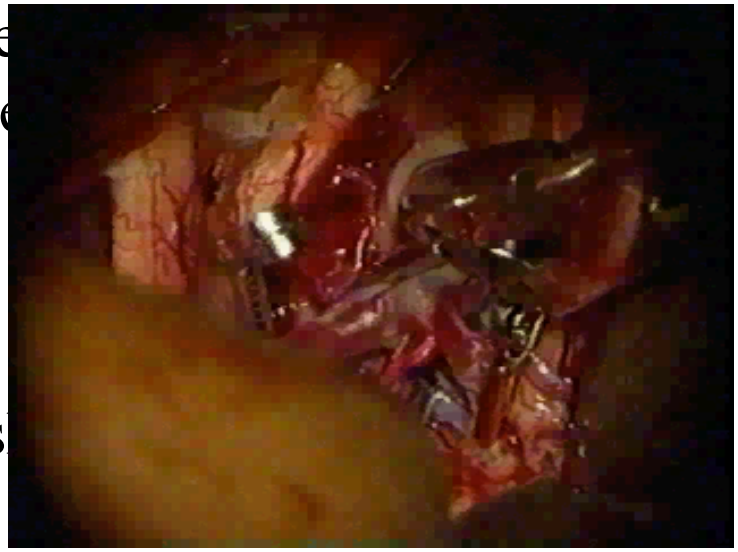
- Anesthetic technique very similar to tumors
  - Goals: Prevent rupture, ischemia and avoid/exacerbate vasospasm
- Few exceptions exist:
  - ICP may be normal so hyperventilation usually avoided unless it helps expose the aneurysm
  - Induced hypotension may be employed
  - Barbiturate coma may be needed
  - Potential for huge blood loss present
  - Hyperventilation also avoided in patients with vasospasm
- In cases of rupture: Get help fast; lower blood pressure if needed, 100% oxygen, prepare for barbiturate coma

Anesthesia for Aneurysms and AVMs
Intraop Management

- Make sure you have large bore IV access
- Can justify central line placement for access and intravascular volume measurement
- Cordis placement good idea especially in cases of large AVMs

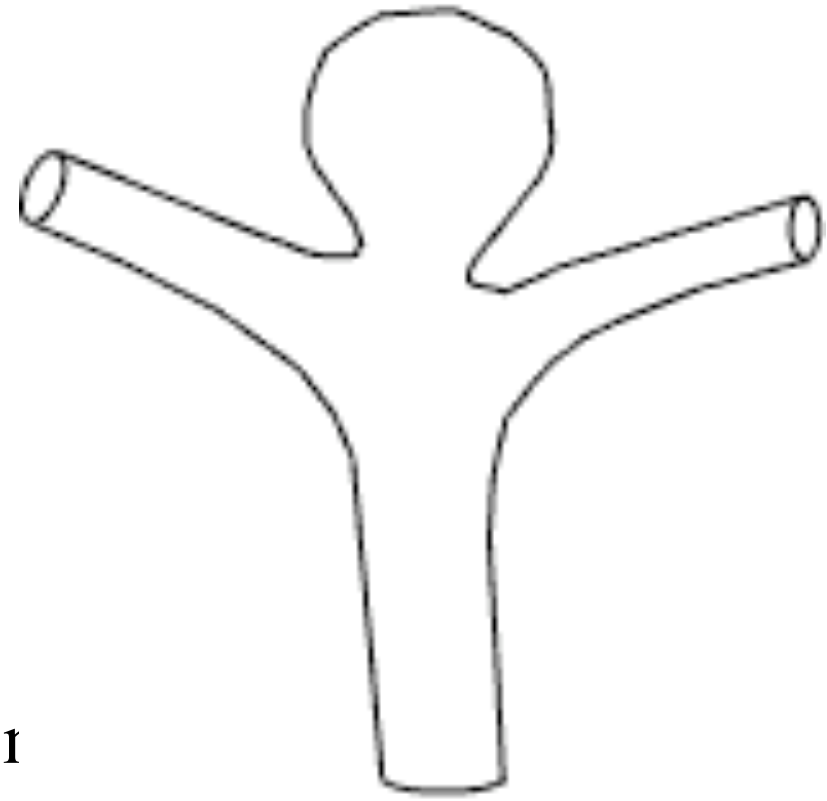
Anesthesia for Aneurysms and AVMs
Extubation

- If extubation is planned, you need to have complete control of blood pressure Have a plan ready and be ready to act fast.
- In case of large AVM's, some advocate postop intubation because of ris of bleeding postop.



GDC

- Minimal invasive aneurysm surgery
- Anesthesia set up
- Our track record
- Problems: Bleeding (rupture) and ventriculostomy problems
- Goals: Like aneurysı



Carotid Endarterectomy
Preop Evaluation

- Most common surgery for patients with TIAs or carotid stenosis of >70%
- Normal H&P,labs as in all patients
- Attention paid to cardiovascular (HTN, CAD) and neurological disease (TIA, syncope, CVA)
- These patients are “true vasculopaths”
- Allows interpretation of postop deficits from existing ones

Carotid Endarterectomy
Anesthesia Management

- Goals of Anesthesia
  - Maintain CePP and CeBF
  - Critical part of case is during cross clamping of diseased artery; one is dependant on collateral flow
  - Some surgeons place shunts to decrease dependence on collateral circulation
  - Some place shunts when monitoring indicates need for one
  - Stump Pressure another way to “measure collateral flow”

Carotid Endarterectomy
Anesthesia Management: Monitors

- ASA monitors
- A-line: Positioning, rapid changes in BP, access for electrolytes and PaO2 and PaCO2
- Central Access: Not unless otherwise indicated
- Foley Monitor: usually no
- NMB Monitor: yes if GA
- Neurologic Monitors as needed: EPs, EEGs if GA

Carotid Endarterectomy
Anesthesia Management: Local Anesthesia

- Choice include local by surgeons and MAC by anesthesia
- Choice of superficial and deep cervical plexus block
- Advantage:
  - Monitor patients motor function
  - NOT ENTIRELY RELIABLE; CVAs can occur despite normal function intraop
- Disadvantage
  - Slow surgeons taking too long
  - Patient position, cooperation, coughing, claustrophobia
- No diff: Blood pressure management, risk of CVA, cerebral protection, better monitoring, risk of postop cardiovascular complications

Carotid Endarterectomy
Anesthesia Management:General Anesthesia

- Induction: Thiopental, Etomidate,propofol
- Maintenance: N20, isoflurane or other volatile anesthetic, narcotics and NMB
- Some administer thiopental 3-5 mg/kg immediately before clamping the carotid; no data to suggest barbiturates reduce morbidity after CEA
- Goal: maintain CePP: maintain blood pressure close to patients normal range if available
- Maintain BP: fluids and phenylephrine drip (10-80 mcg/min)
- Avoid HTN: Leads to cerebral edema especially in areas of ischemia that have lost auto regulation; also leads to increase myocardial work by increasing afterload

Carotid Endarterectomy
Anesthesia Management

- Ventilation: maintain $PaCO_2$ around 35. Do not hyperventilate (ischemia)

Carotid Endarterectomy
Anesthesia Management: Postop Problems

- Common Problems:
- BP lability: Hypotension and HTN in previously HTN patients
  - HTN: Treat with NTG and NTP
  - HTN: Mechanism:NK; perhaps secondary to denervation or altered sensitivity of carotid sinus
  - Hypotension: Also altered sensitivity of carotid sinus (shielded by plaque before)
- Tracheal compression due to hematoma formation
- Loss of carotid body function
- Myocardial Infarction
- CVA (most are embolic)

Brain Biopsy

- Function: Obtain brain tissue to determine course of action
- Anesthetic technique: MAC acceptable if patient is psychologically competent; GA otherwise
- Remote location: Have everything available

Trigeminal Decompression

- Function: To alleviate pain secondary to TG nerve compression
- Anesthetic: General Anesthesia as the procedure is very painful; Use of atropine or glycopyrolate to avoid vagal response.
- Also a remote location