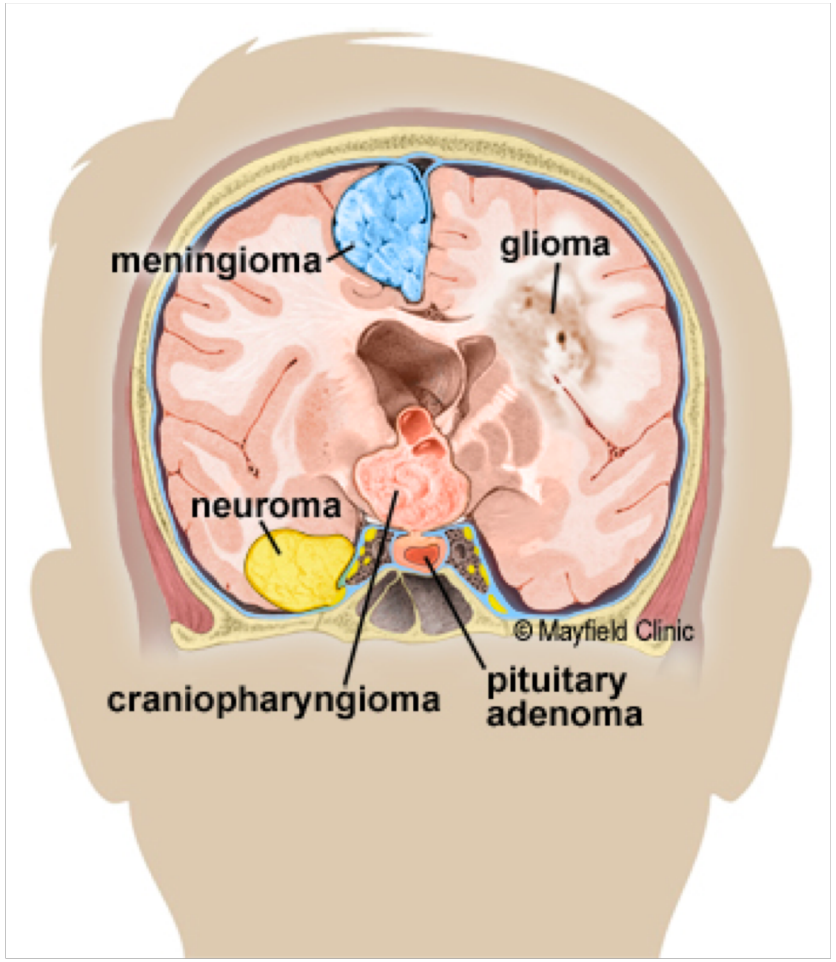
Supratentorial Masses


meningioma
glioma
neuroma
© Mayfield Clinic
craniopharyngioma
pituitary
adenoma

Epidemiology

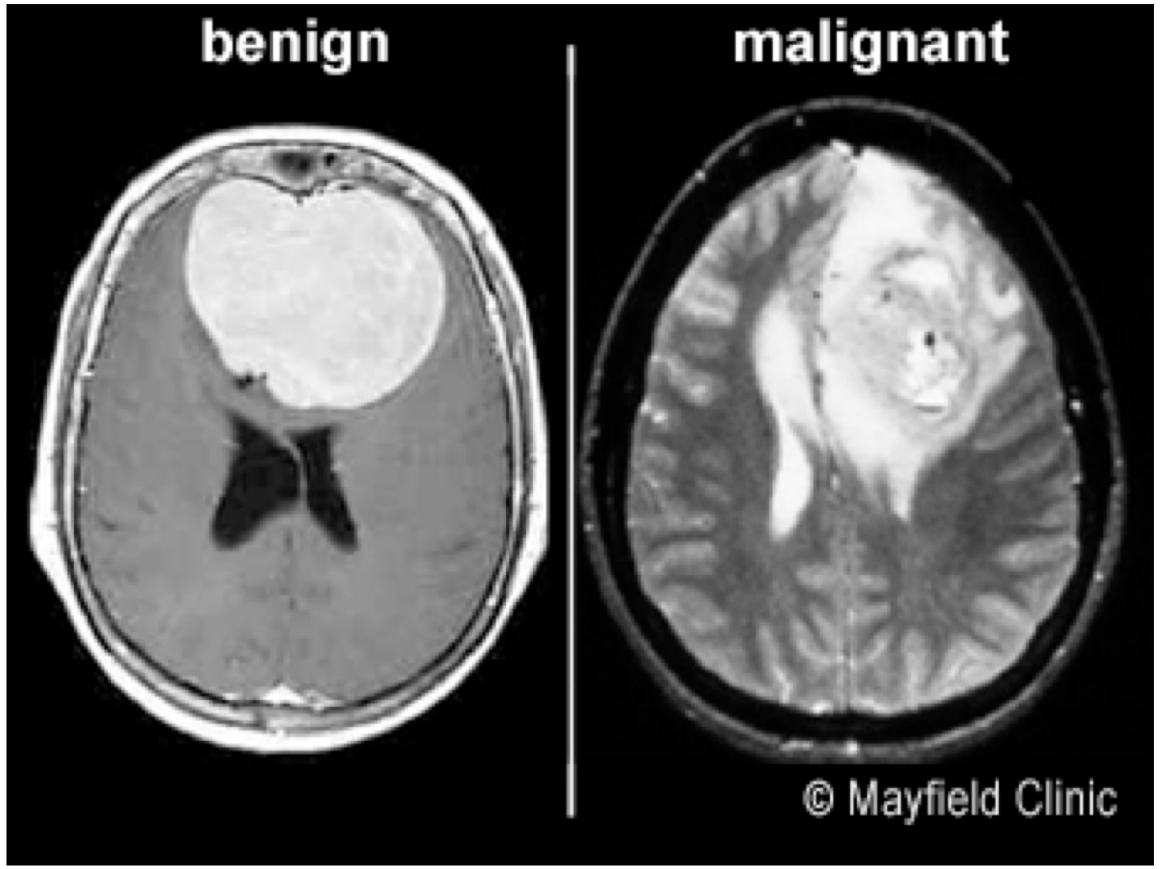
Adult incidence of primary brain & CNS ~ 27/100,000

Approximately 34% of these tumors are malignant

Most common tumor is meningioma (36%) > glioblastoma (15%)

Majority of CNS tumors >80% are supratentorial

5 most common sources of brain metastases: breast, colorectal, kidney, lung, melanoma


benign
malignant
© Mayfield Clinic

General Considerations

The anesthetic goal:	To preserve brain from secondary insult
The anesthetic risk factors:	Hypoxemia, hypercapnia, anemia, hypotension
The anesthetic actions:	Conserve cerebral autoregulation and CO_2 responsiveness Maximize brain elastance to decrease retractor pressure

Under Pressure

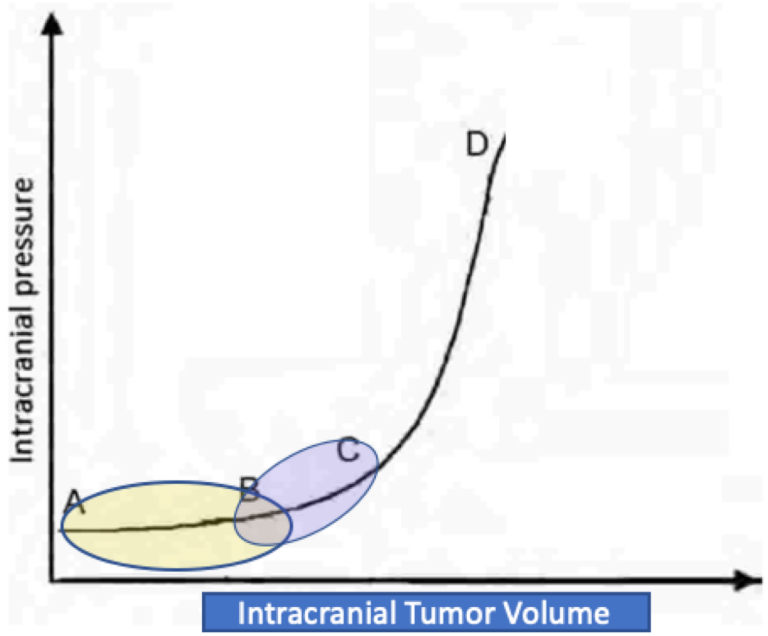


Fig 2 ICP–volume compliance curve. (A and B) Compensation phase—ICP nearly constant with increase in intracranial volume initially. (C and D) Decompensation phase—ICP increases rapidly with increasing intracranial volume as the buffers are exhausted.

Things to consider as a neuroanesthesiologist

BOX 11.1 Secondary Insults to the Already Injured Brain

Intracranial

- Increased intracranial pressure
- Midline shift: tearing of the cerebral vessels
- Herniation: falx, transtentorial, trans-foramen magnum, transcraniotomy
- Epilepsy
- Vasospasm

Systemic

- Hypercapnia
- Hypoxemia
- Hypotension or hypertension
- Hypo-osmolality or hyperosmolality
- Hypoglycemia
- Hyperglycemia
- Low cardiac output
- Hyperthermia

The cornerstone of neuroanesthesia:	Intracranial pressure–volume relationship
The main goal of neuroanesthesia:	Avoiding intracranial compartment volume increase, especially for cerebral blood volume (anesthetics, mean arterial pressure autoregulation, CO_2)
Anesthetic risk factor:	Administration of hypotonic fluids Medications that affect cerebral autoregulation

A refresher on autoregulation

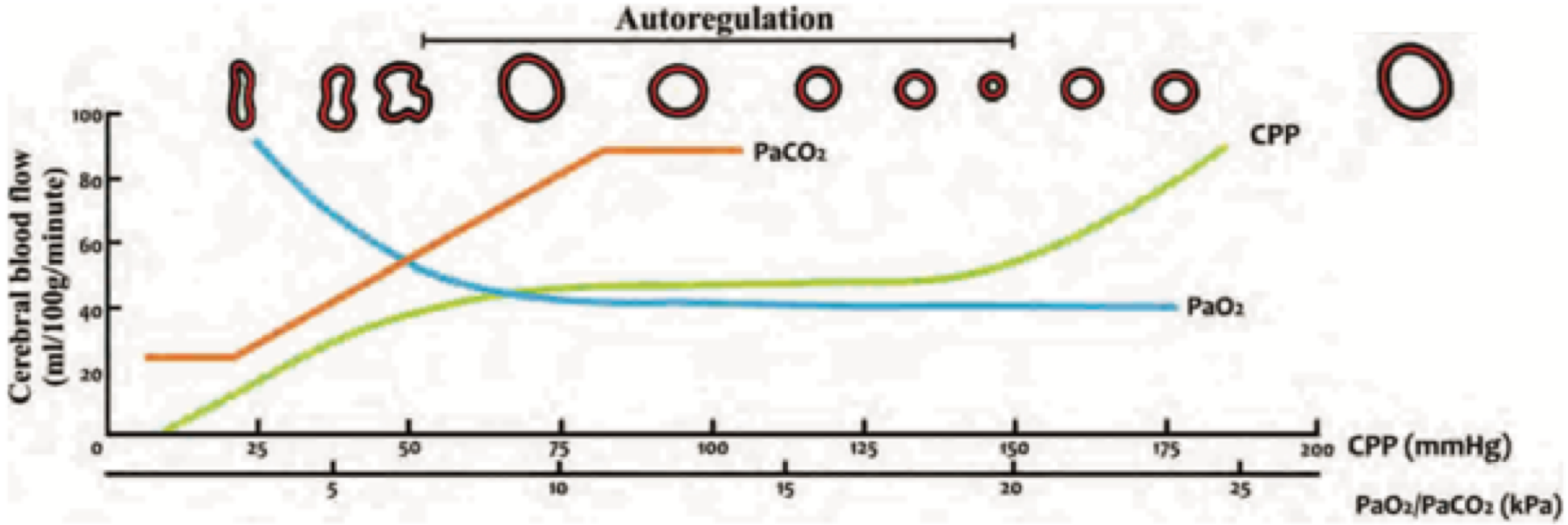


Fig 3 Effect of changes in MAP, arterial oxygen and carbon dioxide tensions, and cerebral vascular resistance on cerebral blood flow. Reproduced with permission from Shardlow and Jackson.[10] Elsevier Limited.

Hyperventilation can be our friend

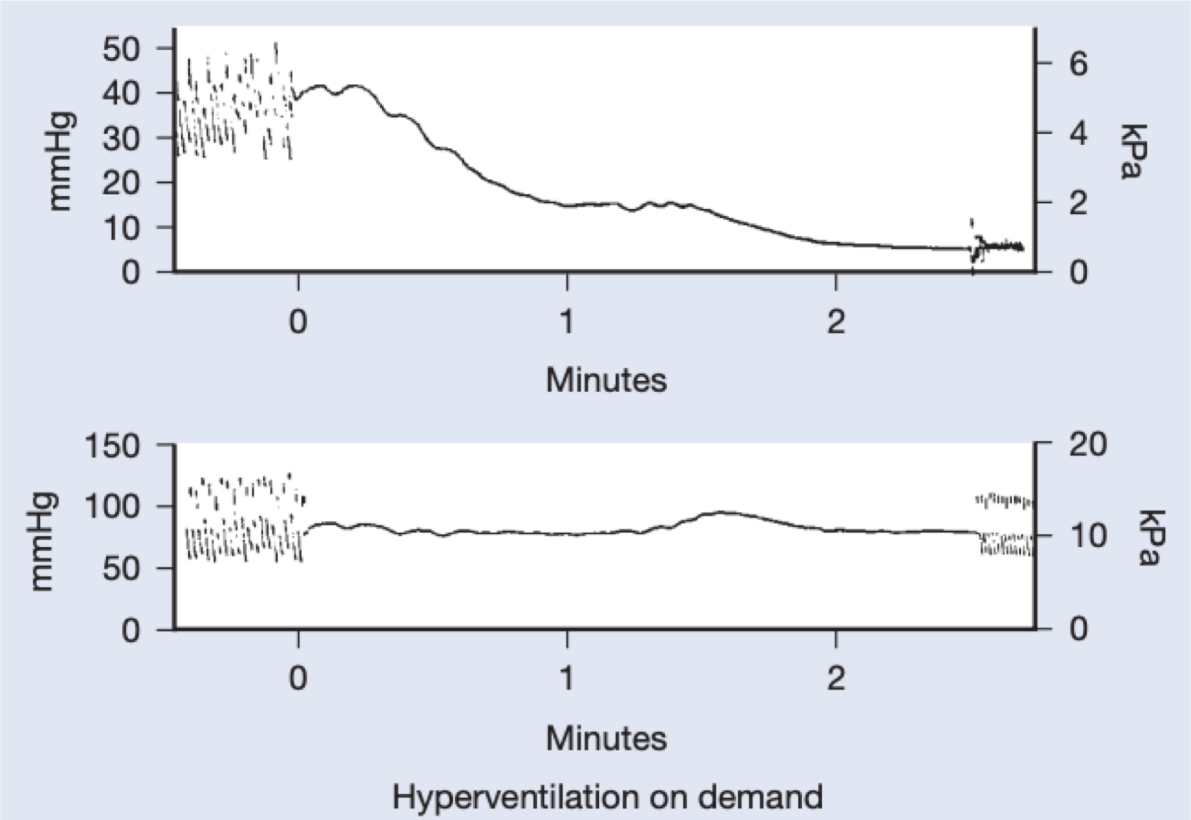


Fig. 11.3 Beneficial effect of voluntary hyperventilation on intracranial pressure before anesthesia induction. The upper trace is the ICP trend. The bottom trace shows the stability of the mean arterial pressure. *(Courtesy R Chiolero, MD)*

To summarize

The anesthetic goal:	Hemodynamic stability
The reason:	Autoregulation takes 30 to 120 seconds to be established; thus sharp MAP fluctuations entrain undesirable CBF, CBV, and ICP changes
The formulas:	CBF = CPP/CVR CPP = MAP − ICP Normally, ICP < CVP

So how do we manage ICH

- Euvolemia
- Sedation, analgesia, anxiolysis
- Head-up position
- Osmotic agents: hypertonic saline, mannitol
- Steroids
- Maintain stable hemodynamics
- Hyperventilation
- Adequate oxygenation
- Maintain adequate venous drainage, decrease PEEP, decrease inspiratory time
- EVD/Lumbar Drain

Pre-Anesthetic Planning

BOX 11.3 Preoperative Neurologic Evaluation

History
- Seizure (type, frequency, treatment)
- Increased intracranial pressure (ICP): headache, nausea, vomiting, blurred vision
- Decreased level of consciousness, somnolence
- Focal neurologic signs: hemiparesis, sensory deficits, cranial nerve deficits, etc.
- Paraneoplastic syndromes, including presence of thrombosis

Physical Evaluation
- Mental status
- Papilledema (increased ICP)
- Signs of Cushing's response: hypertensive bradycardia
- Pupil size, speech deficit, Glasgow Coma Scale score, focal signs

Medication
- Steroids
- Antiepileptic drugs

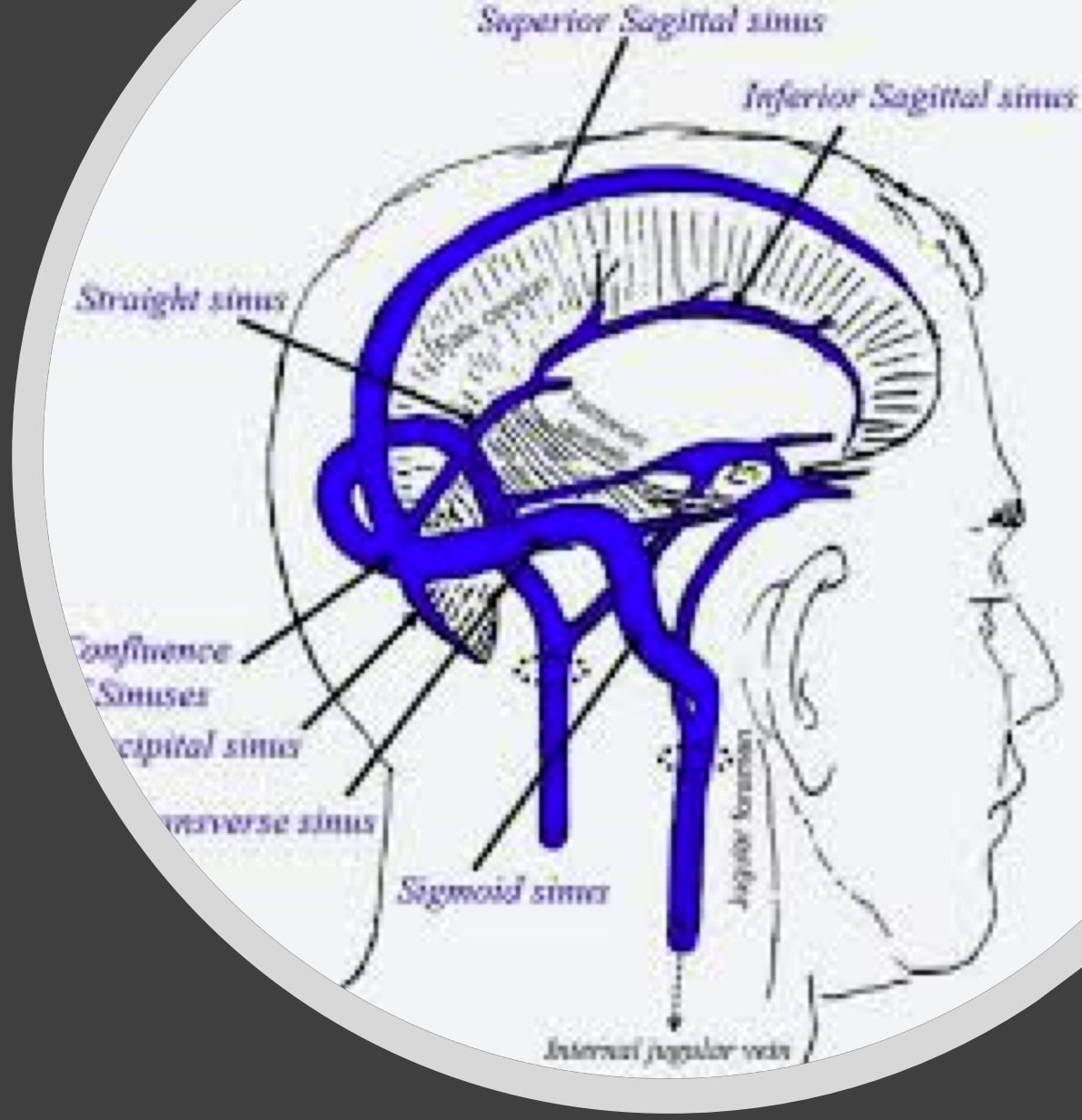
Technical Examination (Computed Tomography or Magnetic Resonance Imaging)
- Size and location of the tumor: silent or eloquent area, near a major vessel, etc.
- Intracranial mass effect: midline shift, decreased size of the ventricles, temporal lobe hernia
- Intracranial mass effect: hydrocephalus, cerebrospinal fluid space around brainstem
- Others: edema, brainstem involvement, pneumocephalus (repeat craniotomy)

Evaluation of Hydration Status
- Fever; infection
- Duration of bed rest
- Fluid intake
- Diuretics
- Inappropriate secretion of antidiuretic hormone

Neurologic Working Diagnosis
- Tissue type of tumor

Consider the surgical intervention!

- Size and position of tumor
- Tissue diagnosis
- Surgical approach: structures in proximity (sinuses, arteries)
- Common approaches to supratentorial masses are: pterional, temporal or frontal craniotomy; bifrontal approach traverses the sagittal venous sinus! Beware of bleeding.



Planning your strategy

- Vascular Access
  - 1-2 large bore PIV if bleeding is suspected or concern for violating the sinus
  - CVC if high risk of air embolism or continuous vasoactive infusions
- Fluid Therapy
  - Goal euvolemia with balanced salt solution e.g. normosol
- Anesthetic Regimen
  - Volatile, remifentanil, Propofol
- Ventilatory Regimen
  - Goal normocapnia, low intrathoracic pressure
- Monitoring
  - Arterial line for tight BP control
  - Precordial doppler if seated position or high risk of VAE
- Intracranial Monitoring
  - Usually booked by surgeon if concern for damaging nerve tracts, important structures

Waking Up

Neurosurgical awakening should maintain:

- Stable arterial blood pressure and thus cerebral blood flow and intracranial pressure
- Stable oxygenation and carbon dioxide tension
- Stable $CMRO_2$
- Normothermia

Neurosurgical awakening should avoid:

- Coughing
- Tracheal suctioning
- Airway overpressure during extubation
- Patient-ventilator dyssynchrony

In Summary PROTECT THE BRAIN!

- Maintain homeostasis
  - Normovolemia
  - Normotension
  - Normoglycemia
  - Oxygenate
  - Mild hyperosmoalality
- Preserve CBF
  - Moderate hyperventilation
  - Maintenance of CPP
  - Osmotherapy
  - CSF drainage