NEUROANESTESIA II

Dr. John Béjar

Marzo 2021

Craneotomía en el paciente Despierto

Anestesia para procedimientos vasculares intracerebrales

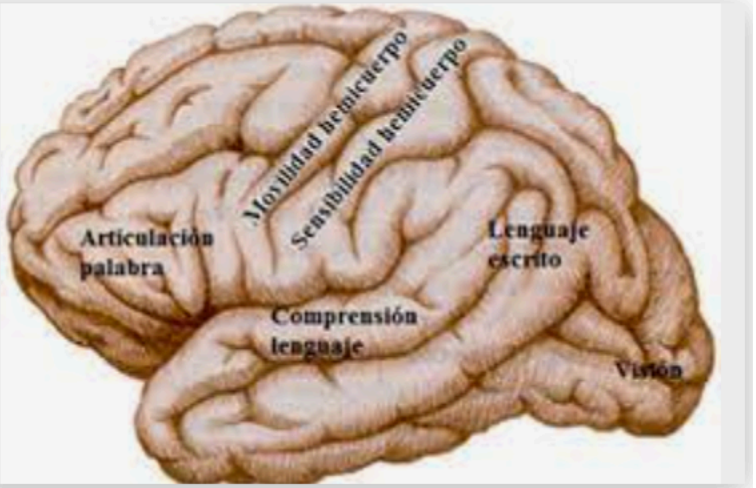
Anestesia para fosa posterior

EXPERIENCIA :” Es el concocimiento adquirido , fruto de los fracasos vividos”

INDICACIONES. AWAKE CRANIOTOMY

- ✓ Para permitir el mapeo en la resección de tumores cerebrales ,lesiones vasculares a menudo grandes, cercanos a zonas elocuentes a nivel cortical.
- ✓ Cirugía de la epilepsia.

Zonas elocuentes : zonas que controlan funciones motoras, sensoriales o del habla.

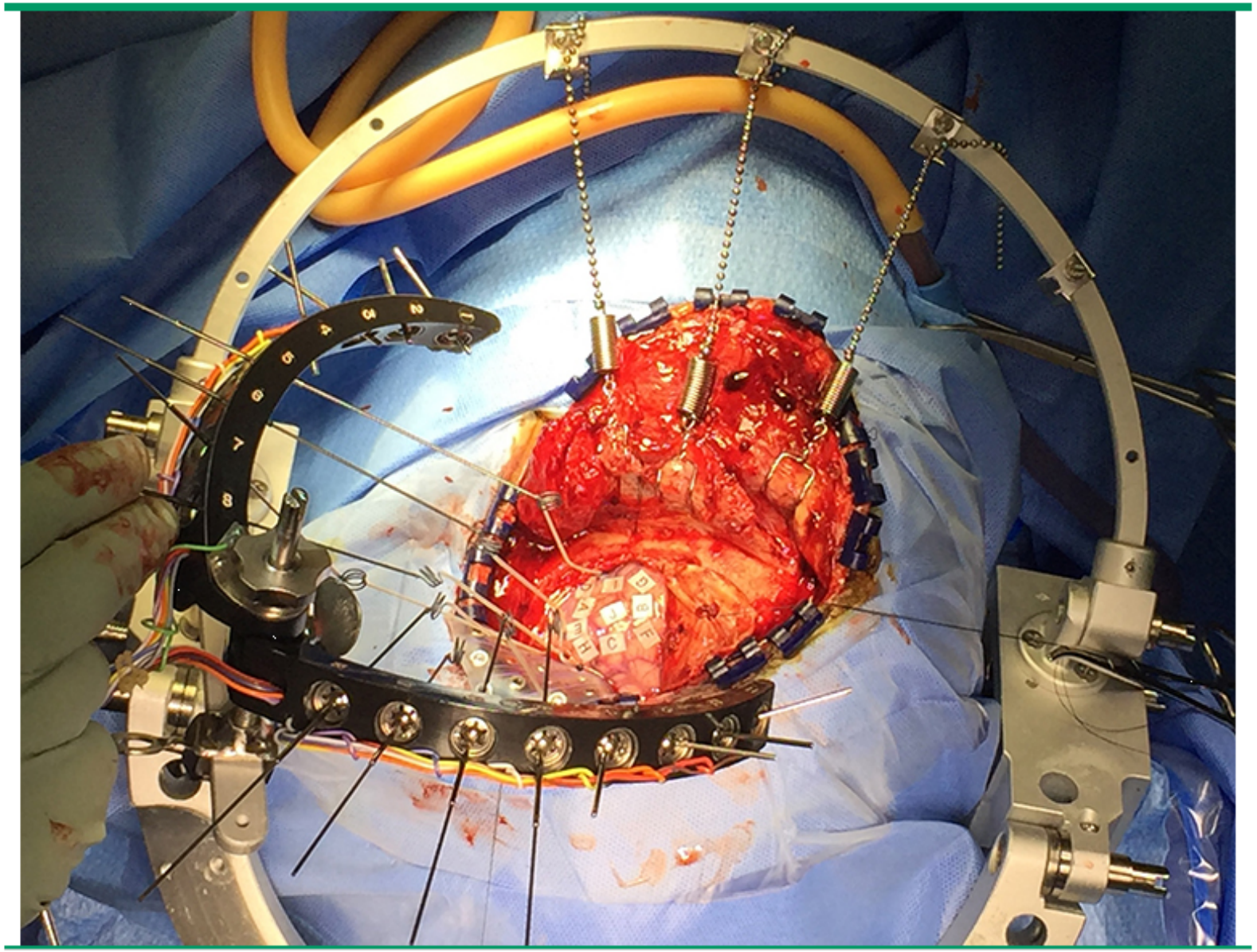


Otras lesiones CON FINES DE E.R.A.S.

- ➢ Disminuir la estadía hospitalaria
- ➢ Disminuir el ingreso a UTI
- ➢ Disminuir el riesgo de AG

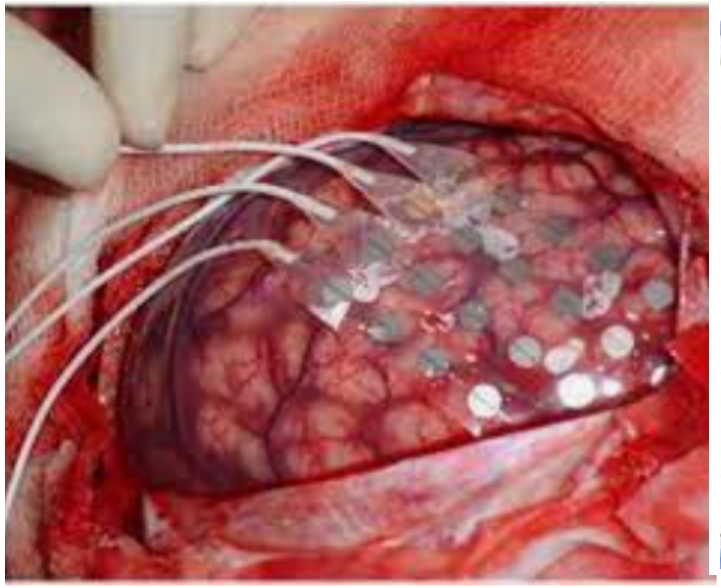
“ No necesariamente despierto durante todo el procedimiento"

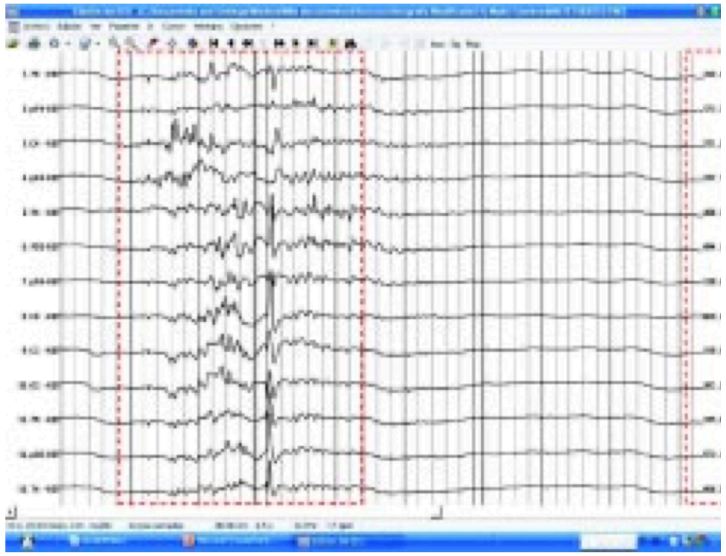
Intraoperative electrocorticography and cortical mapping



This photo shows the open cranium, with the Medusa frame and intracranial electrodes for electrocorticography. Cortical areas that produce informative responses during cortical mapping are labeled with paper tickets.

ELECTROCORTICOGRAFIA (ECoG)





- La perfusión de propofol debe detenerse 20 min. antes del registro.
- El foco epileptógeno puede estimularse con 10 a 20 mg IV de propofol.

CONTRAINDICACIONES

TRASTORNOS DE ANSIEDAD, INESTABILIDAD EMOCIONAL, CLAUSTROFOBIA
DISFASIA SIGNIFICATIVA
CONFUSIÓN O SOMNOLIENCIA
ABUSO DE ALCOHOL O DROGAS
DOLOR CRÓNICO
UMBRAL BAJO AL DOLOR
OBESIDAD MORBIDA
SAOS
VÍA AÈREA DIFICULTOSA
TOS INCONTROLABLE
DISNEA EN REPOSO
PERDIDA SANGUÍNEA ESPERABLE > 750 cc

- ✓ El anticonvulsivante de uso habitual debe tomarse.
- ✓ No se hace dosis IV de anticonvulsivante antes de Inducción Anestésica.

PREMEDICACIÓN

Individualizarla, evitar Benzodiacepinas, sobre todo porque interfieren con ECoG

🤷‍♂️ → MIDAZOLAM IV dosis bajas

SONDA VESICAL ,SI DURACIÓN ES MAYOR A 4 HS. o SI SE VA A USAR MANITOL

ESTRATEGIAS ANESTÉSICAS

MAS CONFIABLE ?

M.A.C .
Cuidado anestésico Monitorizado
(Sedación consciente)

A.A.A.
asleep awake asleep

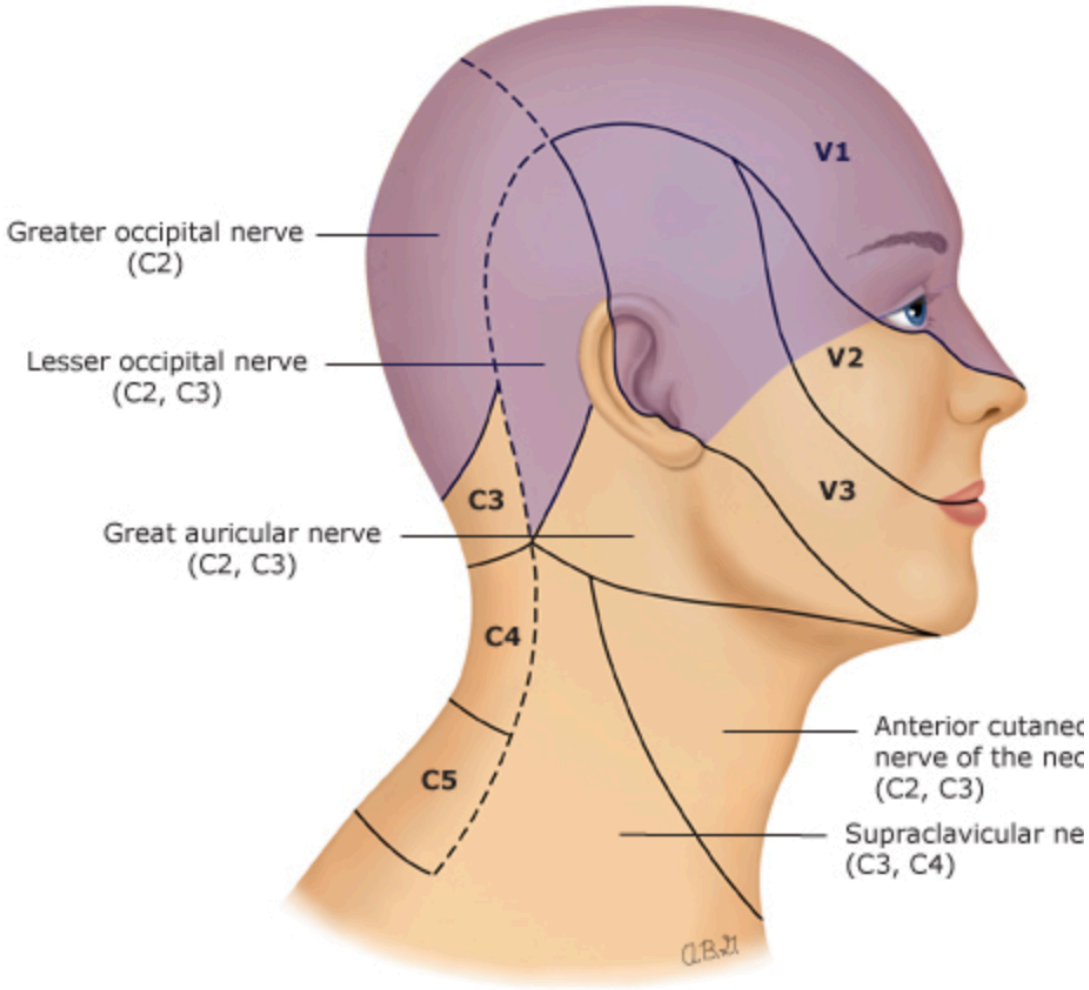
Sin diferencias Clínicas ni Estadísticas significativas

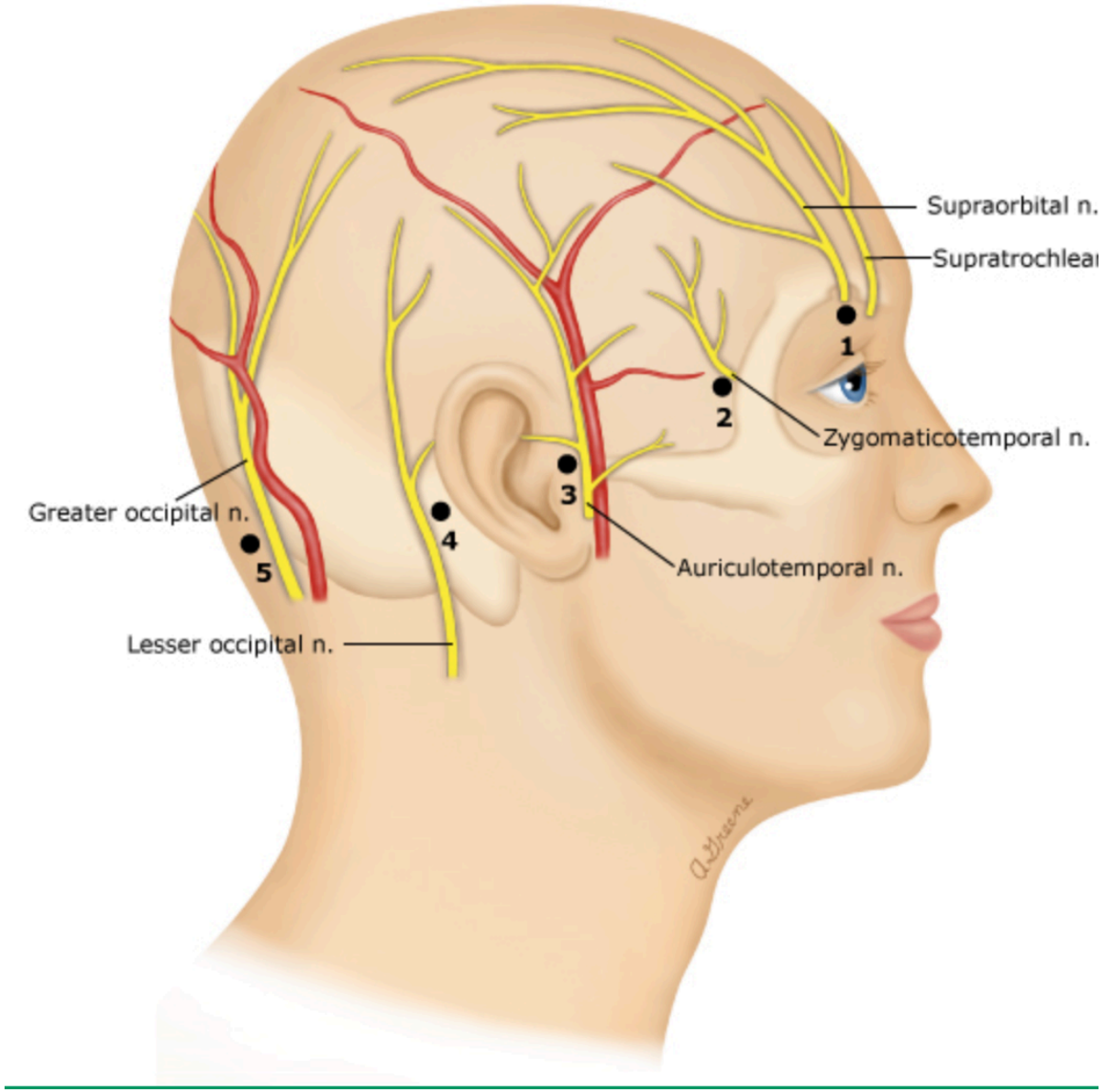
Continuum of depth of sedation: Definition of general anesthesia and levels of sedation/analgesia*

	Minimal sedation anxiolysis	Moderate sedation/analgesia ("conscious sedation")	Deep sedation/analgesia	General anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful ¶ response to verbal or tactile stimulation	Purposeful ¶ response following repeated or painful stimulation	Unarousable even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired

INFILTRACIÓN LOCAL

Sensory distribution scalp block





ANESTÉSICO, DOSIS , INTERVALO , PESO CORPORAL MAGRO, TOXICIDAD

C.A.M. Cuidado Anestésico Monitorizado.

ESTRATEGIA ANESTÉSICA

PREMEDICACION MIDAZOLAM 1ª 2 mg IV Fentanilo 50 mcg IV, recordar ECoG

dosis de carga de Dexmedetomidina 1 mcg/kg IV seguido de perfusión 0.3 a 0.7 mcg kg h titular sedación y de ser necesario Agregar propofol de 1.8 a 4.5 mg/kg/h titulando sedación

Bolos de 10 mg de propofol IV(máximo 30-40 mg) , cirujano infiltra sitios de los pines con Lidocaína al 1 o 2 %, bolos adicionales de 25 a 50 mcg de Fentanilo IV

Se posiciona al paciente y cuida sitios de apoyo

CIRUJANO infiltra cuero cabelludo con Bupivacaína 40 cc al 0.25% con adrenalina 1/200000
Se lo apoya con bolos de propofol 10 a 20 mg IV , fentanilo 25 a 50 mcg IV, o se aumenta la velocidad de perfusión durante la disección.

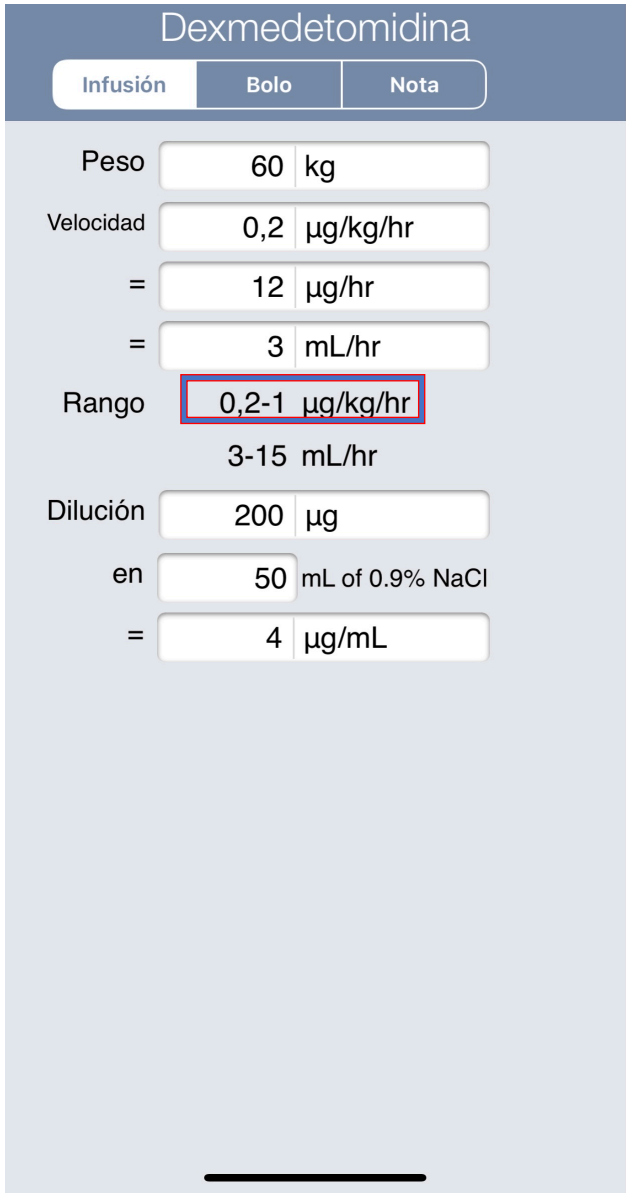
DEXMEDETOMIDINA amp 2cc :200 mcg

¨Agonista α 2 adrenérgico que produce depresión de la conciencia , amnesia, analgesia, sin depresión respiratoria¨

Hipotensión, Bradicardia

DOSIS DE CARGA OPCIONAL

1 mcg/kg IV
en 10 min.



CUIDADO

- Error de dosis mcg/kg/h.
- No garantiza amnesia , por eso es coadyuvante ,(BDZ, Propofol)
- Efectos hemodinámicos importantes.
- La depresión respiratoria puede existir.
- Efecto residual.

Parar el propofol cuando el colgajo se haya levantado, y suspender o diminuir la DXM, esperar que el Paciente despierte para el mapeo

Bolo de 10 a 20 mg IV de propofol , y restaurar las perfusión previa,

Durante el cierre del cuero cabelludo , parar perfusión , administrar Ondasetron 4 mg IV , y bolos de fentanilo 25 mcg IV , según necesidad.

A.A.A. AWAKE ASLEEP AWAKE. DESPIERTO DORMIDO DESPIERTO

Dormido

AWAKE

- PROPOFOL/DXM – REMIFENTANILO
- BNM ?
- LMA

Despierto

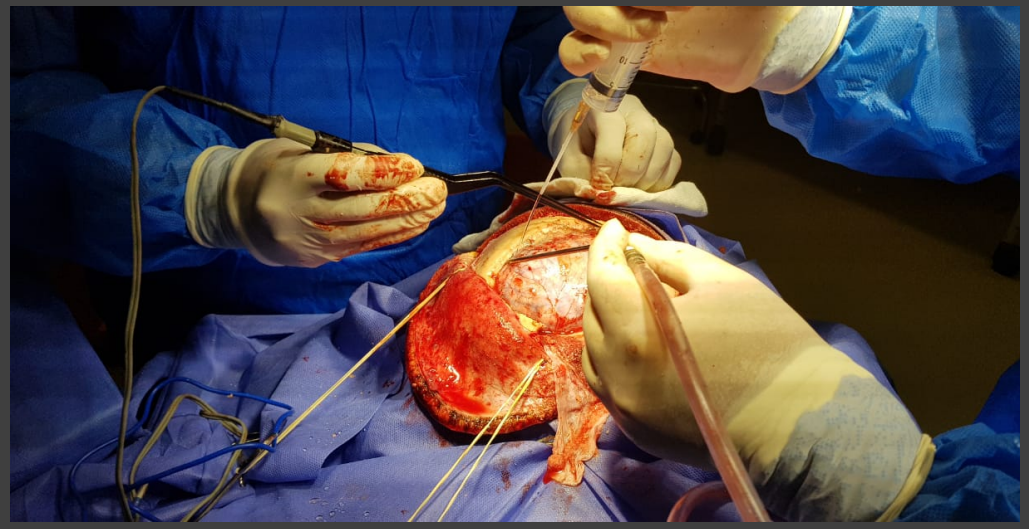
ASLEEP

- Pedir Asistencia
- REMOVER LMA
- Titular perfusión

Dormido

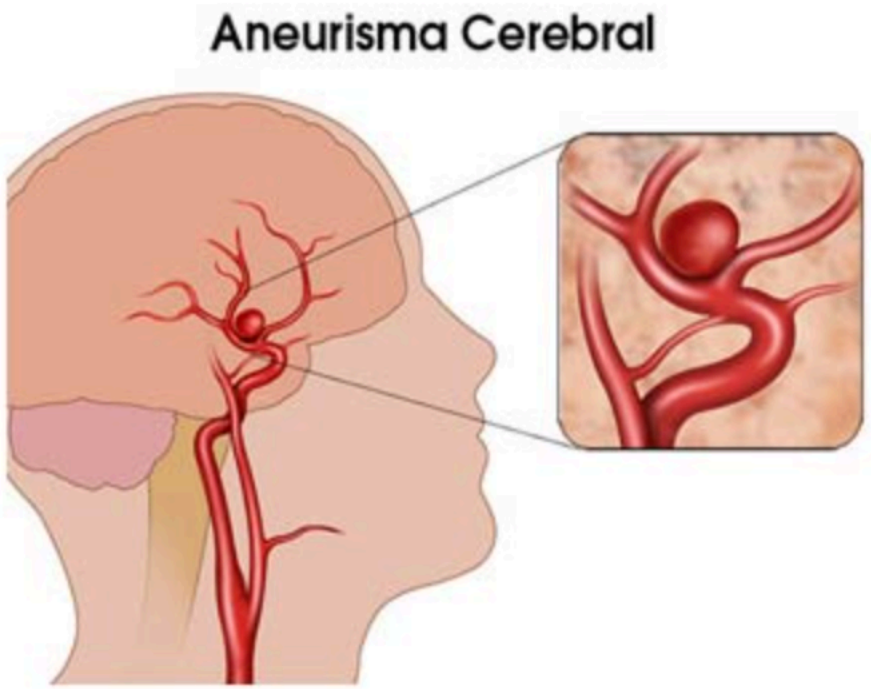
AWAKE

- Restaurar AG
- Reinsertar LMA




21:20
Conversación
LMNeuquén
@LMNeuquen
La práctica fue llevada a cabo en la clínica San Agustín y las autoridades dieron a conocer el avance mediante un video. La nota contiene IMÁGENES SENSIBLES.
Video: Neuquén realizó la primera cirugía de cerebro con paciente despierta de la Patagonia
lmneuquen.com
20:33 · 18/5/20 · La Mañana de Neuquén
1 Retweet 5 Me gusta

ANEURISMAS CEREBRALES



Clip por Cirugía

Intervención Endovascular

Ambos

Ruptura de Aneurisma Intracraneal

Hemorragia Subaracnoidea (HSA)

32 % DE ACV SON HEMORRAGICOS

Hemorragia intracerebral

HSA 2 a 16 /100.000

MANEJO PRECOZ DE HSA

- MANTENER OXIGENACIÓN Y VENTILACIÓN
- RESTAURAR RAPIDAMENTE LA PERFUSIÓN CEREBRAL
- PREVENIR EL RESANGRADO
- PROFILAXIS DE LA CONVULSIONES
- INICIAR LA NIMODIPINA
- PLANEAR EL MOMENTO DE EL TRATAMIENTO DEFINITIVO

Severidad de HSA

Grade*	Hunt and Hess*
0	Unruptured aneurysm
I	Asymptomatic or minimal headache and slight nuchal rigidity
II	Moderate to severe headache, nuchal rigidity, but no neurologic deficit other than cranial nerve palsy
III	Drowsiness, confusion or mild focal deficit
IV	Stupor, mild or severe hemiparesis, possible early decerebrate rigidity, vegetative disturbance
V	Deep coma, decerebrate rigidity, moribund appearance

- RIESGO DE HTE
- CEREBRO NO RELAJADO
- PERDIDA DE AUTOREGULACIÓN
- REACTIVIDAD ALTERADA AL CO2

RIESGO DE VASOESPASMO, se basa en la cantidad y distribución de sangre en la TAC inicial

Group/Grade	Fisher Grade
0	
1	No blood detected
2	Diffuse deposition or thin layer with all vertical layers (in interhemispheric fissure, insular cistern, ambient cistern) < 1 mm thick
3	Localized clot and/or vertical layers 1 mm or more in thickness
4	Intracerebral or intraventricular clot with diffuse or no subarachnoid blood

ISQUEMIA CEREBRAL

RIESGO DE VASOESPASMO

Consecuencias Fisopatológicas de HSA

Table 3. Major Pathophysiological Sequalae of Subarachnoid Hemorrhage Grade

- Neurologic [35–38,88–94,197,198]
  - Raised intracranial pressure/reduced cerebral perfusion pressure
  - Reduced cerebral blood flow
  - Intraoperative “tight” brain
  - Impaired cerebral autoregulation
  - Impaired cerebrovascular reactivity to carbon dioxide
  - Seizures
  - Delayed cerebral ischemia/cerebral vasospasm
- Cardiovascular [101–105,107,108,111,112]
  - Electrocardiographic changes
  - Cardiac arrhythmias
  - Myocardial stunning and troponin leak
  - Takatsubo cardiomyopathy (stress cardiomyopathy)
  - Thromboembolism
- Pulmonary [95–101]
  - Aspiration
  - Neurogenic pulmonary edema
  - Cardiogenic pulmonary edema
  - Pneumonia
- Fluid and Electrolyte Imbalance [120–128]
  - Hypovolemia
  - Cerebral salt wasting
  - Syndrome of Inappropriate Antidiuretic Hormone Secretion
  - Diabetes Insipidus
  - Hypokalemia
  - Hypocalcemia
- Endocrine [117–119]
  - Hyperglycemia

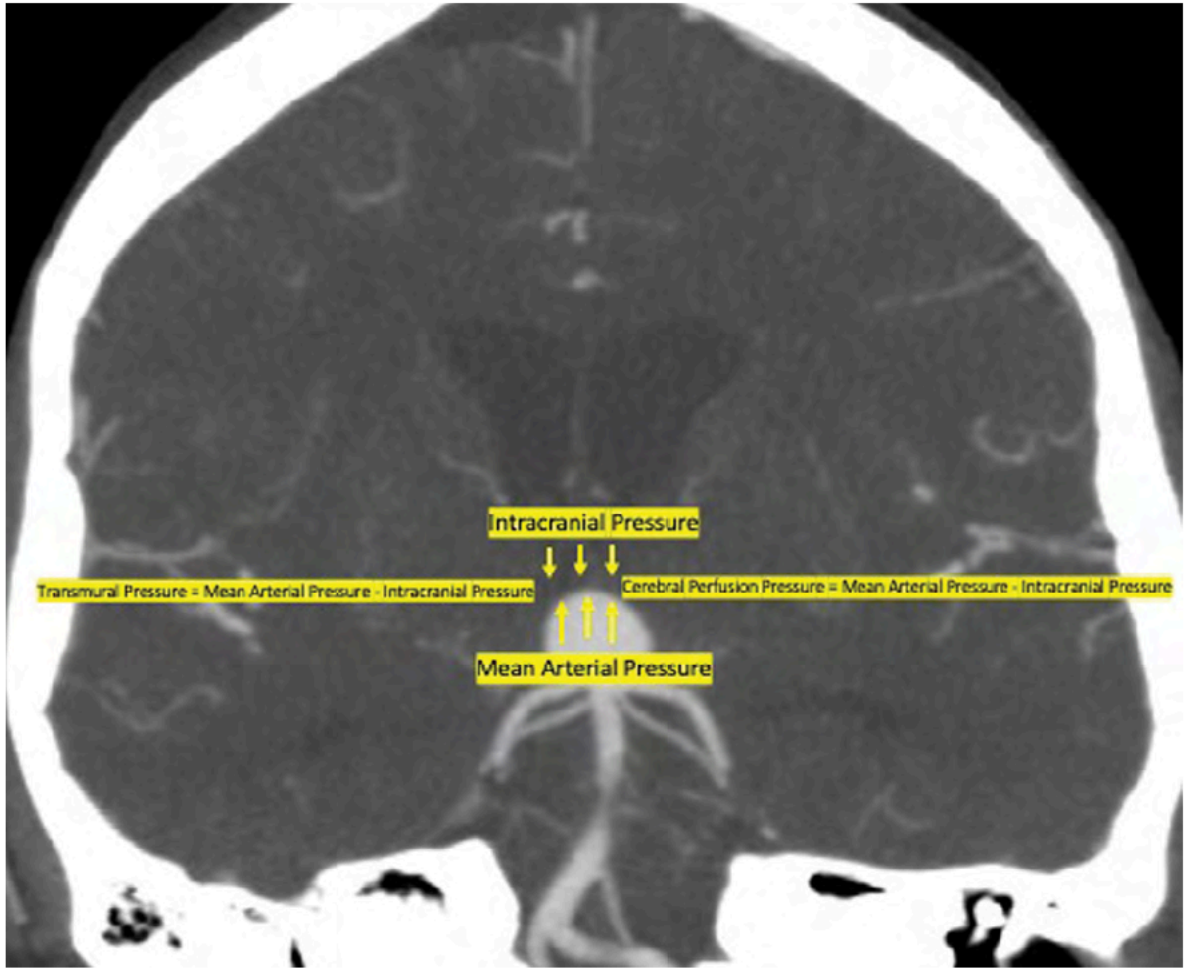


Table 4. Summary of Evidence-based Recommendations Relevant to Perioperative Management of Patients with Aneurysmal Subarachnoid Hemorrhage Based on the Guidelines from the American Heart Association/American Stroke Association*[63]

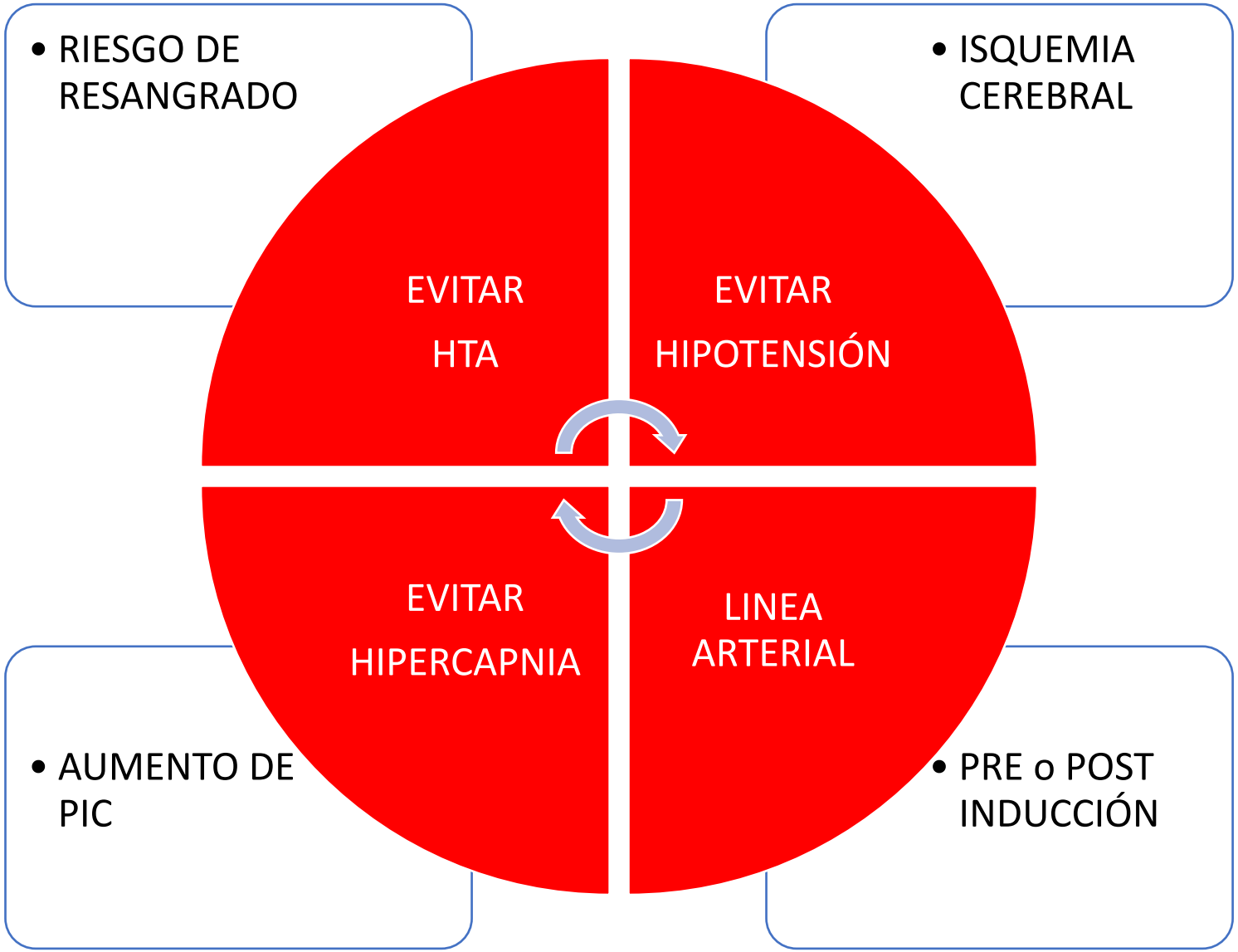
Level of Evidence	Recommendation
Class 1 Level of Evidence A	Oral nimodipine should be administered to all patients. (Improves neurologic outcomes but not cerebral vasospasm. The value of other calcium antagonists, whether administered orally or intravenously, is uncertain.)
Class 1 Level of Evidence B	The risk of early aneurysm rebleeding is high and is associated with very poor outcomes. Surgical clipping or endovascular coiling of the ruptured aneurysm should be performed as early as feasible
Class 1 Level of Evidence B	Before aneurysm obliteration, blood pressure should be controlled with a titratable agent to balance the risk of stroke, hypertension-related rebleeding, and maintenance of cerebral perfusion pressure.
Class 1 Level of Evidence B	Low-volume hospitals should consider early transfer of patients to high-volume centers with experienced cerebrovascular surgeons, endovascular specialists, and multidisciplinary neuro-intensive care services.
Class 1 Level of Evidence B	Maintenance of euvolemia and normal circulating blood volume is recommended to prevent delayed cerebral ischemia.
Class 1 Level of Evidence B	Induction of hypertension is recommended for patients with delayed cerebral ischemia unless blood pressure is elevated at baseline or cardiac status precludes it.
Class 1 Level of Evidence B	Acute symptomatic hydrocephalus should be managed by cerebrospinal fluid diversion (external ventricular drainage or lumbar drainage, depending on the clinical scenario).
Class IIa, Level of Evidence C	The magnitude of blood pressure control to reduce the risk of rebleeding has not been established, but a decrease in systolic blood pressure to < 160 mmHg is reasonable.
Class IIa, Level of Evidence B	Transcranial Doppler is reasonable to monitor for the development of arterial vasospasm.
Class IIa, Level of Evidence B	Aggressive control of fever to a target of normothermia by use of standard or advanced temperature modulating systems is reasonable in the acute phase.
Class IIa, Level of Evidence B	The use of packed erythrocyte transfusion to treat anemia might be reasonable in patients who are at risk of cerebral ischemia. The optimal hemoglobin goal is still to be determined.
Class IIa, Level of Evidence B	For patients with an unavoidable delay in obliteration of aneurysm, a significant risk of rebleeding, and no compelling medical contraindications, short-term (<72 hours) therapy with tranexamic acid or aminocaproic acid is reasonable to reduce the risk of early aneurysm rebleeding.

*The recommendations follow the American Heart Association Stroke Council's methods of classifying the level of certainty of the treatment effect and the class of evidence. Also, this is not a complete list of all the recommendations from American Heart Association/American Stroke Association. Only select recommendations from the guideline that, in the author's opinion, are directly relevant to anesthetic and perioperative management are listed here. For complete guidelines, the readers should refer to the American Heart Association/American Stroke Association publication in *Stroke* 2012 (PMID:22556195)

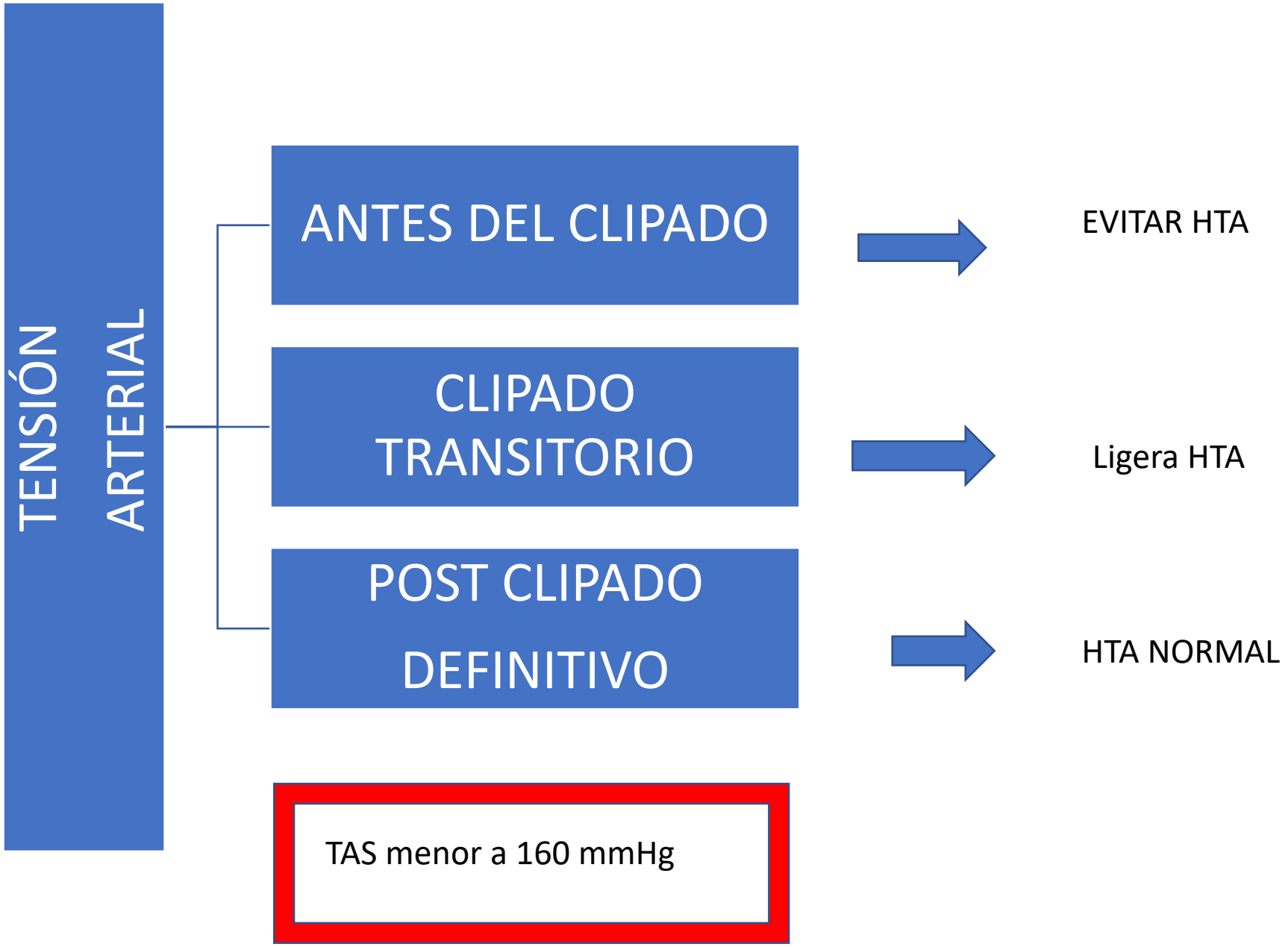
MANEJO ANESTÉSICO

1. Prevención de resangrado
2. Mantener la perfusión cerebral
3. Prevenir / manejar la inflamación cerebral intraoperatoria para facilitar exposición quirúrgica
5. Facilitar el monitoreo neurofisiológico
6. facilitar el clipado
7. Optimizar la fisiología sistémica y controlar la glucemia
8. Anticipar y manejar situaciones de crisis (por ejemplo, ruptura de aneurisma)
9. Obtener una educción oportuna, suave para evaluación neurólogica.
10. Prevenir el dolor postoperatorio y otras complicaciones.

INDUCCIÓN DE LA ANESTESIA

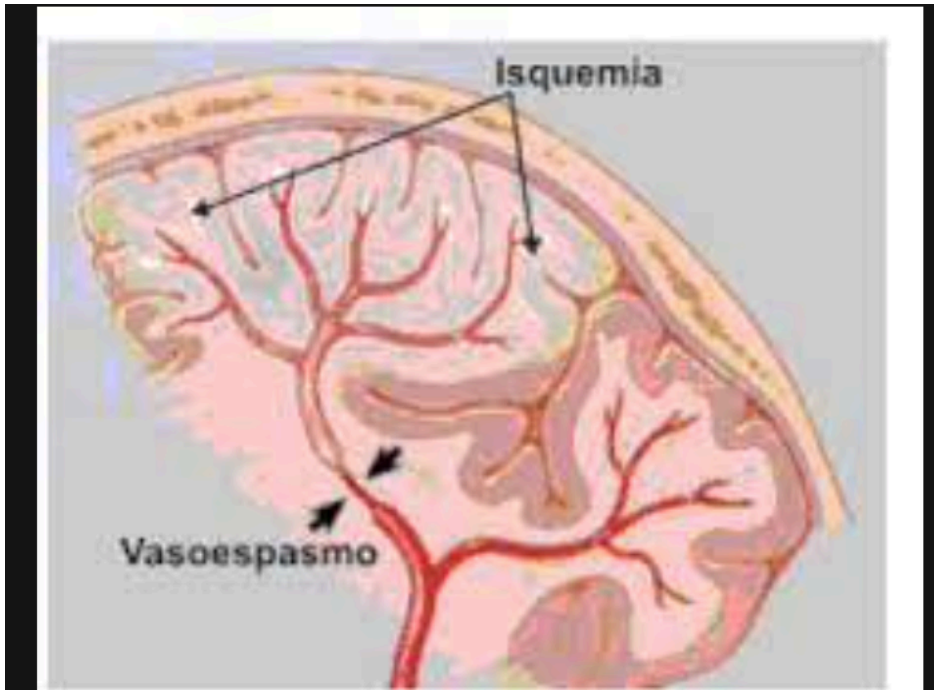


MANEJO HEMODINÁMICO



VASOESPASMO CEREBRAL

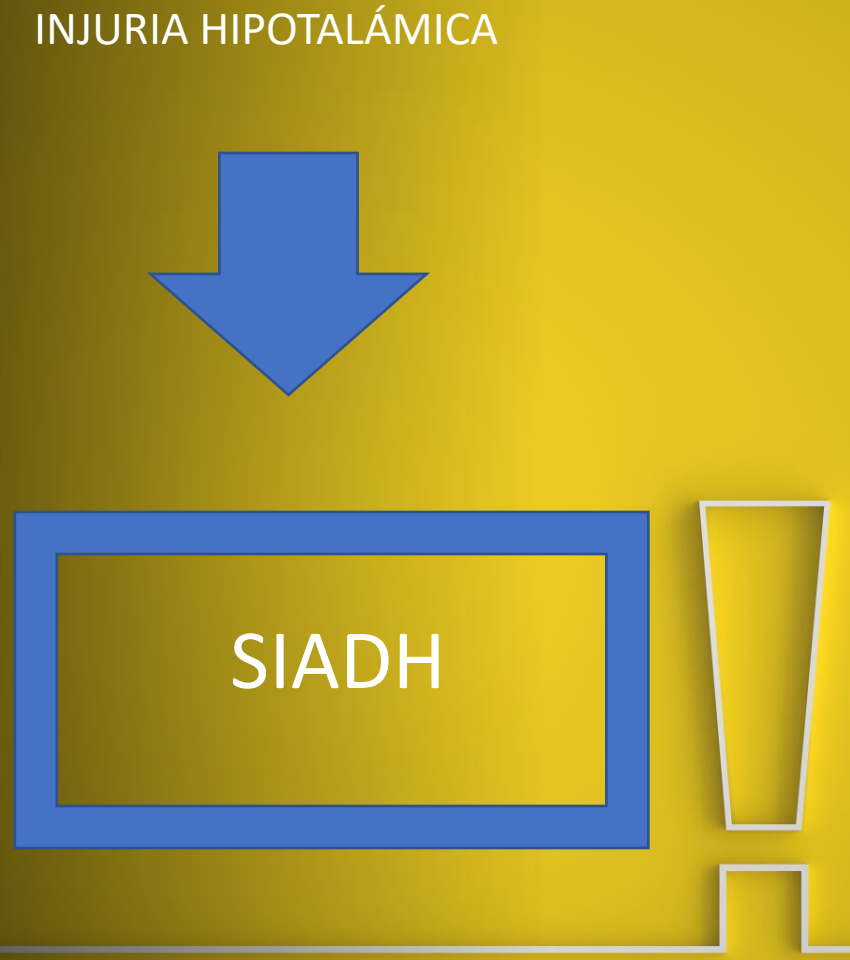
- Producido por disbalance entre vasodilatadores y vasoconstrictores endógenos
- Se da entre el 3 y 21 días post hemorragia
- 70 % se ve en angiografía , pero solo un tercio es sintomático



TRIPLE H
HIPERTENSIÓN ,HIPERVOLEMIA, HEMODILUCIÓN

EVITAR HIPOTENSIÓN ARTERIAL, DURANTE EL TRATAMIENTO ENDOVASCULAR

HIPONATREMIA SE DA EN EL 30 % DE HSA



Protocol for management of hyponatremia in patients with subarachnoid hemorrage

For Na level <133 mEq/L or a decrease of 6 mEq/L in 24 to 48 hours:
1. NaCl tabs 3 g PO/NGT every 6 hours
2. Initiate 3 percent NaCl infusion at 20 mL/hour IV
3. Check serum Na every 6 hours
a. If Na <130 mEq/L:
Increase rate by 20 mL/hour (max rate = 80 mL/hour)
If on hold at present, initiate 3 percent NaCl infusion at 20 mL/hour IV
b. If Na = 130 to 135 mEq/L:
Increase rate by 10 mL/hour (max rate = 80 mL/hour)
If on hold at present, initiate 3 percent NaCl infusion at 10 mL/hour IV
c. If Na = 136 to 140 mEq/L:
No change
d. If Na ≥140 mEq/L:
Hold infusion

NaCl: sodium chloride; PO: by mouth; NGT: nasogastric tube; IV: intravenously.

RUPTURA DE ANEURISMA EXPUESTO

Mejorar El campo para El clipado → Proteger el cerebro → Volumen con Fluídos

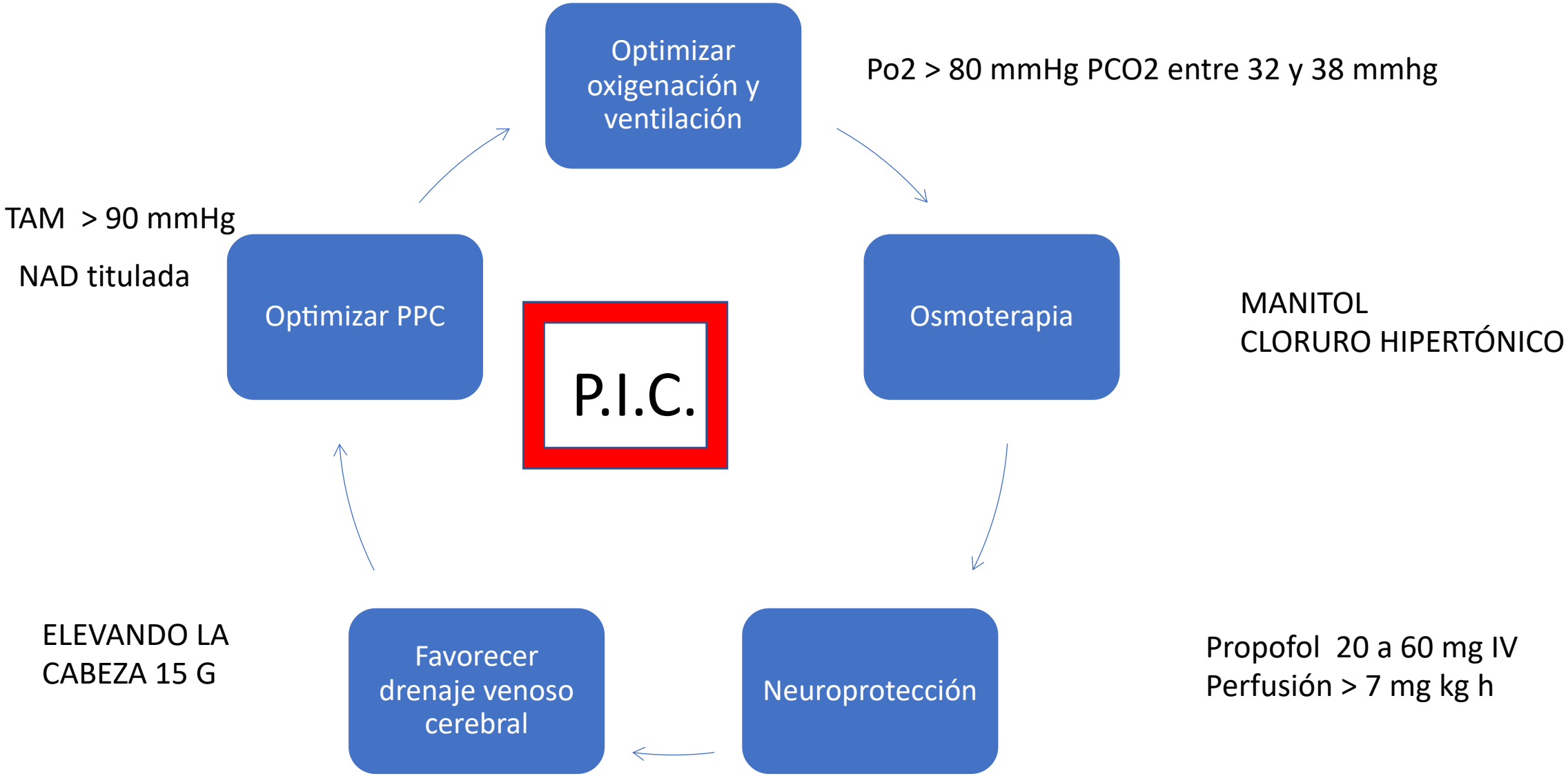
- ✓Disminuir la TA, TAM 50 a 60 mmHg , Esmolol 10 a 20 mg IV.
- ✓Adenosina 0.4 a 0.6 mg poduce paro circulatorio transitorio.
- ✓Disminuir el consumo de oxigeno cerebral propofol 20 a 60 mg IV y aumentar perfusión a 9 a 12 mg kg h
- ✓Resucitación con Fluídos y sangre, Hb de 8gr-dl o más

RUPTURA DE ANEURISMA NO EXPUESTO

Dificil diagnóstico

↓ TAM ↑ PIC

Angiografía o cirugía ?



Po2 > 80 mmHg PCO2 entre 32 y 38 mmhg

MANITOL
CLORURO HIPERTÓNICO

Propofol 20 a 60 mg IV
Perfusión > 7 mg kg h

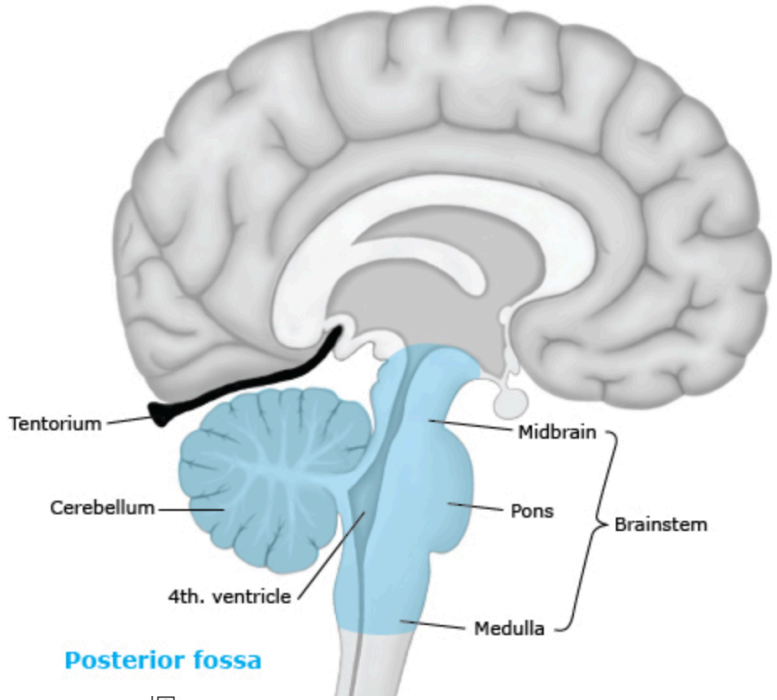
ELEVANDO LA CABEZA 15 G

TAM > 90 mmHg

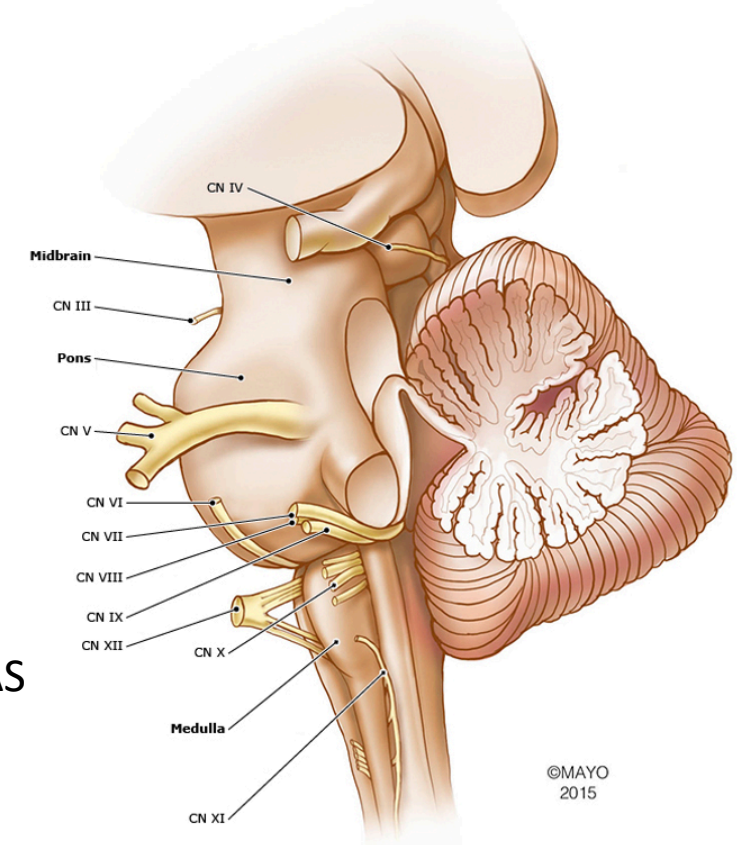
NAD titulada

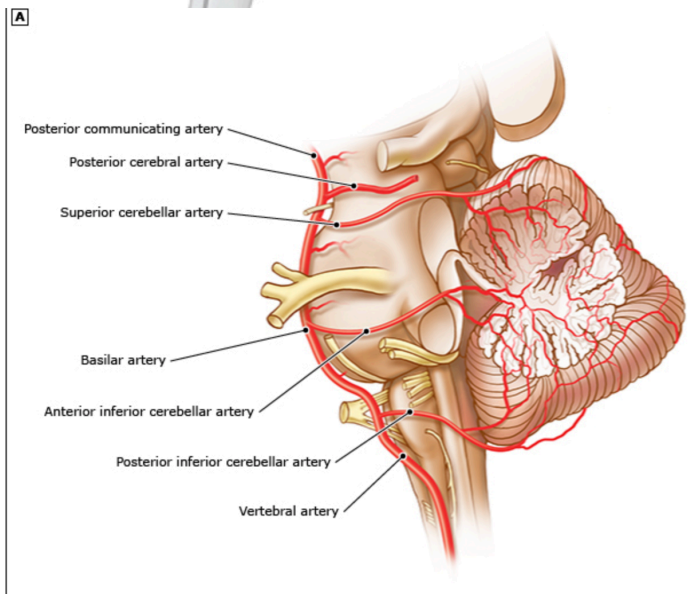
ANESTESIA PARA CIRUGÍA DE FOSA POSTERIOR o INFRATENTORIAL

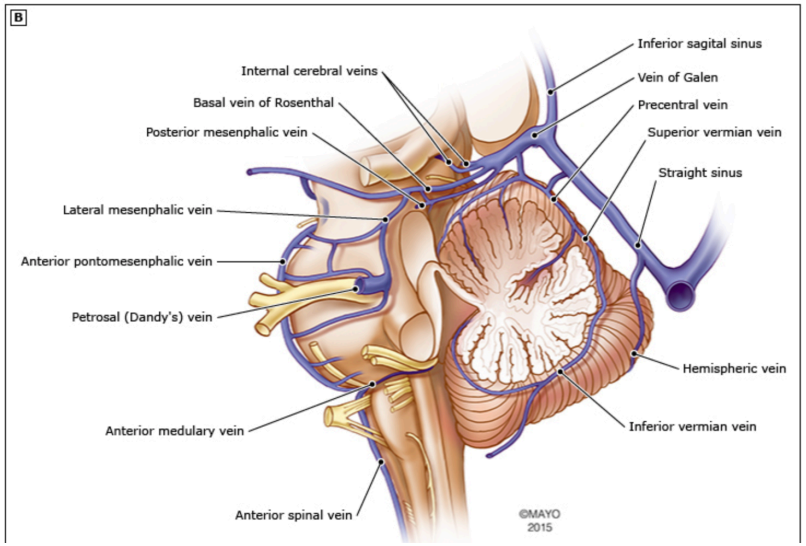
Posterior fossa structures, sagittal view



TUMORES
LESIONES VASCULARES
HEMORRAGIAS
COMPRESIONES NERVIOSAS

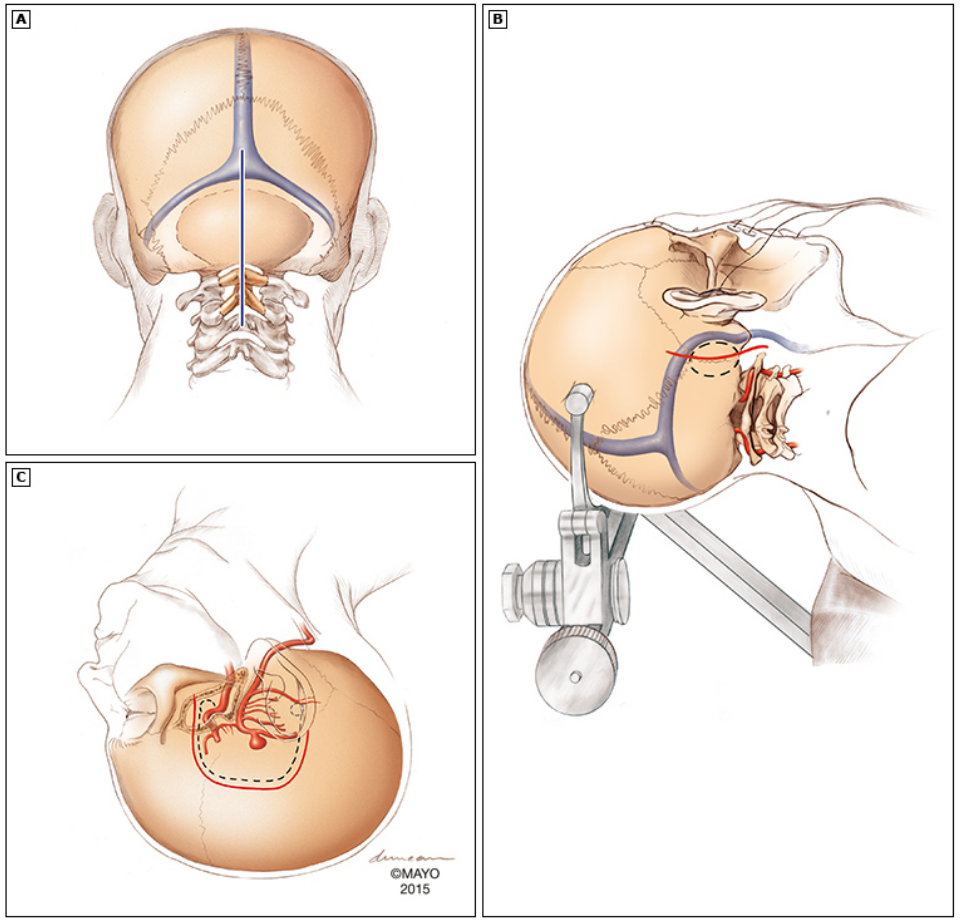






POSICIÓN

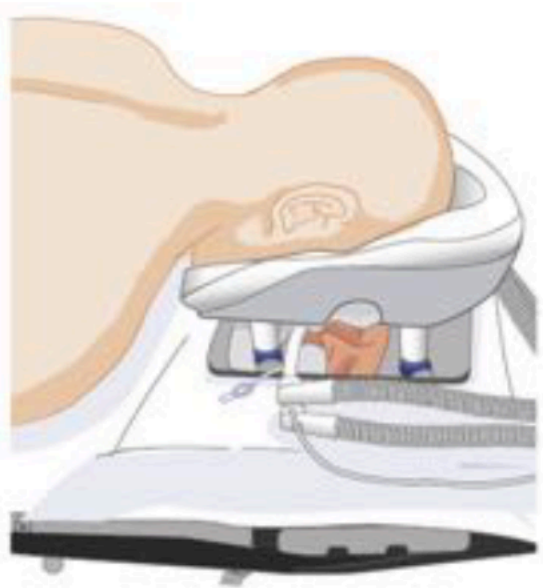
Several surgical approaches for posterior fossa craniotomy



The surgical approach to posterior fossa craniotomy determines the required patient positioning.

- The midline suboccipital approach (panel A) often requires the patient to be positioned prone or sitting.
- For the lateral suboccipital (panel B) and temporal (panel C) approaches, the patient may be placed in the lateral decubitus or park bench positions, or supine with the head turned.

POSICIÓN PRONO



Menor incidencia de embolismo aéreo

Mal acceso a vía aérea

Peor acceso quirúrgico

Pérdida visual

Zonas de presión

Cottrell and Young
Neuroanesthesia, 2016

SENTADO

Fijación a Mayfield

Presión arterial ➔ Cero en base de cráneo

Acolchamiento de prominencias óseas

Evitar estiramiento de nervios

Mantener drenaje venoso

Cottrell and Young
Neuroanesthesia, 2016

RIESGO ALTO DE EMBOLIA AÉREA VENOSA 18 a 76 %

ECOCARDIOGRAMA TRANSTORÁCICO. ETT TRANSESOFÁGICO POST INDUCCIÓN ETE

Contraindicación Relativa

- Riesgo de Isquemia Miocárdica
- Infarto
- Stroke

Table 2 Contraindications for sitting position

Absolute contraindications	Relative contraindications
Ventriculo-atrial shunt	Patent foramen ovale
Right to left heart shunt	Uncontrolled hypertension
	Extremes of age
	Severe autonomic neuropathy

V.A.E.

50 cc de aire puede

COR PULMONALE AGUDO
ASISTOLIA
EMBOLIA PARADOJAL

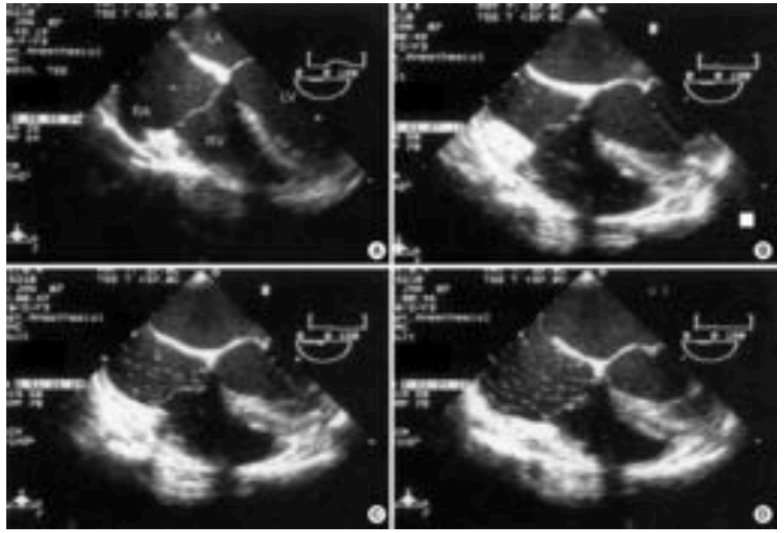
Venous air embolism during craniotomy: Rapid overview

Risk factors
▪ Craniotomy in the sitting position ▪ Surgery involving major intracranial venous sinuses; air entry possible from any venous opening above the level of the heart
Clinical signs
▪ Air visible on TEE ▪ Change in precordial Doppler tone ▪ Decrease in $ETCO_2$* ▪ Decrease in SPO_2* ▪ Hypotension* ▪ Increase in CVP*
Treatment

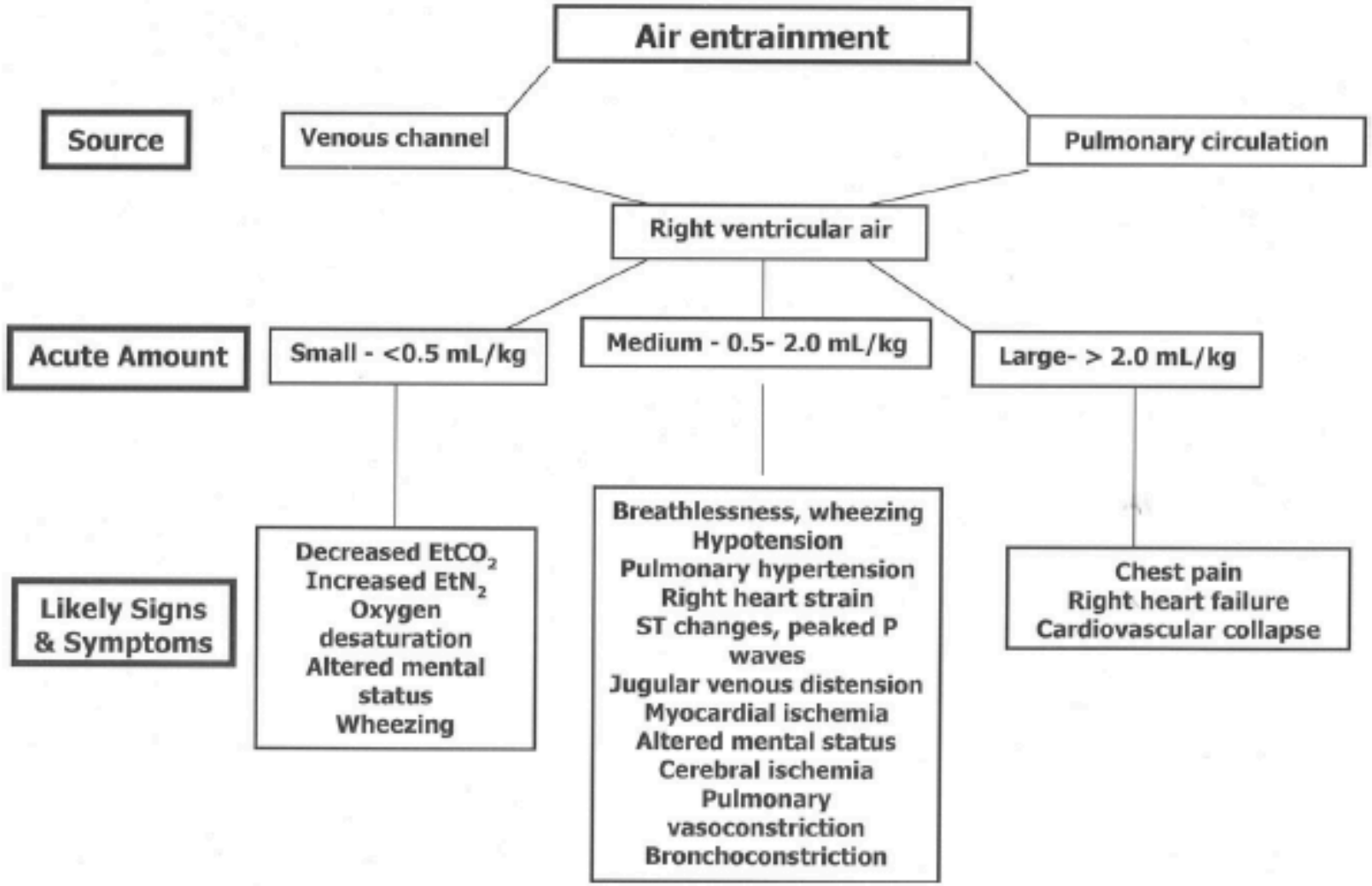
▪ Notify surgeon
  • Flood field with saline
  • Repair site of air entry
▪ Lower the head
  • May result in bleeding from air entry site
  • May limit surgical access to operative site
▪ Discontinue N_2O and administer 100 percent O_2
▪ Aspirate air from central venous catheter
▪ Discontinue PEEP
▪ Cardiovascular support
  • IV fluids
  • Vasopressors as needed

TEE: transesophageal echocardiography; $ETCO_2$: end-tidal carbon dioxide; SPO_2: oxygen saturation; CVP: central venous pressure; N_2O: nitrous oxide; O_2: oxygen; PEEP: positive end-expiratory pressure; VAE: venous air embolism.
* Clinical signs depend on severity of VAE.

UpToDate®



3 a 5 ml-kg es letal


Air entrainment
Source
Venous channel
Pulmonary circulation
Right ventricular air
Acute Amount
Small - <0.5 mL/kg
Medium - 0.5- 2.0 mL/kg
Large- > 2.0 mL/kg
Likely Signs & Symptoms
Decreased EtCO2
Increased EtN2
Oxygen desaturation
Altered mental status
Wheezing
Breathlessness, wheezing
Hypotension
Pulmonary hypertension
Right heart strain
ST changes, peaked P waves
Jugular venous distension
Myocardial ischemia
Altered mental status
Cerebral ischemia
Pulmonary vasoconstriction
Bronchoconstriction
Chest pain
Right heart failure
Cardiovascular collapse

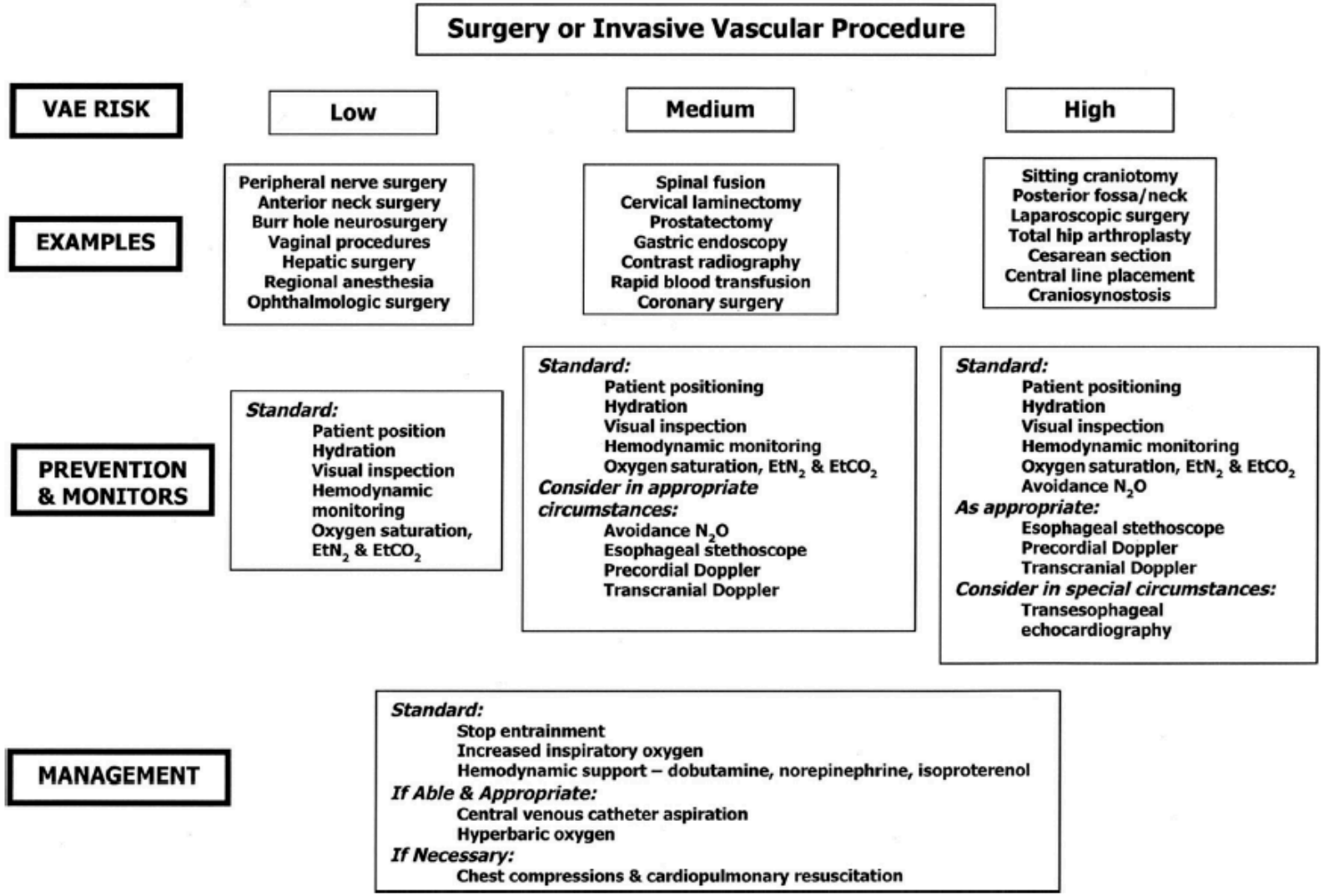
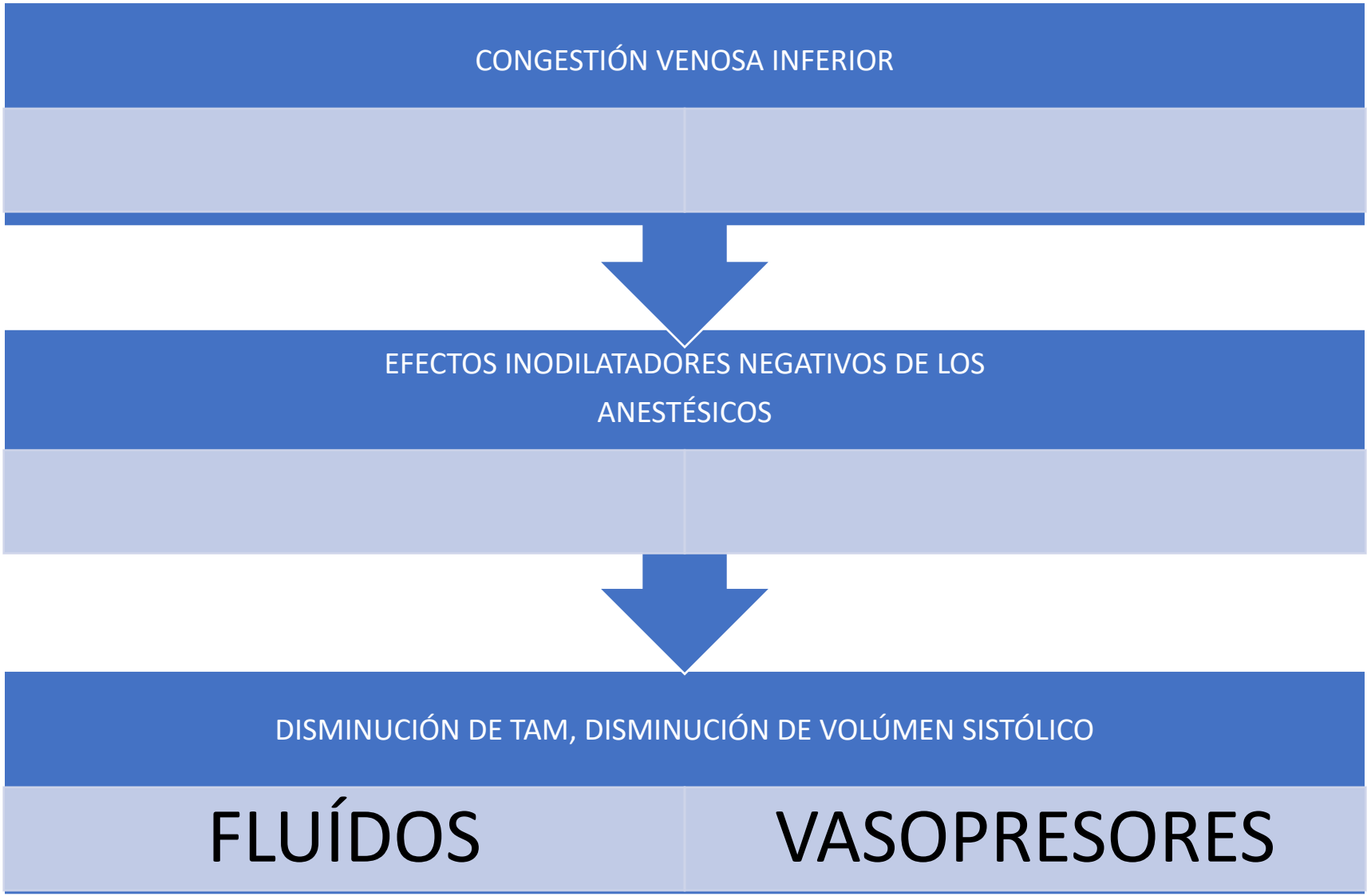

Surgery or Invasive Vascular Procedure
VAE RISK
Low
Medium
High
EXAMPLES
Peripheral nerve surgery
Anterior neck surgery
Burr hole neurosurgery
Vaginal procedures
Hepatic surgery
Regional anesthesia
Ophthalmologic surgery
Spinal fusion
Cervical laminectomy
Prostatectomy
Gastric endoscopy
Contrast radiography
Rapid blood transfusion
Coronary surgery
Sitting craniotomy
Posterior fossa/neck
Laparoscopic surgery
Total hip arthroplasty
Cesarean section
Central line placement
Craniosynostosis
PREVENTION & MONITORS
Standard:
Patient position
Hydration
Visual inspection
Hemodynamic monitoring
Oxygen saturation, EtN2 & EtCO2
Standard:
Patient positioning
Hydration
Visual inspection
Hemodynamic monitoring
Oxygen saturation, EtN2 & EtCO2
Consider in appropriate circumstances:
Avoidance N2O
Esophageal stethoscope
Precordial Doppler
Transcranial Doppler
Standard:
Patient positioning
Hydration
Visual inspection
Hemodynamic monitoring
Oxygen saturation, EtN2 & EtCO2
Avoidance N2O
As appropriate:
Esophageal stethoscope
Precordial Doppler
Transcranial Doppler
Consider in special circumstances:
Transesophageal echocardiography
MANAGEMENT
Standard:
Stop entrainment
Increased inspiratory oxygen
Hemodynamic support – dobutamine, norepinephrine, isoproterenol
If Able & Appropriate:
Central venous catheter aspiration
Hyperbaric oxygen
If Necessary:
Chest compressions & cardiopulmonary resuscitation

Table 3 Monitoring of venous air embolism (VAE); VAE detection techniques in order of decreasing sensitivity. Reproduced from[3] with permission from the *British Journal of Anaesthesia*

Monitor	Associated clinical signs
Transo esophageal echocardiography	Absent
Praecordial Doppler	Absent
Pulmonary artery pressure	Minor (heart rate, MAP)
End-tidal carbon dioxide	Minor (heart rate, MAP)
Right atrial pressure	Significant
Electrocardiography	Cardiovascular collapse
Oesophageal stethoscope	Cardiovascular collapse

EFECTOS CARDIOVASCULARES DE POSICIÓN SENTADO



AJUSTES DE POSICIÓN

drbejar@gmail.com
www.drjohnbejar.com.ar