ANESTHESIA IN PATIENTS WITH INCREASED INTRACRANIAL PRESSURE. ESTABLISHING THE BEST PROTOCOL IN SMALL ANIMALS.

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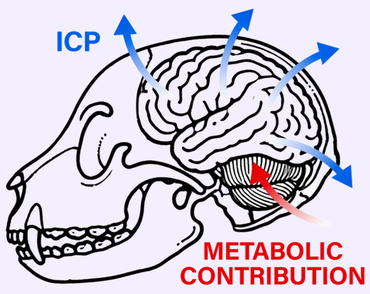
OBJECTIVES

1. Describe optimal anesthetic management strategies for small animals with increased intracranial pressure (ICP).
2. Analyze the impact of anesthetic and analgesic drugs on ICP regulation and potential complications.
3. Propose a safe and evidence-based anesthetic protocol for patients at risk of increased ICP.

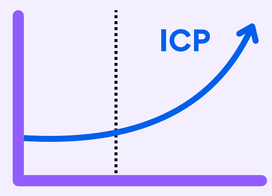
ANATOMY



CNS inside the skull, a rigid structure that does not allow the volume to expand.

The space occupied by each of these components can vary, compromising the ICP (5 - 12 mmHg), which is the pressure exerted by the tissues and fluids inside the skull.

ICP REGULATION



IC pressure-volume

Blood and CSF can temporarily reduce volume to keep pressure stable. If compensatory mechanisms fail, small increases in volume cause an exponential increase in ICP, which can affect **CPP** → **CPP = MAP – ICP**

The brain needs O_2 and glucose, so needs strict control of ICP.

During anesthesia, decompensated increases in ICP must be avoided to protect cerebral autoregulation and maintain adequate CPP.

CAUSES

- Space-occupying lesions
- Cerebral edema
- Poor venodilation/drainage
- Alterations of CBF

CLINICAL SIGNS

- Changes in mental state, seizures, headache
- Nausea, vomiting, blurred vision, drowsiness and papilledema
- Cranial nerve deficits

Alterations can be detected in computed tomography (CT), but it is a more complex tool. In veterinary medicine, we do not have a methodology for direct measurement of ICP.

ANESTHETIC MANAGEMENT & MONITORING

- ✗ **Jugular vein occlusion**
- ✗ **Inadequate head positions**
- ✗ **Hypotonic fluids**
- ✓ **Mannitol**
- ✓ **Hyperosmolar solutions**

Importance of ICP monitoring, that affects CPP, which determines the supply of oxygen and nutrients to the brain.

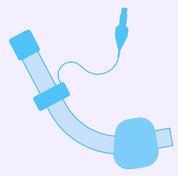
Alterations in ICP can cause serious complications such as cerebral ischemia or herniation.

Control of $PaCO_2$ levels (35 - 40 mmHg) is crucial to avoid hypercapnia, which causes cerebral vasodilation and increased VSC and ICP.

Hypocapnia
Cerebral VC = ↓ CBV

Indicated in cases of **herniation** or cerebral inflammation.

Temporary effect: May reduce perfusion in vulnerable areas
Rebound effect in ICP if CO_2 levels are restored abruptly.



- ✗ **Cough reflex**
- ✓ **Lidocaine**
- ✓ **Fentanyl**

ANESTHETIC DRUGS

PREMEDICATION

SEDATIVE AGENTS		OPIOIDS	
ACEPRIMAZINE	↓	MORPHINE	↑
BENZODIAZEPINES	↓	METHADONE	↑
α2-AGONISTS	↓	FENTANYL	↑↓
		BUPRENORPHINE	=
		BUTORPHANOL	=

INDUCTION

GENERAL INJECTABLE ANESTHETICS

THIOPENTAL ↓	PROPOFOL ↓	ETOMIDATE ↓
ALFAXALONE ↓	KETAMINE ↑	

MAINTENANCE

INHALATION ANESTHESIA	TIVA
ISOFLURANE ↑	PROPOFOL + OPIOIDS ↓
SEVOFLURANE ↑	Minimizes the vasodilator effects of inhaled anesthetics and provides adequate hemodynamic stability

OTHERS

NEUROMUSCULAR BLOQUING AGENTS	NSAIDs
DEPOLARIZING DRUGS ↑ Succinylcholine	CARPROFEN ↓
NON-DEPOLARIZING DRUGS ↓ Rocuronium, atracurium and cisatracurium	MELOXICAM ↓
	ROBENACOXIB ↓
	METAMIZOLE ↓

EFFECT ON INTRACRANIAL PRESSURE (ICP)

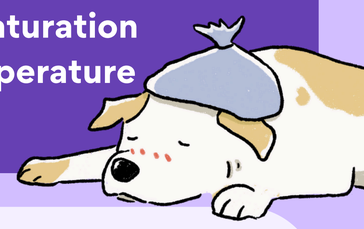
RECOVERY

Smooth recovery → to prevent ↑ ICP
Excitement or pain → ↑ sympathetic activity → ↑ ICP

- ✓ **Adequate analgesics**
- ✓ **Minimize exposure to external stimuli**
- ✓ **Maintaining a quiet environment, with little light**
- ✓ **Consider opioid, benzodiazepine or others**

⚠ **Multidisciplinary management with constant care** ⚠

- ✓ **Blood pressure**
- ✓ **Oxygen saturation**
- ✓ **$PaCO_2$**
- ✓ **Body temperature**



CONCLUSION

Anesthetic management in patients with elevated ICP requires continuous monitoring and a multimodal approach to preserve cerebral perfusion and avoid complications. Precise adjustment of mechanical ventilation, adapted fluidotherapy, oxygen supplementation and control of $PaCO_2$ are essential to maintain a stable ICP.

Protocols based on TIVA with drugs (propofol + opioids) → better hemodynamic control, minimizing adverse effects on ICP.