Into the cerebral venous system: monitoring an open approach to the cavernous sinus

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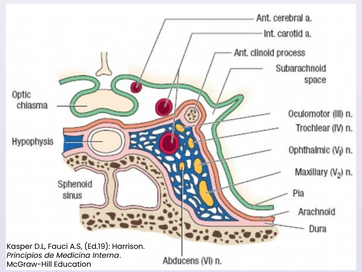
BACKGROUND

Epidermoid cysts of the cavernous sinus are rare benign tumours. Their closeness to neurovascular structures carries a certain morbidity when it comes to plan their radical removal, which may be reduced by the development of minimally invasive approaches, such as modern endoscopic techniques. Still, for cases where wider exposure of the workspace is required, the use of intraoperative neurophysiologic monitoring (IONM) gains value.



Kasper D.L, Fauci A.S, (Ed.19): Harrison. *Principios de Medicina Interna*. McGraw-Hill Education

The cavernous sinus lies between the inner and outer layers of duramater.

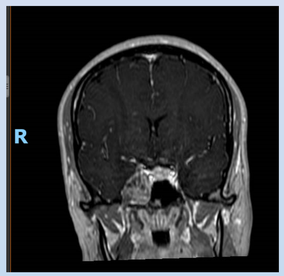
Gallardo FC. Intra-and extradural anterior clinoidectomy: anatomy, review and surgical technique step by step. *Surg Radiol Anat*. 2021 Aug;43(8):1291–1303

The carotid siphon of the internal carotid artery and cranial nerves III, IV, V and VI pass through this space.

CASE

♀ 19 years old

Acute photopsia and headache



The lesion:

- 21 x 22 x 24 mm
- Clear boundaries
- T2 hyperintense
- Gadolinium: heterogeneous enhancement of the cyst wall.

METHODS

Due to expected lesion growth and symptoms, surgery was recommended. Neurosurgeons planned a **Dolenc approach** for intradural resection. Since it´s a rare surgical procedure, there is limited literature on IONM protocols and monitoring techniques for this approach.

Guided by an anatomical guide we identified potential critical points for several neurovascular structures at different stages in their approach:

- Cranial nerves II, III, IV, V, VI
- Internal carotid artery

Steps for exploration of the cavernous sinus

Extradural Stage		Intradural Stage	
1a:	orbital roof; 1b: optic canal	1:	dural opening
2:	anterior clinoid process	2:	carotid rings
3:	superior orbital fissure	3:	oculomotor nerve
4:	foramen rotundum	4:	trochlear nerve
5:	foramen ovale	5:	trigeminal nerve
6:	Glasscock's triangle	6:	abducens nerve

Van Loveren HR, et al. (1991) The Dolenc technique for cavernous sinus exploration (cadaveric prosection). Technical note. *J Neurosurg*. 1991 May;74(5):837–44.

Monitoring was conducted with a 16 channel amplifier Xltek Protektor (Natus Medical Incorporated). These are the techniques we performed during this surgery:

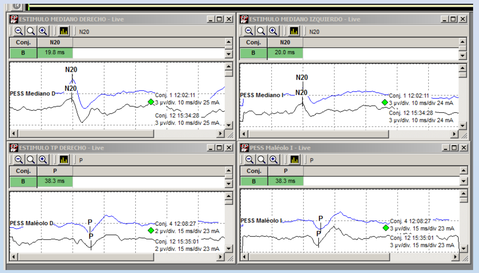
TRANSCRANIAL MOTOR EVOKED POTENTIALS
Stimulus: C3-C4
Recording: first dorsal interosseous, anterior tibial, abductor hallucis (right and left)

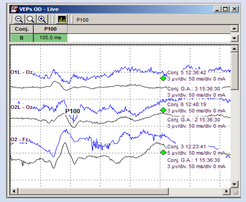
SOMATOSENSORY EVOKED POTENTIALS
Stimulus: Median and posterior tibial nerves, right and left
Recording: C3'/C4'-Fz

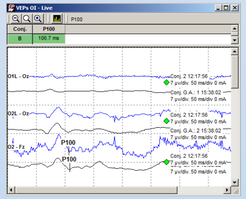
FREE-RUNNING ELECTROMYOGRAPHY
Recording: Cranial nerve muscles

CORTICOBULBAR MOTOR EVOKED POTENTIALS
Stimulus: C3Lateral-Cz
Recording: Cranial nerve muscles

VISUAL EVOKED POTENTIALS
Stimulus: LED googles
Recording: Oz, O1, O1Lateral, O2, O2Lateral*

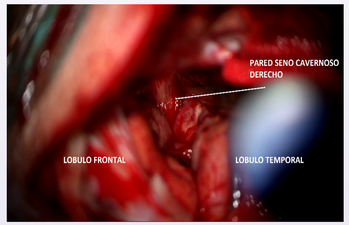




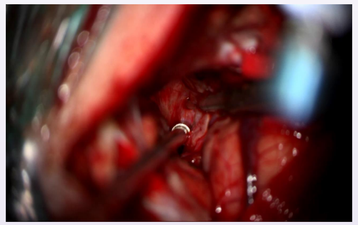


Baselines and recording waves after resection.

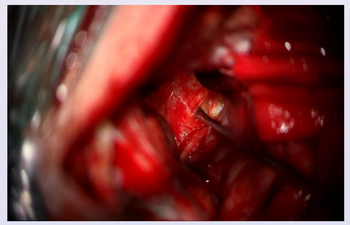
RESULTS



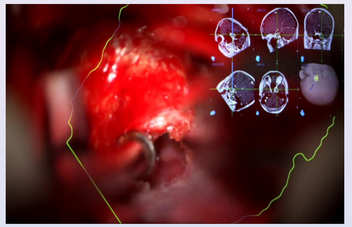
Reaching the sinus: fontal and temporal lobes.



Bipolar stimulator over cavernous sinus dural wall to identify cranial nerves, in order to find a safe access.



Surgeons opened the dura mater after neurophysiological confirmation.



Opening made in the wall of the sinus. Green line outlines the tumor, as projected by the navigator.

An optimal resection was achieved, without any critical alarm along the surgery. Neurological manifestations improved, and no new focal deficits were found.

CONCLUSIONS

We state the use of IONM as a valuable tool, in order to preserve the neurological structures at the same time a radical removal is safely achieved, when Dolenc technique is used for cavernous sinus lesions.

ACKNOWLEDGEMENTS