“What cranial nerves can we monitor?”

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What cranial nerve (CN) monitoring could be expected for acoustic neuroma (vestibular schwannoma) resection surgery?

A) This is a case where neuromonitoring is usually determined by surgeon and/or institutional preference. I’ll tailor my anesthetic for whatever the surgeon selects.

B) **CN V**

C) **CN VII**

D) **CN VII ± CN V ± CN VIII ± CN IX-XII**

E) **CN VIII**
Acoustic neuroma (vestibular schwannoma) surgery is one of the few instances in which there is an established standard of care for intraoperative neuromonitoring.
The trigeminal nerve (CN V) is less likely to be injured than the facial nerve (CN VII) in acoustic neuroma (vestibular schwannoma) surgery.

Trigeminal nerve injury with this surgery is usually a sensory injury and can result in facial pain and hypesthesia.
Monitoring of the facial nerve (CN VII) in acoustic neuroma (vestibular schwannoma) surgery is one of the few times where there is a true standard of care for neuromonitoring.

J Clin Neurophysiol 2002; 19:444
Choice E

Try Again

CN VIII is obviously at risk during acoustic neuroma (vestibular schwannoma) surgery, but this surgery is one of the few instances in which there is an established standard of care for intraoperative neuromonitoring, and this includes monitoring cranial nerve VII.
Choice D

Correct!

CN VII, CN V, CN VIII, and the lower CNs (CN IX – XII) are all at risk of surgical injury during acoustic neuroma (vestibular schwannoma) surgery.
Monitoring of the facial nerve (CN VII) helps keep the nerve intact during acoustic neuroma (vestibular schwannoma) surgery and has been shown to improve postop outcome. A National Institutes of Health consensus panel in 1991 concluded that, “...benefits of routine intraoperative monitoring of the facial nerve have been clearly established. This technique should be included in surgical therapy for vestibular schwannoma.” Thus, monitoring CN VII for this surgery is one of the few times where there is a true standard of care for neuromonitoring.

Holland NR. J Clin Neurophysiol. 2002; 19:444
Orbicularis oculi and orbicularis oris are the muscles commonly used for facial nerve monitoring with acoustic neuroma (vestibular schwannoma) resection. (Skull Base Surgery 1991;1(2):85-92.)

A meta-analysis of vestibular schwannoma resection literature (consisting of 11,873 pts) found EMG monitoring was 1 of 3 factors that led to improved facial nerve preservation. (Br J Neurosurg 2010;24:666-71.)
In acoustic neuroma (vestibular schwannoma) surgery, the trigeminal nerve (CN V) is often also monitored. Injury to CN V during this surgery is usually a sensory injury and can result in facial pain and hypesthesia.

CN V monitoring can **directly** monitor for these injuries.

A) True
B) False
Choice A

Only the motor component of a cranial nerve can be monitored with cranial nerve monitoring, which is a form of electromyography (EMG).
Choice B

Correct!

The sensory division of the trigeminal nerve is monitored indirectly (via close proximity) through cranial nerve V monitoring of its motor division. The masseter and temporaliś muscles are the most accessible for trigeminal nerve monitoring.

What cranial nerves cannot be monitored with CN monitoring?

A) CN III, IV, and VI
B) CN XI
C) CN I, II, and VIII
D) CN I, II, III, IV, VI, and VIII
Intraoperative neuromonitoring of oculomotor nerves is not commonly performed, but there are reports in the literature of oculomotor CN monitoring in skull base surgery, and in brainstem, anterior fossa, cavernous sinus, and orbital procedures. However, there is little information regarding complications with the more invasive monitoring techniques usually required to monitor CN III, IV, and VI.
The spinal accessory nerve (CN XI) has a very reliable response. Thus, CN XI is often monitored even when it does not have high vulnerability to injury since activation of CN XI may indicate adjacent CNs at risk.

Neurosurg Rev 2008;31:45-53.
-CN I, CN II, and CN VIII can not be monitored by EMG techniques (since they do not have a motor component).
-Intraoperative neuromonitoring of oculomotor nerves is not commonly performed, but there are reports in the literature of oculomotor CN monitoring for multiple surgeries.
-The spinal accessory nerve (CN XI) is easily monitored with a very reliable response.
Choice C

Correct!

CN I, CN II, and CN VIII can not be monitored by EMG techniques (since they do not have a motor component).

CN II and CN VIII can be monitored using evoked potentials (visual evoked potentials and brainstem auditory evoked potentials, respectively).
Cranial Nerve Monitoring

CN monitoring can elicit information regarding risk of injury to a nerve being manipulated and/or help identify the course of a nerve, especially in patients with distorted anatomy (such as by tumor).

Intraoperative CN monitoring is a form of electromyography (EMG).
Cranial Nerve Monitoring

Monitors spontaneous or evoked compound muscle action potentials (CMAPs) in the muscles innervated by at-risk nerves.

- “Spontaneous EMG” is a continuous free-running EMG that can identify blunt mechanical trauma/thermal irritation to nerves by evoking high-frequency motor unit potential bursts (= neurotonic discharges).
- “Triggered EMG” is a stimulus triggered EMG that can help identify intact nerves by their CMAP response. Triggered EMG employs a handheld electrical stimulating electrode to probe the surgical field and surface, subcutaneous, or intramuscular electrodes to record EMG activity from muscle groups innervated by the at-risk CNs.


Cranial Nerve Monitoring

Monitoring of spontaneous EMG activity is based on the principle that mechanical, thermal, or metabolic irritation of a nerve leads to activity in the innervated musculature.

- A quiet EMG indicates an intact and functioning nerve OR a severed/disrupted nerve.
- Burst EMG activity usually results from direct nerve manipulation. This activity is unlikely significant in terms of permanent postoperative dysfunction.
- Train EMG activity with an abrupt onset and repetitive, monomorphic pattern suggests increasing irritation of nerve fibers and possible permanent nerve injury. With this type of EMG activity, the precipitating surgical maneuver should be ceased.