

IONM for Your Child During a Surgery

What is IONM?

IONM stands for **intraoperative neurophysiological monitoring**. It's a general term used to describe testing and monitoring of the nervous system — the brain, spinal cord, and nerves — during a surgery.

IONM helps the medical team understand how the nervous system is working during surgery. This knowledge can increase the safety of the surgery, lowering the chance of complications like loss of movement, feeling, or hearing.

It's your choice whether to allow IONM to be used during your child's surgery. To help you decide, the surgeon will talk about the potential benefits, risks, and alternatives to IONM and the specific surgery planned for your child. The second page of this handout lists some of the points that may be covered in your discussion.

Who's involved in IONM?

IONM is done by a specially trained technician or doctor (the IONM provider). This provider stays with the patient throughout the surgery. The provider's job is to set up the equipment, connect it to the patient, and to monitor the IONM readings throughout the surgery. (The readings, sometimes called waveforms, are displayed on a computer screen.) During surgery, the provider communicates with the surgeon about any changes in nervous system function.

Another doctor — a specialist such as a physiatrist or neurologist — provides extra oversight during IONM. This doctor will also watch the waveform data from IONM, either from within the operating room or from another location.

Why does my child need IONM?

Your child's doctor may recommend IONM to lower the chance that the surgery could harm part of your child's nervous system. For example, IONM is commonly used in surgeries to remove tumors in or near the nervous system, surgeries involving the bones of the spine, and surgeries to release part of the spinal cord from the tissue around it (tethered cord).



In these types of surgeries, IONM can give valuable information to the medical team. For example, IONM may help the surgeon tell the difference between a nerve and the tumor, or to locate specific nerves. It can show whether the blood supply to the spine is adequate, and if hardware placement is affecting the nervous system.

What are some IONM tests? How are they done?

Several tests can be used in a single surgery. The type of tests used depends on the patient and the surgery. The surgeon will discuss which tests may be used during your child's surgery. Common tests include:

- **SSEP (somatosensory evoked potential):** SSEPs give information about the sensory nerves (the nerves dealing with feeling or touch). Sticky electrode pads connected to wires are placed over specific nerves at the wrist or ankle. Small bursts of electricity activate the nerves and cause a signal to go through the spine to the brain. Small recording electrodes placed in the skin of the scalp then pick up this brain activity. This signal is displayed on the computer screen.
- **MEP (motor evoked potential):** MEPs give information about the part of the nervous system that controls movement. Electrodes are placed in the skin of the scalp, over the part of the brain that controls movement. When this area is stimulated, it causes nerve activity to run from the brain through the spine out to the nerves that makes your muscles contract. Electrodes placed in or near your muscles record the nerve activity. The activity is displayed on the computer screen.

- **ABR (auditory brainstem response):** An ABR allows the team to test the hearing of a patient who's asleep. Specifically, it measures the hearing nerve's response to sound. For the test, a small in-the-ear earphone makes a sound that the ear then turns into an electrical response. This response travels from the ear through the brainstem up into the brain. Nerve activity is recorded from the electrodes placed in the scalp.
- **Free Running EMG (electromyography):** EMGs represent muscle activity that could be caused by damage or irritation to the nervous system. It's recorded by electrodes placed in or close to a muscle. EMGs help the surgical team know when they are getting close to a nerve.
- **Triggered EMG:** The surgeon uses a hand-held stimulator to create an electrical impulse in a nerve. The impulse from the nerve causes the muscle to contract. Electrodes placed on the muscles record the nerve activity. This type of EMG helps surgeons find specific nerves and make sure there are no nerves around where they are cutting.
- **BCR (bulbocavernosus reflex):** This test monitors the function of the sacral portion of the spinal cord. (This is the part of the spine connected to the pelvis.) BCR is important for monitoring the nerves that control bowel, bladder, and sexual function. For BCR, stimulating electrodes are placed over the skin of the penis or clitoris (a group of nerves in females located above where urine comes out). Recording electrodes are placed in the muscle around the anus.

Instructions and additional information

How do I prepare for IONM?

- Before your surgery, take a bath or shower and gently scrub your skin (especially wrists and just behind your inside ankles). Don't use lotion or make-up afterward.
- Braid long hair or put it in ponytails.

What happens before the surgery?

- The IONM provider or supervising IONM doctor will examine you and ask questions about your symptoms and medical history. This is a good time to ask any questions about the IONM monitoring.

What happens during the surgery?

- After you're asleep, the IONM provider will place the electrodes. (You won't feel the electrodes.)
- After all of the equipment is in place and you're positioned for the surgery, the IONM provider will get reference values called "baselines." Later, after the surgeon has opened the area to be operated, another set of baseline values will be taken. This second set will serve as a reference point for the rest of the surgery.
- If at any time changes to the nervous system are detected, the surgeon is immediately notified.

What happens after the surgery?

- All the electrodes will be removed before you wake up.
- You may notice a small amount of bleeding at the electrode sites. This is normal.

Potential benefits	Risks and potential complications	Alternatives
<ul style="list-style-type: none"> • Decreases the risk of losing movement (paralysis) • Decreases the risk of numbness • Decreases the risk of losing hearing • May decrease swallowing or speaking difficulties • Decreases the risk of losing bowel or bladder control • Decreases the risk of nerve damage from poorly positioned arms or legs • Decreases the chance of having to wake the patient up during the surgery to make sure the nerves are functioning (called a wake up test) • Improves ability to safely remove more of the tumor without damaging the nervous system • Improves the ability to free up tethered nerves/spinal cord without damaging nerves 	<p>The risk of complications caused by IONM is small. Risks may include:</p> <ul style="list-style-type: none"> • Lip or tongue injury (happens 2 in 1000 cases) • Burns at the electrode site, usually caused by the high energy of the device that the surgeon uses to cut the skin and stop the bleeding (1 in 1000 cases) • Infection at the IONM electrodes site • Bruising, bleeding, or damaging the underlying tissue when placing or removing electrodes • Pain at the electrode sites • Extremely rare complications: heart arrhythmias, jaw fracture, inducing a seizure, damage to an indwelling medical device such as a cardiac pacemaker or nerve stimulator, injury resulting from muscle movement caused by nerve stimulation 	<ul style="list-style-type: none"> • Waking the patient up during the surgery to see if their nerves are working • Performing the surgery without IONM and assuming the higher risk of complications