

## Intraoperative Neurophysiological Monitoring

Intraoperative neurophysiological monitoring (IONM) encompasses a variety of procedures that are used to assess and monitor the central and peripheral nervous systems during surgery. These modalities have evolved over the years and are now commonly used in many types of surgery, including spinal, brain, cardiac, and vascular surgeries.<sup>1</sup> IONM has been heralded for its ability to prevent permanent neurological injuries through early detection and subsequent corrective action by the medical team.

Like any type of technology, though, IONM can present risks if it is not used appropriately, medical personnel are not properly educated and trained, policies and standards are not followed, communication breakdowns occur, equipment is not tested and maintained, safeguards are not in place, and so on. Unfortunately, IONM errors can have devastating consequences from both an injury and a liability perspective.

This checklist provides broad considerations for managing risks associated with IONM.<sup>2</sup> Healthcare organizations can use this tool to assess their current policies and approaches to IONM and identify gaps or opportunities for improvement.

	Yes	No
<i>Organizational Considerations</i>		
Does your healthcare organization have policies that define specific requirements for procedures involving IONM, such as:		
• Roles and responsibilities?	<input type="checkbox"/>	<input type="checkbox"/>
• Documentation standards?	<input type="checkbox"/>	<input type="checkbox"/>
• Handoff processes?	<input type="checkbox"/>	<input type="checkbox"/>
• Determination of the level of monitoring required?	<input type="checkbox"/>	<input type="checkbox"/>
• Onsite location of the physician interpreting the IONM results in real time?	<input type="checkbox"/>	<input type="checkbox"/>

	Yes	No
<b>Organizational Considerations (continued)</b>		
Are surgeries involving IONM performed by multidisciplinary teams that include surgeons, anesthesiologists, nurses, and qualified neuromonitoring personnel (i.e., neurophysiologists and specially trained medical technicians)?	<input type="checkbox"/>	<input type="checkbox"/>
Are all members of the multidisciplinary team aware of their roles and responsibilities as well as those of all other team members?	<input type="checkbox"/>	<input type="checkbox"/>
Has your organization verified that: <ul style="list-style-type: none"> <li>• Neurophysiologists who are involved in IONM have received extensive training on the methods of electrophysiological testing?</li> <li>• Medical technicians who are part of IONM teams have sufficient education and training in relation to IONM, and that their competencies have been observed and documented prior to working independently?</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
Are policies in place to define and ensure the appropriate level of supervision for medical technicians performing IONM? Do these policies adhere to state and federal requirements?	<input type="checkbox"/>	<input type="checkbox"/>
Do neurophysiologists take accountability for the overall management of IONM, determining the appropriate level of monitoring, interpreting IONM results, and training and overseeing medical technicians?	<input type="checkbox"/>	<input type="checkbox"/>
Is a strong culture of safety in place that supports speaking-up behavior and nonpunitive responses to any member of the team voicing safety concerns?	<input type="checkbox"/>	<input type="checkbox"/>
Does your organization monitor for adherence to all IONM policies and provide timely feedback to providers as needed?	<input type="checkbox"/>	<input type="checkbox"/>
<b>Preoperative Considerations</b>		
Does each surgery include a comprehensive informed consent process that includes a discussion about IONM and its potential risks?	<input type="checkbox"/>	<input type="checkbox"/>
Does the IONM team use a technique such as <b>teach-back</b> to ensure patients understand informed consent discussions and their proposed treatment plans?	<input type="checkbox"/>	<input type="checkbox"/>

	Yes	No
<b><i>Preoperative Considerations (continued)</i></b>		
Are informed consent discussions — including risks, benefits, alternatives, and risks of alternatives — documented in patients’ health records (including copies of any signed consent forms)?	<input type="checkbox"/>	<input type="checkbox"/>
Are patients provided with both verbal and written plain-language information about their procedures in their preferred language?	<input type="checkbox"/>	<input type="checkbox"/>
Is a thorough preoperative assessment conducted that includes patient history, physical examination, and review of health records, imaging, test results, etc.?	<input type="checkbox"/>	<input type="checkbox"/>
Are patients screened for relative contraindications (e.g., epilepsy, vascular clips, cardiac disease, implanted cardiac pacemakers, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>
Does the neuromonitoring team work collaboratively with: <ul style="list-style-type: none"> <li>• The surgeon/surgical team to determine the appropriate IONM methods for each surgical procedure based on the patient’s condition?</li> <li>• The nursing staff to determine room setup and equipment placement?</li> <li>• The anesthesiologist/anesthesia team to develop an acceptable anesthesia plan based on the type of procedure and IONM method, and to optimize anesthesia maintenance during the procedure?</li> </ul>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Does the neuromonitoring team communicate with the surgical and anesthesia teams about alert criteria and testing strategies to coordinate monitoring throughout the procedure?	<input type="checkbox"/>	<input type="checkbox"/>
Are necessary equipment and supplies inventoried and verified prior to the start of each procedure?	<input type="checkbox"/>	<input type="checkbox"/>
Is IONM equipment checked for proper functioning prior to the start of each procedure to avoid skin burns, equipment disruptions, and other complications?	<input type="checkbox"/>	<input type="checkbox"/>
Is a backup plan in place to manage any equipment disruptions or failures that could occur during the procedure, particularly if the neurophysiologist is remote?	<input type="checkbox"/>	<input type="checkbox"/>

	Yes	No
<b><i>Intraoperative Considerations</i></b>		
Is electrical safety maintained in the operating room, and are team members prepared for how to respond to electrical safety issues?	<input type="checkbox"/>	<input type="checkbox"/>
Are safety precautions, such as bite blocks, used to prevent known risks of certain IONM methods?	<input type="checkbox"/>	<input type="checkbox"/>
Does the multidisciplinary team cooperate throughout the procedure to optimize IONM and to effectively communicate changes to the patient’s nervous system?	<input type="checkbox"/>	<input type="checkbox"/>
Does the multidisciplinary team have well-defined protocols and cognitive aids (e.g., checklists) to follow in response to signal changes that may result in notifications or alerts?	<input type="checkbox"/>	<input type="checkbox"/>
Is pertinent information about IONM documented for each procedure, including surgical event times, communication between teams, alerts issued during the procedure, and anesthesia drugs/dosages used?	<input type="checkbox"/>	<input type="checkbox"/>
<b><i>Training Considerations</i></b>		
Does the multidisciplinary team participate in:		
<ul style="list-style-type: none"> <li>• Training to enhance team-based care and address communication barriers (e.g., <b>TeamSTEPPS®</b> training)?</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>• Simulation exercises to practice stepwise approaches to various IONM scenarios and critical events?</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>• Training to stay current on evolving IONM technologies?</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>

## Endnotes

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<sup>1</sup> American Society of Neurophysiological Monitoring. (n.d.). History of the American Society of Neurophysiological Monitoring. Retrieved from [www.asnm.org/history](http://www.asnm.org/history); Tewari, A., Francis, L., Samy, R. N., Kurth, D. C., Castle, J., Frye, T., & Mahmoud, M. (2018). Intraoperative neurophysiological monitoring team's communiqué with anesthesia professionals. *Journal of Anaesthesiology, Clinical Pharmacology*, 34(1), 84–93. [https://doi.org/10.4103/joacp.JOACP\\_315\\_17](https://doi.org/10.4103/joacp.JOACP_315_17)

<sup>2</sup> This checklist is based on information from the following sources: Ghatol, D., & Widrich, J. (2022, May 8). Intraoperative neurophysiological monitoring. *StatPearls* [Internet]. Retrieved from [www.ncbi.nlm.nih.gov/books/NBK563203/](http://www.ncbi.nlm.nih.gov/books/NBK563203/); Korean Society of Intraoperative Neurophysiological Monitoring, Korean Neurological Association, Korean Academy of Rehabilitation Medicine, Korean Society of Clinical Neurophysiology, Korean Association of EMG Electrodiagnostic Medicine. (2021). Clinical practice guidelines for intraoperative neurophysiological monitoring: 2020 update. *Annals of Clinical Neurophysiology*, 23(1), 35-45. doi: <https://doi.org/10.14253/acn.2021.23.1.35>; Tewari, et al., Intraoperative neurophysiological monitoring team's communiqué with anesthesia professionals; Vitale, M. G., Skaggs, D. L., Pace, G. I., Wright, M. L., Matsumoto, H., Anderson, R. C., . . . Lenke, L. G. (2014). Best practices in intraoperative neuromonitoring in spine deformity surgery: Development of an intraoperative checklist to optimize response. *Spine Deformity*, 2(5), 333–339. doi: <https://doi.org/10.1016/j.jspd.2014.05.003>

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