



Scoliosis and Intraoperative Neurophysiological Monitoring: Benefits of Using Multimodality IONM During Complex Spine Surgeries - Part 1.

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INTRODUCTION

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Scoliosis is a deformation of the spine. Although the human spine typically has a slight curvature, when this curvature exceeds 10 degrees out of its required measurements, a scoliosis diagnosis starts to become a plausible explanation for it. There are three leading causes of scoliosis: idiopathic, neuromuscular, and congenital. The first is idiopathic scoliosis, and there is no clear explanation for why the disease is happening and progressing. It is the most prevalent cause of scoliosis, representing 80 percent of registered cases. The second type is neuromuscular, a type of spinal deformation usually accompanied by other diseases directly affecting the musculature, such as muscular atrophy. The third and last type is congenital scoliosis, caused by embryological defects. This latter variation of scoliosis is encountered at birth; thus, it is diagnosed and detectable in children's early stages of development. Idiopathic and neuromuscular scoliosis develops and is diagnosed at later stages, specifically during adolescence and adulthood.

Some of the symptoms that start to emerge and that represent early signs of spine deformation may include a pronounced unevenness of the shoulders, hips, and waist, the patient's body leaning more towards one side compared to the other, and the head being off the body's centered position, rib cages, and shoulder blades present abnormal positions, different types of skin abnormalities over the spine area (irregularities in the texture and color of the skin, etc.), an evident asymmetry in how the arms hang while the patient is standing, etc. In addition to these symptoms, scoliosis is diagnosed through testing imaging such as magnetic resonance (MRI), computed tomography scan (CT scan), and X-rays.

DISCUSSION

Scoliosis' degenerative range varies from patient to patient; thus, it is crucial to detect it and visit a medical professional as soon as the earliest symptoms appear. There are three main types of treatments for scoliosis – observation, bracing, and surgery. Observation is chosen as a treatment for mild variations of scoliosis in which bracing and surgery are not or still not necessary at that specific time. Bracing is another non-invasive treatment for patients whose skeletal maturity has not yet been completely reached (children). The abnormal curvature of the spine has not surpassed 40 degrees or is still within the accepted range of spinal curvature. Surgery is chosen as a scoliosis treatment, often considered the last treatment resource, when the spine deformation continuously progresses and the spinal curvature has exceeded normal degree ranges.

Surgical treatments for scoliosis are considered extremely risky since the spinal area involves crucial and delicate neural tissue, such as the spinal cord and nerves, representing almost the entirety of the peripheral nervous system. There are two surgical approaches to treating scoliosis: the anterior and posterior. Although both methods are commonly used and offer several benefits to the patient, they also represent a tremendous risk. Intraoperative neurophysiological monitoring plays a crucial role in this type of surgery since the spinal cord's motor and sensory aspects are at risk. Thus, it usually involves several IONM modalities that monitor different features of the region in question. For instance, some of the IONM modalities that are used during scoliosis are SSEP (Somatosensory Evoked Potentials), which is used to monitor ascending sensory pathways; s-EMG and t-EMG (Spontaneous and Triggered electromyography, respectively), which monitor the bioelectricity emitted by the musculature of the patient, TCeMEP (Transcranial electrical Motor Evoked Potentials) which is used to the motor or the descending neural pathways of the patient and TOF (Train of four) which is usually used alongside EMGs and TCeMEPs and plays an important role in monitoring peripheral neural activity.

Although spine surgeries have always been regarded as complex and represent a challenge not only to the surgical team but also to the patient's life, the use of a multimodality IONM program during scoliosis surgeries reduces the probabilities of post-operative deficits by guiding and correcting the surgeon as the surgery progresses thus offering a better and safer way of treating not only scoliosis but also other complex and life-threatening spine deformations.

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