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Precision Nerve Monitoring in Otologic and Thyroid Surgery: Segmental Electrophysiology and Adaptive Technologies

Intraoperative nerve monitoring has evolved into a segment-specific, anatomy-driven strategy grounded in quantitative electrophysiology. In otologic surgery, facial nerve stimulation thresholds vary predictably along the intracranial, labyrinthine, geniculate, horizontal, vertical, and extratemporal segments due to differences in epineurial thickness, bone coverage, and tissue insulation. Intratemporal epineurium progressively thickens from approximately 0.05 mm in the horizontal segment to 0.13 mm in the vertical segment, directly influencing triggered EMG thresholds and surgical vulnerability. Clinical application in acoustic neuroma surgery demonstrates how calibrated stimulation supports tumor removal with preservation of facial function.

In thyroid surgery, advances in recurrent laryngeal nerve monitoring include direct needle electrode placement through the thyroid cartilage, providing stable and high-fidelity EMG acquisition while minimizing variability associated with endotracheal tube positioning. This approach enhances real-time functional assessment and reduces false-negative signals. Emerging innovations include AI-assisted, self-adjusting stimulation platforms that dynamically calibrate amplitude based on real-time EMG feedback and tissue impedance. Amplitude adjustment curves and automated sweep functions improve threshold stability and mapping precision while reducing unnecessary current exposure.

Together, segment-specific monitoring, transcartilaginous laryngeal recording, and adaptive stimulation technologies represent the next evolution in nerve protection in contemporary otolaryngologic surgery.

Biography

Dr. Andrew J. Fishman, MD is a board-certified otologist, neurotologist, and cranial base surgeon from the United States. He specializes in advanced ear surgery, skull base surgery, cochlear implantation, and complex head and neck conditions. He has served as Director of Neurotology and Cranial Base Surgery and Director of Cochlear Implant Programs, contributing significantly to clinical care, surgical innovation, and medical education.