

Intraoperative Neurophysiological Monitoring: An Interview with Paul R. Kileny, PhD

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Paul R. Kileny, PhD

Paul R. Kileny, PhD, is a Professor of Otolaryngology and Director of Audiology and Electrophysiology at the University of Michigan. Dr Kileny is well known for his comprehensive audiological knowledge, particularly in the area of intraoperative neurophysiological monitoring (IONM). Recently, Plural Publishing released his new book, *The Audiologist's Handbook of Intraoperative Neurophysiological Monitoring* (Plural Publishing, 2019),¹ so we thought this would make for an excellent opportunity to catch up with Dr Kileny.

Beck: Good morning, Paul. Nice to chat with a fellow guitarist/audiologist!

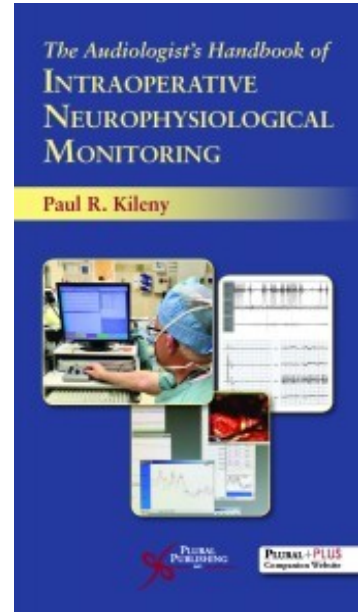
Kileny: Hi Doug. Thanks for remembering that. We've had the same core interests for decades, and a third touch-point would be intraoperative neurophysiological monitoring.

Beck: Absolutely. Paul, if you don't mind, I'll brag a little about you, and then we'll talk about your new book. Dr Kileny received his Doctorate in Audiology with an emphasis in neurophysiology from the University of Iowa in 1978, and his involvement with intraoperative monitoring began in the early 1980s. He joined the faculty of the University of Michigan Medical School in 1985, as an Assistant Professor and Director of Audiology and was promoted to the rank of Professor with Tenure in 1992. He co-founded the Cochlear Implant Program and established Newborn Hearing Screening and Neurophysiologic Intraoperative Monitoring Programs. Dr Kileny has received multiple NIH grants and has authored over 200 journal articles and book chapters. He is the recipient of the American Academy of Otolaryngology-Head and Neck Surgery Certificate of Honor (2001), the American Academy of Audiology Career Award in Hearing (2002), the Presidential Citation of the American Otological Society (2006), and the recipient of ASHA Honors of the Association in (2011).

So there you have it, quite accomplished by all measures!

Kileny: Thanks Doug. It's been an exciting and rewarding career.

Beck: And to add to your already impressive curriculum vitae, you've written a new book, titled *The Audiologist's Handbook of Intraoperative Neurophysiological Monitoring* which is available now from Plural Publishing, even if it does have a copyright of 2019.



Kileny: Yes, that's right. It seemed like a good time to review and update our thoughts and the literature, and as you mentioned, the result is the new book.

Beck: As you can imagine, your new book was of immediate interest to me, as I authored and edited the original *Handbook of Intraoperative Monitoring* (1994) more than 20 years ago, and it goes without saying, it is extremely outdated in 2018. Nonetheless, for the audiologist, EP technician, neurologist, or any other professional interested in IONM, I love the way your book is presented. Easy to read, logical sequencing, and well referenced.

Kileny: Thanks. And, as you know, there are accompanying videos on the companion website, which makes all of it come alive. It's a difficult task to learn about anatomy and physiology and how to monitor and interpret information all in real time, while reading a book. The video clips really are instructive, and they will continue to be updated. And, so to access the videos, each copy of the book has a passcode, and one simply registers online through the Plural Publishing website.

Beck: So, if I may, I want to start by saying that when we speak about IONM, although auditory brainstem response (ABR) measures for thresholds are indeed an important and valuable measure, that's a very tiny percentage of what we do in the operating room. IONM includes multiple sensory, motor and mixed nerve monitoring, and it requires a basic understanding of the fundamentals and the interaction between IONM and anesthesia. Further, there are unique goals and protocols associated with specific surgeries like cochlear implant surgery, acoustic neuroma surgeries, parotid surgery, thyroid surgery, IONM during superior semicircular canal dehiscence surgery, as well as protocols and goals for hemifacial spasm, microvascular decompression, and various other skull base and spinal surgeries. Did I miss anything?

Kileny: Well, you listed some of the most-common monitoring protocols and surgeries; however, each has multiple versions. For example, if one were monitoring an acoustic neuroma surgery, there are multiple surgeries which might be applied based on the size and location of the tumor, preoperative hearing status, age of the patient, as well as the surgeon's preference.

That is, the surgeon may elect a retro sigmoid approach, a middle fossa approach, a translabyrinthine approach, or even a sub-occipital approach—each of which has its own associated IONM protocols and issues. One of my standard statements when I give talks about IONM to either physicians or audiologists is that in order for monitoring to be effective, the

monitoring clinician should be very familiar with the surgical procedure and the anatomy. On the other hand, the surgeon should be familiar with monitoring, its advantages, and limitations. Communication between the monitoring and surgical team is the key to success, and knowing what each other does is essential for effective communication.

Beck: Excellent point, and one which underscores the need to have more than a working familiarity with anatomy! That is, as the surgical approach changes, so too, do the risks and complications to the nervous system. Thus, the IONM protocols need to be flexible, as well as appropriate.

Kileny: Exactly, and just like in clinical audiology, it all comes down to how well is the person trained and how well and how quickly can they interpret results. Unlike clinical audiology, IONM literally involves working in a sterile and sometimes very high-pressure, very intense environment—and clearly, that sort of pressure is not for everyone. It requires the background and the ability to make split second determinations: “Is this the [fill in the blank] nerve?” “Can the cochlear nerve withstand more retraction for X more minutes?” You don’t have the time or the luxury to ponder over a waveform, call a friend, read a chapter, and get back to them the next day.

Beck: I certainly don’t want to scare anyone, but people often ask me about this, so I’ll tell one or two of my OR stories, and then I’ll ask you to tell yours!

I would estimate that in the more-than-1000 cases I monitored, more than 98% went extremely well and exactly as planned. But sometimes, on rare occasion, I can absolutely recall times when things went poorly in the operating room and surgeons—and residents, fellows, nurses and others—sometimes reacted emotionally. Yet, as the person doing the IONM, your only job is to maintain focus on the task at hand. That sort of pressure is not for everyone, and it takes a certain personality to be able to work in that intense situation. And, of course, over the years I spent in Los Angeles, I vividly recall we were once in the middle of a craniotomy to remove an acoustic neuroma when an earthquake violently shook the hospital. We were on the 6th floor, so we felt it. The surgeon immediately stood up over the patient and protected the patient from any falling debris. Luckily, nothing fell, but there was no turning back and we had to finish. After the quake ended, things got pretty quiet in that room, but after 10-15 minutes we resumed and everything turned out fine. That was an interesting day. Okay, your story?

Kileny: Well, no earthquakes in my OR experience! I think some of the more embarrassing moments have been when inexperienced neuromonitoring audiologists inadvertently violated the sterile field, by touching or brushing against the inside of a sterile drape. Or when an OR rookie became so enthused by an operation with a great outcome that they went up to the table and attempted to shake the gloved hand of the operating surgeon! Of course, occasionally we had to break the sterile field to adjust a needle electrode or two, or replace a transducer in the ear canal. That is why I have always preached (and practiced) taking time to set up the patient before draping, so that no further adjustments are necessary. The surgeons I have worked with have learned to just step back and give me and my team the necessary time. This is more difficult for those who don’t have a consistent surgical team they work with.

Beck: I believe you got involved with IONM in the 1980s? Is that correct?

Kileny: Yes, that’s correct. I started in the operating room in the early 1980s, and at that time, it was more of a research project, than IONM to protect neural structures. I was trying to figure out whether the Middle Latency Response (MLR) was myogenic or neurogenic. In the late 70s and early 80s, we weren’t certain about this. My data was recorded during open heart surgery, and I noticed I could predict a drop in blood pressure (or perfusion pressure) as the MLR amplitude

dropped, indicating that the [MLR was neurogenic](#).²

So that was very interesting to me. Very quickly I got more interested and more involved in trying to help the surgeons protect neural structures and maintain function throughout multiple surgeries and using various techniques to provide useful and real-time feedback to the surgeons.

Beck: It's funny you mentioned the ability to predict things unrelated to audiology. So again, more than 20 years ago, I used to notice and often reported that based on the electromyographic (EMG) recordings from the naso-labial fold, I was often able to predict (before the anesthesiologist!) that the patient was getting "light." Meaning, they were about to start moving as their neuromuscular blockade was wearing off. And the first few times I made that call, the anesthesiologists would certainly express doubt, but very soon thereafter, they would ask me to tell them if I noticed anything unusual. Of course, the goals of anesthesiology include keeping the patient out of pain, to impose "surgical amnesia" and to prevent movement, as clearly any of those occurrences could be very damaging or debilitating. And without doubt, anesthesiology is more sophisticated now than it was 20 years ago. But still, the role we play in the OR is far greater than most clinicians would suspect.

Kileny: I agree. And one of the very substantial areas within IONM is monitoring motor evoked potentials, as well as somatosensory evoked potentials (SSEP) during back surgery. Doug, I'm sure you've monitored some of these cases in which children with scoliosis were having instrumentation implanted (eg, Harrington Rods) to help straighten their spines, and the role of IONM is to make sure the neurologic integrity is maintained throughout the surgery.

As a matter of fact, my first "real" intraoperative monitoring experience consisted of SSEP monitoring during scoliosis surgery when I practiced in Edmonton, Canada. This was before the advent of motor potentials providing now the ability to monitor both the ventral and dorsal spinal tracts. Basically, we simply send an electrical pulse up the leg or the arm, across the spine, and measure the response at the scalp. It's a very robust evoked potential; if there is an observable and negative change, we report that immediately to the surgeon, and he or she reacts appropriately to make sure no damage is done, and that neural and motor integrity are maintained, all of which was (and is) very rewarding. However, SSEP's are very sensitive to anesthetics, so the monitoring clinician needs to understand the principles of anesthesia and communicate with the anesthesia team regarding preferences (see the chapter in the book I co-wrote with my son, [Joel Kileny, MD](#), who is a cardio-thoracic anesthesiologist).

Beck: I did a few of those, and some laminectomies and such, but I tried to avoid back cases! I'll bet 99% of my IONM cases were head and neck. To be honest, I was never as comfortable with my knowledge of the anatomy and physiology of the spine and dermatomes, so I pretty much focused on surgical cases above the neck.

"Of course, anyone can learn anything, but in the operating room everyone is counting on you being a highly trained expert, and that's as it should be!"

Kileny: And, like clinical audiology and all areas of medicine, it's best to stay within your area of expertise. Of course, anyone can learn anything, but in the operating room everyone is counting on you being a highly trained expert, and that's as it should be! I agree with your analysis of the type of IONM I am involved with; I do an occasional neurosurgical SSEP case, typically combined with multiple cranial nerves, but my IONM practice consisted primarily of craniotomies and other head and neck cases such as parotid and thyroid surgeries.

Beck: I agree. And it changes rapidly. One must stay on top of the literature constantly and read the new books to see what our new understanding is, as well as to learn about new developments in IONM. So I'm glad we got to chat a little about IONM, and I hope our colleagues who are

involved (or would like to be involved) with IONM will read through yourbook and view the videos. There's always more to learn, and even if we just confirm our protocols and suspicions, that's very useful in the OR. Finally, I believe you offer a one year training program for interested professionals.

Kileny: Yes. At the University of Michigan, in the [Division of Audiology](#), we have an intraoperative monitoring team, and we offer one annual post-doctoral fellowship in IONM. We've had two previous fellows, and we are currently training our third. So, for anyone looking for a career in IONM, they can get in touch with us and we'll happy to explore the possibilities with them. They can also contact the national organizations involved in training and credentialing professionals in this area, such as the [American Audiology Board of Intraoperative Monitoring \(AABIOM\)](#).

Beck: Paul, thank you for your time and thanks for reminding all of us that the audiology scope of practice often reaches beyond the sound booth! Your book is easy to follow, thorough, and I highly recommend it—as well as the associated educational videos.

Kileny: Thanks Doug. I appreciate your comments and your time, too, and thanks for sharing your IONM experiences, too!

References

1. Kileny PR. *An Audiologists Handbook of Intraoperative Neurophysiological Monitoring*. San Diego: Plural Publishing;2019.
2. Kileny P, Dobson D, Gelfand ET. [Middle latency auditory evoked responses during open-heart surgery with hypothermia](#). *Electroencephalogr Clin Neurophysiol*. 1983; 55:268-276.