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# Facial Nerve Monitoring Standards

## *Using the Anesthesia Model*

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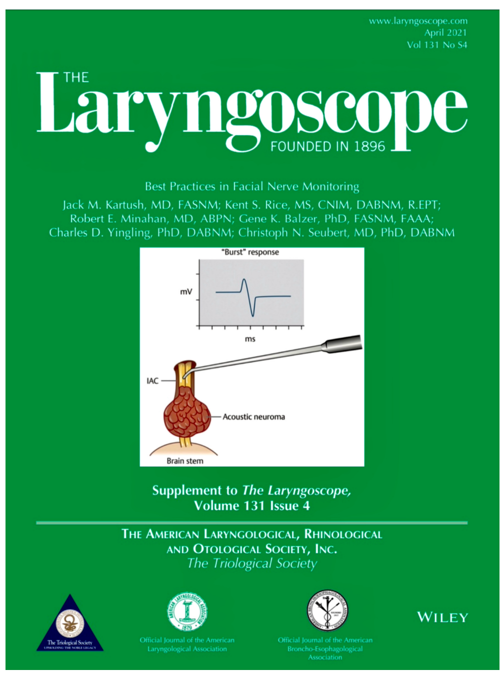
*Appendix S2.*

**Online Supplement 2**




Written standards of medical practice are developed by physicians and medical societies to improve patient care. These may be in the form of clinical practice guidelines, best practices, consensus statements, and/or checklists. In their different forms, they are all based on a combination of scientific evidence and knowledge gained from clinical experience. While initially criticized as an undue limitation of physician autonomy and a potential basis for litigation, guidelines now commonly serve to describe best practices to optimize patient care. The consistent application of best practices such as the World Health Organization's Surgical Safety Checklist[1] has been shown to reduce surgical morbidity and mortality.

To assess the current state of facial nerve monitoring practice, the development of "Standards for Basic Anesthetic Monitoring"[2] in anesthesia serves as an example of a successful medical standard. In 1984, anesthesiologists represented 3% of faculty at Harvard but were responsible for 12% of its medical malpractice payouts. A review of all claims by the Harvard Risk Management Committee revealed that many cases involved failure of adequate spontaneous or controlled ventilation. The committee ultimately developed a set of minimal monitoring standards focused on essential behaviors for anesthesia professionals, specifically, the physical presence of a qualified professional and continual/continuous—rather than episodic—monitoring of anesthesia-relevant parameters such as ventilation and circulation. Of note, specific technologies such as pulse oximetry were intended to be extensions of continual human monitoring, not substitutes. Despite the concerns of some, these monitoring standards were prominently published[3] and ultimately adopted by professional societies worldwide.[4] These standards were adopted even though a subsequent review of anesthesia accidents at Harvard failed to show a statistically significant reduction of catastrophic incidents and even though individual technologies—like pulse oximetry—do not predictably change perioperative outcomes.[5] Despite these studies, in the years after these standards were adopted, anesthesia-related malpractice payouts decreased dramatically, and related insurance premiums for anesthesia faculty decreased by two-thirds.

In 1993, Eichenhorn[6] reviewed the early disagreements generated by the American Society of Anesthesiologists' (ASA) inclusion of pulse oximetry in their Basic Guidelines. Standards can originate from published recommendations or from de facto standards having evolved through time in a clinical area. Standards can "codify, validate and universalize" existing behavior but they can also prompt adoption of new, improved methods. Note that the initial 1986 ASA "recommendations" for using pulse oximetry were later mandated in a 1990 update.

It is instructive to note that despite the debates surrounding pulse oximetry, the field came to a consensus within six years from when the technology came to market. In an interesting analogy, in 1988, when anesthesia providers were beginning to use pulse oximetry prior to publication of ASA guidelines, the American Association of Nurse Anesthetists legal counsel published a society legal brief entitled "Practice Standard in the Making: Pulse Oximeters."[7] He advised that, "Ultimately, it is the profession itself that determines its own standards. No institution, not even Harvard nor the AANA, can set standards for the

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profession." However, he went on to conclude:

> *"Even though the decision is up to the profession and is demonstrated by expert testimony in court, I believe that the use of a pulse oximeter either is or is about to become the standard of care… However, if you are a CRNA administering anesthesia without a pulse oximeter, I would urge you to prepare now to defend your practice."*

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| Filename | Description |
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| **lary29459-sup-0001-Online_Supplement_1.docx Word 2007 document , 32.9 KB** | **Appendix S1. History and Evolution of Facial Nerve Monitoring** |
| **lary29459-sup-0002-Online_Supplement_2.docx Word 2007 document , 17.1 KB** | **Appendix S2. Development of Standards for Monitoring in Anesthesia—a Model for Facial Nerve Monitoring?** |
| **lary29459-sup-0001-Online_Supplement_3.zip Zip archive, 333.8 MB** | **Appendix S3.**<br>**1 - Facial Nerve Monitoring Protocol Checklist 2021 pdf**<br>**2 - IOM electrode montage – color coding pdf**<br>**3 - Video: Placement of blue "eye" recording electrodes just above the brow.**<br>**4 - Video: Placement of red "mouth" recording electrodes along the nasolabial groove.**<br>**5 - Video: Placement of green ground and white anode electrode. The anode represents the return of the stimulus current.**<br>**6 - Video: Final electrode positions secured with clear adhesive tape. These electrical wires will be led off the table to be connected into the headbox. Electrode wires should be kept distant from electrocautery cables in order to reduce artifact as well as the risk of burn injuries.**<br>**7 - Video: Proper color-coded connection of recording electrodes into the headbox. A black-colored sterile cable is used to routinely attach the stimulator to the headbox. The stimulus can be delivered using dedicated monopolar or bipolar probes, or Kartush Stimulating Instruments that allow simultaneous surgical dissection with monopolar stimulation.**<br>**8 - Video: Placement of all electrodes is demonstrated using standardized color-coding to minimize errors.**<br>**9 - Video: Prior to sterile draping of the patient, a "Tap test" is performed to confirm that there are auditory and visual responses elicited by tapping adjacent to the electrodes. Note that this is an artifact, not a true EMG response which can be elicited even when muscle relaxants are present. Therefore, while this test provides critical information, it is not by itself sufficient to demonstrate a fully functioning monitoring set up.**<br>**A - Video: A NIM monitor is used to demonstrate proper pre-check assessments of output volume and electrode impedance.**<br>**B - Video: A novel method to confirm both stimulus and recording functionality is demonstrated by stimulating the facial nerve transcutaneously prior to sterile draping.**<br>**C - Video: A variety of NIM response tones are demonstrated including responses to electric stimulation and trauma: electrically triggered responses, bursts and trains.**<br>**D - Video: Obtaining an early baseline EMG response to electrical stimulation is critical to exclude neuromuscular blockade or temporary paralysis of the facial nerve by local anesthetics.**<br>**E - Video: The response to stimulus evoked facial nerve responses are demonstrated during acoustic tumor resection.**<br>**F - Video: An increased EMG baseline is demonstrated when the depth of anesthesia becomes too light.**<br>**G - Video: EMG train of responses is demonstrated following stretching of the facial nerve. Note that interpretation of EMG trains can only be properly performed when the interpreting professional is aware of the ongoing real-time surgical events.**<br>**H - Video: Proper electrode removal is critical to minimize post-monitoring ecchymoses and trauma to the eye. The eyelids must remain taped shut until the electrodes are off the field.** |