Response to APSF Updated Monitoring Recommendations – EEG to Assess Anesthetic Depth

March 12, 2023

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To the Editor:

The APSF recently published recommendations for preventing awareness during general anesthesia. The recommendations include:

1. Whenever an inhaled agent is administered, its end-expired concentration shall be measured, and a low concentration alarm be activated if available.
2. Whenever a neuromuscular blocking agent is administered during inhalational anesthesia, if 0.7 MAC cannot be maintained, an EEG-based monitor of anesthetic depth should be used and an inadequate anesthetic depth alarm limit set if available.
3. Whenever a neuromuscular blocking agent is administered during total intravenous anesthesia (TIVA), an EEG-based monitor of drug effect is recommended, and alarm limits activated when available.

The article also notes, “In some patients, it is not possible to maintain an inhaled anesthetic concentration consistent with 0.7 MAC due to hemodynamic compromise and in those patients, monitoring for the risk of awareness is especially compelling. In those cases, an EEG-based monitor of anesthetic depth should be used to help ensure adequate depth of anesthesia.”

Awareness during general anesthesia although important is an extremely rare event but devastating when it occurs. On the other hand, myocardial injury after non cardiac surgery (MINS) and acute kidney injury (AKI) owing to hypotension and vasopressor administration, are much more common and are most likely to occur during the induction of anesthesia to incision interval, when there is little or no patient stimulation. Therefore, anesthesia providers need to strike a balance between providing enough anesthesia to ensure absence of awareness and avoid organ injury.

As recommended by the APSF, employing 0.7 MAC will prevent awareness. However, the 0.7 value was determined in the absence of intravenous medications. Utilizing a fixed 0.7 MAC to
prevent awareness, overlooks the effects of routinely administered intravenous medications on the depth of anesthesia and “hemodynamic consequences.” The combination of 0.7 MAC and intravenous medication can produce a depth of anesthesia that can result in hypotension, vasopressor use, and possibly MINS and AKI.

Is it the fixed 0.7 MAC in combination with intravenous medications (benzodiazepines, opioids, etc.) that de facto causes the hemodynamic instability, which in turn necessitates, as recommended by the APSF, decreasing the MAC, and employing an EEG-based monitor to ensure lack of awareness? If so, why not use an EEG-based monitor in all patients and allow MAC to vary according to the patient’s wakeful state, as determined by the EEG-based monitor and the mean arterial pressure? A recommendation such as this has been proposed.9

Unfortunately, MAC is so ingrained in our culture that not relying on it is impossible for most anesthesia providers to accept. Philips and Hendrickx propose, in an APSF Editorial, that end-tidal agent monitoring should be a "standard of care,"10 noting that the concentration of end-tidal agent is a reliable indicator of a patient's level of consciousness, and an end-tidal agent concentration of 0.7 MAC makes it highly improbable for the patient to be aware. However, the depth of anesthesia and absence of awareness depends on many variables, including judgements on how much IV and inhaled agents to administer and their effects on awareness and hemodynamics. On the other hand, Jin, et. al., suggest that an EEG-based monitor be considered as a standard of care for monitoring the depth of anesthesia.11

To summarize,

1. The depth of anesthesia results from a combination of inhalational and intravenous agents
2. The combined effect is not reflected by calculating the MAC value of the inhaled agents
3. An EEG-based monitor is currently the only way to assess the combined effect of anesthetic medications on the patient
4. Maintaining a proper anesthetic depth based on EEG monitoring, can result in a MAC value < 0.7 MAC without risk of awareness and may positively impact patient outcome

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The author has nothing to disclose.
REFERENCES