Evoked Potential Monitoring

Anesthesia Protocol
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Volatile Inhalational Anesthetics

SSEP (somatosensory evoked response)

- All agents produce a dose-dependent increase in latency and reduction in amplitude of cortically recorded SSEP responses.
- Smaller effects are seen on responses recorded over cervical spine, and minimal effects are seen in epidural or peripherally recorded responses.
- Potency of these effects is probably N2O > isoflurane = sevoflurane = desflurane > enflurane > halothane.
- Subcortical effects such as at Erb’s point and the cervical spine are minimal (0-9%) and are not dose related.
- Most of the dose-dependent effect occurs at lower concentrations (such as 0.7-1.3 MAC). There is a diminishing dose-dependent effect at higher concentrations.
- Combining N2O with other inhalational anesthetics produces unpredictable effects, suggesting drug interaction.
- Usually the effect of adding N2O to other inhalational anesthetics is more than additive.

BAER (brainstem auditory evoked response); Cortical AER

- BAER little affected by inhalational anesthetics.
- Latency change in wave V, less in III, and minimal in I.
- Amplitude changes are minimal. AER are affected like cortical SSEP.

VER (visual evoked response)

- Dose related effect; increase in latency and decrease in amplitude.

MEP (motor evoked response)

- Dose related effect.
- Unfortunately, major effect occurs at very low concentrations (such as less than 0.2 to 0.5 percent isoflurane).
- Magnetically induced MEP may be more sensitive than electrically induced MEP.
Sensitivity

- For latency change: SSEP (Erb’s) = SSEP (spinal cord) = BAER I < BAER III < BAER V < SSEP (cortex) < VEP (cortex) < cortical AEP < tcMMEP = tcEMEP.
- For amplitude change: SSEP (Erb’s) = SSEP (spinal) = BAER I < BAER III < BAER V < cortical AEP < SSEP (cortex) < VEP (cortex) < tcMMEP = tcEMEP.
- For SSEP, lower extremity responses appear to be more sensitive than upper extremity responses.

Intravenous Anesthetics

Opioids

- Effects are mild; less when opioid given as infusion as compared to intermittent bolus.

Ketamine

- Minimal effects; may even increase amplitude of cortical SSEP.

Barbiturates

- After bolus dose used to induce anesthesia, increased latency of cortical SSEP with increasing effects on longer latency waves and minimal effects on brainstem responses.
- BAER virtually unaffected. MEP more sensitive than SSEP.

Benzodiazepines

- Initial mild increase in latency and decrease in amplitude gradually resolving over time.
- Interestingly, for median nerve SSEP mild decrease amplitude for early peaks (N18, P22), moderate decrease amplitude for late peaks (N60), loss of very late peaks (200 to 400 msec), but increase amplitude for middle latency peaks (N35 to N60).
- MEP more sensitive than SSEP.

Etomidate

- Induction doses cause little change in BAER, cortical AEP and VEP.
- Increase amplitude of cortical components of SSEP.
- Continuous infusion of etomidate has enhanced cortical responses to permit monitoring in cases where it would have been otherwise impossible.
- Minimal amplitude depression and no latency changes in MEP.

Propofol

- Induction dose depresses amplitude of cortical AEP and SSEP, with rapid recovery after dose no longer being given (bolus or infusion).
- When used without any other anesthetics, may increase SSEP amplitude.
- Increase BAER latency without amplitude decrease.
- No effect on epidurally recorded SSEP. Decrease amplitude of MEP.
Recommendations

For subcortical responses, any anesthetic technique (except regional anesthesia) is usually acceptable.

For cortical responses, 0.5 MAC inhalational anesthetic combined with opioid (currently, remifentanil is used most often). If responses cannot be monitored with this anesthetic, discontinue inhalational anesthetic and replace with another class of anesthetic (etomidate or ketamine appear best based on the above information; propofol has also been used successfully; dexmedetomide is another option).

For motor evoked responses, don’t even try inhalational anesthetics. Most commonly used anesthetics are opioids and ketamine.

References


