

# Review: Absence of somatosensory-evoked potentials after onset of coma has a high specificity for predicting nonawakening

Robinson LR, Micklesen PJ, Tirschwell DL, Lew HL. Predictive value of somatosensory evoked potentials for awakening from coma. *Crit Care Med.* 2003;31:960-7.

## QUESTION

Are somatosensory-evoked potentials (SEPs) performed early after onset of coma accurate for predicting the probability of nonawakening?

## DATA SOURCES

Studies were identified by searching MEDLINE (1980 to 2000) and reviewing bibliographies of relevant studies.

## STUDY SELECTION

Studies were selected if they were published in English; assessed the association between SEPs (initial cortical responses from median nerve stimulation—i.e., the N19 or N20 responses) and awakening from coma; and reported coma cause, age group studied, presence or absence of SEP responses, timing of SEPs, and coma outcomes. Study exclusion criteria included single case reports, case series with < 4 patients, and articles from non-peer-reviewed journals.

## DATA EXTRACTION

Data were extracted on sample size, demographic characteristics of the patients, coma cause, SEP timing, stimulation frequency, duration of follow-up, presence or absence of SEPs (when present, SEPs were further separated into normal and abnormal SEPs),

and outcomes (5 categories based on the Glasgow Outcome Scale: death, persistent vegetative state [PVS], severe disability, moderate disability, or mild disability). To predict nonawakening, PVS was combined with death as poor outcomes and severe disability was combined with the good outcomes.

## MAIN RESULTS

41 studies (2701 patients) met the selection criteria. The data were subsequently rearranged into 4 groups of patients: adults with hypoxic-ischemic encephalopathy ( $n = 1136$ ), adults with intracranial hemorrhage ( $n = 157$ ), adults and adolescents with traumatic brain injury ( $n = 838$ ), and children and adolescents in a coma for any reason ( $n = 570$ ). 44% of all patients awakened.

The percentage of patients who did not awaken in each group defined by cause and SEP results (SEPs present or absent) with the corresponding sensitivity and specificity of SEPs for predicting nonawakening are in the Table.

## CONCLUSION

The absence of somatosensory-evoked potentials performed early after onset of hypoxic-ischemic coma has a high specificity for predicting the likelihood of nonawakening.

*Source of funding: No external funding.*

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### Diagnostic characteristics of somatosensory-evoked potentials (SEPs) for predicting nonawakening from coma\*

Patient category	Percentage not awakening (95% CI)		Sensitivity (CI)	Specificity (CI)†
	SEPs absent	SEPs present		
Adults with HIE	100% (99 to 100)	59% (56 to 63)	42% (38 to 45)	100% (99 to 100)
Adults with ICH	99% (96 to 100)	62% (52 to 73)	57% (48 to 66)	97% (84 to 100)
Adults and adolescents with TBI	95% (93 to 98)	18% (15 to 21)	67% (61 to 71)	98% (96 to 99)
Children and adolescents with coma for any reason	93% (90 to 96)	20% (16 to 24)	75% (69 to 80)	95% (91 to 97)

\*HIE = hypoxic-ischemic encephalopathy; ICH = intracranial hemorrhage; TBI = traumatic brain injury. Diagnostic terms defined in Glossary.

†Specificity represents the number of patients with SEPs present of the total who awaken.

## COMMENTARY

The review by Robinson and colleagues showed that the absence of SEPs assessed > 24 hours after the onset of coma was associated with a very poor prognosis. The specificity of this finding is excellent, although the sensitivity is rather low. In other words, many patients with coma and SEPs that are present also do very badly.

The likelihood of waking up is largely determined by the cause of the coma—brain hemorrhage and anoxia are associated with the worst prognosis. Only in the case of adult anoxic encephalopathy, where none of the 336 patients with absent cortical SEPs woke up, would this finding allow for rapid treatment withdrawal. The authors correctly point out the self-fulfilling nature of applying these prognostic findings uncritically to new patients.

A concern is the lack of discussion regarding the standardized performance of SEPs. No standards are offered on exactly how and when the tests should be done, although it is indicated that they should be performed > 24 hours after the event. As well, performance of SEPs in an intensive care unit (ICU) is not always technically easy, with the attendant possibility of false-negative readings.

A critical issue that is not discussed in this review but is of great practical interest to clinicians relates to the incremental value of the prog-

nostic information supplied by SEP performance. The prime determinant of coma prognosis lies in the specific cause of the coma and associated neurologic findings on examination (1). Findings on cerebral imaging and electroencephalography (EEG) are also of prognostic utility (2, 3). Left unexamined by the review is how much more a clinician will know about a patient's prognosis with the results of the SEPs added to information from imaging and EEG. Until that information is available, it is not possible to make an evidence-based decision regarding whether SEP assessment should be added to the other clinical and paraclinical evaluations routinely available in an ICU.

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