The Relationship Between Preoperative Memory Formation and Awake Bispectral Index Readings

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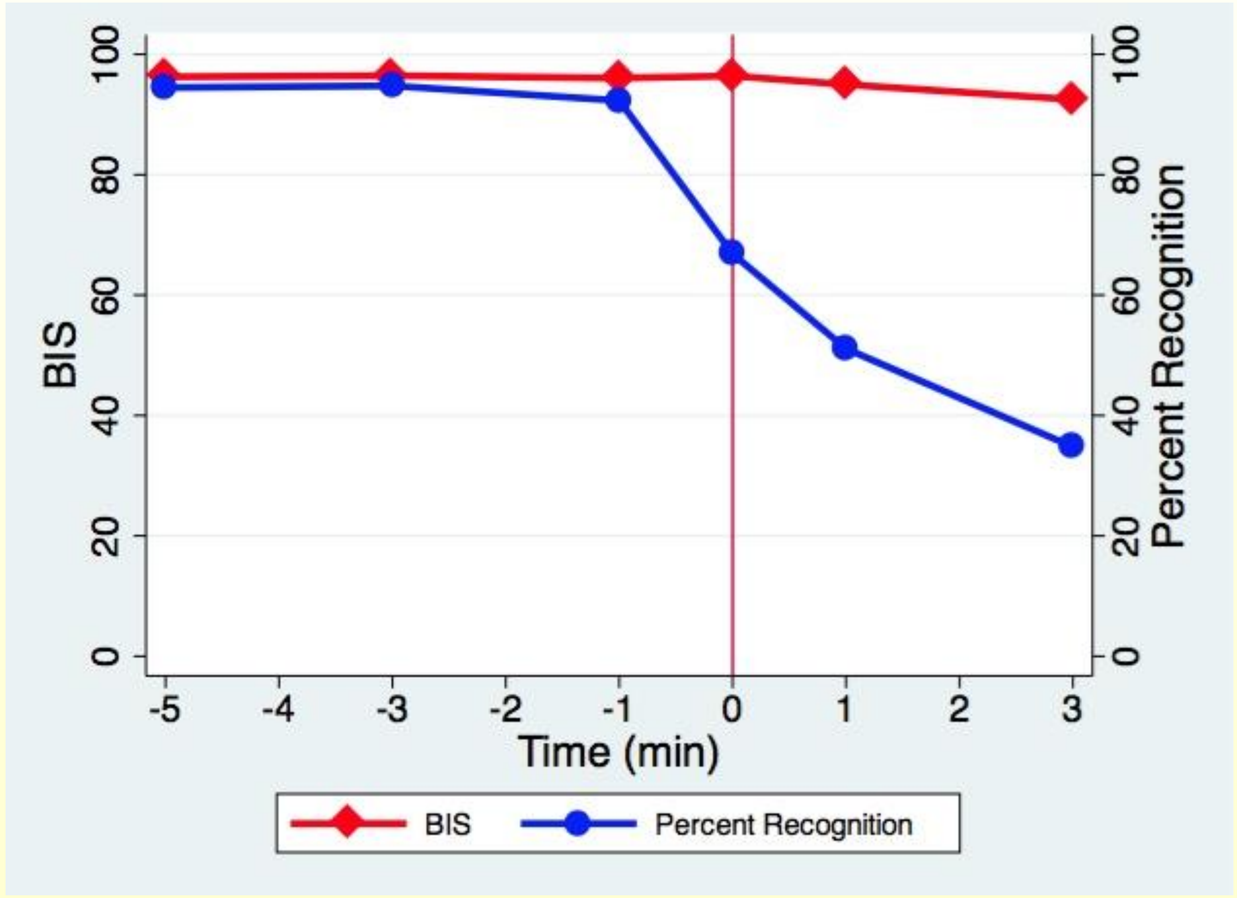
Background

Awareness with recall (AWR) is an uncommon but potentially dangerous occurrence in anesthetic practice.[1] To guard against instances of AWR, clinicians may use awareness monitors like the BIS Vista (Covidien), which processes EEG information and outputs a single dimensionless integer that indicates the patient's level of wakefulness. The BIS monitor was initially shown to be more effective than other monitoring techniques in preventing AWR,[2] but more recent studies have called this into question.[3] The present study was designed to assess if BIS values are correlated with memory formation, a fundamental component of AWR that can be studied outside the operating room.

Methods

258 subjects were enrolled in the study. All were adult surgical patients who received preoperative midazolam and general anesthesia. Each subject was fitted with a BIS Vista monitor in the preoperative area. BIS values were recorded five, three and one minutes pre-midazolam, at the time of midazolam administration, and one and three minutes afterwards. At each of these times, a unique word was given for the subject to remember. On the day following the operation, subjects were invited to select the words they could remember from a list containing the six given words and 18 others. A Wilcoxon rank-sum test was used to investigate the correlation between BIS scores and word recognition.

Preoperative Mean BIS and % Word Recognition Vs. Time before and after Midazolam administration



Average BIS (bispectral index) score and % of subjects recognizing the word at 24 hours post-op are plotted along the time scale of pre-op word administration. Each point represents a pre-op word, and zero minutes is the time of midazolam administration. Percent recognition declines swiftly after the 3rd word. BIS readings stay relatively constant and begin to decline gradually after the 4th word. The decline in BIS is not clinically significant.

Results

For the word given one minute after midazolam administration, the mean BIS scores for those who did and did not recognize the word were 95.9 and 94.2, respectively ($p = .002$). Of the five other words subjected to analysis, none yielded a statistically significant difference between BIS scores of subjects who recognized the words and those who did not.

Discussion

Although one significant difference was found, the discrepancy in BIS scores is too small to permit prediction of memory formation in the clinical setting. The dataset as a whole suggests that a relationship between BIS and memory formation cannot be established. It is notable that the downward trend in subject word recognition precedes midazolam administration, suggesting a possible retrograde amnestic effect.

References

1. Anesth Analg 2004; 99(3):833-9
2. NEJM 2008; 358(11):1097-108
3. NEJM 2011; 365(7):591-600