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Perioperative Brain Monitoring (Part 2 of a 3-Part Series)

Integrating BIS Monitoring Into Enhanced Recovery Pathways

Faculty

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Introduction

The concept of enhanced recovery after surgery (ERAS), a widely recognized surgical quality improvement initiative, was originally developed by Henrik Kehlet, a Danish colorectal surgeon.¹ It was later popularized by the ERAS Society in Europe and American Society for Enhanced Recovery (ASER) in the United States.^{2,3} Enhanced recovery pathways (ERPs) are available for numerous surgical domains, all of which embrace a multimodal and multidisciplinary approach to perioperative care.^{2,3} The primary objectives of ERPs are to mitigate the patient's surgical stress response, optimize their physiologic function, and expedite the recovery process.³⁻⁵ Pathways are constantly evolving to reflect the most current and compelling evidence regarding perioperative care.³ As a result of their implementation, ERPs have demonstrated reductions of up to 50% in hospital stays and complications, as well as notable decreases in readmission rates and associated costs.^{3,6}

The use of processed electroencephalogram (EEG) monitoring, with specific emphasis on the bispectral index (BIS), is recommended in various ERPs for different types of surgery.^{4,5,7-13}

BIS Monitoring in Enhanced Recovery

Depth of anesthesia monitoring is one of the critical components of ERPs.^{4,5,7-13} While too little anesthesia increases the risk for intraoperative awareness, too much anesthesia prolongs postoperative recovery and increases the risk for anesthesia-related

adverse events, including hemodynamic instability and respiratory complications.^{14,15} The use of BIS provides a more objective measure of anesthetic depth compared with traditional assessments by quantifying the level of sedation.

The Table lists a number of ERPs that incorporate use of BIS monitoring.^{4,5,7-13} Of note, strong recommendations for the use of BIS-guided anesthesia are provided in pathways for gastrointestinal and colorectal procedures, as well as bariatric surgery and gastrectomy.^{4,5,8,11} Using BIS to titrate anesthesia has been shown to reduce intraoperative awareness, decrease total anesthetic dose and rate of anesthesia-related adverse reactions, as well as facilitate rapid awakening and intermediate postoperative recovery.^{16,17} In general, a BIS index between 40 and 60 is

Table. BIS in ERAS Society Pathways

Type of Procedure	Strength of Recommendation/ Level of Evidence
Gastrointestinal	Strong/NR
Gastrectomy	Strong/High
Colorectal	Strong/High
Bariatric	Strong/Low
Rectal/pelvic ^a	NR/NR
Gynecologic/oncology	NR/NR

BIS, bispectral index; **ERAS**, enhanced recovery after surgery; **NR**, not reported.

^a In conjunction with the European Society for Clinical Nutrition and Metabolism and the International Association for Surgical Nutrition and Metabolism.

Based on references 4, 5, and 7-13.



recommended for maintenance of general anesthesia.¹⁸⁻²¹ Overly deep sedation (BIS<45) has been associated with an increased risk for death at a follow-up duration of at least 90 days.²² This is of particular concern in older adults, especially those with multiple comorbidities and/or cognitive dysfunction.⁴ Furthermore, BIS may also prove beneficial in preventing postoperative delirium in older adults, but research in this field is still ongoing.^{5,7,23}

In addition to being supported by the ERAS Society, ASER and the Perioperative Quality Initiative (POQI) strongly recommend EEG monitoring to reduce the risk for awareness with recall in patients receiving general anesthesia and total intravenous anesthesia.^{7,14} Furthermore, ASER states that anesthesiologists should

consider including EEG as part of the vital organ monitors to guide anesthesia.^{7,14}

Conclusion

Various ERAS pathways have incorporated BIS monitoring to enable continuous tailoring of anesthesia depth to individual patient needs.^{4,5,7-11} Furthermore, this approach serves as a strategy to prevent excessive sedation and reduce the risk for related adverse events, while expediting postoperative recovery.¹⁷

The BIS™ monitoring system should not be used as the sole basis for diagnosis or therapy and is intended only as an adjunct in patient assessment. Reliance on the BIS™ monitoring system alone for intraoperative anesthetic management is not recommended.

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