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

BIS Monitoring in Older Patients Undergoing Surgery

Faculty

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Introduction

Bispectral index (BIS) monitoring is widely used to personalize anesthesia and prevent intraoperative awareness.[1] With the increasing number of surgical procedures among patients aged 65 years and older, a demographic set to expand in the coming decades, this article describes the benefits of BIS monitoring within older surgical populations.[2-4]

Surgical Complications in Older Adults

Advanced age increases sensitivity to anesthesia due to age-related physiologic changes.[2,4] Older patients generally require less anesthesia and have an increased risk for anesthesia-related complications, including bradycardia, hypotension, and delayed emergence.[4-6] In addition, approximately 50% of older adults experience postoperative delirium (POD) 1 to 3 days after surgery.[7,8] A related syndrome, postoperative cognitive dysfunction (POCD), is typically assessed at 1 to 3 months after surgery.[8] Postoperative delirium and POCD are associated with a longer hospital length of stay,[7,9] decreased quality of life, and an increased risk for postoperative mortality within the first year.[10]

Ongoing research suggests that choosing total intravenous anesthesia (TIVA) over inhaled anesthetics may reduce the risk for POD.[11] Within this context, BIS-guided anesthesia is an effective strategy for mitigating the risks associated with TIVA, since BIS correlates with the depth of sedation independent of the age of the patient.[12,13] BIS monitoring allows for personalized anesthesia, often resulting in lower anesthetic doses, which may lead to faster emergence from anesthesia as well as other positive perioperative outcomes.[12,13]

Role of BIS Monitoring

The American Geriatrics Society recommends the use of processed electroencephalographic monitors of anesthetic depth during anesthesia in older patients to reduce POD (Figure).[14] The literature has consistently supported this recommendation showing improved cognitive outcomes along with other positive outcomes (eg, reduced inflammation, lower mortality) in older adults who

Figure. The BIS™ Quatro (4 Electrode) Sensor measures brain activity in adult patients undergoing general anesthesia.

receive BIS-guided anesthesia.[5,9,15] Furthermore, studies have shown older patients needing lower anesthesia requirements.[2,16,17] A 2020 meta-analysis of 8 randomized controlled trials (RCTs) in mixed surgical populations of adults aged 60 years and older found that BIS monitoring reduced POD when compared with a control group without BIS monitoring (17.7% vs 22%; odds ratio, 1.32; 95% CI, 1.11-1.57; *P*=0.001).[18] Similar results were seen in a 2022 meta-analysis that included a subgroup analysis of 9 RCTs of patients (n=4,648) at high risk for POD (19.0% vs 23.3%), defined as being older than 60 years or undergoing cardiac surgery.[19]

Additional studies have demonstrated improved outcomes when using BIS monitoring to compare the effects of targeting light versus deep general anesthesia in older adults.[5,9,15] A trial of adults aged 65 years and older with serious comorbidities (Charlson Comorbidity Index score >4) undergoing hip fracture repair found that 1-year mortality was reduced by 57% when targeting a BIS value over 80 compared with a BIS value of approximately 50; a 67% reduction was seen among patients with a Charlson Comorbidity Index score greater than 6.[15]

Evered and colleagues conducted a multicenter trial of at-risk patients aged 60 years and older undergoing major surgery who were randomized to light general anesthesia (BIS value of 50; n=269) or deep general anesthesia (BIS value of 35; n=278) to assess POD.[9] Results showed a 19% incidence of POD among patients in the BIS 50 group compared with 28% among those in the BIS 35 group (*P*=0.010).[9]

Lastly, a trial of patients aged 60 years and older undergoing hip arthroplasty found that maintaining a BIS value between 50 and 59 reduced the incidence of POCD (3.33% vs 20%) and improved other postoperative recovery outcomes, such as breathing recovery time and tube drawing time, compared with a BIS target between 40 and 49.[5]

Conclusion

Older adults have heightened sensitivity to anesthetics and are at increased risk for anesthesia-related complications. BIS technology effectively measures depth of sedation independent of age, making it a valuable tool for enhancing perioperative safety in this vulnerable patient demographic.

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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