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

**BIS Monitoring in Older Patients Undergoing Surgery**

**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

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**Figure.** The BIS™ Quatro (4 Electrode) Sensor measures brain activity in adult patients undergoing general anesthesia.
receive BIS-guided anesthesia. Furthermore, studies have shown older patients needing lower anesthesia requirements. 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). 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.

Additional studies have demonstrated improved outcomes when using BIS monitoring to compare the effects of targeting light versus deep general anesthesia in older adults. 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.

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. 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).

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.

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.

References