

## CONTRIBUTION OF BISPECTRAL INDEX (BIS™) MONITORING TO VALUE-BASED ANESTHESIA CARE

### KEY TAKEAWAYS

- Bispectral Index (BIS™) technology monitoring uses processed electroencephalogram (EEG) signals to measure sedation depth based on level of consciousness (LOC) signals, and allows anesthesia providers to titrate general anesthesia to achieve a desired LOC on the brain.<sup>1</sup>
- Side effects of general anesthesia may include postoperative delirium (POD), increased post anesthesia care unit (PACU) time, and intraoperative awareness (IA).<sup>1,2,3</sup>
- Costs are often associated with side effects related to increased PACU time, incidence of IA, and an increase in length of stay (LOS).<sup>4,5</sup>
- Clinical evidence suggests that intraoperative BIS™ monitoring may present an opportunity for hospital cost savings when reduction in adverse effects from general anesthesia are considered.<sup>6</sup>
- An economic model demonstrated the use of BIS™ monitors to be cost-effective over a five year period, resulting in substantial cost savings when adverse events were avoided.<sup>6</sup>

### OVERVIEW

Intraoperative evaluation of depth of anesthesia is a critical clinical assessment. Too little anesthesia may result in patient awareness during surgery, while too much anesthesia can result in prolonged recovery and may increase the risk for adverse postoperative outcomes and associated costs.<sup>7</sup>

BIS™ monitoring uses processed EEG signals to measure sedation depth based on LOC signals, and allows anesthesia providers to titrate anesthesia to achieve a desired LOC. Over time, this may result in an opportunity for hospital cost savings, when reductions in adverse effects from too much or too little general anesthesia are considered.<sup>1</sup>

An economic model demonstrated the use of BIS™ monitors to be cost-effective, resulting in substantial cost savings when adverse events were avoided.<sup>6</sup> In this model, if 1.35 million operations are conducted using BIS monitors over a period of 5 years, a cumulative savings of over \$208 million could result.<sup>6</sup>

## BIS™ MONITORING AND VALUE IN ANESTHESIA CARE

### ADVERSE EVENT

#### Post-Operative Delirium (POD)

Patients often emerge easily from general anesthesia, and may be lucid in the PACU. Patients receiving too much anesthesia may develop POD, or an altered mental status, most often between postoperative days 1 and 3.<sup>4,8</sup>

### BIS ECONOMIC IMPACT

- A randomized controlled trial demonstrated a 35% relative reduction in POD attributable to BIS-guided anesthesia versus routine care among elderly patients.<sup>9</sup>
- POD has been shown to be associated with longer and more costly hospital stays (average increase of 13 days) as well as a higher likelihood of death within 6 months after general anesthesia administration (average increase of 10.6%).<sup>4,10</sup>

#### Increased Time in Post-Anesthesia Recovery Unit

Time in the PACU may be reduced in patients who received BIS-guided anesthesia, compared to standard methods of practice.<sup>1</sup>

- With a reduction in emergence and recovery time, clinical trials show PACU discharge times were reduced from 6.7 to 30 minutes for BIS titrated patients, compared to standard methods of practice.<sup>1,12</sup>
- Studies have shown that BIS-guided anesthesia significantly reduced anesthetic drug amounts by as much as 58.9% and patients woke up faster, were extubated sooner, and were more oriented upon arrival to the PACU.<sup>1,13,14</sup>

#### Intraoperative Awareness (IA)

When general anesthesia is insufficient for deep anesthesia, a patient may become aware of some or all events during surgery with varying levels of recall of those events.<sup>15</sup>

- BIS™ technology is a consciousness monitoring technology proven in rigorous prospective clinical studies to help clinicians reduce the incidence of IA in adults, with recall, by approximately 80% compared when BIS technology is not used.<sup>8,15,16,17</sup>
- Taking into account the decreased usage of anesthetic agents, it was found that use of BIS™ technology resulted in a net cost of only \$5.55 per use, while the cost of preventing a single case of IA was \$11,111.<sup>9,5</sup>

### REFERENCES

- Gan TJ, Glass PS, Windsor A, et al. Bispectral index monitoring allows faster emergence and improved recovery from propofol, alfentanil, and nitrous oxide anesthesia. BIS Utility Study Group. *Anesthesiology*. 1997;87(4):808-815.
- www.asahq.org [Internet]. Washington, D.C.: When Seconds Count From the American Society of Anesthesiologists; 2015. Effects of Anesthesia. Available from: <http://www.asahq.org/whensecondscount/patients%20home/preparing%20for%20surgery/effects%20of%20anesthesia>
- The Joint Commission. Sentinel Event Alert: Preventing, and managing the impact of, anesthesia awareness. Oakbrook Terrace, (IL): The Joint Commission (US); 2004 Oct. 2 p. Issue No.:32.
- Deiner S, Silverstein, JH. Postoperative delirium and cognitive dysfunction. *British Journal of Anaesthesia*. 2009; 103 (Suppl. L): i41 – i46.
- Klopman, MA and Sebel, PS. Cost-effectiveness of bispectral index monitoring. *Current Opinion in Anesthesiology*. 2011;24:177-181.
- Vincent O, Sabatelli L, Craig J, Taylor M. Clinical and Cost-Effectiveness and Budget Impact of Routine Use of Bispectral Index Monitors in Theatres [poster]. North Yorkshire (UK): University of York; 2014. 1 poster: color.
- Johansen JW, Sebel, PS, Sigl, JC. Clinical Impact of Hypnotic-Titration Guidelines Based on EEG Bispectral Index (BIS) Monitoring During Routine Anesthetic Care. *Journal of Clinical Anesthesia*. 2000;12:433-443.
- www.scientificamerican.com [Internet]. New York, N.Y.: The Hidden Dangers of Going Under; 2014. Available from: <http://www.scientificamerican.com/article/hidden-dangers-of-going-under/>.
- Chan MT, Cheng BC, Lee TM, GinT; CODA Trial Group. BIS-guided anesthesia decreases postoperative delirium and cognitive decline. *J Neurosurg Anesthesiol*. 2013 Jan;25(1):33-42.
- Ansalconi L., Catena, F., Chattat R., Fortuna D., Franceschi C., Mascitti P., and Melotti R.M. Risk factors and incidence of postoperative delirium in elderly patients after elective and emergency surgery. *British Journal of Surg*. 2010; 97:273-280.
- Panagiotis K, Maria P, Argiri P, Panagiotis S. Is Postanesthesia Care Unit Length of Stay Increased in Hypothermic Patients? *AORN Journal*. 2005 Feb; 81(2):379-392.
- National Institute for Health and Clinical Excellence (NICE) diagnostics guidance 6. Issued: November 2012.
- White PF, Ma H, Tang J, Wender RH, Sloninsky A, Kariger R. Does the use of electroencephalographic bispectral index or auditory evoked potential index monitoring facilitate recovery after desflurane anesthesia in the ambulatory setting? *Anesthesiology*. 2004;100(4):811-817.
- Punjasawadwong Y, Boonjeungmonkol N, Phongchiewboon A. Bispectral index for improving anaesthetic delivery and postoperative recovery. *Cochrane Database Syst Rev*. 2014;(6):CD003843.
- Ekman A, Lindholm ML, Lennmarken C, Sandin R. Reduction in the incidence of awareness using BIS monitoring. *Acta Anaesthesiol Scand*. 2004;48(1):20-26.
- Myles PS, Leslie K, McNeil J, Forbes A, Chan MT. Bispectral index monitoring to prevent awareness during anaesthesia: the B-Aware randomised controlled trial. *Lancet*. 2004;363(9423):1757-1763.
- Kaplan LJ, et al. Bispectral Index (BIS) Monitoring of ICU Patients on Continuous Infusion of Sedatives and Paralytics Reduces Sedative Drug Utilization and Cost. *Critical Care*. 2000;4 (suppl 1):5110.