

**Medtronic**

BIS™ Advance monitor

# Perfecting your art. Advancing patient care.

Postoperative delirium can be prevented.  
Let's work together to reduce the risk.



# Common occurrence. Significant risk.

Postoperative delirium (POD) is a serious complication of surgery – described as “tantamount to an acute brain failure, and should be considered akin to other postoperative organ failures.”<sup>1</sup> Postoperative delirium is common though the prevalence varies significantly between surgical populations.<sup>2</sup>



In high-risk surgery, such as trauma and cardiac surgery, **36-40%** of adult patients develop POD<sup>3</sup>

Risk increases **up to 87%** depending on the age of patients and the type of surgery<sup>2</sup>

With an upsurge in the number of patients ages 60 and older undergoing anesthesia and surgery, these numbers are projected to rise.<sup>4</sup>

- Postoperative delirium is independently associated with decreased quality of life<sup>5</sup>
- Patients with postoperative delirium have 2 to 4 times greater odds of dying in the hospital and up to 5 times greater odds of dying within 6 months<sup>5,6</sup>
- Complications include dementia, loss of independence, and poor cognitive and functional outcomes<sup>7</sup>

# POD takes more resources. Increases costs.



Patients with POD have a **50% higher risk** for developing any complication in the hospital<sup>6</sup>



National healthcare cost burden of POD is estimated at **\$32.9 billion per year**, similar to cardiovascular disease and diabetes<sup>8</sup>



Additional cost for patients with POD can be as high as **\$20,327<sup>8</sup>**

## Personalize dosing. Reduce risk of postoperative delirium.

Postoperative delirium poses a serious complication, consumes more resources, and increases costs.<sup>1,6,8</sup> Fortunately, postoperative delirium is preventable in up to 40% of cases with a proper screening program, the identification of risk factors, and the implementation of evidence-based monitoring methods within the OR.<sup>3</sup>

To help minimize risk of postoperative delirium, you need a direct measurement of the anesthetic effect on your patient's brain. With its validated algorithm, BIS™ technology accurately reflects the anesthetic effect on your patient's brain, so you can personalize dosing throughout a procedure.



## BIS™ technology-guided anesthetic dosing may:

- Reduce risk of postoperative delirium<sup>9-13</sup>
- Improve emergence and recovery times<sup>14-17</sup>
  - Promote faster wake-up, recovery, and discharge from the PACU<sup>18</sup>
- Reduce primary anesthetic delivery by as much as 38%<sup>14,19-22</sup>

Studies show that using less anesthetic agent improves outcomes when using TIVA anesthetic approach,<sup>14,23</sup> when following ERAS™\* protocols,<sup>24,25</sup> and in elderly patient populations at risk for postoperative neurocognitive disorders.<sup>9-13</sup> In addition, brain monitoring is recommended in multiple society guidelines.<sup>26-28</sup>



# 1

POD is preventable in up to **40% of cases**<sup>3</sup>

# 2

Peer-reviewed, published data associates **the levels and type of anesthesia as risk factors for POD**<sup>29</sup>

# 3

BIS™ index-guided anesthetic dosing may **reduce POD by up to 29%**<sup>9</sup>

# 4

Use up to **38% less anesthetic agents**<sup>14,19-22</sup>

# 5

Patients monitored with BIS™ technology **wake up 27-53% faster in the OR**<sup>14,20,22,30</sup>

# Easy to use. Easy output.

The completely redesigned BIS™ Advance monitor is engineered to help make your workflow more efficient while giving you the insight you need with:

- A large, high-resolution, touchscreen monitor that's simple to read
- Data output protocols that enable connectivity to electronic medical records (EMRs)
- Configurable data and settings so you can see just the information you want
- Color-coordinated data to quickly review readings
- The ability to track total suppression time detected during the procedure
- Built-in troubleshooting guides with information on clinical parameters and data significance
- Ability to maintain continuous monitoring when moving between care settings

Now, using BIS™ monitoring makes personalizing anesthesia easier than ever.



To request a full clinical demo of the BIS™ Advance monitor, contact your Medtronic representative.



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.

1. Sanders R, Pandharipande P, Davidson A, et al. Anticipating and managing postoperative delirium and cognitive decline in adults. *BMJ*. 2011; 343:d4331.
2. Whitlock E, Vannucci A, Avidan M. Postoperative Delirium. *Minerva Anesthesiol*. 2011 April; 77(4): 448-456.
3. Swarbrick CJ & Partridge JSL. Evidence-based strategies to reduce the incidence of postoperative delirium: a narrative review. *Anaesthesia*. 2022; 77 (Suppl. 1), 92-101.
4. Evered L, Silbert, B, Knopman DS, et al. Recommendations for the nomenclature of cognitive change associated with anaesthesia and surgery. *Anesthesiology*. 2018; 129(5): 872-879.
5. Abelha FJ, Luis C, Veiga D, et al. Outcome and quality of life in patients with postoperative delirium during an ICU stay following major surgery. *Crit Care*. 2013;17(5):R257.
6. Veiga D, Luis C, Parente D, et al. Postoperative delirium in intensive care patients: risk factors and outcome. *Rev Bras Anesthesiol*. 2012;62(4):469-483.
7. Evered L, Atkins K, Silbert B, et al. Acute peri-operative neurocognitive disorders: a narrative Review. *Anaesthesia*. 2022; 77 (Suppl. 1), 34-42.
8. Gou, RY, Hshieh TT, Marcantonio ER, et al. One-Year Medicare costs associated with delirium in older patients undergoing major elective surgery. *JAMA Surgery*. 2021; 462-470.
9. Punjasawadwong Y, Chau-In W, Laopaiboon M, Punjasawadwong S, Pin-On P. Processed electroencephalogram and evoked potential techniques for amelioration of postoperative delirium and cognitive dysfunction following non-cardiac and non-neurosurgical procedures in adults. *Cochrane Database Syst Rev*. 2018;5:CD01128.
10. Sieber FE, Zakriya K, Gottschalk A, et al. Sedation depth during spinal anesthesia and the development of postoperative delirium in elderly patients undergoing hip fracture repair. *Mayo Clin Proc*. 2010; 85(1), 18-26.
11. Evered LA, Chan MT, Han R, et al. Anesthetic depth and delirium after major surgery: a randomised clinical trial. *Br J Anaesth*. 2021; 27 (5): 704-712.
12. Chan MT, Cheng BC, Lee TM, Gin T; CODA Trial Group. BIS-guided anesthesia decreases postoperative delirium and cognitive decline. *Neurosurg Anesthesiol*. 2013 Jan; 25(1), 33-42.
13. Radtke FM, Franck M, Lendner J, et al. Monitoring depth of anesthesia in a randomized trial decreases the rate of postoperative delirium but not postoperative cognitive dysfunction. *Br J Anaesth*. 2013; 110: i98-i105.
14. Lewis SR, Pritchard MW, Fawcett LJ, Punjasawadwong Y. Bispectral index for improving intraoperative awareness and early postoperative recovery in adults. *Cochrane Database Syst Rev*. 2019;9:CD003843. doi:10.1002/14651858.CD003843.pub4.
15. Zhang C, Xu L, Ma Y-Q, et al. Bispectral index monitoring prevent awareness during total intravenous anesthesia: a prospective, randomized, double-blinded, multi-center controlled trial. *Chin Med J (Engl)*. 2011;124(22):3664-3669. <https://www.ncbi.nlm.nih.gov/pubmed/22340221>.
16. Myles PS, Leslie K, McNeil J, Forbes A, Chan MTV. Bispectral index monitoring to prevent awareness during anaesthesia: The B-Aware randomised controlled trial. *Lancet*. 2004;363(9423):1757-1763. doi:10.1016/S0140-6736(04)16300-9.
17. Ekman A, Lindholm M-L, Lennmarken C, Sandin R. Reduction in the incidence of awareness using BIS monitoring. *Acta Anaesthesiol Scand*. 2004;48(1):20-26. doi:10.1111/j.1399-6576.2004.00260.
18. 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? *J Am Soc Anesthesiologists*. 2004 Apr 1;100(4):811-7.
19. Punjasawadwong Y, Phongchitwong A, Bunchungmongkol N. Bispectral index for improving anaesthetic delivery and postoperative recovery. *Cochrane Database Syst Rev*. 2014(6).
20. Song D, Joshi GP, White PF. Titration of volatile anesthetics using bispectral index facilitates recovery after ambulatory anesthesia. *Anesthesiology*. 1997;87(4):842-848.
21. Luginbuhl M, Wutrich S, Petersen-Felix S, Zbinden AM, Schnider TW. Different benefit of bispectral index (BIS) in desflurane and propofol anesthesia. *Acta Anaesthesiol Scand*. 2003;47(2):165-173. <https://www.ncbi.nlm.nih.gov/pubmed/12631045>.
22. Gan TJ, Glass PS, Windsor A, et al. Bispectral index monitoring allows faster emergence and improved recovery from propofol, alfentanil and nitrous oxide anesthesia. *Anesthesiology*. 1997;87(4):808-815. doi:10.1097/0000542-199710000-00014.
23. Gao WW, He YH, Liu L, Yuan Q, Wang YF, Zhao B. BIS monitoring on intraoperative awareness: a meta-analysis. *Current Med Sci*. 2018 Apr;38(2):349-53.
24. Lau CSM, Chamberlain RS. Enhanced recovery after surgery programs improve patient outcomes and recovery: A meta-analysis. *World J Surg*. 2017;41: 899-913. doi: 10.1007/s00268-016-3807-4.
25. Thillainadesan J, Yumol MF, Suen M, Hilmer S, Naganathan V. Enhanced recovery after surgery in older adults undergoing colorectal surgery: a systematic review and meta-analysis of randomized controlled trials. *Diseases of the Colon & Rectum*. 2021 May 11;64(8):1020-8.
26. Inouye SK, Sharon K, et al. Postoperative delirium in older adults: Best practice statement from the American Geriatrics Society. Intraoperative Measures to Prevent Delirium. *J Am Coll Surg*. 2014; 220(2):136-148.e1.
27. Nunes R, Fonseca N, Simões C, et al. Brazilian consensus on anesthetic depth monitoring. *Braz J Anesthesiol*. 2015;65(6):427-436. doi: 10.1016/j.bjane.2015.10.001.
28. Guideline essentials: Moderate sedation key takeaways. Association of Perioperative Registered Nurses. [http://aorn.org/-/media/aorn/essentials/moderate-sedation/files/keytakeaways\\_moderatesedation\\_021716.pdf](http://aorn.org/-/media/aorn/essentials/moderate-sedation/files/keytakeaways_moderatesedation_021716.pdf). Published 2015.
29. Weinstein SM, Poultsides L, Baaklini LR, Mörwald EE, Cozowicz C, Saleh JN, Arrington MB, Poeran J, Zubizarreta N, Memsoudis SG. Postoperative delirium in total knee and hip arthroplasty patients: a study of perioperative modifiable risk factors. *Br J Anaesth*. 2018 May 1;120(5):999-1008.
30. Wong J, Song D, Blanshard H, Grady D, Chung F. Titration of isoflurane using BIS index improves early recovery of elderly patients undergoing orthopedic surgeries. *Can J Anaesth*. 2002;49(1):13-18. doi:10.1007/BF03020413.