

Clinical and Cost-Effectiveness and Budget Impact of Routine Use of Bispectral Index Monitors in Theatres



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Background and Aim

Bispectral Index (BIS) monitoring systems monitor spontaneous electroencephalography, track sedative drug effects and help guide anaesthetic administration. At least one review of clinical evidence concludes that such monitoring presents a strong opportunity for cost reduction on anaesthesia due to demonstrated potential to reduce adverse events including cases of post-traumatic stress disorder (PTSD), postoperative nausea and vomiting (PONV), postoperative cognitive dysfunction (POCD) and postoperative delirium (POD) compared with monitoring clinical signs only. It may also reduce recovery time in the post-anaesthesia care unit and use of anaesthesia. However, the cost-effectiveness of monitors is uncertain.

The aim was to conduct a cost utility analysis comparing BIS to current practice and estimate the associated budget impact of introducing BIS into theatres in the UK.

Assumptions

Absolute event rates, relative risk reduction values and utilities were obtained from peer-reviewed literature, using systematic review sources where possible. The key values adopted are shown in Table 1.

Table 1: Values adopted for key parameters

Parameter	Value	Source
Incidence:		
POAR	0.15%	Ghoneim ¹
PTSD	18%	Ghoneim ¹
POD	24%	Chan ²
PONV	38%	Liu ³
POCD	15%	Chan ²
Relative risk reduction with BIS monitors:		
POAR with propofol only	80%	Punjasawadwong ⁴
PTSD	80%	Assumption
POD	35%	Chan ²
PONV	16%	Liu ³
POCD	31%	Chan ²
Utilities:		
PTSD	0.8	All from CEA Registry ⁵
POD	0.6	
PONV	0.9	
POCD	0.8	
Cost per episode:		
PTSD	£925	NICE Costing Statement ⁶
POD	£615	
PONV	£244	
POCD	£188	
BIS monitor and accessories	£5,580	Manufacturer (Covidien)
Disposable sensors		Manufacturer (Covidien)
Cost per minute in theatre		Paton ⁷

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Methods

A cost utility analysis and budget impact (BI) were developed using a decision model to compare the incremental outcomes and costs of monitoring the depth of anaesthesia with BIS monitors compared with using clinical signs, electrocardiography (ECG) and other devices (standard clinical monitoring) over a five-year period. The health outcomes included are utility values associated with adverse events avoided. An NHS perspective was adopted and costs and outcomes were discounted at 3.5% a year. Sensitivity analyses explored uncertainty in the model. In the base-case, a cohort of 100,000 patients aged 15 and older undergoing surgery lasting more than 2 hours with general anaesthetic was adopted. Subgroup analysis was conducted for an elderly patient group.

Figure 1: BIS sensors positioned on a patient



Results

The modelled results show that using BIS monitors dominates clinical observation of signs and ECH being cost saving by £82 per operation, whilst improving quality adjusted life years (QALYs) by 0.016 per patient. The savings and improved QALYS arise because of the fewer adverse events.

In the population aged over 65 years, incremental savings increase to £109 because POD events are also avoided in this group. The incremental QALY of 0.016 is unchanged across this group due to the short duration of this event (2 days). Sensitivity analyses show result is robust to parameter changes, being most sensitive to treatment costs of PONV and POD and cost of theatre time. The BI showed a cumulative saving of over £136 million if theatres in the UK adopt a phased increase in monitor use such that 1.35 million operations are conducted using monitors in five years time.

Conclusions

Adopting BIS monitors is clinically and cost-effective and results in substantial cost savings compared with observing clinical signs plus conventional devices only.

References

- Ghoneim MM, Block RI, Haffarnan M, Mathews MJ. Awareness During Anesthesia: Risk Factors, Causes and Sequelae: A Review of Reported Cases in the Literature. *Anesthesia & Analgesia*. 2009;108(2):527-35.
- Chan MTV, Cheng BCP, Lee TMC, Gin T, CODA Trial Group. BIS-guided Anesthesia Decreases Postoperative Delirium and Cognitive Decline. *J Neurosurg Anesthesiol*. 2013;25(1):33-42.
- Liu SS. Effects of Bispectral Index monitoring on ambulatory anesthesia: a meta-analysis of randomized controlled trials and a cost analysis. *Anesthesiology*. 2004;101(2):311-5.
- Punjasawadwong Y, Boonjeungmonkol N, Phongchiewboon A. Bispectral index for improving anaesthetic delivery and postoperative recovery. *The Cochrane Database of Systematic Reviews*. 2010 (10).
- The CEA Registry. 2012;[cited 2012]; Available from: <http://www.tufts-nemc.org/cearegistry/> (accessed 23 July 2013).
- National Institute for Health and Clinical Excellence. Costing statement: Generalised anxiety disorder and panic disorder (with or without agoraphobia) in adults London. 2011.
- Paton F, Paulden M, Chambers D, Heirs M, Duffy S, Hunter JM, et al. Sugammadex compared with neostigmine/glycopyrrolate for routine reversal of neuromuscular block: a systematic review and economic evaluation. *Br Jour of Anaesthesia*. 2010;105(5):558-67.

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