DEPTH OF ANAESTHESIA MONITORING

Professor Paul Myles
Director of Anaesthesia & Perioperative Medicine,
The Alfred Hospital, Melbourne, Australia

Although the introduction of general anaesthesia remains one of the great achievements in medicine, awareness continues to worry anaesthetists and their patients. In addition, despite monitoring numerous variables during anaesthesia, we have not been able to directly monitor the effects of anaesthetic drugs. The relatively recent introduction of depth of anaesthesia monitoring provides solutions to these dilemmas.

The incidence of awareness is about 1 to 2 per 1,000 in an unselected surgical population undergoing relaxant general anaesthesia (2-5), but is high in at-risk groups such as patients with cardiovascular or end-stage lung disease (5,6), and those undergoing cardiac surgery (7), caesarean section under general anaesthesia (8), and major trauma surgery (9).

The detection of awareness is not straightforward. Fluctuating memories, confusion with timing of the event being recalled, and biases in detection and classification make accurate figures and comparison between studies problematic. About two-thirds of awareness cases will be missed if the anaesthetist is reliant upon notification from the patient or surgeon (10). Some memories of intraoperative events are not recollected by the patient until days or weeks after surgery, and some are recalled immediately but not at later times (6,11). Also, some reports of awareness are not true awareness, in that the recollection relates to postoperative events on emergence, in the recovery room, or intensive care unit (6). Intraoperative or postoperative dreaming may be misinterpreted as awareness during surgery (6,12). Thus, spurious reports of awareness do occur. These outnumber true incidents of awareness, and it cannot be expected that such events will be reduced with depth of anaesthesia monitoring. It is strongly recommended that a structured questionnaire (5,6,11,13,14) and adjudication committee be used to verify awareness reports (5,6). This should be a gold standard for future studies.

Can depth of anaesthesia monitor prevent awareness? A recent publication has challenged this belief (14). Proof-of-concept studies have demonstrated a relationship between depth of anaesthesia monitor and hypnotic drug concentration, and/or with increasing sedation. Many of these studies have found that some particular EEG parameter, or proprietary device, is superior to others in some respects. Results vary and are sometimes contradictory. Nevertheless, it is common for there to be a moderate correlation between anaesthetic drug concentration and any particular depth of anaesthesia monitor, with a correlation coefficient of about 0.7 (15,16).

Reduced drug usage and faster recovery times have been demonstrated for BIS (18,19), entropy monitoring (20), evoked potential monitoring (21), and Narcotrend (22). However, other studies have found no reduction in recovery times (23,24).

The B-Aware Trial (6) included 2643 adult patients at high risk of awareness, and randomly allocated them to routine monitoring or monitoring that included BIS. Awareness was identified by blinded structured interviews done at about 4 hours, 24 hours, and 30 days after surgery. A blinded adjudication committee assessed all reports of awareness. There were two confirmed reports of awareness in the BIS-guided group and 11 reports in the routine monitoring group: a risk reduction of 82% (95% CI: 17 to 98%), P=0.022.

There has also been a large nonrandomized study in 4,945 patients (25), which used a before-and-after design and found a significant (P=0.038) similar 5-fold reduction in the incidence of awareness with BIS monitoring. More recently, a prospective observational study found 25 awareness cases from 19,575 patients in 7 US centres: an incidence of 0.13% (5). Although BIS monitoring was used in about 40% of cases, it was not associated with a reduction in the risk of awareness. But, as the authors point out, this was not the purpose of this study (which is more validly tested with a randomized design), and it is likely that patients at a high risk of awareness were more likely to receive BIS monitoring.

Several professional organizations have adopted guidelines for use of depth of anaesthesia monitoring to prevent awareness (26-28). Although differences exist, the general recommendation is that depth of anaesthesia monitoring should be available and the anaesthetist should consider such use in at-risk patients.
As stated above, a recent study failed to replicate the findings of the B-Aware Trial (14). This study was established as a non-inferiority trial (see www.clinicaltrials.org) yet was reported differently. In any case it was underpowered to detect a clinically important benefit of BIS monitoring, because they could only identify 4 confirmed awareness events. An updated meta-analysis still demonstrates statistically significant effectiveness (29): revised risk reduction 69% (95% CI: 9 to 89%), P=0.03.

In conclusion, BIS monitoring can lead to a marked reduction in the risk of awareness and this monitoring should be used in patients with any risk factor for awareness. Depth of anaesthesia monitor will not however prevent all cases of awareness.

References


