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Routine use of depth of anaesthesia monitoring in patients receiving volatile anaesthesia: is it worth it?

This article discusses the place of routine use of depth of anaesthesia monitoring in patients receiving volatile anaesthesia. Benefits include reducing the probability of accidental awareness or excessive depth of anaesthesia, and creating training opportunities to improve familiarity with its use, but these must be weighed against the costs, as it may not be advantageous from a cost–benefit perspective.

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Introduction

Accurate assessment of depth of anaesthesia can be challenging for practitioners seeking to tailor the depth of anaesthesia to each patient, despite the increasing commercial availability of equipment to monitor the depth of anaesthesia.

Depth of anaesthesia monitoring involves using a processed electroencephalogram to provide insight into the effects of anaesthetic agents on the brain. Users interpret this information using an index between 0 and 100, the processed electroencephalogram waveform and its general trend. Processed electroencephalogram monitoring only correlates with the probability of unconsciousness or explicit recall following a general anaesthetic. A low bispectral index value does not prevent awareness or intraoperative movement (Andrzejowski and Wiles, 2015).

Monitoring guidelines from the Association of Anaesthetists of Great Britain and Ireland recommend the use of a processed electroencephalogram rather than the index number when using total intravenous anaesthesia together with neuromuscular blockade (Klein et al, 2021). This article explores the arguments for and against extending the routine use of depth of anaesthesia monitoring in the form of processed electroencephalogram to patients receiving volatile anaesthesia.

Depth of anaesthesia monitoring should be used in patients receiving volatile anaesthesia

Routine use of depth of anaesthesia monitoring in patients receiving volatile anaesthesia could reduce the probability of accidental awareness in general anaesthesia, especially in patients at higher risk as outlined by the 5th National Audit Project (NAP5) on accidental awareness during general anaesthesia (Pandit et al, 2014).

Routine monitoring of the depth of anaesthesia is not currently recommended for patients receiving volatile anaesthesia, given the availability of minimal alveolar concentration and end-tidal anaesthetic gas monitoring, which are reliable and clinically relevant end-points of a general anaesthetic. However, this does not preclude the addition of depth of anaesthesia monitoring to these measures as this provides additional data to assess a patient's depth of anaesthesia. It is worth noting that bispectral index is the only processed electroencephalogram monitor that has been shown to decrease the incidence of accidental awareness in general anaesthesia (Myles et al, 2004).

Depth of anaesthesia monitoring could be especially beneficial in patients who have risk factors for accidental awareness in general anaesthesia. These include drug factors such as neuromuscular blockade use and total intravenous anaesthesia techniques; patient factors such as female sex, age (younger adults), obesity, previous accidental awareness in general anaesthesia, possible difficult airway management; subspecialties such as obstetric, cardiac, thoracic or neurosurgery (because of underlying physiological and pathological patient factors and complex surgical factors); and organisational factors such as emergency cases, out of hours operating and anaesthesia being administered by junior anaesthetists (Pandit et al, 2014).

The reported incidence of 1:19 000 for accidental awareness in general anaesthesia from NAP5 implies that this is relatively uncommon, although the previous accepted estimate was 1:1000 using Brice post-anaesthetic interviews (Sebel et al, 2004). This should not detract from the immediate and long-term psychological distress that awareness can cause, with 41% of patients who reported accidental awareness in general anaesthesia experiencing moderate or severe long-term sequelae (Pandit et al, 2014).

Routine depth of anaesthesia monitoring use could also reduce the probability of excessive depth of anaesthesia, which has been linked to negative patient outcomes including postoperative delirium, cognitive decline and an association with increased mortality (Sessler et al, 2019).

Additionally, routine use of depth of anaesthesia monitoring could be an important training opportunity. Its interpretation requires user experience, as it is subject to variability from factors such as interference artefacts, use of neuromuscular blockade and a estimated timelag of 15–30 seconds. Routine use of depth of anaesthesia monitoring in low risk cases would be beneficial for training experience, allowing more accurate interpretation of monitoring output and therefore optimising outcomes in high-risk cases.

Depth of anaesthesia monitoring should not be used in patients receiving volatile anaesthesia

There is literature suggesting that the cost of routine use of depth of anaesthesia monitoring could outweigh its potential benefits. The incremental cost-effectiveness ratio, a model used by the National Institute for Health and Care Excellence to guide health economic evaluations, is the ratio of the incremental cost of an intervention to the benefit accrued in quality-adjusted life years. Smith et al (2013) suggested that the incremental cost-effectiveness ratio for use of depth of anaesthesia monitoring varies depending on the incidence of unintended awareness used in the calculation. Additionally, the B-aware trial suggests a number needed to treat of 138, and a cost to prevent one case of awareness in high-risk patients of around 2200 Australian dollars (£1195.93) (Myles et al, 2004). Routine use of depth of anaesthesia monitoring would also increase consumption of disposable single-use items.

In terms of improving healthcare resource allocation, Lewis et al (2019) showed that although bispectral index-guided anaesthesia may reduce the risk of intraoperative awareness and shorten recovery times compared with using clinical signs, there was no evidence of these outcomes being different in bispectral index-guided and end-tidal anaesthetic gas-guided anaesthesia.

Conclusions

Routine use of processed electroencephalogram can be a great training opportunity and improve accuracy of waveform interpretation among anaesthetists in training. In high-risk cases, extending routine use of depth of anaesthesia monitoring to patients receiving volatile anaesthesia could improve outcomes by promoting a more individualised anaesthetic. It could reduce the probability of accidental awareness in general anaesthesia or excessive depth of anaesthesia, but this must be weighed against the costs of its routine use.

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