Using the bispectral index for anaesthesia

Sir,

The editorial by Gan and Habib provides an excellent overview of the clinical utility of the bispectral index (vol 63(2), 2002, p. 68). For the clinician it is important to fully understand how the bispectral index relates to anaesthesia.

Understanding the mechanism(s) providing the state of anaesthesia remains a 'holy grail'. Lord Kelvin aptly stated 'When you can measure what you are talking about and express it in numbers, you know something about it: but when you can not…your knowledge is of a meagre and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely… advanced to the stage of science'.

Many advances have been made over the past few years that have brought us closer to understanding anaesthesia. At the molecular level Franks and Lieb focused our attention on the protein fraction of the cellular membrane (Franks and Lieb, 1984, 1994). This has led to numerous investigators concentrating on portions of the γ-aminobutyric acid (GABA) receptor as playing a central role in the mechanism of volatile anaesthetics (Tanelian et al, 1993).

At the same time Rampil (1994) and Antognini and Schwartz (1993) demonstrated that the prevention of movement by volatile anaesthetics was caused by an action of the volatile anaesthetic at the level of the spinal cord. This has prompted the suggestion that the state of anaesthesia may be provided by a dual mechanism; consciousness through an action in the brain and prevention of movement by an action on the spinal cord (Eger et al, 1997).

This hypothesis is further supported by several studies that defined the interaction between volatile anaesthetics and opioids (McEwan et al, 1993; Lang et al, 1996). In these studies opioids were only able to reduce the minimum alveolar concentration (MAC) of the volatile anaesthetic to its MAC_{awake} concentration. This implies that anaesthesia has two distinct components; first the ability to render a patient unconscious (at a MAC_{awake} concentration) and second the ability to prevent the noxious stimuli of surgery from reaching the brain and causing arousal (by the volatile anaesthetics at a MAC concentration, opioids or local/regional anaesthesia).

The bispectral index is derived entirely from electrical activity of the brain and thus can only at best directly monitor that component of anaesthesia that is provided within the brain. At any moment the bispectral index reflects the state of consciousness at that moment and cannot predict the impact of a noxious stimulus on the state of consciousness or arousal. Thus the bispectral index does not measure anaesthesia itself but does measure one component of the anaesthetic state.

The bispectral index must therefore be interpreted with cognisance of the degree of stimulation applied to the patient and amount of analgesia present. When this important distinction is accepted by the clinician the bispectral index, as described by Gan and Habib, becomes a very valuable tool to the clinician in titrating the drugs used to provide anaesthesia and helps to optimize the recovery from anaesthesia.

The Physiometrix™ (N. Billerica, MA) monitor which provides a parameter also derived from the electroencephalogram and the Alaris™ (Fremont, CA) monitor which provides a parameter derived from the auditory evoked potential have also been recently approved by the Food and Drug Administration in the United States. These two monitors potentially provide similar information.

The bispectral index has created a very important step forward in our ability to monitor the state of anaesthesia and, like non-invasive blood pressure measurement, it provides an important monitoring tool in the armamentarium of the anaesthesiologist.

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