

3. Bruhn J, Myles PS, Sneyd R, Struys MMRF. Depth of anaesthesia monitoring: what's available, what's validated and what's next? *Br J Anaesth* 2006; 97: 85–94.
4. Barr G, Anderson RE, Öwall A, Jakobsson JG. Effects on the bispectral index during medium–high dose fentanyl

induction with or without propofol supplement. *Acta Anaesthesiol Scand* 2000; 44: 807–811.

5. Myles PS, Leslie K, McNeil J, Forbes A, Chan MT. Bispectral index monitoring to prevent awareness during anaesthesia: the B-Aware randomised controlled trial. *Lancet* 2004; 363: 1757–1763.

Reply

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EDITOR:

We thank Dr McCahon and colleagues for their interest in our study [1]. Dr McCahon enquires whether the effect of ephedrine on bispectral index scores (BIS) values were clinically significant or not. In this study, we examined whether ephedrine increased BIS values during propofol anaesthesia as it does during sevoflurane anaesthesia [2] and whether ephedrine decreased propofol concentrations.

Johnson and colleagues [3] reported arousal following isoprenaline administration during propofol anaesthesia. They also examined the effect of intravenous epinephrine on BIS and sedation, reporting that mean BIS values increased from 63 to 76 and exogenous catecholamines seemed to display an arousal effect [4]. This could be due to changes in neurotransmitter levels in the brain. The adrenergic system has a role to play in the process of arousal from anaesthesia, and this has been previously demonstrated [5]. β -receptors in the reticular-activating system interact with the information processing in the thalamus. However, another possible explanation that propofol concentration decreased due to increased cardiac output on administration of a catecholamine had not been examined. In our previous study, we showed decreases in propofol concentration with increased cardiac output following dopamine administration [6].

Ephedrine exerts a potent stimulating effect on the central nervous system [7]. Ishiyama and colleagues [2] reported that ephedrine increased BIS during sevoflurane anaesthesia. We examined the effect of ephedrine on propofol concentrations and on BIS. Our study showed that ephedrine increased BIS to >60 in eight of 20 patients without changing the propofol concentrations. In our study, post-operative interviews revealed that there were

no patients who had any recall during the surgical procedure. No other study reports arousal following ephedrine administration. As suggested by McCahon and colleagues, the clinical significance in the effect of ephedrine on BIS is not clear from our study. Further work on anaesthetic depth is required concerning the clinical significance of the effect of drugs that act on the central nervous system.

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Reference

1. Takizawa D, Takizawa E, Miyoshi S *et al.* The effect of ephedrine and phenylephrine on BIS values during propofol anaesthesia. *Eur J Anaesthesiol* 2006; 23: 654–657.
2. Ishiyama T, Oguchi T, Iijima T, Matsukawa T, Kashimoto S, Kumazawa T. Ephedrine, but not phenylephrine, increases bispectral index values during combined general and epidural anaesthesia. *Anesth Analg* 2003; 97: 780–784.
3. Johnson IA, Andrzejowski J, Sikiotis L. Arousal following isoprenaline. *Anaesth Intens Care* 1999; 27: 221.
4. Andrzejowski J, Sleigh JW, Johnson IA, Sikiotis L. The effect of intravenous epinephrine on the bispectral index and sedation. *Anaesthesia* 2000; 55: 761–763.
5. Berridge CW, Foote SL. Enhancement of behavioral and encephalographic indices of waking following stimulation of noradrenergic beta-receptors within the medial septal region of the basal forebrain. *J Neurosci* 1996; 16: 6999–7009.
6. Takizawa D, Nishikawa K, Sato E *et al.* A dopamine infusion decreases propofol concentration during epidural blockade under general anaesthesia. *Can J Anaesth* 2005; 52: 463–466.
7. Malec D, Langwinski R. Anticataleptic action of psychostimulating drugs and serotonin in brain. *Acta Physiol Pol* 1979; 30: 589–595.

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