Use of BIS (Bi Spectral Index) for Sedation Monitoring in a Morbidly Obese Patient

Dr Giju George, Mrs Laura Kaura, Mrs JA Macpherson
Liverpool University Dental Hospital

Propofol is a short acting hypnotic agent and has many uses both in sedation and general anaesthesia. In sub-anaesthetic doses it has useful sedative and anxiolytic properties[1]. It may be administered by continuous infusion or by Target Controlled Infusion (TCI) systems. The TCI infusion pump incorporates a pharmacokinetic model to calculate and deliver enough propofol to maintain a stable concentration of drug in a patient and maintain an optimum level of sedation[2]. The anaesthetist administering the drug uses a TCI (target controlled infusion) pump which adjusts the rate of delivery according to a pharmacokinetic/pharmacodynamics model[3], of which there are several models which have been shown to be clinically effective[4].

Figure 1: Graseby® Diprifusor pump

The bispectral index (BIS) interprets electroencephalographic activity and may be used to predict level of sedation and loss of consciousness in both general anaesthesia and sedation. It can be used to measure the level of responsiveness of a patient and predict the loss of consciousness[5]. A BIS value of 90-100 is an awake state; 71-90, light to moderate sedation; 61-70, moderate sedation and 45-60, hypnosis suitable for surgery[6]. An electroencephalogram is detected utilising three electrodes placed on the frontotemporal region. The analog signal is then digitised and filtered and the signal mathematically processed with bispectral analysis[7].

Figure 2: BIS monitoring equipment

Clinical Case

GC was a 27 year old male with a medical history of depression, obesity, needle phobia and dental anxiety. His height was 182cm, weight 178.7kg and BMI 53. GC was referred to Liverpool University Dental Hospital by his general dental practitioner for extraction of several teeth under intravenous sedation. The patient was diagnosed with irreversible pulpitis due to unrestorable 16, 25, and 36.

Figure 3: GC pre-op OPG

Risks and benefits of surgical removal of teeth under intravenous sedation were explained and GC returned to the hospital on a subsequent day having abstained from liquids and solids for six hours.

The patient was laid supine on a trolley and a cannula inserted by the anaesthetic team. The BIS electrode was applied to the frontotemporal region, then an initial dose of 3mg midazolam was given intravenously before TCI propofol (1%) was administered.

Supplemental oxygen was given via nasal specs at a flow rate of 2L/min. The anaesthetic team monitored the patient throughout the procedure using the BIS monitor, pulse oximetry and clinical assessment.

Propofol TCI using Graseby® Diprifusor pump was started at Cpt (target plasma concentration) of 1.5 microgram/ml. Verbal contact was maintained throughout the procedure. The maximum targeted dose was 2.2 microgram / ml. The total dose used for the 1 hour procedure was 500 mg of Propofol .

25 and 36 were routine forceps extractions and 16 was removed surgically. Co-operation throughout the procedure was excellent and treatment was carried out unremarkably.

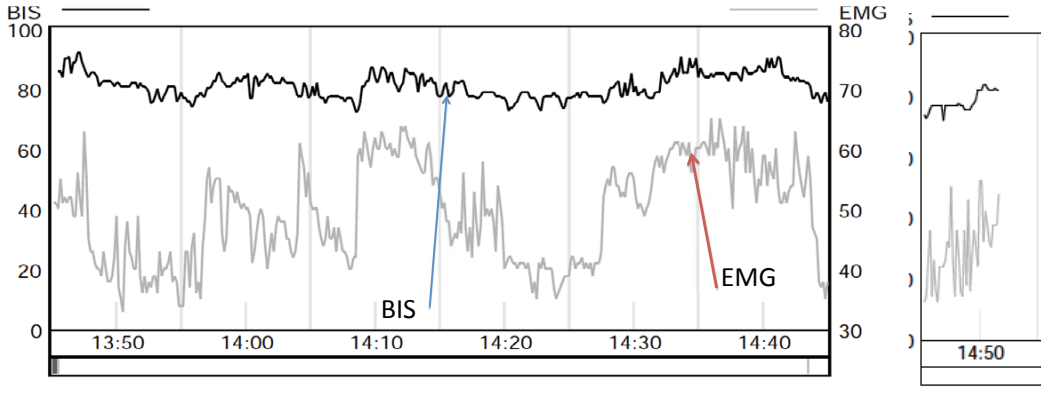

Figure 4: BIS tracing

Discussion

This patient was morbidly obese and very anxious. The use of midazolam alone would mean titration of large amounts per kg body weight of midazolam and this risks re-sedation at later point in the day even if flumazenil is used in the clinic.

Pharmacokinetics of drugs in obese patients vary according to Vd (volume of distribution), Cl (clearance) and protein binding. Propofol is highly lipophilic but does not accumulate and it has been suggested to use the dose according to TBW (total body weight). This means administering large amounts of propofol for induction of anaesthesia. In TCI models, Marsh model is based on actual or Total Body weight and the Schnider Model uses the James Equation to calculate lBW (lean body weight). [8,9]
A paper published by Anderson et al concluded that allometric model using TBW was superior to other size descriptors [9]
However there are several new models and it could be concluded that a combination of parameters namely Weight, height and lean body mass and gender used together are a better profile than any individual parameter.
The propofol was used in targeted doses using grasby pump and monitoring levels of sedation / consciousness with BIS. The margins of safety are proposedly much higher using this technique with specific monitoring and targeted infusions

The use of Propofol and significantly low doses could be attributed to the monitoring of EMG and BIS values throughout and titrated to obtain satisfactory levels of conscious sedation.
This case demonstrates the potential use for BIS monitoring in obese patients receiving TCI propofol for more complex dental procedures such as surgical exodontia.

Future considerations

Further cases using the above demonstrated technique would be useful to demonstrate the eifficacy of this technique.

References

1. Oei-Lim VLB, White M, Kalkman CJ, Engbers FHM, Makkes PC, Ooms WG. Pharmacokinetics of propofol during conscious sedation using target-controlled infusion in anxious patients undergoing dental treatment. *Br. J. Anaesth.* 1998; **80**: 324-331
2. McMurray TJ, Johnston JR, Milligan KR, Grant IS, Mackenzie SJ, Servin F, Janvier G, Glen JB. Propofol sedation using Diprifusor™ target-controlled infusion in adult intensive care unit patients. *Anaesthesia* 2004; **59**: 636-641
3. Barakat AR, Sutcliffe N, Schwab M. Effect site concentration during propofol TCI sedation: a comparison of sedation score with two pharmacokinetic models. *Anaesthesia* 2007; **62**: 661-666
4. Coetzee JF, Glen JB, Wium CA, Boshoff L. Pharmacokinetic model selection for target controlled infusions of propofol. *Anaesthesiology* 1995; **82**: 1328-1345
5. Sandler, NA. The use of bispectral analysis to monitor outpatient sedation. *Anesth Prog* 2000; **47**: 72-83
6. Yeganeh N, Roshani B, Almasi A, Jamshidi N. Correlation between bispectoral index and predicted effect-site concentration of propofol in different levels of target-controlled, propofol induced sedation in healthy volunteers. *Arch Iran Med* 2010; **13**: 126-134
7. Garcia JM, Marcos AV, Lozano AR, Garcia CG. Utility of bispectral index monitoring during intravenous sedation in the dental office. *Int J Oral Maxillofac Implants* 2012; **27**: 375-382
8. Haberland CM, Baker S, Liu H. Bispectral index monitoring of sedation depth in pediatric dental patients. *Anesth Prog* 2011; **58**: 66-72
9. Contin Educ Anaesth Crit Care Pain (2004) 4 (5): 152-155 Luc EC De Baerdemaejer, Eric P Mortier, Michael MRF Struys.

Acknowledgements
NIHR