Persistent low bispectral index values with propofol in a patient of cirrhosis

Dear Editor,

Current practice in anesthesiology is based on multimodal-monitoring. One such parameter includes a bispectral index (BIS) for determining the optimal depth of anesthesia. This noninvasive modality holds more importance during total intravenous anesthesia (TIVA) and aids in avoiding underdosing and overdosing of drugs. Herein, we report a case in which a conventional maintenance anesthetic dose of propofol produced extremely low BIS in a patient with cirrhosis of the liver.

A 50-year-old male (80 kg, 178 cm) was posted for corrective surgery of cervicothoracic kyphosis (C7-T4). The patient was a known case of chronic hepatitis C (genotype 3)-related cirrhosis (Child-Turcotte-Pugh score 5/15, Class A) and consequent portal hypertension. His liver function tests

showed alanine aminotransferase 123 U/L (0–50 U/L), aspartate aminotransferase 74 U/L (0–50 U/L), alkaline phosphatase 89 U/L (80–240 U/L), bilirubin 0.8 mg/Dl, and albumin 3.7 mg/dL. In the operating room, his baseline blood pressure, heart rate, and percentage of oxygen saturation were 130/80 mmHg, 80/min and 98–99% on room air, respectively. Besides, the BIS sensor was also applied and the value recorded was 98–99 in the awake state. Induction of general anesthesia was achieved with fentanyl 150 μg and propofol 120 mg titrated to the loss of verbal responsiveness. The lowest BIS value reached after induction was 47. Atracurium 40 mg was used for the facilitation of tracheal intubation. Anesthesia was maintained with O_2:Air (1:1) mixture, fentanyl (1 μg/kg/h) and propofol titrated to maintain BIS from 40–50. No muscle relaxant (MR) was administered further because of motor evoked potential (MEP) monitoring. We initiated propofol infusion at a dose of 100 μg/kg/min. At this rate of propofol infusion, the BIS value dropped below 15 (12–13) with suppression ratio (SR) of 65–70%. Hence, we reduced the rate of propofol to 70 μg/kg/min keeping the fentanyl infusion rate constant. Consequently, the BIS value increased to 23–25 with an SR of 30–35%. We further reduced the dose of propofol to 60 μg/kg/min. This time, BIS increased up to 33–35 with an SR of 18–20%. Further reducing the dose of propofol to 50 μg/kg/min allowed BIS to increase up to 42 (41–43) with an SR of 5–7%. The same dose was continued for the rest of the surgery. We did not further reduce the dose in the fear of bucking and coughing on the endotracheal tube in the absence of MR. On being interviewed after tracheal extubation and in the postoperative period, the patient did not complain of any awareness of the intraoperative period.

In our case, we excluded the common intraoperative causes of low BIS and burst suppression such as hypotension, hypothermia, hypoxia, hypoglycemia, and metabolic abnormalities. Further, since our patient had intact sensorium in the preoperative and postoperative periods without any neurological deficit, new-onset cerebral injury, and hepatic encephalopathy were excluded.[1] Moreover, our patient had normal serum ammonia levels preoperatively.

In our case, BIS values increased and SR decreased respectively as we reduced the dose of propofol and thus showed good correlation. All BIS values were interpreted when signal quality index and electromyographic activity were 100% and <25 dB respectively. Notably, the dose of propofol used during maintenance of TIVA was far below the conventional dose. This phenomenon is difficult to explain as the pharmacokinetics of propofol in patients with liver dysfunction is not clear. One possible explanation for the reduced dose of propofol may be due to decreased metabolism of propofol owing to limited hepatic reserve.[1] Besides, patients with cirrhosis may have increased sensitivity to propofol.[2] In a study by Wu *et al*., the authors demonstrated that patients with chronic virus-related liver dysfunction had low propofol requirements.[3] Moreover, end-stage liver disease has also been associated with significantly prolonged time to recovery after propofol infusion.[4] Another possibility of increased sensitivity to propofol in our case could be due to genetic susceptibility.

In our case, the dose of fentanyl was kept constant throughout the surgery; therefore, it has a little potential influence on BIS. Moreover, the metabolism of fentanyl is not significantly altered in patients with liver disease.[5] Thus, BIS monitoring can be a useful guide to allow rational administration of propofol, provide the optimal depth of anesthesia and facilitate rapid recovery in this population. Ideally, a target-controlled infusion (TCI) approach should be used in the case of TIVA, however, in the absence of its availability, the BIS monitor should be used to guide the depth of anesthesia with TIVA when weight-based dose regimen is used. The use of TIVA without BIS is entirely unreliable and this is further compounded by the presence of hepatic or renal disease due to altered pharmacokinetics of the drug as in this particular case.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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