



Can Bispectral Index be Used in the Diagnosis and Treatment of Non-convulsive Status Epilepticus in Children?

Bispektral İndeks Çocuklarda Non-konvülsif Statüs Epileptikusun Tanı ve Tedavisinde Kullanılabilir mi?

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Dear Editor,

Bispectral index (BIS) which is used more in evaluating sedation deepness in anesthesia, can also be used in the evaluation of sedation deepness in pediatric intensive care units. Withholding a BIS level below 60, cognizance is reduced therefore patients would be monitored at safe intervals.¹ BIS analyses electroencephalographic (EEG) signals through algorithms to value patients' consciousness levels. BIS levels are between 0 to 100. "Zero" value means no brain activity, "0-20" levels mean burst suppression, "20-40" levels mean deep hypnotic state, "40-60" levels mean general anesthesia state, 60-80 levels mean sedation, and "100" value means awoken state. BIS pediatric sensors are available for measuring brain activity by detecting low-voltage EEG waves. Anesthetic agents, age, hypothermia, neurological disturbances, and interactions with medical devices can affect BIS evaluation.

A 7-year-old girl diagnosed with febrile infection-related epilepsy syndrome was put in a barbiturate coma because of refractory status epilepticus. In the patients' follow-up monitored by BIS, the patient's BIS levels are increased to around 90 while levels are around 20-30 even though the patient wasn't awakened and didn't have convulsion. When dormicum intravenous (IV) bolus (0.1 mg/kg) was given to the patient, levels decreased to around 70 levels, and after propofol IV bolus (3 mg/kg) and propofol infusion rate increased to 4 mg/kg/hr, BIS levels are decreased to around 25-30. Seizure patterns in EEG are seen consistent with BIS levels. This patient's non-convulsive seizures and treatment

efficiency and burst suppression competency are obtained by drug titration using BIS.

A 12-year-old patient who was receiving supportive treatments for earthquake related crush syndrome, sepsis and multiorgan failure developed refractory status epilepticus and sudden increases were detected in the patient's BIS level from 30 to 90 during EEG monitorization. Readings in continuous EEG monitorization were consistent with seizures. Non-convulsive status epilepticus treatment is titrated by holding BIS levels below 40 when continuous EEG monitorization can't be done.

Kaisti et al.² saw consistency between sudden increases in BIS levels and EEG waves during sevoflurane-induced anesthesia in 2 healthy patients when seizure activity is seen in EEG. Correlation between EEG and BIS was shown in 8 patients who were put in barbiturate coma in Prins et al.'s³ study which emphasized the value of the usage of BIS for easy monitoring in a patient whose basal EEG was seen. BIS that can distinguish seizures can also be used to differentiate pseudo-seizure.⁴ EEG signals are recorded 0.5-30 Hz frequency band while electromyogram (EMG) signals are recorded 30-300 Hz frequency band. BIS uses EEG signals up to 47 Hz. Hence, low-frequency EMG activity can overestimate BIS. This fact defined the patient as a temporary false negative. In these situations, muscle relaxants must be given. Thus, interpreting BIS results must be done carefully.⁵

In conclusion, in pediatric intensive care units where continuous EEG monitorization can't be done, BIS can be used in patients with non-convulsive status epilepticus follow-

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up and drug titration. We think BIS has a benefit in deciding EEG repeat, whether there is a burst suppression or else, and the treatment method and advice using BIS in non-convulsive status epilepticus follow-up. There is a need for more qualified studies on the use of BIS in non-convulsive status epilepticus in children.

Keywords: Bispectral index, children, non-convulsive status epilepticus, pediatric intensive care

Anahtar Kelimeler: Bispektral indeks, çocuk, non-konvülfik statüs epileptikus, çocuk yoğun bakım

Ethics

Authorship Contributions

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References

1. Avidan MS, Zhang L, Burnside BA, Finkel KJ, Searleman AC, et al. Anesthesia awareness and the bispectral index. *N Engl J Med.* 2008;13:1097-108.
2. Kaisti KK, Jääskeläinen SK, Rinne JO, Metsähonkala L, Scheinin H. Epileptiform discharges during 2 MAC sevoflurane anaesthesia in two healthy volunteers. *Anesthesiology.* 1999;91:1952-55.
3. Prins SA, de Hoog M, Blok JH, Tibboel D, Visser GH. Continuous noninvasive monitoring of barbiturate coma in critically ill children using the Bispectral index monitor. *Crit Care.* 2007;11:R108.
4. Donnelly B, Boyd V. Use of the bispectral index (BIS) monitor to aid in the diagnosis of pseudoseizures. *Br J Anaesth.* 2006;96:538-9.
5. Escudero D, Otero J, Muñoz G, Gonzalo JA, Calleja C, et al. The Bispectral Index Scale: its use in the detection of brain death. *Transplant Proc.* 2005;37:3661-3.