

Isoelectric Electroencephalography in Infants and Toddlers during Anesthesia for Surgery: An International Observational Study

Yuan I, Xu T, Skowno J, Zhang B, Davidson A, von Ungern-Sternberg BS, Sommerfield D, Zhang J, Song X, Zhang M, Zhao P, Liu H, Jiang Y, Zuo Y, de Graaff JC, Vutskits L, Olbrecht VA, Szmuk P, Kurth CD; BRAIN Collaborative Investigators. *Anesthesiology*. 2022 Aug 1;137(2):187-200. doi: 10.1097/ALN.0000000000004262.

Background: Intraoperative isoelectric electroencephalography (EEG) has been associated with hypotension and postoperative delirium in adults. This international prospective observational study sought to determine the prevalence of isoelectric EEG in young children during anesthesia. The authors hypothesized that the prevalence of isoelectric events would be common worldwide and associated with certain anesthetic practices and intraoperative hypotension.

Methods: Fifteen hospitals enrolled patients age 36 months or younger for surgery using sevoflurane or propofol anesthetic. Frontal four-channel EEG was recorded for isoelectric events. Demographics, anesthetic, emergence behavior, and Pediatric Quality of Life variables were analyzed for association with isoelectric events.

Results: Isoelectric events occurred in 32% (206 of 648) of patients, varied significantly among sites (9 to 88%), and were most prevalent during pre-incision (117 of 628; 19%) and surgical maintenance (117 of 643; 18%). Isoelectric events were more likely with infants younger than 3 months (odds ratio, 4.4; 95% CI, 2.57 to 7.4; $P < 0.001$), endotracheal tube use (odds ratio, 1.78; 95% CI, 1.16 to 2.73; $P = 0.008$), and propofol bolus for airway placement after sevoflurane induction (odds ratio, 2.92; 95% CI, 1.78 to 4.8; $P < 0.001$), and less likely with use of muscle relaxant for intubation (odds ratio, 0.67; 95% CI, 0.46 to 0.99; $P = 0.046$). Expired sevoflurane was higher in patients with isoelectric events during preincision (mean difference, 0.2%; 95% CI, 0.1 to 0.4; $P = 0.005$) and surgical maintenance (mean difference, 0.2%; 95% CI, 0.1 to 0.3; $P = 0.002$). Isoelectric events were associated with moderate (8 of 12, 67%) and severe hypotension (11 of 18, 61%) during preincision (odds ratio, 4.6; 95% CI, 1.30 to 16.1; $P = 0.018$) (odds ratio, 3.54; 95% CI, 1.27 to 9.9; $P = 0.015$) and surgical maintenance (odds ratio, 3.64; 95% CI, 1.71 to 7.8; $P = 0.001$) (odds ratio, 7.1; 95% CI, 1.78 to 28.1; $P = 0.005$), and lower Pediatric Quality of Life scores at baseline in patients 0 to 12 months (median of differences, -3.5; 95% CI, -6.2 to -0.7; $P = 0.008$) and 25 to 36 months (median of differences, -6.3; 95% CI, -10.4 to -2.1; $P = 0.003$) and 30-day follow-up in 0 to 12 months (median of differences, -2.8; 95% CI, -4.9 to 0; $P = 0.036$). Isoelectric events were not associated with emergence behavior or anesthetic (sevoflurane vs. propofol).

Conclusions: Isoelectric events were common worldwide in young children during anesthesia and associated with age, specific anesthetic practices, and intraoperative hypotension.