The Dynamic Relationship Between End-Tidal Sevoflurane Concentrations, Bispectral Index, and Cerebral State Index in Children

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Abstract

BACKGROUND: To guide anesthetic administration with electroencephalogram monitors in children, an adequate characterization of the anesthetic effect measured by these monitors in this population is needed. We sought to quantify and compare the dynamic profile of sevoflurane's effect measured with the cerebral state index (CSI) and the bispectral index (BIS) in children. METHODS: Fifteen healthy children, aged 3–15 yr, scheduled to undergo minor surgery were prospectively studied. During the simultaneous recording of CSI and BIS, the sevoflurane vaporizer was set at 6 vol [percent] for 5 min and then decreased. End-tidal concentrations (CET) were measured. The CET–sevoflurane effect–site concentration equilibration and pharmacodynamics were modeled. Goodness of fit between models was compared. Data are typical value (coefficient of variation). RESULTS: Within the anesthetic depth range studied, the rate of change of sevoflurane's effect expressed as the effect–site equilibration half-life (t1[slash]2 ke0) was slower with the CSI [2.0 (14) min] than with BIS [1.2 (53) min] (P ■ 0.05). The estimated baseline effect of BIS and CSI before sevoflurane administration (E0) was 84 (39) for CSI and 87 (7) for BIS (NS). The sensitivity to sevoflurane hypnotic effect expressed in the C50 [steady-state CET eliciting half of the maximum response (Emax)] was 2.1 (68) [percent] with CSI and 2.1 (16)[percent] with BIS (NS). The Emax with CSI 45 (0) was higher than that with BIS 27 (39) (P ■ 0.05). The population prediction error was significantly better for BIS (0.7 26.9) than for CSI (3.0 178.6) (P ■ 0.05). CONCLUSIONS: In children, the t1[slash]2 ke0 of sevoflurane and the pharmacodynamics of sevoflurane were quantified and the results were entirely dependent on the monitor used to measure its hypnotic effect. Within the anesthetic depth range studied, the rate of change of sevoflurane's effect was slower with the CSI. To adequately guide sevoflurane administration with these monitors in children, these differences should be considered.