

■ CORRESPONDENCE

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Electroencephalographic Monitoring during Cardiac Surgery

To the Editor:—The following comments relate to the recent article by Bashein *et al.*¹ and accompanying editorial by Levy.² Our observations are based on successful electroencephalographic (EEG) monitoring in more than 600 cardiac surgery cases, including a prospective controlled study involving 100 patients.³ This study confirmed the earlier work of Arom *et al.*,⁴ which demonstrated a decrease in minor postoperative neurologic dysfunction through the use of interventionist EEG monitoring. In both studies, the EEG criterion for developing cerebrocortical dysfunction was a loss of high-frequency or further augmentation in low-frequency activity. Also, both used increased perfusion pressure to correct the EEG abnormality and prevent the development of postoperative neurologic dysfunction. Our study group without benefit of the EEG-based intervention experienced a 29% rate of dysfunction, which was strikingly similar to the 36% incidence in the earlier report from Townes *et al.*⁵ In contrast, our intervention group experienced only a 4% incidence. Subsequently, analysis of our entire database indicated a 25% incidence of EEG changes prompting intervention, and the postoperative dysfunction rate had decreased even further to 2.5%.

Discrepancies between these successes and the failure of Bashein *et al.* seem related to methodologic differences. The successful approaches used a minimum of eight bipolar EEG channels. Statistically significant changes occurring during bypass were detected by continuous online comparison with an individualized reference baseline obtained before insertion of the perfusion cannulae. Measures of EEG amplitude (power), both absolute and fractional, utilized the conventional frequency bands (δ , θ , α , β), in addition to the 1-Hz segments of the compressed spectral array (CSA) or density-modulated spectral array (DSA) displays. Compared with CSA or DSA, band spectral analysis decreases variance up to fivefold, thus increasing the opportunity for detection of statistical change. Additionally, in our study, the DSA was used to verify the absence of roller pump artifactual contamination. It had been virtually eliminated with the introduction of centrifugal pumps.

Since completion of the study, our database comprising a "prohibitively large sample size"¹ has been used to illustrate the value of EEG for identifying the onset of *major* neurologic injury. EEG change signifying severe brain dysfunction, as indicated by a greater than 3 standard deviation decrease in total power from a pre-bypass reference unrelated to cooling, was noted in 19 cases (12 deaths, 1 stroke, 1 marked disorientation). The deaths were all caused by selective brain damage or multisystem organ failure. In only one of 600 cases did a postoperative neurologic deficit appear without intraoperative EEG changes. This was a lacunar infarct with no evidence of cortical involvement.

The recent published reports of successful EEG monitoring during cardiac surgery are clearly at variance with Levy's editorial comments regarding its diagnostic value. Although this opinion may be justified regarding his own experience and the results of Bashein *et al.*, an unqualified rejection that seems to include the newer, statistically based EEG approaches seems unwarranted.

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