

TITLE: EEG CHANGES WITH ALFENTANIL ANESTHESIA
AUTHORS: W.J. Levy, M.D., T. E. McDonnell, M.D.
AFFILIATION: Department of Anesthesiology, University of Pennsylvania,
Philadelphia, PA

Introduction: Alfentanil is a new, synthetic, short-acting narcotic, whose use for the induction of anesthesia has been reported previously. Because the electroencephalographic changes associated with this agent have not been reported, we examined the EEG changes which occur during the induction of anesthesia with a bolus of alfentanil in unpremedicated patients.

Materials and Methods: 14 healthy adults (13 women) gave informed consent and participated in this protocol, which was approved by the institution review committee. After arrival in the operating room, EEG recordings were established, using a common reference electrode montage of F₇ and F₈, to A₁ with A₂ as ground. The recorded bandwidth was 4 - 45 Hz (3 db points). EEG recording was performed during a baseline period of oxygen administration and for at least three minutes following the induction of anesthesia. The initial dose of alfentanil ranged from 75 to 250 microgram/kg, and an additional dose of 50 microgram/kg was given if the patient showed a response to the placement of a nasal airway 90 seconds after the administration of the initial dose. At 30, 60, and 90 seconds after the initial dose, the response to the verbal command "take a deep breath" was also assessed. At 90 seconds, succinylcholine was administered, with intubation 60 seconds later.

Quantitative analysis of the EEG was performed by the calculation of the power spectrum from successive 2-second epochs of data, sampled at 128 Hz. The absolute and relative powers of the total activity and the delta band (0.5 to 4.0 Hz) activity were then calculated. Relative power was normalized by comparing with the total power in the band 0.5 to 32 Hz. Statistical significance was assessed with the paired t-test on the 8 subjects with artifact-free baseline recordings.

Results: A typical study is shown in figure 1. Within 30 seconds of the injection of alfentanil, all subjects showed the abrupt occurrence of high amplitude theta and delta activity bilaterally. The absolute power in the 0.5-4 Hz band increased 25-fold and the relative power in this band increased from 13 to 41%. Total EEG power increased almost 8-fold. All changes were significant at $p < .01$. High-frequency EEG activity was observed following the injection of alfentanil. It uniformly disappeared following the onset of neuromuscular blockade, suggesting that this activity represented contamination of the EEG by muscular artifact.

Three subjects responded to verbal commands at either 30 or 60 seconds, however, the absolute

and relative powers of the EEG activity in this group were not significantly different from the activity of non-responders. Nine patients moved in response to the placement of the airway and received the supplemental dose of alfentanil. No changes in the EEG were observed in response to this second dose. No differences in mean or relative power were observed between responders and non-responders. No patient had recall for laryngoscopy; however, one patient reported recall for the nasal airway. This subject demonstrated a change in EEG in response to the placement of the airway.

Conclusion: The EEG changes observed during the induction of anesthesia with alfentanil in unpremedicated patients are similar to those previously recorded for anesthetic induction with fentanyl or sufentanil. Low-frequency activity predominates, and some muscle-induced high-frequency artifact is seen in patients without neuromuscular blockade. In this study, movement, recall, and EEG change in response to painful stimulation were observed, even though low-frequency EEG activity was present. Accordingly, the presence of these characteristic EEG changes following bolus alfentanil do not provide a reliable assessment of anesthetic depth.

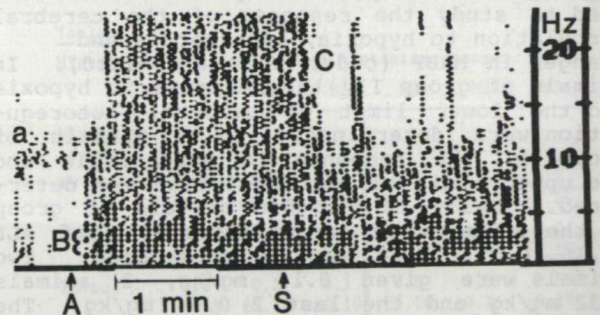


Figure 1. Density-modulated spectral array (D) of the EEG of a typical alfentanil study. Baseline alpha rhythm (a) is at left. Alfentanil is given at (A) producing high-amplitude low frequency activity (dark band at B). High-frequency activity (C) disappears after succinylcholine (S).

References:

1. Sebel PS, Bovill JG, Wauquier A, et al: Effects of high-dose fentanyl anesthesia on the electroencephalogram. *Anesthesiology* 55:203-211, 1981.
2. Sebel PS, Bovill JG, Wauquier A, et al: Electroencephalographic effects of sufentanil anesthesia in man. (Abstr) *Anesthesiology* 55:A254, 1981.