TITLE: DEVELOPMENT OF A MONITORING-FOR-CHANGE ALGORITHM FOR A NEW ANESTHESIA MACHINE

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Previously, two of us introduced the concept of monitoring-for-change algorithms in anesthesia.[1] Recently, a new anesthesia machine has become available which uses this concept in its "alert-zone" system. We initially evaluated the algorithm's performance in a clinical setting. Subsequently, we have improved the performance of the alert-zone system and are currently testing its efficacy.

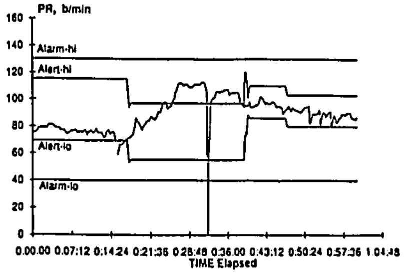
In addition to traditional alarms, alert zones are available which are dynamic and are determined by an internal algorithm. The alert-zone system operates as follows: During a period of relative patient stability, the anesthesiologist can activate the alert-zones. An alert zone is set around a reference value of each variable. The reference value is based on the current value or recent history of the variable. The alert zones are determined as a function of the reference value. When any of the variables change outside of it's alert zone, the anesthesiologist is informed and new reference values may be established.

1. Philip JH and Raemer DB, "A Physiologic Variation Monitor - Keeping the Anesthetist in the Loop." Proceedings of 3rd Space Age Monitoring Conference, Vail, CO, March 1982.

We initially evaluated the anesthesia machine in 45 cases for a cumulative total of 52.2 hours. 52% of the time the alert zone system had been activated by the anesthesiologist. We found 44% of the time a variable was in violation of the alerts. Most of the alerts were attributable to artifactual raw data signals from the measuring instruments, especially CO2 and minute volume.

The software of the anesthesia machine was modified to improve artifact rejection. In addition, we redefined the relationships between the alert-zone limits and their reference values using a delphi procedure. Alert zones typically were defined as an offset plus a proportional component. In addition, we defined three types of alert zone; wide, normal, and tight. An example of the normal alert zone for pulse rate is shown in the figure.

We have begun evaluating the new version of the anesthesia machine and the new alert zones. In 93 cases representing 82.3 hours, the anesthesiologist activated the alert zones 64% of the time. The proportion of time when a variable violated the alert zones was reduced to 34%. The alerts rarely have been artifactual and they have appeared to be clinically appropriate.



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TITLE: COMPUTER-PROCESSED EEG MONITORING FOR ELECTROCONVULSIVE THERAPY (ECT): THE ISSUE OF INTERRATER RELIABILITY OF SEIZURE DURATION

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Treatment of major depression by ECT is invariably equal or superior to that of antidepressant drugs. Furthermore, seizure duration is the most significant variable for therapeutic efficacy. With the introduction of "modified" ECT (i.e., use of intravenous anesthetic drugs, neuromuscular blockade and controlled ventilation), this therapy now significantly involves anesthesiology. The present study addressed the issue of interrater reliability of seizure duration for different measurement strategies.

All consenting patients met the DSM-III-R criteria for a major depressive episode. A total of 15 patients received 115 treatments. For nondominant unilateral and bilateral ECT, brief bipolar pulses were administered using the Multiple-Monitor Electroconvulsive Therapy Apparatus (MECTA Corp., Portland, OR). All patients received intravenously 0.2 mg glycopyrrolate, 3 mg dTC and esmolol (35-140 mg) as a pretreatment, methohexital (40-140 mg) for anesthesia, and succinylcholine (50-150 mg) for neuromuscular blockade. Seizure duration was measured independently by three techniques: (1) duration of tonic-clonic convulsions of one arm with an inflated cuff, (2) single-channel analog EEG recorded by the MECTA, and (3) two-channel computer-processed EEG displayed as a dot-density spectral array (DSA) using the SRD Cerebro Trac 2500+ (Misgav, Israel). In addition, post-hoc "blind" readings were made of each EEG method by two independent investigators.

For the observed values, there was a significant disagreement between the "cuff" method and either of the two EEG methods (cuff= 31.63 ± 2.29 s; single-channel EEG = 51.37 ± 2.92 s; computer-processed EEG =56.23 ±3.09 s; $\bar{x}$±sem; repeated measures, P <0.02). The greatest disparity in measurement of seizure duration was 78 s and occurred between the blind readings of the MECTA. In contrast, this difference was only 14 s for the DSA profiles. The average absolute difference between blind measurements was 4.41 ±0.975 for the MECTA and 1.59 ±0.185 for the DSA profiles (paired t-tests, P <0.001). Furthermore, a greater incidence of the blind readings were similar or identical for the DSA profiles (interrater difference <5 s; 97%) than for the MECTA (81%; McNemar's test; χ^2 =14.73, P<0.001).

The major advantage of computer-processed EEG and EMG is that both the anesthetic and psychiatric events for modified ECT can be continuously monitored, and more easily and consistently interpreted. This includes anesthesia, neuromuscular blockade, seizure duration and recovery from each. Both EEG methods for measuring seizure duration yielded values which exceeded the indirect cuff method by almost the minimally acceptable seizure duration (25s) for therapeutic efficacy. Variation in seizure duration between raters was the least for computer-processed EEG. We conclude that computer-processed EEG (or brain monitors) are superior to conventional techniques, offering several advantages for both research and clinical capabilities related to the management of ECT.