Facilitating Perioperative Beta Blockade: Titration of Anesthetic to Processed Electroencephalogram Parameters.

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Introduction

Despite evidence from randomized trials (1,2) and revisions to professional guidelines (3), beta blockade remains underutilized in the perioperative setting; perhaps because clinicians fear hemodynamic instability which could result from the concurrent administration of beta blockers and volatile anesthetics. Processed EEG monitors may help facilitate perioperative beta blockade by allowing the use of lower volatile anesthetic concentrations, possibly avoiding hypotension.

Methods

After Institutional Review Board approval and obtaining written patient consent, 18 patients undergoing vascular or total joint arthroplasty surgery were randomized to have an EEG-guided (n=8) desflurane anesthetic titrated to a Patient State Index (PSI; Patient State Analyzer 4000, Physiometrix; North Billerica, MA) value of 25-50 or a control EEG-blinded (n=10) desflurane anesthetic titrated by conventional means (heart rate, blood pressure, reflex response, movement, and minimum alveolar concentration of anesthetic). For analgesia and adrenergic stress blockade, all patients received alternating intravenous doses of fentanyl (50mcg) and metoprolol (2.5mg) to maintain heart rate below 80bpm. EEG-guided cases were compared against EEG-blinded cases using the primary endpoints of Patient State Index values and metoprolol administered perioperatively. Initial regression analysis indicated significant associations for further modeling with two sided t-tests, chi-squared analyses, and analyses of covariance.

Results

EEG-guided patients spent significantly less time overanesthetized (4.2% vs. 8.6%, $p<0.0001$) as measured by the Patient State Index, a processed EEG parameter. Though this allowed for a clinically significant increase in beta blockade (3.4mg/hr vs. 1.4mg/hr,) this difference was not statistically significant ($p=0.1452$).

Discussion

Compliance with evidence-based guidelines for perioperative beta blockade remains poor with less than half of highest risk patients receiving such treatment (5). Like perioperative beta blockade, processed EEG monitoring has had limited acceptance and implementation. Intraoperatively, patients with EEG-guided anesthetics spent significantly less time in the over-anesthetized state. EEG guidance has been shown to decrease volatile anesthetic administration (6). In this series of patients, the shallower depth of anesthesia achieved via processed EEG titration of volatile anesthetic was associated with a trend towards increased perioperative beta blockade. Further refinements in processed EEG technology and awareness of its potential applications may help facilitate increased perioperative beta blockade.

(1) N Engl J Med. 1996;335:1713-20; (2) N Engl J Med. 1999;341:1789-94; (3) Anesth Analg. 2002;94:1052-64; (4) N Engl J Med. 2005;353:349-61; (5) Anesthesiology. 2002;97:82-9;
(6) Circulation. 1999;100:1043-9.

Anesthetic Administration	EEG-guided (n=8)	Hemodynamically Guided (n=10)	p-value
Propofol (mg)	205	235	0.5371
Fentanyl (mcg/hr)	87.3	56.6	0.277
Metoprolol (mg/hr)	3.4	1.4	0.1452
Over-anesthetized Patient State Index <25 (sec)	4876 (4%)	10970 (9%)	<0.0001
In-range Patient State Index >25 and <50 (sec)	78219 (67%)	104422 (82%)	<0.0001
Under-anesthetized Patient State Index >50 (sec)	34505 (29%)	12168 (10%)	<0.0001
Average Weighted Patient State Index	48	37.8	0.1611
Average Intraoperative Time (sec)	16335	14436	0.4461
Emergence Time (sec)	369	420	0.7017