

Evaluation of Significance of Bispectral Index As a Monitor of Depth of Anesthesia

Thesis

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AIM OF WORK

To evaluate the significance of bispectral index as a monitor of depth of anesthesia by comparing the bispectral analysis monitor score and stress hormones level and hemodynamic readings at pre-determined intervals throughout the whole surgical procedure. So, if it beneficial we will recommend to widen its use to decrease the incidence of awareness during anesthesia and if not, we will go on searching for other methods to fulfill this target.

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List of Abbreviation

AAI	A-line ARX Index
AANA	American Association of Nurse Anesthetists
ACTH.....	AdrenoCorticoTrophic Hormone
AER(P)	Auditory Evoked Response (Potential)
ANOVA	Analysis of Variance
ARX	Autoregressive model with an exogenous input
ASA	American Society of Anesthesiologists
ASSR	Auditory Steady State Evoked Response
AUC	Area under the Curve
AVP.....	Arginine Vasopressin
BAER	Brainstem Auditory-Evoked Response
BDZ	Benzodiazepines
BIS	Bispectral Index Scale
BSR	Burst Suppression Ratio
CNS	Central Nervous System
CPB	Cardiopulmonary Bypass
CS.....	Cesarean Section
CVS	Cardiovascular System
DoA	Depth of Anesthesia
ECG	Electrocardiogram
EEG	Electroencephalogram
EMG	Electromyogram
ETT	Endotracheal Tube

FDAFood and Drug Administration
GAGeneral Anesthesia
GH Growth Hormone
HRVHeart rate variability
Hz Hertz (cycle/sec)
ID Identification
IDT Induction to Delivery Time
IV Intravenous
JCAHOJoint Commission on Accreditation of
Health Care Organization
LTMLong Time Memory
MACMinimum Alveolar Concentration
MIC Monitor Interface Cable
MLAERMiddle Latency Auditory Evoked Response
N₂O Nitrous Oxide
P value Probability value
PACUPost Anesthesia Care Unit
PETPositron Emission Tomography
PIC Patient Interface Cable
PSAPatient State Analyzer
PSIPatient state Index
PTSDPost Traumatic Stress Disorder
REResponse Entropy
SD Standard Deviation
SEState Entropy
SEFSpectral Edge Frequency
SEMGSpontaneous Surface Electromyogram

SLOCSpontaneous Lower Esophageal
Contractility

SPSSStatistical Package for Social Sciences

SQI Signal Quality Indicator

SSERSomatosensory Evoked Response

STMShort Time Memory

TIVATotal Intravenous Anesthesia

UDTUterine incision to Delivery Time

US United States

USBUniversal Serial Bus

VERVisual Evoked Responses

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INTRODUCTION

Intraoperative awareness is defined as the spontaneous recall of an event occurring during general anesthesia. Awareness during general anesthesia is a problem that has been increasingly recognized since the introduction of muscle relaxants as a component of the anesthetic regimen (*Tsai et al, 2001*).

Patient awareness may take the form of explicit or implicit memory. Explicit memory involves information that is consciously recalled; whereas implicit or indirect memory involves retention of information that may be recalled under hypnosis or psychological testing. Explicit and possibly implicit memory under general anesthesia may result in long-term psychological problems such as anxiety, flashbacks, and sleep disturbances up to post traumatic stress disorder (PTSD). Litigation may also result (*Ghoneim, 2000*).

General anesthesia for caesarean section (CS) is traditionally considered a high risk procedure for awareness

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where the lack for sedative premedications, low inspired concentrations for volatile agents and withholding opioids until after fetal delivery; all of which contribute to the risk of awareness (*Tsai et al, 2001*).

The incidence for awareness in obstetric population is reported to be 0.4% compared to 0.1% to 0.2% in the general anesthetic population (*Ghoneim, 2000*).

A move away from the rigid anesthetic protocols, which were designed to limit drug transmission across the placenta, has reduced the incidence of awareness during CS to approximately 0.26%. Nevertheless, it remains an undesirable complication with potential for the development of PTSD. Thus the objectives of general anesthesia for CS are to keep the mother and fetus adequately oxygenated while limiting fetal drug transmission and maintaining maternal comfort (*Robins and Lyons, 2009*).

The bispectral index, an EEG derived variable for measuring depth of anesthesia, has been shown to be a reliable indicator of the level of consciousness and thus it is useful in

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measuring the hypnotic component of the anesthetic state. The bispectral index has also been shown to be a useful aid for titration of inhaled anesthetics in patients undergoing CS, to insure maternal hypnosis without compromising fetal outcome. BIS index values between 40 and 60 have been recommended to prevent awareness and postoperative recall in CS (*Yeo and Lo, 2002*).

REVIEW OF LITERATURE

Memory and Awareness

Intraoperative recall of awareness is defined as the unexpected, undesirable patient wakefulness during general anesthesia and the subsequent conscious recollection of events, feelings, or sensations specific to that period (*Rungreungvanich et al, 2005*).

Anesthesia awareness usually occurs when the patient is paralyzed with muscle relaxants but hasn't had enough general anesthetic or analgesic to prevent consciousness, or more importantly the sensation of pain and the recall of events. In this situation, the patient may be aware of the pain of surgery, as well as other discomforts as the endotracheal tube. He may also be aware of sounds or conversation in the operating room (*Jones, 1994*).

A patient who is paralyzed but awake will usually have a functioning autonomic nervous system which will result in signs such as increased heart rate and blood pressure (tachycardia & hypertension), as well as pupillary dilatation (mydriasis), sweating, lacrimation in response to pain. Therefore, even though the patients may not be able to directly signal their distress, there are clinical signs of awareness which would be expected to pick up (*Merikle and Rondi, 1993*).

Definition of Memory:

Memory is one of the activities of the human mind, much studied by cognitive psychology. It is the capacity to retain an impression of past experiences. It was defined by *Lefrancois (1995)* as the availability of information and the ability to retrieve it and the previously acquired skills.

Memory is also defined as a set of active processes that encode and store information and rearrange it with