CLINICAL USE OF THE BARM (with a current perspective on awareness monitoring in the operating theatre)

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Conflicts of Interest: Nil
INDICATIONS FOR AWARENESS MONITORING

- ALL PATIENTS?
- ALL NMB BASED TECHNIQUES
- ALL TIVA
- HISTORY OF AWARENESS
- TRAUMA
- GA C/S
- CPB
- HIGH RISK? IVDU PSYCH MORBID ANXIETY BENZOS
AWARENESS: INCIDENCE AND RISKS

• 1:19 000 for all anaesthetics - not for *at risk*
• Female
• Younger adults
• Obesity
• Previous awareness
• Emergencies
• Neuromuscular blockers
AWARENESS: HAVE YOU SEEN IT?

- I HAVE PERSONALLY REPORTED ONE CASE TO MY MDU – AWARENESS OF INTUBATION IN A CAUTIOUS TIVA INDUCTION OF A BARIATRIC PATIENT WITH CO-MORBID CARDIAC INSTABILITY

- PATIENT WAS HAPPY AFTER 2 SESSIONS OF COUNSELLING –NO pEEG AVAILABLE AT THAT HOSPITAL AT THAT TIME -2001
AWARENESS MONITORING NOT NECESSARY DURING INHALATIONAL?

- Private Hospital: Man was awake during tonsillectomy
- EXCLUSIVE: Carleen Frost, The Daily Telegraph
- December 8, 2015 12:00am
AWARENESS MONITORING NOT NECESSARY DURING INHALATIONAL?

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A PATIENT having his tonsils removed at a Sydney hospital lived out a real-life nightmare when he “heard and felt what was happening” during the surgery after the anaesthetist failed to switch on the necessary sedation machine.

The 34-year-old man told staff at the Private Hospital he suffered pain and emotional distress when he found himself awake but unable to properly move or communicate during the procedure in February 2013.

His suffering became apparent during the routine tonsillectomy when staff noticed him twitching and his blood pressure rising.

An inquiry into the incident found that while he had been given a neuromuscular block, the machine to administer an ongoing sedation gas was not turned on at the power point.

Anaesthetist X told investigators he was “multi-tasking” during the surgery and had also checked a message on his mobile phone.

He accepted that it was his responsibility to ensure the machine was switched on and working prior to the commencement of the procedure.

“(The patient) was aware during most of the surgical procedure, which caused him not only significant discomfort but also emotional and psychological distress,” a report into the incident said.

The Medical Council of NSW last week found Dr X guilty of unsatisfactory professional conduct and ordered him to undergo mentoring and complete a daylong course in anaesthesia safety.

Private Hospital did not respond to a request for comment on the matter.
EEG-based Anaesthesia Monitors

- NEUROsense
- IoC-view
- Narcotrend
- aepEX
- BIS
- SEDline
- SNAP
- E-ENTROPY
EEG-based Anaesthesia Monitors

• All other current monitors use methods which extract features from EEG signals which correlate with behavioural assessments of sedation and hypnosis
• The analysis methods are therefore not based on physiological laws or equations
• Time delays of 14 to 155 seconds (between changes in patient state and the displayed measure) have been reported for the different devices (e.g. ~30sec for BIS)
• BARM has a realm of only 2 Seconds in detecting shifts in levels of consciousness
Brain Anaesthesia Response (BAR) Monitor
Brain Anaesthesia Response (BAR) Monitor

• The BAR Monitor uses processed electroencephalography (pEEG) to monitor the brain response to anaesthetic and sedative agents

• The BAR Monitor is the only monitor to use EEG analysis based on a model of brain electrical activity (Liley Model)

• Other monitors use methods that are empirical and not based on a physical law or equation
How is the BAR Monitor Different?:

• A physiologically inspired method of EEG analysis allows more accurate monitoring during anaesthesia
• BAR indices provide measures of cortical as well as sub-cortical mechanisms
• Wider range of anaesthetic agents can be monitored
• Shifts in levels of consciousness reflected with only a 2-second delay
BAR Indices

- The state of the cortex as well as the magnitude of the subcortical input are quantified using two measures:
  - Composite Cortical State (CCS)
  - Cortical Input (CI)
BAR Indices

• Composite Cortical State (CCS)
  o represents the resonant state of the cortical filter
  o Is shown to be a measure of hypnosis
• Cortical Input (CI)
  o is a measure of input to the cortex from subcortical areas
  o Is shown to be a measure of analgesia
BAR Monitor Display
BAR Studies
Validation

• Validation of the BAR Monitoring System during anaesthesia for cardiac surgery using two different doses of fentanyl
• Twenty-five patients scheduled to undergo elective first-time coronary artery bypass surgery (CABG) were tested at St. Vincent’s Hospital Melbourne

Shoushtarian et al. (2015), Journal of Clinical Monitoring and Computing
BAR Validation

- Patients were randomised to receive a low or medium dose of fentanyl:
  - Fentanyl low dose (FLD, 12μg/kg)
  - Fentanyl moderate dose (FMD, 24μg/kg)

- Study period:
BAR Studies

- Effect of propofol and remifentanil on frontal electroencephalographic activity
- 45 patients randomised to receive remifentanil levels of 0, 2 or 4 ng/ml
- All patients received stepwise-increased targeted effect-site concentrations of propofol

Liley et al. (2010), Anesthesiology
Sleigh 2010, Anesthesiology (editorial)
BAR our patients at SLC AND SPH

- Elective arthroscopic shoulders: ISCB/Tci Remifentanil/Propofol
- (Complete Blocks)
- Elective arthroscopic knees/ ACL (No Block or FNB ) Tci Remifentanil/Propofol
- Elective TSR/TKR with continuous ISCB or FNB Tci Remifentanil/Propofol
BAR our patients

- We also tried some inhalational cases superimposed on our basic block techniques and data were equally resilient.
- In addition we performed two cases with our OFA mixture of Lignocaine/Ketamine/Precedex with profound NMB and we were able to achieve accuracy, predictability and a smooth wake-up.
BAR PRO-CON

- Remarkably stable and responsive signal permitted a new level of “belief” in the awareness monitoring technique and allowed us to run cases at say 45 with confidence in early tapering of TCI
- Ease of application of sensor
- User-friendly interface

- Bulky “sim card”
- Unable to print but can store to USB

- Next generation: modules for GE and other common machines/monitoring systems
BAR Monitor Display
Session started 16:45 13 Mar 2018

Stop Session

47

Seconds

Open File
Mark Log

Monitor Setup

18:01:34
BAR Monitor Benefits

Patient benefits

• Reduced risk of waking up or having recollections of surgical procedures or dreams during the surgical procedure

• Reduced risk of receiving too high a dose of anaesthetic agent which can lead to post-operative nausea and discomfort or permanent injury or death in the most severe cases

• Significantly improved outcomes particularly for patients at high risk of awareness
BAR Monitor Benefits

Benefits to Anaesthetists

• Facilitate the use of the optimal dose of anaesthetic agent
• Facilitate the delivery of higher quality and more reliable service to hospitals and patients
• reduce the risk of litigation due to patients experiencing awareness during surgery
BAR Monitor Benefits

Benefits to Hospital/ Day Clinics

• Improved likelihood of delivering a better service to patients

• Optimising the dose of anaesthetic agent used can reduce the use of anaesthetic agents, and improve patient turn-around times and lead to cost savings

• Reduced risk of litigation
BAR Monitor
Next Generation Monitor of Anaesthesia

• A physiologically inspired method of EEG analysis allows more accurate monitoring during anaesthesia
• BAR indices
• CCS and CI provide measures of cortical as well as sub-cortical mechanisms
• Shifts in levels of consciousness are reflected with less delay compared to current monitors
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Cortical Dynamics Ltd