Thank you for your concern to General Meditech, Inc. and our G9L anesthesia depth monitor.

The sedation depth of anesthesia surgery have changed from “easy to be exceeded” to “easy to be insufficient” since the muscle relaxants was widely used to the anesthesia. The awareness during the surgery and the memories after the surgery have attracted more and more attention due to the lack of the monitoring method of the anesthesia depth. Sebel investigated 7 medical center of USA in 2004 and found that 25 patients of 19575 persons had awareness during the surgery (probability 0.13%), there are about 20 million patients doing general anesthesia every year, so that means about 26000 patients may have the awareness during the surgery.

The patients may have various extent of nervousness, anxiety, pain and discomfort during diagnosis surgery and therapeutic surgery when they are local anesthetized, regional anesthetized or not anesthetized, and the reflex of the patients may be more serious when there is visceral pull. In order to provide a good operation condition and make sure the patients pass through the dangerous time safely and adaptively, the American Anesthetist association (ASA) mentioned the monitored anesthesia care (MAC), the definition of MAC is that the anesthetist provide the monitoring and analgesia tech when the patients are local anesthetized, regional anesthetized or not anesthetized.

Along with the Critical Care gotten more and more attention in recent years, the suffering for patients during treatment has also been noticed. Mechanical ventilation in the treatment of patients; the daily care; invasive treatment and illness itself will all bring pain and emotional instability to patients, and cause adverse effects to the treatment and prognosis of the disease. Sedation can relieve the patient’s pain and improve the patient’s emotional instability, so it has been widely used.

The traditional instrument of the depth of anesthesia becomes the “ornaments” of the anesthesia department because of the high cost machine itself as long as the expensive accessories, furthermore the operation is very complicated. General Meditech Inc. and Danmeter A/S from Denmark built the G9L, the depth of anesthesia monitor. it gets the precise cerebral state index (CSI) through the fuzzy logic operations on the EEG, combining with the ECG, NIBP, SpO2, TEMP etc. basic vital signs parameters of patient, guide the anesthetic medication to reduce the risk of surgery, easily operation, economic and universal accessories, to bring you a whole new experience of depth of anesthesia monitoring.

G9L is designed to improve the efficiency of anesthesia surgery and become the conventional equipments of anesthesia surgical departments.

Looking forward to cooperate with you and wishing you happiness!

General Meditech, Inc.
Danmeter A/S: Danmeter A/S is a company specialized in brain and EMG signal measurement products. It has 34 years history since it’s founded in 1977. The main products are: non-invasive CSM, stroke rehabilitation, Neuromuscular electrical stimulation, Incontinence treatment and Noninvasive central blood volume. The A-Line cerebral state monitor is the first generation product that was very popular in China before.

General Meditech, Inc: General Meditech, Inc is a national high-tech enterprise which specialized in development, production and marketing of monitoring series products. The senior management and R&D staffs have over 20 years experience in medical industry. GMI has its own products intellectual property rights.

Since its establishment, GMI has been steadfastly and constantly devoted to technical work, made brilliant achievements gradually.

**Company Profile**

2003

2004
- Sep. GMI created.

2005

2006
- Jun. Shenzhen high-tech enterprise assertion in the expert evaluation organized by the Shenzhen Information and Technology Bureau.

2007
- Sept. National High-tech Enterprise

2008
- Aug. CE mark for patient monitors and pulse oximeter

2009
- Oct. FDA 510(k) Clearance for pulse oximeter
- Dec. pulse oximeter, central monitoring system and multi-parameter patient monitor were identified as "The products of independent innovation" both by shenzhen Information and Technology Bureau and Shenzhen Trade and Industry Bureau, meanwhile they were listed into 2009 government centralized procurement catalog.

2010
- Jan. “Credit AAA Enterprise” by Shenzhen Credit Union Association
- Feb. FDA 510(k) Clearance for G3 Series patient monitor
The awareness depth of anesthesia index (cerebral state index, CSI) is a new monitoring index for depth of anesthesia (Danmeter A/S); it is same as BIS to reflect the brain awareness ingredients, but it is not equivalent to BIS. The BIS monitor is using the bi-spectral analysis of EEG activity, while the CSI monitor is using adaptive neuro-fuzzy inference system, which integrated four parameters of EEG. The response time of CSI is shorter than BIS (the former response time is 10-20 seconds, the latter is 30 seconds).

Clinical significance

The awareness depth of anesthesia index (cerebral state index, CSI) is a new monitoring index for depth of anesthesia (Danmeter A/S); it is same as BIS to reflect the brain awareness ingredients, but it is not equivalent to BIS. The BIS monitor is using the bi-spectral analysis of EEG activity, while the CSI monitor is using adaptive neuro-fuzzy inference system, which integrated four parameters of EEG. The response time of CSI is shorter than BIS (the former response time is 10-20 seconds, the latter is 30 seconds).

Introduction of G9L Depth of Anesthesia Monitor

As regular measurement equipment in anesthesia department, G9L has superior advantages as below:

1. The transducer has superior sensitivity and low requirement for EEG electrode which can be replaced by normal ECG Electrode. (Test cost for each patient: USD50 for BIS’s special electrode, less than USD2 for G9L’s common electrode)
2. With digital & classified depth of anesthesia state, direct and clear
3. Based on the data of BIS% and CSI, G9L will judge patient’s coma state.
4. High ability of Anti-artifact. Benchmark analysis of EEG by using fuzzy logic operation theory, the CSI will not be influenced by the disturbance on EMG from surgical electro equipments.
5. EMG reflect the state of Muscle relaxation
6. Showing vital signs parameters, therefore G9L is the unique equipment that combines multi-parameter patient monitor with depth of anesthesia monitor.
7. 15”color, high brightness, wide view angle TFT LCD screen
8. With superior advantage to be routine measurement equipment for anesthesia department
9. With Europe CE and USA FDA approval and many clinical cases, the depth of anesthesia monitor technology guarantee its performance both electrical safety and clinical use.
10. Streamlined and fashionable design, foldable hook handle, easy to carry
12. Applicable to adults, pediatric, neonate monitoring.

Configuration

Standard Configuration: CSI + Stand 6 parameters (SUNTECH NIBP, NELLCOR SpO2, YSI-400 Body Temperature Probe)
Optional Configuration: ETCO2, Thermal Array Printer, Wall Mount, Trolley, Touch Screen
CSI: (Cerebral State Index)
The operating principle of CSI is using EEG, Burst suppression, EMG as a basis for input self-adaptive fuzzy logic inference system, its advantage is the accidental contact between the EEG and the clinical status of the patients will not be controlled by an assumed and potential mathematical function. The reaction level of consciousness in patients is with a strong following feature and more accurate, timely. 

**Operation principle**

**CSI**

Clinical state

<table>
<thead>
<tr>
<th>CSI</th>
<th>Clinical state</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 – 100</td>
<td>Awake</td>
</tr>
<tr>
<td>80 – 90</td>
<td>Drowsy</td>
</tr>
<tr>
<td>60 – 80</td>
<td>Light anesthesia sedation</td>
</tr>
<tr>
<td>40 – 60</td>
<td>Range considered as adequate for surgical anaesthesia</td>
</tr>
<tr>
<td>10 – 40</td>
<td>Deep anaesthesia, in most cases accompanied with BS</td>
</tr>
<tr>
<td>0 – 10</td>
<td>Close to coma and BS index greater than 75, When CSI less than 3, the EEG is basically isoelectric.</td>
</tr>
</tbody>
</table>

BS%: Burst Suppression
Indicate the burst suppression in the last 30 seconds of EEG signal when the EEG is ISO-electric or flat line. A BS%=20 means that the EEG has been ISO-electric during 20% of the last 30 seconds. Frequency, variability of burst suppression and EEG power reflect intracranial pressure's change directly.

EMG: it shows the myoelectric energy level between the bandwidth of 75-85 Hz (0-100 logarithm), indicate the state of muscle relax.

**Tips:** the universal ECG electrode is applicable due to EEG transducer’s superior sensitivity!

**Tips:**

- General Meditech Inc. and Denmark Danmeter built the G9L, the depth of anesthesia monitor.
- Danmeter released CSM after A-Line, open a new era of the depth of anesthesia monitoring, getting the precise cerebral state index through the self-adaptive fuzzy logic neural inference operation on the EEG, combining with the ECG, NIBP, SpO2, TEMP etc. basic vital signs parameters of patient, guide the anesthetic medication to reduce the risk of surgery, easily operation, economic accessories, to bring you a whole new experience of depth of anesthesia monitoring.

**Analysis of social and economic benefits**

At present, there are three similar products in market: BIS of Aspect Company from USA, Narcotrend of Hannover Medical University and Anesthesia depth monitor of Danmeter from Denmark. The significant advantages are as below list for GMI G9L anesthesia depth monitor:

1. **Price:** BIS USA is priced at around $56,000.0 in the market (It has been purchased by Convidien in 2009); And Narcotrend is around $60,000 (It was branded as Shiller Depth of Anesthesia Monitor in the former market). The price of G9L is the most favorable and reasonable one in the market.
2. **Operation cost:** The price of BIS’s disposable electrode is $50 - $80 per patient per time (Although many doctors will reuse it in clinical application, the electrode with electronic conductive which attached to patient’s skin will probably cause cross infection, if there is any accident, BIS will not be responsible for it). Narcotrend use normal nerve electrode, but you should input the patient information during application; it’ll increase the burden for the medical stuff’s daily work. However, CSM can use the normal ECG electrode or nerve electrode, the general electrode isn’t limited by the manufacturer. It almost has no adverse reaction, and the cost is less than $2.0 per patient per time.
3. **Revenue analysis:** depth of anesthesia monitoring has become increasingly open and conventional nowadays. There has well-built medical charge standard and anesthetic quality control standard. In the anesthetic quality control standard, there is listing the ratio requirements of the depth of anesthesia monitoring in detail for third degree hospital and second degree hospital.
4. **Expenditure analysis:** G9L (depth of anesthesia) exactly reflect the situation of anesthesia depth through CSI which monitor consciousness of patient, with BS% which predict the extent of patient brain coma, supply guidance of medication for anesthesiologist, cut back the anesthetic dose, shorten recovery time, cost savings and reduce cost, increase efficiency.
5. **Social benefit analysis:** It exactly reflect real-time depth of anesthesia for patient, avoid medical dispute due to deep or shallow anesthesia, improve medical level of department, improve social influence of hospital, meantime, increase security of patient.
6. **According to statistics,** there is 30% shortage of anesthesia specialists in China. Now they are facing daily increasing clinical workload. Improving their quality and technical level is one of the effective way to easy this contradiction. G9L depth of anesthesia monitor provides a direct CSI index value which is conducive to the cultivation of young anesthesiologist. It takes 5-6 years for a common anesthesiologist to work independently in real clinical anesthesia practice. With this monitor, it will signally shorten the mature period of an anesthesiologist.
Validation of the Cerebral State Monitor for assessing anaesthetic depth

**Presentation Time:** Tuesday, 9:15 a.m. - 10:45 a.m.

**AUTHORS:** E. W. Jensen, H. Litvan

**AFFILIATION:** CREB, Sant Pol de Mar, Spain, 2Hospital Santa Creu y Sant Pablo, Barcelona, Spain.

**Presentation Number:** 5-229

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**Introduction:** The objective of this study was the validation of a new index, called Cerebral State Index (CSI) during cardiac anesthesia. The CSI was defined using sub-parameters from the EEG as inputs of an adaptive neuro-fuzzy inference system (ANFIS). The advantage of ANFIS is that it does not assume an underlying mathematical function governing the causal relationship between the EEG values and the clinical state of the patient.

**Methods:** The study was approved by the local ethics committee. Fifteen patients, (12 male, 3 female, age 60-79 years) scheduled elective cardiac surgery were included in the study. Propofol was the only anesthetic, administered using a TCI-pump (target 5 ug/ml plasma concentration during 5 min). CSI and BIS was monitored simultaneously and LOC defined as loss of response to a verbal command was assessed. After LOC, surgery was carried out according to the protocol of the department.

**Results:** Both CSI and BIS showed significant differences between awake and anaesthetised values asshown in the table (mean(SD)). During surgery, both BIS and CSI remained below 60 and in an interview 24 h after surgery none of the patients reported intra operative awareness.

<table>
<thead>
<tr>
<th></th>
<th>Awake</th>
<th>CSI</th>
<th>BIS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSI</td>
<td>56(4)</td>
<td>55(4)</td>
</tr>
</tbody>
</table>

**Discussion:** The results show that in this population depth of anaesthesia can be measured reliably by using a combination of parameters calculated from the frequency content of the EEG.
The objective of this study was to show that a reliable index for assessing confidence in the depth of anaesthesia for the individual patient and independently of drug type using EEG-based monitors has proven difficult.

Results: Both CSI and BIS decreased with increasing concentration of sevoflurane (Figure A). The correlation coefficients were -0.83 and -0.79 for CSI and BIS, respectively. The values at which 50% (95% CI) of patients failed to respond to verbal command were 72 (69-75) for CSI and 69 (66-73) for BIS (Figure B). The PK (±SE) values indicates similar accuracy of CSI (0.89 ± 0.04) and BIS (0.87 ± 0.03) to predict OAA/S scale.

Discussion: During steady state conditions, we found that both CSI and BIS accurately detect the level of consciousness after sevoflurane anesthesia.

Reference:

Materials and Methods. After Gent Hospital Ethics Committee approval, informed consent was obtained from 20 ASA I female patients (18-60 years), scheduled for ambulatory gynecologic surgery. The data has recently been published in another study1. Propofol infusion was initiated until the patient had no response to noxious stimuli (Observer’s Assessment of Alertness and Sedation scale (OAA/S)). OAAS level was estimated every 4min. and the effect-site concentration for propofol was calculated using the Schnider model. Four EEG sub-parameters (beta ratio=log(E30-42.5Hz/E11-21Hz), alpha ratio=log(E30-42.5Hz/E6-12Hz), beta – alpha ratio=log(E6-12.5Hz/E11-21Hz) and Burst Suppression) were used to define the inputs to the fuzzy system. The output of the fuzzy system is the CSI.

Results and Discussions. The prediction probability (Pk) between the CSI and OAAS was 0.92. The figure shows the box plot of the CSI versus the OAAS for the data set.

Conclusion. The results show that in this population depth of anaesthesia can be measured reliably by using a combination of parameters calculated from the frequency content of the EEG.

References. 1.Struys MMRF et al. Anesthesiology 2002; 96:803-16

Cerebral state index during anaesthetic induction: a comparative study with propofol or nitrous oxide

R. E. ANDERSON 1, G. BARR 1 and J. G. JAKOBSSON 2

1Department of Cardiothoracic Anaesthetics and Intensive Care, Karolinska Hospital, and 2Department of Anesthesiology, Sabbatsberg Hospital, Stockholm, Sweden

Background: Confidently predicting the depth of anaesthesia for the individual patient and independently of drug(s) type using EEG-based monitors has proven difficult. This open, randomized, explorative study of day surgical patients evaluates the ability of the Cerebral State Monitor™ (Danmeter AB, Odense, Denmark) of anaesthetic depth to identify loss of response (LOR) using either propofol or N2O for induction.

Methods: In this open, randomized study, day surgical patients (n = 10 in each group) were studied using the Cerebral State Index Monitor™. After baseline measurements, induction to LOR was achieved with either repeated

by a right frontal BIS-XP sensor, and was computed online by an A-2000 monitor (Aspect Medical, Newtown, MA). Ten minutes was allowed for equilibration before each step change (0.1%) in sevoflurane concentration. End-tidal CO2 concentration was maintained at 3.5-4.0 vol%. Patient response was assessed by an blinded observer using the modified Observer’s Assessment of Alertness/Sedation (OAA/S) scale. Loss of response was defined as OAA/S score ≤ 2. Patient responses vs CSI or BIS were analyzed by logistic regression and sevoflurane concentration vs CSI or BIS was tested by nonlinear regression. The ability of CSI or BIS to detect OAA/S level was evaluated by prediction probability (PK, ranging from 0-1), PK of 1 indicates perfect prediction. Differences between indices were tested by Mann-Whitney test.

Results: Both CSI and BIS decreased with increasing concentration of sevoflurane (Figure A). The correlation coefficients were -0.83 and -0.79 for CSI and BIS, respectively. The values at which 50% (95% CI) of patients failed to respond to verbal command were 72 (69-75) for CSI and 69 (66-73) for BIS (Figure B). The PK (±SE) values indicates similar accuracy of CSI (0.89 ± 0.04) and BIS (0.87 ± 0.03) to predict OAA/S scale.

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Conclusion. The results show that in this population depth of anaesthesia can be measured reliably by using a combination of parameters calculated from the frequency content of the EEG.

References. 1.Struys MMRF et al. Anesthesiology 2002; 96:803-16
30-mg boluses of propofol every second minute or with N2O (after premedication 5 min before with 30 mg propofol) increased every other minute in 15% increments (max. 75%). Sedation level was evaluated every other minute using the Observer’s Assessment of Alertness/Sedation scale.

**Results**: Baseline values were 91 (82—98) and 94 (82—100) for N2O and propofol patients, respectively. During induction CSITM decreased with increasing sedation in patients given propofol (P < 0.001) but not in patients given nitrous oxide. Median value at LOR was 56 (40—76) and 95 (87—100) for the propofol and nitrous oxide group of patients, respectively.

**Conclusion**: The Cerebral State Index™ behaves as other depth of anaesthesia monitors with a progressive decrease during propofol induction but loss of consciousness with N2O results in no change in CSI™.


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**Monitoring the level of consciousness: BIS vs CSI**

**Authors**: Massó E, Rodríguez M, Flo A, Ibáñez C, Jensen EW, Canet J

**Hospital Universitarri Germans Trias i Pujol, Barcelona, SPAIN**

**Introduction**: The analysis of the EEG signal allows the monitoring of the level of consciousness during general anaesthesia. Recordings of the Bispectral Index (BIS, Aspect Medical Systems, MA, USA) and the Cerebral State Index (CSI) (Cerebral State Monitor, Danmeter, Odense, Denmark) have been correlated with the level of depth of anaesthesia and the auditory evoked potential records.

**Objectives**: To compare prospectively the monitoring of the level of depth of anaesthesia with the BIS and CSI during anaesthetic induction with sevoflurane.

**Material and Methods**: The study included 10 patients scheduled for cardiac surgery. Premedication consisted of diazepam 10mg the day before and the morning preceding surgery. In the operating room the invasive blood pressure, ECG, pulsioximetry and end tidal sevoflurane concentration were monitored. Basal values were registered before premedication and fentanyl 1μg.kg and midazolam 10 mg.kg-1 administered intravenously. Inhalational induction was then started with sevoflurane 2% or 4% and fentanyl 4-5μg.kg-1. After the loss of eyelash reflex and apnea, rocuronium 0.6mg.kg-1 were also administered. All parameters and sevoflurane concentrations were registered for the following phases of surgery: start of induction, loss of response to verbal stimuli, loss of response to tactile stimuli, loss of eyelash reflex, start of apnea, NMBA administration, intubation and every 2-10 minutes after intubation. The BIS and CSI indexes were compared using a Spearman rho correlation. The results are stated as N(%) or mean value (rank). P<0.05
Results: Records were obtained for seven patients: 3 scheduled for valve and 4 for coronary surgery. Anthropometric details were: age 62(51-84) years, 6 male/1 female, weight 69(55-89)kg, height 164(157-178)cm, ASA 3/4 : 2/5. Basal values were: BIS 96 (87-98) and CSI 93 (86-98), at apnea BIS 84 (70-96) and CSI 78 (67-88) and for intubation BIS 41 (30-48) and CSI 44 (37-57), after this phase both indexes kept values under 50. Correlation between BIS and CSI for all phases of the study was significant p<0.001, R2=0.85 with the equation CSI=0.8BIS+13.4

Conclusions: This preliminary results indicate that there is a good correlation between the BIS and CSI record during inhalational induction with sevoflurane. The adequate depth for surgical (40-60) or deep (10-39) anaesthesia was only obtained with both devices after apnea and muscular relaxation. Further studies are needed in order to define the performance of the Cerebral State Monitor and its correlation with the BIS on different levels of consciousness.

Discussion. The CSI achieved good correlation values for monitization of the awake and asleep states of anesthesia for this specific study population. This preliminary results are part of a broader study with a larger number of subjects and comparing more anesthetic states and drug consumption values, among other parameters.
After-sales service commitment

General Meditech Inc has offices all around the country to support local marketing and after-sale service. 24 hours telephone technical supports in Shenzhen headquarter. National toll free hotline: 400-6111-903.

Annex: Related certificates of General Meditech, Inc. and Danmeter A/S

- SFDA certificate
- Europe CE certificate
- Europe CE certificate
- USA FDA certificate