How Effective is BIS Monitoring in Comparison to the Traditional use of ETAG/MAC values for Reducing time to Extubation?

Natalie Tyley, SAA, MCW & Gabriella Metten, SAA, MCW

Introduction

- In anesthesia practice, timely and safe emergence from anesthesia is a critical aspect of patient care.
- Extubation marks a key step in the process and depends on achieving an optimal balance between adequate depth of anesthesia and smooth recovery.
- Traditionally, Minimum Alveolar Concentration (MAC) and End-Tidal Anesthetic Gas (ETAG) values have been used to guide anesthetic depth
- Now there is an alternative approach for monitoring anesthetic depth: the Bispectral Index (BIS) monitor, a non-invasive method that uses EEG data to provide a numerical value indicative of the brain's level of sedation (Bagle, et al.,2023).
- BIS monitoring has gained popularity for its potential to provide individualized feedback and optimize anesthetic management.
- Still debate about its advantages over traditional methods, particularly in terms of shortening time to extubation.
- By comparing these two approaches, this analysis seeks to compare the effectiveness of BIS monitoring to MAC/ETAG values in reducing extubation time.

Background

- MAC Value of 1.0 = conc. of anesthetic gas required to prevent movement in response to surgical stimuli in 50% of patients
- BIS utilizes a digital scale ranging from 0 (isoelectric EEG) to 100 (completely awake) with a BIS score of 40-60 generally indicating unconsciousness (Nair, et al., 2021)
- ETAG monitors the conc. of anesthetic gas at the end of expiration. Often used to estimate how close you are to the desired MAC level during anesthesia.

Methods

This literature review followed a systematic approach to evaluate the effectiveness of BIS monitoring compared to the traditional ETAG/MAC values for reducing time to extubation. The databases PubMed and Google Scholar were used, utilizing key terms such as "Bis Monitoring," MAC Values," "ETAG," and "Extubation Time".

Materials and Data Sources

Inclusion Criteria:

- Articles published between 2014 and 2024
- Randomized Control Studies (RCTs) and Observational Studies
- Studies comparing BIS with MAC or ETAG monitoring in patients undergoing general anesthesia
- Having an outcome of extubation time

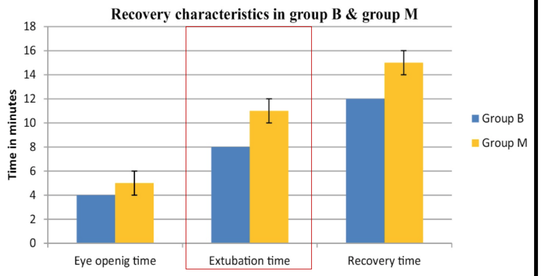
Relevant data on extubation times was extracted and analyzed. Studies focusing on halothane anesthesia and studies done prior to 2014 were excluded to rule out lack of relevance.

Results

- **Bagle, et al. (2023)** - RCT (not blinded) comparing BIS and MAC-guided isoflurane general anesthesia recovery; use of BIS speeds up extubation time

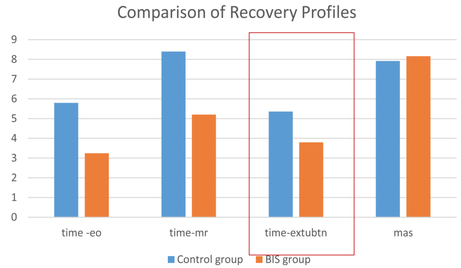
** Median time to extubation = 8min in group B, 11min in Group M (P<0.001)

Group B = BIS-guided isoflurane anesthesia
Group M = MAC-guided isoflurane anesthesia



- **Chaudhuri, et al. (2022)** - RCT (double-blinded) comparing recovery times of BIS vs EtSevo-guided anesthesia from sevoflurane- nitrous oxide anesthesia; Time to extubation did not vary significantly between the groups

** Median time to extubation was 10 minutes for both the BIS and ETAG group (P=0.32)



- **Nair, et al. (2021)** - Observational study comparing BIS vs MAC-guided sevoflurane anesthesia recovery in patients undergoing breast cancer surgery; Time to extubation was shorter in the BIS group

** The time taken to extubate the patients was 5.36 ± 2.05min in control group and 3.80 ± 1.47 min in the BIS-group (P = 0.003)

BIS group = BIS-guided sevoflurane anesthesia
Control Group = HR, MAP, and MAC guided sevoflurane anesthesia

- **Shukla, et al. (2020)** - RCT (double-blinded) compared BIS vs ETAG monitoring as a tool for time to tracheal extubation; Time to tracheal extubation was significantly shorter in BIS group as compared to ETAG group

** Mean time to tracheal extubation was 308.77 ± 20.48s in the BIS group and 377.90 ± 25.06 s in the ETAG group (P < 0.001)

- **Vance, et al. (2014)** - RCT (double-blinded) compares BIS with MAC-guided anesthesia with improving time to extubation after elective cardiac surgery; Use of intraoperative BIS monitoring during cardiac surgery did not change time to extubation in cardiac surgery

** median [IQR] time to extubation was 307 [215 to 771] minutes in the BIS group and 323 [196 to 730] minutes in the anesthetic concentration group (p = 0.61)

Discussion

This literature review highlights the significant advantages of using Bispectral Index (BIS) monitoring in general anesthesia for ASA I and II patients. By effectively reducing extubation time, BIS monitoring enhances recovery profiles while maintaining an adequate depth of anesthesia. However, its effectiveness may diminish in more complex surgical cases, particularly regarding postoperative ICU extubation criteria (Vance et al., 2014). Traditional assessment methods often lead to excessive use of inhalation agents, contributing to morbidity and delayed recovery. Implementing BIS monitoring not only minimizes the risks associated with high concentrations of volatile anesthetics but also supports better outcomes by potentially reducing the incidence of postoperative cognitive dysfunction (Ling et al., 2022).

Limitations

- Observations cannot be generalized to all types of surgeries and protocols due to limited surgical procedure types
- Small sample sizes
- Factors impacting recovery from general anesthesia were not taken into account

Conclusion

Integrating BIS monitoring into perioperative care can optimize time to tracheal extubation and expedite the patient recovery process.

References

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