

## IMAGEM EM ANESTESIOLOGIA

# Comparative EEG Spectral Analysis for Anesthesia Depth in Elderly and Middle-Aged Patients: Don't be Fooled by the Number!

## *Análise Espectral Comparativa de EEG para Profundidade de Anestesia em Pacientes Idosos e de Meia-Idade: Não se Deixe Enganar pelo Número!*

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### Afilição

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### Palavras-chave

Anestesia; Consciência; Eletroencefalografia; Monitores de Consciência

Postoperative delirium (POD) is the most common complication after surgery in the elderly and should be taken into consideration during geriatric anesthesia practice. When assessing anaesthesia depth through EEG readings in an 80-year-old and a 45-year-old patient, marked by similar BIS values of 54 and 52, it is crucial to consider age-related EEG changes. Although BIS is a standard index used to gauge anesthesia depth across all ages, it does not indicate a similar anesthesia effect in both patients and this may not reflect an accurate comparative depth due to age-related neurophysiological variations.

Purdon *et al*<sup>1</sup> stated that elderly patients exhibit reduced EEG power across all frequencies, with particularly diminished alpha power, and are more prone to burst suppression. This pattern of high amplitude EEG activity alternating with flat EEG is linked to an increased risk of postoperative delirium, a concern in elderly surgical patients. These findings suggest that the same BIS value can represent different anaesthesia depths and effects in older versus younger patients due to these EEG alterations.<sup>2</sup>

For the 80-year-old patient, inherent EEG changes such as reduced brain volume and cortical thinning may lead to lower amplitude EEG oscillations, influencing the BIS reading. Consequently, an anesthesiologist might administer a lower anaesthetic dose to an elderly patient for the same BIS value compared to a younger individual. This comparison illustrates

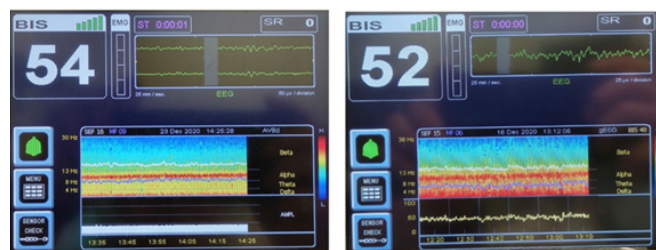
the need for a patient-centered precision anesthesia care for all patients (adjusted according to patient characteristics as age).

While the BIS monitor offers a valuable tool, it should be interpreted cautiously in older patients, considering the natural variability and age-related EEG changes that could affect anaesthesia depth assessment.

In the current anesthesia practice, EEG-based indicators of delirium are promising for the future and EEG metrics are more and more used as biomarkers in different situations as postoperative delirium or cognitive disorders.

In pursuit of patient-centered precision anesthesia care, the integration of advanced monitoring techniques, specifically the analysis of DSA in BIS monitors, is imperative for all ages and especially for elderly patients.

These technologies offer real-time insights into individual neurophysiological responses, enabling anesthesiologists to tailor interventions, ensuring a safer and more personalized anesthesia practice.



**Figure 1.** The two images are of a bispectral index (BIS) monitor, used to assess the depth of anaesthesia in a patient during surgical procedures. In the two images provided, the BIS monitors display both the numerical BIS value and the spectral array, which shows the EEG frequency breakdown. Left: 80-year-old patient; Right: 45-year-old patient

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BCM: Data Conception and design of the study, writing of the article, statistical analysis and final review.

EK: Statistical analysis and final review

All authors approved the final version to be approved.

*BCM: Conceção e desenho do estudo, escrita do artigo, análise estatística e revisão final.*

*EK: Análise estatística e revisão final.*

*Todos os autores aprovaram a versão final a ser aprovada.*

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## REFERENCES

1. Purdon PL, Pavone KJ, Akeju O, Smith AC, Sampson AL, Lee J, et al. The Ageing Brain: Age-dependent changes in the electroencephalogram during propofol and sevoflurane general anaesthesia. *Br J Anaesth.* 2015;115 Suppl 1:i46-i57. doi: 10.1093/bja/aev213.
2. McCulloch TJ, Sanders RD. Depth of anaesthesia monitoring: time to reject the index? *Br J Anaesth.* 2023;131:196-9. doi: 10.1016/j.bja.2023.04.016.