



REVISTA BRASILEIRA DE ANESTESIOLOGIA

Official Publication of the Brazilian Society of Anesthesiology
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MISCELLANEOUS

Correlation of bispectral index (BIS) monitoring and end-tidal sevoflurane concentration in a patient with lobar holoprosencephaly



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Received 27 March 2014; accepted 3 July 2014

Available online 25 October 2014

KEYWORDS

Holoprosencephaly;
Bispectral index;
Sevoflurane;
Seizures

Abstract

Objective: The bispectral index (BIS) is a parameter derived by electroencephalography (EEG) which provides a direct measurement of the effects of sedatives and anesthetics on the brain and offers guidance on the adequacy of anesthesia. The literature lacks studies on BIS monitoring in pediatric patients with congenital brain disease undergoing general anesthesia.

Clinical features: A 13-year-old child weighing 32 kg, suffering from lobar holoprosencephaly, underwent surgery in which the bispectral index (BIS) monitoring the depth of anesthesia showed an abnormal response. Detailed analysis of the trends of BIS values in the different observation times demonstrated sudden falls and repetitive values of BIS likely related to repetitive epileptiform electrical activity caused by sevoflurane.

Conclusion: The BIS is a very useful monitoring tool for assessing the degree of depth of anesthesia and to analyze the electroencephalographic variations of anesthetics. Particular attention should be given to patients with congenital disorders of the central nervous system in which the BIS may give abnormal responses that do not reflect an accurate assessment of the depth of anesthesia.

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PALAVRAS-CHAVE

Holoprosencefalia;
Índice bispectral;
Sevoflurano;
Convulsões

Correlação entre monitoração do índice bispectral (BIS) e concentração expirada de sevoflurano em paciente com holoprosencefalia lobar

Resumo

Objetivo: O índice bispectral (BIS) é um parâmetro derivado por eletroencefalografia (EEG) que fornece uma medida direta dos efeitos de sedativos e anestésicos no cérebro e orientação sobre a adequação da anestesia. A literatura carece de estudos sobre a monitoração do BIS em pacientes pediátricos com doença cerebral congênita submetidos à anestesia geral.

Características clínicas: Criança de 13 anos de idade, pesando 32 kg, com holoprosencefalia lobar, foi submetida à cirurgia em que a monitoração da profundidade da anestesia com o uso do BIS mostrou uma resposta anormal. A análise detalhada das tendências dos valores do BIS nos diferentes tempos de observação mostrou quedas súbitas e valores repetitivos do BIS, provavelmente relacionados à atividade elétrica epileptiforme repetitiva causada por sevoflurano.

Conclusão: O BIS é uma ferramenta de monitoração muito útil para avaliar o grau de profundidade da anestesia e as variações eletroencefalográficas dos anestésicos. Atenção especial deve ser dedicada aos pacientes com doenças congênitas do sistema nervoso central nos quais o BIS pode apresentar respostas anormais que não refletem a avaliação precisa da profundidade da anestesia.

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Introduction

Holoprosencephaly

Holoprosencephaly (HPE) is a complex brain malformation in which there is an incomplete separation of the forebrain between the 18th and 28th day of intrauterine life, affecting both the forebrain and the face, causing neurological and facial defects of varying severity.¹

It has a prevalence of 1 in 250 during early embryo development, and 1 in 10,000 to 1 in 20,000 at term.

Three classic forms of progressive severity have been described, classified according to their anatomical features: HPE lobar, semi-lobar, and alobar. A milder subtype, known as middle interhemispheric variant (MIH), was also identified. The HPE phenotype also includes aprosencefalia/atelencefalia (the most severe sign), schizencephaly and septo-preoptic HPE. The less severe forms are defined microforms, characterized by defects in the midline, in the absence of brain malformation typical of HPE. However, the disease is characterized by a continuous spectrum of abnormal separation of the cerebral hemispheres rather than a distinct subdivision of these forms which present, however, significant in clinical inter- and intra-familial variability. In many cases, there is a correlation between the severity of facial abnormalities and brain anomaly (with the exception of mutation cases in the *ZIC2* gene). In descending order of severity the main facial features are cyclopia, a proboscis, premaxillary agenesis, a cleft lip, coloboma, retinal dysplasia, choanal stenosis, stenosis of the pyriform sinus, hypotelorism, a single median maxillary incisor, and even a normal face. Severe forms (especially in the presence of a chromosomal abnormality) are often fatal and mortality is associated with the severity of the brain malformation and associated defects. In children who survive, a broad

spectrum of related signs has been described: developmental delay, hydrocephalus, motor deficits, eating problems, motor dysfunction, epilepsy, and hypothalamic dysfunction. Endocrine disorders from pituitary abnormalities, such as central diabetes, are common.

Lobar holoprosencephaly is the milder classic form of holoprosencephaly. It is characterized by the separation between the left and right cerebral hemispheres and lateral ventricles with a junction along the frontal neocortex, particularly rostrally and ventrally. Approximately 19% of patients with lobar HPE have the shape.

The bispectral index

Bispectral index (BIS) monitoring allows for an early assessment, in real time, of the effects of anesthetic agents during monitored patient care.² The clinical impact of BIS monitoring has been demonstrated in several randomized controlled studies that reveal how this tool also allows for greater patient safety. In particular, this equipment can reduce the risk of a potential awareness and/or intraoperative awareness measured on a continuous, non-invasive level of sedation of the patient by means of special adhesive sensors. The bispectral index is a parameter derived by electroencephalography (EEG) which provides a direct measurement of the effects of sedatives and anesthetics on the brain and offers guidance on the adequacy of anesthesia.^{3,4} Research shows that under general anesthesia approximately 2 out of 1000 patients experience an intraoperative awareness. The BIS is currently the only technology for monitoring the state of consciousness that can reduce the incidence of intraoperative risk in adults by about 80%. The BIS is represented by a numerical value between 0 and 100, two numbers which indicate the absence of brain activity and wakefulness. The anesthesiologist, thanks to this index, is able to administer

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