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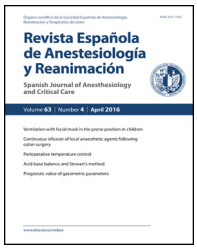

CASE REPORT

Idiopathic decreased bispectral index during anaesthesia emergence: Possible causes for the phenomenon of paradoxical arousal☆

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KEYWORDS
Electroencephalography;
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Abstract In a small percentage of patients, sound, touch and even nociceptive stimulation in the presence of a light anaesthetic depth does not cause an electroencephalogram wave pattern of cortical activation (α, β waves) as would be expected, but leads to a slowed electroencephalogram pattern instead.

We report the case of a patient who on emerging from anaesthesia showed very slowed brain activity on the electroencephalogram and reduced algorithmic value, that lasted approximately 5 min coinciding with sound and tactile stimulation. After keeping her under observation for 24 h during the postoperative period she did not present any brain disorder that could justify that event.
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PALABRAS CLAVE
Electroencefalografía;
Monitores de consciencia;

Disminución idiopática del índice biespectral durante la educción anestésica: posibles causas del fenómeno delta paradójico

Resumen En un pequeño porcentaje de pacientes, la estimulación sonora, táctil e incluso nociceptiva en presencia de una ligera profundidad anestésica no provoca la aparición de ondas cerebrales propias de la activación cerebral (ondas α, β), sino que desencadena un enlentecimiento del trazado de las ondas del electroencefalograma.

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Monitorización intraoperatoria; Estimulación

Presentamos el caso de una paciente en la que se registra una actividad cerebral muy enlentecida en el electroencefalograma procesado del monitor del índice biespectral, así como una disminución del valour algorítmico, que dura aproximadamente 5 min en el momento de la educción anestésica, coincidiendo con la estimulación sonora y táctil, que tras mantenerla en observación durante 24 h en el postoperatorio, no coincide con ningún trastorno a nivel cerebral que lo pueda justificar.
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Introduction

Almost 80 years ago, Gibbs et al. showed that increased doses of ether or pentobarbital cause systematic changes in the electroencephalogram (EEG) and the wake-up threshold of patients. The authors suggested that these EEG changes may be used to monitor depth of hypnosis during general anaesthesia.[1]

Subsequently, Bart et al. used the spectrogram–which breaks up the EEG signal according to the strength of each frequency band–to show that the EEG trace oscillated around specific frequencies during general anaesthesia.[2]

However, despite efforts to link EEG traces to different phases of general anaesthesia, doses of hypnotics and awakening thresholds, the unprocessed EEG or spectrogram has never become a standard tool in daily anaesthesiology practice.

Nevertheless, since the 1990s, depth of hypnosis during general anaesthesia has been monitored using indexes developed on the basis of the changes observed in the EEG of patient cohorts in response to different drugs and planes of anaesthesia.

One of the most widely used EEG-derived indices today is the bispectral index (BIS). The BIS was developed by Aspect Medical Systems in 1994 as a method of monitoring hypnosis in patients under general anaesthesia. The device used an algorithm to processes EEG data practically in real time, generating an index value between 0 and 100 that reflects the state of hypnosis. A BIS score of 100 corresponds to being fully awake, while 0 corresponds to deep coma or unconsciousness, shown as an isoelectric waveform in the EEG. A value of between 40 and 60 is considered an appropriate level for general anaesthesia.

However, these values are not completely reliable, and can be affected by artefacts in the EEG signal, patients that do not meet the criteria of the population reference group used to generate the mathematical algorithm, and interindividual differences in the cerebral physiology (alcohol/alcoholism, diabetes, insulin resistance, schizophrenia, drugs, etc.). Thus, in a small percentage of patients, auditory, tactile and even nociceptive stimuli during light anaesthesia does not cause the brain waves typical of brain activation to appear (α, β waves), but instead cause decreased EEG frequency. This phenomenon is known as paradoxical arousal. During this event, EEG waveforms describe a paroxistic EEG alteration consisting of focal, transitory (gradual normalisation after 5–10 min) slow, large-amplitude waves (EEG delta range: 1–4 Hz and voltage 50–150 μV), with no obvious aetiology.

Case report

We present the case of a 72-year-old woman, classified as ASA (American Society of Anesthesiologists) I, 165 cm, 86 kg, allergic to penicillin, with no toxic habits or medical and surgical history of interest. She had been scheduled for laparoscopic hysterectomy with double anexectomy and lymphadenectomy due to uterine neoplasia.

Prior to anaesthesia induction, the patient was conscious and oriented, with no neurological focal signs, with normal heart and lung sounds, peripheral oxygen saturation 98%, non-invasive blood pressure 135/90 mmHg and sinus rhythm of 65 bpm.

During the intervention, monitoring consisted of pulse oximetry, continuous electrocardiogram, non-invasive blood pressure, inspired oxygen fraction, central temperature, end tidal CO_2, peripheral oxygen saturation, and end-tidal sevoflurane (ET-Sevo). Neuromuscular blockade was evaluated using a train-of-four monitor (S/5 M-NMT Neuro-Muscular Transmission Module, Datex-Ohmeda, Madison, WI, USA), with the electrodes placed on the ulnar nerve on the volar side of the wrist.

Unilateral BIS monitoring was performed using the BIS VISTA Monitoring System Rx only EC REP (Aspect Medical Systems software version 4.1 for unilateral BIS) with the BIS TM Quatro unilateral exploratory electrode (with a 1-year expiration date) at FPz, FP1, AF7 and FT9, according to the 10–20 electroencephalography system, with no impedance detection and with a signal quality index of over 90.

After uneventful anaesthesia induction with remifentanil 0.1 $\mu g\,kg^{-1}\,min^{-1}$, propofol 100 mg, and rocuronium 60 mg, general anaesthesia was maintained with ET-Sevo between 1.5 and 2, remifentanil between 0.1 and 0.2 $\mu g\,kg^{-1}\,min^{-1}$ depending on surgical stimulation, continuous infusion of rocuronium 0.2 $mg\,kg^{-1}\,h^{-1}$, and 16 mg of morphine as rescue analgesia 90 min before education. Haemodynamic and respiratory values were stable during the intervention. Pre-induction baseline BIS was 95, with a minimum value of 28 after induction, with no observed burst suppression phenomenon. Anaesthesia was maintained at a range of between 40 and 50, with a suppression rate of 0.

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