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Body movement during propofol anesthesia appears to be related to the individual rather than to environmental conditions

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Introduction

Propofol causes hyperesthenia and involuntary movement in some patients [1–4]; the mechanism of this response is not yet known. We occasionally experience cases in which propofol causes abnormal body movement that does not disappear when the propofol dose is increased. We report a volunteer who showed similar body movements on two occasions when propofol was administered as part of our original research protocol.

Case report

The subject was a 22-year old man who reported no significant health problems throughout his life. He weighed 56 kg and was 165 cm tall. The research protocol that the volunteer had consented to called for the administration of propofol through an indwelling venous catheter in the right arm. No preliminary medication was given.

The propofol dose was infused by target-controlled infusion (TCI); with the Diprifusor TCI (Graseby 3500 TCI; Graseby Medical, Watford, UK) so that the bispectral index (BIS) value (A-2000; Aspect Medical Systems, Newton, MA, USA) was less than 60 (stable sedation). The subject was asked to grip a syringe; the time when the syringe was dropped and the time when the subject was unresponsive to his name being called were recorded. When the subject dropped the syringe, the effect-site concentration of propofol was 0.8 μg·ml^{-1} and BIS was 86; when the spoken name reaction was lost, the propofol concentration was 1.4 μg·ml^{-1} and BIS was 79. Because the BIS values ranged between 60 and 70 at the target concentration of 3.5 μg·ml^{-1}, the target concentration of propofol was increased to 3.8 μg·ml^{-1} at first, and gradually to over 5 μg·ml^{-1} in order to get a BIS of less than 60. Five minutes after initial administration of propofol, however, the upper extremities began to move although the BIS value was 58 just before the body movement occurred, and the movement gradually became stronger. At this time, the effect-site concentration of propofol was 4.0 μg·ml^{-1}.

The body movement became so strong that the volunteer was in danger of falling off the bed. We therefore determined that it was impossible to continue the research and stopped the propofol administration. As his body movement stopped, the BIS value increased. When the effect-site concentration of propofol was 2.6 μg·ml^{-1}, the volunteer opened his eyes in response to our calling his name. During propofol administration, there were no spike waves on his raw electroencephalogram (EEG) continuously displayed on the BIS monitor. In the interview after the subject awakened, he mentioned that he could not remember anything after falling asleep, and that he woke in good spirits.

Thereupon, we explained to him that the research protocol had been halted owing to his unexpectedly strong body movement. We arranged for him to return a week later to try to perform the protocol again.

The protocol described above was repeated. The subject dropped the syringe at an effect-site propofol concentration of 2.0 μg·ml^{-1} and the spoken-name reaction was lost at 2.2 μg·ml^{-1}. However, the BIS value was between 60 and 70, which was considered to be insufficient sedation. We therefore increased the target effect-site concentration to 3.0 μg·ml^{-1} in an attempt to get a BIS of less than 60. Eleven minutes after initial admin-

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istration of propofol, when the BIS was 62, both upper extremities moved toward the acromion, and the body movement gradually became intense. The effect-site concentration of propofol was $3.0\,\mu g \cdot ml^{-1}$, and the subject's body movement was so intense that he almost fell off the bed. We again judged that it was impossible to continue the research and stopped the propofol administration. When the effect-site concentration of propofol was $1.2\,\mu g \cdot ml^{-1}$, the subject opened his eyes. After awakening, he said that he had no memory after going to sleep and that his waking was as pleasant as it had been the week before.

Discussion

In the present patient, we did not give any preliminary medication, so that it was possible to examine the particular effects of propofol. We confirmed that this volunteer had neither neurological diseases nor EEG abnormality, and he reacted to propofol in exactly the same way on two occasions, 1 week apart. The symptoms consisted of shaking of the upper and lower extremities that might be described as "fiapping wings" and "moving the torso." We therefore suggest that abnormal body movement in response to propofol is dependent on the individual differences of patients to whom the propofol is administered, and not on environmental factors affecting its use.

When propofol is injected with the Diprifusor TCI at a target concentration of $5\,\mu g \cdot ml^{-1}$, almost all patients fall asleep within 3 min, at an effect-site propofol concentration of $1.85\,\mu g \cdot ml^{-1}$ [5]. This volunteer also lost consciousness at that concentration, but then remained unconscious and manifested a state of excitement. The body excitement of this volunteer resembled the movement which we sometimes observe during induction only with inhalation anesthetics.

With inhalation anesthesia, the time it takes for the drug to reach an effective concentration is different in each anatomical location [6, 7]. Thus, for a certain time, the cerebral cortex might be inhibited, but the ventral horn or a small portion of the cortex is excited, causing involuntary body movement. With intravenous anesthetics, however, the blood concentration is rapidly increased, and the resultant concentration difference between locations is small. The abnormal body movements noted in the present subject suggest that the central inhibitory activity of propofol may be heterogeneously produced.

In summary, we have reported findings in a male adult volunteer who developed abnormal body movements during propofol administration. He showed similar movements when he was given intravenous propofol on a second occasion. The findings in this subject showed the possibility that the causes of this kind of body movement are less dependent on the infiuence of the environment and more on individual differences. As a result, we recommend avoiding administration of propofol to patients who have experienced extraordinary body movements when given propofol previously.

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