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SCIENTIFIC ARTICLE

Comparison of propofol and midazolam on patients undergoing spinal surgery with intraoperative wake-up test: randomized clinical trial

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Wake-up test;
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Abstract
Background and objectives: Instrumentation in correction operations for spinal deformities carries a 0.5–5% risk of injuring the spinal cord. The wake-up test is used for early detection of these injuries. In this study we compared the effects of propofol and midazolam during wake-up test in scoliosis surgery.
Methods: Thirty patients were randomly assigned as group P and group M. Anesthesia was induced with propofol 2.5 mg kg^{-1} for group P or midazolam 0.5 mg kg^{-1} for group M with remifentanil 0.5 μg kg^{-1} and cisatracurium 0.15 mg kg^{-1} for both groups. At the maintenance of anesthesia O_2/air and infusions of remifentanil and cisatracurium were used. In group P, propofol 6–10 mg kg^{-1} h^{-1} and in group M, midazolam 0.5 mg mg kg^{-1} were preferred. Approximately 15 min before the wake-up test, all drugs were discontinued. At the wake-up test, anesthesiologist asked the patients to open their eyes and squeeze his/her hand at every 30 s until the patients responded. Then patients were told to wiggle their toes. Hemodynamic parameters, time of eye-opening, appropriate movement upon verbal command were evaluated. BIS frequency throughout the operation was recorded.
Results: The eye opening time was 9 ± 2.15 min in group P and 7 ± 3.15 min in group M. Motor movement time was 12 ± 2.55 min in group P and 21.25 ± 3.93 min in group M.
Conclusion: Propofol provided better wake-up conditions and conducted a better neurologic assessment within the same BIS values than midazolam.

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PALAVRAS-CHAVE
Teste de despertar;
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BIS;
Cirurgia de coluna

Comparação de propofol e midazolam em pacientes submetidos à cirurgia de coluna vertebral com teste de despertar no intraoperatório: estudo clínico randomizado

Resumo
Justificativa e objetivos: A instrumentação em cirurgias de correção de deformidades da coluna vertebral tem risco de 0,5 a 5% de lesionar a medula espinhal. O teste de despertar é usado para a detecção precoce dessas lesões. Neste estudo comparamos os efeitos de propofol e midazolam durante o teste de despertar em cirurgia de escoliose.
Métodos: Trinta pacientes foram designados de forma aleatória para os grupos P e M. A anestesia foi induzida com propofol (2,5 mg kg^{-1}) no grupo P ou midazolam (0,5 mg kg^{-1}) no grupo M, com remifentanil (0,5 μg kg^{-1}) e cisatracúrio (0,15 mg kg^{-1}) em ambos os grupos. A manutenção da anestesia foi feita com O_2/ar e infusões de remifentanil e cisatracúrio. Nos grupos P e M, respectivamente, doses de propofol (6-10 mg kg^{-1} h^{-1}) e de midazolam (0,5 mg mg kg^{-1}) foram preferidas. Aproximadamente 15 min antes do teste de despertar, todos os medicamentos foram interrompidos. No teste de despertar, o anestesiologista pedia ao paciente que abrisse os olhos e apertasse sua mão a cada 30 s até que o paciente respondesse. Depois, o paciente era solicitado a mexer os dedos dos pés. Os parâmetros hemodinâmicos, o tempo de abertura dos olhos e o movimento apropriado sob comando verbal foram avaliados. A frequência do BIS foi registrada durante toda a cirurgia.
Resultados: O tempo de abertura dos olhos foi de $9 \pm 2{,}15$ min no grupo P e de $7 \pm 3{,}15$ min no grupo M. O tempo de movimento motor foi de $12 \pm 2{,}55$ min no grupo P e de $21{,}25 \pm 3{,}93$ min no grupo M.
Conclusão: Propofol proporcionou melhores condições de despertar e possibilitou uma melhor avaliação neurológica dentro dos mesmos valores do BIS que midazolam.

Introduction

Instrumentation in correction operations for spinal deformities as vertebral fusion, congenital and traumatic scoliosis, carries a 0.5–5% risk of injuring the spinal cord during spinal surgery.[1] These complications are generally results of complex factors such as direct effects of compression on the spinal cord, distraction, the effects of spinal ischemia or arterial hypotension.[2–4] The intraoperative monitoring of spinal cord function is necessary to prevent these series complications. The wake-up test is one of the methods used for early detection and possibly prevention of these spinal cord injuries[5] and was performed for the first time successfully by Vauzella and Stagmara in 1973.[6]

Somatosensorial evoked potentials (SSEPs) and motor evoked potentials (MEPs) are more recent methods which give an idea about the spinal cord functions intraoperatively. But many factors may affect these kinds of neuromonitoring and yield erroneous results which necessitate the wake-up test to prevent long-term complications. A wake-up test is recommended for all cases in which threshold monitoring changes occur because spinal cord injury may exist even when monitored variables return to baseline.[7]

The purpose of the wake-up test is to monitor voluntary motor function of the lower limbs once the vertebrae have been instrumented and distracted. The depth of anesthesia is gradually lightened up to the point where patients are able to respond to verbal commands. As the voluntary movement of lower extremities is demonstrated, the depth of anesthesia is increased to complete the surgery.[8] That is why during the wake-up test monitoring the depth of anesthesia carries additional importance. BIS values between 85 and 90 may also support superficial anesthesia or wakefulness at which stage reliable neurological assessment can be made.

Nitrous oxide and halogenated anesthetics are known to have restraining effects on the MEPs from the lower extremities. TIVA (total intravenous anesthesia) has been recommended in the correction of scoliosis for several years because it may provide optimal conditions to monitor the spinal cord function reliably with rapid emergence during the wake-up test.[9,10]

In this study our aim is to compare the effects of two different intravenous anesthetic agents during wake-up test in patients undergoing scoliosis surgery. Although TIVA is recommended, there is no study comparing the effects of propofol and midazolam together with remifentanil infusion during wake-up test under BIS monitoring.

Materials and methods

Thirty patients (between 10 and 30 years old, ASA physical status I–II) who had idiopathic spinal deformity but no neurologic deficit were enrolled in this randomized prospective study. Following local ethics committee approval and obtainment of informed consent from patients or the parents of the children, all patients were scheduled for posterior instrumentation operation. None of the patients had any history of drug allergy, mental retardation or psychiatric problems. After detailed specific information about the wake-up test was instructed, all the patients were told that during the wake-up test the anesthesiologist would first ask them to squeeze the anesthesiologist's hand, then wiggle their toes. Patients were randomly assigned for two groups as group P ($n = 15$) and group M ($n = 15$), using a computer-generated