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SCIENTIFIC ARTICLE

The effect of different doses of esmolol on hemodynamic, bispectral index and movement response during orotracheal intubation: prospective, randomized, double-blind study

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KEYWORDS
Depth of anesthesia;
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Abstract
Objective: A prospective, randomized and double-blind study was planned to identify the optimum dose of esmolol infusion to suppress the increase in bispectral index values and the movement and hemodynamic responses to tracheal intubation.
Materials and methods: One hundred and twenty patients were randomly allocated to one of three groups in a double-blind fashion. 2.5 mg kg^{-1} propofol was administered for anesthesia induction. After loss of consciousness, and before administration of 0.6 mg kg^{-1} rocuronium, a tourniquet was applied to one arm and inflated to 50 mm Hg greater than systolic pressure. The patients were divided into 3 groups; 1 mg kg^{-1} h^{-1} esmolol was given as the loading dose and in Group Es50 50 μg kg^{-1} min^{-1}, in Group Es150 150 μg kg^{-1} min^{-1}, and in Group Es250 250 μg kg^{-1} min^{-1} esmolol infusion was started. Five minutes after the esmolol has been begun, the trachea was intubated; gross movement within the first minute after orotracheal intubation was recorded.
Results: Incidence of movement response and the ΔBIS max values were comparable in Group Es250 and Group Es150, but these values were significantly higher in Group Es50 than in the other two groups. In all three groups in the 1st minute after tracheal intubation heart rate and mean arterial pressure were significantly higher compared to values from before intubation ($p < 0.05$). In the study period there was no significant difference between the groups in terms of heart rate and mean arterial pressure.
Conclusion: In clinical practise we believe that after 1 mg kg^{-1} loading dose, 150 μg kg^{-1} min^{-1} iv esmolol dose is sufficient to suppress responses to tracheal intubation without increasing side effects.

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PALAVRAS-CHAVE
Profundidade da anestesia;
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Esmolol

Efeito de diferentes doses de esmolol sobre a resposta hemodinâmica, BIS e resposta de movimento durante a intubação orotraqueal: estudo prospectivo, randômico e duplo-cego

Resumo
Objetivo: Estudo prospectivo, randômico e duplo-cego planejado para identificar a dose ideal de perfusão de esmolol para suprimir o aumento dos valores do BIS e os movimentos e respostas hemodinâmicas à intubação traqueal.
Materiais e métodos: 120 pacientes foram randomicamente alocados um dos três grupos, usando o método duplo-cego. Propofol (2,5 mg kg^{-1}) foi administrado para indução da anestesia. Após a perda da consciência e antes da administração de rocurônio (0,6 mg kg^{-1}), um torniquete foi aplicado a um braço e insuflado a 50 mm Hg acima da pressão sistólica. Os pacientes foram divididos em três grupos; uma dose de 1 mg kg^{-1} h^{-1} de esmolol foi administrada como carga e perfusão de 50 μg kg^{-1} min^{-1} de esmolol foi iniciada no Grupo ES50, 150 μg kg^{-1} min^{-1} no Grupo Es150 e 250 μg kg^{-1} min^{-1} no Grupo ES250. Cinco minutos após o início da perfusão, a traqueia foi intubada; o total de movimentos no primeiro minuto após a intubação orotraqueal foi registrado.
Resultados: A incidência da resposta de movimentos e os valores máximos de ΔBIS foram comparáveis nos grupos ES250 e Es150, mas esses valores foram significativamente mais elevados no Grupo ES50 que nos outros dois grupos. Nos três grupos, os valores de frequência cardíaca e pressão arterial média foram significativamente maiores no primeiro minuto pós-intubação, comparados aos valores pré-intubação ($p < 0,05$). Não houve diferença significativa entre os grupos em relação à frequência cardíaca e pressão arterial média durante o período de estudo.
Conclusão: Na prática clínica, acreditamos que após uma dose com carga de 1 mg kg^{-1}, uma dose de 150 μg kg^{-1} min^{-1} de esmolol IV é suficiente para suprimir a resposta à intubação traqueal sem aumentar os efeitos colaterais.

Introduction

During anesthesia induction tracheal intubation is one of the most intensive noxious stimuli and can induce hemodynamic and movement responses and increase the bispectral index (BIS).[1–3] Hemodynamic changes due to tracheal intubation, similar to changes due to other surgery-related stimuli such as anesthesia and skin incisions, are often transient. However, in patients with coronary artery disease, hypertension (HT) or with a history of cerebrovascular disease, a possible increase in hemodynamic parameters may cause myocardial ischemia, arrhythmia, infarction or cerebral bleeding.[1,2] The close relationship of tachycardiac heart rate (HR) to myocardial ischemia has suggested the use of β-adrenergic receptor blockers for the suppression of the hemodynamic response to tracheal intubation.[3–5]

During anesthesia primarily for the treatment of HT and tachycardia β_1 adrenoreceptor antagonists are indicated, which have been proven in clinical studies to have a role in pain modulation.[6–13] While the mechanism is unknown, esmolol infusion is known to suppress the BIS increase and movement response linked to tracheal intubation compared to placebo.[14,15] However no study was found on the relationship between the effects of esmolol at different infusion doses. The hypothesis of this study is that the responses to tracheal intubation of increased movement and BIS will be suppressed due to the antinociceptive effect of esmolol in a dose-linked fashion, causing a reduction in BIS increase and movement after tracheal intubation. To test this hypothesis and identify the optimum infusion dose to suppress BIS increase and movement response, along with hemodynamic response, to tracheal intubation, a prospective, randomized and double-blind study was designed.

Methods

After receiving Dokuz Eylül University, Faculty of Medicine Clinical Trials Local Ethics Committee approval and informed patient consent this prospective, randomized, double-blind study was completed. One hundred and twenty adult patients in ASA I–II risk groups, between the ages of 18 and 65, undergoing elective surgery, apart from head, neck and cardiac surgery, were enrolled in the study.

Patients with predicted difficult intubation or airway management, body mass index > 30 kg/m^2, HR < 60 beats min^{-1}, systolic arterial pressure (SAP) < 100 mm Hg, cardiac diseases, diabetes mellitus, renal failure, liver failure, COPD, asthma, reactive airway disease, symptomatic gastroesophageal reflux, patients with neuropsychiatric or neurological diseases, pregnant and lactating patients, patients with a history of use of opioids, tricyclic antidepressants, benzodiazepines, anticonvulsants, clonidine, β-adrenergic receptor blockers, or alcohol abuse, and patients with a history of allergic reaction to the study drugs were excluded.

No drugs were administered for preoperative medication. Anesthesia was administered after 18 G intravenous preparation of 10 mL kg^{-1} 0.9% NaCl with fluids through a vascular