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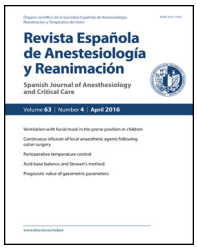

ORIGINAL ARTICLE

End-tidal desflurane concentration for tracheal extubation in adults☆,☆☆

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KEYWORDS
Desflurane;
End-tidal concentration;
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Abstract
Objective: To determine the end-tidal desflurane concentration required for tracheal extubation in anaesthetised adults.
Material and methods: After hospital Ethics Committee approval, eighteen ASA I–II adult patients (19–65 years of age), who had been scheduled for elective ambulatory surgery were included in the study. Anaesthesia was induced with propofol 2.5 mg/kg, fentanyl 2 μg/kg, and rocuronium 0.6 mg/kg for intubation. Maintenance of anaesthesia was provided by desflurane in oxygen and air (40:60), and remifentanil at 0.05–0.25 μg/kg/min. Neuromuscular function was monitored with train-of-four (TOF) nerve stimulation and acceleromyography. At the end of the surgery neuromuscular blockade was reversed with sugammadex 2–4 mg/kg in accordance with the TOF ratio. The concentration of desflurane at which extubation was attempted was determined by using Dixon's up-and-down method with 0.5% as a step size. Smooth extubation was defined as one without coughing, teeth clenching, gross purposeful movements, and no breath-holding or laryngospasm within 1 min of tracheal extubation.
Results: It was found that the end-tidal concentration of desflurane was 3.17 ± 0.18% (95% CI: 3–3.35%) for successful extubation in 50% of adults.
Conclusion: Extubation in patients receiving desflurane may be feasible at 0.62 minimum alveolar concentration.

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PALABRAS CLAVE
Desflurano;
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Extubación vía aérea

Concentración al final de la espiración de desflurano requerida para la extubación en el paciente adulto

Resumen
Objetivo: Determinar en el paciente adulto la concentración al final de la espiración (end-tidal) de desflurano que previene la respuesta a la extubación en el 50% de los pacientes (CAM_{EXT}).
Material y método: Tras la aprobación por el comité ético del hospital, 18 pacientes adultos ASA I y II (19-65 años) programados para cirugía ambulatoria fueron incluidos en el estudio. La inducción anestésica se realizó con propofol 2,5 mg.kg^{-1}, fentanilo 2 μg.kg^{-1} y rocuronio en dosis de 0,6 mg.kg^{-1} para facilitar la intubación orotraqueal. El mantenimiento se llevó cabo con desflurano en oxígeno y aire (40:60) con una concentración end-tidal de 5,5 a 7,5%, acorde a la edad del paciente. Se asoció remifentanilo en perfusión continua en dosis de 0,05-0,25 μg/kg/min. El bloqueo neuromuscular se monitorizó mediante aceleromiografía a través del «tren de cuatro» (TOF). Al finalizar la intervención se revirtió el bloqueo neuromuscular con sugammadex en dosis de 2-4 mg.kg^{-1} acorde con la relación del TOF. La concentración de desflurano en la que se realizó la extubación fue determinada con la metodología secuencial de Dixon de *up-and-down* con incrementos y decrementos en la concentración de desflurano del 0,5%. Se definió como respuesta la presencia de tos, movimiento, mordida del tubo endotraqueal, laringoespasmo o apnea hasta 1 min tras la extubación.
Resultados: La concentración end-tidal de desflurano para realizar una extubación exitosa en el 50% de los pacientes adultos fue de 3,17 ± 0,18% (IC 95%: 3-3,35%). Un 33% de los pacientes presentó tos y un paciente presentó desaturación inferior a 90%, que se resolvió con ventilación con mascarilla facial.
Conclusiones: La extubación exitosa de pacientes adultos anestesiados con desflurano puede ser realizada con una concentración alveolar mínima de desflurano de 0,62 en el 95% de los pacientes.

Introduction

During extubation following a surgical intervention under general anaesthesia, the stimulation caused by the tracheal tube can provoke exaggerated reactions, such a sudden coughing and laryngospasm, spasmodic head movements, bruxism, or biting down on the tube to make it difficult to remove.[1,2] Other complications can include serious respiratory events, increased bleeding at the surgical site, or even surgical failure (for example, intraocular lens dislocation in cataract surgery). Other more serious complications, such as acute negative pressure pulmonary oedema, can be overlooked and will subsequently require rapid diagnosis and treatment.[3] For these reasons, a gentle movement, called smooth tracheal extubation by some authors, is recommended, and should be performed while the patient is still anaesthetised in order to reduce the risk of complications associated with excessive airway stimulation.[4]

Desflurane has a lower (0.42) blood–gas partition coefficient than other halogenated anaesthetics, such as sevoflurane (0.65) or isoflurane (1.43). This, together with its low brain/blood partition coefficient (1.29 compared with 1.70 in sevoflurane or 1.6 in isoflurane), enables rapid post-anaesthesia elimination and early recovery of protective airway reflexes.[5,6] This rapid post-anaesthesia recovery make desflurane the ideal agent if extubation is performed while the patient is anaesthetised.

Nevertheless, to the best of our knowledge, the minimum end-expiratory alveolar concentration of desflurane (MAC_{EXT}) needed to prevent extubation reflex in 50% of patients has yet to be determined.

The aim of this study has been to determine the desflurane MAC_{EXT} needed for extubation in adult patients receiving general anaesthesia plus a muscle relaxant.

Materials and methods

The study was approved by the hospital's Ethics Committee in December 2012 (document 249/12). Patients were given a full description of the study and asked to give both verbal and signed consent before inclusion. Inclusion criteria were: aged between 18 and 60 years, ASA I and II, scheduled for outpatient surgery requiring general anaesthesia and orotrachael intubation. Patients scheduled for general, maxilofacial (wisdom teeth extraction), dental surgery and minor orthopaedic surgery were included.

Exclusion criteria were: known difficult airway, history of gastroesophageal reflux disease, bronchial hyperresponsiveness, recent history of pulmonary infection, smoking habit, patients on long-term treatment with drugs that could alter MAC, and refusal to take part in the study.

After transfer to the surgery prep room and placement of a peripheral venous catheter, patients were pre-medicated with 1 mg IV midazolam. Once transferred to the operating room, standard monitoring techniques were used and depth of anaesthesia was monitored using bispectral analysis (BIS) (BIS-VISTA™, Monitoring System, Aspect