



Original contribution

The intubating laryngeal mask airway: Rocuronium improves endotracheal intubating conditions and success rate[☆]

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Abstract

Study objective: To assess intubating conditions without neuromuscular blocking drugs, to determine the relation between the dose of rocuronium and the probability of achieving excellent or at least good (good or excellent) intubating conditions with the intubating laryngeal mask airway (ILMA), and finally, to determine the relationship between rocuronium use and the success rate of endotracheal intubation.

Design: Prospective, randomized, double-blinded, placebo-controlled study.

Setting: University-affiliated medical center.

Patients: Sixty American Society of Anesthesiologists physical status I and II patients undergoing elective surgery.

Interventions: Anesthesia was induced with propofol 2.5 mg/kg and fentanyl 1 μ g/kg. One minute after loss of consciousness, patients received rocuronium 0.2 mg/kg or saline. In the rocuronium group, if intubating conditions were scored as poor, rocuronium dose in the next patient was increased by 0.05 mg/kg. If intubating conditions were scored as good, no change was made, but if conditions were scored as excellent, the dose was decreased by 0.05 mg/kg. One minute after rocuronium or saline administration, an ILMA was used to intubate the trachea. If intubation was unsuccessful, a second attempt was made using the ILMA.

Measurements: We recorded intubating conditions and the success rate of tracheal intubation.

Main results: Without rocuronium, the probability of achieving at least good intubating conditions with the ILMA was 30%. A rocuronium dose of 0.2 mg/kg resulted in a probability of 80% to achieve at least good intubating conditions. Rocuronium significantly increased the success rate of the second intubation attempt.

Conclusion: To achieve good or excellent intubating conditions with the ILMA, a rocuronium dose lower than the standard intubating dose of 0.6 mg/kg can be used. Neuromuscular blockade increases the success rate of intubation if a second attempt is necessary.

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1. Introduction

The intubating laryngeal mask airway (ILMA) consists of a standard Laryngeal Mask Airway (The LMA Co, Inc, San Diego, Calif) modified with a wide, short airway tube and a metal handle, that allows maneuvering of the device within the oral cavity without the need for head and neck manipulation [1]. The success rate of tracheal intubation with an endotracheal tube (ETT) using the ILMA has been reported in several studies to range between 62% and 99% [2-7]. This wide discrepancy may be explained by the fact that individual studies differ in the use of neuromuscular blocking drugs, depth of anesthesia at time of insertion, and whether the ETT that was designed by the manufacturer was or was not used. Attempts at tracheal intubation without muscle relaxation can result in poor intubating conditions and the potential for significant airway trauma [8]. The muscle relaxant dose required to achieve adequate intubating conditions remains unknown.

The goals of this study were to assess intubating conditions without neuromuscular blocking drugs and to determine the relation between dose of rocuronium and the probability of achieving excellent or at least good (good or excellent) intubating conditions with the ILMA. The effect of rocuronium on the success rate of endotracheal intubation was also studied.

2. Materials and methods

After obtaining Stanford University Medical Center Institutional Review Board approval and informed consent, we studied 60 American Society of Anesthesiologists physical status I and II patients aged 18 to 55 years and scheduled for elective surgery. Patients undergoing head or neck surgery, pregnant patients, and patients with cardiac, respiratory, renal, hepatic, neuromuscular, or gastroesophageal reflux diseases were excluded from the study. Patients received intravenous (IV) midazolam 1 to 2 mg premedication and they breathed oxygen by facemask for 3 minutes. Thereafter, anesthesia was induced with propofol 2.5 mg/kg IV and fentanyl 1 μ g/kg IV, and the lungs were ventilated by bag and mask with 100% oxygen. One minute after loss of consciousness, patients received rocuronium or saline. One minute after administration of rocuronium or saline, an ILMA with the appropriate size was inserted using the technique recommended by Brain et al [7]. Successful insertion of the ILMA was confirmed by normal capnogram and adequate chest rise in response to gentle positive pressure ventilation of the lungs. Thereafter, the trachea was intubated with the ETT provided by the manufacturer. If intubation was unsuccessful, a second attempt was made after repositioning of the ILMA. If needed, additional propofol was given. Intubating conditions were scored based on the guidelines of the Consensus Conference on Good Clinical Research Practice in Pharmacodynamic

Studies of Neuromuscular Blocking Agents [9]. Conditions were scored as follows: (a) excellent, if insertion of the ILMA was without resistance, if there was no airway reaction, and if the patient did not move his or her limbs during endotracheal intubation; (b) good, if insertion of the ILMA was with slight resistance, if there was diaphragmatic movement (cough, hiccups, or breathing) less than 10 seconds, or if there was slight limb movement during endotracheal intubation; and (c) poor, if ILMA insertion was with moderate to severe resistance, if there was diaphragmatic movement for more than 10 seconds, or if there was vigorous limb movement during endotracheal intubation. In the rocuronium group, the first patient received 0.2 mg/kg. If conditions were scored as poor, the rocuronium dose in the next patient was increased by 0.05 mg/kg. If intubating conditions were scored as good, no change was made, but if conditions were scored as excellent, the dose was decreased by 0.05 mg/kg. Two anesthesiologists with experience in insertion of the ILMA performed all tracheal intubations. On the day after surgery, patients were asked if they had a sore throat or hoarseness.

For the saline group and each rocuronium dose given, the proportion of excellent and at least good intubating conditions was determined as well as the standard error. The relation between dose and the probability of achieving excellent or at least good intubating conditions were analyzed using the following logistic regression model:

$$P(Y \leq m) = E_0 + \frac{E_{\max} * D^N}{D_{50}^N + D^N}$$

where

$P(Y \leq m)$ = probability of score equal to or at least m ,
 m = intubation score,
 E_0 = baseline effect,
 E_{\max} = maximum effect,
 D = dose of rocuronium given ($D = 0$ in saline group),
 D_{50} = dose at which the probability of score m is 50%,
 N = slope parameter describing the steepness of dose-response curve.

Fisher exact test was used to compare intubation condition scores in each group. The log likelihood ratio test for contingency tables was used to analyze the success rate of intubation with and without rocuronium. All analyses were performed using S-PLUS version 6.0 (Insightful Corp, Seattle, Wash).

3. Results

There was no difference between the 2 groups in patient characteristics or ILMA size used (Table 1). In all 60 patients, the ILMA could be inserted, and in 51 patients, the trachea could be intubated with the ETT in 1 or 2 attempts. Table 2 shows the intubating condition

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