Journal of Clinical Anesthesia (2009) **21**, 427–430

ELSEVIER

Journal of Clinical Anesthesia

Original contribution

Rapid injection of rocuronium reduces withdrawal movement on injection☆

Yong Cheol Lee MD, PhD (Assistant Professor)*, Young Ho Jang MD, PhD (Assistant Professor), Jin Mo Kim MD, PhD (Professor), Sang Gyu Lee MD (Resident)

Department of Anesthesiology and Pain Medicine, Keimyung University, School of Medicine, Joong-gu, Daegu, 700-712, Korea

Received 6 November 2007; revised 20 November 2008; accepted 25 November 2008

Keywords:
Injection pain;
Lidocaine pretreatment;
Rocuronium injection pain;
Withdrawal movement;
Withdrawal response

Abstract

Study Objective: To test whether rapid injection of rocuronium reduces withdrawal movement on injection.

Design: Randomized, prospective trial.

Setting: Operating room in a university hospital.

Patients: 150 ASA physical status I and II patients aged 18 to 60 years, undergoing general anesthesia.

Interventions: Patients were randomized to three groups. After undergoing anesthesia induction with thiopental sodium, then 5 seconds later receiving a rubber tourniquet applied to the mid-forearm to stop intravenous (IV) flow by gravity, the pretreatment drug was injected. The tourniquet was held for 15 seconds then released, and 1.0 mg/kg of 1% rocuronium was injected IV. Group C patients (n = 50) were pretreated with 0.1 mL/kg of 0.9% NaCl and then injected with rocuronium slowly within 10 seconds. Group L patients (n = 50) were pretreated with 0.1 mL/kg of preservative-free 1% lidocaine and then injected with rocuronium slowly within 10 seconds. Group R patients (n = 50) were pretreated with 0.1 mL/kg of 0.9% NaCl and then rapidly injected with rocuronium within approximately one second (as quickly as possible).

Measurements: After injection of the patient with the study drug, a single anesthesiologist with no knowledge of the study protocol graded each patient's response as follows: 0 = no response; 1 = mild movement limited to the wrist only; 2 = moderate movement involving the elbow and shoulder; and 3 = severe movement involving more than one extremity.

Main Results: Group C had the most intense and frequent withdrawal response. The frequency and intensity of withdrawal movement was significantly less in Groups L and R than Group C. No significant difference in withdrawal response between Groups L and R was noted.

Conclusions: Withdrawal response can be significantly reduced for rocuronium injection without lidocaine pretreatment, simply through rapid injection.

1. Introduction

Rocuronium is a widely used nondepolarizing muscle relaxant of intermediate duration with a rapid onset [1]. Its

☆ Supported by a 2007 Bisa Research Grant from Keimyung University, Daegu, Korea.

* Corresponding author. Tel.: +82 53 250 7193; fax: +82 53 250 7240.
E-mail address: yclee@dsmc.or.kr (Y.C. Lee).

0952-8180/$ – see front matter © 2009 Elsevier Inc. All rights reserved.
doi:10.1016/j.jclinane.2008.11.011

injection after induction of anesthesia has often been associated with pain-induced withdrawal movement near the site of injection [2,3], which is commonly reduced by pretreatment with lidocaine. Indeed, pain from rocuronium injection occurs in 50% to 80% of patients [2-5]. Attempts to reduce this adverse effect have included pretreatment or mixing rocuronium with a variety of drugs [3-10]. As far as we can determine, however, there have been no reports of studies of injection speed.

In principle, simply increasing the speed of injection might lessen the pain. Rapid injection would allow the rocuronium to be cleared from the vein and replaced with blood, whereas slow injection prolongs the drug's contact time with the endothelium. Whether rapid injection of rocuronium reduces pain-induced withdrawal movement was determined.

2. Materials and methods

After obtaining Keimyung University Hospital ethics committee approval and patients' informed consent, 150 ASA physical status I and II patients, aged 18-60 years, and undergoing general anesthesia, were enrolled in the study. Patients with neurologic deficits or allergies to thiopental sodium, rocuronium, or lidocaine were excluded from the study.

All patients were premedicated with 0.1 mg/kg of midazolam orally and 0.2 mg glycopyrrolate intramuscularly one hour before anesthesia induction. On patient arrival in the operating room, routine noninvasive monitoring was established and a 20-gauge intravenous (IV) catheter with a three-way stopcock attached was placed on the dorsum of the patient's hand. Free flow of lactated Ringer's IV fluid was confirmed.

Each group of patients underwent IV induction of anesthesia using 5 mg/kg of 2.0% thiopental sodium, followed by free flow of IV. Five seconds later, a rubber tourniquet was applied to the mid-forearm to stop the IV flow by gravity, and the pretreatment drug was injected. The tourniquet was maintained for 15 seconds and then released, and 1.0 mg/kg of rocuronium IV was injected. All study drugs were injected into a three-way stopcock directly connected to the IV catheter.

Patients were randomized to three groups via a table of computer-generated numbers. Group C patients (control group; n = 50) were pretreated with 0.1 mL/kg of 0.9% NaCl and then slowly injected with 1.0 mg/kg of rocuronium within 10 seconds. Group L patients (lidocaine group; n = 50) were pretreated with 0.1 mL/kg of preservative-free 1% lidocaine and then slowly injected with 1.0 mg/kg of rocuronium within 10 seconds. Group R patients (rapid-injection group; n = 50) were pretreated with 0.1 mL/kg of 0.9% NaCl and then rapidly injected with 1.0 mg/kg of rocuronium within approximately one second (as quickly as possible).

Table 1 Assessment of withdrawal movement on injection of rocuronium

Withdrawal score	Severity of withdrawal	Patient's response
0	None	None
1	Mild	Mild movement, limited to the wrist
2	Moderate	Moderate movement involving the elbow and shoulder
3	Severe	Severe movement involving more than one extremity

After injection of the study drug, a single anesthesiologist with no knowledge of the study protocol graded each patient's response, according to Table 1. After injection of the study drugs, the study was terminated. Then an opioid was used and the anesthetic was continued at the discretion of the attending anesthesiologist. We assessed erythema, thrombosis, and phlebitis of the vein by noting skin redness, vein hardness, and tenderness on vein palpation in the injected hand and arm immediately after injection, at one hour, and 24 hours after injection.

Demographic data were compared by one-way analysis of variance, and frequency of movement (response) was assessed by chi-square test. A P-value < 0.05 was considered statistically significant.

3. Results

There were no significant differences in demographic characteristics among groups regarding age, gender, body weight, or height (Table 2).

Fig. 1 shows the distribution of responses among the three groups. Group C had the most intense and frequent withdrawal response. Frequency and intensity of withdrawal response were significantly less in Groups L and R than Group C. There were significantly fewer withdrawal scores of 0 (no response) in Group C than Groups L and R (P = 0.0001 and 0.001, respectively) and significantly more withdrawal scores of 2 (moderate response) in Group C than Groups L and R (P = 0.004 and 0.019, respectively). Total frequency of response was significantly higher in

Table 2 Demographic characteristics

Group (n)	Age (yrs)	Gender (M/F)	Weight (kg)	Height (cm)
C (50)	41.0 ± 13.3	19/31	61.2 ± 9.9	164.8 ± 8.5
L (50)	41.7 ± 11.3	21/29	63.7 ± 10.7	165.1 ± 9.3
R (50)	43.4 ± 12.0	18/32	59.8 ± 9.6	162.5 ± 8.0

Values are presented as means ± SD. No statistical significance was found among groups. Group C was pretreated with NaCl, then slowly injected with rocuronium. Group L was pretreated with lidocaine, then slowly injected with rocuronium. Group R was pretreated with NaCl, then rapidly injected with rocuronium.