Pain on injection of rocuronium: influence of two doses of lidocaine pretreatment

K. F. Cheong* and W. H. Wong

Department of Anaesthesia, National University Hospital, 5 Lower Kent Ridge Road, Singapore 119074, Singapore

**Corresponding author*

We have assessed the incidence of pain on injection of rocuronium and evaluated if pretreatment with lidocaine i.v. reduced it, in a randomized, controlled study in 90 patients. We found that 37% of patients who received lidocaine 10 mg pretreatment had pain on injection of rocuronium compared with 77% of patients who received saline pretreatment and 7% of patients who were pretreated with lidocaine 30 mg ($P<0.05$ in each instance compared with control). In addition, patients pretreated with lidocaine were less likely to suffer moderate or severe pain. Both lidocaine 10 mg and 30 mg i.v. given before administration of rocuronium significantly reduced the incidence and severity of pain on injection of rocuronium, and the higher dose was more effective.

Br J Anaesth 2000; **84**: 106–7

Keywords: neuromuscular block, rocuronium; anaesthetics local, lidocaine; pain, injection

Accepted for publication: August 31, 1999

Rocuronium is given in precurarization, timing or priming techniques before induction of anaesthesia.[1 2] (The timing principle entails administration of a single bolus dose of a non-depolarizing neuromuscular blocking agent followed by an induction drug at the onset of clinical weakness.) The incidence of pain on injection of rocuronium is high; reports suggest that 50–80% of patients suffer pain.[3 4] The aim of this study was to examine the incidence of pain on injection of rocuronium and to evaluate if prior administration of lidocaine 10 mg or 30 mg i.v. decreased the incidence and severity of injection pain.

Methods and results

After obtaining approval from the Institutional Ethics Committee and informed consent, we studied 90 ASA I–II patients undergoing a variety of orthopaedic and general surgical procedures requiring general anaesthesia with positive pressure ventilation. Patients were allocated randomly to one of three groups: lidocaine 10 mg, lidocaine 30 mg or placebo (control). Those with difficult venous access or requiring rapid sequence induction were excluded. Patients were informed that they would be receiving a drug at the start of their anaesthetic that may make their arm 'sting'. They were told that they would be asked to score the pain, if any occurred, after the drug had been given. No premedication was given.

On arrival in the operating room, a 22-gauge cannula was placed in the largest vein on the dorsum of the hand without the use of local anaesthesia. All patients were monitored with an electrocardiograph, pulse oximeter and an automatic non-invasive arterial pressure monitor. Patients were allocated randomly using sealed envelopes to receive isotonic saline (control group), lidocaine 10 mg or lidocaine 30 mg at ambient temperature (20–24°C). All syringes were prepared by another investigator and covered so that the investigator who assessed the patient's response was unaware of the nature of the solution. Ten seconds after injection of the pretreatment drug, an intubating dose of rocuronium 0.6 mg kg^{-1} at room temperature was injected over 10–15 s. The patient was asked during this period if his arm was comfortable and to report the severity of any pain on a four-point scale (none, mild, moderate, severe). Thirty seconds after administration of rocuronium, propofol was administered i.v. until loss of consciousness and anaesthesia proceeded as planned.

Based on an estimated incidence of approximately 80% of patients experiencing pain on injection of rocuronium, the sample size required to detect a 50% reduction at a level of significance of 5% and a power of 90% was 30 patients per group. Patient characteristics were compared using the Student's *t* test. The chi-square test was used to compare the incidence of pain in the three groups. Results were considered significant when $P<0.05$.

There were no differences in patient characteristics between the three groups in terms of mean age (control 34.9 (range 20–58) yr; lidocaine 10 mg 36.9 (18–62) yr; lidocaine 30 mg 37.7 (20–55) yr), sex distribution (control

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Table 1 Incidence and characteristics of pain on injection of rocuronium. Results are expressed as number of patient responses. *$P<0.05$ compared with control; †$P<0.05$, lidocaine 30 mg compared with lidocaine 10 mg (chi-square)

	Control ($n=30$)	Lidocaine 10 mg ($n=30$)	Lidocaine 30 mg ($n=30$)
None	7	19*	28*†
Mild	5	4	0
Moderate	11	4	2*
Severe	7	3	0*

20 males/10 females; lidocaine 10 mg 22 males/eight females; lidocaine 30 mg 17 males/13 females) or mean body weight (control 66.8 (SD 12.5) kg; lidocaine 10 mg 63.2 (15.2) kg; lidocaine 30 mg 64.8 (10.5) kg). Twenty-three of 30 patients in the control group had pain on injection of rocuronium (76.7%). Both lidocaine groups had significantly lower incidences of pain compared with the control group. Eleven of 30 patients (37%) in the lidocaine 10 mg group had pain on injection of rocuronium, which was significantly greater than the two of 30 patients (7%) in the lidocaine 30 mg group ($P<0.05$) (Table 1). In addition, patients who were pretreated with lidocaine 30 mg before administration of rocuronium were less likely to suffer moderate or severe pain than those in the control group ($P<0.05$).

Comment

Pain associated with injection of rocuronium is common and can be very distressing. In our study, several patients described the pain as 'burning' in nature and occurred immediately on administration. We do not know the exact mechanism for the pain, although the immediate onset probably reflects a direct irritant effect and not an indirect effect on the kinin cascade. Klement and Arndt[5] showed that acidic and alkaline solutions elicited pain at pH values less than 4 and more than 11, respectively. Pain latency also decreased with increasing osmolality, acidity and alkalinity. They postulated that pain is caused by the unphysiological osmolality or pH of the formulations. Rocuronium is supplied as an isotonic solution with a pH of 4. Injection pain is probably caused by the low pH.

Information in the packet insert suggests that lidocaine pretreatment may be effective in attenuating pain on injection, without alluding to the efficacy of this modality. We have examined the efficacy of lidocaine pretreatment, which was found to be effective in obtunding the pain associated with injection of propofol.[6] Our data showed that the incidence of pain on injection of rocuronium was reduced significantly from 77% to 37% ($P<0.001$) when lidocaine 10 mg was given before rocuronium, and was reduced further to 7% when lidocaine 30 mg was given. The number of patients who complained of moderate and severe pain in the lidocaine 30 mg group was significantly smaller than that in the control group. A smaller incidence of moderate and severe pain in the lidocaine 10 mg group compared with the control group was also seen, although this was not statistically significant. A dose-dependent effect of lidocaine in attenuating pain was present. While our study examined only two doses of lidocaine pretreatment, perhaps a higher dose (such as 50 mg) may completely abolish rocuronium injection pain.

Pain on injection of rocuronium is significant and perhaps other clinical strategies could be developed to prevent it. Rocuronium is an invaluable addition to our practice, allowing more rapid tracheal intubation. Attenuation of the pain caused by its injection could make it less distressing for the patient to receive, and improve the quality of induction and acceptability of this otherwise useful agent.

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