Cardiovascular effects of an intubating dose of rocuronium 0.6 mg kg(-1) in anaesthetized patients, paralysed with vecuronium

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Summary

We have studied, in adult patients, ASA I–II, the cardiovascular effects of an intubating dose of rocuronium 0.6 mg kg^{-1}. After induction, patients were paralysed with vecuronium and the trachea intubated. Heart rate (HR) and non-invasive mean arterial pressure (MAP) were measured every 1 min. After stabilization of HR and MAP, defined as <3% change over three measurements, rocuronium ($n=20$) or saline ($n=10$) was injected at random. Mean HR increased initially from 66.6 to 72.1 beat min^{-1}, 4 min after rocuronium, and then decreased gradually to 69.6 beat min^{-1}, that is a net increase of 3.3 beat min^{-1} over 10 min ($P<0.001$), whereas after saline there was a gradual decrease from 65.8 to 60.9 beat min^{-1} ($P<0.001$) over 10 min. From the third minute, HR was significantly higher in the rocuronium group. Mean MAP decreased in both groups within 10 min to a similar extent after rocuronium and saline, that is from 74.9 to 72.1 mm Hg and from 74.7 to 72.2 mm Hg, respectively (both $P<0.001$). There were no differences in MAP at any time between the rocuronium and saline groups. We conclude that an intubating dose of rocuronium, in the absence of haemodynamic effects related to paralysis itself, resulted in a limited increase in HR without change in MAP, probably because of its weak vagolytic activity. (*Br. J. Anaesth.* 1997; **78**: 586–587).

Key words

Neuromuscular block, rocuronium. Neuromuscular block, vecuronium. Cardiovascular system, effects. Intubation tracheal.

Rocuronium is a steroidal non-depolarizing neuromuscular blocking agent with a time course similar to that of vecuronium, but with a faster onset of action. In the cat, rocuronium has a lower vagal: neuromuscular blocking ratio than vecuronium,[1] which may be (partly) responsible for the haemodynamic effects reported in humans.[2–4] An indirect, relaxation-induced reduction in preload caused by abdominal pooling may also contribute to the haemodynamic effects of neuromuscular blocking agents. We studied the cardiovascular effects of an intubating dose of rocuronium in anaesthetized, paralysed patients, to exclude interference from neuromuscular block-induced haemodynamic effects.

Methods and results

After approval of the local Ethics Committee and with informed consent, we studied 30 ASA I–II patients (aged 18–65 yr), undergoing elective surgery. Patients with neuromuscular or cardiovascular disease and those receiving any potentially interacting medication were excluded. After premedication with oral midazolam 0.1–0.15 mg kg^{-1}, anaesthesia was induced with thiopentone 4–6 mg kg^{-1} i.v. and fentanyl 1–3 μg kg^{-1} i.v., and maintained with 1% end- tidal isoflurane concentration and 65% nitrous oxide in oxygen. Tracheal intubation was performed 3 min after vecuronium 70 μg kg^{-1}. Heart rate (HR) and mean arterial pressure (MAP) were monitored non-invasively from induction at 1-min intervals. Oxygen saturation was measured continuously, end-expiratory carbon dioxide was maintained at 4.0–4.5 kPa and neuromuscular block was monitored by accelerometry (train-of-four ratio, TOF-Guard). After stabilization of HR and MAP, a bolus of rocuronium 0.6 mg kg^{-1} ($n=20$) or 0.9% saline ($n=10$) was administered over 10 s into a forearm vein according to a randomization scheme. Stability was assumed if <3% change in HR and MAP had occurred over the last three measurements. Measurements were continued for 10 min in the absence of surgical stimulation and HR and MAP were compared within each group (ANOVA for multiple measurements) and between groups (Student's *t* test for independent samples).

All patients were classified as ASA I. Groups (rocuronium *vs* control) were comparable in age (mean 37.5 (range 20–63) *vs* 34.5 (25–56) yr), height (mean 179 (SD 10) *vs* 178 (7) cm), weight (76.5 (10.3) *vs* 76.1 (10.5) kg) and sex distribution (M/F: 15/5 *vs* 6/4). The interval between intubation and stabilization was 12–16 min. At the time of administration of rocuronium or saline, all patients showed >95% neuromuscular block.

HR and MAP values were similar in both groups

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Table 1 Heart rate (HR) and mean arterial pressure (MAP) just before (0 min), and for 10 min after a bolus dose of rocuronium 0.6 mg kg^{-1} (2×ED_{90}) or saline (0.9% NaCl) to anaesthetized, paralysed patients. Values are mean (SD) and *P* values are for comparisons between the rocuronium and saline groups

	Rocuronium ($n=20$)		Saline ($n=10$)		
Time (min)	HR (beat min^{-1})	MAP mm Hg	HR (beat min^{-1})	MAP mm Hg	*P* HR/MAP
0	66.6 (11.0)	74.9 (8.2)	65.8 (10.4)	74.7 (10.3)	
1	72.0 (11.8)	76.1 (7.5)	64.6 (9.4)	73.6 (10.4)	0.08/0.51
2	71.5 (11.1)	74.6 (6.9)	64.0 (9.5)	73.3 (10.8)	0.07/0.74
3	71.9 (11.0)	73.7 (7.9)	63.5 (9.6)	72.3 (11.0)	0.04/0.74
4	72.1 (10.8)	73.0 (7.3)	62.6 (9.6)	72.0 (10.6)	0.02/0.80
5	72.0 (10.6)	73.0 (8.0)	62.0 (9.4)	71.2 (9.8)	0.02/0.62
6	71.2 (10.6)	72.4 (7.3)	61.6 (8.8)	71.3 (10.8)	0.02/0.78
7	71.0 (10.7)	72.3 (7.6)	60.3 (8.2)	71.1 (10.4)	0.01/0.74
8	70.3 (10.6)	72.3 (7.4)	60.1 (8.4)	71.6 (10.0)	0.01/0.85
9	69.7 (10.4)	72.3 (7.1)	60.1 (7.9)	71.3 (10.6)	0.01/0.80
10	69.6 (10.2)	72.1 (7.4)	60.9 (8.2)	72.2 (11.0)	0.02/0.97

immediately before administration of rocuronium or saline (table 1). After rocuronium, HR increased significantly ($P<0.001$), whereas after saline a limited, but statistically significant decrease in HR occurred ($P<0.001$). In both groups MAP decreased with time to the same small extent ($P<0.001$). After rocuronium, HR was significantly higher than after saline over the interval from 3 to 10 min, whereas MAP did not differ between the groups (see table 1 for *P* values). At the end of the study all patients in the rocuronium group showed complete block whereas twitch height depression in the saline group was still 93.9 (4.1)%.

Comment

Although rocuronium has a relatively low vagal:neuromuscular blocking ratio in animals compared with vecuronium,[1] it did not show clinically relevant haemodynamic effects in a dose range up to $3\times ED_{90}$ in humans.[3 4] Our results in paralysed patients are in agreement with earlier findings for the same dose in non-paralysed patients.[3] In contrast, Booth and colleagues[2] found more significant increases (>30%) in HR in humans after a similar dose of rocuronium. However, in the latter study hyoscine, a vagolytic agent, which was given as premedication, may have enhanced the slight vagolytic effect of rocuronium, either by addition or synergism. A clinical study[5] in which these drugs were given in reverse order may support this assumption. Methyl-atropine induced a more pronounced vagolytic effect in the presence of high concentrations of rocuronium, compared with low concentrations. In another clinical study,[6] premedication with atropine i.m. was associated with a lower pre-induction HR, most probably because of vagomimetic activity associated with small doses of atropine. This vagomimetic action disappeared after induction of anaesthesia, resulting in a more pronounced increase in HR in patients premedicated with atropine. These findings[5 6] support the likelihood of a drug interaction being the explanation for the different increases in HR in the current study and in that of Booth and colleagues.[2]

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