

SHORT COMMUNICATIONS

BRADYCARDIA AND VECURONIUM: COMPARISON WITH ALCURONIUM DURING CHOLECYSTECTOMY

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SUMMARY

We have compared the incidence of bradycardia in two groups of patients undergoing cholecystectomy. Twenty consecutive patients were allocated randomly to receive either vecuronium ($n = 8$) or alcuronium ($n = 12$) as part of a standard anaesthetic technique. Bradycardia was defined as a heart rate less than 50 beat min^{-1} . Five episodes of bradycardia occurred with vecuronium and none with alcuronium ($P < 0.01$).

KEY WORDS

Neuromuscular relaxants: vecuronium. Complications: bradycardia.

When first introduced into anaesthetic practice, vecuronium was considered to be devoid of cardiovascular side effects. Subsequently, several reports have been published of bradyarrhythmias associated with its use, often in association with other drugs or surgical procedures known to cause slowing of the heart. One study [1] concluded that vecuronium has no intrinsic bradycardic activity; therefore, it may be that bradycardia associated with vecuronium occurs either in the presence of other drugs that can slow the heart or during operations that induce vagal reflexes. The first of these hypotheses has been confirmed [2], but no previous study has compared vecuronium with another agent in a homogeneous group of patients to test the second. This study was designed to compare the incidence of bradycardia during cholecystectomy, which may cause cardiac slowing [3], in patients allocated randomly to receive either vecuronium or alcuronium for neuromuscular block.

METHODS AND RESULTS

After Ethics Committee approval and informed consent, we studied 20 patients (ASA I-II) undergoing elective cholecystectomy. Patients received oral temazepam 20 mg for premedication. Anaesthesia was induced with thiopentone $3-5 \text{ mg kg}^{-1}$, tracheal intubation was facilitated with suxamethonium 100 mg and anaesthesia maintained with oxygen, nitrous oxide and enflurane. According to a previously established randomization table, patients then received either vecuronium (group V, $n = 8$) or alcuronium (group A, $n = 12$) in increments at 4-min intervals until one twitch of the train-of-four re-

mained. Thereafter, neuromuscular block was monitored continuously and maintained at this level. During surgery, the ECG trace was displayed continuously and the low alarm set at 50 beat min^{-1} , bradycardia being defined as a heart rate less than this. All episodes of bradycardia were recorded. Morphine was given i.v. in increments of 2-3 mg as clinically indicated. Depth of anaesthesia was judged clinically using systolic arterial pressure and other clinical signs and maintained constant by altering the inhaled enflurane concentration.

The incidence of bradycardia in the two groups was compared using Fisher's exact test.

The characteristics of each group and the results are shown in table I. In general, group V were older, shorter and weighed less than group A. This may be because seven of the eight patients in group V were male. Five of eight patients in group V developed bradycardias, whereas none occurred in group A ($P < 0.01$). All bradycardias occurred during manipulation of the gall bladder. Four patients were given atropine i.v. in increments (0.3-0.6 mg total dose).

COMMENT

Our study confirms that when vecuronium is used in patients undergoing surgery that can induce reflex vagal efferent action, bradycardia is common. Although physique and sex distribution differed between our two groups, both neuromuscular blocking drugs were titrated to the same neuromuscular block and the differences in body size are unlikely to have influenced the results. The dose of morphine used was small and similar in both groups. At the

TABLE I. Characteristics of patient groups and results (numbers or median ((range or interquartile range)). ** $P < 0.01$

	Group A	Group V
<i>n</i>	12	8
Male	5	7
Age (yr)	54 (24-72)	65 (32-86)
Ht (cm)	168 (159, 172)	158 (156, 162)
Wt (kg)	77 (58, 88)	62 (48, 83)
Body weight > 10% expected	5	3
Bradycardia	0	5**

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time of bradycardia, no patient had received more than 4 mg of morphine and this dose is unlikely to have influenced heart rate [4].

The relationship between vecuronium and bradycardia has been investigated elsewhere. Cozantis, Pouttu and Rosenberg [5] compared bradycardias associated with vecuronium and pancuronium and found the incidence was greater with vecuronium. However, their patients were undergoing a variety of different operations with potentially different degrees of vagal stimulation and were also given varying doses of fentanyl—a drug which increases vagal efferent activity. In addition, pancuronium is markedly vagolytic.

In the absence of surgical stimulus or vagotonic drugs, vecuronium does not alter heart rate in anaesthetized patients [1] and therefore the bradycardia is likely to be a result of the combination of vecuronium with either surgical procedures that can induce reflex vagal efferent action or other drugs that can slow the heart. Our study confirms the first of these hypotheses. The second has been confirmed by Salmenpara and colleagues [2], who studied patients anaesthetized with fentanyl $75 \mu\text{g kg}^{-1}$ before the start of surgery. Vecuronium 0.1 mg kg^{-1} caused a significant decrease in heart rate.

Bradycardia could occur because vecuronium either fails to mask, or amplifies, the efferent pathway of the vagal reflex. The exaggeration of the bradycardia caused by fentanyl suggests that the mechanism is one of amplification. The site of action could be either the conducting system of the heart itself or at the ganglia of its autonomic innervation. Bellis, Day and Barnes [6] reported that *in vitro* vecuronium did not sensitize the heart to the

chronotropic effects of acetylcholine. This suggests that vecuronium produces its bradycardia by acting on the autonomic ganglia. Prevention of reflex bradycardia of this nature could be achieved most simply by antimuscarinic agents such as atropine or glycopyrronium, but alternative neuromuscular blocking agents that do not possess the properties of vecuronium may also be useful [5].

In conclusion, when used in patients undergoing surgery involving reflex vagal efferent action, vecuronium is associated with a high incidence of bradycardia. Previous work suggests that this effect may be mediated by amplifying efferent vagal activity by action on autonomic ganglia.

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