Anaesthesia, 1984, Volume 39, pages 277–279

Forum

The use of atracurium besylate for laparoscopy

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Summary

An anaesthetic technique is described for laparoscopy using an intravenous induction, atracurium 0.2 mg/kg for muscle relaxation and intermittent positive pressure ventilation of the lungs with nitrous oxide and oxygen. It was found to be a suitable and simple technique. Recovery of spontaneous ventilation was achieved without the use of reversal agents in all 40 patients. A 15% incidence of cutaneous histaminoid reactions was noted. This is no higher than reported in other studies of atracurium, and further clinical trials are awaited.

Key words

Neuromuscular relaxants; atracurium.

Atracurium is a newly released non-depolarising muscle relaxant which differs from other similar agents in possessing a non-enzymatic degradation pathway, the Hoffman elimination.[1] It appears that this drug has a shorter duration of action and a faster rate of elimination than other non-depolarising muscle relaxants.[1,2]

Using the recommended dose of atracurium of 0.3 mg/kg, we found that muscle relaxation was too prolonged to allow the return of adequate neuromuscular function by the end of laparoscopy, thus necessitating the use of a reversal agent. The purpose of this study was to assess whether atracurium in a smaller than recommended dose (0.2 mg/kg instead of 0.3–0.6 mg/kg) could be used as the sole relaxant in patients undergoing laparoscopy. This would avoid the problems associated with suxamethonium and anticholinergic reversal agents as well as the hypercarbia seen with spontaneous ventilation techniques.[3]

Methods

Forty patients aged between 21–47 years, and weighing between 49–90 kg undergoing laparoscopy for sterilisation, or infertility studies, were included in our series. All were grade I ASA except for one patient who was Grade 2. Premedication consisted of either pethidine 75 mg and promethazine 25 mg (21 patients) or morphine 10 mg and atropine 0.6 mg (19 patients), given intramuscularly 1 hour preoperatively. Anaesthesia was induced with 0.2 mg/kg of atracurium, then either 1% methohexitone (in the pethidine/promethazine premedication group) or 2.5% thiopentone (in the morphine/atropine premedication group), until the patients were asleep.

In the former group an additional dose of 20–30 mg of methohexitone was given just before intubation to prevent awareness. The patients were intubated 3 minutes after induction and the intubation conditions classified as good if the vocal cords were abducted and there was no response to intubation, adequate if there was a slight cough and poor if there was severe coughing or any other movement.

Anaesthesia was maintained with intermittent positive pressure ventilation with a 30% mixture of oxygen in nitrous oxide using a Brompton Manley ventilator.

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A tidal volume of 10 ml/kg and a respiratory frequency of 12–16 breaths/minute were used. Additional doses of the intravenous induction agent or a few breaths of halothane were given, if the patient showed signs of being too lightly anaesthetised.

Blood pressure and pulse rate were monitored pre-induction, postintubation, after any postural changes and thereafter at 5-minute intervals.

End-tidal carbon dioxide concentration was monitored on 12 patients using a Datex infrared spectrometer. Neuromuscular function was monitored using a Newman New-stim nerve stimulator in the train-of-four mode over the ulnar nerve at the wrist. The electrodes were taped in position in a standard fashion. At the end of surgery, provided a fourth twitch was present in the train-of-four, intermittent positive pressure ventilation was stopped and the patient allowed to breathe spontaneously on 100% oxygen and extubated. The patient was then taken to the recovery area and the time at which she could lift her head for 5 seconds was noted. We assessed that respiratory function was adequate after the operation by the movement of the reservoir bag before extubation, and by the absence of anxiety, restlessness and sweating in the recovery period.

Results

The mean dose of methohexitone given for induction, including the supplement before intubation, was 1.8 mg/kg and the mean total dose, including the supplements given during the anaesthetic was 2.8 mg/kg. The mean induction dose of thiopentone was 5.7 mg/kg and the mean total dose was 6.6 mg/kg. Eight patients were also given small amounts of halothane at some stage during the procedure. Details of intubation conditions are given in Table 1. Overall the intubation conditions were good in 55% of patients, adequate in 30% and poor in 15%.

Table 1. Intubation conditions

Intubation conditions	Methohexitone group	Thiopentone group
Good	47%	63%
Adequate	34%	27%
Poor	19%	10%

End-tidal carbon dioxide concentrations ranged from 4.2–5.5%. Cardiovascular stability was maintained in all cases. The mean postinduction increase in systolic blood pressure was 9 mmHg and in heart rate was 17 beats/minute.

Six patients showed evidence of histaminoid reactions. Of these, two patients who were induced with methohexitone had a generalised erythematous macular rash on the upper trunk and of the four patients in whom thiopentone was the induction agent, three developed urticaria up the line of the vein and the fourth also developed erythema of the trunk. The incidence of cutaneous histaminoid reactions was 9.5% in the methohexitone group and 21% in the thiopentone group, with an overall incidence of 15%. There was no associated bronchospasm, tachycardia or hypotension.[4]

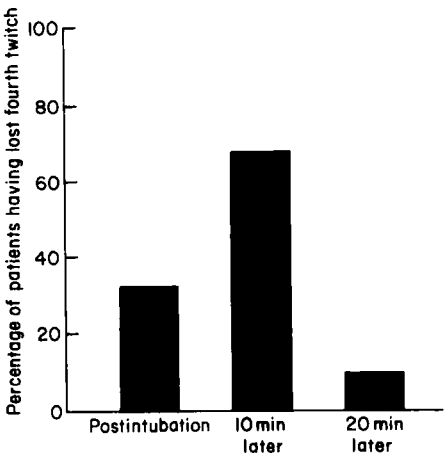

Fig. 1. Neuromuscular paralysis as measured by loss of fourth twitch in train-of-four.

The extent of the neuromuscular paralysis, as measured by the number of twitches in the train of four was variable, and Fig. 1 shows the numbers of patients who had lost the fourth twitch and the time after their injection. Three patients were felt to be insufficiently paralysed for surgery after intubation, and were given additional doses of 0.1 mg/kg of atracurium.

In all patients the fourth twitch in the train-of-four was present by the end of surgery and adequate spontaneous ventilation commenced without the use of reversal agents. The recovery times to the start of spontaneous respiration and to sustained head lifting are summarised in Table 2. In all the patients it was felt unnecessary to check blood gases postoperatively for hypercarbia. One patient, even when able to lift her head had difficulty in opening her eyes, but was judged to be breathing adequately.

Discussion

The use of atracurium as a sole relaxant in this small dose (0.2 mg/kg) appears to be suitable for laparo-

Table 2. Recovery times

	Mean (min)	Range (min)
Time to spontaneous ventilation	22.5	11–32
Time to maintenance of head lifting	25.8	20–42

scopy without recourse to reversal agents. The moderate degree of relaxation at 0.2 mg/kg was sufficient for intubation, provided that adequate time was given for the atracurium to act. Our previous experience using pancuronium (0.08 mg/kg) and alcuronium (0.2 mg/kg) as the sole relaxants for laparoscopy showed that intubating doses were often difficult to reverse at the end of a quick operation.

There was a wide range of times after the commencement of spontaneous ventilation until maintenance of head lifting and this is difficult to appraise for it obviously depends on the patient being sufficiently awake to respond to verbal commands. The degree of paralysis, as monitored by the train-of-four stimulator, was extremely variable and bore little relationship to the clinical conditions at intubation. It did, however, reveal a relatively slow onset of action at this dose, with maximum paralysis being achieved, on average, 10 minutes after induction.

It has been shown that during neuromuscular recovery the presence of the fourth twitch served as a guide to the adequacy of the tidal volume and we used this as an indication to stop positive pressure ventilation.[5] To monitor neuromuscular function more accurately would require a quantitative pressure transducer to measure the ratio of the first to fourth twitch heights. We confirmed that atracurium does not affect cardiovascular stability.

It has been stated that the ability of atracurium to release histamine at equal levels of neuromuscular blockade, is one third that of tubocurarine.[6] Our own incidence of cutaneous histaminoid reactions, 9.5% in the pethidine/promethazine/methohexitone group and 21% in the morphine/atropine/thiopentone group does not appear to be higher than reported previously.[7] The difference between the two groups is not statistically significant particularly in the absence of detailed immunological investigations, but it would seem possible that the promethazine helped to reduce the incidence in the methohexitone group. We think that the cutaneous histaminoid reactions were probably caused by the atracurium rather than the induction agents for the incidence of hypersensitivity reactions to these barbiturates is very low.[8] In the absence of the more serious hypersensitivity reactions, we do not think that these mild histaminoid responses preclude the use of atracurium.

In conclusion, we have shown that this technique does not require the use of reversal agents and is suitable for laparoscopies lasting about 20 minutes.

Acknowledgments

The authors wish to thank Mr D. Rees FRCOG for permission to study his patients.

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Anaesthesia, 1984, Volume 39, pages 279–281

Reduction of postoperative vomiting in high-risk patients

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Summary

Twenty-eight patients who had a history of severe postoperative vomiting were divided into two groups. The first group received various anaesthetic drugs and the second group received a pethidine promethazine premedication and