Muscle Pain Occurs after Outpatient Laparoscopy Despite the Substitution of Vecuronium for Succinylcholine

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The occurrence, location, and severity of muscle pain were determined when vecuronium was used in lieu of succinylcholine during outpatient laparoscopy. Postoperative muscle pain, in 11 body parts, was assessed by a linear analogue scale questionnaire that was completed by each patient on the evening of surgery and for the next three mornings. All patients had general endotracheal anesthesia with nitrous oxide, thiopental, and fentanyl. Succinylcholine 1.5 mg/kg (3-4 min after 3 mg of d-tubocurarine) was given to 14 patients for tracheal intubation and then by infusion for additional muscle relaxation. Another 14 patients received vecuronium 50 μg/kg iv as the only muscle relaxant used; all of these patients had residual neuromuscular blockade antagonized with glycopyrrolate 7 μg/kg and edrophonium 0.5 mg/kg iv. Both groups were similar in age, weight, length of procedure, time to discharge, and amount of thiopental and fentanyl used (P > 0.05). No difference was noted in either group with respect to the severity of pain by body part over time. Mean total body pain scores were generated for each group at all four intervals as an alternate type of analysis. No statistical significance was demonstrated by a Student's t test in any group at any interval sampled. The authors failed to demonstrate that the substitution of vecuronium for succinylcholine lowers the incidence of myalgia when used in outpatient diagnostic laparoscopy. They refrain from concluding that vecuronium contributes to postanesthetic myalgia, but feel justified in stating that the avoidance of succinylcholine did not lower the severity or occurrence of muscle pains after laparoscopy when vecuronium was used in its place. (Key words: Complications: muscle pain. Neuromuscular relaxants: Succinylcholine; Vecuronium. Surgery: outpatient.)

Myalgia is a well-known side effect of succinylcholine, particularly when given to young women and in those who receive it during outpatient surgery. On the other hand, myalgia is not thought to occur after the use of nondepolarizing muscle relaxants. With the advent of the intermediate acting nondepolarizing muscle relaxants, it has become feasible that these drugs can be used for brief procedures, such as diagnostic laparoscopy. To avoid troublesome myalgia, nondepolarizing muscle relaxants have been recommended in place of succinylcholine for outpatient anesthesia. We undertook a randomized, prospective study of the occurrence, location, and severity of muscle pains in patients who received either succinylcholine (after a subparalyzing dose of d-tubocurarine) or vecuronium for laparoscopy on an ambulatory basis.

Materials and Methods

This study was approved by our Committee on Research and informed consent was obtained from each patient. We studied 35 healthy (ASA Class I or II) nonpregnant women undergoing outpatient diagnostic laparoscopy without tubal surgery or manipulation. Women were excluded if there was a contraindication to succinylcholine. During the preoperative period, we reviewed a linear analogue scale questionnaire with each patient. Subjects were instructed to place an "X" on a 10-cm line in proportion to the pain they experienced in each of the 11 body parts on the form, with the left end representing no pain and the right end the worst pain imaginable. The 11 body parts sampled were the eyes, jaw, throat, arms, neck, shoulders, back, abdomen, buttock, thighs, and calves. They were also asked to record their oral temperature and the presence/absence of nausea or vomiting. Patients were instructed to complete one form at each of the following times: the evening of surgery, and the first, second, and third postoperative mornings after they arose from bed. They were provided with preaddressed stamped envelopes to facilitate return of all the questionnaires to the authors.

We randomly assigned patients to receive either succinylcholine (after d-tubocurarine, 3 mg iv) or vecuronium as the only muscle relaxant used during a balanced anesthetic technique. All patients were brought to the operating room unmedicated. We applied a blood pressure cuff, precordial stethoscope, and ECG. An intravenous infusion was started and each patient received 0.4 mg of atropine iv. If the patient was assigned to receive succinylcholine, we also gave 3.0 mg of d-tubocurarine iv and waited 1–2 min before induction of anesthesia. After the patients breathed oxygen for 1 min, 2 μg/kg of fentanyl and 6 mg/kg of thiopental were given iv over 45 s. When consciousness was lost, we documented a supramaximal twitch from the adductor pollicis using a conventional nerve stimulator and strain gauge transducer. We then administered either 1.5 mg/kg of succinylcholine or 0.05 mg/kg of vecuronium iv. Ventilation was con-
trolled throughout induction and maintenance of anesthetic to a end-tidal CO₂ of 30 mmHg. All patients' tracheas were intubated with a cuffed endotracheal tube, and the patients were positioned in lithotomy (with the legs in conventional leg supports and the table in 10–30° Trendelenburg). Anesthesia was maintained with 70% N₂O in 30% O₂, and additional thiopental and fentanyl, iv as clinically indicated. We maintained single twitch height at 10% of control with either additional doses of vecuronium iv or a 0.2% succinylcholine infusion. At the end of the procedure, neuromuscular blockade was antagonized in all patients who received vecuronium with edrophonium, 0.5 mg/kg iv (preceded by 7 μg/kg of glycopyrrolate iv).

Time from induction of anesthesia to both the conclusion of the procedure and to recovery room discharge were noted. Routine discharge criteria were used that included acceptable vital signs; minimal nausea, vomiting, or dizziness; PAR score of 10; and the ability of the patient to dress and walk without assistance. All patients were called the following day to assess recovery and to offer assistance in completing the forms.

Distance along the 10-cm muscle pain analogue scale was recorded to the nearest mm. Mean pain intensity values for each body part were computed for each treatment group at each time interval sampled. Overall mean pain intensity scores were also computed for all 11 body parts per patient. A Student's t test was used to reject the null hypothesis with a P value set at less than 0.05. A two-way analysis of variance (ANOVA) was used to compare myalgia in each group (alpha = 0.05).

Results

Thirty of the 35 patients who agreed to participate in the study actually returned the questionnaires (return rate of 87%) by mail. One patient in the succinylcholine group was admitted overnight for persistent vomiting and another patient in the vecuronium group filled out the forms incorrectly. This left 28 patients eligible for data analysis. We compared the groups and found them similar (in equal groups of 14) in age, weight, length of procedure, time to discharge, and the total doses of fentanyl and thiopental used (table 1). We found no statistical difference between the two groups (P > 0.05 by a Student's t test). No patient had a temperature of over 38°C and the incidence of nausea and vomiting was comparable in both groups when a t test of proportions was used (P > 0.05).

Myalgia was assigned a numerical value in mm based upon the linear distance of the X on the patient's questionnaire. Figures 1 and 2 show pain data for the first and third mornings after surgery, respectively. Data from the evening of surgery and second morning after surgery are not shown but were analyzed. Muscle pain was analyzed for each body part in each treatment group at all four time intervals using a two-way analysis of variance (ANOVA). No statistical significance was noted in either group, with respect to the severity of pain reported in either group, by body part studied over time using this type of analysis. Alternatively, a mean total body pain score was generated for each patient and an average total

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<th>Table 1. Patient Characteristics, Operative and Recovery Times, and Drug Dosages</th>
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NS = not significant at P < 0.05.
* Mean ± standard deviation.

![Fig. 1. Mean muscle pain for each group versus body part on the first morning after laparoscopy. Pain data ranges from 0 to 10 (mean ± standard deviation) based on a linear analogue scale described in the Materials and Methods section. S = succinylcholine group; V = vecuronium group; THR = throat; SHOU = shoulder; ABD = abdomen; and BUTT = buttocks.](image)
body pain severity score per patient group was generated for all four intervals. When these scores were subjected to a Student's t test, no statistical significance could be demonstrated in any group at any time sampled.

**Discussion**

Since myalgia after the use of vecuronium in laparoscopy has not been reported,6 we thought that, by substituting vecuronium for succinylcholine, we could eliminate complaints of myalgia altogether. We were surprised to find a similar incidence of myalgia in both muscle relaxant groups. We did take measures thought to prevent myalgia after succinylcholine in that both groups received thiopental.7 In addition, the succinylcholine group received d-tubocurarine approximately 3–4 min prior to succinylcholine.8 It has been suggested that d-tubocurarine given at this time might be useful in terms of lowering the severity of fasciculations.9 Due to conflicts in the literature as to what the actual incidence of myalgia is after succinylcholine exposure, it is difficult to project an incidence of myalgia without any of these protective measures.

Post-laparoscopy pain might be secondary to causes other than succinylcholine exposure, such as abdominal distension and manipulation, residual intraperitoneal gas, and movement of an anesthetized patient into the lithotomy position.10 Because none of our patients had a fever postoperatively, it is unlikely that a flu syndrome would have contributed to myalgia. On the other hand, since all the patients who received vecuronium also received edrophonium, it is possible that this drug or the combination of the two drugs led to myalgia. In one study on outpatient laparoscopy by Fragen and Shanks,6 edrophonium was not used in all of the patients unless needed, and this could account for the differences in our findings as we routinely used it. It is also noteworthy that the patients studied were not followed for more than one day, and myalgia could have been missed by their protocol. We used a linear analogue scale that allows the patient to quantitate pain and is reproducible with different degrees of pain intensity in each subject at different times.11 Our study, in agreement with the clinical experience of others, indicates that muscle pain exists as long as 3 days postoperatively. Shorter observation protocols would not detect this. Analysis of our data suggests that the use of vecuronium may be associated with myalgia in these patients. Because no mechanism is known for the etiology of muscle pain in patients who receive succinylcholine, we find it difficult to postulate one for vecuronium.

We were concerned that our sample sizes were not large enough to detect a difference between the groups, and that we might have a Type II error. Accordingly, we calculated beta errors with an alpha error set at 0.05. The power (1 minus beta) for our pooled body pain data was 70% for the first postoperative day and 90% for the third. When a body part that might be specific for succinylcholine pain, such as the neck, was used in lieu of the pooled pain data (which includes areas that might have pain secondary to the laparoscopy), the power was 98% on the first morning and 94% on the third morning.

Collins et al.12 studied a group of outpatients having laparoscopy where atracurium or vecuronium was used for tracheal intubation. Eighty percent of patients reported some degree of muscle pain 24 h postoperatively. Sosis et al.13 failed to show any benefit from using atracurium or vecuronium in lieu of succinylcholine in terms of myalgia. However, the design of their study only allows for limited (1 day) follow-up. Because postsuccinylcholine myalgia does not often occur before 24 h and will not improve until 72 h postoperatively, their results may be inaccurate. Kenefick et al.14 prospectively studied three anesthetic techniques for outpatient laparoscopy and found an equal incidence of muscle pain up to 48 h postoperatively. All patients received isoflurane/N₂O/O₂ anesthesia, with group I receiving anesthesia via a mask (without relaxants), while group II received succinylcho-
line for intubation and group III received succinylcholine both for intubation and by infusion (both groups II and III had 3 mg d-tubocurarine). The fact that the incidence of muscle pain was similar in these studies, even when succinylcholine or nondepolarizing relaxants were avoided, implicates the procedure itself—and not necessarily the muscle relaxant—as the major cause of morbidity after laparoscopy.

We failed to demonstrate that the substitution of vecuronium for succinylcholine lowers the incidence of myalgia when used in outpatient diagnostic laparoscopy. Other causes for pain and discomfort might exist in our patients. We refrain from concluding that vecuronium contributes to postanesthetic myalgia, but, therefore, feel justified in stating that the avoidance of succinylcholine did not lower the severity or occurrence of muscle pains in outpatient laparoscopy when vecuronium was used in its place.

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References