mine (2 mg) produces a high incidence of nausea and/or vomiting. Physostigmine (1 mg) is an effective antagonist to anesthetic depression following diazepam–nitrous oxide anesthesia, and is not associated with a high incidence of nausea, vomiting or other problems.

REFERENCES

Anesthesiology 51:259–261, 1979

Pancuronium Pretreatment and Post-succinylcholine Myalgias


Various attempts have been made to decrease the incidence of muscle pains that often follow the use of succinylcholine.1 The most widely practiced method has been to administer a subparalyzing dose of a non-depolarizing muscle relaxant prior to giving the paralyzing dose of succinylcholine.5–7 These previous studies have proven the efficacy of gallamine4,5 and/or d-tubocurarine6,7 in preventing postsuccinylcholine myalgias, but a controlled study with pancuronium has not been done. Therefore, we decided to look at the effect of pretreatment with pancuronium bromide on the incidence and severity of postoperative myalgias associated with the use of succinylcholine.

METHODS

Forty adult patients with Hodgkin’s disease undergoing “staging laparotomy” (spleenectomy, liver biopsy, abdominal and pelvic lymph-node biopsies, and bone marrow aspiration) were randomly divided into two groups. All patients were similarly premedicated with an opiate and an anticholinergic drug. Following preoxygenation, anesthesia was induced in both Group I and Group II with thiopental, 4 mg/kg, iv, followed 60 sec later by succinylcholine, 1.5 mg/kg. Patients in Group I had been given pancuronium bromide, 1 mg, iv, 4 min before receiving succinylcholine. Laryngoscopy and endotracheal intubation were performed 60 sec after administration of succinylcholine.

The occurrence of muscle fasciculations and patient relaxation at endotracheal intubation were recorded. Each patient was visited on the first and second postoperative days by an anesthesiologist who was unaware of the patient’s group assignment. The interviewer asked a series of standard questions,2 the third of which was, “Do you have, or have you had, any pain in your muscles following your operation?” When the answer was affirmative, the location, duration and severity of pain were recorded.

Data were analyzed by the chi-square method, with P < 0.05 considered significant.

RESULTS

There was no significant difference between the two study groups with respect to age, body weight, anesthetic technique, or length of operation. Relaxation was considered adequate for endotracheal intubation in all patients. Seventeen patients in Group II (85 per cent) had complete relaxation (+3), and three
Table 1. Patients with Postoperative Myalgias

<table>
<thead>
<tr>
<th>Age (Years), Sex</th>
<th>Fasciculations*</th>
<th>Relaxation†</th>
<th>Myalgia‡</th>
<th>Site(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day 1</td>
<td>Day 2</td>
<td></td>
</tr>
<tr>
<td>Group I (pancuronium pretreatment)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient 1</td>
<td>21, F</td>
<td>0</td>
<td>+2</td>
<td>0</td>
</tr>
<tr>
<td>Patient 2</td>
<td>19, M</td>
<td>0</td>
<td>+1</td>
<td>+1</td>
</tr>
<tr>
<td>Patient 3</td>
<td>65, F</td>
<td>+1</td>
<td>+2</td>
<td>+2</td>
</tr>
<tr>
<td>Patient 4</td>
<td>47, F</td>
<td>+1</td>
<td>+3</td>
<td>0</td>
</tr>
<tr>
<td>Group II (succinylcholine bolus)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient 5</td>
<td>52, M</td>
<td>+3</td>
<td>+3</td>
<td>+2</td>
</tr>
<tr>
<td>Patient 6</td>
<td>27, F</td>
<td>+2</td>
<td>+3</td>
<td>+1</td>
</tr>
<tr>
<td>Patient 7</td>
<td>29, M</td>
<td>+2</td>
<td>+3</td>
<td>+1</td>
</tr>
<tr>
<td>Patient 8</td>
<td>36, M</td>
<td>+3</td>
<td>+3</td>
<td>0</td>
</tr>
<tr>
<td>Patient 9</td>
<td>36, F</td>
<td>+1</td>
<td>+3</td>
<td>0</td>
</tr>
<tr>
<td>Patient 10</td>
<td>58, F</td>
<td>+3</td>
<td>+3</td>
<td>0</td>
</tr>
<tr>
<td>Patient 11</td>
<td>35, F</td>
<td>+1</td>
<td>+3</td>
<td>0</td>
</tr>
</tbody>
</table>

* Fasciculations: 0, none visible; +1, fine facial and/or fingertip; +2, minimal trunk and/or extremities; +3, vigorous trunk or extremities.
† Relaxation: 0, inadequate; +1, vigorous coughing; +2, slight movement; +3, complete.
‡ Myalgias: 0 none; +1, transient; +2, multiple sites and/or severe single site; +3, incapacitating.

patients in this group (15 per cent) had only slight movement during endotracheal intubation (+2). In Group I, ten patients (50 per cent) were completely relaxed (+3), nine (45 per cent) had slight movement (+2), and one patient (5 per cent) coughed vigorously (+1) at endotracheal intubation. Five patients in Group I (20 per cent) experienced fasciculations after receiving succinylcholine, but only one of these had vigorous (+3) fasciculations. All but one patient in Group II (95 per cent) had fasciculations after receiving succinylcholine.

Four patients in Group I (20 per cent) and seven patients in Group II (35 per cent) experienced postoperative myalgias $[\chi^2 = 0.50$ d.f. = 1 (nonsignificant)] (table 1). Two patients in each group (10 per cent) had muscle pains at two or more sites or clinically significant complaints of severe myalgias (+2 or +3). Postoperative muscle pain was not correlated with the presence or absence of fasciculations, or the patient's age or sex. The sites of myalgias found in this study were similar to those previously reported. All patients received opiate analgesics for incisional pain, had uncomplicated postoperative courses, and were ambulatory within 24 hours of receiving succinylcholine.

**DISCUSSION**

Muscle pains following surgical procedures may have many causes. Frequently it is not possible to identify a specific cause. However, postsuccinylcholine muscle pain is a real clinical entity. Postoperative myalgias associated with the use of succinylcholine were originally believed to be related to the presence of muscle fasciculations. However, no correlation has been found between postoperative muscle pains and fasciculations. Churchill-Davidson first suggested that by pretreating a patient with a small amount of gallamine, one could decrease the incidence and severity of fasciculations and also the occurrence of postoperative myalgias. Studies have since shown that pretreatment with gallamine or d-tubocurarine can decrease the incidence of, but not completely abolish, postsuccinylcholine muscle pains. It is generally assumed that the third popular nondepolarizing relaxant, pancuronium, would also be effective, but this had not previously been tested. Gibb, in his thorough review of succinylcholine, states that “pancuronium is said to be less effective than gallamine or d-tubocurarine” in preventing succinylcholine myalgias, but he does not document this statement.

The occurrences of muscle pain after succinylcholine are reported to range from 0.2 to 89 per cent. It occurs more frequently following minor operative procedures, in women, and in ambulatory rather than bedridden patients. We chose to study patients undergoing a standard operation by the same surgical team. The two study groups were similar with respect to age and sex of patient, underlying disease, premedication and induction agents, duration of anesthesia, intraoperative position, anesthetic technique, postoperative surgical management, and hours to ambulation. These are all factors that might influence the occurrence of muscle pains. Studying two such closely matched groups allowed us to see what effect a single variable, pretreatment with pancuronium, had on the subsequent development of myalgias. The actions of nondepolarizing relaxants and succinylcholine are an-
The authors thank Dr. Thomas S. Neelen, Professor of Surgery, Stanford University School of Medicine, for his cooperation during this study.

REFERENCES

Morquio Syndrome and Anesthesia

ANNE E. P. JONES, M.B., B.S., F.F.A.R.C.S.,* AND THOMAS F. CROLEY, M.D.†

Morquio syndrome, mucopolysaccharidosis IV, was definitively described in 1929 by Morquio in Uruguay and Brailsford in England. It is also known as chondro-osteodystrophy and eccentric-osteochondroplasia.

Inherited as an autosomal recessive disorder, the basic defect is an abnormality of mucopolysaccharide metabolism in the connective tissues, mainly in cartilage and bone. Pathologically, abnormal amounts of keratan sulfate are excreted in the urine, the levels decreasing as the patient grows older. In contrast to Hurler’s syndrome, intelligence is normal. Cardiac impairment is generally secondary to the distortion of the chest.

The striking skeletal deformities consist of marked shortening of the trunk and limbs, with severe spinal curvature and pigeon chest. Limbs are deformed, with laxity rather than stiffness of joints. The facial appearance is characteristic, with prominent maxilla, short nose, and widely spaced teeth with defective enamel. Hepatosplenomegaly, corneal opacities, and deafness also occur.

Neurologic symptoms frequently result from the vertebral anomalies. There is a high incidence of instability of the cervical spine with paraplegia, and hypoplasia of the odontoid leading to spinal-cord compression is a major complication.1

Because there are few references to this disease in the anesthetic literature, the following case is presented.

REPORT OF A CASE

A 29-year-old man was admitted to the hospital for excision of a melanoma of the scalp, which biopsy during local anesthesia had shown to be malignant. Radical dissection of the cervical lymph nodes was also planned.

The patient was severely dwarfed, height 92 cm and weight 22.7 kg. He had been unable to walk for 15 years, and for some years prior to that had walked with the aid of leg braces. In 1964 he had sustained a fall, which had resulted in a head injury and left hemiparesis, with present residual weakness and uncoordination of the left arm and hand. The chest was grossly deformed, with kyphoscoliosis and pectus carinatum, and the patient became