MUSCLE PAINS AFTER INTRAMUSCULAR SUXAMETHONIUM CHLORIDE

BY
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SUMMARY
The use of suxamethonium chloride by intramuscular injection as a short acting muscle relaxant for endotracheal intubation is described. The incidence and severity of post-operative muscle pains in this group of 94 patients is compared with the results of another group (of 112 patients) in which the drug was given intravenously. The incidence of pains was similar in the two groups (26.6 and 28.6 per cent respectively). The percentage of severe pains was reduced from 18.7 in the intravenous series, to 12.8 in the intramuscular; this reduction was not statistically significant.

A disadvantage of the use of suxamethonium is the occurrence of muscular pain and stiffness in the postoperative period. "Scoline pains" as they are usually called may be so severe as temporarily to incapacitate patients, hence various measures have been adopted in attempts to reduce this undesirable effect. The administration of a moderate dose of a non-depolarizing muscle relaxant before induction of anaesthesia has been the most successful but this decreases the intensity of the action of the depolarizing agent (Bryson and Ormston, 1962), creates a potentially dangerous situation (Foster, 1960), and does not always abolish the pains (Morris and Dunn, 1957).

In this paper we describe a technique using suxamethonium and hyaluronidase by the intramuscular route to produce relaxation for endotracheal intubation; and we compare the incidence and severity of muscle pains when the drug is given in this manner with the more conventional intravenous route.

THE MATERIAL
Two hundred and eighty consecutive in-patients for dental surgery were studied. The majority were admitted for removal of impacted wisdom teeth, and on routine pre-operative examination were clinically fit. There were 123 male and 157 female patients, whose ages ranged from 7 to 72 years, with values for the median and mode of 28 and 23 years respectively.

TECHNIQUE USING INTRAMUSCULAR SUXAMETHONIUM AND HYALURONIDASE

Premedication. Papaveretum 22 mg and hyoscine 0.4 mg, with the dose modified for patients under 5 and over 65 years of age, was given by subcutaneous injection 1 hour before operation.

Induction. After spraying both nostrils with 5 per cent cocaine solution, anaesthesia was induced with a sleep dose of 2.5 per cent sodium thiopentone. When the patient lost consciousness, as judged by disappearance of the eyelash reflex, 150 mg of suxamethonium mixed with 500 units of hyaluronidase was given through a No. 1 hypodermic needle into the left pectoralis major muscle.

The site of the intramuscular injection was massaged while the patient breathed spontaneously a mixture of nitrous oxide and oxygen (6 l./min and 2 l./min) together with minimal trichloroethylene from a Boyle anaesthetic apparatus via a Magill attachment.

After 3 to 4 minutes muscular relaxation was adequate for laryngoscopy and following inflation of the lungs with 100 per cent oxygen, nasal endotracheal intubation was performed and a pack inserted into the pharynx. At this stage most patients were apnoeic with a wide-open glottis and only a few gave a single cough as the endotracheal tube entered the trachea.

Maintenance. The patient's lungs were gently inflated with nitrous oxide, oxygen and trichloroethylene mixture until respiratory movements
returned, usually after an interval of approximately 5 minutes. Thereafter ventilation was assisted until spontaneous ventilation was considered adequate, which was usually 20 minutes after the injection of suxamethonium. The jaw muscles always remained sufficiently relaxed for the dental surgeon to place a prop between the teeth with ease.

Further management. Precautions regarding care of the airway during and after dental surgery were taken, and patients regained consciousness soon after extubation.

THE INVESTIGATION

A double blind trial was constructed in the following manner.

Suxamethonium was given to every patient, either intramuscularly or intravenously. The choice of route was made at random. The details of anaesthesia were recorded on a proforma and were not disclosed to the dental surgeons until the investigation had been completed.

On the morning after operation before being allowed out of bed, the patients were asked the following questions by one of the surgeons:

1. “How do you feel apart from your jaw?”
2. “How are your neck and stomach?”
3. “Do you have any ache or stiffness in your neck, chest or stomach?”

One week later, after discharge from hospital the patients were interviewed in the Dental Out patient Department by the same surgeon at the end of 9 months the details of the anaesthetics and the patients' replies were correlated.

In order to simplify analysis, muscle pains were classified as mild or severe. The term “mild” was used for those described spontaneously as such (or in like terms) by the patient and limited to one site, e.g., neck or back only, for a single day. The term “severe” referred to those which were incapacitating, occurred at two or more sites, or persisted for longer than 24 hours.

THE RESULTS

Of the 280 patients investigated, 206 attended the final follow-up clinic in the Dental Department after discharge from hospital. Consideration of the results is confined to these patients, 94 of whom were given suxamethonium by the intramuscular and 112 by the intravenous route.

These two groups of patients were similar as regards the operation performed, sex and age distributions (table I).

There was no difference in the percentages of patients that developed muscle pains after suxamethonium administered by either route, but the proportion classified as severe, when considered, was higher with intravenous suxamethonium.

### Table I

<table>
<thead>
<tr>
<th>Route of administration</th>
<th>Number</th>
<th>Male</th>
<th>Female</th>
<th>Age range in years, with values for median and mode in brackets</th>
<th>Type of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intramuscular</td>
<td>94</td>
<td>45</td>
<td>49</td>
<td>7–72 (29.5 and 23)</td>
<td>(a) 67</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(b) 13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(c) 15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(d) 0</td>
</tr>
<tr>
<td>Intravenous</td>
<td>112</td>
<td>55</td>
<td>57</td>
<td>7–73 (29 and 25)</td>
<td>(a) 83</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(b) 14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>(c) 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(d) 0</td>
</tr>
<tr>
<td>Total</td>
<td>206</td>
<td>106</td>
<td>106</td>
<td></td>
<td>206</td>
</tr>
</tbody>
</table>

(a) Removal of impacted 3rd molar teeth.
(b) Multiple extractions.
(c) Removal of unerupted teeth, other than 3rd molar teeth.
(d) Removal of dental cysts.
TABLE II
Incidence and severity of muscle pains following intramuscular and intravenous administration.

<table>
<thead>
<tr>
<th>Route of administration of suxamethonium</th>
<th>Number with muscle pains</th>
<th>Percentage with muscle pains</th>
<th>Number with severe muscle pains</th>
<th>Percentage with severe muscle pains</th>
<th>Severe muscle pains expressed as a percentage of number of patients who developed muscle pains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intramuscular (34 patients)</td>
<td>25</td>
<td>26.6</td>
<td>12</td>
<td>12.8</td>
<td>48</td>
</tr>
<tr>
<td>Intravenous (112 patients)</td>
<td>32</td>
<td>28.6</td>
<td>21</td>
<td>18.7</td>
<td>66</td>
</tr>
</tbody>
</table>

were with the number who had mild or no muscle pains, was less when the drug was given intramuscularly. In fact only 33 patients (16 per cent) of the total number concerned in the trial had pains that were classified as severe.

Several other items of interest regarding intramuscular administration were recorded during this investigation. More than twice as many female than male patients complained of muscle pains allowing intramuscular suxamethonium.

The relationship between fasciculations and muscle pains was that 18 of the 25 patients had visible fasciculations at any time; in 5 patients they were limited to the fingers, and in the remaining 2 the movements were indistinguishable from those seen on intravenous injection.

Only 1 patient, in contrast to 6 in the intravenous groups, complained of muscle pains at both interviews.

The anaesthetists considered that the degree of muscular relaxation was identical to that associated with intravenous injection on 60 occasions, and was "adequate" for endotracheal intubation 32 times. Conditions were twice classified as poor.

One patient was still apnoeic at the end of an operation, which lasted 20 minutes, and required ventilation for a further 5 minutes. This patient was a dwarf weighing only 32 kg who was inadvertently given 150 mg of suxamethonium—obviously a gross overdose.

DISCUSSION
The syndrome of muscular pain and stiffness following the use of suxamethonium was described originally in 1952 by Bourne, Collier and Somers. The pain may be so severe that it has been mistaken as being pleuritic in origin (Leatherdale, Mayhew and Hayton-Williams, 1959) or when associated with neck rigidity has mimicked poliomyelitis or meningitis (Price, 1954). The wide variations reported in the incidence of muscle pains (Foster, 1960 quotes a range of 3.7 to 85 per cent) seem to depend largely on the type of operation performed and consequently on how soon patients are ambulant after surgery—most authors have found an incidence of about 50 per cent. Females are more susceptible to (Currie, 1953) and children almost exempt from (Bush and Roth, 1961) these untoward effects of the drug.

The incidence of muscle pains in the two groups, intramuscular and intravenous, was similar (26.6 and 28.6 per cent); and though the number of patients with severe pains was reduced by using the intramuscular route the difference was not statistically significant ($\chi^2 = 1.36$). The results, therefore are disappointing, but in each of the groups the incidence was lower than has usually been recorded. It is of interest that, in spite of the criteria for severity and type of operation differing, severe pains were equally common in this series and in that reported by Bryson and Ormston (1962).

We confirmed that female patients are more susceptible to this untoward effect of suxamethonium than males, and none of the 5 children under the age of 12 years developed muscle pains.

In approximately one-third of the patients to whom suxamethonium was given intramuscularly, relaxation was classified only as "adequate" for endotracheal intubation. From this it is reasonable to assume that the concentration of the drug at the motor endplate was less than when it was given intravenously in very much smaller amounts (150 mg as against 50 mg). Our findings, there-
fore, are in agreement with Foldes, who stated that slow intravenous injection lessened the visible fasciculations (1959), and reduced the incidence of pains (1957). They are, however, contrary to those of Morris and Dunn (1957), who found that the worst symptoms occurred after the drug was given slowly, and also contrary to those of Halldin and Palmer (1961), who noted that the pains were reduced with large doses of suxamethonium and after severe fasciculations. The fact that after intramuscular injection fasciculations were minimal or absent in over 90 per cent of the patients who developed muscle pains is positive evidence that there is no correlation between the extent of the movements and the incidence of subsequent symptoms.

Possibly the duration of muscle pains following suxamethonium may be reduced by intramuscular administration but the number of patients who had pains lasting several days is too small (only 7) to allow comment.

It is worth while recording that one patient, a 32-year-old housewife, reported most enthusiastically about the diminished severity of muscle pains after intramuscular injection compared with effects of intravenous suxamethonium, which she had suffered two years previously after a similar dental operation.

ACKNOWLEDGMENT
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REFERENCES

BRITISH JOURNAL OF ANAESTHESIA.

SOMMAIRE
Les auteurs décrivent l'emploi du chlorure de suxaméthonium comme muscleplégique d'action très brève pendant l'intubation intra-trachéale. L'incidence et la gravité des douleurs musculaires post-opératoires chez un autre groupe de 94 patients, qui reçoivent le médicament par voie intra-veineuse. L'incidence des douleurs était analogue dans les deux groupes (26,6 et 28,6% respectivement). Dans le groupe des patients auxquels la substance fut administrée par voie i.v., le pourcentage des douleurs graves était réduit de 18,7 (26,6 et 28,6% respectivement). Die intramuskuläre Injektion von Suxamethoniumchlorid als kurz wirkendes Muskelrelaxans für die endotracheale Intubation wird beschrieben. Die Häufigkeit und Schwere postoperativer Muskelschmerzen bei dieser Gruppe von 94 Patienten wird mit den Ergebnissen einer anderen Gruppe (von 112 Patienten) verglichen, die das Medikament intravenös erhielten. Die Schmerzhäufigkeit war in beiden Gruppen ähnlich (26,6 und 28,6% jeweils). Der Prozentsatz schwerer Schmerzen wurden von 18,7% bei der intravenösen Gruppe auf 12,8% vermindert; statistisch war diese Abnahme nicht signifikant.

ZUSAMMENFASSUNG