SINGLE DOSE SUXAMETHONIUM AND MUSCLE PAIN IN PREGNANCY

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SUMMARY
The frequency of muscle pain was studied in two groups of patients. One group consisted of 106 women undergoing Caesarean section; the other comprised 20 pre-menopausal women undergoing hysterectomy. Both groups received a single bolus injection of suxamethonium 100 mg to facilitate tracheal intubation. There was a statistically significant decrease in the frequency of muscle pain in the pregnant group (7.5%) compared with the non-pregnant group (30%).

Muscle pain, which may be severe, is an unpleasant consequence of the use of suxamethonium. The aetiology of this pain is unknown and the anaesthetist may attempt to minimize the discomfort by adopting one of the empirical methods which have been proposed to decrease the frequency of muscle pain and this may further complicate the anaesthetic technique (Bennetts and Khalil, 1981).

In pregnancy, Crawford (1971) and Datta, Crocker and Alper (1977) have shown that the frequency of muscle pain is low when suxamethonium is administered as a continuous infusion. Bryson and Ormston (1962), using intermittent injections of suxamethonium, reported a much greater frequency (table I). However, suxamethonium is administered

| TABLE I. Frequency of muscle pains following suxamethonium in pregnant women |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| No. of patients | Frequency of pain (%) | Route of administration | Type of surgery | Average total dose (mg) |
| Bryson and Ormston (1962) | 130 | 33.7 | Intermittent i.v. injection | Caesarean section | 340 |
| Crawford (1971) | 959 | 1 | Continuous i.v. infusion | Caesarean section | 350 |
| Datta, Crocker and Alper (1977) | 50 | 20 | Continuous i.v. infusion | Tubal ligation | 297 |
| Present series | 106 | 7.5 | I.v. bolus | Caesarean section | 100 |

most commonly in obstetric anaesthetic practice in the U.K., as a single bolus to facilitate tracheal intubation, neuromuscular blockade being main-

bolus of suxamethonium 100 mg i.v.; any fasciculations were noted and the trachea intubated. Once muscle tone had returned, pancuronium 0.075 mg kg⁻¹ was administered. Anaesthesia was maintained with a mixture of 65% nitrous oxide and 0.2% trichloroethylene (for the first 10 min), in oxygen (Whitford, Cory and Beddard, 1973). Er-

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gometrine 500 μg was given i.v. at delivery and followed by fentanyl 1 μg kg⁻¹. Lateral tilt was maintained during surgery. Following operation analgesia was provided by increments of morphine 10 mg plus cyclizine 50 mg (Cyclimorph) for the first 24 h, by which time all the patients were ambulant.

In addition, a group of 20 non-pregnant women aged 26–45 yr undergoing abdominal hysterectomy were studied. These patients were all premenopausal and were anaesthetized as described above with the exception that gometrine was not given.

As suxamethonium pain may first appear as late as on the 4th day following the operation (Burtles and Tunstall, 1961), all patients were interviewed on that day. At this interview the following questions were asked in sequence:
(a) How have you been since your operation?
(b) What has been the worst thing since the operation?
(c) Have you had any aches or pains, apart from at the site of operation, since surgery?
(d) Have you had any aches or pains in your limbs, back or neck since the operation?
If pain in the muscle(s) was volunteered in response to the non-specific questions (a) or (b), severe pain was recorded. Mild pain was present if a positive reply was given to questions (c) or (d). Muscle pain was only noted as absent if negative replies were given to the leading questions (c) and (d). The site, severity, time of onset and duration of any pain noted was recorded. Low backache in isolation was disregarded as this was thought to be unrelated to suxamethonium. Any patient with a preoperative history of muscle tenderness or backache was excluded from the investigation.

RESULTS
Eight (7.5%) of the 106 pregnant patients and six (30%) of the 20 non-pregnant patients complained of muscle pain—a significant difference (table II). Not only did the non-pregnant group have a greater frequency of myalgia, but this pain was more severe and generalized, and the complaint of "stiffness" was common. In the pregnant group, pain was localized to a single site such as the back of the neck, shoulder girdle, rib cage, upper back, thighs or legs. The duration of the pain varied between 24 and 72 h in both groups.

Fasciculations were observed in 88.7% of the pregnant group and in 97.2% of the non-pregnant group. This difference was not significant and was in contrast to the frequency of muscle pain in the two groups, giving further support to the lack of association between muscle pain and fasciculation (Bennetts and Khalil, 1981).

DISCUSSION
Suxamethonium stimulates the alpha motor end-plates on the extrafusal fibres of the main muscle mass and the gamma motor end-plates on the nuclear bag fibres of the muscle spindles. It has been suggested (Paton, 1959) that muscle pain is a result of mechanical damage to some of the muscle spindles. Following the administration of suxamethonium it has been shown that there is good correlation between muscle pain after operation and high-frequency EMG potentials (Collier, 1975). There is also evidence of muscle damage. Tammisto and Airaksinen (1966) reported increases in the serum creatinine phosphokinase concentration after the injection of suxamethonium. Crawford (1971) suggested that pregnancy protected women from post-suxamethonium muscle pain. Our results confirm this suggestion. The frequency of muscle pain following a single bolus dose of suxamethonium was significantly lower in the pregnant group (7.5%) compared with the non-pregnant group (30%). The reasons for this decrease in muscle pain in pregnancy are not clear, but several factors may be involved. Crawford suggested that progesterone may be important and we believe that oestrogens may play a part. The concentration of

<table>
<thead>
<tr>
<th>Group</th>
<th>No. with pains (%)</th>
<th>No. with severe pains (%)</th>
<th>No. with mild pains (%)</th>
<th>Type of surgery</th>
<th>Mode of administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnant</td>
<td>8</td>
<td>0</td>
<td>8</td>
<td>Caesarean section</td>
<td>I. v. bolus</td>
</tr>
<tr>
<td>(n = 106)</td>
<td>(7.5)</td>
<td>(0)</td>
<td>(7.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-pregnant</td>
<td>6*</td>
<td>2</td>
<td>4</td>
<td>Hysterectomy</td>
<td>I. v. bolus</td>
</tr>
<tr>
<td>(n = 20)</td>
<td>(30)</td>
<td>(10)</td>
<td>(20)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.001
oestrogen increases throughout pregnancy, especially after 20 weeks gestation. The hormone affects the polymerization of acid mucopolysaccharide and therefore affects the physicochemical properties of the ground substance which acts as an adhesive between the fibres in collagen tissue (Hytten and Leitch, 1971). The uterine cervix has a high collagen content and stretches easily in pregnancy. Striated muscle has a high collagen content also. It is suggested that the high oestrogen concentration, at term, renders the extrafusal and intrafusal fibres in striated muscle more pliable so that less mechanical damage to the muscle spindle occurs after suxamethonium. In small children, whose collagen tissues are also more elastic, the frequency of muscle pains associated with suxamethonium is remarkably low (Bush and Roth, 1961). Datta, Crocker and Alper (1977) investigated the frequency of muscle pain following a continuous infusion of suxamethonium in women who were less than 20 weeks pregnant. The frequency was 20%, which was less than in non-pregnant women, but not as low as that found using a similar technique in pregnant patients at term. A possible explanation of this anomaly is that the main increase in the oestrogen concentration in pregnancy occurs after 20 weeks gestation.

However, even at term the frequency of muscle pains is high following intermittent injections of suxamethonium (Bryson and Ormston, 1962). Intermittent administration is known to cause increased muscle damage (Tammisto and Airaksinen 1966). This is probably because of the prolonged continuous relaxation and contraction which occurs with this form of administration compared with the less violent changes and clinically smoother course when using the drug by continuous infusion.

In pregnancy, the use of suxamethonium by continuous infusion or by bolus injection i.v. is associated with such a low frequency of muscle pain that any further attempt to decrease this seems hardly worthwhile.

REFERENCES


DOSE UNIQUE DE SUXAMETHONIUM ET DOULEURS MUSCULAIRES AU COURS DE LA GROSSESSE

RESUME
La fréquence des douleurs musculaires a été étudiée dans deux groupes de patientes. Un groupe consistait en 106 femmes subissant une césarienne; l'autre comprenait 20 femmes en période de pré-ménopause subissant une hysterectomie. Les deux groupes recevraient une injection directe unique de 100 mg de suxaméthonium pour faciliter l'intubation trachéale. Il y avait une diminution statistiquement significative de la fréquence des douleurs musculaires dans le groupe des femmes enceintes (7,5%) par rapport aux groupes des femmes non enceintes (30%).

SUXAMETHONIUM IN EINZELDOSIS UND MUSKELSCHMERZ IN DER SCHWANGERSCHAFT

ZUSAMMENFASSUNG
Bei zwei Gruppen von Patientinnen wurde die Häufigkeit von Muskelschmerzen untersucht. Eine Gruppe bestand aus 106 Frauen während Kaiserschnitt, die andere aus 20 Frauen während Hysterektomie vor der Menopause. Beide Gruppen erhielten eine einfache Bolusinjektion von Suxamethonium 100 mg zur Erleichterung der trachealen Intubation. Bei den schwangeren Frauen war mit 7,5% eine statistisch signifikant niedrigere Häufigkeit von Muskelschmerz zu beobachten als bei den nichtschwangeren (30%).

DOsis simple de suxametonió
Y dolor muscular durante el embarazo

SUMARIO
Se estudió en dos grupos de pacientes la frecuencia del dolor muscular. Uno de los grupos estuvo formado por 106 mujeres sometidas a operación de cesárea, mientras que el otro grupo abarcó 20 mujeres en el periodo previo a la menopausia sometidas a hysterectomía. Ambos grupos recibieron una inyección de un solo bolo de 100 mg de suxametonió para facilitar la intubación traqueal. Se observó una disminución estadística significativa en la frecuencia del dolor muscular del grupo de pacientes embarazadas (7,5%) en comparación con el grupo de mujeres no embarazadas (30%).