Influence of Tetrahydro-aminacrine on Muscle Pains after Suxamethonium

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SUMMARY

The incidence and severity of muscle pains were investigated in patients who had been given suxamethonium and thiopentone anesthesia for bronchoscopy. Group I patients received no other drugs. Groups II and III received d-tubocurarine and THA respectively before suxamethonium. Administration of these drugs resulted in a highly significant reduction in the incidence of severe and moderate pains. The use of d-tubocurarine necessitated a significantly greater amount of suxamethonium to maintain paralysis.

It was therefore decided to investigate the incidence and severity of muscle pains after the use of suxamethonium in combination with THA.

PATIENTS AND METHODS

The study was carried out on adult patients undergoing diagnostic bronchoscopy. In this hospital it is the practice to record bronchoscopic findings photographically, so that the procedure is prolonged, usually lasting 15-20 minutes, which provided an ideal length of time for studying THA. The anaesthetic technique for bronchoscopy has been described in detail elsewhere.

Pre-operative medication in each case consisted of an appropriate dose of papaveretum (maximum 20 mg) with atropine 0.6 mg. Induction of anaesthesia was achieved with a sleep dose of 2.5% thiopentone, and maintained with incremental doses of thiopentone (20% of the induction dose) given at 5-minute intervals unless there was clear indication for it to be given earlier.

The patients were allocated to one of three relaxant techniques, determined from a table of random numbers:

Group I: 50 mg suxamethonium immediately after the thiopentone, followed by increments of 25-50 mg as required.

Group II: 5 mg d-tubocurarine 3-5 minutes before induction, then suxamethonium as in group I.

Group III: 15 mg THA 3-5 minutes before induction, 25-50 mg suxamethonium after induction with incremental doses of 12.5-25 mg as necessary.

The patients (all of whom were ambulatory within 12 hours) were seen on postoperative day 3 by one of us (M.M.) who did not know which relaxant technique had been employed. The difficulties in assessing pain are well known, and the method used was that suggested by Waters and Mapleson:1-no pain related to suxamethonium; 2-mild pain at one site only, causing little inconvenience; 3-pain at more than one site or severe pain in one area which caused inconvenience; 4-severe pain which limited movement.

RESULTS

It was hoped initially to have 50 patients in each group. However, some of the patients who had been discharged on the day after bronchoscopy failed to return on the third postoperative day, as requested. Thus the results per-
TABLE I. NUMBER OF PATIENTS IN EACH GROUP, MEANS OF AGES, DURATION OF BRONCHOSCOPY AND DOSES OF THIOPENTONE AND SUXAMETHONIUM

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of patients</th>
<th>Mean age ± 1 SD</th>
<th>Mean duration bronchoscopy ± 1 SD</th>
<th>Mean dose (mg) thiopentone ± 1 SD</th>
<th>Mean dose (mg) suxamethonium ± 1 SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>43</td>
<td>57.7 ± 15.3</td>
<td>17.0 ± 7.4</td>
<td>285 ± 75</td>
<td>141 ± 59.3</td>
</tr>
<tr>
<td>II</td>
<td>34</td>
<td>55.7 ± 15.1</td>
<td>18.0 ± 8.6</td>
<td>262 ± 61</td>
<td>208 ± 77.1</td>
</tr>
<tr>
<td>III</td>
<td>35</td>
<td>55.3 ± 14.5</td>
<td>19.0 ± 7.2</td>
<td>290 ± 69</td>
<td>66.1 ± 26.4</td>
</tr>
</tbody>
</table>

TABLE II. DISTRIBUTION OF PAIN BETWEEN THE THREE GROUPS

<table>
<thead>
<tr>
<th>Number with pain</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>2</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Group II</td>
<td>9</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Group III</td>
<td>9</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

The results from group I in this series confirm the high incidence of suxamethonium pains in patients who are ambulatory soon after minor surgical procedures. The incidence (63%) was very similar to that reported after bronchoscopy by other workers.\(^5,6,13\)

It was evident from this series that both d-tubocurarine and THA markedly reduced the incidence of moderate and severe muscle pains after suxamethonium. The assessment of moderate and severe pain presented no difficulties, but it was much more difficult to decide whether slight pain was due to suxamethonium. Since slight pain did not cause any inconvenience to the patients, it would be reasonable to add these patients to those who had no pain. Considered in this way, the incidence of distressing pain in the control group (which received suxamethonium only) was 58%. This was reduced to 9.7% and 17.4% respectively in those who received d-tubocurarine, and THA. Chi-square analysis then shows a highly significant difference between the control group and groups II and III ($\chi^2 = 23.394$, $P <0.0005$), but again no difference between groups II and III ($\chi^2 = 0.447$, $P >0.5$).

Administration of small doses of gallamine\(^6\) or d-tubocurarine\(^4\) prior to suxamethonium are well known to protect against muscle pains. The use of a non-depolarising relaxant before administration of a depolarising agent is however, questionable, since the two types of drug are antagonistic and larger amounts of suxamethonium would be needed to maintain paralysis. This was borne out in the present results (Table II). In this group, one patient did show inadequate respiratory efforts at the end of the procedure and ventilation had to be assisted for 30 minutes before it was adjudged to be satisfactory.

THA also significantly reduced the incidence of moderate and severe muscle pains after suxamethonium, thus confirming the impression of Barrow and Smethurst.\(^3\) Waters and Mapleson\(^4\) did not find this effect with THA, but it must be pointed out that these workers used a small dose of THA (5 mg) and only one dose of suxamethonium. It is interesting to note that the drug hexafluorenium, which also extends the duration of action of suxamethonium, has been shown to have a protective effect against the development of muscle pains.\(^13\)

Two other successful methods of preventing post-operative muscle pains have been reported. Gupte and Savant\(^1\) reduced the frequency of pains from 36.5% to 12% by the use of oral vitamin C during the peri-operative period. Excellent results have also been obtained with intravenous lignocaine, either 6 mg/kg or 3-4 mg/kg.\(^6\) The former workers, however, did report instances of hypotension in their patients, and also a downward displacement of the S wave of the ECG in all cases. Since patients requiring diagnostic bronchoscopy are frequently in the older age group and debilitated, it would seem unwise to use a drug such as lignocaine in that group of patients.

In this series, prior administration of both d-tubocurarine and THA has significantly reduced the occurrence of suxamethonium pains. The latter can cause considerable distress to the patient, and due consideration must be...
given to the use of suxamethonium in minor procedures. If it is deemed mandatory, then some method which will prevent the occurrence of these pains must be used.

REFERENCES

Mesothelial Reaction to Asbestos and Other Irritants after Intraperitoneal Injection

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SUMMARY
Ten groups of rats were injected intraperitoneally with one of the following suspensions: (i) standard reference crocidolite; (ii) acid-treated crocidolite; (iii) crocidolite + iron oxide; (iv) crocidolite + silica; (v) iron oxide; (vi) silica; (vii) long fibre crocidolite; (viii) short fibre crocidolite; (ix) long fibre glass and (x) short fibre glass.

Two rats from each group were killed at 45, 90, 150, 240 and 330 days respectively, and the pathology induced by the different suspensions was studied histologically at each time interval. No evidence in support of the chemical induction theory or mechanical irritation theory in the pathogenesis of peritoneal mesotheliomas could be found, although all the suspensions except iron oxide caused a reactive mesothelium.


Clinical, epidemiological and experimental evidence indicates that asbestos, and especially the crocidolite variety, is extremely carcinogenic. However, the mode of action of asbestos as a carcinogen remains a matter of speculation.

In a previous experimental study, peritoneal mesotheliomas were induced in rats by asbestos suspensions after intraperitoneal injection. Histopathologically the asbestos fibres were first encapsulated by fibrous tissue and the latter covered by a layer of mesothelial cells. These meso-

thelial cells eventually underwent metaplasia, due either to soluble carcinogens slowly diffusing from the entrapped asbestos particles, or to the continuous mechanical irritation of the cells by the long needle-like fibres. It was also suggested that iron and silica compounds or other metal inclusions in the asbestos lattice were probably carcinogenic agents.

In following up these suggestions, the present experiments were planned to investigate, on a comparative basis, (i) the carcinogenicity of natural and acid-treated (metal-free) asbestos; (ii) the effects of iron and silica in association with acid-treated and natural asbestos, and (iii) the possible contribution of mechanical irritation in the pathogenesis of mesotheliomas.

MATERIALS AND METHODS

Samples
Asbestos, (a) UICC standard reference crocidolite, supplied by the Pneumoconiosis Research Unit, Johannesburg.
(b) Long fibre crocidolite, prepared from the standard reference sample by sedimentation of the long fibres in de-ionised water.
(c) Short fibre crocidolite, prepared by centrifuging the supernatant of (b) after allowing 30 minutes for the long fibres to sediment.
(d) Acid-treated crocidolite, prepared by successively boiling samples for 30 minutes with concentrated hydrochloric and nitric acid to remove soluble organic and inorganic components. After each treatment the samples were washed with de-ionised water until neutral, pH = 7.0.
Glass: After milling, commercial fibre glass was separated into long and short fibres by sedimentation and