EFFECTS OF DIFFERENT DOSES OF THIOPENTONE ON THE INCREASE IN SERUM MYOGLOBIN INDUCED BY SUXAMETHONIUM IN CHILDREN†

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SUMMARY

We have studied the effects of different doses of thiopentone on the increase in serum myoglobin after administration of suxamethonium during inhalation induction of anaesthesia in children. Forty-three children were anaesthetized with halothane and nitrous oxide in oxygen and allocated to four groups: group S received suxamethonium 1 mg kg\(^{-1}\) to facilitate intubation; group ST2 received thiopentone 2 mg kg\(^{-1}\) and group ST4 received thiopentone 4 mg kg\(^{-1}\), before administration of suxamethonium 1 mg kg\(^{-1}\); group N did not receive thiopentone or suxamethonium. Serum myoglobin and creatine kinase (CK) concentrations were measured until 60 min after the injection of suxamethonium. Both myoglobin and CK concentrations increased in the three groups receiving suxamethonium. There were no significant differences between groups S and ST2, but the myoglobin concentration was less in group ST4 than in groups S and ST2. A significant difference in CK concentration was found only between groups ST2 and ST4 at 60 min. In group N, both values remained reasonably constant. Thiopentone 4 mg kg\(^{-1}\), but not 2 mg kg\(^{-1}\), attenuated the increase. The results indicate that to prevent a marked elevation in serum myoglobin after administration of suxamethonium, thiopentone 4 mg kg\(^{-1}\) should be administered. (Br. J. Anaesth. 1993; 71: 291-293)

KEY WORDS

I.v administration of suxamethonium to children anaesthetized with halothane is associated with increases in serum concentrations of myoglobin [1-4] and creatine kinase (CK) [2, 3]. Although the inhibitory effects of thiobarbiturates on the release of myoglobin and CK have been reported previously [5], the effects of different doses of thiopentone administered during inhalation induction of anaesthesia have not been described clearly.

We have studied the effects of different doses of thiopentone on changes in serum myoglobin and CK until 60 min after administration of suxamethonium to children anaesthetized with halothane and nitrous oxide.

METHODS AND RESULTS

We studied 43 children of both sexes, aged from 2 yr 11 months to 13 yr 10 months, ASA I, undergoing minor elective urological, orthopaedic or oral surgery under general anaesthesia. All parents had been informed of the nature of the study and informed consent was obtained.

All children received diazepam 0.5-0.7 mg kg\(^{-1}\) (maximum dose 10 mg) and atropine 0.02 mg kg\(^{-1}\) (maximum dose 1.0 mg) orally 1-2 h before induction of anaesthesia. Inhalation induction was performed with halothane and nitrous oxide in oxygen via a face mask. After loss of consciousness, the children were allocated randomly to four groups. The first group received suxamethonium 1 mg kg\(^{-1}\) to facilitate tracheal intubation (group S; \(n=12\)). The second group (ST2; \(n=10\)) received thiopentone 2 mg kg\(^{-1}\) and the third group (ST4; \(n=10\)) received thiopentone 4 mg kg\(^{-1}\), before administration of suxamethonium 1 mg kg\(^{-1}\). In the fourth group, tracheal intubation was performed without either thiopentone or suxamethonium (group N; \(n=11\)). Anaesthesia was maintained with halothane and nitrous oxide in oxygen via a Jackson Rees system. Lactated Ringer's solution was infused at 10-15 ml kg\(^{-1}\) h\(^{-1}\) and blood samples were obtained before and at 5, 20 and 60 min after injection of suxamethonium in groups S, ST2 and ST4, and at the same times in group N. The values obtained before the injection of suxamethonium were taken as baseline.

Blood samples were allowed to stand and coagulate for 20-30 min. After centrifugation, all specimens were kept frozen at -20 °C until required for assay. Myoglobin concentrations were determined in non-haemolysed sera using a radioimmunoassay (Daichi Radioisotope, Tokyo, Japan). The range of detection was myoglobin 0.3-200 ng ml\(^{-1}\). When the value was > 200 ng ml\(^{-1}\), the serum was diluted 2-, 5- or 10-
Fold. CK concentrations were measured by the modified Rosalki method (Yatoron, Tokyo, Japan).

Statistical analyses were performed using Kruskal-Wallis and Wilcoxon U test for myoglobin and CK concentrations, and chi-square and Student's t test as appropriate. The results were considered significant when $P < 0.05$. All data are presented as mean (SD).

The four groups were comparable in age, weight and operations performed. The concentrations of halothane administered during induction and maintenance were also comparable.

Changes in myoglobin and CK are shown in table 1. Baseline concentrations were normal in all four groups and increased in the three groups receiving suxamethonium. Among those three groups, there were no significant differences between groups S and ST2, the myoglobin concentration was less in group ST4 than in groups S and ST2, and a significant difference in CK concentration occurred only between groups ST2 and ST4 at 60 min.

**COMMENT**

In 1971 Ryan, Kagen and Hyman reported a greater incidence of myoglobinemia in children than in adults, after suxamethonium. However, the study used various induction techniques. Tammisto, Leikkonen and Airaksinen [5] found that the increases in myoglobin and CK concentrations were less in those receiving barbiturates, in both children and adults.

Reduced increases in serum myoglobin and CK concentrations by barbiturates have been reported in adults [6]: thiamylal 1.5–2.0 mg kg$^{-1}$ administered after induction of anaesthesia with halothane reduced the increase in myoglobin and CK concentrations to 10–35% of control. In contrast, a dose of thiopentone 2 mg kg$^{-1}$ was found to be ineffective in the present study. The reasons for this difference could be attributed to age differences in the responsiveness to barbiturates. In addition, the timing of administration, or pharmacological differences between thiopentone and thiamylal should be considered.

In contrast, Sekino and colleagues [7] administered thiopentone 5 mg kg$^{-1}$ for i.v. induction of anaesthesia in children, and found that the concentration of myoglobin was reduced to about 22% of that without thiopentone. However, they concluded that the dose was ineffective, as a statistically significant difference was not found.

Manani and colleagues [8] reported that thiopentone reduced the incidence of myalgia and fasciculation induced by suxamethonium. It has been reported previously that a correlation does not necessarily exist between the intensity of muscle fasciculation and the degree of muscle damage as indicated by the serum concentrations of myoglobin and CK [2, 3]. This suggests that the increases are not necessarily attributable to muscle cell damage by fasciculation, but rather to accelerated permeability of the muscle cell by depolarization. The mechanism that reduces the rate of increase by barbiturates has not been delineated clearly and requires further investigation. It is possible that the mechanism might involve a cell membrane stabilizing effect,

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline</th>
<th>5 min</th>
<th>20 min</th>
<th>60 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>134 (35.9)</td>
<td>2192 (639)</td>
<td>19 (2)</td>
<td>1814 (708)</td>
</tr>
<tr>
<td>ST2</td>
<td>168 (1577)</td>
<td>1301</td>
<td>677</td>
<td>146 (751)</td>
</tr>
<tr>
<td>ST4</td>
<td>160 (1530)</td>
<td>1301</td>
<td>677</td>
<td>146 (751)</td>
</tr>
<tr>
<td>N</td>
<td>160 (1530)</td>
<td>1301</td>
<td>677</td>
<td>146 (751)</td>
</tr>
</tbody>
</table>

- $*$ indicates $P < 0.05$, **$*$ indicates $P < 0.01$, $***$ indicates $P < 0.001$, vs baseline. Significance differences vs baseline: $P < 0.05$, **$P < 0.01$, $***P < 0.001$.
THIOPENTONE AND SERUM MYOGLOBIN

although an effect on neuromuscular transmission also may play a role.

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REFERENCES