Clinical Workshop
S. G. HERSHEY, M.D., Editor

Potassium Release after Succinylcholine in Acutely Uremic Monkeys

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The safety of succinylcholine in the uremic patient is being questioned because there have been reports of cardiac arrest and serious ventricular arrhythmias after its use.1,2 Hyperkalemia secondary to succinylcholine has been suggested as the cause of the arrhythmias. Succinylcholine is known to liberate large amounts of potassium in a variety of disease states—massive burns,3 trauma,4 and certain neurologic disorders.5 However, little is known about the potassium changes in uremia secondary to succinylcholine.5 It is not known whether there is a latent period for change in the pattern of potassium release after administration of succinylcholine to the uremic patient, or whether change may occur acutely. Hence, we examined the pattern of potassium changes after administration of succinylcholine to acutely uremic monkeys.

Methods
Five macaque monkeys with an average weight of 3.5 kg were studied. With the monkey awake but sedated with phencyclidine, the trachea was intubated with a 3.5–4.0-mm ID uncuffed endotracheal tube. Anesthesia with halothane (1 per cent) in 80 per cent N2O–40 per cent oxygen was used to facilitate control of ventilation with a Bird Mark IV anesthesis ventilator.

A femoral arterial cannula was placed. Arterial blood samples were drawn in heparinized plastic syringes and analyzed immediately for Pco2, Paco2, and pH using a Radiometer Blood Gas Analyzer. Arterial samples were also used for control measurements of blood urea nitrogen (BUN), creatinine, and potassium. Succinylcholine, 1 mg/kg, was administered iv. Blood samples were drawn into dry syringes 3, 5, 7, 10, and 15 minutes after succinylcholine administration for measurement of potassium. A 10-minute sample was also obtained for determination of pH, Pco2, and Paco2.

The samples for potassium measurement were transferred to heparinized test tubes and centrifuged. Potassium values were determined on an Instrumentation Laboratories flame photometer incorporating an automatic dilutor. The precision of the technique was assessed at ±0.05 mEq/l. Blood urea nitrogen and creatinine were determined by standard Auto-Analyzer techniques.

Following the potassium determinations, bilateral ureteral ligation was performed through an abdominal incision. Seventy-two hours later, the animals were rechallenged with succinylcholine as described above.

Results
Blood urea nitrogen, creatinine, and potassium values for each time period during the control and uremic state are shown in Table 1. Statistical analysis was made with Student’s paired t test. Each monkey had significantly elevated blood urea nitrogen, creatinine, and potassium following ureteral ligation compared with the control period. pH was held constant within ±0.02 units during succinylcholine challenge. Potassium concentrations increased
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TABLE 1. Changes in BUN, Creatinine, and Potassium*

<table>
<thead>
<tr>
<th></th>
<th>BUN (mg/100 ml)</th>
<th>Creatinine (mg/100 ml)</th>
<th>Potassium (mEq/l)</th>
<th>Change from Initial Potassium (mEq/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 Min</td>
</tr>
<tr>
<td>Control group</td>
<td>24.4</td>
<td>1.16</td>
<td>3.32</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>± 0.33</td>
<td>± 0.07</td>
<td>± 0.17</td>
<td>± 0.12</td>
</tr>
<tr>
<td>Uremic group</td>
<td>152.4†</td>
<td>12.12†</td>
<td>0.28†</td>
<td>0.30†</td>
</tr>
<tr>
<td></td>
<td>± 12.40†</td>
<td>± 0.63</td>
<td>± 0.32</td>
<td>± 0.09</td>
</tr>
</tbody>
</table>

* Mean ± SE.
† Significant at P < 0.01.
‡ Nonsignificant at P < 0.05.

to above control levels in both “normal” and uremic monkeys. At no time was there a significant difference between changes of potassium levels in the two groups.

DISCUSSION

The mean changes in potassium in the two groups are comparable to those seen in normal man during nitrous oxide-oxygen-halothane anesthesia. Like Powell and Colby, who studied rats, we saw no significant change in potassium levels after administration of succinylcholine to control and uremic animals. Unlike Powell and Colby, we did not see much variation in the potassium responses in our uremic group. Our data clearly show that the increase of potassium after succinylcholine is no greater in acutely hyperkalemic uremic monkeys than in control monkeys. Whether potassium changes after succinylcholine may be greater in the chronically uremic monkeys following some latent period remains to be determined. Such work is hampered by a high death rate in undialyzed animals.

REFERENCES


Severe Hypotension during Prosthetic Hip Surgery with Acrylic Bone Cement

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The use of methylmethacrylate, a self-curing cement, is revolutionizing orthopedic joint surgery. The FDA has recently released this product, and its use to anchor the components in major joint replacement is gaining popularity. Transient hypotension coincident with its insertion into the shaft of the femur has been reported, and is mentioned in the package insert accompanying the product. In recent months several reports of cardiovascular