Effect of Acute Hypothermia upon the Noradrenaline and Adrenaline Content of the Adrenal Gland in the Cat

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In my previous studies the effects of insulin hypoglycemia and hemorrhagic hypotension upon the noradrenaline and adrenaline contents of the cat adrenal gland were investigated. The purpose of the present study has been to know the influence of acute hypothermia induced by the application of cold to the animal body upon the adrenal noradrenaline and adrenaline contents.

EXPERIMENTAL

Methods and Results

Two groups of 4 male and 4 female cats each were used. All the animals were anesthetized with Evipan sodium.

One group of cats were immersed into cold water of 6-8°C for 30 minutes and then withdrawn from it. One and a half hours after withdrawal from cold water the adrenal glands of both sides were extirpated. The other group of cats were used for the control experiments, the adrenal glands being removed 2 hours after Evipan sodium injection.

Adrenal extracts were made with 4% trichloracetic acid and were assayed for noradrenaline and adrenaline by the permanganate method of Suzuki and Ozaki.

All the data are presented in Table I.

In control experiments the adrenal adrenaline and noradrenaline contents were on the average 0.63 μg. and 0.61 μg. per mg. of gland weight, respectively. They were 44 μg. and 42 μg. per kg. of body weight, respectively. The mean relative noradrenaline content was 50 per cent.

In cats, immersed into cold water, the body temperature fell from 37.4-38.5°C markedly. Ten or 20 minutes after withdrawal from cold water the lowest level (24.2-27.1°C) was reached. Then it rose very slowly. One and a half hours after withdrawal from cold water it was measured as 26.7-31.3°C.

All the data are presented in Table I.
TABLE I. Effect of Cold Application to the Cat Body on the Noradrenaline and Adrenaline Contents of the Adrenal Gland

<table>
<thead>
<tr>
<th>No.</th>
<th>Body weight (kg.)</th>
<th>Sex</th>
<th>L or R</th>
<th>Weight of gland (mg.)</th>
<th>Adrenaline and noradrenaline content (μg.)</th>
<th>Per cent noradrenaline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.35</td>
<td>♂</td>
<td>l</td>
<td>134</td>
<td>106</td>
<td>102</td>
</tr>
<tr>
<td>2</td>
<td>2.06</td>
<td>♂</td>
<td>r</td>
<td>130</td>
<td>109</td>
<td>102</td>
</tr>
<tr>
<td>3</td>
<td>2.48</td>
<td>♂</td>
<td>l</td>
<td>209</td>
<td>132</td>
<td>90</td>
</tr>
<tr>
<td>4</td>
<td>2.48</td>
<td>♂</td>
<td>r</td>
<td>209</td>
<td>132</td>
<td>90</td>
</tr>
<tr>
<td>5</td>
<td>1.68</td>
<td>♂</td>
<td>r</td>
<td>193</td>
<td>96</td>
<td>115</td>
</tr>
<tr>
<td>6</td>
<td>2.18</td>
<td>♂</td>
<td>l</td>
<td>192</td>
<td>101</td>
<td>124</td>
</tr>
<tr>
<td>7</td>
<td>1.68</td>
<td>♂</td>
<td>r</td>
<td>193</td>
<td>96</td>
<td>115</td>
</tr>
<tr>
<td>8</td>
<td>2.44</td>
<td>♂</td>
<td>r</td>
<td>140</td>
<td>124</td>
<td>134</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>106</td>
<td>107</td>
</tr>
</tbody>
</table>

Cold application experiments

|     |                  |     |        |           |     |         |     |          | 44   | 42      | 50    | 50     |
|     |                  |     |        |           |     |         |     |          | 44   | 42      | 50    | 50     |

this group of cats the adrenaline and noradrenaline contents of the adrenal gland were on the average 0.40 μg. and 0.54 μg. per mg. of gland weight, respectively. They were 28 μg. and 36 μg. per kg. of body weight, respectively. The mean relative noradrenaline content was 58 per cent.

The adrenaline content of the adrenal gland in the hypothermic cats was
definitely smaller than that in control animals. The difference was statistically significant (P<0.01). The noradrenaline content of the adrenal gland in cats immersed into cold water seemed to be somewhat smaller than that in control animals. This difference was, however, statistically not significant (P>0.05).

DISCUSSION

It was well established that adrenal medullary hormone content of the adrenal gland was decreased by cooling the animal.\textsuperscript{4-6} However, no exploration has been performed to evaluate differentially the effect of cold upon the adrenal noradrenaline and adrenaline contents.

In the present study it has been elucidated that by the application of cold to the animal body the adrenaline content of the adrenal gland is decreased, whereas there is no definite reduction in the adrenal noradrenaline content.

In the previous study\textsuperscript{1} it was found that the adrenaline content of the adrenal gland in the cat was reduced definitely by the administration of insulin in a dose of 2 units per kg. of body weight, while no definite change in adrenal noradrenaline content was produced. After giving insulin in a dose of 5 units per kg. of body weight, both adrenaline and noradrenaline contents of the adrenal gland decreased definitely, the adrenaline depletion being much more remarkable than that of noradrenaline.

Similar results were obtained in the hemorrhage experiments\textsuperscript{2} in cats. After bleeding two-fifths of the total blood quantity, a definite decrease in adrenaline content of the adrenal gland was observed. However, no decrease in the adrenal noradrenaline content was found. In cats, in which blood was taken out at first in an amount of two-fifths of the total and after one hour again in a volume of one-fifth of the total, there was a marked decrease in adrenaline content and a moderate reduction in noradrenaline content of the adrenal gland.

The above experiments and the present study showed that insulin hypoglycemia, hemorrhagic hypotension and cold stress reduced adrenaline content of the adrenal gland rather than noradrenaline content.

SUMMARY

The noradrenaline and adrenaline contents of the adrenal gland in cats were estimated by the permanganate method of Suzuki and Ozaki. Hypothermia was induced by immersing the animals into cold water.

After application of cold to the animal body a marked decrease in adrenaline content of the adrenal gland was found, whereas there was no definite alteration in adrenal noradrenaline content.

The author wishes to express appreciation to Prof. T. Suzuki for his interest and to Dr. M. Motomura for his help in conducting experiments.
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References

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