A comparative study on the influence of dopamine and metaproterenol on the ventricular fibrillation threshold in cats

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With 10 tables

(Received October 11, 1976)

Summary

The influence of 3,4-dihydroxyphenylethylamine (dopamine) on the VFT of the cat heart was checked with different doses in comparison to metaproterenol (Alupent®). In the therapeutical doses dopamine has no significant influence on the VFT in contrast to metaproterenol. The clinical relevance of our findings seems to be that dopamine can be applied in therapeutical doses without running the risk of inducing serious cardiac arrhythmia.

It is commonly known that catecholamines are able to induce cardiac arrhythmias. Under certain clinical circumstances, however, we are forced to apply catecholamines, deliberately accepting this disadvantage in order to achieve other desired therapeutical effects. Recently, the application of the so-called "third biogenous catecholamine" – dopamine – is widely recommended because of the positive cardiovascular and renal effects (1, 2, 4, 7, 8, 10, 11, 14, 16, 17, 19). Little attention was paid so far to the possible induction of cardiac arrhythmia by this drug.

The purpose of the present investigation was to find out whether and to what extent dopamine4) alters the ventricular fibrillation threshold (VFT) of the cat heart in comparison to metaproterenol (Alupent®).

Methods

Cats weighing between 2.5 and 3.9 kilograms were anaesthetized by intramuscular injection of 35 mg Pentobarbital (Nembutal®) per kilogram body-weight. The temperature of all cats was measured with an electronic thermometer (Fa. Hellige, Germany) placed in the distal esophagus and was kept constant (37–38 °C) by the intermittent use of an electrical heating pad or by covering the animals with layers of surgical drapes. A left thoracotomy was

4) The dopamine used in this study was furnished by courtesy of Giulini Pharma, Germany.
performed in the 4th or 5th intercostal space, respectively. The pericardium was incised longitudinally and the left ventricle exposed. Ventilation was maintained with a positive pressure respirator (Fa. Draeger, Germany), using compressed room air. Detailed descriptions of the electronic equipment and the determination of the fibrillation threshold are given elsewhere (13). The fibrillation threshold was measured in Milliamperes (mA) immediately after the preparation of the cats. The fibrillation threshold was accepted if two corresponding values of the current produced ventricular fibrillation for at least 10 seconds. Further fibrillation threshold determinations were made right before and after the intravenous infusion of dopamine or metaproterenol, respectively. At the same time the heart rate was counted and samples of arterial blood were taken through an art. carotis catheter to determine PO₂, PCO₂, pH, and K⁺. The infusion period lasted 15 minutes. The doses of dopamine were 2.5 µg, 5.0 µg, 10.0 µg, and 20 µg/kg body weight/minute; the doses of metaproterenol were 7.5 µg, 15.0 µg, and 30 µg/kg body weight/minute.

5 cats undergoing the same anaesthesia, preparation, and measurement procedures were used as control group to assess the influence of anaesthesia, duration of the test, and blood sample taking on the VFT. These animals received neither dopamine nor metaproterenol.

The statistical evaluation was done according to the test of Wilcoxon (differences of pairs).

**Results**

As shown in table 1, the 5 animals of the control group showed no significant changes in the VFT over a period of 3 hours. No significant changes were seen in the arterial PO₂, PCO₂, and pH if ventilation rate was chosen correctly. After a loss of blood of approximately 20–30 ml the serum potassium level tended to decrease so that intravenous substitution of K-Cl-solution was necessary to maintain the serum potassium level constant between 3.6 and 4.6 mval/L.

Table 1. VFT of the control group over a period of 3 hours.

<table>
<thead>
<tr>
<th>Animals</th>
<th>VFT (mA) before</th>
<th>VFT (mA) after</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22.5</td>
<td>20.0</td>
</tr>
<tr>
<td>2</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>3</td>
<td>17.0</td>
<td>18.0</td>
</tr>
<tr>
<td>4</td>
<td>24.5</td>
<td>26.0</td>
</tr>
<tr>
<td>5</td>
<td>28.5</td>
<td>30.0</td>
</tr>
</tbody>
</table>

**Average** 21.5 ± 5.51 21.8 ± 6.10

Table 2 shows a decrease in the VFT of 0.9% in those animals receiving 2.5 µg dopamine/kg/min. The decrease in those animals receiving 5.0 µg was 7.2% (table 3). Neither decrease is statistically significant.

Those animals which received 10 µg dopamine showed a decrease in the VFT of 17.9% which is statistically significant (2 α ≤ 0.10), as is the decrease of 41.5% in the group of those cats which received 20 µg dopamine (2 α ≤ 0.01).