Effects of adrenergic receptor agonists / antagonists on arterial blood pressure in rabbit

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[Objectives]

- To observe the pharmacological effects of adrenergic agonists on regulation of arterial blood pressure in rabbit.

- To demonstrate and analyze the underlying mechanisms of adrenergic agonists actions by using adrenergic antagonists.
## Principle

<table>
<thead>
<tr>
<th>Receptor type</th>
<th>$\alpha_1$</th>
<th>$\alpha_2$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distribution</strong></td>
<td>Postsynaptic, Smooth muscular cells of blood vessels</td>
<td>Presynaptic</td>
<td>Postsynaptic, heart</td>
<td>Postsynaptic, blood vessels</td>
</tr>
<tr>
<td><strong>Effects</strong></td>
<td>Vasoconstriction (arterioles, veins)</td>
<td>inhibition of norepinephrine release</td>
<td>enhancement of heart rate, contractility and conduction velocity</td>
<td>vasodilation (skeletal muscle vasculature)</td>
</tr>
<tr>
<td>Drug</td>
<td>Receptor specificity</td>
<td>Effect</td>
<td></td>
<td></td>
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<tr>
<td>------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Adrenaline (epinephrine)</td>
<td>(\alpha_1, \alpha_2, \beta_1, \beta_2)</td>
<td>agonist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noradrenaline (norepinephrine)</td>
<td>(\alpha_1, \alpha_2 (\beta_1))</td>
<td>agonist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isoprenaline (isoproterenol)</td>
<td>(\beta_1, \beta_2)</td>
<td>agonist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>phentolamine</td>
<td>(\alpha_1, \alpha_2)</td>
<td>antagonist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>propranolol</td>
<td>(\beta_1, \beta_2)</td>
<td>antagonist</td>
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</tr>
</tbody>
</table>
Adrenoceptors

A. α Adrenoceptors

- Epinephrine
- Norepinephrine
- Isoproterenol

α Receptor

High affinity → Low affinity

B. β Adrenoceptors

- Epinephrine
- Isoproterenol
- Norepinephrine

β Receptor

High affinity → Low affinity
Effects of catecholamines in therapeutic doses

Predominant Effects:

NE: $\alpha$ effects & very weak $\beta_1$ effects
EPI: $\alpha$ effects (higher concentrations) $\beta$ effects (lower concentrations)
ISO: $\beta_1$ and $\beta_2$ effects
α-Adrenergic blockers have no effect on the actions of *isoproterenol*, which is a pure β agonist.

α-Adrenergic blockers reverse the vasoconstrictive action of epinephrine.
CATALOGUE

- EXP 18 Measurement of cochlear microphonic potential in guinea pig

- EXP 19 Measurement of afferent impulses of muscle spindle

- EXP 20 Compensatory effect of body fluid redistribution in acute hemorrhage

- EXP 21 Effect of nonvolatile acid on blood pH

- EXP 22 Role of plasma colloid osmotic pressure in the development of edema

- EXP 23 Effects of several drugs on isolated guinea pig ileum

- EXP 24 Effects of several drugs on arterial blood pressure in rabbit

- EXP 25 Inhibitory effect of morphine on rabbit respiration

- EXP 26 Inhibitory effect of dolantin on rabbit respiration
 Effects of several drugs on arterial blood pressure in rabbit

Objectives and principle (实验目的原理)

Materials (实验材料)

Methods (方法步骤)

Simulation experiment (模拟实验)

Questions (思考题)

Test (问题测验)
<table>
<thead>
<tr>
<th>Treatment 1 (dose)</th>
<th>Treatment 2 (dose)</th>
<th>SP/DP [Systolic blood pressure /Diastolic blood pressure] (mmHg)</th>
<th>Pulse pressure (mmHg)</th>
<th>Heart rate (bpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td></td>
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<tr>
<td>Adrenaline (</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noradrenaline</td>
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<tr>
<td>Isoprenaline</td>
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<tr>
<td>Phentolamine</td>
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<td>Isoprenaline</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
The underlying action mechanism of adrenaline

- $\beta_1$: contractility $\uparrow$
  - HR $\uparrow$
- $\alpha_1$: vasoconstriction
  - (skin, mucous, viscera),
- $\beta_2$: vasodilatation of skeletal muscles and coronary vessels

- cardiac output $\uparrow$
- Peripheral resistance $\downarrow$

- Systolic BP $\uparrow$
- Diastolic BP $\downarrow$ (slightly)
- Pulse pressure $\uparrow$
The underlying action mechanism of noradrenaline

- **α1**: vasoconstriction (skin, renal, brain, hepatic, mesenteric, etc.)
- **α2**: inhibiting NE release
- **β1**: weak directly cardiac stimulates

**Cardiac output** ↑ (slightly)
**Peripheral resistance** ↑

**Systolic BP** ↑
**Diastolic BP** -
**Pulse pressure** ↑

**Cardiac inhibition via reflex** (baroreceptor)

**Heart rate** ↓
The underlying action mechanism of isoproterenol

- \( \beta_1 \): contractility \( \uparrow \) HR \( \uparrow \)
- \( \beta_2 \): dilatation of skeletal muscles and coronary vessels

- Cardiac output \( \uparrow \)
  - Peripheral resistance \( \downarrow \)

- Systolic BP \( \uparrow \)
- Diastolic BP \( \downarrow \)
- Pulse pressure \( \downarrow \)
BP

X drug  α antagonist  X drug
 Experiment Report

- Subject
- Objectives
- Materials and methods:
- Results
- Discussion
- Conclusion