

# Beta-blockers

Propranolol – nejstarší klinicky užívaný  $\beta$ -blokátor Beta-blockers (BB) belong to the group of sympatholytics, they block  $\beta$ -adrenergic reactions. Their effect is competitive antagonism with  $\beta$ -adrenomimetics, ie it suppresses the effect of sympathetic and sympathomimetics on  $\beta$ -adrenergic receptors.

## Effects

The effect of  $\beta$ -blocker administration is most pronounced within the cardiovascular system. The answer is a negative inotropic, dromotropic, chronotropic and bathmotropic effect on the heart. In other words:

- reduce the heart rate
- **reduce the force of contraction, ,**
- **reduce the conductivity of the transmission system,**
- **reduce the excitability (irritability) of the myocardium.**

By slowing down the heart rate, myocardial oxygen consumption is reduced and renal excretion in the kidneys is reduced. If  $\beta$ -blockers are given for a short time, they can cause a decrease in cardiac output and an increase in peripheral resistance. Non-selective  $\beta$ -blockers have this effect, as vasodilation is blocked while the function of  $\alpha_1$ -adrenergic receptors causing vasoconstriction is preserved. On the contrary, the effect of long-term use is to reduce peripheral resistance.

## Effect on the heart rhythm

$\beta$ -sympatholytics slow down the heart rate by the following mechanisms:

- they reduce the steepness of the phase 4 action potential, where they block the phosphorylation of the calcium channel and the entry of calcium into the cells.
- the depolarization rate of the SA and AV nodes is slower,
- the speed of excitation conduction in the atria and in the AV node is slower,
- the functional refractory phase of the AV node is prolonged.

## Effect on the blood pressure

They correct hypertension. The effect usually appears within two hours after administration. At the start of treatment, the blood pressure is adjusted after about 1-2 weeks.

## Effect on the pulmonary system

Some  $\beta$ -blockers cause bronchoconstriction, so flat-rate prescribing to patients with asthma or COPD is contraindicated. However, if the patient is pharmacologically stabilized, it is possible to use so-called cardioselective  $\beta$ -blockers, which do not affect or stimulate  $\beta_2$ -receptors, such as Template: HVLP, Template: HVLP, Template: HVLP, Template: HVLP, Template: HVLP, Template: HVLP or Template: HVLP.

## Effect on the metabolism

In healthy people, the effect on metabolism is minimal. In diabetics,  $\beta$ -blockers prolong the recovery time from hypoglycemia and at the same time hide one of the symptoms of the onset of hypoglycemia - tachycardia.

## Division

There are selective and non-selective  $\beta$ -blockers. Both types can have intrinsic sympathomimetic activity (VSA), which allows for a degree of  $\beta$ -adrenomimetic activity referred to as competitive dualism. After their administration, there is no such severe decrease in basal heart rate, and therefore they are often preferred for a lower risk of arrhythmias.

Selective  $\beta$ -blockers have fewer side effects. They are suitable for the treatment of angina pectoris and hypertension and do not affect the plasma lipid spectrum. preview Betaloc® ZOK - Template: HVLP in retarded form for oral administration Vasocardin® - Template: HVLP with a faster onset of action for oral administration

Name of the group	Name of the drug	Comments
<b>Nonselective BB</b>	Template:HVLP	the oldest $\beta$ -blocker used
	metipranolol	
	nadolol	
	Template:HVLP	antiarrhythmic drug
	Template:HVLP	treatment of local glaucoma
	Template:HVLP	treatment of local glaucoma
<b>Nonselective BB with ISA</b>	pindolol	
	bopindolol	Long-lasting effect
	Template:HVLP	for local therapy of glaucoma
<b>Selective BB without ISA</b>	Template:HVLP	Cardioselective $\beta$ -blocker
	atenolol	Cardioselective $\beta$ -blocker
	metoprololTemplate:HVLP	Cardioselective $\beta$ -blocker
	Template:HVLP	Cardioselective $\beta$ -blocker
	Template:HVLP	Cardioselective $\beta$ -blocker
	talinolol	Cardioselective $\beta$ -blocker
	Template:HVLP	antiarrhythmic in SV tachyarrhythmias
<b>Selective BB with ISA</b>	Template:HVLP	
	Template:HVLP	cardioselective $\beta$ -blocker

**First definition of ecotoxicology (1969): René Truhaut: the study of the adverse effects of chemicals with the aim of protecting natural species and communities. Rachel Carson (1962): the memoir The Silent Spring** highlights the use of pesticides, especially DDT and other agrochemicals. The book led to the establishment of the US Environmental Protection Agency (EPA) in the USA. Introduction of methods describing the toxic effects of human-produced substances on the environment and the organisms contained therein. Systematic implementation of fish toxicity testing methods. In addition to direct toxic effects, the effects of bioconcentration and bioaccumulation are studied – increases in the concentration of foreign substances in the tissues of organisms as a result of exposure from the environment.

**2004 EC ratification: Persistent Organic Pollutants Protocol** to the 1979 Convention on Long-Range Transboundary Air Pollution. The aim of the protocol is to limit, reduce or eliminate the discharge, emissions and losses of persistent organic pollutants that have significant adverse effects on human health or the environment due to long-range transboundary air transport.

**In 2006**, Regulation No. 166/2006 of the European Parliament and the EC Council was issued, establishing the **European Register of Releases and Transfers of Pollutants**. It represents a publicly accessible database of pollutant releases into the air, water and soil, information on wastewater, information on pollutant releases from dispersed sources.

**In 2003**, the proposal for a new framework for legislation covering the safety of chemicals **REACH (Registration, Evaluation and Authorization of Chemicals)** was accepted by the European Commission and approved by the European Parliament. Enterprises and firms that import more than 1 ton of a chemical compound per year will be forced to register this chemical in a central data bank. The aim is to improve the protection of the health of nature, including people, to increase the innovation capacity and the ability of the chemical industry to compete in the European Union. The new measures concern not only new chemical substances introduced to the market, but also substances that have been used for a long time. The program aims to ensure that by 2020 at the latest, only chemical substances with known properties and in a way that does not harm human health and the environment are used.

In acute medicine, esmolol is used in supraventricular tachyarrhythmias (fibrillation or flutter with rapid ventricular response).

## Use

### Arterial Hypertension

$\beta$ -blockers are among the five basic antihypertensives. The exact mechanism by which  $\beta$ -blockers reduce pressure is unknown. Undoubtedly, it improves the prognosis of patients, reduces left ventricular hypertrophy and is of great importance in hyperkinetic circulation in young hypertensives.

### Arrhythmias

$\beta$ -blockers are also class II antiarrhythmics. They are mainly used for supraventricular tachycardias. They slow the ventricular response in atrial flutter and reduce the ectopic activity of the ventricles. They are used for thyroid hyperfunction, where they reduce tachycardia and mild muscle tremors. They prevent severe arrhythmias.

## Ischemic heart disease- Angina Pectoris

By slowing down the frequency, the metabolic oxygen demand of the heart is reduced and at the same time perfusion through the myocardium is improved, as the diastole is prolonged, in which the myocardium is mainly nourished from aa. coronariae. Thus, in myocardial infarction, it is given to promote blood flow and prevent arrhythmias.

## Other heart diseases

$\beta$ -blockers are used in heart failure and hypertrophic cardiomyopathy, mainly due to their beneficial effect on myocardial remodeling and reduce the risk of sudden cardiac death. The most commonly used in the treatment of heart failure are: bisoprolol, metoprolol, nebivolol or carvedilol.

## Glaucom

By reducing the production of intraventricular water, it reduces intraocular pressure in patients with glaucoma.

## Other indications

- Migraines: prophylaxis
- tremors
- portal hypertension, risk of bleeding from esophageal varices

## Side effects

- Heart failure due to effects on cardiac output
- Bradycardia
- Hypotension
- Bronchoconstriction
- Cold limbs (insufficient blood supply)
- Depression
- Metabolic derangements
  - hyperkalemia
  - prolongation of recovery from hypoglycaemia in diabetics
  - increase in triacylglycerol concentration, decrease in HDL-lipoproteins (only for  $\beta$ -blockers without VSA)

## Contraindications

Contraindications result from side effects. It must not be used in bronchial asthma, hypotension, advanced heart failure, significant bradycardia, advanced AV block, in DM.

## Links

### Related articles

- Antihypertensives
- Antiarrhythmics
- Sympatholytics

### External links

- $\beta$ -blokátory a EKG (TECHmED) (<https://www.techmed.sk/beta-blokatory-intoxikacia/>)

## Reference