



MODERN APPROACHES TO THE USE OF BETA-BLOCKERS IN CLINICAL PHARMACOLOGY

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Introduction. Cardiovascular diseases (CVDs) remain the leading cause of mortality worldwide and in the Republic of Kazakhstan. According to the World Health Organization (WHO), more than 17.9 million people die from CVDs every year (WHO, 2021). In Kazakhstan, the prevalence of arterial hypertension among the adult population exceeds 25%, which makes its control particularly relevant (Ministry of Health of the Republic of Kazakhstan, 2022).

One of the key classes of drugs for the treatment of CVDs are beta-blockers (BBs), which have been used for more than 50 years and play an important role in the therapy of arterial hypertension, ischemic heart disease (IHD), chronic heart failure (CHF), and cardiac arrhythmias. Despite the accumulated clinical experience, discussions continue regarding the rationality of their widespread use, the choice of a particular drug, and its combinations with other therapeutic agents.

Pharmacological features

BBs are a heterogeneous class of drugs differing in their selectivity for β_1 - and β_2 -adrenoreceptors, vasodilating properties, and metabolic effects.

Non-selective BBs (propranolol, nadolol) block both receptor types but may cause bronchospasm and impair glucose metabolism.

Cardioselective BBs (bisoprolol, metoprolol, atenolol) predominantly affect β_1 -receptors of the myocardium, providing antianginal and antihypertensive effects with a lower risk of bronchospasm.

Third-generation BBs (carvedilol, nebivolol) have additional vasodilating and endothelium-protective properties, improving tolerability in patients with metabolic syndrome and diabetes mellitus.

The mechanism of action of BBs includes reducing heart rate, decreasing myocardial contractility, and suppressing the activity of the renin–angiotensin–aldosterone system.

Clinical efficacy

Large multicenter trials have proven the effectiveness of BBs in reducing mortality and hospitalizations in patients with CHF and IHD. In the MERIT-HF and CIBIS-II studies, bisoprolol and metoprolol reduced mortality risk by 34% and hospitalization risk by 32% (MERIT-HF, 1999; CIBIS-II, 1999). In the COPENICUS trial, carvedilol demonstrated a 35% reduction in mortality (COPENICUS, 2002).

Regarding arterial hypertension, Cochrane meta-analyses (2020) and studies by Lindholm et al. (2017) showed that BBs are less effective in stroke prevention compared with calcium channel blockers or angiotensin-converting enzyme (ACE) inhibitors. Nevertheless, their role remains critical in cases of hypertension combined with IHD, tachyarrhythmias, and CHF.

Safety and tolerability



The main adverse effects of BBs include bradycardia, hypotension, fatigue, and disturbances of lipid and glucose metabolism. Non-selective drugs are contraindicated in patients with bronchial asthma and chronic obstructive pulmonary disease (COPD). Modern cardioselective and vasodilating BBs have a better safety profile.

In diabetic patients, preference should be given to nebivolol and carvedilol, as they have less impact on insulin resistance and glucose metabolism.

Perspectives of use

Modern research focuses on the individualization of therapy, taking into account the pharmacogenetic characteristics of patients. There is also increasing interest in combination therapy, where BBs are used together with ACE inhibitors, calcium antagonists, and diuretics. Third-generation drugs such as nebivolol demonstrate additional pleiotropic effects, including antioxidant and endothelium-protective properties, which expand their therapeutic potential.

Conclusion

Beta-blockers remain a cornerstone in the treatment of cardiovascular diseases. Their rational use requires consideration of the clinical picture, comorbidities, and individual drug tolerability. Promising directions include personalized medicine, pharmacogenetic approaches, and the further study of combination therapy with new-generation BBs.