Carvedilol: Molecular and Cellular Basis for Its Multifaceted Therapeutic Potential

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Key Words: Adrenoceptor blockade—Antioxidant effects—Cardiac ion channels—Cardiovascular protection—Carvedilol.

ABSTRACT

Carvedilol is a unique cardiovascular drug of multifaceted therapeutic potential. Its major molecular targets recognized to date are membrane adrenoceptors (β₁, β₂, and α₁), reactive oxygen species, and ion channels (K⁺ and Ca²⁺). Carvedilol provides prominent hemodynamic benefits mainly through a balanced adrenoceptor blockade, which causes a reduction in cardiac work in association with peripheral vasodilation. This drug assures remarkable cardiovascular protection through its antiproliferative/atherogenic, antiischemic, antihypertrophic, and antiarrhythmic actions. These actions are a consequence of its potent antioxidant effects, amelioration of glucose/lipid metabolism, modulation of neurohumoral factors, and modulation of cardiac electrophysiologic properties. The usefulness of carvedilol in the treatment of hypertension, ischemic heart disease, and congestive heart failure is based on a combination of hemodynamic benefits and cardiovascular protection.