

ARTERIAL HYPERTENSION DEVELOPING ON THE BACKGROUND OF TYPE 2 DIABETES MELLITUS: ETIOLOGY, PATHOGENESIS AND MODERN THERAPEUTIC APPROACHES

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Abstract: Type 2 diabetes mellitus (T2DM) and arterial hypertension (AH) rank among the leading contributors to the worldwide rise in chronic non-communicable illnesses. These two conditions commonly coexist, and their combined presence markedly elevates the likelihood of cardiovascular death and illness. This article reviews the root causes, intricate biological processes, and up-to-date treatment advances for controlling high blood pressure in people with diabetes. Major disease drivers encompass widespread insulin resistance, damaged blood vessel lining function, excessive stimulation of the renin-angiotensin-aldosterone system (RAAS), and harm from oxidative processes. Successful control calls for a comprehensive plan involving changes in daily habits, strict blood sugar management, and targeted selection of blood pressure-lowering medications like ACE inhibitors and angiotensin receptor blockers (ARBs). Gaining insight into these overlapping processes is essential to improve results for patients and avert serious large-vessel complications.

Introduction

Type 2 diabetes mellitus represents a metabolic condition marked by reduced responsiveness to insulin and a progressive loss of function in pancreatic beta cells, ultimately causing persistently high blood sugar. Among people with T2DM, high blood pressure ranks as one of the most frequent accompanying disorders, affecting 60% to 80% of them. When these two issues occur simultaneously, they create a major danger by hastening the onset of heart failure, strokes, and advanced kidney failure.

The biological relationship between elevated blood pressure and diabetes involves multiple layers, including diverse hormonal and blood vessel alterations. Extended periods of elevated glucose provoke lasting modifications in vessel structure, resulting in greater rigidity and resistance to flow. Moreover, the metabolic disturbances characteristic of diabetes activate nerve-hormone pathways that raise blood pressure directly. In light of the growing worldwide health challenge posed by these disorders, a thorough examination of their common disease origins is crucial to enhance current medical strategies.

Main Discussion

Causes of Hypertension in the Setting of Diabetes

High blood pressure develops in patients with T2DM due to an interplay of inherited traits and behavioral elements. Prominent influences include excess body weight, lack of physical activity, and excessive salt intake. A central element in this relationship is insulin resistance brought on by obesity.

In states of insulin resistance, elevated insulin concentrations prompt the kidneys to hold onto additional sodium and heighten activity in the sympathetic nervous system. Together, these effects raise vascular resistance and overall blood pressure levels.

Pathophysiological Pathways

Multiple biological routes account for the way diabetes promotes elevated blood pressure:

- Insulin Resistance and Elevated Insulin Levels: High insulin acts to activate the sympathetic nervous system, accelerating heart rate and increasing sodium retention in the kidneys, thereby expanding circulating blood volume.

- Endothelial Dysfunction: Persistently high glucose reduces nitric oxide (NO) generation. As NO serves as a key vessel-relaxing substance, its shortage causes vessel narrowing and increased pressure.

- Excessive RAAS Activation: In diabetic individuals, the renin-angiotensin-aldosterone system frequently becomes overactive. Angiotensin II functions as a strong vessel constrictor, fostering inflammation and causing damage to arterial structure.

Oxidative Damage and Inflammatory Response: Elevated glucose produces reactive oxygen species (ROS), inflicting harm on vessel walls. This ongoing inflammatory condition leads to arterial hardening and overall decline in vascular condition.

- Vascular Structural Changes: Prolonged exposure to high pressure and high glucose results in thickening of arterial walls and reduced flexibility, commonly termed arterial stiffness.

Contemporary Treatment Approaches

Addressing the combination of T2DM and hypertension demands an all-encompassing, individualized strategy:

- Lifestyle Improvements: These form the foundation of prevention and control. Achieving weight loss, following a reduced-sodium eating pattern (such as the DASH diet), and engaging in regular aerobic physical activity are critical components.

- Blood Sugar Control: Achieving and sustaining recommended HbA1c targets is vital. Newer agents, including SGLT2 inhibitors and GLP-1 receptor agonists, stand out because they provide effective glucose lowering alongside cardiovascular benefits.

- Drug-Based Treatments: Preferred initial options for lowering blood pressure include ACE inhibitors and ARBs, owing to their kidney-protective effects. When blood pressure proves harder to manage, calcium channel blockers (CCBs) and thiazide-type diuretics are often added to the treatment plan.

Conclusion

The overlap of type 2 diabetes and hypertension presents a multifaceted medical issue fueled by shared processes such as insulin resistance and oxidative damage. Their joint occurrence dramatically heightens the chance of fatal cardiovascular incidents. Nevertheless, by adopting unified management—integrating strict lifestyle modifications with modern drug therapies—healthcare providers can substantially lower these dangers. Prompt action continues to serve as the strongest means of alleviating the worldwide impact of these interconnected conditions.

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