

Diabetic Nephropathy: The Impact of Chronic Hyperglycemia on Kidney Health

Hiroshi Ito*

Department of Nephrology, Southwest Medical University, Luzhou, China

Corresponding author: Hiroshi Ito, Department of Nephrology, Southwest Medical University, Luzhou, China, E-mail: hiroshi@gmail.com

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Description

Diabetic nephropathy, also referred to as diabetic kidney disease, presents a significant complication of diabetes mellitus and stands as a leading cause of Chronic Kidney Disease (CKD) globally. This condition progresses gradually over many years and is characterized by damage to the glomeruli, the kidneys' intricate filtering units. It affects a substantial number of individuals with both type 1 and type 2 diabetes, highlighting the critical need for early detection and effective management to prevent or delay its advancement. The pathophysiology of diabetic nephropathy involves complex mechanisms set off by chronic hyperglycemia (elevated blood sugar levels) and other metabolic changes linked with diabetes. Prolonged exposure to high glucose levels damages the glomeruli initially by thickening the glomerular basement membrane, leading eventually to increased permeability and leakage of proteins into the urine, a condition known as proteinuria. Activation of the Renin-Angiotensin-Aldosterone System (RAAS) further complicates matters. Chronic hyperglycemia triggers RAAS activation, causing renal blood vessel constriction and elevating pressure within the glomeruli, thus perpetuating kidney damage and progressive loss of kidney function. Oxidative stress and inflammation play pivotal roles in exacerbating kidney injury in diabetic nephropathy.

Diabetic nephropathy

Diabetic nephropathy progresses through distinct stages, each indicating varying levels of kidney damage. In the early stage, known as microalbuminuria, there is a presence of small amounts of albumin in the urine, a sign of mild kidney impairment that often shows no symptoms and requires urine tests for detection. As kidney function further declines, proteinuria develops, characterized by larger amounts of albumin and other proteins leaking into the urine. This stage may be asymptomatic or present with foamy urine and mild swelling (edema) in the legs, ankles, or around the eyes. As kidney damage advances, the Glomerular Filtration Rate (GFR)

decreases, indicating reduced kidney function. Symptoms at this stage can include fatigue, nausea, poor appetite and difficulty concentrating. In severe cases, diabetic nephropathy progresses to end-stage kidney disease, where kidney function is significantly impaired, necessitating dialysis or kidney transplantation for survival. Diagnosis and screening for diabetic nephropathy involve a comprehensive approach. It includes clinical evaluation, urine tests to detect microalbuminuria or proteinuria using dipstick tests or quantitative measurements like the albumin-to-creatinine ratio and blood tests to measure serum creatinine and estimate GFR.

Oral hypoglycemic agents

Managing diabetic nephropathy focuses on controlling blood glucose levels and blood pressure to slow or prevent kidney damage progression. Tight regulation of blood sugar through diet, exercise, and medications like insulin or oral hypoglycemic agents is pivotal in reducing diabetic complications, including nephropathy. Blood pressure is managed with medications such as Angiotensin-Converting Enzyme (ACE) inhibitors or Angiotensin II Receptor Blockers (ARBs) to block the Renin-Angiotensin-Aldosterone System (RAAS) and preserve kidney function. Promoting healthy lifestyle changes such as quitting smoking, maintaining a healthy weight, and limiting salt intake supports blood pressure management and enhances overall kidney health. Regular monitoring of kidney function using urine and blood tests is essential for early detection of changes, facilitating timely adjustments in treatment. The prognosis of diabetic nephropathy hinges on the stage at diagnosis and the efficacy of blood glucose and blood pressure control. Early detection and intervention significantly slow kidney damage progression and reduce risks like end-stage kidney disease. Regular screening and comprehensive management are critical in preventing or delaying the advancement of diabetic nephropathy. Ongoing research into underlying mechanisms and targeted therapies offers promise for enhancing outcomes and quality of life for individuals managing this serious complication of diabetes mellitus.