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NEUROPATHY OF DIABETES: THE COMPLEX INTERPLAY BETWEEN METABOLIC DYSFUNCTION AND NERVE DAMAGE

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Diabetes mellitus (DM) represents a multifaceted challenge in modern healthcare, characterized by its intricate interplay between metabolic dysregulation and consequential neurological manifestations. A prominent complication within the spectrum of DM-related complications is diabetic neuropathy, affecting a substantial portion of individuals afflicted with this metabolic disorder. This review aims to provide a comprehensive exploration of the diverse mechanisms underpinning the development of neuropathy in DM, spanning molecular, anatomical, and functional alterations across the intricate landscape of the nervous system.

Articles from PubMed and Google Scholar databases were closely studied, analyzed and reviewed attentively to summarize the subject of the study, where a specific keyword “diabetic neuropathy” was used from years 2014 to 2024 to deduce their significant correlation for the aim of the study. This review seeks to elucidate the clinical implications of diabetic neuropathy, delineating its short- and long-term complications, identifying key risk factors, and evaluating current strategies for both prevention and treatment. Central to our analysis is the recognition of the pivotal role played by the maintenance of normoglycemia in mitigating the risk and severity of neuropathic complications in individuals with DM.

The most common type, distal symmetric polyneuropathy, it's a primary focus will be referred to simply as diabetic neuropathy. This type typically presents with a pattern known as 'stocking and glove' distribution, affecting the hands and lower limbs predominantly. The manifold pathways are implicated in the pathogenesis of diabetic neuropathy, including but not limited to the Polyol Pathway, Hexosamine Pathway, Advanced Glycation End-Products Pathway, Oxidative Stress, Protein Kinase-C Pathway, Poly Adenosine Phosphate Ribose Polymerase Pathway, Mitogen-Activated Protein Kinase Pathway, Nuclear Factor-Kb Pathway, Tumor Necrosis Factor- α Pathway, and Cyclo-Oxygenase Pathway. Through an in-depth exploration of these pathways, we indicate the complex cascade of events that culminate in nerve damage, elucidating the molecular intricacies that contribute to the onset and progression of neuropathy in the context of DM. Diabetic peripheral neuropathy involves sensory, motor, and autonomic nerve dysfunction. Factors contributing to nerve damage include oxidative stress, sorbitol accumulation, advanced glycation end products, and disruptions in pathways involving hexosamine, protein kinase C, and polymerase. Additionally, neurovascular issues, along with impaired repair processes and endothelial dysfunction, are also considered significant factors.

By synthesizing current knowledge and insights gleaned from both experimental and clinical studies, we revealed such insights not only inform the development of targeted therapeutic interventions but also hold promise in enhancing patient outcomes and quality of life in the face of this debilitating complication of diabetes mellitus. Through a concerted effort to unravel the complexities of diabetic neuropathy, we paved the way for novel approaches to management and ultimately alleviate the burden of this prevalent and often devastating complication. Managing diabetic neuropathy involves various treatment modalities aimed at improving glycemic control, lifestyle modifications, and alleviating neuropathic pain. Various disease-modifying therapies target the underlying pathogenesis of diabetic neuropathy, offering symptomatic relief and potential long-term benefits. Effective pain management is crucial in diabetic neuropathy, with several medication classes demonstrating efficacy in alleviating neuropathic pain.

The precise origin of diabetic peripheral neuropathy remains unclear, stemming from complex interactions between metabolic dysfunction and nerve damage. Various theories have been suggested, offering avenues for targeted therapies. Early diagnosis through comprehensive assessments and various screening tools is crucial for timely intervention.