

Balance Impairment as a Complication of Diabetic Neuropathy in a Patient with Poorly Controlled Type 2 Diabetes Mellitus

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Abstract

Diabetic neuropathies are one of the most prevalent complications of diabetes, affecting nearly half of diagnosed patients. There are many different types of diabetic neuropathy, with each one varying greatly in severity and symptomatic presentation. One aspect of diabetic neuropathy that will be explored in this case study is its role in balance impairment. The case of a 71 year old male with a long-standing history of poorly controlled Type 2 Diabetes Mellitus will be discussed. Secondary to this is a history of diabetic neuropathy, which has largely manifested in the form of ataxia, unsteady gait, and increased falls in the dark. This case study discusses the patient's medical history, clinical course, and treatment options. The impact of diabetic neuropathy on the somatosensory, visual, and vestibular systems are also discussed, particularly in the context of this patient's symptoms. The purpose of this report is to provide medical professionals with a deeper understanding of balance impairment secondary to diabetic neuropathy. Doing so will allow treatments to become more targeted, effective, and better improve a patient's quality of life. Furthermore, the treatment of balance impairment will also help mitigate fall risk, which is one of the most dangerous complications of long-standing diabetic neuropathy in elderly patients.

Introduction

Diabetic neuropathies are one of the most common neuropathies in clinical practice, often varying greatly in severity and symptomatic presentation. Thorough and careful assessment of diabetic neuropathy is essential in formulating a targeted and effective treatment plan. This case study presents a 71 year old male with a long-standing history of poorly controlled Type 2 Diabetes Mellitus. Secondary to this is a history of diabetic neuropathy, which has largely manifested in the form of balance impairment. This case study discusses the patient's medical history, clinical course, and treatment options. The purpose of this report is to provide medical professionals with a deeper understanding of balance impairment secondary to diabetic neuropathy so that it can be more easily identified and effectively treated.

Case Presentation

Chief Complaint: A 71 year old male presents for a follow up on 7/25/25 to discuss lab results. The patient has also been experiencing ataxia, unsteady gait, and has been falling in the dark with increased frequency.

PMH: Patient has a history of poorly controlled Type 2 Diabetes Mellitus. He also has peripheral neuropathy secondary to Type 2 Diabetes Mellitus. Additionally, he has been diagnosed with osteoarthritis, hyperlipidemia, hypertension, and hepatic steatosis. He has also had a total knee replacement on his right knee as a result of his osteoarthritis.

Physical Exam:

Gen: Well kept and cooperative male

Gait: Ataxic and unsteady. Ambulates with a single-prong cane

Labs:

- HbA1C: 11.4
- Fasting glucose: 127
- Triglycerides: 466

Assessment:

- Type 2 Diabetes Mellitus
- Peripheral Neuropathy
- Ataxia

Plan of Care

Treatment has primarily been targeted at managing the patient's chronic conditions. For his diabetes, the patient has been prescribed Trulicity, Lantus, and Humalog. He was also prescribed a diabetes glucose monitor and diabetes test strips to track his blood sugar. Gabapentin was prescribed to alleviate his symptoms of peripheral neuropathy. Lipitor was prescribed for the patient's hyperlipidemia and he was also advised to follow a low fat diet. Additionally, the patient was referred to physical therapy 3 times a week for 6 weeks to aid in the symptoms of his osteoarthritis and peripheral neuropathy.

The patient was encouraged to schedule routine follow up visits to effectively manage these conditions.

Overview

Diabetic neuropathies are one of the most prevalent complications of diabetes, affecting nearly half of diagnosed patients and presenting with a wide array of symptoms. The pathogenesis of diabetic neuropathy is multifactorial, with oxidative and inflammatory stress secondary to metabolic dysfunction playing a key role in causing long-term nerve damage. Diabetic neuropathy affects both small and large nerve fibers. Presenting symptoms of small fiber neuropathy include pain, dyesthesias, and allodynia. In contrast, symptoms of large fiber neuropathy involve numbness, sensory loss, and imbalance.¹

One aspect of diabetic neuropathy that warrants further discussion is the role it plays in balance impairment, which is especially significant for older adults with a long-standing history of diabetes, as a deeper understanding of this may mitigate fall risk. Balance impairment in the context of diabetic neuropathy affects the three sensory systems required for balance control: the somatosensory, visual, and vestibular systems.

The somatosensory system utilizes information from joints and cutaneous nerves to define the body's position in space. In diabetic peripheral neuropathy, key nerves involved in communicating proprioceptive information are negatively affected. These include muscle spindle afferents that relay information about changes in muscle length, Golgi tendon organs that sense changes in muscle tension, and cutaneous mechanoreceptors that communicate information about vibration and pressure sensations.

With regard to the visual system, the impact of diabetic neuropathy is also profound. Both nonproliferative and proliferative diabetic retinopathy can contribute to reduced contrast sensitivity. This resulting compromise in a patient's visual field can ultimately increase the risk of falls.

The vestibular system provides information about head positioning and spatial orientation. In patients with long-standing hyperglycemia, structural damage to the otolith organs of the vestibular system occurs. This causes the vestibular system to provide inaccurate information about head movement, leading to symptoms of dizziness and disorientation.²

Discussion

It is evident that key aspects of this patient's medical history are likely linked to the impact of diabetic neuropathy on the sensory systems involved in balance control. For example, the patient's increased incidence of falling in the dark could be attributed to reduced contrast sensitivity as a result of proliferative diabetic neuropathy.² An ophthalmology visit on 9/7/2023 also revealed that the patient had proliferative diabetic retinopathy in both eyes. Thus, it is likely that the low contrast and visibility inherent with dark environments combined with the patient's already decreased contrast sensitivity contributed to a greater predisposition of falling in dark environments.

The patient's ataxia and unsteady gait could also be attributed to the effects of diabetic neuropathy on balance control. Kardm et al assessed ankle joint proprioception in diabetic patients and found that diabetic patients had greater proprioceptive errors in ankle dorsiflexion and plantar flexion. These proprioceptive errors are a result of the deterioration of ankle joint mechanoreceptors due to peripheral neuropathy. Furthermore, a longer history of diabetic neuropathy leads to a more progressive degeneration of these fibers and a greater compensatory dependence on visual and vestibular outputs.³ As previously noted, this patient was found to have proliferative diabetic retinopathy in both eyes, leading to decreased contrast sensitivity. Thus, it is likely that the deterioration of ankle joint mechanoreceptors and the increased, compensatory dependence on an already diminished visual output system were synergistic factors in this patient's increased ataxia and unsteady gait.

It is also worth noting that the patient received a right total knee replacement due to a history of osteoarthritis. Regarding the impact of a total knee replacement on proprioception, a meta analysis performed by Xue et al found conflicting evidence— some studies suggested that knee arthroplasty improves proprioception while others found no significant difference.⁴ However, patients with diabetes were found to have reduced knee muscle strength, increased proprioception errors, and decreased muscle function. This is a result of chronic hyperglycemia encouraging the formation of advanced glycation end products. These products negatively impact collagen formation in muscles, leading to stiffness and decreased muscle function.⁵ It is possible that diminished proprioception in the lower extremities due to diabetic neuropathy and decreased muscle stiffness as a result of chronic hyperglycemia were both significant, contributing factors in the cause of ataxia and unsteady gait in this patient.

Treatment

The treatment for patients with balance impairment secondary to diabetic neuropathy is multifactorial in nature. As with all patients with diabetes, proper glycemic control remains the most cardinal aspect of the treatment plan, as doing so will both ameliorate existing diabetic

neuropathy and prevent further complications. Proper glycemic control involves comprehensive medication management, lifestyle modifications, and consistent follow-up visits with both primary care providers and specialists.

Furthermore, diabetic patients with balance impairment will benefit from routine optometry and ophthalmology visits, as the visual system is one of the three sensory systems involved in balance control. These patients should aim to see an optometrist regularly to allow for routine vision checks and should work closely with ophthalmologists to assess for the presence of diabetic retinopathy.

An elevated fall risk is one of the most dangerous consequences of balance impairment secondary to diabetic neuropathy, particularly for older patients. To help mitigate fall risks, diabetic patients with balance impairment should engage in routine exercise or physical therapy. Physical activity has been shown to increase muscle strength and stability in these patients and can also improve balance.⁵ Providers should also aim to conduct a thorough medication review for these patients, as some medications can inherently increase fall risk. At an individual level, patients should aim to wear non-slip shoes for increased stability when walking. For patients with compromised mobility, use of a four-prong cane should be encouraged, as these promote greater balance and weight bearing support compared to single prong ones. Within these patients' homes, supportive rails should be installed as needed. Lighting should also be modified to increase brightness throughout the home, as many patients with balance impairment also have compromised visual fields.

Conclusion

While diabetic neuropathy is one of the most common complications of diabetes mellitus, it is important to note that it can present with a wide variety of symptoms. As such, providers should be cognizant about the different presentations of diabetic neuropathy. In particular, there should be increased awareness about the role of diabetic neuropathy in balance impairment, especially in older patients with a long-standing history of diabetes. Carefully assessing for balance impairment in these patients will aid in a more comprehensive and targeted treatment plan that allows for more effective glycemic control, decreased fall risk, and improved quality of life.

Author Disclosures

No relevant financial affiliations or conflicts of interest.

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