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Preventing and Treating Diabetic Peripheral Neuropathy with a Plant Based Diet

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Abstract

Diabetic Peripheral Neuropathy (DPN) can cause pain, sometimes severe, or loss of feeling in the toes, feet, legs, hands and arms. It is likely to affect as many as 236 million people worldwide. Treatment strategies usually involve medications for symptomatic relief, with relatively little attention paid to dietetic therapy. However, a plant-based diet can be an effective treatment for Type 2 Diabetes and DPN. There is considerable evidence that both altered blood flow in the endoneurial microvasculature and endoneurial ischemia are important factors in the etiology of diabetic neuropathy. A whole-food, plant-based diet has also been shown to improve the ability of endothelial cells to produce nitric oxide, allowing for better blood flow. The accumulation of Persistent Organic Pollutants (POPs) in the tissues has been shown to be a major factor in the development of Type 2 Diabetes. Studies show that diabetics with higher levels of POPs have several times the risk of DPN. Since vegetarians avoid animal derived foods where POPs accumulate, they are exposed to lower levels of POPs, resulting in a lower risk of DPN. Interventional studies have demonstrated that patients with DPN show significant improvement on a plant-based diet. The clinician should note that a plant-based diet is more efficacious than metformin in reducing glycated hemoglobin, so it's important for the physician to titrate the patient's medications during the course of treatment.

Keywords: Diabetes; DPN; Endoneurial; Nerve hypoxia; Nerve pain; Persistent organic pollutants; Plant-based diet; POPs; Vegan; Vegetarian

Abbreviations: BMI: Body Mass Index; DPN: Diabetic Peripheral Neuropathy; POPs: Persistent Organic Pollutants; T2DM: Type 2 Diabetes Mellitus

Introduction

Peripheral neuropathy, the most common type of diabetic neuropathy, causes pain or loss of feeling in the toes, feet, legs, hands, and arms. Diabetic Peripheral Neuropathy (DPN) affects as many as 50% of older type 2 diabetic patients. Some patients may have extremely painful symptoms [1]. The public health impact of DPN is considerable. In the estimated global prevalence of diabetes of 472 million by 2030, DPN is expected to affect as many as 236 million people worldwide. In the United States alone, the total cost associated with DPN is $10.9 billion a year [2]. Clinical lore considers DPN difficult to treat, and often frustrates patients and physicians alike. While most treatment strategies have focused on the use of medications for symptomatic relief, relatively little attention has been paid to treating a patient with diet.

There is a valuable treatment for Type 2 Diabetes, a plant-based diet, which has a corresponding beneficial impact on any DPN they are experiencing. Those following a plant-based diet were shown to have a 78% reduction risk of Type II diabetes mellitus (T2DM), as well as a 56% reduced risk of metabolic syndrome and a lower average BMI, 22.4 for men and 21.8 for women [3,4].

Pathophysiology

There is considerable evidence that both altered blood flow in the endoneurial microvasculature and endoneurial ischemia are important factors in the etiology of diabetic neuropathy [5-8]. Factors contributing to impaired perfusion and peripheral nerve hypoxia in patients suffering from diabetes include decreased endothelial production of the vasodilator nitric oxide, and an increase in blood viscosity constituting an unfavorable rheologic change [5, 9, 10]. One study showed that vegetarians have lower blood viscosities, with a dose response relationship - the more plant foods included in the diet, the lower the blood viscosity. The study concluded, Stricter avoidance of animal products was associated with even lower values [of viscosity] [11]. A whole-food, plant-based diet has also been shown to improve the ability of endothelial cells to produce nitric oxide, resulting in increased vasodilation [12,13]. In addition to the impact on blood viscosity

and the ability of the endothelial cells to produce nitric oxide, the accumulation of Persistent Organic Pollutants (POPs) in the tissues has been shown to be a major factor in the development of Type 2 Diabetes [14]. Exposure of most human populations to POPs is through consumption of fat, in animal derived foods such as fish, dairy products, and meat. Humans bioaccumulate these lipophilic pollutants in their adipose tissues for many years because POPs are highly resistant to metabolic degradation [15-18]. Studies show that diabetics with higher levels of POPs have several times the risk of DPN [19-22]. In one study, organochlorine pesticides showed a strong dose-response relationship with the prevalence of peripheral neuropathy and was also strongly associated with poor glycemic control [23]. Since vegetarians avoid animal-derived foods where POPs bioaccumulate, they are exposed to lower levels of POPs, resulting in a lower risk of DPN.

Intervention

There have been two significant studies done on the impact of a plant-based diet on patients with DPN.

Crane and Sample were able to achieve complete abatement of pain in 17 of 21 subjects placed on a vegan diet in only a month, with many patients achieving results in only 2 weeks. Long term results were maintained in 71% of patients even after four years. The authors state, in our opinion, these results appear to be related to a factor(s) in the TVD [Total Vegetarian Diet, also known as vegan or plant-based diet], and not necessarily to an improved glucose control, since the serum glucose was not under good control until about the 10th day [24]. McCarthy suggests that improved blood rheology (mainly due to decreased blood viscosity) plays a prominent role in mediating the analgesic effect in Crane's study [5]. In another study, 35 patients with Type 2 diabetes and painful neuropathy were randomly assigned to two groups for a 20-week study. The intervention group was asked to follow a low-fat, plant-based diet, with weekly classes for support in following the prescribed diet, and to take a vitamin B12 supplement. The control group was asked to take the same vitamin B12 supplement but received no other intervention. After 20 weeks, the between-group difference in change in pain, as measured by the McGill pain questionnaire, was -8.2 points. [25].

Clinical considerations

Diagnosis requires careful examination of the lower limbs. Management involves establishing that the neuropathy is caused by diabetes instead of other causes and aiming for optimal glycemic control. Medications, such as tricyclic antidepressants, serotonin/norepinephrine reuptake inhibitors, and gamma-aminobutyric acid analogs, are generally recommended as first-line treatments for symptomatic relief. Opioids and topical treatments may be considered as second-line treatment options. These medications can have significant side effects [1] (Table1).

Table 1: Drugs commonly prescribed for Diabetic Peripheral Neuropathy [1].

Drug Class	Drug	Daily Dose (mg)	Side Effects
Tricyclics	Amitriptyline	25-150	++++
	Imipramine	25-150	++++
SSRIS	Paroxitene	40	+++
	Citalopram	40	+++
Anticonvulsants	Gabapentin	900-1,800	++
	Pregabalin	160-600	++
	Lamotrigine	200-400	++
	Carbamazepine	up to 800	+++
Antiarrhythmics*	Mexilitene	up to 450	+++
Opioids	Tramadol	50-400	+++
	Oxycodone CR+	10-60	++++
All medications is this table have demonstrated efficacy in randomized, controlled studies. *Mexilitene should be used with caution and with regular electrocardiogram monitoring; + Oxycodone controlled release (CR) may be useful as an add-on therapy in severe symptomatic neuropathy.			

A plant-based diet is an effective treatment for both Type 2 Diabetes and DPN and has the benefit of also treating other comorbidities. It is also affordable for the patient, whereas some patients may have difficulty paying for their medications. The efficacy of treatment with a plant-based diet becomes evident over the course of a few weeks, so it's important for the physician to titrate the patient's medications for other comorbidities during this time. The clinician should note that a plant-based diet is more efficacious than Metformin in reducing glycated hemoglobin [14]. It is important for clinicians to include supplemental vitamin B12 in any plant-based treatment regimen, but especially with older patients who are at greater risk of pernicious anemia. Some common diabetic medications such as Metformin may also be B12 depleting.

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Discussion

Medications for DPN are not fully effective. Side effects and risk of dependency and addiction make several of these treatments' problematic. A plant-based diet has no side effects. It also has no contraindications and helps prevent common comorbidities such as dyslipidemia, coronary artery disease, and other chronic diseases such rheumatoid arthritis, fibromyalgia and inflammatory bowel syndrome. It is also very cost effective. of course, the best way to prevent diabetic peripheral neuropathy is to prevent diabetes in the first place, and a plant-based diet is an effective way to do that.

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