

USE OF A LOW-CARB DIETARY APPROACH IN TREATING TYPE 2 DIABETES

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Abstract

A 58-year-old male patient was admitted to hospital with a large diabetic ulcer. A treatment plan, which included a strict low-carbohydrate diet, was initiated. Over his three-and-a-half month stay, his blood sugars stabilized such that he was taken off his diabetes medications, his weight dropped, and the pain from the ulcer became more manageable. Over the following year, his blood sugars remained within normal ranges and the ulcer significantly decreased in size. This led to the question of whether type 2 diabetes can be effectively treated through a low carbohydrate/high fat (herein used synonymously with “ketogenic”) dietary approach. A literature search on PubMed returned many results, most of which showed that low-carb diets have beneficial results on blood sugar levels in diabetic patients. Some also showed that the diet can allow for decreases in patients’ diabetic medications. However, according to UpToDate, there remains much debate around its use for this purpose, likely because of difficulty in adhering to the diet long-term. Taken in combination with the case presented here, it seems that finding ways to improve patients’ long-term adherence to the diet could be immensely beneficial for their health.

Case Report

A 58-year-old male patient with a history of type 2 diabetes, congestive heart failure, gout, hypothyroidism, depression, and conversion disorder, presented to ER with a large diabetic skin ulcer on his lower right leg, which had been causing unmanageable pain. The ulcer was approximately 15 cm across and had been present for around five years. He was then admitted to hospital, in the late spring of 2018. Prior to the time of admission, he had been taking 850 mg of metformin and 10 units of insulin per day to control his blood sugar levels.

From early on during his admission, the patient showed an interest in trying to lose weight. His physician recommended implementing a diet of fewer than 25 g of carbohydrates per day, with a maximum of around 1600 calories per day. The patient was willing to adopt this approach but struggled to get enough foods low in carbohydrates at first. One reason for this was that the patient initially had much difficulty identifying which foods were high in carbohydrates. In order to resolve this, his physician had several discussions with him about which foods to avoid and which to have as suitable replacements, in order to help him better adhere to the new diet. Another obstacle was the food provided by the hospital. Often included in his meals were foods high in starch content such as potatoes and grain-based foods. To circumvent this, he had members of his family bring low-carb/high-fat foods for him to eat, such as nuts, avocados, eggs, and cheese.

Within a week of implementing the low-carbohydrate diet, his metformin was discontinued, and his blood sugars remained within normal ranges for the duration of his stay in hospital. However, for the first two to three weeks, his weight was increasing, and he reached a total gain of seven kilograms. But by a month after being admitted, his weight began to decline consistently as he got more accustomed with the diet.

The patient remained in hospital for a total of three-and-a-half months. For the rest of his stay, several of his medications were discontinued, including his insulin. By the time he was discharged, he had lost eighteen kilograms from his maximum weight, his blood sugars had remained stable and within normal ranges, and the pain from his ulcer had become more manageable, although it had not decreased in size by a remarkable degree. After being discharged, the patient remained on the low-carb diet. Although there has been some struggle with adhering to the diet on a long-term basis, he has lost

another five kilograms, his hemoglobin A1c has kept within normal range without any medication for lowering it, and the ulcer has decreased in size from its initial 15 cm to about 3 cm across.

Literature Search

To find information regarding how effective a low carbohydrate/high fat diet is for the treatment of type 2 diabetes, a literature search was undertaken. Two online databases were used to perform this search – PubMed and UpToDate.

First, to search the PubMed database, the MESH terms “Diet, ketogenic” and “Diabetes Mellitus” were used. This yielded two relevant articles from the last five years, a review and a randomized controlled trial (RCT). Both articles stated that the low carb diet had led to significant reductions in Hemoglobin A1c levels, when compared to other diets.^{1,2} Another search was performed on PubMed with the MESH terms “Diet, Carbohydrate-Restricted” and “Diabetes Mellitus,” which returned many results. In the first three pages of results, another five relevant articles were obtained, including one review article³, two meta-analyses^{4,5}, and two RCTs^{6,7}. Most of the seven articles demonstrated at least short-term benefits to blood sugar levels compared to other diets^{1,2,3,4,5,7}. The study that did not find a significant benefit to blood sugar levels used a high carbohydrate diet as a comparison, but still found that the low carb diet had greater reductions in diabetes medications over the course of the study⁶. One of the meta-analyses showed no significant benefit to blood sugar levels after periods of one year and two years⁴, while the other meta-analysis did show a benefit to blood sugar levels after one year⁵. Both meta-analyses cited adherence to the diet as an issue for the participants^{4,5}.

Finally, a search was done on UpToDate to determine if there are any dietary recommendations for treating diabetes, and if so, whether these recommendations include low-carb diets. “Diabetes mellitus type 2 treatment” was searched, and one relevant article titled “nutritional considerations in type 2 diabetes mellitus” was found.⁸ This article stated the controversial nature of low-carb diets, and that there remains much debate around whether they or other diets are more effective at treating type 2 diabetes and reducing weight.⁸

Discussion

Most of the literature concerning the implementation of low-carbohydrate diets in patients with type 2 diabetes showed several benefits in doing so. All but one of the examined articles on PubMed demonstrated that the low-carb diet had a more beneficial effect in lowering blood sugars than the comparison diets^{1,2,3,4,5,7}. The study which did not, showed a similar reduction in blood sugars compared to the other diet, however the patients on the low-carb diet had further decreases in diabetes medications.⁶ The studies by Saslow et al.² and Wang et al.⁷ also reported that the patients in the low-carb diet group had more reductions in diabetes medications than the other groups.^{2,7}

It should also be mentioned that the meta-analysis performed by Sainsbury et al.⁴ only showed benefits to the patients’ blood sugar levels in the three and six month periods, and that there were only small but insignificant decreases shown at the twelve and twenty-four month intervals.⁴ However, the other meta-analysis by Huntriss et al.⁵ did show a significant benefit to blood sugar levels after a twelve month period.⁵ Both meta-analyses stated that adherence was an issue in many of the studies they examined,^{4,5} with Sainsbury et al. proposing this as one possible explanation for why they did not find a significant decrease in blood sugar levels at the twelve and twenty-four month intervals⁴. Given that diabetes is a life-long diagnosis, it is no wonder then, why controversy and debate exist concerning the

use of low-carb diets in treating it.⁸ Even still, the meta-analyses conclude that low-carb diets may be clinically beneficial for patients with type 2 diabetes,⁵ and that they could be offered as a component of patients' management plans, on an individual basis⁴.

The information obtained from the literature search seems to reflect the story contained in the case report. For example, the discontinuation of his metformin and insulin matches the reported finding that patients on the low-carb diet experience more reductions in diabetes medications than those in comparison diets.^{2,6,7} Of course the stabilization of the patient's blood sugar levels, along with the reported benefits of the low-carb diet to blood sugar levels^{1,2,3,4,5,7} lends another link between the case study and the results found in the literature. These findings appear to reinforce the notion that it may be possible for the low-carb diet itself to play a major role in the treatment of type 2 diabetes. Still, the issue of adherence is one which cannot be overlooked. If more could be done to assist patients' adherence to the diet over the long-term, it would be immensely valuable for the use of the diet in the treatment of type 2 diabetes.

What is also noteworthy about this case is the substantial improvement of the patient's diabetic ulcer, which had been present for about five years before beginning the low-carb diet. The papers found in the literature search did not contain extensive consideration regarding the possible benefits conferred by the low-carb diet towards diabetic complications, but perhaps this is something that could be explored further. If it is another potential benefit, acquired through dieting instead of treating with medications, it could be an excellent reason to further continue this avenue of research.

Conclusion

This case demonstrates the potential value of utilizing low-carbohydrate diets for treating type 2 diabetes. The patient described in this case report experienced several significant health benefits after beginning the diet, and continues to do so. The literature, for the most part, also demonstrates similar health benefits. However, whether the diet itself or a healthier lifestyle in general contributed to the substantial decrease of the patient's diabetic skin ulcer is not known, and the literature did not focus on the effects of low-carb diets on diabetic complications. Furthermore, there exists uncertainty over whether this diet is a viable treatment option over long-term periods, due to challenges with adherence. Thus, more research into the effects of the low-carb diet on diabetic complications, as well as into improving patient adherence to the diet, would be highly valuable.

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