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Perioperative Low Carb Diet in a Type 2 Diabetic Prior Duodenopacreatectomy

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ABSTRACT

Background: There is a positive association between various types of cancer and diabetes. Duodenopancreatectomy is the treatment of choice for diabetic patients with duodenal tumors. Pancreatic resections may trigger endocrine insufficiency. There is an association between poor glycemic control and lower survival rates. Low carb diets appears to be an effective approach in the treatment of diabetic patients that require pancreatic resections.

Case Presentation: We report the case of a type II diabetic diagnosed with resectable duodenum cancer. At the time of diagnosis he was jaundiced and with decompensated diabetes. The patient was submitted to a low carb diet for three weeks and, having improved its physiological and metabolic parameters, we performed a duodenopancreatectomy. The patient evolved without complications, with easy management of postoperative glycemia.

Conclusions: Low carb diets can prove to be a powerful, inexpensive, and safe tool to add to our ther-apeutic arsenal before pancreatic resections.

Keywords: Pancreatectomy, ketogenic diet, duodenal carcinoma, type 2 diabetes, pancreatic endocrine insufficiency

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Background

There is a positive association between various types of cancer and diabetes, whose prevalence has increased in developed countries [1,2,3,4,5,6]. Although we do not know if the incidence tumors of the second portion of the duodenum is also rising, the treatment of choice for diabetic patients with tumors in this anatomical segment is duodenopancreatectomy [7].

In these patients, pancreatic resections may make glycemic control even more difficult and trigger endocrine insufficiency [8,9]. There is also an association between poor glycemic control with lower survival rates after treatment [10]. In view of these data, it is relevant to search strategies that could assist in the perioperative treatment of this particular and probably growing group of patients.

We report the case of a type II diabetic diagnosed with resectable duodenum cancer. At the time of diagnosis he was jaundiced and with decompensated diabetes. The patient was submitted to a low carb diet for three weeks and, having improved its physiological and metabolic parameters, we performed a duodenopancreatectomy. The patient evolved without complications, with easy management of postoperative glycemia. Low Carbohydrate diets may be an adjunctive tool in the treatment of diabetic patients that require pancreatic resections.

Case presentation

Male, 52 years old, sought emergency care at Hospital Vivalle, São José dos Campos, Brazil, complaining of choluria, itching and jaundice for 7 days, accompanied by mild epigastric discomfort. He was diabetic and hypertensive, regularly treating with potassium losartan 100mg, Hydrochlorothiazide 25mg, Vildaglipine 50mg, Metformin 1000mg and Glicazida 60mg. Did not refer fever or weight loss. Clinical findings were jaundiced and blood pressure of 160X100 mmHg. His abdomen was painless but with palpable gallbladder. BMI 29.1 (1.70m 84kg). His entrance exams were a 12.7g/dL hemogram without leukocytosis, 1.85 mg/dl creatinine, GGT 2230 U/L, total bilirubin 18.83 mg/dL, blood glucose 389 mg/dL , CEA 2.81 ng/ml and CA19.9 117.2 U/ml. He was hospitalized with “standard diet for diabetics” without oral hypoglycemic agents controlling his blood glucose with regular insulin subcutaneously (20- 25 Ui/day) while he was clinically compensated and underwent diagnostic investigations.

Ultrasonography showed intra and extrahepatic bile duct dilation without cholelithiasis or choledocolithiasis. Due to the use of metformin and its pre-renal insufficiency, we chose to perform a nuclear magnetic resonance imaging with cholangioresonance that showed dilatation of the intra and extrahepatic bile ducts up to the height of the papilla, without visualizing lesions. There were no lymph nodes or secondary lesions. Endoscopy with lateral vision diagnosed an ulcerated and infiltrative lesion with 2,5cm, occupying 50% of the circumference of the organ, in the second portion of the duodenum and extending to the apex of the papilla. In this procedure an endoscopic plastic prosthesis with 10 french was introduced in the papila and bile duct.

During hospitalization the patient did not need medication for his blood pressure. Kidney function improved rapidly after hydration and bilirubin drop. However, it was very difficult to control his blood glucose. We opted to wait a few days until liver, kidney and clotting labs and function improved while we waited for the biopsy result (moderately differentiated duodenum adenocarcinoma).

In the meantime, he was told to eat a diet of less than 50g of carbohydrate per day. We suggested eliminating sugar, candy, flour, fruits and starch in the form of tubers and grains and prioritize proteins of animal origin (meat, eggs, fish) and vegetables, together with olive oil, butter and coconut oil. We also advised him to measure his blood glucose and blood pressure before and after his meals until the surgery day. He lost 8 kg

in 3 weeks and his last fasting blood glucose before hospitalization was 76mg/dl, without medication. His blood pressure was 130X80 mmHg without the use of Losartan.

He underwent gastroduodenopancreatectomy and progressed without surgical or anesthetics complications. He needed insulin control only on the 1st and 2nd postoperative days (10UI/day). Kept glucose-free hydroelectrolytic replacement and started a carbohydrate-restricted diet rich in proteins in the 3 postoperative, having partial acceptance. He was told to eat only what was necessary to satiate the hunger. He noticed that his stomach was "smaller", but he felt satisfied and without nausea, with little hunger. We progressed the diet and he was discharged at 6 postoperative without oral hypoglycemic agents and controlling his blood pressure and blood glucose with the devices he was already used to (HEM 7113 - Omron and Accu-Chek Active Roche).

The drain was removed at 10º postoperative. He had no fistula or other complications. The biopsy revealed aadenocarcinoma (moderately differentiated, grade II) pT3, pN0, M0 with free margins and no microsatellite instability. We chose not to undergo adjuvant chemotherapy or radiotherapy.

At 90 days postoperatively the patient was still following the diet and says he got used to it. He started using again only Losartan potassium 100mg and Metformin 1000mg per day. His exams showed Peptide C 4.28, negative Sudam 3, insulinemia 9 and glycated hemoglobin of 4.9.

Discussion

Duodenum tumors are rare [11]. However, the prevalence of tumors in the same segment such as the pancreas (and who receive the same type of operative treatment), are rising as well as the rates of obesity and diabetes in the population. According to data from CDC, in 2016, 42.8% of middle-aged adults in the USA were already considered obese [12] and 43.3% diabetic or pre-diabetic [13]. Therefore, the study of therapeutic strategies for cases similar to the one reported becomes increasingly important.

Without specific symptoms, the clinical diagnosis of tumors in the duodenum is very difficult when no obstructive symptoms are presented [14]. Endoscopy with biopsy is considered to be the gold standard, endoscopic ultrasound may help determine the depth of invasion and the presence of enlarged lymph nodes [14]. The staging should be complemented with abdominal and chest tomography [15]. When the tumor affects the second portion of the duodenum, the duodenopacreatectomy with en block lymph node resection is the treatment of choice [7].

This surgery has high rates of morbidity and mortality (26 and 3%) [16]. Some authors suggest that biliary drainage before the operation for a few weeks improves liver function and decrease morbidity [17]. Better control of other diseases, such as diabetes, before intervention would have the same rationale.

As this patient had impaired renal and hepatic functions, in addition to bilirubinemia above 18mg/dl, we chose to perform endoscopic drainage and wait a few weeks until the exams normalized. We took advantage of this recovery period of a few weeks as suggested to institute nutritional guidelines with the primary objective of better controlling his blood glucose before the operation. The patient left the hospital with the prescription of Losartan and Metformin. Studies have already shown that carbohydrate-restricted diets may lower blood glucose levels (and the need for insulin and hypoglycemic drugs) even in the first day, achieving better control in a few weeks, the time we had [18,19,20,21,22,23]. The measurements taken by the patient registered a drop to below 100mg/dL at the end of the second week, when he also gradually began to delay his morning breakfast and anticipate his dinner by compressing his “feeding window” [24]. The sudden reduction in carbohydrates in the diet triggers a drop in insulinemia and an increase in diuresis, with loss of electrolytes, which may even, in some cases, cause weakness and

hypotension [25]. In fact, the patient's blood pressure improved within a few days, dropping to 12X8mmHg as well as his blood glucose levels and he was able to stop using the hypertensive and oral hypoglycemic agents.

In this specific case, electrolyte replacement was performed with 400mg magnesium dimalate per day and with the suggestion to increase salt (NaCl) according to appetite (increased on average 3g per day). Due to his initially impaired renal function and hyperkalemia, we didn't supplemented with potassium. We encouraged him to consume foods that had a higher proportion of fat in relation to proteins such as fatty meat, salmon and the inclusion of olive oil and butter in the dishes [26].

In addition to glycemic control, carbohydrate restriction induces the production of ketone bodies and can double basal metabolic intake of fatty acids [27]. With this change, despite weight loss, protein consumption decreases for neoglycogenesis preserving muscle mass (protein sparing effect) [27, 28]. This change has also been studied to prevent cachexia in cancer patients (27, 28, 29). Although the patient has lost weight 6kg before the surgery, his albumin remained stable (4.38 - 4.36g/DL). There is always a concern that the tumor will evolve in the time between drainage to surgery. If in one hand there are no studies that can bring us security in this regard, at least there are evidence suggesting that metabolic adaptations related to low carbohydrate diets, such as a drop in insulinemia and inflammatory markers, as well as increased endogenous production of ketone bodies may have anticancer effects [29].

The patient was admitted for surgery in good general condition and with normalized exams. The surgical procedure had no complications and his blood glucose was easily controlled with insulin only in the first three postoperative days (8ui, 12ui and 4ui).

Oral diet was introduced in the 3rd postoperative day and the patient reported feeling "early" satiety, but managed to maintain an adequate caloric/protein intake from the 4 postoperative thanks to the high nutritional density of what was offered. We think this may be an adjuvant strategy in cases of gastroparesis, a common complication in duodenopacreatectomies, in which oral intake may be absent or reduced in the first days [30]. Patient was discharged from second hospitalization with adequate glycemic and blood pressure control, without medication but with the guidance to continue monitoring his blood pressure and blood glucose.

When oncologic resection is complete, as in this case, long-term survival is often higher than in patients with pancreatic cancer, reaching 100%, 73.3% 3 31.6% in 1, 3 and 5 years respectively [16]. In this context of longer survival, it is even more important to prevent and treat endocrine insufficiency that may arise or worsen after surgery. After all, one of the factors that reduces survival, at least in patients with pancreatic cancer who underwent surgical resection of the same segment is the increase in blood glucose (10). In this case the patient did not develop exogenous or endocrine insufficiency (presenting a negative SUDAM 3 and Peptide C of 4,28) showing a better control of his diabetes than before the surgery.

Low carbohydrate diets have been shown to be effective in keeping blood glucose under control and this has been the case here. One of the concerns with this dietary approach would be a possible worsening of the lipid profile that would increase the cardiac risk. However, there are a number of studies showing improvement of these parameters in obese and diabetics patients [18,25]. The patient also improved those markers (table) and lost 14kg.

In this case we chose not to indicate adjuvant terapy. However, if indicated, strategies such as fasting or ketogenic diet could add benefits to chemotherapy [18,31,32,33].

Conclusions

Although we have not measured ketone bodies nor performed Dexascam, we realize that carbohydrate reduction strategy was very effective in controlling blood glucose, reducing

the patient's blood pressure and weight without compromising his albumin levels, renal functions or lipid profile. As there is a tendency to endoscopically drain these patients (or to submit them to a neoadjuvant chemotherapy) a few weeks before the operation, we believe that a low carb/ketogenic diet should be established in this interval, mainly in obese and diabetic patients, with the purpose of reducing complications and possibly increasing survival rates. We need more studies in this area because Low carb diets can prove to be an effective, inexpensive, safe and with few side effects tool for us to add to our therapeutic arsenal.

Declarations

List of abbreviations - BMI- body mass index, GGT - gamma glutamyl transferase, CEA - carcinoembryonic antigen, CA19.9 - carbohydrate antigen 19-9, CDC - Center for Disease Control, USA - United States of America.

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Endnotes - não tem

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