Surgical treatment of a non-obese patient with type 2 diabetes – primary experience – a case report

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Abstract

The idea of type 2 diabetes surgical treatment was established in the U.S. and was based on observation of patients after bariatric procedures. Exclusion of the duodenum and gastrointestinal anastomosis performed in cases of morbid obesity cause shortened absorption of nutrients, which obviously promotes weight loss. Results of surgical treatment showed a beneficial effect on weight loss, resolution of co-morbidities and the reduction of risk of developing cardiovascular diseases and cancer. Analysis of the results of surgical treatment of obese patients with type 2 diabetes confirmed the usefulness of surgical methods. Surgeons performing these procedures have noticed regression of type 2 diabetes within a few weeks and in some cases this phenomenon is even observed during hospitalization [1]. So rapid improvement is not only the result of the weight loss. Investigators of this phenomenon cannot precisely explain how a relatively simple procedure could cure diabetes. We present the first experience of our centre based on the operative treatment of type 2 diabetes in a non-obese patient.

Key words: *type 2 diabetes, non-obese patient, gastric bypass, glycated haemoglobin, effect of incretins.*

Case report

On 07.15.2010 in the Department of General, Endocrine and Transplantation Surgery, Medical University of Gdańsk, gastric bypass surgery (Roux-en-Y gastric bypass RYGB) was performed in a non-obese patient with type 2 diabetes. It was probably the first procedure of this type in Poland, in which the only indication for surgical treatment was type 2 diabetes without accompanying obesity. Over a month before, a 51-year-old patient (body mass index – BMI 28 kg/m^2) with type 2 diabetes enquired about the possibility of undergoing such a intervention in our centre. She learned about it on the Internet and consulted a diabetes specialist about the subject. She had been treated for type 2 diabetes for over 12 years, and the disease had been progressing so rapidly that recently the patient required extra doses of insulin depending on diet and lifestyle apart from the regular insulin pump dosage.

The initial level of glycosylated haemoglobin (HbA_{1c}) was 9.4%. The average level of glycaemia came to 184 mg/dl with a tendency to frequent fluctuations above 250 mg/dl and drops of glycaemia below 60 mg/dl.

On the basis of the Department's experience of 150 bariatric procedures including many patients with type 2 diabetes, the patient was selected for gastric bypass surgery. The initial stage of the procedure – the creation of a stomach pouch with a capacity of 100 ml – was performed under laparoscopy. The stomach was transected by means of two 60 mm endo-staplers with green cartridges. Next the jejunojejunal and gastrojejunal anastomoses were created via a 10 cm percutaneous incision. Economic factors dictated this modification of the approach. Intestinal

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anastomoses could then be performed manually (loops of respectively 80 and 60 cm were excluded) (Figure 1).

Gastrointestinal anastomosis was performed by means of a 60 mm endo-stapler with a blue cartridge.

Insulin could be discontinued as early as on the second postoperative day. The patient was discharged from the Department on the 4th postoperative day after the standard X-ray of the upper gastrointestinal tract. It was performed to detect any possible leaks or obstructions. The diabetological consultation confirmed no further indications for insulin supply. The patient sends via e-mail regular glycaemic reports. Three weeks after the surgery the level of HbA_{1c} was 7.1% while the average level of glycaemia was 100 ±15.2. mg/dl. As yet (at the 12th week of follow-up) the patient still does not require any antidiabetic drugs.

Discussion

In 2004 the first attempts at surgical therapies of diabetes took place. Then Rubino and Marescaux used a type 2 diabetes animal model (Goto-Kakizaki) to assess the results of duodenal exclusion surgery. Regression of the disease in all animals tested was observed within 3 weeks from the procedure. The average glycaemia was 96.3 ±10.1 mg/dl [2].

Although in 2008/2009 over 1000 non-obese type 2 diabetic patients were operated on, the American Diabetes Association (ADA) acknowledged the need for further controlled, randomized clinical trials [3]. In

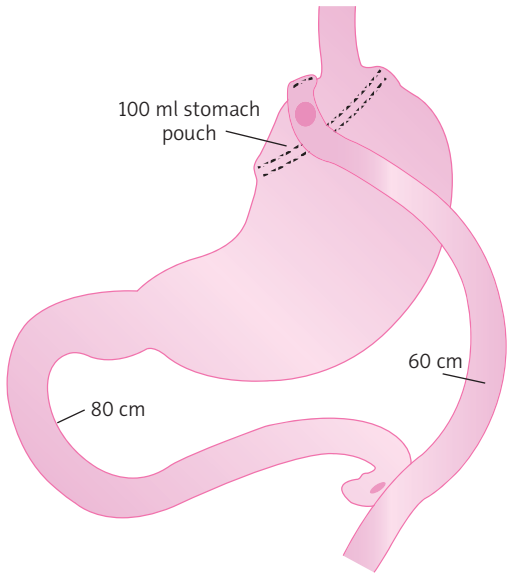

Figure 1. RYGB, length of loop and pouch capacity

2007 in a meeting of 53 diabetic experts a less conservative approach was presented. Surgical treatment of type 2 diabetes difficult to control by conventional measures was admitted to be acceptable in patients with BMI between 30 kg/m^2 and 35 kg/m^2. In February 2010 endocrinologists gathered in the Diabetes Surgery University of Malaga Meeting went one step further. They agreed that metabolic-surgical procedures were indicated not only in all patients aged from 18 years to 65 years with insulin-dependent, hard to control type 2 diabetes, but also in those patients in whom oral, antidiabetic drug therapy was unsuccessful and as a result had to be replaced by insulin therapy [4, 5].

Pathogenesis of type 2 diabetes involves increasing insulin resistance accompanied by dysfunction of beta cells located within pancreatic islets. It is suspected that an incretin effect of intestinal hormones underlies the pathology. The effect is based on decreased secretion of a glucagon-like peptide 1 (GLP-1) combined with a retained insulinotropic effect, while secretion of a gastric inhibitory peptide (GIP) conforms to physiological norms, but its effect is considerably impaired.

Incretins function at many levels. Firstly, they augment insulin secretion in pancreatic β cells and suppress glucagon secretion at the same time. Secondly, they inhibit the process of stomach emptying and suppress the appetite. Finally, they increase insulin sensitivity. Impaired secretion of GLP-1 in persons with type 2 diabetes has been proven [6-8].

The incretin effect is one of the known mechanisms of diabetes regression unconnected to weight loss. It is assumed that the duodenum may send a chemical signal which prevents tissues from reacting to insulin and decreasing glycaemia. It is suspected that in the initial part of the gastrointestinal tract there is an unknown substance or even substances created, which block the action of insulin. These substances are called anti-incretins. The gastric bypass procedure makes the increased use of insulin by the organism possible [9, 10].

The experiences of other authors are so encouraging that they may determine the use of bariatric procedures with the exclusion of the initial segment of the jejunum in treatment of obese and non-obese patients with diabetes [11, 12]. Results of type 2 diabetes surgical treatment in patients with BMI values of 20-34 kg/m^2 were described in DePaula's work. Complete regression of the disease was observed in

64.7% of cases (HbA_{1c} < 6%), in 26.5% a condition requiring glycaemia control and periodic antidiabetic drugs supply (HbA_{1c} 6-7%) was observed and in 8.8% of cases an improvement in diabetes control was observed (HbA_{1c} > 7%) [13]. Similarly good results were presented in the series of patients with type 2 diabetes and accompanying obesity. Schauer on the basis of 240 bariatric interventions performed on patients with type 2 diabetes observed therapeutic effects in 80% of patients good enough to discontinue both insulin and oral antidiabetic drugs [14]. The next publication dedicated to this matter was Ferzl's text. In a pioneering group of 7 non-obese patients who underwent gastric bypass, insulin could be discontinued in one patient in an early stage directly after the procedure and 12 months later diabetes was still not observed. In other patients a decrease of glycaemia (on average from 209 mg/dl to 154 mg/dl) and HbA_{1c} (from 9.4% to 8.5%) was observed, which permitted lower doses of taken drugs and better control of glycaemia [15]. An interesting comparison was made in Geloneze's work. A group of 180 patients with type 2 diabetes was divided into 2 groups (duration of the disease in both groups was < 10 years). The first group consisted of patients who complied with the criteria and were selected for surgical treatment. The second group consisted of patients treated conventionally. Twenty-four months after duodeno-jejunal exclusion, statistically significant decreases of glycaemia and HbA_{1c} were observed. Glycaemia was reduced in group 1 (14%) vs. in group 2 (7%), HbA_{1c} from 8.7% before the procedure to 7.4% after the procedure in group 1 and from 8.93% to 8.74% after 24 months of observation in group 2 (p < 0.01). Similar differences were observed in daily demand for insulin: 93% of patients in group 1 in comparison with 29% of patients in group 2 [16]. Also Fried in his meta-analysis assessed the results of type 2 diabetes surgical treatment. The criteria were very tight – glycaemia on an empty stomach < 99 mg/dl, HbA_{1c} < 6% with no form of postoperative treatment of diabetes. Positive results were observed in 81.8% of cases and RYGB and biliopancreatic diversion (BPD) were thought to be the most successful [17].

Our so far only surgical experience with a non-obese patient with type 2 diabetes allows us to draw optimistic conclusions. The reduction of diabetic parameters, both glycaemia and HbA_{1c}, and no need to take up any medicaments reducing glycaemia during one month after the procedure permit an optimistic prognosis. Combined laparoscopic and classical access is dictated by economic factors. The possibility to perform some of the anastomoses manually permits the reduction of costs of the surgery. The expenses connected with the laparoscopic surgery exceed the refund offered by the National Health Fund (NHF). It is worth mentioning here that gastric bypass performed without bariatric indications is not included in the registered procedures of the NHF. However, laparoscopic access is especially useful when creating a stomach pouch due to much better visualization of the area operated on. The final assessment of the new method has to last a few years at least. However, taking into consideration the costs of long-term antidiabetic therapy and its complications, considerably decreasing patients' quality of life and the crucial outcome of the disease itself, surgical treatment may turn out to be a desirable solution in selected cases.

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