Predictors for Remission of Major Components of the Metabolic Syndrome After Biliopancreatic Diversion with Duodenal Switch (BPDDS)

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Abstract

Background Metabolic surgery causes the remission of type 2 diabetes mellitus (T2DM), hypertension, and hyperlipidemia to varying degrees, depending on the patient characteristics and the surgical procedure. The aim of this study was to find predictors for the remission of T2DM and hypertension after biliopancreatic diversion with duodenal switch (BPDDS).

Methods Eighty patients with T2DM were followed up for 2 years or more after BPDDS, and changes in body weight and metabolic status were noted. Remission was defined as fasting glucose <7 mmol/l with HbA1C <6.5 %, blood pressure <140/90 mmHg, and low-density lipoprotein (LDL) <2.6 mmol without the use of medication.

Results Preoperatively, the mean age was 44 years, body mass index (BMI) was 48 kg/m², and duration of diabetes was 5 years. Of the 80 patients, 38 patients were using insulin, 48 patients were using antihypertensives, and 38 patients were using a lipid-lowering drug. Five percent of the patients had recommended levels for HbA1C, blood pressure, and LDL prior to the operation. The remission rate at 2 years was 94 % for T2DM, 54 % for hypertension, and 86 % for LDL hyperlipidemia. Preoperative predictors for nonremission of T2DM were a higher BMI, insulin usage, and low insulin C-peptide, and for hypertension, older age and more severe hypertension. Postoperative weight loss was important for both.

Conclusions Surgical intervention with BPDDS is an effective treatment of T2DM, hypertension, and hyperlipidemia. The duration of T2DM and age of the patient are the most important preoperative predictors for the remission of T2DM and hypertension, respectively.

Keywords Biliopancreatic diversion with duodenal switch · Type 2 diabetes · Hypertension · Hyperlipidemia · Remission · Predictors · Latent autoimmune diabetes of the adult

Introduction

The metabolic syndrome is defined by the World Health Organization as a clustering of glucose intolerance, hypertension, hyperlipidemia, and central adiposity [1]. It is increasingly prevalent in humans with an increase in body mass index (BMI) and with a natural tendency to progression [2]. Type 2 diabetes mellitus (T2DM), which is a major component of the metabolic syndrome, is an independent and strong risk factor for heart attack, stroke, renal failure, blindness, lower limb amputation, and premature death. At the beginning of the century, the prevalence of T2DM in Norway was estimated to be 3–4 % of the population above the age of 30, causing suffering and high costs for the individual and society due to health care expenditure, sick leave, and disability pension [3]. Guidelines for the
treatment of T2DM include having a sharp focus not only on blood glucose but also on hypertension and hyperlipidemia [4]. Medical treatment, including recommendations for diet, physical activity, oral medications, and insulin, has, however, a high failure rate in obtaining the recommended treatment targets, especially for patients that are morbidly obese [5].

As it is increasingly recognized that bariatric surgery is the only treatment proven to give sustained weight loss for the morbidly obese, bariatric surgery in general has gained increased acceptance and popularity [6]. When performed by experienced surgeons, it is safe and provides a dramatic improvement or even remission of metabolic disease [7]. It has, therefore, also been named “metabolic” or “diabetic” surgery and has recently been recognized as an appropriate treatment of T2DM in patients with a BMI above 30 [8].

For gastric bypass surgery, several studies have identified longstanding diabetes, insulin usage, and lower weight loss as the most important predictors for nonremission of T2DM [9–11]. Different types of biliopancreatic diversion (BPD) have been reported to give different results, depending on the technique performed [12, 13]. However, among the metabolic operations, the biliopancreatic diversion with or without the duodenal switch (BPDDS) is the procedure that gives the highest remission rates for T2DM [7, 14], and the aim of this study was to evaluate the remission rates and predictors for nonremission of T2DM, hypertension, and hyperlipidemia after this procedure.

Patients and Methods

Our bariatric surgery program started in 2001, and all diabetic patients with a minimum of 24 months follow-up were evaluated for inclusion in the study. Among 224 consecutive patients undergoing BPDDS in the time period April 2001–January 2010, 90 were identified as having diabetes. Ten patients were excluded; one had type 1 diabetes, two had been classified as T2DM but the preoperative fasting glucose and HbA1C were normal, one patient was excluded due to inadequate data to conclude on diabetic status at 2 years, and six patients were found to have latent autoimmune diabetes of the adult (LADA) at follow-up. LADA was diagnosed by the presence of antibodies to glutamic acid decarboxylate, IA2, and/or insulin [15], and these six patients are presented separately. This left us with 80 patients with T2DM with or without concurrent hypertension and/or hyperlipidemia eligible for the study. Data were collected prospectively in a database after having obtained written informed consent from the patients. The database is approved by the Norwegian Data Inspectorate, and the present study is a prospective cohort study with data extracted from the database.

T2DM was defined as a fasting blood glucose ≥7 mmol/l, or independent of blood value if using medication. Diabetic status was subdivided into “controlled by diet,” “controlled by oral medication,” or “controlled by insulin.” Most of the patients using insulin were also taking oral medication. Remission for diabetes was defined as fasting blood glucose <7 mmol/l with an HbA1C <6.5 % without medication [16]. The blood pressure was measured using a wide-cuff sphygmomanometer after the patient had been sitting in a relaxed position for at least 5 min. Hypertension was defined as a blood pressure ≥140/90 mmHg, or independent of blood pressure if taking antihypertensive medication. Hypertension status was subdivided into “hypertension without medication,” “hypertension using one medication,” or “hypertension using two or more medications.” Due to some missing data for serum lipids at 24 months, we decided to present lipidemia status as whether the patient was using lipid-lowering medication or not, but the remission rate and the percentage of patients having obtained the recommended level for low-density lipoprotein (LDL) were calculated based on the available data. The LDL level was calculated according to Friedewald’s formula \((\text{LDL} = \text{Chol} – \text{HDL} – 0.45 \times \text{Trigl})\), provided that the serum triglyceride level was <4.5 mmol/l [17]; if not, the patient was categorized as having hyperlipidemia and not having obtained the recommended level. Waist circumference was not measured as this is a useless task in the morbidly obese, measuring as much the subcutaneous fat as the intra-abdominal fat in this patient category [18, 19].

The BPDDS combines a longitudinal gastric resection (creating gastric volume restriction) with a proximal small bowel bypass (creating intestinal malabsorption). Different combinations of restriction and malabsorption can be created, and as we have gained experience with the procedure, the weight loss among our patients has increased without giving more side effects [20]. The patients were evaluated at the outpatient clinic preoperatively and at 3, 12, and 24 months after the operation. In addition, all patients were encouraged to visit their general practitioner at 6, 9, and 18 months or as often as needed. The program also includes a 5- and 10-year follow-up at the hospital, with yearly visits to their general practitioner between these checkups and yearly thereafter.

Changes in weight were calculated as percent excess BMI loss (%EBMIL) and percent excess weight loss (%EWL) [21], and an EWL <50 % was defined as weight loss failure. Standard biochemical analysis including fasting values of glucose, HbA1C, and serum lipids were performed at the Laboratory of Førde Central Hospital. Fasting serum insulin and insulin C-peptide were analyzed at the Hormone Laboratory, Haukeland University Hospital using the Immulite 2000 (Siemens, Tarrytown, NY, USA).

Data at the 2-year control, for a few patients supplemented with data from the 18- or 36-month control, were