Influence of gastrectomy for stomach cancer on type 2 diabetes mellitus for patients with a body mass index less than 30 kg/m²

Kyu Chul Kang, Seok Hwan Shin, Yeon Ji Lee¹, Yoon Seok Heo

Departments of Surgery and ¹Family Medicine, Inha University Hospital, Inha University School of Medicine, Incheon, Korea

Purpose: The impressive effect of LRYGBP on mildly obese patients (30 kg/m² < BMI < 35 kg/m²) with T2DM raises the argument for lowering the threshold for surgical intervention to non-obesity (BMI < 30 kg/m²). The goal of this study was to evaluate the effect of gastrectomy on non-obese patients with T2DM and what preoperative clinical factors are associated with postoperative long term improvement.

Methods: In this retrospective review, we analyzed the change in diabetic status in 75 patients with gastric cancer undergoing three different gastrectomies in a single institution from June 1996 to September 2009. Pre- and postoperative fasting blood glucose, serum hemoglobin A1c and diabetic medication requirements were compared. The demographic data and other biochemical markers were also collected.

Results: At an average follow-up of 35.0 ± 25.9 months, we collected the data of 75 patients and evaluated the change of diabetes status. There was no resolution of diabetes in Billroth-I (B-I) group, and 45.2% of patients improved whereas the resolution rate of Billroth-II (B-II) and RY group was 22.2% and 23.5% and 85.2% and 88.2%, respectively. The improvement rate of diabetes mellitus (DM) status was 7.46 times higher in B-II than in B-I patients. The method of reconstruction is the most powerful factor and severity and duration of diabetes showed significant clinical factors for the improvement of the disease after surgery.

Conclusion: According to these results, foregut-bypass procedure may improve the type 2 DM better than can be explained by the effect of weight loss only. Diabetes remission is significantly higher in those with duration of diabetes less than 5 years.

Key Words: Type 2 diabetes mellitus, Gastrectomy, Gastric bypass, Low BMI, Body mass index

INTRODUCTION

The incidence of diabetes has been increasing globally at an alarming rate. The World Health Organization currently estimates that type 2 diabetes mellitus (T2DM) affects 171 million people worldwide. With an increase in the number of obese children diagnosed with T2DM, it is predicted that more than 366 million people will be affected by diabetes by year 2025 [1]. Such a rapid increase in diabetes is thought to be related to economic growth, westernization of life style, reduction of physical activity, emotional and physical stress and the extension of life expectancy. Although current antidiabetic treatment includes a variety of medications with enhanced efficacy,
T2DM and the associated complications remain a substantial burden on the affected individuals and the society as a whole.

T2DM is characterized by resistance to insulin signaling, and is closely associated with obesity. The normal metabolic, neural and hormonal effects of the small intestine on the pancreatic islets, referred as the enteroinsular axis, are altered in patients with T2DM. When T2DM is associated with morbid obesity, weight loss induced by bariatric surgical procedures has been shown to be extremely effective in improving or resolving diabetes [2-4]. Increased insulin sensitivity accompanying the weight loss appears to be the most likely explanation for the improvement in diabetes in these patients. However, improvement from diabetes following the procedures that bypass the foregut (i.e., stomach, duodenum, proximal jejunum) such as gastric bypass or biliopancreatic diversion (BPD) seems to occur almost immediately after the surgery, well before significant weight loss occurs [4], thus, suggesting additional mechanisms contributing to the rapid glycemic control. Gastric bypass has been shown to increase glucagon like peptide-1 (GLP-1) and peptide YY (PYY) secretion [5,6] and decrease ghrelin level [7]. It is speculated that the “pro-incretin” effects of gastric bypass is related to the anatomical exclusion of the foregut from the nutrient passage.

Amelioration of diabetes in patients undergoing subtotal gastrectomy with Roux-en-Y (RY) reconstruction was reported in 1955 [8]. When the duodenum of a lean diabetic rat is bypassed surgically, normal glycemic control is restored [9]. These reports collectively suggest a glycemic control mechanism present in the foregut, and the exclusion of this area from the nutrient passage may help improve insulin sensitivity and diabetes. Several hypothesis have been proposed to explain the change of glycemic control after foregut bypass; foregut hypothesis, hindgut hypothesis, anti-incretin hypothesis, etc.

Gastrectomy removes some portions of the stomach, and is indicated mostly in patients with gastric cancer and intractable ulcer disease. The gastrointestinal (GI) tract is reconstructed either by Billroth-I (B-I) or Billroth-II (B-II). While B-I gastrectomy preserves normal GI tract configuration, B-II gastrectomy limits food entrance into the duodenum. Based on the studies demonstrating a positive impact on diabetes through exclusion of the foregut, a diabetic patient undergoing B-II gastrectomy is suggested to improve from diabetes better than a B-I gastrectomy patient. It has not been shown, however, in a systematic way whether duodenal exclusion by B-II reconstruction improves diabetes when compared to B-I gastrectomy. Because of a high incidence of gastric cancer in Korea, a significant number of gastrectomies are performed annually. The aim of this study is to examine retrospectively and compare the progression of diabetes in non-obese patients undergoing gastrectomy.

METHODS

Patients

From June 1996 to September 2009, a total of 2,134 Korean patients with stomach cancer underwent radical gastrectomy at Inha University Hospital (1,433 radical subtotal gastrectomies, 701 radical total gastrectomies). T2DM was noted in 169 patients (T2DM prevalence rate, 7.9%). Diagnosis of T2DM was based on fasting blood glucose (FBG) concentrations according to criteria established by the American Diabetes Association [10]. In addition, patients with a known history of T2DM and using diabetic medication prior to surgery were also classified as having T2DM regardless of FBG or glycosylated hemoglobin A1c (HbA1c) levels. Cancer of the stomach was established by endoscopic biopsy in all cases. Three patients who had undergone intestinal resection due to other diseases, six patients who had pancreatectomy due to gastric cancer invasion, one patient with body mass index (BMI) greater than 30, five patients with other endocrinopathies were excluded from the study. Five patients expired within 6 months after operation, and 28 patients who died prior to the study were also excluded from the analysis. From the total of 121 patients during this period, 75 of these patients were evaluated for follow-up (62.0%). Clinical data collected for this study include age, sex, onset of DM, duration of DM, pre- and postoperative FBG, BMI, serum HbA1c, diabetic medications, serum lipid levels. The study protocol was approved by the Institutional Review