ELSEVIER

Surgery for Obesity and Related Diseases ▮ (2016) 00–00

SURGERY FOR OBESITY AND RELATED DISEASES

Original article

Does bariatric surgery really prevent deterioration of renal function?

Eun Young Kim, M.D.[a], Yong Jin Kim, M.D.[b,*]

[a]Department of Surgery, College of Medicine, The Catholic University of Korea, Seoul, Korea
[b]Department of Surgery, Soonchunhyang University Seoul Hospital, Seoul, Republic of Korea

Received August 17, 2015; accepted October 8, 2015

Abstract

Background: Obesity is related to impaired renal function; bariatric surgery is associated with an improvement in renal function.

Objectives: We investigated obesity-related changes in renal function after bariatric surgery and identified related clinical factors.

Setting: Soonchunhyang University Seoul Hospital, Korea.

Methods: From December 2011 to February 2014, 493 consecutive patients who met the criteria underwent bariatric surgery. Of these patients, 136 patients were enrolled. The exclusion criteria were as follows: revisional bariatric surgery, laparoscopic adjustable gastric banding, significant chronic kidney disease, macroalbuminuria, nephrotic range proteinuria, and absence of laboratory data on renal function. Overall, there were 126 patients with Roux-en-Y gastric bypass and 10 with sleeve gastrectomy. Preoperative and postoperative 1-year renal function was evaluated by the estimated glomerular filtration rate, urinary albumin-to-creatinine ratio (UACR), and urinary protein-to-creatinine ratio (UPCR).

Results: Of 136 patients, 101 were women, and the mean age was 35.9 ± 11.2 years. UACR was significantly lower postoperatively than preoperatively (27.0 ± 47.2 versus 9.0 ± 8.6 mg/g; $P < .001$). Microalbuminuria was present in 22.1% of patients preoperatively, decreasing to 4.4% 1-year postoperatively. A significant reduction was observed in the UPCR (90.7 ± 101.2 versus 64.6 ± 34.8 mg/g; $P = .004$). The mean value of estimated glomerular filtration rate improved from 117.8 to 119.6 mL/min/1.73 m^2, although this was not significant.

Conclusion: In obese patients, bariatric surgery significantly improves microalbuminuria and decreases the UACR and UPCR. Therefore, bariatric surgery should be considered as an early treatment for obesity with renal impairment and may prevent the progression to overt disease. (Surg Obes Relat Dis 2016;▮:00–00.)

Keywords: Bariatric surgery; Renal function; Estimated glomerular filtration rate; Urinary albumin-to-creatinine ratio; Urinary protein-to-creatinine ratio

Currently, the obese population is increasing steadily throughout the world; >1.5 billion people are overweight or obese [1]. It has also been reported that 51% of the world's population will be obese within 2 decades [2,3]. In line with this projection, the prevalence of obesity in Korea has increased from 26.9% in 1998 to 32.0% in 2011, according to data from the Korean National Health and Nutrition Examination Surveys [4].

Obesity is usually associated with increased morbidity, disability, and mortality because of cardiovascular disease, diabetes mellitus, cancer, obstructive sleep apnea,

*Correspondence: Yong Jin Kim, M.D., Ph.D., Department of Surgery, Soonchunhyang University College of Medicine, Seoul, Korea, 657 Hannam-dong, Yongsan-gu, Seoul, 140-743, Korea.
E-mail: yjgs1997@gmail.com

http://dx.doi.org/10.1016/j.soard.2015.10.068

gastroesophageal reflux disease, and musculoskeletal disorder [5]. The main issue associated with the treatment of obese patients is not only the maintenance of weight loss but also amelioration of co-morbidities, which can prove difficult using weight loss treatment approaches such as lifestyle modifications or pharmacologic interventions. Thus, the increasing popularity of bariatric surgery is attributed mainly to its beneficial effects on multiple obesity-related conditions and long-term weight loss outcomes [6–9].

In addition to the previously described conditions, obesity has also been recognized as a risk factor for kidney disease. Investigations in the United States and Europe have documented an independent association between a higher body mass index (BMI) and chronic kidney disease (CKD) risk [10–12]. Several systematic reviews have reported benefits of weight loss on renal function [13–16]. However, the majority of these investigations have shown a relationship between weight loss and improved kidney function only in the context of limited parameters and small sample sizes.

Therefore, we investigated the effects of bariatric surgery on renal function using serologic and urologic examinations and identified related clinical factors based on data from a specialized Korean bariatric center.

Materials and methods

Prospectively collected data on 493 consecutive patients who underwent bariatric surgery at Soonchunhyang University Seoul Hospital between December 2011 and February 2014 were reviewed. Patients were selected for surgery if they had a BMI $\geq$ 35 kg/m^2 or $\geq$30 kg/m^2 with one or more obesity-related co-morbidities. Of these 493 patients, 136 were enrolled. The exclusion criteria were as follows: revisional bariatric surgery, laparoscopic adjustable gastric banding, significant CKD, macroalbuminuria, nephrotic range proteinuria, and absence of laboratory data on renal function. Institutional Review Board approval was obtained. Overall, 126 (92.6%) patients underwent Roux-en-Y gastric bypass, and 10 underwent sleeve gastrectomy.

Surgical technique

All patients were proposed for 2 types of procedures: laparoscopic sleeve gastrectomy or laparoscopic Roux-en-Y gastric bypass. The decision regarding procedure type depended largely on the patients' own selection after extensive discussion of the specific risks associated with each procedure. The procedures were standardized as described previously [17,18].

Anthropometric measurements

The height and weight of each patient were recorded during the preoperative evaluation. BMI was calculated according to the following formula: weight (kg) / height^2 (m^2). To yield the percentage of excess weight loss (%EWL), excess weight was calculated by subtracting ideal weight from actual weight. The ideal weight corresponded to a BMI value of 23 kg/m^2, which is the upper limit of normality according to the World Health Organization definition of obesity for Asians. Then the reduction in weight was divided by the excess weight. Weight loss failure was defined as a %EWL $\leq$ 50 at postoperative 1 year. Patients were classified according to BMI as follows: obesity group BMI $\geq$ 30 and $<$40 kg/m^2; morbid obesity group BMI $\geq$ 40 kg/m^2.

Obesity-related co-morbidities

Obesity-related co-morbidities consist of diabetes mellitus, hypertension, dyslipidemia, sleep apnea, and arthropathy. The diagnosis of diabetes mellitus was according to the criteria established by the American Diabetes Association (ADA). These were fasting blood glucose $\geq$126 mg/dL or glycated hemoglobin (HbA1 c) $\geq$6.5%. The ADA criteria for diabetes remission were used. These included as HbA1 c $<$6.5% without the use of antidiabetic medication, 1 year after bariatric surgery. Hypertension was diagnosed when the patient was taking medication for the condition. Using the definition of metabolic syndrome, we defined dyslipidemia as the presence of 1 or more abnormalities in serum triglyceride $\geq$150 mg/dL, high-density lipoprotein $<$40 mg/dL, or taking medication. Remission of dyslipidemia was defined as normal lipid panel without medication or with decreased medication at the end of 1 year. Sleep apnea was considered as a medical condition that required overnight continuous positive pressure support or had strongly suggestive symptoms.

Analysis of blood and urine samples

In all patients, urine and serum samples were obtained preoperatively and 12 months after surgery to measure creatinine levels, the estimated glomerular filtration rate (eGFR), urinary albumin-to-creatinine ratio (UACR), and urinary protein-to-creatinine ratio (UPCR).

Definition or classification of renal function impairment

Significant CKD was defined as an eGFR $<$60 mL/min/1.73 m^2 using the Modification of Diet in Renal Disease formula, and CKD $\geq$ Stage 3 according to the Kidney/Dialysis Outcome Quality Initiative guidelines [19]. Hyperfiltration was defined as an eGFR $>$125 mL/min/1.73 m^2. Albuminuria was classified as microalbuminuria (UACR $\geq$ 30 and $<$300 mg/g) or macroalbuminuria (UACR $\geq$300 mg/g). Proteinuria was classified as normal/minimal (UPCR $<$500 mg/g), elevated (UPCR $\geq$500 and $<$2000 mg/g), or nephrotic range (UPCR $\geq$2000 mg/