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Original Research

Survival impact of postoperative body mass index in gastric cancer patients undergoing gastrectomy

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Abstract ***Background:*** The relationship between preoperative body mass index (BMI) and the survival of postoperative gastric cancer patients is not clear. Furthermore, the survival impact with postoperative BMI is not known, even though weight loss is inevitable after gastrectomy.
Methods: Patients who underwent gastrectomy for gastric cancer between 2000 and 2008 were included in the study (n = 1909). Patients were divided into three groups based on their BMIs: low (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), and high BMI (≥25.0 kg/m^2). Patient survival was compared according to BMI at two time points: baseline and 1 year after surgery.
Results: Regarding BMI 1 year after surgery, overall survival, disease-specific survival, and recurrence-free survival were longer in the high BMI group than the low and normal BMI groups. In a Cox proportional hazards model, adjusting for the patient's age, sex, type of surgery, tumour stage, histology, curative resection, and BMI at baseline, a high BMI 1 year after surgery was associated with lower overall mortality compared to normal BMI (hazard ratio 0.51; 95% confidence interval, 0.26–0.98). However, BMI at baseline was not an independent prognostic factor.
Conclusion: BMI 1 year after surgery significantly predicted the long-term survival of patients with gastric cancer compared with the preoperative BMI.

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1. Introduction

The increase in numbers of overweight and obese people is a major public health concern. Excess body weight can cause several lifestyle diseases, such as diabetes, hypertension, hyperlipidaemia and cardiovascular disease. Overweight and obese statuses are associated with an increased risk of death.[1] Body mass index (BMI) is the most widely used method to estimate obesity. It is very easy to measure and correlates better with total body fat than with body weight alone.[2] BMI is classified as underweight (<18.50 kg/m^2), normal (18.50–24.99 kg/m^2), overweight (≥25.00 kg/m^2), or obese (≥ 30.00 kg/m^2).[3] These current World Health Organisation cut-offs provide an adequate basis for taking action against risks related to being overweight and obese in many populations.

Contrary to conventional belief, overweight and obese patients may paradoxically have favourable outcomes compared with patients of normal weight. This has been supported by several recent studies on critically and chronically ill patients, such as those suffering acute lung injury, heart failure, chronic renal failure, chronic obstructive pulmonary disease and rheumatoid arthritis.[4–8] Although several studies have been conducted in this population, conflicting results have been reported about the effect of excess body weight on long-term surgical outcomes.[9–11] These studies analysed patient outcomes based on their preoperative BMI. However, unlike other surgeries, gastrectomy is always followed by weight loss. Therefore, the preoperative BMI of the patients undergoing gastrectomy will differ from their postoperative BMI. Prominent losses in body weight and abdominal fat are observed during the first 3 months after gastrectomy in patients with early gastric cancer. Body weights are then maintained without any significant changes until 12 months after surgery.[12]

The aims of this study were to evaluate the relationship between BMI and long-term survival of gastric cancer patients undergoing gastrectomy using preoperative and postoperative BMIs.

2. Material and methods

2.1. Patients

From January 2000 to December 2008, 1989 patients with gastric cancer underwent gastrectomy at the Seoul St. Mary's Hospital, Korea. Gastric cancer patients who underwent gastric wedge resection (n = 6), Whipple's pancreaticoduodenectomy (n = 1), palliative gastrojejunostomy (n = 32), and open and closure (n = 41) procedures or had no BMI data (n = 4) were excluded. An electronic database of the remaining 1905 patients was reviewed. All relevant data, including clinical, surgical, and pathological records, were collected retrospectively from the database. Cancers were staged in accordance with the tumour node metastasis classification system used by the Union Internacional Contra la Cancrum, 6th edition.[13] The Institutional Review Board of our institution approved this study (KC14RISI0716).

Patients were divided into three groups on the basis of their BMIs. The height and weight of all patients were measured on the admission day for gastrectomy, and the weight 1 year after gastrectomy was gauged on the scale in outpatient clinic. Patients with BMIs <18.50 kg/m^2, 18.50–24.99 kg/m^2, or ≥25.00 kg/m^2 were classified as having a low, normal, or high BMI, respectively. This grouping was applied to BMIs both at baseline and 1 year after gastrectomy.

2.2. Measurements

The percentage weight loss was calculated as the difference between the two BMIs divided by the BMI at baseline. The histology of gastric cancer was divided into two groups, differentiated and undifferentiated, based on the Japanese classification of gastric carcinoma.[14] Three patients had neuroendocrine carcinomas and two patients were missing data regarding histology and were thus excluded from the multivariable analysis. R0 resection was pathologically defined as complete surgical resection without residual tumour. R1 resection was defined as no residual tumour except for a positive resection margin. R2 resection was defined as palliative resection with visible residual tumour.

2.3. Outcomes

All included patients were registered by the Comprehensive Cancer Institute of Seoul St. Mary's Hospital. The cause of death was determined by physician review of the medical records in the institution and by mortality data from the National Statistical Office of Korea. The diagnostic codes of the International Classification of Diseases, 10th edition, were used to classify death due to cancer or other causes. Person-years (PY) were counted from enrolment to the date of death or the end of follow-up. Patient survival was categorised as overall survival (OS), disease-specific survival or recurrence-free survival.

2.4. Statistical analysis

Pearson's χ^2 test for categorical variables and the Student t test for unpaired data for continuous variables were performed to compare clinicopathological characteristics among the three groups. A P value of <0.05 was regarded as significant. Survival rates were calculated by the Kaplan-Meier method, with the date of gastrectomy as the starting point. Patients who were alive were