Bariatric surgery reduces cancer risk in morbidly obese patients

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Abstract

Background: To assess the effect of bariatric surgery on the cancer risk of patients with morbid obesity because evidence is mounting of an association between obesity and cancer.

Methods: We performed an observational 2-cohort study. The treatment cohort (n = 1035) included patients who had undergone bariatric surgery from 1986 to 2002. The control group (n = 5746) included age- and gender-matched morbidly obese patients who had not undergone weight-reduction surgery and who were identified from a single-payer administrative database. The subjects with physician or hospital visits for a cancer-related diagnosis or treatment within the 6 months previous to the beginning of the study were excluded. The cohorts were followed up for a maximum of 5 years from study inception.

Results: Bariatric surgery resulted in a significant reduction in the mean percentage of excess weight loss (67.1%, P < .001). The surgery patients had significantly fewer physician/hospital visits for all cancer diagnoses (n = 21, 2.0%) compared with the controls (n = 487, 8.45%; relative risk .22, 95% confidence interval .143–.347; P = .001). The physician/hospital visits for common cancers such as breast cancer were significantly reduced in the surgery group (P = .001). For all other cancers, the physician/hospital visits showed a trend toward being lower in the surgery group. Because of the low frequencies, statistical significance could not be demonstrated for individual cancer diagnoses.

Conclusion: The data suggest that bariatric surgery improves the cancer outcomes in some morbidly obese patients. (Surg Obes Relat Dis 2008;4:691–697.) © 2008 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords: Obesity; Bariatric surgery; Cancer

Morbid obesity is a significant cause of mortality, morbidity, and healthcare expenditure in North America. The prevalence of obesity in the United States and Canada is increasing exponentially, with >25% of individuals in the United States and 14% in Canada affected by this disease [1]. It has been estimated 300,000 deaths attributable to obesity occur in the United States each year, with 80% of these deaths in people with a body mass index (BMI) >30 kg/m². Severe and morbid obesity is associated with major mobility problems and pain, leading to a reduction in the quality of life [2]. The respiratory difficulty experienced by morbidly obese patients diminishes functional capacity and prevents them from performing the activities of daily living [3].

In addition to the increased risk of hypertension, myocardial infarction, stroke, and gallstones and their complications, cancer of the prostate [4], breast [5,6], colon (in men) [7], endometrium [8], and gallbladder [9] are more frequently diagnosed in the obese population. The relative risk of cancer associated with greater body weight is also greater among younger patients [6].
The published data have shown that medical interventions are ineffective for weight loss in severely obese patients. Surgical interventions and, more specifically, bariatric surgery have been shown to produce effective weight loss for patients with morbid obesity [10,11]. In another study conducted by Christou et al. [12], bariatric surgery was shown to be associated with significant reductions in morbidity, mortality, and healthcare use and direct healthcare costs. The present study has expanded on these findings by assessing the differences between the 2 study cohorts with respect to cancer in general and cancers of specific sites for which obesity is a known or postulated risk factor.

Methods

Study design

This was an observational 2-cohort study that compared a cohort of morbidly obese patients treated with bariatric surgery at the McGill University Health Centre with a cohort of matched morbidly obese controls who had not been treated surgically. The inception time of the bariatric cohort was the admission for surgery. The inception time for the control cohort was the date of surgery for their matched bariatric surgery patients. A maximum of 6 controls were identified for each bariatric patient. The 2 cohorts were followed up for a maximum of 5 years.

Identification of cohorts

A total of 1118 patients who had undergone bariatric surgery from January 1986 to June 2002 comprised the bariatric cohort. The unique health insurance numbers of these patients were used to retrieve their information from the provincial health insurance database of the Régie de l’assurance maladie du Quebec (RAMQ). The RAMQ database includes information regarding all healthcare use claims, including those for hospitalization, physician visits, prescription medications, and other paramedical services. Data concerning weight loss parameters for these patients were extracted from the McGill University Health Centre bariatric surgery patient registry.

Of the 1118 patients in the bariatric surgery cohort, 83 (7.4%) were excluded because of a previous diagnosis for 1 of the chronic conditions (which included cancer) listed in Table 1 before surgery. If a patient had undergone repeat bariatric surgery, the index surgery was used as the inception date and the subsequent procedure was included in the morbidity assessment. The RAMQ database was queried to identify a maximum of 6 control subjects for each bariatric patient. The inclusion criteria for the controls were a diagnosis of morbid obesity according to the “International Classification of Diseases, Ninth Revision,” codes for treatment in a hospital, treatment by a physician, or as an indication for a prescription, as well as never having undergone surgery for the treatment of obesity. Each bariatric patient was matched with ≤6 controls using the date of the first diagnosis of morbid obesity within 2 years, age within 5 years, and gender. A total of 6210 controls were identified of whom 464 (7.5%) were excluded because they had been diagnosed with 1 of the chronic conditions listed in Table 1 before the surgery date of their matched bariatric patient. The final study sample included 1035 bariatric surgery patients and 5746 matched controls.

Matching

The 2 study cohorts were matched with respect to gender, age, and duration since the diagnosis of morbid obesity, as indicated by the first mention of medical treatment of obesity in the RAMQ database. This included the mention of obesity as a primary or secondary diagnosis for hospitalization or consultation with a physician, including general practitioners and specialists. To minimize bias, all patients included in the study had to be at risk of the target conditions before inclusion in the study cohort. This was accomplished by excluding any patient who had had a diagnosis or treatment related to the general class of conditions defining the study outcomes during the prestudy period.

Because the control patients did not undergo bariatric surgery, the date of surgery of their matched bariatric subject was used to define the prestudy period. Therefore, control patients were also excluded if they had an indication for having any of the target conditions during the prestudy period. This exclusion might have produced a bias against the bariatric cohort, because although the time of onset of follow-up for the bariatric patients was a well-defined and documented event (i.e., surgery), for the controls, this was arbitrary. As a result, the likelihood of being excluded from the study for controls might have been greater, and this cohort might have been healthier than the bariatric cohort. However, the proportion of patients excluded from each cohort was similar, indicating that the prestudy risk of the 2 cohorts was similar.
Outcome ascertainment

A comprehensive search of the RAMQ database was conducted to identify all claims for healthcare services used by the subjects in both cohorts during the 5-year period after the date of inception. The “International Classification of Diseases, Ninth Revision,” codes were used to classify the primary conditions leading to the use of health services [13]. Morbidity was ascertained using the incidence of new conditions during the follow-up period from the data on primary and secondary diagnoses recorded in the RAMQ database. A patient was considered to have had the event if ≥1 mention of the diagnosis or treatment was detected during the follow-up period.

The weight loss for the bariatric surgery cohort was estimated using the percentage of change in the BMI and the percentage of excess weight loss. The percentage of change in the BMI was calculated as 100% \(\times \frac{\text{BMI}_{0} - \text{BMI}_{i}}{\text{BMI}_{0}}\), where \(\text{BMI}_{i}\) is the BMI at the last follow-up visit and \(\text{BMI}_{0}\) is the BMI at surgery. The percentage of excess weight loss was calculated as 100% \(\times \frac{\text{W}_{0} - \text{W}_{i}}{\text{EW}_{0}}\), where \(\text{W}_{0}\) is the weight in kilograms at surgery, \(\text{W}_{i}\) is the weight in kilograms at the last follow-up visit, and \(\text{EW}_{0}\) is the excess weight at surgery. The excess weight was estimated according to the formula reported by Deitel and Greenstein [14] and the Metropolitan Tables for medium-framed individuals.

Statistical analysis

The statistical significance of weight loss in the bariatric surgery cohort was assessed using the paired Student \(t\) test and described using the mean change and 95% confidence intervals (CIs) for the cohort. The incidence of target conditions and procedures was defined as the proportion of patients in each cohort with ≥1 mention of the target condition or intervention. The relative risks with the 95% CIs and exact significance tests were used to assess the difference in incidence rates between the 2 cohorts. The relative risks were calculated using the bariatric cohort as the exposed group and the control cohort as the reference. Therefore, relative risk estimates that are less than unity indicate a protective or beneficial association for the bariatric cohort.

Results

Study sample description

A total of 7 different surgeons affiliated with the McGill University Health Centre treated the 1035 bariatric patients at 2 hospitals during a 16.4-year period. Four surgeons performed most (97%) of the procedures. One surgeon performed 48.5% of the bariatric procedures (Table 2). A total of 5746 controls were included in the study. The data in Table 3 describe the demographics of the 2 cohorts. As expected, the 2 cohorts were well matched with respect to age and gender, with a mean age of approximately 45–47 years and the percentage of men at 34–36%.

Weight loss in bariatric surgery patients

The data in Table 4 describe the weight loss achieved in the bariatric surgery cohort. Significant reductions were found in the mean percentage of excess weight loss (62.1%, \(P < .001\)) and in the percentage of change in the BMI (31.9%, \(P < .001\)).

Overall cancer risk

The data in Table 5 describe the 5-year incidence of cancer in the 2 study cohorts. A total of 21 patients were diagnosed with cancer in the bariatric cohort, for a 5-year incidence of 2.03%. In the control group, 487 patients were diagnosed with cancer during the 5-year follow-up period, for an incidence of 8.49%. The relative risk of cancer was .22 (95% CI .143–.347), indicating a statistically significant reduction in the risk (\(P = .001\)) for the bariatric surgery cohort. This was equivalent to an 80% reduction in the cancer risk within 5 years.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Distribution of patients by surgeon and procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgeon</td>
<td>n (%)</td>
</tr>
<tr>
<td>A</td>
<td>2 (.2)</td>
</tr>
<tr>
<td>B</td>
<td>3 (.3)</td>
</tr>
<tr>
<td>C</td>
<td>27 (2.6)</td>
</tr>
<tr>
<td>D</td>
<td>147 (14.2)</td>
</tr>
<tr>
<td>E</td>
<td>162 (15.7)</td>
</tr>
<tr>
<td>F</td>
<td>192 (18.5)</td>
</tr>
<tr>
<td>G</td>
<td>502 (48.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Patient demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic</td>
<td>Cohort</td>
</tr>
<tr>
<td></td>
<td>Bariatric</td>
</tr>
<tr>
<td>Patients (n)</td>
<td>1035</td>
</tr>
<tr>
<td>Age (y) Mean ± SD</td>
<td>45.1 ± 11.6</td>
</tr>
<tr>
<td>Median</td>
<td>44.8</td>
</tr>
<tr>
<td>Gender (n)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>356 (34.4)</td>
</tr>
<tr>
<td>Female</td>
<td>679 (65.6)</td>
</tr>
</tbody>
</table>

Data in parentheses are percentages.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Weight loss for bariatric surgery cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>Mean</td>
</tr>
<tr>
<td>Excess weight loss (%)</td>
<td>62.1</td>
</tr>
<tr>
<td>BMI reduction (%)</td>
<td>31.9</td>
</tr>
</tbody>
</table>

CI = confidence interval; BMI = body mass index.
The results of the present study have shown that for the first 5 years after bariatric surgery, patients experience significant and sustained weight loss. This result is expected and compatible with those reported in other studies [24]. The results of a previous study conducted using these cohorts has demonstrated reduced morbidity and mortality after surgery, along with reduced healthcare use and direct healthcare costs [12]. The present study has demonstrated that in addition to these benefits to patients and society, bariatric surgery resulted in a significant reduction in the incidence of specific cancers and overall cancer rates. Cancers that occur at a high frequency in the population, such as breast cancer, showed a significant reduction in incidence during the 5-year follow-up period in the surgery cohort. Although not all risk reductions were statistically significant, most were clinically important, and the differences did not achieve statistical significance because of the small number of events (cancers) in the cohorts.

The validity of our results is because we have been able to demonstrate the benefits of bariatric surgery in a nonbiased sample of morbidly obese patients. The recent definition of generalizability of evaluative studies is not determined on how representative the study sample is to the general target population but on the validity of the observed treatment–outcome associations and our ability to translate these results into recommendations for the treatment of the patients in the target population [25]. Therefore, with respect to the present study, the results have provided evidence that bariatric surgery produces significant weight loss, as well as a reduced incidence of cancer. This study was not intended to compare the incidence of cancer in a population of morbidly obese patients. In contrast, we tried to exclude patients with pre-existing cancer from the study. To our knowledge, this is the first study to show such a powerful effect of bariatric surgery on the cancer incidence. Adams et al. [26] reported a 40% reduction in mortality after gastric bypass, primarily owing to fewer deaths from coronary artery disease, diabetes, and cancer. They stated in their discussion that they were surprised by the reduced deaths resulting from cancer. Our results may provide an explanation and provide strong support for the notion that bariatric surgery reduces cancer risk. We have previously shown, using the same cohorts, an 89% reduction in the relative risk of death for the surgical group [12].

### Specific cancer risk

The incidence of specific cancers was also lower for the bariatric cohort than for the control patients. The relative risk of breast cancer was 0.17 (95% CI 0.098–0.311; \( P = .001 \)) and for colorectal cancer was 0.32 (95% CI 0.076–1.313; \( P = .063 \)). The latter only approached statistical significance but the reduction was clinically important. The power of the study to detect this difference was only 50% for a 5% significance. Similarly, a clinically important relative risk of 0.29 was observed for pancreatic cancers that was not statistically significant (\( P = .166 \)). The power for this difference was only 31% at 5% significance. For melanoma and non-Hodgkin’s lymphoma, the relative risk observed was 0.41 (\( P = .158 \)) and 0.50 (\( P = .432 \)), with a power at 5% of 54% and 10%, respectively.

### Discussion

The effects of morbidity on the risk of hypertension, coronary artery disease and vascular disorders [15], diabetes [16], cancer [6–8,17–20], and respiratory conditions [21,22] have been well documented. In 2000, the National Institutes of Health published an evidence-based guideline [21,22] have been well documented. In 2000, the National Institutes of Health published an evidence-based guideline stating that surgical therapy should be offered to obese patients (BMI >35 kg/m²) who have experienced obesity-related co-morbidities [23].

We performed this observational study using a combination of hospital and provincial insurance administrative databases to assess the effect of bariatric surgery on cancer risk. The selection of patients according to their exposure or treatment, without knowledge of the outcome, the inclusion only of patients who were at risk of cancer (i.e., excluding those with a history of cancer), and matching the controls with respect to the duration of disease and age were key elements of the present study’s design. These elements have made the present study an excellent simulation of a “real-life” situation.

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our findings. The strengths of the present study are related to the design and the selection of the cohorts. The exclusion of patients with a history of the ascertained outcomes allowed for the estimation of the true incidence and removed potential selection bias and confounding. Matching the patients and controls with respect to age, gender, and duration of disease further reduced the possibility of confounding from these factors, because both are potentially associated with the morbidity indexes studied and with an increased risk of mortality. The random selection of controls from an administrative database reduced the selection bias and bias by indication that would have been introduced if hospital-based controls had been used.

Conclusion

The results of our study have shown that bariatric surgery produces effective weight loss and significant reductions in all cancers and in specific cancers with known etiologic links to obesity. Although more extensive risk–benefit assessments might be useful in providing more detailed data regarding the effect of bariatric surgery, the present study has produced evidence supporting the implementation of bariatric surgery in the treatment of the morbidly obese patient. Furthermore, these results have also shown that bariatric surgery not only reduces morbidity and improves the quality of life, but, more importantly, also reduces the incidence of malignant disease.

Disclosures

The authors claim no commercial associations that might be a conflict of interest in relation to this article.

References