Hypothesis: Older patients experience the same benefits from a laparoscopic gastric banding (LGB) operation as younger patients.

Design: A case series of 320 morbidly obese and superobese patients who underwent LGB within a 46-month period.

Setting: University Hospital Innsbruck, General Surgical Department, Innsbruck, Austria.

Patients: A consecutive sample of 320 patients who met the criteria for a bariatric procedure and were aged 18 years or older. Patients were divided into the following 2 age groups: younger patients (group A, 18-49 years) and older patients (group B, ≥50 years).

Intervention: Laparoscopic gastric banding with an adjustable gastric band.

Main Outcome Measures: Clinopathologic features, including weight loss, complications, length of hospital stay, and operative times, were reviewed retrospectively, and a multivariate analysis was carried out.

Results: Of 320 patients, we identified 68 older patients (21.5%, group B). The mean postoperative follow-up period was 12 months (range, 6-28 months). The average preoperative weight was 127.8 kg (body mass index [calculated as weight in kilograms divided by the square of height in meters], 44.29). The average total weight loss was 4.3 kg per month for the first 3 months, reaching an average total of 31.0 kg after 1 year. The excess weight loss after 12 months was 68%. Complications requiring reoperation occurred in 10.3% of patients. Ninety-seven percent of the patients reported an improvement in their comorbid conditions.

Conclusions: Older patients receive the same benefits from LGB as younger patients, with an acceptable postoperative complication rate. Presently, our upper age limit is 70 years.

Arch Surg. 2001;136:1171-1176

Morbid obesity contributes to many health risks, including physical, emotional, and social problems. Because morbid obesity is associated with several chronic diseases and is the biggest independent risk factor for early mortality, its increasing prevalence has become a major public health concern. Additionally, the incidence of obesity is further increasing in the older population. Various options for the surgical treatment of morbid obesity, including laparoscopic gastric banding (LGB), have been developed with varying results. We attempted to determine if older patients can expect the same advantages from LGB that are known to exist for younger patients. Based on our experience, we addressed the following questions: (1) How frequent is LGB in older patients? (2) Do these patients have a higher perioperative or postoperative risk? (3) Do they have the same results in terms of weight reduction as published for younger groups? (4) How are their comorbidities affected?

Morbid obesity is an increasing health threat in industrialized nations and carries considerable comorbidities. Recent evidence clearly links obesity to increased morbidity and mortality. As conservative treatment usually fails, the only hope for these patients may be surgical treatment. More than 50 different surgical methods have been proposed for the management of morbid obesity (body mass index [BMI] [calculated as weight in kilograms divided by the square of height in meters] >40). In the United States, gastric restrictive or bypass surgery is the recommended treatment option for morbidly obese patients. Presently, the Roux-en-Y gastric bypass (RYGB) operation has
### PATIENTS AND METHODS

Patients with a BMI greater than 40 or a BMI between 35 and 40 accompanied by a complication of obesity were considered for the SAGB operation after a psychological and metabolic evaluation, exclusion of any medical contraindications, and gastroscopy and esophageal manometry to assess esophageal function. All patients underwent a routine cardiological examination consisting of medical history, physical examination, and electrocardiogram, and in case of any evidence of heart disease, extensive tests such as echocardiography and coronary angiography were performed. Lung function was also a concern in all patients, and any evidence of chronic obstructive pulmonary disease or other pulmonary disease prompted further investigation with pulmonary function tests. We did not perform any special preoperative screening procedures in older patients.

From January 1996 until October 2000, we performed surgery on 320 consecutive patients, who all underwent laparoscopic procedures with the published technique. The average operating time was 85 minutes with no major intraoperative complications. Patients' mean age at surgery was 38 years, and the mean preoperative weight was 135.5 kg. The median EW was 64 kg with an average BMI of 46.69 (range, 95-240). These patients were divided into younger patients between ages 18 and 50 years (group A) and patients aged 50 years and older (group B). The mean age for group A was 29.4 years; average BMI, 48.25; and average EW, 66.4 kg. Eighty percent of group A (n=252) had 1 or more comorbidities (Table 1). Fifty-five patients (21.8%) had previous abdominal operations. The preoperative weight of group A was slightly higher, and the number of comorbidities and previous operations were less (Table 1).

Group B consisted of 68 patients (21.5% (Figure 1) with an average BMI of 44.29 (P=.70) and an EW of 58.3 kg (P=.80). Ninety-two percent of the patients had 1 or more co-morbidities (Table 1). Twenty-eight (41.1%) patients had undergone previous abdominal operations. Ten (14.7%) underwent conventional cholecystectomies, and 2 (2.9%) underwent laparoscopic cholecystectomies. The rest had undergone appendectomies or various gynecological procedures. A Mann-Whitney U test was used for comparison of differences between the 2 groups in terms of weight loss and differences between preoperative and postoperative values within the groups. Categorical parameters were compared using the McNemar test. For the postoperative change in comorbidity, the McNemar test was used. Statistical significance was assumed at $P<.05$.

### RESULTS

A total of 320 patients underwent surgery between January 1996 and October 2000. Of these, 252 (group A) were younger than and 68 (group B) were older than 50 years. For group A the mean initial weight was 138.6 kg, and the initial BMI was 48.25. The male-female ratio was 48:252 (19.5:81%). Eighty percent of the patients reported at least 1 coexisting morbidty at the time of operation. For group B the male-female ratio was 12:56 (17.6:83.4%). The mean age was 55.9 years (range, 50-66 years). Mean initial weight was 128.8 kg, and initial BMI, 44.29. Ninety-two percent of the patients had 1 or more coexisting comor-

### Table 1. Preoperative Demographics for 320 Patients*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group A, Aged 18-49 y, n = 252</th>
<th>Group B, Aged ≥50 y, n = 68</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age, y</td>
<td>29.42</td>
<td>55.85</td>
</tr>
<tr>
<td>BMI</td>
<td>48.25</td>
<td>44.29†</td>
</tr>
<tr>
<td>Excess weight, kg</td>
<td>66.4</td>
<td>58.3†</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>239 (94.4)</td>
<td>62 (91.7)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>187 (74.2)</td>
<td>48 (70.5)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>38 (15.0)</td>
<td>20 (29.4)</td>
</tr>
<tr>
<td>Insulin dependent diabetes mellitus</td>
<td>15 (5.9)</td>
<td>9 (13.2)</td>
</tr>
<tr>
<td>Pulmonary disease</td>
<td>57 (22.6)</td>
<td>28 (41.1)</td>
</tr>
<tr>
<td>Degenerative joint disease</td>
<td>63 (25.0)</td>
<td>42 (61.7)</td>
</tr>
<tr>
<td>Gastritis</td>
<td>41 (16.2)</td>
<td>21 (30.8)</td>
</tr>
<tr>
<td>Reflux disease</td>
<td>39 (15.4)</td>
<td>12 (17.6)</td>
</tr>
<tr>
<td>Previous abdominal operation</td>
<td>55 (21.8)</td>
<td>28 (41.1)</td>
</tr>
</tbody>
</table>

*Data are numbers (percentages) unless indicated otherwise. BMI indicates body mass index, calculated as weight in kilograms divided by the square of height in meters.
†Not significant.
bilities (Table 1). All patients were treated using a laparoscopic approach. In 1 group B patient, we were unable to complete the operation laparoscopically owing to a difficult anatomical situation (BMI=64), as our standard laparoscopic instruments were of inadequate length. Therefore, the operation was abandoned and the patient treated with an endoscopically placed intragastric balloon (BioEnterics). Once the patient achieves a weight loss of 30 to 40 kg, laparoscopic banding will be attempted once again. The mean length of hospital stay for all patients was 4.5 days, including admission 1 day before surgery and then 3 days of postoperative recovery time with hospital discharge on postoperative day 3. Deep venous thrombosis and pulmonary embolus prophylaxis consisted of perioperative compression stockings and low-dose subcutaneous heparin. All patients received a postoperative Meglumine diatrizoate (gastrografin) swallow and consultation with a dietitian during which an appropriate understanding of the rules regarding nutritional fluid intake was established.

**WEIGHT LOSS**

Complete follow-up was obtained from all patients. The mean follow-up time was 18 months (range, 6-36 months). All 320 patients had a regular consultation once monthly for the first 6 months then every 3 months if no problems occurred and the weight loss continued at an appropriate rate. After 1 year the follow-up is every 6 months, and after 2 years, a control visit is planned annually. All patients received a barium swallow to evaluate pouch size after 6 months and regular psychological and dietary follow-up visits after the operation. Patient metabolism was checked every 6 months for the first 2 years to assess changes in comorbidities such as hypertension, hyperlipidemia, and diabetes mellitus. The improvement of the other coexisting comorbidities were assessed at the regular follow-up visits by asking the patient directly and using an additional multiple-question patient survey. The follow-up strategy was identical for all patients. After 1 month the balloon is filled for the first time with 2 mL of iopamidol (Iopamiro 200; Astra Pharmaceuticals, Malmö, Sweden), and then, according to the weight loss, every month an additional 1 mL is added depending on the patient’s comfort and weight loss objectives. We tend to fill the bands with no more than 8 mL. The total amount of liquid injected should not exceed 8 to 9 mL. For the older patients (group B), the average total weight loss was 4.3 kg per month for the first 3 months and 31 kg after 1 year. The average body weight 1 year after the operation was 97.8 kg (Figure 2). Body weight reduction was slightly accelerated during the first 3 months, followed by a linear decline thereafter. The EW loss was 68% after 12 months and 71% after 24 months (Figure 3). For the younger patients (group A), the weight loss was 5.6 kg per month for the first 3 months and 36 kg after 1 year (Figure 2). The acceleration in the first 3 postoperative months and linear decline thereafter were similar in both groups. The EW loss after 12 months was 71% and after 24 months, 75% for group A (Figure 3). The BMI for group A was 33.5 after 1 year and 29.5 after 2 years.

For group B, the BMI was 32 after 1 year and 28 after 2 years (Figure 4). There is no statistical difference between the 2 groups in terms of weight loss.

**EARLY AND LATE POSTOPERATIVE PROBLEMS**

Postoperative complications that required additional therapy or reoperation occurred in 7 patients (10.2%) in group B (Table 2). In group A, the postoperative complications were initially higher with 18 port disconnections (7.1%) and 3 early pouch dilatations (1.2%). Additionally, 4 intragastral band migrations (1.5%) and 6 band leakages (2.3%) requiring laparoscopic band replacements occurred. In both groups the most common complication adjusted to the number of patients was port
disconnection. Since we changed the port position to a higher location on the sternum requiring an additional incision, this complication has virtually vanished. In group B, 5 disconnections (7.3%) at the port site between the tube and reservoir occurred. All port disconnections were treated by reconnection under local anesthesia. In 1 additional case (1.4%), the band had to be replaced owing to leakage. With the SAGB, we have had no late pouch dilatation so far (a prolapse of the stomach through the band), which leads initially to increased capacity and then to obstruction as the proximal pouch rotates. The most serious late postoperative problem encountered was 1 case (1.4%) of intragastral migration of the gastric band in group B compared with 4 cases (1.5%) in group A. This occurred in the group B patient 18 months after the operation and is felt to be unrelated to the patient’s age. This patient presented with sudden weight gain and the ability to eat without restriction. We theorize that overfilling or rapid filling of the band or band infection originating from an infected port can cause erosion of the gastric wall and subsequent band migration. The band was removed via an endoscopic approach with gastroscopic division and removal of the band. The reservoir was removed under local anesthesia (Table 2). No additional laparoscopic reoperations or laparotomies were necessary.

One patient in group B and 6 patients in group A underwent a laparoscopic cholecystectomy after the SAGB owing to symptomatic cholelithiasis. In all of our patients, laparoscopic cholecystectomy is the most common secondary intra-abdominal procedure. Both patient groups had various secondary plastic surgery procedures consisting mostly of abdominoplasties and breast reconstructions. No other complications associated directly with the gastric banding operation have occurred thus far.

**COMORBIDITIES**

All patients in both groups reported marked improvement of their accompanying diseases ($P<.007$). Of the 48 group B patients with hypertension, 38 (79.1%) reported improved blood pressure control with a decreased need for antihypertensive medication, and in group A, 138 patients (73.7%) reported similar improvement. Regardless of age, all patients with insulin-dependent diabetes mellitus required less insulin after the weight reduction. All patients in group A and group B with preexisting pulmonary disorders had a marked improvement in all aspects, including medication reduction and exercise tolerance. The accompanying orthopedic problems improved in all patients, making prosthetic replacement (hip or knee) in 8 cases (group B) possible. The number of patients with reflux disease or symptoms in both groups improved postoperatively. Twenty-five patients (64.1%) in group A and 8 (66.6%) in group B had an improvement of their reflux symptoms, and in 6 group B patients, improvement of reflux esophagitis was verified endoscopically and histologically. However, 14 patients (35.8%) in group A and 4 (33.3%) in group B reported aggravated reflux symptoms. No patient without preexisting reflux esophagitis developed reflux disease postoperatively (Table 3).

**COMMENT**

Surgery as a treatment for morbid obesity must be safe and effective. Therefore, the ideal operation must have minimal risks of short- and long-term morbidity and mortality and result in good levels of permanent weight loss, significant improvement or resolution of preexisting comorbid conditions, and a good quality of life. Internationally, conventional obesity surgery consisting of vertical gastric banding or standard RYGB is now considered safe with low morbidity and mortality rates and good long-term results. Recently, there have been 2 articles on the laparoscopic approach to the RYGB showing a reduction in postoperative pain and complications, a shorter hospital stay, and a faster recovery. Still, in the article by Schauer et al, the overall postoperative complication rate is 30% (3.3% major, 27% minor) with a 68% EW loss at 12 months. In a second article by Higa et al reporting on 400 laparoscopic RYGB procedures, the major complication rate is at least 15% with EW loss of 69% after 12 months. Schauer et al report an average operating time of 260 minutes, whereas Higa et al describe operating times between 60 and 90 minutes. The lapa-
The laparoscopic SAGB is still an evolving procedure with no available long-term results. The technique has changed considerably since the early stages, and with the present high placement of the ring, the band slippage acknowledged in several early reports is less frequently reported. In our own series, this occurred only 3 times in the first 100 patients. Since we now position all bands higher, just below the gastroesophageal junction and always above the lesser sac, this complication has vanished. Additionally, the creation of a pouch size smaller than 15 mL seems to be, together with good anterior fixation, of importance. With the use of the SAGB and high band positioning, late pouch dilatation is no longer occurring. Slipping of the stomach through the fascia of the sternal body and implanted cranial onto the fascia of the sternoxiphoid union. After we experienced a high rate of disconnections at the port side, we changed the technique as described. This complication was observed no more early pouch dilatations in our patients.

The laparoscopic approach has been associated with a low frequency of postoperative complications and offers the benefit of retaining control over the degree of gastric restriction through intermittent adjustments of the band. Subsequent adjustments can be made to achieve a lower target weight, to sustain a certain weight, or to relieve the restriction during periods of serious illness or pregnancy. The gastric bypass is presently the criterion standard in the United States. However, the complication rate of these operations performed laparoscopically remains high at the moment. The operating times are significantly longer than for the SAGB procedure, for which we presently have an average operating time of 65 minutes. A prolonged laparoscopic procedure will further compress the lung owing to increased intra-abdominal pressure and can adversely affect the patient, especially in the case of older patients. Additionally, long-term follow-up is essential after a gastric bypass procedure owing to the metabolic disturbances and deficiencies induced. The SAGB as a gastric restrictive operation offers less radical surgery and fewer nutritional and metabolic deficiencies, as the anatomy of the gastrointestinal tract is not as deformed. The gastric banding operations are more readily reversed laparoscopically, if necessary, and have the potential for lower associated morbidity and mortality rates. Although long-term results are not yet available, we remain confident in this procedure, which offered an acceptable complication rate and excellent weight loss results in the short observation period. Another advantage to its being less invasive and easier to perform is that the criteria for operation are not so restrictive (ie, older patients, patients with decreased cardiac or pulmonary reserve). Clearly, further follow-up regarding long-term weight loss and weight maintenance and late complications will be necessary before this method can be recommended for routine use in bariatric surgery, but we remain optimistic about its future, based on its promising early results.

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Table 3. Comorbidity and Change

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Group B, Aged ≥50 y, No. (%) (n = 68)</th>
<th>Group A, Aged 18-49 y, No. (%) (n = 252)</th>
<th>Group B, No. (%) Improved</th>
<th>Group A, No. (%) Improved</th>
<th>Group B, No. (%) Aggravated</th>
<th>Group A, No. (%) Aggravated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperlipidemia</td>
<td>62 (91.7)</td>
<td>203 (80.5)</td>
<td>58 (93.7)</td>
<td>193 (95.2)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hypertension</td>
<td>48 (70.5)</td>
<td>187 (74.2)</td>
<td>38 (79.1)</td>
<td>138 (73.4)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>20 (29.4)</td>
<td>38 (15.0)</td>
<td>15 (75.0)</td>
<td>35 (93.0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Insulin dependent diabetes</td>
<td>9 (13.2)</td>
<td>15 (5.9)</td>
<td>9 (100.0)</td>
<td>14 (99.5)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pulmonary disease</td>
<td>28 (41.1)</td>
<td>57 (22.6)</td>
<td>28 (100.0)</td>
<td>53 (92.6)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Degenerative joint disease</td>
<td>42 (61.7)</td>
<td>63 (25.0)</td>
<td>35 (83.3)</td>
<td>60 (96.0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gastritis</td>
<td>21 (30.8)</td>
<td>41 (16.2)</td>
<td>15 (70.0)</td>
<td>21 (50.5)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Reflux disease</td>
<td>12 (17.6)</td>
<td>39 (15.4)</td>
<td>8 (66.6)</td>
<td>25 (68.5)</td>
<td>4 (33.3)</td>
<td>14 (35.8)</td>
</tr>
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REFERENCES


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