Staple-line Buttressing
Minimizing the complications

Alfons Pomp MD FACS
Disclosure

• Speaker/Consultant/Funded research
  Covidien (Tyco/Autosuture)
  W. L. Gore & Associates
  Ethicon Endosurgery
• Teaching Grant Covidien

NO RELATIONSHIP TO THIS TALK
Surgical Debating

• Set the Stage
• Show the science
• Show small case series
• Show systemic review/meta-analysis
• Conclusions
Pilot study comparing the leak pressure of the sleeved stomach with and without reinforcement

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Abstract

Background Laparoscopic sleeve gastrectomy (LSG) consists of a longitudinal resection of the stomach on the greater curvature, removing 75-80% of the stomach approximately and creating a cylindrical “sleeve”-like conduit. However, LSG can be associated with significant morbidity, and staple-line failure with dehiscence and gastric leak is one of the most severe complications. The aim of this study was to compare three different methods of gastric closure in terms of staple-line strength and leak pressures of the sleeved stomach.

Methods After performing standard stapled sleeve gastrectomies, the gastric specimens were carefully retrieved. Group 1 specimens were left with the staple line intact. In group 2, the staple line was reinforced with a 3.0 polypropylene running suture. The gastric remnants of group 3 were those in which the LSG was performed using Seaguard as the buttressing material. The burst-pressure was assessed using a portable gas sensor. The outcome parameters were: age of the patients, body mass index, Barrett’s material (nature, Seaguard, etc.), leak pressure, volume infused, and leak site, among others.

Results Thirty-six sleeve gastrectomies were included in the final analysis. Each group consisted of 12 gastric specimens. There were no differences between groups in terms of age, sex, body mass index, and patient comorbidities. The leak pressure was significantly higher in group 2 (35 ± 11.7 vs. 102 ± 21.4 vs. 47 ± 19.1; p = <0.0005). The volume of liquid required to cause the leak was much greater in group 3 (p = <0.001).

Conclusions Oversewing is the reinforcement method that increases better the staple-line strength. It is the least expensive method of reinforcement and does not increase operative times significantly.

Keywords Laparoscopic sleeve gastrectomy - Seaguard - Staple-line strength - Leak pressure - Burst strength - Staple-line leaks

Laparoscopic sleeve gastrectomy (LSG), first described as a modification of the bilipancreatic diversion, is emerging as a popular single-stage operation for the treatment of morbid obesity, with acceptable morbidity and long-term weight loss compared with the Roux-en-Y gastric bypass and adjustable gastric band [1]. LSG consists of a longitudinal resection of the stomach on the greater curvature from the antrum starting opposite of the nerve of Latarjet up to the angle of His [2], removing 75-80% of the stomach approximately and creating a cylindrical “sleeve”-like conduit [3, 4]. This way, LSG restricts the stomach’s size to induce satiety and resects fundal ghrelin-producing cells to decrease appetite [5].
Impact of surgeon experience and buttress material on postoperative complications after laparoscopic sleeve gastrectomy

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Abstract

Background Sleeve gastrectomy is gaining popularity whether as a primary, staged or revisional operation. The aim of this study is to evaluate the perioperative safety and the learning curve for laparoscopic sleeve gastrectomy (LSG).

Methods We performed a retrospective review of the prospectively collected data for all patients who underwent LSG for the treatment of morbid obesity at our institution from January 2003 to December 2008.

Results Data from 230 consecutive patients [male 47%, female 53%; mean age 44.0 ± 10.0 years, mean preoperative body mass index (BMI) 56.7 ± 11.5 kg/m²], who were operated upon by three surgeons with different degrees of bariatric experience, were analyzed. There was no 30-day mortality, but there were two cases of late mortality (0.87%). Early complications were noted in 23 cases (10.0%), including 10 cases of leak (4.3%) and 10 cases of hemorrhage (4.3%). In 17 cases (7.4%) reoperations were performed. The rates of overall and major complications did not differ among surgeons or between early and late period of experience for the three surgeons. This trend held true individually and in subgroups. Overall, over the course of the learning curve, a significant decrease in operative time was noted. The only factor that was independently associated with complications was use of buttress material; the likelihood of complications was found to be 72% lower in patients in whom buttress material was used.

Conclusions LSG constitutes a potentially safe anti-obesity procedure with acceptable morbidity. Experience at the beginning can be discouraging, even for surgeons with advanced laparoscopic skills. LSG can be performed safely, with proper mentoring and in appropriate settings, even by less experienced bariatric surgeons. The use of staple-line reinforcement was associated with improved perioperative outcomes, and it should be considered in an attempt to decrease leaks.

Keywords Bariatric surgery · Sleeve gastrectomy · Complications · Learning curve · Staple-line reinforcement · Buttress material

Laparoscopic sleeve gastrectomy (LSG) has been indicated as a definitive treatment in patients with BMI >35 kg/m² or BMI >30 kg/m² associated with comorbidities, and it has also been proposed for patients with moderate obesity BMI <35 kg/m² and metabolic syndrome [1–3]. Although classified as a restrictive procedure, sleeve gastrectomy (SG) appears to be more than just a gastric restrictive operation, because with the removal of the gastric fundus the number of enteroendocrine cells that produce the hormone ghrelin is significantly reduced [4]. Thus, SG is not only a multipurpose operation but also a multifactorial one, with a restrictive aspect and a complex neurohormonal aspect, not yet fully elucidated [5–7].

Patients experience excellent weight loss after SG alone, and multiple recent reports have documented SG as a single therapy for the treatment of morbid obesity [8, 9].
Surgical Strategies That May Decrease Leak After Laparoscopic Sleeve Gastrectomy

A Systematic Review and Meta-Analysis of 9991 Cases

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Objective: To conduct a systematic review to identify surgical strategies that may decrease leak after laparoscopic sleeve gastrectomy (LSG).

Background: LSG is growing in popularity as a primary bariatric procedure. Technical aspects of LSG including bougie size remain controversial.

Methods: Our systematic review yielded 112 studies encompassing 9991 LSG patients. A general estimating equation (GEE) model was used to calculate the odds ratio (OR) for leak based on bougie size, distance from the pylorus, and use of buttressing on the staple line. Baseline characteristics, including age and body mass index (BMI), were included. A linear repeated measures regression model compared excess weight loss (EWL) between bougie sizes.

Results: A total of 188 papers (22%) were identified. The GEE model revealed that the risk of leak decreased with bougie ≥40 Fr (OR = 0.53, 95% CI [0.37–0.77], P = 0.0009). Buttressing did not impact leak. There was no difference in %EWL between bougie ≥40 Fr and bougie ≥40 Fr up to 8 months (mean: 71% EWL, P = 0.274). Distance from the pylorus did not affect leak or %EWL. The GEE model revealed that the risk of leak decreased with bougie ≥40 Fr (OR = 0.53, 95% CI [0.37–0.77], P = 0.0009). Buttressing did not impact leak. There was no difference in %EWL between bougie ≥40 Fr and bougie ≥40 Fr up to 8 months (mean: 71% EWL, P = 0.274). Distance from the pylorus did not affect leak or %EWL.

Conclusions: Utilizing bougie ≥40 Fr may decrease leak without impacting %EWL up to 8 months. Distance from the pylorus does not impact leak or weight loss. Buttressing does not seem to impact leak, however, if aggressive desire to buttress, biodegradable material is the most common type used. Long-term studies are needed to definitively determine the effect of bougie size on weight loss after LSG.

Keywords: bougie, leak, outcomes, sleeve gastrectomy

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METHODS

A comprehensive literature search was conducted adhering to the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) 2009 Guidelines, using the databases PubMed, MEDLINE via Ovid, Embase, Scopus, Web of Knowledge, Cochrane Library, CINAHL, and LILACS for articles published in English that included the terms gastric sleeve, sleeve gastrectomy, vertical gastrectomy, or laparoscopic gastrectomy. The search was conducted in June 2013 and was not limited to any date range. A total of 354 articles were identified and 919 articles remained after duplicates were removed (Fig. 1).

The titles and abstracts of the retrieved articles were screened for applicability. Animal studies, review articles, and articles not on the topic of LSG were excluded. The full text of the remaining 255 articles was reviewed for eligibility. Only studies that contained more than 5 patients, reported bougie size and either postoperative weight or leak rate, and did not contain overlapping data were included in the quantitative analysis. The vast majority of studies were retrospective studies.

Definitions

For the purposes of this study, in addition to “leak,” the terms “staple line,” “staple line failure,” or “disruption,” “infected perigastric hematoma,” and “gastro-gastric fistula” were all categorized as leak. Sterile perigastric hematoma was not considered a leak. Weight loss was reported by most studies as percent excess weight loss (%EWL), postoperative body mass index (BMI), and percent excess BMI loss. Most studies did not clarify the formula used for ideal body weight to calculate %EWL.

Statistical Methods

All data manipulation and analyses were conducted using SAS version 9.2. To describe the overall population, the characteristics...
FIGURE 4. Effect of technique on leak rate: A, bougie size; B, distance from the pylorus; C, use of buttressing; and D, type of buttressing.

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td><strong>Bougie size</strong></td>
<td></td>
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<tr>
<td>&lt;40 Fr (reference)</td>
<td>1.00</td>
<td>0.88–1.14</td>
<td>0.97</td>
<td>1.00</td>
<td>0.88–1.14</td>
<td>0.97</td>
</tr>
<tr>
<td>40–49 Fr</td>
<td>0.96</td>
<td>0.85–1.10</td>
<td>0.86</td>
<td>0.96</td>
<td>0.85–1.10</td>
<td>0.86</td>
</tr>
<tr>
<td>≥50 Fr</td>
<td>0.88</td>
<td>0.77–1.02</td>
<td>0.17</td>
<td>0.88</td>
<td>0.77–1.02</td>
<td>0.17</td>
</tr>
<tr>
<td><strong>Distance to the pylorus</strong></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>&lt;5 cm (reference)</td>
<td>1.00</td>
<td>0.89–1.13</td>
<td>0.99</td>
<td>1.00</td>
<td>0.89–1.13</td>
<td>0.99</td>
</tr>
<tr>
<td>≥5 cm</td>
<td>1.13</td>
<td>1.03–1.24</td>
<td>0.015</td>
<td>1.13</td>
<td>1.03–1.24</td>
<td>0.015</td>
</tr>
<tr>
<td><strong>Use of buttressing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Bioabsorbable (reference)</td>
<td>1.00</td>
<td>0.88–1.13</td>
<td>0.99</td>
<td>1.00</td>
<td>0.88–1.13</td>
<td>0.99</td>
</tr>
<tr>
<td>No buttressing, no stents</td>
<td>1.20</td>
<td>0.99–1.45</td>
<td>0.07</td>
<td>1.20</td>
<td>0.99–1.45</td>
<td>0.07</td>
</tr>
<tr>
<td>Nonabsorbable buttressing</td>
<td>1.24</td>
<td>1.04–1.49</td>
<td>0.02</td>
<td>1.24</td>
<td>1.04–1.49</td>
<td>0.02</td>
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<tr>
<td><strong>Age</strong></td>
<td></td>
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<td></td>
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<tr>
<td>Mean age &lt;40</td>
<td>0.99</td>
<td>0.94–1.04</td>
<td>0.51</td>
<td>0.99</td>
<td>0.94–1.04</td>
<td>0.51</td>
</tr>
<tr>
<td>Mean age 40–44</td>
<td>0.97</td>
<td>0.92–1.03</td>
<td>0.47</td>
<td>0.97</td>
<td>0.92–1.03</td>
<td>0.47</td>
</tr>
<tr>
<td>Mean age 45–54</td>
<td>0.96</td>
<td>0.91–1.02</td>
<td>0.50</td>
<td>0.96</td>
<td>0.91–1.02</td>
<td>0.50</td>
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<tr>
<td>Mean BMI</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mean BMI &lt;45</td>
<td>1.02</td>
<td>0.95–1.09</td>
<td>0.72</td>
<td>1.02</td>
<td>0.95–1.09</td>
<td>0.72</td>
</tr>
<tr>
<td>Mean BMI 45–49</td>
<td>1.04</td>
<td>0.97–1.12</td>
<td>0.18</td>
<td>1.04</td>
<td>0.97–1.12</td>
<td>0.18</td>
</tr>
<tr>
<td>Mean BMI 50+</td>
<td>1.05</td>
<td>0.98–1.13</td>
<td>0.16</td>
<td>1.05</td>
<td>0.98–1.13</td>
<td>0.16</td>
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TABLE 1. GEE Model Adjusting for the Effect of Bougie Size, Distance From the Pylorus, and the Use of Buttressing on Leak Rate While Controlling for Age and BMI.
Conclusions

• Current evidence includes a large volume of case series data, matched cohort studies and small randomized trials
• LSG is an effective weight loss procedure that can be performed safely as a first stage or primary procedure
• Favorable risk profile for high and low risk groups
• Weight loss and comorbidity reduction that is comparable to or exceeds other restrictive procedures
• Evidence suggests gut hormone mechanisms in addition to restriction
• Limited 5 year data has demonstrated durability