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Impact of Fellowship Training on the Learning Curve for Laparoscopic Gastric Bypass

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Background: We have previously shown that the learning curve for laparoscopic Roux-en-Y gastric bypass (LRYGBP) is approximately 75 cases. Patients have worse outcomes during the learning curve. Our aim was to evaluate the impact of fellowship training on outcomes during a surgeon's early experience with LRYGBP.

Methods: The study population consisted of the first 75 consecutive LRYGBP operations attempted by two laparoscopic surgeons, one with laparoscopic gastric bypass fellowship training (Group A) and one without laparoscopic bypass fellowship training (Group B). Outcome parameters included mortality, major perioperative complications, operative time, and conversion to an open operation.

Results: Age, BMI, and gender distribution were similar in both groups. Operative time was significantly longer in Group B (189 min. vs 122 min., *P*<0.05). Conversion to an open procedure occurred uncommonly in both groups (3%). Major complications occurred more frequently in Group B (13% vs 8%, *P*=NS). In addition, the complications in Group B were more severe, resulting in 2 deaths. No deaths occurred in Group A.

Conclusion: Laparoscopic gastric bypass fellowship training improves perioperative outcomes during a surgeon's early experience with LRYGBP.

Key words: Morbid obesity, bariatric surgery, laparoscopic gastric bypass, complications, learning curve

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Introduction

Laparoscopic Roux-en-Y gastric bypass (LRYGBP) is a technically challenging operation with a long learning curve. We and others have previously shown that the learning curve is approximately 75-100 operations, and that the learning curve is associated with prolonged operative times and increased major complication rates.[1,2] Our aim was to determine how fellowship training impacts perioperative outcomes during a surgeon's early experience with LRYGBP.

Materials and Methods

The study population consisted of two groups of 75 patients. Each group was comprised of the initial 75 LRYGBP operations attempted by one of two surgeons. One surgeon (Group A) was LRYGBP fellowship trained and the other surgeon (Group B) was not LRYGBP fellowship trained. We compared groups of 75, because we previously demonstrated that the learning curve for LRYGBP is approximately 75 procedures.[1]

All patients met the minimal criteria for bariatric surgery proposed by the NIH Consensus Development Panel report of 1991.[3] Patients having a history of previous bariatric operations or previous gastric surgery were excluded. Patients were not selected based on upper BMI limits, history of previous abdominal operations, or gender. Preoperative work-up and specialty medical consultations were

dictated by individual patient need.

The Group A surgeon completed a 1-year laparoscopic surgery fellowship. During this year surgeon A participated in 130 LRYGBP operations. He assisted on the first 30 operations, performed the small bowel portion of the operation on the next 50, and performed the gastric portion of the operation on the final 50. Group A was comprised of the initial 75 LRYGBPs attempted after the completion of the fellowship.

The Group B surgeon did not complete a laparoscopic surgery fellowship. Surgeon B did, however, have experience with advanced laparoscopic surgical procedures. Before starting LRYGBP, surgeon B routinely performed laparoscopic cholecystectomy (>100 cases), laparoscopic inguinal (approximately 50 cases) and ventral hernia repair (approximately 15 cases), and laparoscopic Nissen fundoplication (approximately 30 cases). Surgeon B also performed laparoscopic colectomy (approximately 10 cases), laparoscopic splenectomy (approximately 10 cases), and laparoscopic adrenalectomy (3 cases). Before performing LRYGBP on humans, surgeon B performed 20 open gastric bypasses, completed a nationally recognized 2-day LRYGBP course, and performed 10 LRYGBPs on pigs.

Data were collected retrospectively by chart review. Parameters recorded included patient demographic factors, co-morbidities, operative times, need for conversion to an open procedure, and perioperative complications. Operative times were recorded only for those patients who underwent LRYGBP without other procedures, such as cholecystectomy. Operative times were defined as the time between the initial skin incision and the final skin suture. Significant co-morbidities of obesity were considered to be hypertension, coronary artery disease, dyslipidemia, obstructive sleep apnea / hypoventilation syndrome of obesity, and diabetes. Perioperative complications were considered to be complications occurring within 30 days of surgery. Gastrointestinal leaks, pulmonary emboli, bowel obstructions requiring operation, bleeding resulting in hemodynamic instability or blood transfusion, and any other complication requiring an operation or a significantly prolonged hospital stay were considered to be major complications.

Operative Technique

The operative techniques utilized in the patient population were not constant. Changes were made periodically by both surgeons in an attempt to make the operation safer and easier. The general techniques used were as follows: abdominal access was obtained using either a direct view 12-mm trocar without insufflation (Group A) or a Veress needle in the left upper quadrant (Group B). A total of five ports were routinely used. The jejunum was divided 40-60 cm distal the ligament of Treitz and the Roux limb was constructed to be 75-175 cm in length. A stapled jejunojejunostomy was made. The gastric pouch was constructed to be <30 cc. The gastrojejunostomy was done with a 21-mm circular stapler after transabdominal placement of the anvil. A closed suction drain was left adjacent to the gastrojejunostomy in all patients.

Changes made by surgeon B in operative technique during his first 75 procedures included changing from transoral to transabdominal passage of the circular stapler anvil (after 30 cases), changing from an antecolic to retrocolic Roux limb course (after 30 cases), and making a more careful effort to completely close the transverse mesocolic defect using nonabsorbable sutures. Changes made by surgeon A included changing from a retrocolic to an antecolic Roux limb course after 18 procedures.

Data Analysis

Outcome parameters assessed included mortality, operative time, conversion to an open procedure, and complications. Data were analyzed using analysis of variance for groups of continuous variables and the chi-square analysis, or Fisher's exact test, when appropriate, for categorical variables. A probability of <0.05 was accepted as statistically significant.

Results

The study population consisted of two groups of 75 patients. Demographic details of the two groups are shown in Table 1. Age, ratio of female to male patients, BMI, and co-morbidity rates were not sig-

Table 1. Patient demographics

Patient Group	Age*	Female*	BMI*	Co-morbidity*
Group A (n=75)	39 (14-60)	83%	46 (35-65)	56%
Group B (n=75)	40 (24-64)	77%	49 (37-86)	53%

**P*=NS between groups, age and BMI expressed as mean values with the range in parentheses.

nificantly different between the groups.

Two laparoscopic procedures (conversion rate 2.7%) in each group were converted to open procedures (Table 2). All conversions were necessary to remedy errors made during laparoscopy. In Group A, conversions were necessary after stapling across the nasogastric tube adjacent to the gastroesophageal junction (patient 9) and for a difficult adhesiolysis (patient 66). In Group B, conversions were necessary to repair a hole made in the vena cava (patient 8) and to revise a twisted Roux limb (patient 47).

The mean operative time in Group A (122 minutes) was 67 minutes less than the mean operative time in Group B (188 minutes) (Table 2). This difference was statistically significant ($P<0.05$).

Fewer major complications occurred in Group A (8% vs 13%, *P*=NS) (Table 2). The difference between the groups, however, was not statistically significant. Postoperative bleeding resulting in hemodynamic instability or transfusion was the most frequent major complication in each group, occurring in 4% of Group A patients and 5% of Group B patients. A variety of other complications occurred in both groups (Table 3). Of note, leaks and pulmonary emboli did not occur in Group A. One leak and one pulmonary embolism occurred in Group B.

Table 2. Outcome parameters

Patient Group	Mortality[1]	Major Cx[1]	Conversion[1]	OR Time[2]
Group A (n=75)	0%	8%	2.7%	122
Group B (n=75)	2.7%	13%	2.7%	189

Cx – Complication, OR – operative, OR times expressed as mean values in minutes.
[1]*P* = NS, [2]*P* < 0.05

Table 3. Major complications

Major Complications	Group A (n=75)	Group B (n=75)
Leak	0	1*
Roux Limb Necrosis	0	1*
Vena Cava Injury	0	1
Pulmonary Embolism	0	1
Bowel Obstruction	2	1
Bleeding	3	4
Major Wound Infection	0	1
Gallstone Pancreatitis	1	0

*Complication resulted in death

The complications that occurred in Group A were also of less severity than the complications in Group B (Table 3). Two of the patients in Group B died because of their complications, whereas no patients in Group A died. One death occurred in a 25-year-old female with a BMI of 46 (patient 12) who developed Roux limb necrosis. The second death occurred in a 45-year-old male with a BMI of 69 (patient 29) who developed a leak at the jejunojejunostomy. Mortality rates were not significantly different between the groups (0% vs 2.7%, *P*=NS).

Discussion

Laparoscopic gastric bypass is a difficult operation to perform well. The operation is comprised of many complicated steps that have a small margin for error. Additionally, there are patient-specific variables such as intra-abdominal fat and hepatomegaly that further complicate the successful completion of the operation. The result is that it takes a lot of practice before LRYGBP can reliably be performed well. This translates into a long learning curve during which patients could be subjected to poor outcomes.

We have previously shown that the learning curve for a surgeon skilled in advanced laparoscopy is approximately 75 operations.[1] During the learning curve, we demonstrated significantly higher major complication rates and significantly prolonged operative times.[1] Others have shown a similar learning

curve effect. Schauer et al[2] reported elevated complication rates and prolonged operative times over their initial 100 LRYGBP procedures.[2]

The importance of the learning curve is its association with bad outcomes. Being exposed to the intricacies of LRYGBP in the presence of an experienced surgeon would be expected to minimize major complications due to errors in operative technique. Fellowship training and extended mentoring are ideal methods to accomplish this.

This study suggests that fellowship training improves outcomes during a surgeon's early experience. Our data demonstrate that fellowship training decreases operative time by 35% and decreases major complication rates by 38% over a surgeon's initial 75 LRYGBP procedures. Many of the complications in Group B were likely the result of inexperience, such as Roux limb necrosis, vena cava injury, and major wound infection which occurred after conversion to repair a twisted Roux limb. Moreover, the complications in Group B were more severe, resulting in two deaths. No deaths occurred in Group A.

Pulmonary embolism and gastrointestinal leak are two of the most feared complications after bariatric surgery. Both occurred with low frequency in this study (Table 3). Others have reported gastrointestinal leak to occur more commonly early in a surgeon's experience. Schauer et al[2] reported five leaks in their initial 50 LRYGBPs and no leaks in their third group of 50 patients.[2] Wittgrove and Clark[4] reported a 3% leak rate over their initial 300 LRYGBPs and a 1% rate subsequently. Although we were unable to demonstrate this in the current study, it seems reasonable to expect fellowship training to result in lower leak rates.

Conclusion

The learning curve for LRYGBP is long and is associated with elevated major complication rates and prolonged operative times. Our data suggest that fellowship training decreases major complication rates and operative times during a surgeon's early experience with LRYGBP.

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Comment

The authors present a comparison of the results during the learning curve in a surgeon trained in a laparoscopic bariatric surgery fellowship and in a surgeon previously skilled in laparoscopic technique who attended multiple laparoscopic bariatric surgery courses. The former surgeon experienced a major part of the learning curve (and mortality prevention) during the fellowship. In comparing two surgeons, there are other, independent variables which may affect outcome. These include being meticulous, technical agility, innate hand-eye coordination, judgment, quality of the training program, multidisciplinary support, hospital equipment, luck, etc. Such confounding factors affect a comparison of the results of two surgeons. Thus, the above study serves as a "pilot", and requires two sizeable groups of surgeons representing each cohort for a comparison.

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