

# The effect of intensive preconditioning and close follow-up on bariatric surgery outcomes: Does multidisciplinary care contribute to positive results whether a gastric bypass or sleeve gastrectomy is performed?

Study results indicate that supporting patients who receive laparoscopic bariatric surgery can help with excess weight loss and improve both medical comorbidities and quality of life.

## ABSTRACT

**Background:** An estimated 1.7 billion people worldwide are affected by obesity-related comorbidities such as cardiovascular disease and diabetes. Bariatric surgery is recognized as an effective treatment for morbid obesity. A study of patients at a BC clinic was undertaken to determine if combining bariatric surgery with comprehensive care provided by a multidisciplinary team improves postoperative outcomes.

**Methods:** Patients were observed prospectively from a preoperative baseline and throughout 1 year of postoperative follow-up. Before surgery, patients participated in a comprehensive, structured, multidisciplinary program with a focus on education and counseling. Patients underwent either Roux-en-Y gastric bypass or sleeve gastrectomy. Close postoperative support was provided on an ongoing basis. Outcomes investigated included weight loss (ex-

cess weight loss, absolute weight loss, BMI) and improvements related to type 2 diabetes, hypertension, and quality of life. Results were stratified and compared based on the type of laparoscopic surgery performed.

**Results:** Results were similar for both types of bariatric surgery performed. The mean excess weight loss for all patients was 43.0 kg or 74.2% of excess weight. Beginning with a mean BMI of 49.7, patients in the study achieved a mean BMI of 33.3 at 1 year. Many patients experienced improvements in obesity-related comorbidities: 34 of 35 patients with type 2 diabetes were able to reduce or cease treatment, and 27 of 44 patients with hypertension were able to reduce or cease treatment. Responses to the Impact of Weight on Quality of Life questionnaire showed significant postoperative improvement in patient quality of life.

**Conclusions:** Patients who received laparoscopic bariatric surgery after intensive preconditioning had superior outcomes for weight loss, comorbidity, and quality of life when compared with patients from similar studies with similar time frames. Furthermore, with the use of intensive preconditioning and close, multidisciplinary follow-up, the outcomes were nearly identical for patients receiving gastric bypass and sleeve gastrectomy. This finding differs from those obtained in the majority of previous studies, which have demonstrated superiority for gastric bypass. We postulate that the multidisciplinary focus of our program improves outcomes of surgery generally and also reduces the discrepancy between outcomes for the two bariatric surgery options. Long-term follow-up is required to ascertain the durability of the weight loss and comorbidity and quality-of-life improvements from bariatric surgery with intensive preconditioning and multidisciplinary follow-up.

*This article has been peer reviewed.*

## Background

An estimated 1.7 billion people worldwide are affected by obesity (BMI greater than 30 kg/m<sup>2</sup>).<sup>1</sup> In Canada, 59% of adults are overweight<sup>2</sup> and 25% of these adults are obese. In British Columbia, 59% of adults are overweight and 20% of these are obese.<sup>3</sup> Morbid obesity (BMI greater than 40) is associated with comorbidities such as cardiovascular disease, diabetes, hypertension, hypercholesterolemia, hypercoagulability, cancer, and obstructive sleep apnea.<sup>4-7</sup> The total direct cost of obesity and related comorbidities in Canada in 2005 was estimated to be over \$4.3 billion, or 2.4% of total health care expenditures.<sup>8</sup> The main contributors to this cost were hypertension, coronary artery disease, and type 2 diabetes.<sup>8</sup>

Bariatric surgery is recognized as effective for managing morbid obesity and improving obesity-related

comorbidities.<sup>3</sup> Multiple studies in North America and Europe have demonstrated sustainable excess weight loss from bariatric surgery, along with mortality reduction from cardiovascular events, and improvement or resolution of obesity-related comorbidities.<sup>9,10</sup>

ciplinary care before, during, and after surgery. After initial assessment, patients participate in coursework and counseling (preconditioning) in order to prepare them for successful and durable outcomes after surgery. Counseling is provided by a dietitian, an occupational therapist, an exercise

**In British Columbia, 59% of adults are overweight and 20% of these are obese.**

---

Dr Matthew is a general surgery resident (PGY-6) at the University of British Columbia in the Department of Surgery, Division of General Surgery. Ms Flesher is the regional planning lead for VCH/PHC Surgical Programs. Dr Sampath is director of the Richmond Hospital Metabolic and Bariatric Surgery Program and a clinical instructor at UBC in the Department of Surgery, Division of General Surgery. Dr Nguyen is a general, bariatric, and metabolic surgeon with the Richmond Hospital Metabolic and Bariatric Surgery Program and a clinical instructor at UBC in the Department of Surgery, Division of General Surgery. Dr Alizadeh-Pasdar is a bariatric dietitian at Vancouver Coastal Health, Garratt Wellness Centre, and a sessional instructor at UBC in the Faculty of Land and Food Systems; Food, Nutrition, and Health Program. Ms Barclay is an occupational therapist at Vancouver Coastal Health, Richmond Hospital, and a clinical instructor at UBC in the Faculty of Medicine, Department of Occupational Science and Occupational Therapy.

The two bariatric surgery options available to patients at the Richmond Metabolic and Bariatric Surgery clinic are Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy (SG). Both surgery types are performed using laparoscopic technique. Studies have demonstrated an average percentage excess weight loss of between 38% and 62%<sup>11</sup> and an improved BMI of 35 to 37 following these bariatric procedures. Similarly, obesity-related comorbidities have been shown to improve following surgery in 80% of patients with type 2 diabetes,<sup>11</sup> 70% of patients with hypertension,<sup>12</sup> and 44% to 67% of patients with obstructive sleep apnea.<sup>13-18</sup>

While many bariatric surgery clinics use a multidisciplinary team approach, surgery is often the primary focus. At the Richmond Metabolic and Bariatric Surgery clinic, patients receive intensive, focused multidis-

ciplinary care before, during, and after surgery. After initial assessment, patients participate in coursework and counseling (preconditioning) in order to prepare them for successful and durable outcomes after surgery. Counseling is provided by a dietitian, an occupational therapist, an exercise physiologist, a psychiatrist (as needed), and a surgeon in both group and individual settings. Patients are required to read bariatric literature written by team members and successfully complete focused coursework before they are cleared for surgery. Three separate courses have been designed for the program. The first is a basics of nutrition course. The second is a bariatric cooking course. The third is a group cognitive behavioral therapy course.

Perioperatively, patients are followed closely by an inpatient medical team, including an ICU specialist, an internal medicine physician, an anesthesiologist, and a bariatric surgeon.

From March to June 2013 research was undertaken to determine if combining bariatric surgery with preconditioning and comprehensive multidisciplinary care improves post-operative outcomes.

## Methods

Ethics approval was obtained from the University of British Columbia Clinical Research Ethics Board and the Vancouver Coastal Health Richmond Research Advisory Committee. To be included in the study, patients had to be 19 years of age or older, have a preoperative BMI of 40 or higher, have demonstrated a baseline capacity to participate in preconditioning

daily food and activity journal and attend all appointments. All patients were assessed by a respirologist/respiratory therapist and internal medicine specialist. Referral to the team bariatric psychiatrist was made if the mental health screening questionnaire indicated this was needed. All patients were required to be nonsmokers and to sign a contract of commitment to this and other lifestyle modifications

prospectively for treatment regimen changes. Patient quality of life was measured using the Impact of Weight on Quality of Life (IWQOL-Lite), a validated obesity-specific questionnaire<sup>19</sup> that determines how obesity affects self-esteem, work, physical function, sexual life, and public distress.<sup>20</sup> Patients were asked to complete the IWQOL-Lite before surgery and at 6 months after surgery. Results were compared using the IWQOL-Lite scoring manual.

**From 44 patients requiring medical management of hypertension, 22 patients (50%) were able to completely cease treatment with oral antihypertensives and a further 5 patients (11%) were able to reduce treatment at 1 year.**

and multidisciplinary assessment, and have received either a RYGB or SG laparoscopically at the Richmond Hospital. Patients who had received a laparoscopic gastric band previously were excluded from the study. All patients recruited for the study signed consent forms allowing access to their anthropometric information, laboratory tests, medication records, and quality-of-life questionnaire results. All data were collected retrospectively from a patient chart review.

Preoperatively, all patients received multidisciplinary preconditioning care, which included individualized dietary counseling and group nutrition counseling, group cooking classes, group cognitive behavioral therapy, occupational therapy counseling, and activity counseling from a certified exercise physiologist. All patients were required to maintain a

for the duration of the program. Patients were not randomized to receive a specific surgery type, and were counseled on surgical options preoperatively. Ultimately patients played a role in choosing which type of surgery they were to receive.

Perioperatively, all patients were assessed daily by the bariatric surgeon assigned to their case, and assessed by an internal medicine physician and an anesthesiologist. Postoperatively, patients had strict, scheduled follow-up with each member of the multidisciplinary team at 2 weeks, 1 month, 3 months, 6 months, and 1 year.

Anthropometric measures considered for weight loss were excess weight loss, absolute weight loss, and BMI change. Patients with type 2 diabetes were assessed prospectively for treatment regimen changes. Patients with hypertension were also assessed

## Results

Of 100 patients recruited, 91 (80 females, 11 males) completed all follow-up visits, blood tests, or both. Complications observed in postoperative patients during 1 year of follow-up were rare, and no deaths occurred during the follow-up period. Two patients had a postoperative bleed requiring a blood transfusion (both RYGB patients). One patient developed a gastrojejunostomy stricture that required management with endoscopic dilatations, and eventually revisional surgery (RYGB). One patient developed a stricture that responded to endoscopic dilatations (SG). One patient developed a zinc deficiency that was managed nutritionally (SG). One patient developed a laparoscopic port-site hernia that required elective operative repair (RYGB). No major infections (superficial/intra-abdominal) were observed in any patient. Overall, the complication occurrence rate encountered in this study cohort was less than the expected rate for laparoscopic bariatric surgery.<sup>10,11</sup>

### Anthropometrics and quality of life (baseline)

Before surgery, patients had a mean BMI of 49.7 (range 35.9 to 70.9). Patients who underwent either a Roux-en-Y gastric bypass (42 patients) or a sleeve gastrectomy (49 patients) had

similar anthropometric measures for BMI and weight changes before surgery (Table 1). An average 10.7 kg weight loss was recorded from enrollment to 1 week before surgery. The IWQOL-Lite questionnaire was completed in full before surgery by 40 of the patients and the baseline mean score was 77.8, with a higher score indicating a poorer quality of life.

**Medical comorbidities (baseline)**

The medical comorbidities found on enrollment and followed in this study were type 2 diabetes (34 of 91 patients) and hypertension (52 of 91 patients). No patients with a diagnosis of type 1 diabetes were included in the study.

Of 34 patients with diabetes, 33 required treatment at baseline with at least one antihyperglycemic agent (biguanides or sulfonylureas), 7 required treatment with both insulin and antihyperglycemic agents, and 1 patient was treated solely with insulin. Baseline glycolated hemoglobin (HbA1c) levels were also recorded for all patients participating in the study, whether they were diagnosed with diabetes or not. The mean HbA1c level for the entire study cohort at baseline was 7.7% (RYGB 7.5%, SG 7.9%). The mean HbA1c level for all patients with diabetes at baseline was 8.3% (RYGB 8.2%, SG 8.5%).

Of 52 patients with hypertension at baseline, 8 patients were managed conservatively with diet and lifestyle modifications, while 44 required pharmaceutical management and had been prescribed at least one antihypertensive agent (ACE inhibitor/ARB, diuretic, beta-blocker, or calcium-channel blocker).

**Anthropometrics and quality of life (follow-up)**

All study participants had postoperative follow-up visits with a surgeon,

**Table 1. Enrollment and preoperative anthropometric measures for 91 bariatric surgery patients.**

Anthropometric measures	Roux-en-Y gastric bypass (n = 42)	Sleeve gastrectomy (n = 49)	Both groups
Enrollment BMI (kg/m <sup>2</sup> )			
Mean	49.7 ± 2.8	49.8 ± 3.4	49.7 ± 3.1
Range	35.9–65.6	37.5–70.9	35.9–70.9
Enrollment weight (kg)			
Mean	136.6 ± 12.6	143.1 ± 11.3	140.1 ± 12.5
Range	92.0–185.0	100.0–223.0	92.0–223.0
Weight 1 week before surgery (kg)*			
Mean	126.5 ± 11.4	132.3 ± 10.1	129.7 ± 9.7
Range	89.0–182.0	84.0–209.0	84.0–209.0
Weight change between enrollment and 1 week before surgery (kg)			
Mean	10.1 ± 0.9	10.9 ± 1.2	10.7 ± 1.1
Range	2.0–26.0	0.0–28.0	0.0–28.0
Excess weight at enrollment (kg)			
Mean	65.8 ± 4.8	68.6 ± 3.2	67.5 ± 4.6
Range	30.0–101.0	27.0–130.0	27.0–130.0

\*2 patients had no weight change

**Table 2. Postoperative anthropometric measures for 91 bariatric surgery patients at 1 year.**

Anthropometric measures	Roux-en-Y gastric bypass (n = 42)	Sleeve gastrectomy (n = 49)	Both groups
BMI (kg/m <sup>2</sup> )			
Mean	32.7 ± 2.8	33.8 ± 3.4	33.3 ± 3.1
Range	23.6–46.8	23.4–49.2	23.4–49.2
Weight (kg)			
Mean	85.9 ± 10.7	88.1 ± 9.9	87.2 ± 10.5
Range	60.0–113.0	65.0–162.0	60.0–162.0
Excess weight loss			
Mean (%)	73.9	74.5	74.2
Mean (kg)	43.4	42.8	43.0

dietitian, occupational therapist, and certified exercise physiologist. These follow-up visits occurred at 2 weeks, 1 month, 3 months, 6 months, and 1 year after surgery. Results were reviewed at 1 year postoperatively for all the measures except the IWQOL-Lite, which was completed by patients at the 6-month visit. The postoperative results for weight, BMI, and excess weight loss showed significant reductions for both groups (Table 2). The mean postoperative weight change

for both groups at 1 year was 43.0 kg, and the mean excess weight loss was 74.2%. The IWQOL-Lite results changed from a mean score of 77.8 preoperatively to a mean score of 56.5 postoperatively, indicating a significant improvement in quality of life.

**Medical comorbidities (follow-up)**

Medical comorbidity status was also recorded during follow-up visits, and ultimately reported at 1 year postoperatively. Medical comorbidities were

classified based on the status of treatment at follow-up: no change, treatment reduced, or treatment ceased.

Of 27 patients with diabetes treated only with oral antihyperglycemic agents, 21 patients (78%) were able to completely cease treatment after 1 year (RYGB 10, SG 11). A further

level for patients with diabetes at 1 year was 6.4% (RYGB 6.4%, SG 6.2%), an improvement from the baseline level of 8.3% (RYGB 8.2%, SG 8.5%).

Improvements were also noted for patients with a diagnosis of hypertension at enrollment. From 44 patients

ing sessions, and cognitive behavioral therapy to treat obesity and obesity-related comorbidities.

A majority of the patients with diabetes and hypertension showed improvement in treatment status 1 year later. IWQOL-Lite survey results also indicated improvements in quality of life, with a 21.3-point difference between preoperative and postoperative test scores.

The overall mean excess weight loss for all patients studied was 43.0 kg or 74.2% of excess weight, and the mean BMI achieved at 1 year for both bariatric surgery types was 33.3. The results for mean excess weight loss were better than reported in previous studies with similar time frames. A systematic review by Shi and colleagues in 2010 found 1-year excess weight loss to be 62.8% for RYGB and 59.8% for SG.<sup>22</sup> A similar, systematic review by Fischer and colleagues in 2012 showed 1-year excess weight loss of 64.8% for RYGB and 56.1% for SG.<sup>23</sup>

An interesting finding of the study was that the mean excess weight loss was nearly identical for both the RYGB and SG groups. Previous studies have typically identified superior excess weight loss for RYGB over SG at 1 year.<sup>22,23</sup>

The results of this observational study demonstrate that supporting patients who receive laparoscopic bariatric surgery can help with excess weight loss and improve both medical comorbidities and quality of life. Improvement was found in all patient outcomes, regardless of type of laparoscopic surgery performed.

The results reported here are better than those found previously in bariatric surgery studies with similar time frames. The results were also similar regardless of the type of surgery performed. This supports our hypothesis that treating obesity and

### **Improvement was found in all patient outcomes, regardless of type of laparoscopic surgery performed.**

5 patients (19%) were able to reduce oral antihyperglycemic use (RYGB 3, SG 2). Only one patient using oral antihyperglycemic agents alone saw no change in treatment dose (SG).

Of 7 patients with diabetes treated with both insulin and oral antihyperglycemic agents, 3 (43%) were able to completely cease treatment with both agents after 1 year (RYGB 2, SG 1) and 3 (43%) were able to reduce both insulin and oral antihyperglycemic doses (RYGB 1, SG 2). Only 1 patient was on insulin alone to treat type 2 diabetes before surgery (SG), and after 1 year the dose was reduced.

Overall, 24 of 35 patients requiring pharmaceutical treatment for type 2 diabetes at enrollment were completely treatment-free at 1 year postoperatively. The HbA1c level for all patients at 1 year was 6.2% (RYGB 6.1%, SG 6.2%), an improvement from the baseline level of 7.7% (RYGB 7.5%, SG 7.9%). The HbA1c

requiring medical management of hypertension, 22 patients (50%) were able to completely cease treatment with oral antihypertensives (RYGB 13, SG 9) and a further 5 patients (11%) were able to reduce treatment at 1 year (RYGB 2, SG 3).

### **Conclusions**

Morbid obesity and related comorbidities can be effectively treated with bariatric surgery combined with a multidisciplinary approach to preoperative and postoperative management.<sup>21</sup> In addition to the improvements produced by bariatric surgery, lifestyle changes in diet and exercise routines can increase the magnitude of weight loss and the other benefits derived from losing weight. This study demonstrates the impact of combining gastric surgery with a multidisciplinary approach that includes exercise counseling, cooking classes, individual and group dietary counsel-

obesity-related comorbidities is more effective using a multidisciplinary approach.

In general, the results from most observational bariatric surgery studies have been reported at the 1-year mark, and then again at the 3-year mark.<sup>22,23</sup> Longer-term results (i.e., after 3 years or more) directly comparing outcome improvements between RYGB and SG are currently lacking. We will be following the same cohort of patients to assess longer-term outcomes. While this longer-term data will be useful, the 1-year results are already significant because they include a novel finding—a trend toward equivalence between outcomes after RYGB and SG procedures.

#### Competing interests

None declared.

#### References

- World Health Organization. BMI classification: 2013. Accessed 1 May 2015. [http://apps.who.int/bmi/index.jsp?introPage=intro\\_3.html](http://apps.who.int/bmi/index.jsp?introPage=intro_3.html).
- Tjepkema M. Measured obesity: Adult obesity in Canada: Measured height and weight. Statistics Canada Catalogue no. 82-620-MVE2005001, 2005.
- Obesity in Canada: A joint report of the Public Health Agency of Canada and the Canadian Institute of Health Information. 2011. Accessed 1 May 2015. [www.phac-aspc.gc.ca/hp-ps/hl-mvs/oic-oac/assets/pdf/oic-oac-eng.pdf](http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/oic-oac/assets/pdf/oic-oac-eng.pdf).
- Zalesin K, Franklin BA, Miller WM, et al. Impact of obesity on cardiovascular disease. *Endocrinol Metab Clin North Am* 2008;37:663-684.
- Smith SC. Multiple risk factors for cardiovascular disease and diabetes mellitus. *Am J Med* 2007;120 (3suppl1):S3-S11.
- Danaei G, Vander Hoorn S, Lopez AD, et al. Causes of cancer in the world: Comparative risk assessment of nine behavioural and environmental risk factors. *Lancet* 2005;366(9499):1786-1793.
- Greenburg DL, Lettieri CJ, Eliasson AH. Effects of surgical weight loss on measures of obstructive sleep apnea: A meta-analysis. *Am J Med* 2009;122:535-542.
- Statistics Canada. Canadian community health survey. 2009. Accessed 8 May 2015. [www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SurvId=50653&InstalD=67251&SDDS=3226](http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SurvId=50653&InstalD=67251&SDDS=3226).
- Adams TD, Pendleton RC, Strong MB, et al. Health outcomes of gastric bypass patients compared to nonsurgical, nonintervened severely obese. *Obesity (Silver Spring)* 2010;18:121-130.
- Sjostrom CD. Surgery as an intervention for obesity. Results from the Swedish obese subjects study. *Growth Horm IGF Res* 2003;13(suppl A):S22-26.
- Wang S, Li P, Sun XF, et al. Comparison between laparoscopic sleeve gastrectomy and laparoscopic adjustable gastric banding for morbid obesity: A meta-analysis. *Obes Surg* 2013;23:980-986.
- Carson JL, Ruddy ME, Duff AE, et al. The effect of gastric bypass surgery on hypertension in morbidly obese patients. *Arch Intern Med* 1994;154:193-200.
- Adams TD, Gress RE, Smith SC, et al. Long-term mortality after gastric bypass surgery. *N Engl J Med* 2007;357:753-761.
- Perry CD, Hutter MM, Smith DB, et al. Survival and changes in comorbidities after bariatric surgery. *Ann Surg* 2008;247:21-27.
- Lankford DA, Proctor CD, Richard R. Continuous positive airway pressure (CPAP) Changes in bariatric surgery patients undergoing rapid weight loss. *Obes Surg* 2005;15:336-341.
- Buchwald H, Avidor Y, Braunwald E, et al. Bariatric surgery: A systematic review and meta-analysis. *JAMA* 2004;292:1724-1737.
- Pillar G, Peled R, Lavie P. Recurrence of sleep apnea without concomitant weight reduction increase 7.5 years after weight reduction surgery. *Chest* 1994;106:1702-1704.
- Buchner NJ, Sanner BM, Borgel J, et al. Continuous positive airway pressure treatment of mild to moderate obstructive sleep apnea reduces cardiovascular risk. *Am J Respir Crit Care Med* 2007;76:1274-1280.
- Kolotkin RL, Crosby RD, Kosloski KD, et al. Development of a brief measure to assess quality of life in obesity. *Obes Res* 2001;9:102-111.
- Duke University. Impact of Weight on Quality of Life. Accessed 8 May 2015. <https://olv.duke.edu/iwqol>.
- Lau DC, Douketis JD, Morrison KM, et al. 2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children. *CMAJ* 2007;176:S1-13.
- Shi X, Karmali S, Sharma AM, Birch D. A review of laparoscopic sleeve gastrectomy for morbid obesity. *Obes Surg* 2010;20:1171-1177.
- Fischer L, Hildebrandt C, Bruckner T, et al. Excessive weight loss after sleeve gastrectomy: A systematic review. *Obes Surg* 2012;22:721-731. **BOMJ**