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Abdominoplasty on Persistently Obese Patients Following Bariatric Surgery a Shift in Patient Selection

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Abstract

Background: There is a consensus that patients with BMI>30kg/m^2 undergoing abdominoplasty have higher rates of complication. Despite higher risk of complications, these patients benefit greatly from body contouring procedures. Our objectives are to assess complication rates in carefully selected persistently obese post bariatric surgery patients undergoing abdominoplasty, stratifying by BMI at the time of surgery.

Methods: 134 consecutive post-bariatric patients who underwent a comprehensive pre-operative evaluation with a multi-disciplinary team prior to abdominoplasty between January 2004 and January 2011 were grouped based on BMI at time of abdominoplasty: Group I: BMI<30kg/m^2 (n=44), Group II: BMI 31-34kg/m^2 (n=49), and Group III: BMI>35kg/m^2 (n=41). Complications were graded using the Clavien-Dindo Classification of Surgical Complication.

Results: Overall complication rate was 28%. Complication rates for BMI groups I, II, and III were 34%, 28%, and 21%, respectively (p=0.39). Grade 1 complications were most frequent at 17.2%, followed by grade 2 complications (9.0%) and then Grade 3 (1.5%). There were no grade 4 or 5 complications.

Conclusion: Our overall complication rate was much lower than previously reported rates for post-bariatric patients and comparable to reported rates for non-post bariatric counterparts. There was no statistically significant difference in complication rates between BMI groups suggesting that rather than use an absolute BMI cut-off at which patients are considered inappropriate operative candidates, the use of a comprehensive patient evaluation process with a multi-disciplinary approach is more appropriate.

Introduction

Over a third of American men and women are obese [1,2]. With the obesity epidemic, there has been a subsequent dramatic increase in the incidence of bariatric surgery [3]. The number of bariatric operations performed in the US over the past decade has increased by more than 450% and in the last fifteen years the number of abdominoplasty procedures performed has increased by 340% [4]. Unfortunately, even after considerable weight loss, a large portion of these post-bariatric surgery patients continue to have body mass indices (BMI) above the obesity cut-off level of 30kg/m2 at the time of consultation for abdominoplasty.

With their new malabsorptive anatomy, redundant stretched skin, poor mobility, and higher likelihood of pre-existing infections underneath their skin folds, these post-bariatric patients are predisposed to many complications. Many of these patients benefit from post-bariatric body contouring surgery, such as abdominoplasty, to improve their activities of daily living. Selection of patients for abdominoplasty surgery is thought to be critical to its success and to reduce rates of complications [5]. Historically patients are selected based on several factors including:

- Weight-stability for 6 months
- A BMI<30kg/m^2
- Adequate nutritional status
- Stable medical and psychosocial issues
- Reasonable goals and expectations

Based on current literature, there is a consensus that patients with BMI>30kg/m^2 who undergo abdominoplasty have higher

rates of complication [6]. Our objectives are to assess complication rates in carefully selected persistently obese post bariatric surgery patients undergoing abdominoplasty, stratifying by BMI at the time of surgery.

Methods

This is a single surgeon's experience of 134 consecutive patients who underwent abdominoplasty after bariatric surgery at Montefiore Medical Center, the teaching hospital for the Albert Einstein College of Medicine, between January 2004 and January 2011.Approval for this study was obtained from the Albert Einstein College of Medicine Institutional Review Board on 3/8/2012.A prior Roux-en-Y gastric bypass was necessary for inclusion in this study. Patient data was gathered via retrospective chart review. Information obtained included BMI at time of abdominoplasty, maximum BMI (prior to gastric bypass), change in BMI (BMI at abdominoplasty subtracted from BMI prior to gastric bypass), age, sex, diabetes, smoking history, American Society of Anesthesiologist (ASA) class, hernia repair at the time of abdominoplasty, and the amount of resected tissue during abdominoplasty. Data on development of the following complications within each individual patient's follow up period was also included: skin dehiscence, seroma, hematoma, hypertrophic scar formation, infection, anemia requiring transfusion, deep vein thrombosis (DVT), and reoperation requiring general anesthesia.Complications were graded using the Clavien-Dindo Classification of Surgical Complication [7]. Patients were retrospectively sorted into three groups based on BMI at time of abdominoplasty: Group I: BMI<30kg/m^2 (n=44), Group II: BMI 30-35kg/m^2 (n=49), and Group III: BMI>35kg/m^2 (n=41).

Pre-operative Details

All patients were required to have stable or plateau weight for a minimum of six months prior to abdominoplasty.Patients were also required to abstain from smoking for three months prior to the procedure. All abdominal skin infections were treated to resolution prior to surgery. The surgeon had a lengthy preoperative discussion with all patients to emphasize the need for ambulation on the night of surgery as well as to ensure patient motivation for success.

Pre-operative Markings

The patient is marked in the standing position, prior to entering the operating room. These markings are considered a guide for the resection, as intraoperative adjustments are often made. See for sample preoperative markings (Figure 1).

Figure 1: Pre-operative marketing. Intraoperative adjustments are often made.

Surgical Technique

Perioperative intravenous antibiotics (weight based first generation Cephalosporin or Clindamycin in the case of a penicillin allergy) are given 30 minutes prior to skin incision. Prophylactic prevention of deep venous thrombosis (DVT) involves the use of sequential compression devices (SCDs) and a single weight based subcutaneous injection of heparin prior to induction. After induction, a foley catheter is inserted; the abdomen is shaved with an electric razor and then prepped with multiple chlorhexidine sticks. The area is allowed to dry, and then draped.The surgery is started with periumbillical incision, leaving the umbilicus attached to its stalk. The transverse lower abdominal incision is then made. Abdominal wall perforators including the superficial epigastric vessels are ligated as the abdominal wall flap is raised using electrocautery. During flap elevation, little to no fat is left on the underlying fascia.Laterally, the furthest extent of the flap is raised in accordance to the preoperative markings correlating to the extent of the patient's hip rolls (Figure 2).

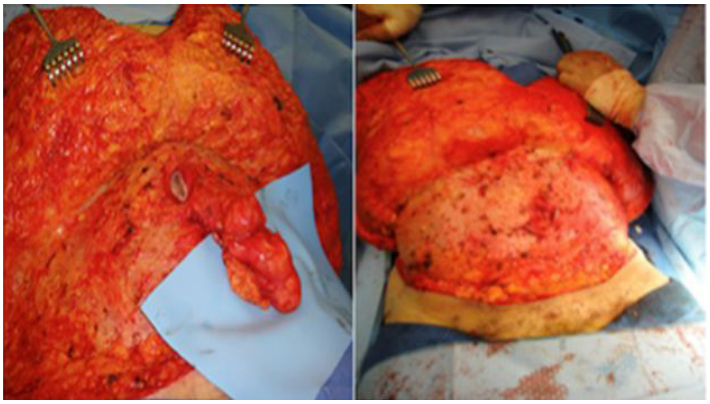

Figure 2: (Left) Post-abdominal flap elevation with limited midline undermining and lateral undermining limited to the superior line of resection. Ventral hernia visible inferolateral to the umbilical stalk. (Right) Post ventral hernia repair

Shows intraoperative images after abdominal flap elevation and hernia repair. Medial undermining is limited and rectus plication is done as necessitated by rectus diastasis. Lateral undermining is carried out to the superior resection line. Careful dissection is then carried out inspecting for hernias. If a hernia is found, repair is carried out, with mesh.

The anesthesiologist is then instructed to place the bed in the beach chair position (back of the bed elevated and the legs flexed at the hips) and the tissue to be excised is measured in a vest-over-pants fashion. In the larger pannus, an Esmarch's tourniquet is wrapped around the tissue to be removed in order to exsanguinate it and therefore minimize blood loss. The tissue is then excised. Number 10 Jackson Pratt drains (J-P) are left in place on the abdominal wall fascia. No liposuction is performed. The distal end of the upper abdominal flap is thinned by removing subscarpal fat. Closure of the abdomen is done using 2-0 Monocryl sutures in an interrupted fashion for the superficial fascial system (Scarpa's fascia). The deep dermal layer is closed using 3-0 Monocryl suture in a running subcutaneous fashion. The dermal layer is closed in a similar fashion using 3-0 Monocryl. The J-P drains are brought out through the mons pubis. Lastly the umbilicus is brought out in the standard midline.

Post-operative Care

Post-operative day #0: The patient is mobilized on the night of the surgery. An abdominal binder is used for added external compression.Postoperative analgesia is provided to adequately control pain. DVT prophylaxis with SCDs and subcutaneous heparin injection is continued from the operating room until patient discharge. The patient is encouraged to use an incentive spirometer ten times an hour while awake. The two #10 J-P drains are continued on closed-suction until the daily output is less than 30 cc/day. Oral antibiotics are continued postoperatively for five days (first generation Cephalosporin or Clindamycin).Post-operative Day #1: Patients are out of bed and ambulating. DVT prophylaxis and incentive spirometry is continued. Drains remain to closed suction. Patients are discharged in afternoon, tolerating a diet and with pain well controlled. Patients are given prescriptions for stool softeners and pain medication to be used PRN. They are taught how to strip, empty, and record drain output. They are also instructed to continue wearing their abdominal binder only removing it for showering. Lastly, patients are restricted from heavy lifting (>20lbs) for at least 6 weeks.

Statistical Analysis

Continuous data that were normally distributed are presented as means and 95% confidence intervals (CI). Categorical data are presented as counts and proportions. Categorical variables were analyzed using Chi-Square and Fisher's Exact tests when appropriate. Continuous variables were analyzed using t-test and ANOVA when assumptions were met. Non-parametric equivalents such as the Mann-Whitney U test and the Kruskal-Wallis analysis of rank test were used when assumptions were violated. Statistical analysis was performed using SAS statistical software (SAS Institute Inc., Cary, North Carolina, USA).

Results

There was a total of 134 patients, 11 men and 123 women with an average BMI of 32kg/m^2 (range BMI 24kg/m^2 to 56kg/m^2), who underwent abdominoplasty following a Roux-en-Y gastric bypass procedure.The overall complication rate for patients undergoing abdominoplasty was 28% (n=37). Patients who developed complications were on average two years older than those who did not (p=0.33). They also had a lower maximum BMI prior to bariatric surgery and on average a larger change in BMI from the time of bariatric surgery to abdominoplasty (p=0.35, p =0.39 respectively). Resection specimen weight was comparable in both groups, 3.1 1.2 vs. 3.12.0kg (p= 0.85). Table 1 provides all demographic data for patients who developed complications and those who did not.Complication rates for BMI groups I, II, and III were 34%, 28%, and 21%, respectively. This trend of decreasing complication rates as BMI increased, did not reach statistical significance (p=0.39).

Based on the Clavien-Dindo Classification of Surgical Complications, Grade 1 complications (n=23) were the most frequent in our sample. They included: limited skin dehiscence (n=15), seroma (n=3), hematoma (n=2), hypertrophic scar (n=3) (Table 1).

	Definition	n (% of Total Sample)
Grade I	Any deviation from normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside **[skin dehiscence, seroma, hematoma, hypertrophic scar]**	23 (17.2)
Grade II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications Blood transfusions and total parenteral nutrition are also included **[Cellulitis, other infections requiring antibiotics, anemia requiring transfusion, DVT]**	12 (9.0)

Grade IIIa	Requiring surgical, endoscopic or radiologic intervention not under general anesthesia	0 (0)
Grade IIIb	Requiring surgical, endoscopic or radiologic intervention under general anesthesia **[Reoperation under anesthesia for enlarging hematoma and wound infection]**	2 (1.5)
Grade IV	Life-threatening complication (single/multi-organ dysfunction)	0 (0)
Grade V	Death of a patient	0 (0)
Total Complications = 37 (27.6)		

Table 1: Clavien-Dindo Classification of Surgical Complications.

provides the rates of complication by Clavein-Dindo Grade. Skin dehiscence, the most common complications seen, was treated with local wound care, minimal debridement and daily dressing changes allowing for healing by secondary intention. Antibiotics were not used. These complications were noted at the first postoperative visit. The most frequent location of skin dehiscence was at the inverted T-junction. Dehiscence sites were most often less than 2cm in diameter. Seroma rate was 2.2%. Of those patients who developed seroma, one required drainage. Sclerosing agents were not used and none of the patients required operative excision of an encapsulated cavity from a persistent seroma. Hematoma rate was 1.5%. These hematomas were small and diagnosed by physical exam in our outpatient clinic. They were managed with observation and neither patient required surgical evacuation. Hypertrophic scars, which developed in three patients, were treated with injection(s) of Kenalog. One patient required three injections in their postoperative course.

Grade 2 complications encountered in this patient sample included cellulitis (n=5) clostridium difficile infection (n=1), anemia requiring transfusion (n=5), and deep venous thrombosis (n=1). The management of cellulitis involved either oral or IV antibiotics based on clinical assessment. Four of the five patients who developed cellulitis patients required readmission for intravenous antibiotics.One patient developed a clostridium difficile infection during admission for treatment of cellulitis and was discharged after resolution of gastrointestinal symptoms on two weeks of oral metronidazole.Patients with anemia were transfused if they were symptomatic or orthostatic. Grade 3 complications consisted of patients requiring reoperation with general anesthesia (n=2). One patient required reoperation for evacuation of an acute hematoma, requiring transfusion of two units packed red blood cells.The other patient required reoperation for a wound infection. This patient required intravenous antibiotics, which were eventually converted to an oral antibiotic regimen and a vacuum assisted closure device for several weeks.No patients developed Grade IV (organ dysfunction/life threatening complication) or Grade V (death) complications.

There was no statistically significant association between rates of complications and age, gender, smoking history, diabetes, ASA class, BMI group, maximum BMI, change in BMI, weight of pathology specimen, or hernia repair (Table 2).

	Complications (n=37)	**No Complications (n=97)**	**P-value**
Age, yrs	42.1□10.7	40.1□9.6	0.33
Sex, n (%) **Male** **Female**	 2(18%) 35 (28%)	 9 (82) 88(72)	0.73
Maximum BMI, kg/m²	52.7□6.7	53.1□9.5	0.86
Change in BMI, kg/m²	21.7□5.8	20.5□6.8	0.35
BMI Category* n (%) **Group I** **Group II** **Group III**	 15 (34) 13 (28) 9 (21)	 29 (66) 34 (72) 34 (79)	0.39
Diabetic n (%) **Non- Diabetic n (%)**	7 (37) 30 (26)	12 (63) 85 (74)	0.33
Smoking History n (%) **No** **Yes**	 27 (25) 10 (36)	 79 (75) 18 (64)	0.34
ASA Class n (%) **Class I** **Class II** **Class III**	 6 (29) 24 (34) 7 (17)	 15 (71) 47 (66) 35 (83)	0.14
Hernia Repair n (%) **No** **Yes**	 23 (26) 14 (30)	 23 (26) 14 (30)	0.69
Specimen Weight, kg	3.1□1.2	3.1□2	0.85
Maximum BMI is defined as BMI prior to gastric bypass, Change in BMI is defined as BMI at abdominoplasty subtracted from BMI prior to bypass. **BMI category at time of Abdominoplasty: Group I = BMI > 30 kg/m², Group II = 31-34kg/m², Group III = BMI > 35kg/m².**			

Table 2: Demographic Data.

provides p values for bivariate associations. Furthermore, there was no statistically significant association between BMI group and the grade of complication seen. The specimen weight correlated appropriately with the BMI group, but again this was not associated with an increased complication rate. Evaluation

of the photographs revealed that patients had an improvement in abdominal contour provide pre and post-operative images of two patients (Figures 3 and 4).

Figure 3: 38-Years old male, (Top) BMI 43.6kg/m2 and large ventral hernia, (Bottom) post abdominoplasty, excision of hip rolls and ventral hernia repair with component separation and mesh.

Figure 4: 36- year old female, (left) preoperative BMI 34.1kg/m2, (Right) post abdominoplasty and excision of hip rolls.

Discussion

It has long been accepted that post-bariatric surgery patients are at higher risk for complications when undergoing body-contouring procedures as compared to their non-bariatric counterparts. A meta-analysis of seven studies comparing complications of body contouring in post-bariatric and non-post-bariatric patients determined that post bariatric patients had 87% increased risk of developing complications after a single body contouring procedure compared to those with weight loss from diet and exercise [8]. Furthermore, literature suggests that within the post-bariatric population, those with BMI >30kg/m^2 at the time of body contouring surgery are at increased risk for complications compared to those with non-obese BMI [6]. In this study, we sought to compare complication rates within the post-bariatric population of patients who fall above and below the cutoff for obesity (BMI> 30 kg/m^2) at time of surgery. We noted a non-significant trend of decreasing complication rates as BMI increased. Complication rate in the Group I (BMI<30 kg/m^2) was highest at 34% compared to 28% in Group II (BMI 30-35 kg/m^2) and 21% in Group III (BMI>35 kg/m^2). Neither pre-operative BMI, change in BMI, maximum BMI nor volume of tissue removed were statistically associated with development of postoperative complication. Other studies have reported these factors as significantly associated with the development of postoperative complications. For example, Rubin et al. prospectively analyzed patients undergoing a single post-bariatric body contour procedure and found that the preoperative BMI predicted postoperative complication rates [5]. Araco et al. reported a statistically significant increase in postoperative wound infections with increased specimen/flap size [9]. These differences might be explained by the fact that our study population represents a group of carefully selected and highly motivated patients.

Our patients were selected based on a comprehensive evaluation including general health, nutritional status, weight stability for six months, strict requirements for smoking cessation three months prior to surgery, good diabetic control, and eradication of skin infections. Evaluation also involved a multidisciplinary approach between the primary care physician, nutritionist, anesthesiologist and plastic surgeon. Our overall complication rate of 28% is much lower than previously reported rates for post bariatric surgery patients. Fraccalveri et al. reported a complication rate of 50.4% in 117 post bariatric abdominoplasty patients while Staalesen et al. reported a complication rate of 48.4% in 95 patients [10,11]. We credit our lower rates to strict patient selection criteria such as smoking cessation three months prior to surgery and the multidisciplinary approach employed in a center for bariatric excellence. The operative technique for a high lateral tension abdominoplasty as described by Ted Lockwood was employed in our patient population [12].We believe this technique of limited undermining in the midline and undermining of the lateral skin flap only to the superior line of resection maintains better vascularity of the superior skin flap, decreases dead space and maintains an anchor for a better lower body lift [12-17]. Enhanced vascularity likely contributed to the lower incidence of wound dehiscence at the junction of the inverted T and other wound healing problems that we observed in this study. Our overall complication rate of 28% is fairly comparable to reported rates in non-bariatric abdominoplasty patients. Greco et al. reported an overall complication rate of 22% in 88 non-bariatric patients who underwent abdominoplasty [6]. Staalesen et al. reported early complication rates of

29% in abdominoplasty patient who had not previously undergone weight loss surgery.11 We assert that even in persistently obese post-bariatric patients, comparably low complication rates can be achieved with careful patient selection and a technique of limited undermining.

The majority of complications observed in our study population were classified as Grade 1 complications. This is consistent with large retrospective studies in both gastric bypass patients and non-bariatric abdominoplasty patients [18-20]. Overall wound infection rate in our sample was low at 3.7%. In a review of Tracking Operations and Outcomes for Plastic Surgeons (TOPS) and CosmetAssure databases from 2003 to 2007, Alderman et al reported an infection rate of 3.5% for the general population undergoing abdominoplasty[19]. Some possible explanations for the observed wound infection rate in this perceived high risk patient population include: smoking cessation 3 months prior to the procedure, antibiotic prophylaxis prior to the start of the procedure, performing a single procedure (limiting total operative and anesthesia time), and limited intraoperative flap undermining. Gravante et al showed the dramatic role of smoking on postoperative wound infections in post-bariatric abdominoplasty [21]. They found a 47% incidence of wound infections in smokers (who had stopped smoking for 4 weeks prior to the procedure) compared to 3% in nonsmokers. They also reported significantly higher values for the number of cigarettes smoked per day, years of smoking, overall estimated cigarettes smoked and the number of pack years in smokers with infections compared to smokers without infections. We believe that lengthening the mandatory smoking cessation period prior to surgery to three months had a major effect on lowering the complication rates in this study.

Venothromboembolic events are one of the most serious complications of plastic surgery procedures. Colwell et al demonstrated that the observed hypercoagulable state seen in abdominal contouring procedures is in fact due to a significant increase in the activity of the coagulation cascade and more specifically due to an increase in thrombin generation in the post-operative period [22]. They also reported that pre-operative chemoprophylaxis decreases thrombin generation intra-operative and post-operatively. Reported rates of venothromboembolism in patients who do not undergo preoperative anticoagulation are as high as 9% [23]. Similar to the Pittsburgh group, we saw very low rates of thromboembolic events in our study sample, 0.7%.5 We credit this to the combination of both pre-and post-surgical DVT prophylaxis with anticoagulation, sequential compression devices and early mobilization in a motivated patient. In this study, we provide data that suggests that persistently obese and morbidly obese post-bariatric patients can undergo abdominoplasty with complication rates comparable to their non-post-bariatric counterparts. We attribute these results to careful patient evaluation and selection involving a multidisciplinary approach. A major limitation of this study is that fact that it is a single surgeons experience. More studies using similar patient evaluation and selection criteria will be needed to further support our conclusions. With our relatively small sample size we may have been underpowered to detect statistically significant associations in our statistical analysis.

Conclusion

Many patients with massive weight loss following bariatric surgery would benefit from body contouring surgery in order to improve quality of life and their ability to complete activities of daily living independently. Rather than use an absolute BMI cutoff at which patients are considered inappropriate operative candidates, the use of a comprehensive patient evaluation process with a multi disciplinary approach is recommended. Factors including general health, nutrition, weight stability, diabetes control, patient motivation and most importantly a long mandatory smoking cessation prior to surgery period must be emphasized. We recommend the operative technique of limited flap undermining, DVT prophylaxis and early post-operative mobilization to achieve comparable complication rates between these persistently overweight, obese and morbidly obese patients and their non-bariatric counterparts.

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