



Body Contouring

The Impact of Protein Nutritional Supplementation for Massive Weight Loss Patients Undergoing Abdominoplasty

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Abstract

Background: As more patients undergo bariatric surgery to assist with weight loss, the demand for post-bariatric body contouring surgery, to address both functional and aesthetic concerns, is increasing. However, high wound healing complication rates remain a significant problem for these patients. One theory is that chronic malnourishment and hypoproteinemia may contribute significantly to these wound healing complications.

Objective: The purpose of this study was to determine the effect of pretreatment protein nutritional supplementation on wound healing in post-bariatric surgery massive weight loss patients undergoing abdominoplasty. Our hypothesis was that protein supplementation would decrease wound healing complications.

Methods: A retrospective review was performed of 23 post-bariatric surgery patients undergoing abdominoplasty who received pretreatment protein nutritional supplementation. This group was compared with a historical control group of 23 post-bariatric surgery patients who underwent abdominoplasty in the period immediately before the implementation of the protein supplementation protocol. Patient demographics and procedural characteristics were similar for the two groups.

Results: Forty-six patients were identified who had undergone abdominoplasty, half of whom were prescribed the protein supplementation protocol. Overall wound healing complication rates were significantly lower in the protein-supplemented group (0.0% vs. 21.8%, $p = 0.04$). There was no significant difference between the protein supplementation and historical control groups in regards to total complication rate.

Conclusions: Pretreatment protein supplementation is a simple intervention that can significantly decrease wound healing complications in post-bariatric surgery massive weight loss patients undergoing abdominoplasty.

Level of Evidence: 4

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With a prevalence of approximately 24% in Canada and 35% in the United States, obesity is one of the major health concerns in North America today.^{1,2} Over the past decade there has been increasing awareness of the deleterious health effects associated with a body mass index (BMI) over 30.³⁻⁵ Furthermore, the financial implications of obesity are staggering. Studies estimate annual obesity-related health costs to be nearly \$2 billion in Canada and a staggering \$147 to 190 billion in the United States.⁶⁻⁸ As obesity rates continue to rise globally, the World Health Organization has declared an

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“obesity epidemic,” and further identified obesity as one of nine noncommunicable diseases targeted for reduction in global mortality by 2025.⁹⁻¹²

At the individual level, achieving and sustaining weight loss through lifestyle changes alone (ie, diet, exercise) remains a difficult process. Obese individuals are increasingly opting for bariatric surgery to facilitate their weight loss. Procedures such as laparoscopic banding and laparoscopic gastric bypass have made surgical weight loss safer and easier, with bariatric surgery now considered to be the most effective treatment for extreme obesity.^{13,14} While there has been a ten-fold increase in the number of bariatric procedures performed annually since 2000, only a small subset of individuals eligible for these procedures (0.1-0.4%) actually undergo surgery for a variety of reasons (ie, access, financial).^{4,13,15-18} Demand for body contouring surgery will only continue to rise in coming years, given the increasing number of studies documenting significant improvements in quality of life following body contouring in the massive weight loss (MWL) population.¹⁹⁻²⁵

Though largely successful, these post-bariatric MWL patients are often left with a deflated soft tissue envelope, as well as skin laxity and excess.^{4,21,26,27} Not only is this excess skin an aesthetic concern, but patients also complain of difficulty with physical activity, finding appropriately-sized clothing, and intertriginous dermatitis.^{20,21,26,28,29} Post-bariatric body contouring surgery developed in response to these growing concerns amongst MWL patients. However, post-bariatric body contouring surgery comes with unique challenges. With wound complication rates reported as high as 80%, this patient population has been compared to other high-risk surgical patient populations such as burn, oncology, and transplant patients.^{15,20,30-34} Though the precise explanation for this elevated complication rate remains unclear, one theory is that chronic malnourishment and hypoproteinemia as a result of the bariatric surgical procedure and/or diet may contribute significantly.^{4,16,35-38}

There have been very few studies that examine the effect nutritional supplementation has for post-bariatric MWL patients undergoing body contouring surgery.^{39,40} The purpose of this study was to determine the effect of pretreatment protein nutritional supplementation on wound healing in post-bariatric MWL patients undergoing abdominoplasty. Our hypothesis was that protein supplementation would decrease wound healing complications.

METHODS

Research and ethics board approval was obtained from the University Health Network in Toronto, Canada, for this study. A retrospective chart review was performed for all post-bariatric surgery patients that underwent abdominoplasty following MWL at a single outpatient plastic surgery practice between January 2009 and November 2012. In October 2010, the senior authors (Drs Lista and Ahmad) began to prescribe protein-rich nutritional supplementation to all patients with sustained weight loss greater than 50 pounds prior to body contouring surgery. Patients included in this study were all consecutive cases leading up to and immediately following the institution of the protein supplementation protocol. For the purposes of this study, MWL was defined as a loss of at least 50 pounds sustained for a minimum of 1 year following bariatric surgery. During the time-course of the study, there were no significant changes in the nature of the abdominoplasty procedure itself that was performed.

The supplement is a low-calorie, all-natural, over-the-counter, whey-isolate protein powder with no added vitamins or minerals (GNC Corporation, Pittsburgh, PA; Table 1). Patients were instructed to supplement their diet with 80 g of protein daily for 4 weeks prior to and 4 weeks after body contouring surgery (8 weeks total). Prior to this, MWL patients undergoing abdominoplasty following bariatric surgery were not prescribed any nutritional supplementation. Therefore,

Table 1. Nutrition Facts Label for Protein Supplementation that is Routinely Prescribed to Post-Bariatric Surgery Massive Weight Loss Patients Undergoing Body Contouring Surgery

Calories	80	Sodium	0 mg
Total Fat	1 g	Potassium	0 mg
Saturated	0 g	Total Carbs	1 g
Polyunsaturated	0 g	Dietary Fiber	0 g
Monounsaturated	0 g	Sugars	0 g
Trans	0 g	Protein	40 g
Cholesterol	0 mg		
Vitamin A	0% RDA	Calcium	0% RDA
Vitamin C	0% RDA	Iron	0% RDA

RDA, recommended dietary allowance.

patients were divided into two cohorts, those that were prescribed protein supplementation before and after abdominoplasty and a historical cohort who did not, to act as a control group.

Demographic data collected included gender, age, BMI at the time of abdominoplasty, pretreatment smoking status, pretreatment hemoglobin level, and type of previous bariatric surgery procedure. Procedural characteristics included length of procedure, whether there were other procedures performed in conjunction with abdominoplasty, and complications. We also collected information on the nature of the abdominoplasty procedure itself, including whether or not there was liposuction of the abdominoplasty flap.

The primary outcome of the study was posttreatment complications associated with the abdominoplasty procedure. If multiple procedures were performed at the same time, only those complications related to the abdominoplasty were included for the purposes of this study. All posttreatment complications were reviewed and classified based on their nature. For the purposes of this study, delayed wound healing was defined as any wound that was not healed within 30 days after the procedure or required major wound care intervention (ie, negative pressure wound therapy or significant wound packing).

Statistical analysis was performed using the *t*-test and Fisher's exact test (where appropriate).

RESULTS

Forty-six post-bariatric surgery patients were identified who underwent abdominoplasty following MWL. Twenty-three patients were prescribed pretreatment protein nutritional

supplementation (22 female, 1 male, average age 49.8 [24.4-64.3]), while twenty-three patients were not prescribed supplementation (21 female, 2 male, average age 43.9 [26.3-58.2]). There was no difference between the two groups with regards to gender, age, BMI at time of surgery, pretreatment smoking status, pretreatment hemoglobin level, or length of procedure (Table 2). The mean follow-up time was 4.5 months (0.9-24.4) for the historical control group compared to 2.4 months (1.1-6.0) in the protein supplementation group.

All patients in both groups underwent an abdominoplasty, with 14 patients (historical control group) and 11 patients (protein supplementation group) undergoing combined procedures (Figure 1). Thirteen patients in the historical control group underwent liposuction of their abdominoplasty flap compared to 10 patients in the protein supplementation group (average lipoaspirate volume 407.6 ± 66.1 cc and 306.3 ± 99.2 cc, respectively; *p* = 0.63).

Overall wound healing complication rates were significantly lower in the protein supplementation group (*p* = 0.049) (Figure 2). There was no significant difference between the two groups with regards to the occurrence of complications including seroma, wound infection, or umbilical necrosis.

Further analysis comparing those patients with complications to those without complications showed no statistically significant difference between the groups in regards to BMI at the time of surgery (30.12 ± 4.74 kg/m² vs. 30.09 ± 4.80 kg/m²; *p* = 0.99), length of procedure (112.1 ± 35.7 minutes vs. 120.9 ± 54.6 minutes; *p* = 0.59), use of liposuction (*p* = 0.20), or lipoaspirate amount (285 ± 159 cc vs. 419 ± 284 cc; *p* = 0.34).

Table 2. Patient Demographics and Procedural Characteristics

	Historical Control Group (n = 23)	Protein Supplementation Group (n = 23)	<i>p</i> -value
Gender			
Female	21 (91.3%)	22 (95.7%)	
Male	2 (8.7%)	1 (4.3%)	
Age (years)	43.9 [26.3-58.2]	49.8 [24.4-64.3]	0.27
BMI (kg/m ²)	29.91 [18.46-39.01]	30.28 [19.98-39.22]	0.80
Smokers	0	4	0.10
Hemoglobin (g/L)	133 [118-159]	130 [105-160]	0.42
Procedure Length (minutes)	109 [59-165]	127 [52-315]	0.22
Length of Follow-up (months)	4.5 [0.9-24.4]	2.4 [1.1-6.0]	
Previous Bariatric Procedure			
Gastric Band	21 (91.3%)	22 (95.7%)	
Gastric Bypass	2 (8.7%)	1 (4.3%)	

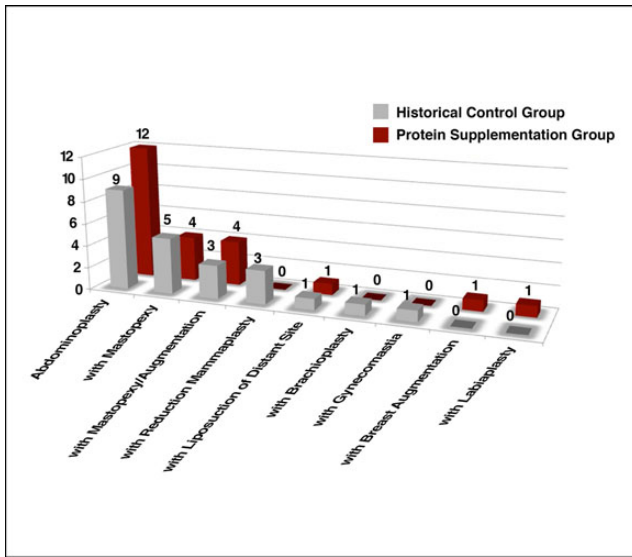


Figure 1. Types of procedures performed in each study cohort. All patients underwent abdominoplasty, and any other procedures listed were performed in addition to abdominoplasty during the same operation.

DISCUSSION

Wound healing is a complex, multifactorial process that requires a fine balance of extracellular matrix proteinases, cytokines, and growth factors.¹⁵ Though little is known about the effects of MWL on the wound healing milieu, this highly regulated cascade is thought to be directly dependent on adequate systemic nutrition.¹⁵ Through either restrictive (ie, banding) or malabsorptive (ie, gastric bypass) means, bariatric surgery aims to limit caloric intake to produce weight loss.⁴¹ Unfortunately, these effects also place post-bariatric surgery patients at high risk for macro- and micronutrient deficiencies, including trace elements, essential minerals, and water/fat-soluble vitamins.^{15,37,42,43}

Protein calorie insufficiency is one of the most common nutritional imbalances seen following bariatric surgery, with an incidence of up to 25%.^{15,16,37} Nutritional studies have shown that up to 38% of post-bariatric MWL patients have low prealbumin levels, and that evidence of protein deficiency can persist for up to 2 years posttreatment.^{16,40} While this protein deficiency is likely more pronounced in gastric bypass procedures due to their malabsorptive mechanism of action, patients undergoing gastric banding have also been shown to fall short of the recommended daily intake of protein.^{42,44,45} In fact, it has been suggested that gastric banding patients may actually maintain a less balanced and unhealthier diet than patients undergoing malabsorptive procedures.⁴⁶ Protein plays an important role in fibroblast maturation, collagen production, and angiogenesis, all of which are critical for posttreatment wound healing.^{15,37} This protein calorie insufficiency is further

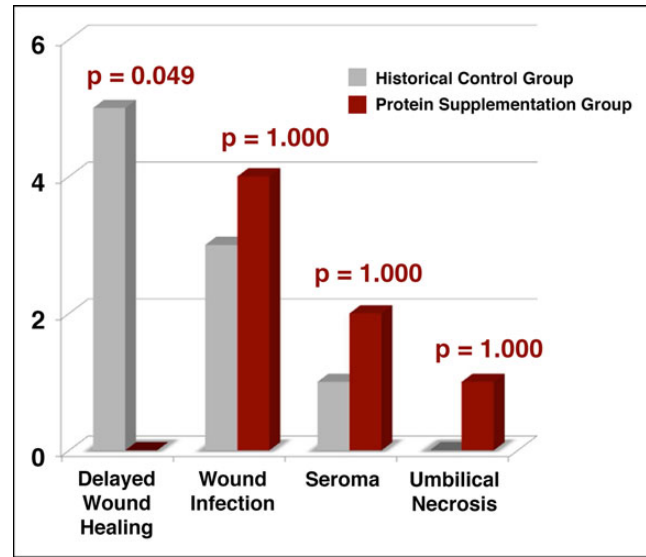


Figure 2. Complications following abdominoplasty in each study cohort.

compounded by the fact that protein calorie requirements increase by 25% following major elective surgery.⁴

Our findings suggest that pretreatment protein supplementation can significantly reduce posttreatment wound healing complications in the post-bariatric MWL patient population after body contouring surgery. In fact, we observed no wound healing complications in the group that was prescribed protein supplementation, compared to 21.7% in the historical control group that was not prescribed protein supplementation. This result is supported by the findings of Agha-Mohammadi and Hurwitz,⁴⁰ who showed that complication rates in post-bariatric MWL patients treated with protein supplementation were similar to normal weight, non-bariatric patients. The overall incidence of seroma in this study was 6.5%, with no statistically significant difference in seroma rates between the two cohorts. This incidence is lower than the rates traditionally reported in MWL and obese patients, populations that the literature suggests may be at higher risk for posttreatment seroma formation following body contouring surgery.^{31,47-49} Further, there was no statistically significant difference in complication rates for wound infection and umbilical necrosis; however, our study may have been underpowered to detect a statistically significant difference in these complication rates.

Though several studies have attempted to identify patient-specific and procedure-specific factors that affect wound healing, many of these factors, such as age, overall change in BMI, amount of weight loss, and nature of bariatric procedure, cannot be modified.⁵⁰

Furthermore, the lack of a significant difference in this study in regards to the frequency of complications between

smokers and nonsmokers should not be misconstrued, since all smokers must quit smoking for a minimum of 1 month prior to having body contouring surgery performed in the practice of the senior authors. Thus, the interaction of smoking and protein supplementation in the immediate pretreatment period were not examined. The deleterious effects of smoking in plastic surgery patients has been well documented.^{32,51,52} Procedural modifications such as limiting the amount of tissue excised, limiting skin undermining and tension on the closure, and limiting procedural time may decrease the complication rate, although the exact implications of each of these variables is unknown.^{53,54} Of the modifiable risk factors, optimizing the nutritional status of the post-bariatric MWL body contouring patient is a simple intervention with minimal risk that can be used to effectively reduce wound healing complications in this high-risk surgical population.

It is important to note that the majority of patients in this study underwent a restrictive bariatric procedure, which is fundamentally different than a malabsorptive procedure. Due to the nature of the procedure, gastric bypass patients likely suffer from greater protein malnourishment than gastric bypass patients.⁴² With a lack of evidence regarding the effectiveness of enteral protein supplementation in the gastric bypass patient population,⁴² we recognize that the results of this study may not apply to all post-bariatric surgery patients. Though further research is required to determine the optimal method of nutritional supplementation in the malabsorptive gastric bypass patient population, we believe that the concept of protein supplementation to correct protein malnourishment and its effectiveness in reducing posttreatment wound healing complications applies to patients that have had most commonly-performed bariatric procedures.

Limitations of this study include its retrospective nature, as well as its relatively small sample size. We recognize that the post-bariatric MWL population is a highly complex and highly variable population. Though the sample size in this study was limited, we did begin to detect statistically significant differences in rates of delayed wound healing, one of the key complications experienced by post-bariatric MWL patients undergoing body contouring surgery. However, we acknowledge that the statistical significance of this finding may be affected by the complex and variable nature of this population and our small sample size. Aside from a complete blood count and coagulation tests (ie, prothrombin time and partial thromboplastin time), patients did not routinely have laboratory studies done that are commonly used as a measure of nutritional status (ie, prealbumin, albumin, transferrin, micronutrients). Additionally, we have no documented proof that the patients that were prescribed protein supplementation were compliant to this protocol. In the future, a prospective study wherein patients complete a pretreatment nutrition questionnaire as well as laboratory measurements to document their

pretreatment nutritional status followed by examining outcomes and comparing with posttreatment laboratory measurements would be of great value.⁵⁵

This is the first comparative study to examine complication rates in post-bariatric surgery MWL body contouring patients with respect to the effect of pretreatment protein nutritional supplementation. Protein deficiency only represents one important aspect in malnutrition. Further studies are necessary to examine the effects of macro- and micro-nutrient supplementation on outcomes in this high-risk surgical population. This information would help us to manage pretreatment deficiencies and, ultimately, improve patient outcomes.⁵⁶

CONCLUSION

As we move forward, body contouring surgery in the post-bariatric surgery MWL patient population is going to become more frequently requested from plastic surgeons. If we hope to treat this high-risk population as safely and effectively as possible, we must continue to investigate methods to reduce pretreatment risk.

Overall, our findings suggest that pretreatment protein nutritional supplementation can significantly decrease wound healing complications in post-bariatric surgery MWL patients undergoing abdominoplasty. Though not all factors that influence wound healing in this population are modifiable, nutritional supplementation is not only easy to modify, but it is safe. We believe that pretreatment nutritional supplementation is an important adjunct to help minimize posttreatment wound healing complications in this high-risk patient population.

Disclosures

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