Research Article

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The correlation of histopathological subcutaneous adipose tissue changes with post bariatric wound healing complications

Dalia. M. El Sakka¹, Mahmoud A. Bahram²*, Mohamed A. Elaskandrany³

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*Correspondence:

Dr. Mahmoud A. Bahram,

E-mail: mahmoudbahreem@yahoo.com

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ABSTRACT

Background: This study aimed at assessing the histopathological changes in the subcutaneous layer as a trigger of wound healing complications.

Methods: This prospective study included 45 post bariatric consecutive patients from March 2012 to May 2015. We presented demographic data of investigated patients, operative procedures, wound complications and revision surgeries and histopathological examination of excised wound edges.

Results: Wound healing complications occurred in 14/40 abdominoplasty patients, surgical revision was necessary in 11 of them. In the 5 lower body lift group, 3 patients suffered from wound healing complications and 3 patients needed revision surgery. These problems in our cases were associated with histopathological changes in the subcutaneous tissue characterized by degenerated collagen (thickened and hyperosinophilic) fibers and collapsed fat with evidence of fat necrosis.

Conclusions: Surgeons operating on post bariatric patients should be concerned that they are not handling healthy structures manifested by degenerated collagen; therefore, accurate knowledge of microscopic changes in these patients is necessary for a better choice of reconstructive procedure and adequate management of complications.

Keywords: Bariatric surgery, Body contouring - abdominoplasty, Histopathological changes, Morbid obesity

INTRODUCTION

The surgical treatment of morbid obesity has increased in popularity with the advent of laparoscopic bariatric procedures. After such dramatic weight loss, patients are left with redundant skin and subcutaneous tissue in the flanks and the lumbo-sacral regions. Surgical excision is an important aspect of treatment for many patients as they often view the redundant tissues as the last barrier to resuming "normalcy", both for cosmetic reasons as well as for physical comfort.

To address these issues, body contouring after bariatric surgery has become an integral part of the surgical treatment of the morbidly obese and has led to a dramatic rise in the number body contouring surgeries.⁴

Abdominoplasty is the most required post-bariatric surgical procedure in patients of both sexes and at any age.⁵ Torsoplasty, or lower body lift, is carried out to correct, at one time, weight loss effects on abdomen, hips, gluteus, and lumbo-sacral regions.^{8,9} Abdominoplasty (whether is associated with hernia repair or rectus sheath plication or not), lipoabdominoplasty or Torsoplasty are demanding operation and are associated with a lot of complications mainly wound complications.^{6,7}

¹Department of Plastic Surgery, Faculty of Medicine, Menofia University, Egypt

²Department of General Surgery, Faculty of Medicine, Menofia University, Egypt

³Department of Pathology, Faculty of Medicine, Menofia University, Egypt

In 2006, a study of post-bariatric patients found that complication rates actually approached 40%, most of these complications included wound compromise. As these post-surgical complications often result in unplanned hospital and emergency room visits, as well as readmissions, there is an imperative need to improve the outcomes of surgery performed on obese patients in order to help decrease health care costs, healing time, and time away from work. ¹⁰

Based on the anatomic data from the study performed by Levy et al., significant macroscopic alterations of the adipose tissue were found in all four areas they examined (epigastric, umbilical, hypogastric and lumbar regions). These alterations were loss of the superficial fascial system (with infiltration by white, atrophic, and hyperplastic adipose cells) and discontinuation of the areolar and lamellar layers.

The objective of this study is to delineate the histopathological changes in the subcutaneous fatty layer in post-bariatric patients and correlate them with post bariatric wound healing complications.

METHODS

This prospective study included 45 post bariatric consecutive patients from March 2012 to May 2015. Ethical committee approval was obtained prior to study initiation and all patients signed an informed consent form. Forty patients underwent classic abdominoplasty and 5 patients underwent circumferential abdominoplasty. The following were recorded: patient demographics, wound healing complications, revision surgeries and histopathological examination of biopsies taken from wound edges.

All patients underwent general anesthesia. The classic abdominoplasty was performed in beach chair position with undermining skin and subcutaneous tissue up to costal margins laterally and the xiphoid process medially with repositioning of the umbilicus. When indicated, diastasis repair of the midline diastasis recti abdominis was performed. In relevant cases, we resected redundant skin additionally on the waist and back in terms of circumferential abdominoplasty. We started with the patient in supine position accomplishing first the abdominoplasty and brought the patient then in a prone position to complete resection at the back. Two drains were placed in patients with abdominoplasty and four drains were placed in patients with circumferential abdominoplasty. An elastic abdominal binder is applied at the end of the operation.

All patients received deep venous thrombosis prophylaxis with low-molecular-weight heparin. Compression abdominal garments for 6 weeks without diastasis repair and for 12 weeks if a diastasis repair was necessary.

Histopathology

Tissue biopsies were pathologically processed. Formalin fixation and paraffin embedding was performed as previously described (12). Five micron thick sections were cut from each paraffin block and stained with haematoxylin and eosin (H and E) staining. Examination of the slides was performed to address the different histopathological changes.

RESULTS

This study included 45 patients: 40 patients (89%) underwent traditional abdominoplasty and 5 patients (11%) underwent circumferential abdominoplasty. This study includes 6 males and 39 females. The mean age is 37.7±7.9 years, and the average weight loss after bariatric surgery is 28±11.3 kg (range: 18-43 kg). Average operative time is 3±1.9 h (range: 2-7 h). On average, 3±3.4 kg of skin and fat tissue excess were removed. All patients remained hospitalized for average 5±3.7 days, while the mean follow-up was 7.3±4.6 months for all patients (Table 1).

Table 1: Demographic data and early operative results in our patients.

Demographic data			
	Male	6	
Sex	female	39	
Age	min	28 years	
	max	47 years	
	Mean±SD	37.7±7.9 years	
weight loss after bariatric procedures	Min	18 kg	
	Max	43 kg	
	Mean±SD	28±11.3 kg	
Operative time	min	2 hours	
	max	7 hours	
	Mean±SD	3±1.9 hours	
Weight of skin and fat removed	Mean±SD	3 ±3.4 kg	
Hospital stay	Mean±SD	5±3.7 days	

Wound healing complications occurred in 22 out of 45 patients. In abdominoplasty patients, 14/40 of patients developed different wound complications. One patient had wound dehiscence, 3 patients developed skin and fat necrosis, 3 patients developed wound infection and 6 patients had delayed problematic scar (wide stretched and depressed scar). Surgical revision was necessary in most of them (11 of 14 patient) either immediate or delayed. In circumferential abdominoplasty patients, 3 patients suffered from wound healing complications and needed revision surgery, one wound dehiscence, one patient with skin and fat necrosis and one stretched depressed scar. Seroma had occurred in 5 patients and it was mild that need only drainage by punctuation (Table 2).

Histopathological examination revealed either normal fat lobule formed of mature fat cells with their characteristic signet ring nuclei (Figure 1), collapsed adipocytes associated with degenerated collagen and sclerosis (Figure 2) or fat necrosis. In the later, ruptured fat cells resulted in tissue infiltration by foamy histiocytes, giant cells of foreign body type and small blood vessel proliferation (Figure 3).

	Abdominoplasty	Circumferential abdominoplasty	Total	%
Seroma	4	1	5	11
Skin and fat necrosis	4	1	5	11
Wound dehiscence	1	1	2	4.5
Infection	3	0	3	9
Delayed problematic scar	6	1	7	13
Total number of complications			22	49
Cases needed surgical revision	11	3	14	31

Table 2: Wound healing complications in our patients.

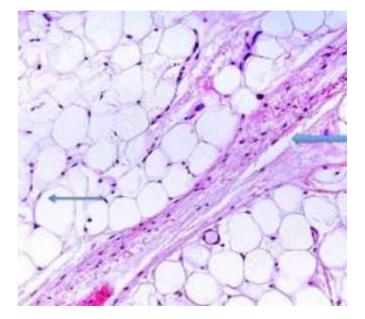


Figure 1: Normal fat lobules formed of mature fat cells separated by delicate connective tissue septate (H and E staining X200).





Figure 2: Collapsed adipocytes: (A) Associated with degenerated collagen and, (B) Sclerosis (H and E staining X200 for A and X100 for B).

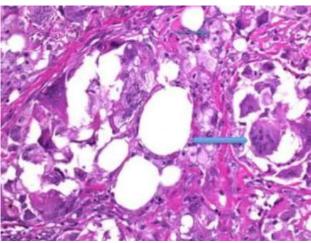


Figure 3: Fat necrosis showing tissue infiltration by lipid-laden tissue histiocytes, foreign body giant cells and small blood vessel proliferation (H and E X 200).

DISCUSSION

There is an increase in body contouring surgeries after the increased number of massive weight loss patients. When performing post-bariatric surgery in massive weight-loss patients, the surgeon is most often aiming for functional improvement in the first line and aesthetic improvement in the second line as has been mentioned by Bruschi et al. ¹³

We agree with Wolf et al who, as bariatric surgeons, reflect that dermolipectomies are one more step in the treatment of the morbidly obese patient, and bariatric surgeons must take care of them as an integral part of the management of their obesity. ¹⁴

Fraccalvieri et al and Breiting et al reported that postbariatric patients have a significantly higher risk of developing complications after abdominoplasty, including wound infection and dehiscence, than non-post-bariatric patients.^{3,15} This is probably affected by the nutrition deficiency and micro-architecture changes of the skin that alter immunity and integrity of the skin through different mechanisms.¹⁶

In the current study, our overall complication rate was high, approaching half of our patients (49% of patients). There were no thromboembolic events and no mesh had to be removed; no mortality has been recorded. We reported 14 patients (31%) of our patients presented with complications that needed a re-intervention. Early surgical re-intervention in 7 patients due to wound dehiscence and skin and fat necrosis. The most common deforming late complications in abdominoplasty patients were wide depressed scar. When necessary scar revision after body-contouring procedures are performed 6 months postoperatively. Overall, the number of patients seeking scar revision surgery was 7/45 patients (15%).

Nevertheless, this rate varied in the literature between 4% and 80%.³ We have defined postoperative complications as any minimal variation from the normal postoperative healing, although these complications did not suppose much discomfort to the patient. We have even included minor events such as small vertex skin necrosis with minimal wound dehiscence in the "anchor" incisions that would require daily care or small seroma that would need just drainage by punctuation in the outpatient clinic. This broad definition could explain our high complication rate.

Saxe et al also used a wide definition of complication, and reported a 46% complication rate similar to ours. ¹⁷ However, they only included patients in the analysis who presented with skin necrosis requiring surgical debridement, while we do not believe surgical debridement of all skin necrosis is mandatory for it to be considered as a complication.

Stewart et al. focused also on early and late complications in their review of complications of 278 consecutive abdominoplasty. They found late complications including dog ears, localized fatty excess, and unsatisfactory scars in 25 % of patients and 24 % patients underwent revision surgery. A stretched scar indicates tension at closure and lack of proper deep closure so scar revision gives a better aesthetic outcome.

The risk of seroma is increased by shearing movements, so flap elevation superficial to Scarpa's fascia has been reported to reduce the drainage output, time to drain rates.¹⁹

In our own surgical practice, we undermine the skin and subcutaneous tissue also superficial to the suprafascial plane. This might be the reason for our lower rate of seroma (5/45).

Logical steps to prevent flap ischemia would be: Minimizing the devascularisation to the absolute minimum required for flap mobilization, using discontinuous dissection and using lipomobilisation more than surgical undermining. 20

The histopathological examination in this study revealed either normal fat lobule formed of mature fat cells with their characteristic signet ring nuclei, collapsed adipocytes associated with degenerated collagen and sclerosis or fat necrosis. In the later, ruptured fat cells resulted in tissue infiltration by foamy histiocytes, giant cells of foreign body type and small blood vessel proliferation which may explain the frequent complications including wound healing complications observed in the current study after abdominoplasty.

Our results concedes with that of Light et al, Chojkier et al and Levy et al who described histological post-bariatric skin changes as poorly organized collagen structure, degradation of elastin and scar formation within areas. 21,22,23 macroscopically normal There deterioration in the extracellular matrix, likely attributed to the constant inflammation and its degrading effect on the skin tissue, possibly leading to wound complications. Changes also take place in the subcutaneous fat, demonstrating poorly defined lobules and more tenuous fibrous attachments to the deep dermis. Furthermore, decreased blood flow also impairs healing in obese patients after massive weight loss. To what extent such changes translate to altered skin immunity and decreased wound healing remains unknown, but there is evidence that the skin of obese patients does change after a bariatric procedure.

CONCLUSION

Surgeons operating on post bariatric patients should be concerned that they are not handling healthy structures manifested by degenerated collagen; therefore, accurate knowledge of microscopic changes in these patients is necessary for a better choice of reconstructive procedure and adequate management of complications.

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institutional ethics committee

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