Scarpa fascia preservation to reduce seroma rate on massive weight loss patients undergoing abdominoplasty: a comparative study

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Running title: Preserving the Scarpa fascia in abdominoplasty decreases the seroma amount and incidence

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Abstract

Background

Seroma is one of the most common complication in abdominoplasty, particularly in massive weight loss patients. Scarpa fascia preservation seems to mitigate postoperative complications. We aimed to further investigate this issue on massive weight loss patients.

Methods

This was single-centered retrospective comparative study, including a total of 202 MWL patients operated between 2009 and 2019 in a University Hospital. Patients with a weight loss greater than 30 kg underwent primary abdominoplasty were included. Of them, 149 went through traditional abdominoplasty and 53 Scarpa fascia preserving abdominoplasty. The primary outcome measure was seroma occurrence, while drainage amount, hospital stay and surgical site occurrence were also charted.

Results

Preserving Scarpa fascia resulted in a significantly reduced seroma occurrence (9.4% vs 26.2%, p=0.011) and decreased mean drainage time (3.7 vs 5.3 days, p=0.025). Trend towards lowered drainage output and shorter hospital stay were also detected. Other complications did not differ between the study groups.

Conclusion

Preserving Scarpa fascia during abdominoplasty for MWL patients may result in decreased seroma occurrence and earlier drains removal. Larger studies are warranted to further support these findings.

Key words: abdominoplasty, Scarpa fascia, seroma, obesity, weight loss

Introduction

Abdominoplasty is a surgical procedure to address the abdominal shape and contour, particularly after weight loss. By removing the excess of skin, fat and tightening the abdominal wall muscular fascia excess is possible to restore and shape the abdominal contour. [1]

The number of abdominoplasties performed annually increases continuously and in 2019 it was the fourth most executed aesthetic surgical procedure based on the annual statistics of the American Society for Aesthetic Plastic Surgery (ASAPS) with over 140,000 cases.[2] Conversely, with the raising of morbidly obesity (body mass index -BMI- $\geq$35 kg/m^2) worldwide and the spreading of bariatric surgery procedures, the number of abdominoplasties is expected to further increase. [3]

Massive weight loss (MWL) may cause an important excess of skin especially in the abdomen, upper arms and thighs, procuring physical discomfort. [4] Body contouring surgery, including abdominoplasty, have been proven to be effective increasing quality of life in MWL patients [5]. In addition, post-bariatric surgery has also been associated with increased ability to lose and maintain achieved weight. [6, 7]

However, abdominoplasty is often associated with relatively high complication rates in MWL patients, reported between 20.2 % and 32.6%. [7-9] Seroma formation is the most common complication of abdominoplasty with an average incidence of 10% and ranging of 5-43%. [7-10]

Many different strategies have been proposed to mitigate this kind of complication including combined liposuction [11,12], tissue glues [13,14], quilting sutures to minimize dead space [15,16], postoperative compression dressings [17], avoidance of electrocautery [18, 19].

Avoiding the classical fascial dissection plane and preserving Scarpa fascia and its sub-fascial fat might reduce seroma formation alone or in combination with other strategies like fibrin glue or quilting sutures. [7] In a meta-analysis, abdominoplasty with Scarpa fascia preservation was associated with a significant decreased seroma formation, decreased total drain output, decreased

time required for suction drains and shorter hospital stay, but no decreasing incidence of other complications as hematoma, bleeding, infection or suture rupture have been reported, while the aesthetic outcomes are equal to the classical abdominoplasty. [20] More recently, another meta-analysis could not demonstrate benefits in decreasing the complications rate using of quilting sutures, drains, or Scarpa fascia preservation in different combinations. [21]

However, most of the encompassed patients in those meta-analysis had a relatively low BMI (<26 kg/m^2) and the MWL population was underrepresented.

Only few studies have reported results on Scarpa fascia preservation in MWL patients, including a small cohort, and relatively controversial outcomes. [22, 23] Therefore, further evaluating this technique in MWL patients may clarify this issue.

The aim of the present study is to compare the outcomes of Scarpa fascia preservation technique versus traditional abdominoplasty in MWL patients, particularly on seroma formation. Despite the fact that seroma formation is commonly associated with factors that are predictive of poor wound healing, based on our clinical experience and before our review of the data, we hypothesized that preserving Scarpa fascia may mitigate the incidence of postoperative seroma.

Material and methods

This is a retrospective study of prospectively maintained database. It was approved by the local Institutional Review Board and it was conducted in accordance with the ethical principles of the World Medical Association Declaration of Helsinki. We included in this study all MWL patients who underwent abdominoplasty at Turku University Hospital from January 1, 2009 until December 31, 2019. Patients were identified thought the hospital surgery registry and, before the analysis, all patient data remained anonymous. Informed consent was obtained from each patient included in the study. We followed the STROCSS (Strengthening the reporting of cohort studies surgery) guidelines for observational cohort studies. [24]

Inclusion criteria were adequate chart data, weight loss over 30 kilograms (MWL), stable pre-operative weight (±5 kilograms), and post-operative follow-up of at least six months. Patients were excluded from this study in case of body lift or belt lipectomy, concomitant procedures, like hernia repair, secondary abdominal procedures, revisions, and a follow-up shorter than six months.

For the purpose of the present study, patients were divided into two groups according to the type of abdominoplasty performed: Scarpa Fascia preserving abdominoplasty (experimental group) and classic plane full abdominoplasty (control group). The indication for technique used was at the discretion of the individual surgeon. Data were accurately collected from the patients' electronic medical records including patients' demographics, medical history, type of bariatric surgery, the history of smoking, amount of weight loss, treatment, and surgical outcomes were directly compared between the experimental and control groups.

Having one or more of the following conditions was considered as a medical comorbidity: coronary artery disease, diabetes mellitus, hypertension, pulmonary disease, or renal disease. Patients taking a diabetic medication were graded as diabetic. Patients who reported smoking within four weeks preoperatively were considered as active smokers.

Outcomes

The primary outcome measure was the postoperative seroma occurrence. Secondary outcomes were as following: drainage amount, hospital stay and surgical complications, and need for blood transfusion.

Definitions

Surgical complication was defined as any complication involving the abdominal area underwent the procedure and the severity was measured by the Clavien–Dindo classification. [25]

Seroma was serous fluid collection or blood between the tissue layers and diagnosed clinically or with ultrasound imaging and requiring drainage in the office or operating room. Superficial wound infection was surgical wound requiring antibiotics (cellulitis), deep infection was infection that required emergency drainage or hospitalization (abscess). Wound dehiscence was wound skin separating >0.5cm including all the skin layers, which lead to over 2 weeks delayed healing or need for specialist dressing care. Fat necrosis was palpable firmness with diameter >1cm staying at least 3 months. Hemorrhage needing blood cell transfusion (Clavien-Dindo grade II) and emergency exploration (Clavien-Dindo grade II) was included in hematomas.

Surgical technique

All operations were performed under general anesthesia by same local surgical team.

Scarpa fascia preserving abdominoplasty or dual plane abdominoplasty is widely similar to classic full abdominoplasty [26]. Incision is made to the level of symphysis pubis, 6-7 cm superior to the anterior vulva commissure and the abdominal flap is elevated up to the subcostal margin. As an exception, abdominal flaps are elevated and avulsed on plane of the Scarpa Fascia whenever possible or immediately beneath that on infra-umbilical area excluding 4 to 8 centimeters wide vertical line in the midline bilaterally which reach pre-muscular plane, so rectus fascia plication can be achieved using interrupted sutures. On the supra-umbilical and epigastric area flap elevation level was carried out on the pre-muscular plane up to the costal margin.

Classic plane full abdominoplasty with umbilical transposition was performed to all of the patients and rectus plication was accomplished in case of a diastasis larger than 5 cm, at the surgeon's decision. Abdominal flap elevation started few centimeters above symphysis pubis from "bikini line" up to the costal margin on the plane of rectus fascia. Then after the excess of the abdominal flap was removed, umbilicus transposed, hemostasis achieved, two closed-suction drains were placed and skin closure was performed in two or three layers at the discretion of the surgeon. Pain

pump catheter have also been used. [27] Post-operative pain was alleviated with opioids and NSAIDs. The majority of patients got enoxaparin 40 mg subcutaneously as thrombosis prophylaxis. Intravenous antibiotics were used in a single dose at the induction and in some cases continued up to the suction drains removal. Surgical drains were removed when the output was less than 30ml/day and kept maximum for 7 days. Follow-up was patient`s last medical care contact at the study Institution.

Statistical analysis

Continuous variables are reported as mean ± standard deviation (SD). Independent t-test and Chi-square tests were used to compare the two groups as appropriate. We performed univariate and multivariable analysis in order to assess the associations for SSO with patients and perioperative variables. Perioperative factors resulted in a p-value <0.4 with univariate analysis were included into a multivariable logistic regression model. Confidence intervals were set at 95% and a two-sided p-value of <0.05 was considered statistically significant. All the analyses were conducted using SPSS version 23.0 (SPSS, Inc., Chicago, IL, USA)

Results

Data from a total of 202 consecutive patients underwent abdominoplasty after MWL were included in the analysis after eligibility assessment (Figure 1). Scarpa fascia preservation group included 53 patients while the control group included 149 patients. Demographics are outlines in Table 1 with statistically differences only in the sex ratio, where female patients were 87.2% in the control group versus 81.1 in the Scarpa preservation group (Table 1).

A significant difference was found in mean drainage duration time favoring the Scarpa preservation group (3.7 vs 5.3 days, p=0.025), while a trend towards lower drainage output and shorter hospital stays in the same group (Table 2). The follow-up was significantly longer in the control group (33.9

vs 60.4). We could not find other significant differences in the perioperative parameters, like operative time, resection weight or rectus plication occurrence (Table 2).

Seroma occurrence was significantly reduced in the Scarpa preservation group (9.4% vs 26.2%, p=0.011, Table 3). No other differences among the postoperative complications' rates graded with the Clavien-Dindo classification were detected between the two study groups (Table 3). There were none of Clavien-Dindo grade III or IV complications.

Perioperative factors resulted in a p-value <0.4 with univariate analysis were included into a multivariable logistic regression model which did not identify any factor to be independent predictors of postoperative seroma formation nor surgical site occurrence (Table 4).

Discussion

These data support our hypothesis that preserving fascia Scarpa results in a significant reduced seroma occurrence and drainage duration in MWL patients. This was confirmed despite possible confounding factors such as preoperative conditions, higher BMI and the amount of weight loss.

A continuously increasing number of patients seeks body contouring surgery procedures after MWL caused by dietary changes and exercise or, more often, by bariatric surgery. Body contouring operations have shown to increase patients` quality of life, [5] but they are at risk of complications. Of these procedures, abdominoplasty is the most common one and it comes with the highest rate complications. [28] In order to achieve the best possible result benefitting patients` quality of life, finding possible strategies to mitigate complications is important.

Studies on traditional abdominoplasty reported an overall complication rates varying from 20.2% to 32.6%. [7-9] Seroma formation is well known as the most common abdominoplasty complication with an incidence ranging between 5 and 43%, typically higher in MWL patients. [7-10] In our analysis we also find an overall complication rate relatively high in both groups (50.9% versus 58.4% favoring the Scarpa fascia preservation group). Possible elucidating factors of those

outcomes may be mostly due to the challenging nature of our study material: all patients went through MWL (mostly over 40kg), high pre-operative BMI (near to 30 kg/m^2), high rate of post-bariatric patients (about 60%), and the percentage of smokers was relatively high (22.6-25.5%). These features have been largely studied as risk factors for complications after abdominoplasty. [9,10] Higher frequency of seroma, longer time with drains needed and greater output have been reported, [9] and obesity is the main risk factor for seroma formation together with smoking. [10] Furthermore, according to a meta-analysis, the risk for complications on post-bariatric population is 60-87% higher when compared to population which achieved weight loss due dietary changes or exercise. [29] In our report, we could not identify any independent risk factors for seroma or SSO maybe due to the relatively small study population.

Scarpa fascia preservation in abdominoplasty was firstly introduced by Le Louarn. [30] After that, this strategy has been shown to be beneficial in several articles, resulting in reducing seroma formation and duration. Interestingly, most of these studies reported a decrease in total drain output, [31-33] decreased time needed for drains, [31, 32, 34] and shorter hospital stay. [34] However, not all these studies detected a decreased seroma rate [34] and, when used ultrasounds to identify postoperative fluid collections, the incidence of seroma was similar. [33] Our outcomes are consistent with the previous published literature, despite our higher morbid population.

Some surgeons consider the aesthetic results to be inferior applying the Scarpa fascia preservation technique in abdominoplasty because untouching the deep fat layer above rectus fascia may result in additional bulking in the lower abdomen. However, the aesthetic result seems to be equal to the traditional abdominoplasty. [32] A recent meta-analysis on Scarpa fascia preservation in abdominoplasty reported pool outcomes of decreased time of drain removal, decreased total drain volume and hospital stay, without benefits on hematoma, bleeding, infection, and wound dehiscence. [20] Still, most of the included studies had patients with BMI close to normal, with only two studies on Scarpa fascia preserving abdominoplasty with MWL and/or bariatric patients and

both included a relatively small cohort of 51 and 42 post-bariatric patients. [22,23]. Both these studies detected a significant lower drain output and faster suction drain removal. One reported also reduced hospital stay, [22] and the other one did not find benefit on postoperative seroma formation rate identified by ultrasounds. [23]

Recently, studies on of abdominal wall anatomy, focusing on the distribution of lymphatic vessels have been performed to clarify if the seroma formation is possibly caused by a damage of the lymphatics and if preserving Scarpa fascia is beneficial because of subsequent preservation of its underlying lymphatics. [35, 36] Anatomical study on tissue samples from abdominoplasties found that around 17% of abdominal wall lymphatics were on the level of Scarpa fascia or beneath it and were most prevalent in the dermis. [35] Another study showed that lymphatic collectors of abdominal wall run above the Scarpa fascia and concluded that saving lymphatics is not the mechanism behind fewer seroma rate. [36] Other considered explanations were the reduced dead space [36] and a better adhesion between surfaces. [32]

Moreover, a study on post-abdominoplasty seroma composition reported that it resembles inflammatory exudate in composition, and it is altered through days to exudate with some features similar to lymph. Because of the inflammatory nature of the exudate, authors concluded that gentler tissue handling including Scarpa fascia preservation may be beneficial. [37]

The mechanisms behind the benefits of Scarpa preservation remain unclear and our results were consistent with previous clinical studies despite the higher BMI and weight loss amount of the included patients. Our findings are valuable for high-risk patients, without differences on operative time nor need for additional surgical equipment. Therefore, preserving Scarpa fascia seems to be a cost-saving strategy to reduce complications and extra costs involved with this procedure.

From the technical point of view, detecting the level of Scarpa Fascia might be a more demanding, but we believe that it is an easy technique to learn and apply with little practice.

The strengths of this study include its relatively large sample size, consistent surgical technique in the two groups, same surgical teams, long-term follow-up, and comparable groups in terms of comorbidities.

The most predominant limitation of this study is its retrospective nature. Secondly, the lack of randomization in the design might introduce a certain bias related to unmeasured confounding factors influencing the decision to preserve the Scarpa fascia for each abdominoplasty case. Third, even though a large cohort of patients was included, the number in Scarpa Fascia preservation group was relatively small compared to the control. Moreover, the presence of smokers may play a role in affecting the outcomes. Smokers were pre-operatively instructed to quit, but, after all, each group had around a quarter of smoking patients, which may have resulted in a complications' increase and could be source of further bias. [10] Finally, some of minor complications may have treated at primary health care facilities, and these possible occurrences have not been considered in our analysis.

Further studies with larger cohorts are needed to confirm the exact benefits of Scarpa fascia preservation particularly on MWL patients. Additional research on the nature of seroma formation and its related factors is also warranted.

Conclusions

Preserving Scarpa fascia on MWL patients may result in decreased seroma occurrence and earlier drains removal.

Disclosures

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

Declaration of conflicting interests

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