

## *" Complete versus Partial Scarpa's Fascia Preservation Technique in Abdominoplasty on Postoperative Seroma Incidence"*

### **Authors**

[Mohamed Elmaghraby](#)<sup>1</sup>, [Nagy Anas](#)<sup>2</sup>, [Hosaam Elkafrawi](#)<sup>3</sup>, [EhabEhab Ali Elhanafy](#)<sup>4</sup>,  
[Sherif Ibrahim Hegazy](#)<sup>1</sup>

<sup>1</sup> Lecturer of Plastic Surgery, Plastic Surgery Department, Faculty of Medicine, Port Said University, Egypt

<sup>2</sup> Plastic Surgery Department, Faculty of Medicine, Port Said University

<sup>3</sup> Plastic Surgery, Faculty of Medicine, Alexandria University

<sup>4</sup> Professor of General Surgery, Surgery Department, Faculty of Medicine, Port Said University, Egypt

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<https://muj.journals.ekb.eg/dean@med.psu.edu.eg>

[vice\\_dean\\_postgraduate@med.psu.edu.eg](mailto:vice_dean_postgraduate@med.psu.edu.eg)

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### **ABSTRACT:**

**Background:** Abdominoplasty is a surgical operation involving the removal of surplus fat and skin from the abdomen, along with the reconstruction of the anterior abdominal wall muscles. A common consequence is seroma, defined as a pathological collection of serous fluid, including lymphatic fluid and plasma, in a dead space. Maintaining Scarpa's fascia in the lower abdomen diminishes seroma formation post-abdominoplasty.

**Objectives:** This study aims to evaluate the entire Scarpa's fascia preservation approach with its partial preservation variant in abdominoplasty concerning postoperative seroma formation and other related surgical sequelae, including postoperative lower limb edema.

**Patients and methods:** The current randomized clinical study was carried out on 46 patients undergoing abdominoplasty surgery admitted to Port Said General Hospital and Alexandria University Surgery Hospital. Patients undergoing abdominoplasty were split into two equal groups of patients: Group I included 23 patients undergoing abdominoplasty with complete Scarpa's fascia preservation. Group II included 23 patients undergoing abdominoplasty with Partial Scarpa's fascia preservation.

**Results:** Our study showed statistically significant differences between the studied groups as regards operative time, hospital stay, postoperative hematoma and patient satisfaction. There were statistically no significant differences between the studied groups as regard drain removal and postoperative seroma.

**Conclusion:** The current study reported no difference in postoperative seroma incidence rates among complete Scarpa's fascia preservation technique and its partial preservation variant in abdominoplasty. There is significant difference in operative time between complete Scarpa's fascia preservation technique and its partial preservation variant in abdominoplasty.

**Key Words:** Abdominoplasty, postoperative seroma, Scarpa fascia preserving abdominoplasty.

## Background

The trunk signifies a region of considerable interest for plastic surgeons due to its substantial potential for body reshaping. It is a surgical treatment including the excision of surplus adipose tissue and dermal layers surrounding the belly, along with the reconstruction of the anterior abdominal wall musculature.

Plastic surgeons develop this technique aiming to reach an visually appealing form, combining various techniques which include direct excision of excess skin and liposculpturing with suction techniques. Due to recent increase in bariatric surgery, this procedure became a paramount method of helping these individuals with excess abdominal skin following weight loss <sup>(1)</sup>.

The indications for undergoing abdominoplasty are numerous, including patients who desire aesthetic enhancement to the shape of their abdomen, females that have redundant skin after repeated pregnancy or major weight loss after bariatric surgery <sup>(2,3)</sup>.

One of the frequently occurring complications that seems to raise the interest of current scientific research efforts is seroma; a known complication of abdominal wall surgery among other potential dead space creating surgeries, with a worldwide incidence of 10.9% after abdominoplasty <sup>(4)</sup>.

The pathophysiology that lies behind seroma occurrence is not fully understood. It develops via multifactorial origin by which fluids can accumulate producing a seroma. Surgeries with vigorous dissection of the soft tissue have a higher chance to transect lymphatic and blood vessels which can result in accumulation of transudate fluid. Patients undergoing excessive resection of tissue are prone to developing a larger potential dead space, which will decrease the chance for flap adherence by generating shearing pressures between the surfaces of the healing tissue <sup>(5)</sup>.

This contributes to an inflammatory process resulting in exudation of serous fluids from tissues which will promote seroma formation <sup>(6)</sup>.

Using quilting sutures has proven to be an effective method that is practiced frequently by plastic surgeons in order to obliterate the large dead space created during dissection. Employing a plane which is more superfascial in dissection beneath umbilicus while conserving the underlying Scarpa's fascia and circumventing the

traditional plane above rectus fascia has been proposed to reduce complication rates and enhance recovery by protecting the lymphatics <sup>(7)</sup>.

The precise trajectory of cutaneous lymphatic collectors in the abdomen wall and their association with Scarpa's fascia remains ambiguous. Preserving Scarpa's fascia in lower abdomen is believed to diminish seroma formation post-abdominoplasty, predicated on the belief that the lower abdominal lymphatics traverse beneath this layer <sup>(8)</sup>.

The preservation of Scarpa's fascia was linked for notable seromal reduction incidence, drain output, drain removal duration, temporary post-abdominoplasty lower leg edema, and length of hospital stay <sup>(9)</sup>.

The main aim of this ongoing research is to compare between complete Scarpa's fascia preservation technique and its partial preservation variant in abdominoplasty in regards to postoperative seroma development and other associated surgical complications including postoperative lower limb oedema. Other related complications and overall surgical outcome were also assessed.

## **METHODS**

This study which is randomized clinical trial was carried out upon 46 patients undergoing abdominoplasty surgery admitted to Port Said General Hospital and Alexandria University Surgery Hospital.

Patients undergoing abdominoplasty were splitted into two equally groups pf participants:

**Group 1:** 23 participant who will had abdominoplasty with complete Scarpa's fascia preservation.

**Group 2:** 23 participant who will had abdominoplasty with partial Scarpa's fascia preservation.

## **Inclusion criteria:**

- ◆ All participants undergoing abdominoplasty surgery for the first time with either complete or partial Scarpa's fascia preservation technique.
- ◆ Patients had abdominal abnormalities characterized with excessive abdominal skin

or fat tissue, accompanied by muscle weakness (as Matarasso types III and IV; Toledo types IV and V).

- ◆ BMI less than 35.

### **Exclusion criteria:**

1. Patients with other comorbidities that are known to contribute to fluid imbalances leading to increased chance of seroma development including patients with documented cardiac, renal or endocrinal abnormalities.
2. Patients who had chronic medical diseases (e.g., bleeding disorders, hepatic, renal, heart illnesses, and diabetes).
3. Patients undergoing abdominoplasty surgery for the second time or revision after initial abdominoplasty surgery done before.
4. Patients with previous history of major abdominal surgeries such as laparotomy.
5. Patients with consistent medication usage (particularly aspirin, NSAIDs, and anticoagulants).
6. Alcoholic patients
7. Patients with body mass index exceeding 35.
8. Patients who had psychological disturbances.

### **Methods:**

#### **A- History:**

- ◆ Age.
- ◆ Complaint of the patient.
- ◆ Previous abdominal surgery.
- ◆ Possibilities of recent pregnancy.
- ◆ Medical co-morbidities.
- ◆ Current use of medication.
- ◆ Smoking.
- ◆ Previous history of DVT.

#### **B- Physical examination:**

Examination was performed in standing, sitting and supine. The examination covered the following aspects:

- ◆ Degree of skin redundancy.
- ◆ Subcutaneous (S.C) fat accumutaletion degree.

- ◆ Muscle weakness degree.
- ◆ Skin quality.

#### **C- Preoperative laboratory assessment:**

- ◆ Complete blood picture (CBC).
- ◆ Liver function tests (LFT) and kidney function tests (KFT).
- ◆ Coagulation profile.
- ◆ HbA1c.
- ◆ Abdominal ultrasound.

#### **D- Preoperative radiological investigations:**

Radiological investigations including pelvi-abdominal ultrasound and CT abdomen if indicated.

#### **Operative technique:**

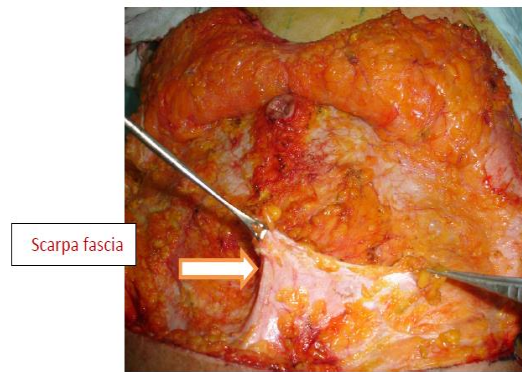
All studied participant received broad-spectrum IV antibiotics (third generation cephalosporins) as a routine prophylaxis.

In both groups, the operation was done under general anesthesia. The abdominal flap was dissected in two distinct planes: lower abdominal pre-scarpal fascia and premuscular layer in epigastric region & infra-umbilical midline.

Lower abdominal incision done and showed stained inguinal region, and identification of suprascarpal plane was done.

In the 1st group, the whole layer of Scarpa's fascia was identified and persevered in the lower abdomen including the central portion and both lateral ends (figure 1)

In the 2<sup>nd</sup> group, following the identification of Scarpa's fascia in the lower abdomen, the central portion was elevated with the abdominal flap to be excised. Dissection followed through until reaching the rectus sheath while preserving the lateral portion of Scarpa's Fascia on both lateral ends with a length ranging between 7 to 12 cm on each side. (figure 2)



**Figure (1):** A well defined scarpa fascia



**Figure (2):** Preserved lateral ends of Scarpa's Fascia with excised central portion.

### **Postoperative care:**

- ◆ Postoperative management including fluid balance, pain management, early ambulation, anti-edema medications and monitoring drains.
- ◆ Systemic antibiotics, local wound care, analgesic anti-inflammatory, anti-edematous, patients were instructed to avoid strenuous activity for 6 weeks postoperatively, and lymphatic massage if needed.
- ◆ Postoperative morbidity and mortality were assessed as regard surgical outcomes including postoperative complications and hospital stay.

### **Follow up:**

The studied participants were followed up by measuring output of drain the total and the daily volume, duration of drain extraction, length of hospital stay, and occurrence of complication either localized or systemic.

Drains then extracted when the daily output was lower than or equal fifty mL which were collected over a 24-hour period for each drain. Drains were not extracted at the first post-operative 24 hours, irrespective of fluid volume. The patients were encouraged for moving around on the initial post-operative day, and compression garments were utilized following surgery.

To measure the waist circumference (WC); it was measured in a point midway iliac crest and costal border along the mid axillary line. It was measured immediately preoperatively, immediately postoperatively, and 3 months postoperatively.

### **Statistical analysis:**

All the participants' findings and observation were gathered, coded, inputted, and analyzed via computer using a data base software program, IBM SPSS 23.0 for windows (SPSS Inc., Chicago, IL, USA).

#### **Data summarization:**

- ❖ **Qualitative data:** Number and percentage.
- ❖ **Quantitative data:** Mean, median, standard deviation (SD), inter-quartile range (IRQ), and ranges were used for presenting numerical variables.
- ❖ For comparing association between qualitative variables; Chi-Square [X<sup>2</sup>] test and Fisher's exact test (f) were utilized.
- ❖ For comparing association between quantitative variables of 2 groups; independent t-test and Mann-Whitney U test were applied.

### **RESULTS**

There was no observed statistical significant discrepancies between the two studied groups as regards demographic data as shown in Table 1.

Also, there was no discrepancies between the studied groups as regards clinical data ( $P > 0.05$ ). (Table 2)

But there was observed significant difference between the two groups as regards the mean of operative time, as operative time was significantly higher among patients of group I when compared with patients among group II ( $P < 0.001$ ). (Table 3)

Table (4) shows a statistically significant difference between the studied groups regarding hospital stay, postoperative hematoma and patient satisfaction, as the mean of hospital stay was higher among group I compared with group II ( $P = 0.02$ ). Also, (78.3%) of the patients among group I had hematoma in comparison to (47.8%) of the patients among group II ( $P = 0.03$ ). Also, most of the patients among group II (69.6%) had marked satisfaction, while most of the patients among group I had moderate satisfaction ( $P = 0.03$ ).

Table (5) shows no significant difference between the studied groups as regards postoperative seroma ( $P > 0.05$ ).

**Table 1: Demographic data among the studied groups**

Variables		Group I (n=23)	Group II (n=23)	Test	P Value
<b>Age</b> (years)	<i>Mean <math>\pm</math> SD</i>	39 $\pm$ 4.96	41.5 $\pm$ 3.94	-1.91	0.06 <sup>1</sup>
	<i>Range</i>	(28 – 46)	(36 – 48)		
<b>Sex (n. %)</b>	Male	3 (13%)	6 (26.1%)	F	0.46 <sup>2</sup>
	Female	20 (87%)	17 (73.9%)		
<b>Smoking status (n. %)</b>	Non-smokers	12 (52.2%)	11 (47.8%)	0.134	0.94 <sup>3</sup>
	Intermittent	5 (21.7%)	6 (26.1%)		
	Smokers	6 (26.1%)	6 (26.1%)		
<b>BMI</b> (kg/m <sup>2</sup> )	<i>Mean <math>\pm</math> SD</i>	30.4 $\pm$ 2.51	31.6 $\pm$ 2.17	-1.76	0.09 <sup>1</sup>
	<i>Range</i>	(24.9 – 33.1)	(27.8 – 34.4)		

\*<sup>1</sup>Student T-test, <sup>2</sup>Fisher exact test, <sup>3</sup>Chi-square test, Non-significant:  $P > 0.05$ , Significant:  $P \leq 0.05$



**Table 2: Clinical data among the studied groups**

Variables (n. %)		Group I (n=23)	Group II (n=23)	Test	P Value
<b>Skin redundancy</b>	Mild	3 (13%)	3 (13%)	F	0.92
	Moderate	9 (39.1%)	11 (47.8%)		
	Marked	11 (47.8%)	9 (39.1%)		
<b>Skin quality</b>	Mild stria	6 (26.1%)	3 (13%)	F	0.56
	Moderate stria	9 (39.1%)	9 (39.1%)		
	Marked stria	8 (34.8%)	11 (47.8%)		
<b>Subcutaneous fat accumulation</b>	Mild	5 (21.7%)	3 (13%)	F	0.39
	Moderate	12 (52.2%)	9 (39.1%)		
	Marked	6 (26.1%)	11 (47.8%)		
<b>Muscle weakness</b>	Mild	6 (26.1%)	3 (13%)	F	0.29
	Moderate	6 (26.1%)	11 (47.8%)		
	Marked	11 (47.8%)	9 (39.1%)		

\*Fisher exact test, Non-significant:  $P > 0.05$ , Significant:  $P \leq 0.05$

**Table 3: Operative data among the studied groups**

Variables (n. %)		Group I (n=23)	Group II (n=23)	Test	P Value
<b>Operative time (hours)</b>	<i>Median (IQR)</i>	3 (0.5)	2.5 (0.25)	90.0	<0.001 <sup>1</sup>
	<i>Range</i>	(2 – 3.5)	(2 – 3)		
<b>Drain removal(days)</b>	<i>Median (IQR)</i>	14 (4)	14 (1)	235	0.51 <sup>1</sup>
	<i>Range</i>	(9 – 19)	(11 – 17)		

\*<sup>1</sup>Student T-test, <sup>2</sup>Fisher exact test, <sup>3</sup>Chi-square test, Non-significant:  $P > 0.05$ , Significant:  $P \leq 0.05$

**Table 4: Postoperative outcome among the studied groups**

Variables		Group I (n=23)	Group II (n=23)	Test	P Value
<b>Hospital stay(days)</b>	<i>Mean ± SD</i>	2.35 ± 0.71	1.83 ± 0.78	2.37	<b>0.02<sup>1</sup></b>
	<i>Range</i>	(1 – 3)	(1 – 3)		
<b>Hematoma (n. %)</b>	Absent	5 (21.7%)	12 (52.2%)	4.57	<b>0.03<sup>3</sup></b>
	Present	18 (78.3%)	11 (47.8%)		
<b>Patient Satisfaction (n. %)</b>	Mild	3 (13%)	0 (0%)	F	<b>0.03<sup>2</sup></b>
	Moderate	12 (52.2%)	7 (30.4%)		
	Marked	8 (34.8%)	16 (69.6%)		

\*<sup>1</sup>Student T-test, <sup>2</sup>Fisher exact test, <sup>3</sup>Chi-square test, Non-significant: P >0.05, Significant: P ≤0.05

**Table 5: Postoperative seroma among the studied groups**

Variables		Group I (n=23)	Group II (n=23)	Test	P Value
<b>Seroma (n. %)</b>	None	12 (52.2%)	9 (39.1%)	F	0.84
	Mild	6 (26.1%)	9 (39.1%)		
	Moderate	3 (13%)	3 (13%)		
	Marked	2 (8.7%)	2 (8.7%)		

\*Fisher exact test, Non-significant: P >0.05, Significant: P ≤0.05

## DISCUSSION

Abdominoplasty is one considered as of the most prevalent aesthetic surgical treatments. As there is raising prevalence of bariatric procedures, there is a proven projected increase in patients exhibiting substantial skin excess and laxity, particularly in abdominal region, which will likely result in a corresponding rise in the demand for abdominoplasties in the future. The incidence of abdominoplasties rose by twenty-eight% from year 2012 to year 2017, with a substantial majority of patients being as a female gender <sup>(10)</sup>.

Abdominoplasty has demonstrated a beneficial effect on patients' quality of life also on patients' self-image; nevertheless, it presents comparatively elevated complication frequencies. The predominant consequences are localized and encompass wound dehiscence, infections, hematoma, seroma and necrosis. Systemic problems, as thromboembolic events, are few <sup>(11)</sup>.

Seroma incidence after abdominoplasty operations varies from one percent to fifty-seven percents, with a commonly acknowledged figure of ten percents. Should a patient encounter a seroma, they may require a return to clinic or hospital due to successive aspirations. Furthermore, the production of seromas can extend recovery duration and postpone the patient's resumption of normal activities <sup>(12)</sup>.

The proposed mechanisms that may lead to seroma production following abdominoplasty include shearing pressures between the fascia and abdominal flap, the creation of dead space, disruption of arterial and lymphatic channels, and the release of inflammatory mediators <sup>(13)</sup>.

Seroma is defined as a substantial accumulation of subcutaneous fluid in the abdominal cavity following drainage, necessitating intervention at least once. Seromas may necessitate many percutaneous interventions, and some may ultimately result in pseudo-tumors. Indeed, a further action may be anticipated to regulate the transition to the current state. The rate of seroma formation after abdominoplasty is significant and is consequently associated with prolonged hospital stays and increased frequency of physician visits post-discharge <sup>(14)</sup>.

As seroma is one of the most common complications of ab-dominoplasty operations, drains are kept for long time which increase hospital stay, patient suffer, and post-operative complications. In this technique, there is a reduction in post-operative seroma formation and then decrease in postoperative comorbidities and improve outcome <sup>(15)</sup>.

The current research main aim is to compare between complete Scarpa's fascia preservation technique and its partial preservation variant in abdominoplasty in regards to postoperative seroma development and other associated surgical complications including postoperative lower limb oedema.

This study was carried out on 46 patients undergoing abdominoplasty operation admitted to Port Said General Hospital and Alexandria University Surgery Hospital.

The current study included two groups of patients: Group I which include 23 patients undergoing abdominoplasty with complete scarpa's fascia preservation. Their ages ranged from 28 to 46 years, with a mean  $\pm$  SD of  $39 \pm 4.96$ . (13%) were males and (87%) were females. (21.7%) were intermittent smokers and (26.1%) were smokers. Their BMI ranged from 24.9 to 33.1 kg/m<sup>2</sup> with a mean  $\pm$  SD of  $30.4 \pm 2.51$ .

Group II included 23 patients undergoing abdominoplasty with Partial scarpa's fascia preservation. Their ages ranged from 36 to 48 years, with a mean  $\pm$  SD of  $41.5 \pm 3.94$ . (26.1%) were males and (73.9%) were females. (47.8%) were non-smokers, (26.1%) were intermittent smokers and (26.1%) were smokers. Their BMI ranged from 27.8 to 34.4 kg/m<sup>2</sup> with a mean  $\pm$  SD of  $31.6 \pm 2.17$ .

**Elhabaa et al.** <sup>(16)</sup> evaluated seroma formation in abdominoplasty at a shallower plane with Scarpa's fascia preservation. A total of 35 patients received abdominoplasty at Banha University Hospital, all performed by the same surgical team. Twenty procedures utilized the conventional technique, while 15 employed the Scarpa's fascia preservation method. The patients ranged in age from 21 to 46 years (mean  $32.2 \pm 6.21$ ), and all were female.

Our results showed no significant differences between the studied groups as regards demographic data, surgical history and clinical data. Similarly, **Aly et al.** <sup>(15)</sup> assessed the rate of post-operative seroma formation in Scarp's fascia preservation technique versus the traditional technique. The sample included female patients with pendulous abdomen (mean age of  $39.10 \pm 8.35$  yrs) and mean BMI of  $26.23 \pm 2.5$  kg/m<sup>2</sup> which is overweight. They found that there was no statistically significant difference between the two groups regarding any baseline characteristics.

Our study showed no significant difference between the studied groups in terms of surgical history. **Elhabaa et al.** <sup>(16)</sup> discovered that all patients had a history of 16 deliveries via caesarean section (CS) and 4 during normal labor.

Regarding operative data, our study showed a statistically significant difference between the studied groups as regards operative time, as operative time was higher among group I when compared with group II, but there was no significant difference between the studied groups as regards drain removal. Also, **Elhabaa et al.** <sup>(16)</sup> reported that the average operative time was  $186 \pm 12.24$ , indicating a substantial difference in operative duration.

Our study showed a statistically significant difference between the studied groups regarding hospital stay, postoperative hematoma and patient satisfaction, as the mean of hospital stay was higher among group I compared with group II. Also, (78.3%) of the patients among group I had hematoma in comparison to (47.8%) of the patients among group II ( $P=0.03$ ). Also, most of the patients among group II (69.6%) had marked satisfaction, while most of the patients among group I had moderate satisfaction ( $P=0.03$ ).

**Elhabaa et al.** <sup>(16)</sup> observed no significant difference ( $p\text{-value} > 0.05$ ) between the classic group (mean =  $2.48 \pm 0.87$ ) and the Scarpa's fascia preservation group (mean =  $2.27 \pm 0.63$ ).

In our study, there was statistically no significant difference between the studied groups as regard drain removal. Also, **Elhabaa et al.** <sup>(16)</sup> extracted drains after 7 to 10 days in all instances, revealing no significant difference between the Scarpa's fascia preservation group and the classic group. However, the mean drain output was  $175.14 \pm 52.81$  of serosanguineous fluid during the first postoperative week, demonstrating a significant difference between the classic and Scarpa's fascia preservation groups. **Shahin et al.** <sup>(17)</sup> similarly reported findings supporting the Scarpa's fascia preservation group. The preservation of Scarpa's fascia during abdominoplasty significantly enhances patient recovery by decreasing total drain output, time to drain removal, and duration of hospital stay. The cohort with preservation of Scarpa's fascia exhibited an average reduction of 2.0 days till drain removal and an average decrease of 1.9 days in hospital stay.

Our study showed no significant difference between the studied groups as regards postoperative seroma. **Aly et al.** <sup>(15)</sup> reported that two patients had developed seroma in the standard abdominoplasty group i.e., persistent seroma secretion after drain removal, mandating frequent aspiration and compression.

**Van Der Sluis et al.** <sup>(18)</sup> assessed the impact of Scarpa's fascia preservation on seroma occurrence and overall drain output following an abdominoplasty. The preservation of Scarpa's fascia during an abdominoplasty is correlated with a diminished occurrence of seroma, decreased total drain output, and expedited drain removal, in contrast to the conventional technique that does not preserve Scarpa's fascia. Preserving Scarpa's fascia may decrease seroma formation post-procedure, thus it should be regarded as standard practice.

Our research benefits from being a randomized clinical trial. Nonetheless, we encountered several limits. The data were obtained from a single center, potentially introducing selection bias. The validation cohort had a rather small sample size.

## CONCLUSION

Abdominoplasty is one of the most popular body-contouring procedures. Despite being considered a safe procedure, abdominoplasty (like other operations) is not free of complications. One of the important postoperative complications is seroma formation which remains the most frequent complication following abdominoplasty.

Multiple surgical strategies have been described to lower the complication rate specially that were related to wound complication and seroma formation, as placement of a drainage catheter, selective undermining, internal fixation sutures, avoidance of electrocautery, use of pressure dressing and the use of fibrin glue.

We have stated that scarpa fascia preservation during abdominoplasty seems to reduce the total amount of drain output, the time of drain removal and the incidence of postoperative seroma and complications. It produces a safe and less eventful postoperative period.

We have concluded that there is a difference in postoperative seroma incidence rates between complete Scarpa's fascia preservation technique and its partial preservation variant in abdominoplasty.

## REFERENCES

1. **Hafezi F and Nouhi A.** Safe abdominoplasty with extensive liposuctioning. *AnnPlast Surg* 2006; 57(2): 149-53.
2. **Hunecke P, Toll M, Mann O, Izbicki JR, Blessmann M, and Grupp K.** Clinical outcome of patients undergoing abdominoplasty after massive weight loss. *Surg Obese Relat Dis* 2019; 15(8): 1362-1366.
3. **Frank K, Hamade H, Casabona G, Gotkin RH, Kaye KO, Tiriyaki T, Freytag DL, Bialowas C, Koban KC, and Cotozana S.** Influences of age, gender, and body mass index on the thickness of the abdominal fatty layers and its relevance for bdominal liposuction and abdominoplasty. *Aesthet Surg J* 2019; 39(10): 1085-1093.
4. **Salari N, Fatahi B, Bartina Y, Kazeminia M, Heydari M, Mohammadi M, Hemmati M, and Shohaimi S.** The global prevalence of seroma after abdominoplasty: A systematic review and meta-analysis. *Aesthetic Plast Surg* 2021; 45(6): 2821-2836.
5. **Seretis K, Goulis D, Demiri EC, and Lykoudis EG.** Prevention of seroma formation following abdominoplasty: A systematic review and meta-analysis. *Aesthet Surg J* 2017; 37(3): 316-323.
6. **Janis JE, Khansa L, and Khansa I.** Strategies for postoperative seroma prevention: A systematic review. *Plastic and Reconstructive Surgery* 2016; 138(1): 240-252.
7. **Costa-Ferreira O, Marco A, Vasconez R, and Amarante L.** Abdominoplasty with scarpa fascia preservation. *Annals of Plastic Surgery (Internet)*, 2016.
8. **Tourani SS, Taylor GI, and Ashton M.** Scarpa fascia preservation in abdominoplasty: Does it preserve the lymphatics? *American Journal of Plastic Surgeons* 2005; 190(5): 717-20.
9. **Xiao X and Ye L.** Efficacy and safety of scarpa fascia preservation during abdominoplasty: A systematic review and meta-analysis. *Aesth Platic Surgery* 2017; 41: 585-590.
10. **Welbourn R, Hollyman M, Kinsman R.** Bariatric surgery worldwide: baseline demographic description and one-year outcomes from the fourth IFSO Global Registry report 2018. *Obes Surg.* 2019;29(3):782-795.
11. **The Aesthetic Society's Cosmetic Surgery National Data Bank.** Statistics 2019. *Aesthet Surg J* 2020; 40(Suppl 1): 1-26.
12. **Cosmetic Surgery National Data Bank Statistics.** *Aesthetic Surg J* 2016; 36 (Suppl 1): 1–29.
13. **Hurvitz KA, Olaya WA, Nguyen A, Wells JH.** Evidence-based medicine: Abdo-minoplasty. *Plast Reconstr Surg* 2014; 133(5): 1214–21.
14. **Di Martino M, Nahas FX, Kimura AK, Sallum N, and Ferreira LM.** Natural evolution of seroma in abdominoplasty. *Plastic and Reconstructive Surgery* 2015; 135(4): 691-8.
15. **Aly AE, Adly OA, Ellabban MA, and Gomaa AA.** Evaluation of postoperative seroma rate in abdominoplasty operations using infraumbilical scarpa's fascia preservation technique. *Suez Canal University Medical Journal* 2023; 26(5): 1-11.
16. **Elhabaa GI, Mansour MA, Mohammed MO, Younes MT, and Abdelmofeed AM.** Effect of scarpa's fascia preservation during abdominoplasty on postoperative seroma formation in overweight patients. *Benha Journal of Applied Sciences (BJAS)* 2021; 6(2): 233-242.
17. **Shahin M, Hagag M, El-Meligy M.** Outcome after preservation of Scarpa's fascia in abdominoplasty. *Egypt J Surg* 2018; 37(2): 260–4.
18. **Van Der Sluis N, Van Dongen JA, Caris FLS, Wehrens KME, Carrara M, and Van Der Lei B.** Does Scarpa's Fascia Preservation in Abdominoplasty Reduce Seroma? A Systematic Review. *Aesthetic Surgery Journal* 2023; 43(7): NP502-NP512.