

Comparative Study between the Supra-Scarpa's and the Supra-Fascial Planes of Dissection in Abdominoplasty Procedures, in the Incidence of Seroma Formation Postoperatively

WESSAM SAMIR WAHDAN, M.D.; AHMED MOHAMED SOBHY, M.D.;
MUSTAFA AHMED SEDDIK, M.Sc. and KARIMA TAHER ISMAIL, M.D.

The Department of Plastic and Reconstructive Surgery, Faculty of Medicine, Cairo University

Abstract

Background: As with any surgical procedure, abdominoplasty has been related to risks and complications, primarily seroma formation. Two of the popular modifications aiming to prevent seroma are: (1) Protection of the Scarpa's fascia; using a supra Scarpa's plane. (2) Placement of quilting sutures.

Objective: The aim of this research is to compare the incidence of abdominoplasty associated seroma formation; when using the supra-Scarpa's plane; and using the conventional supra-fascial pre-muscular plane with and without placement of quilting sutures.

Methods: In our randomized comparative controlled study, 30 patients underwent traditional abdominoplasty surgery split into 3 groups. The 1st group A, containing 10 studied cases, were performed using the supra Scarpa's plane. The other two groups, B and C, were done using the classic supra fascial pre-muscular plane; where group B, comprising of 10 patients, quilting sutures were placed; and group C, comprising of 10 patients, were done as a control group. All studied cases had been fitted with 2 abdominal drains. Postoperative seroma diagnosis had been confirmed with clinical signs and symptoms along with the net exudate collected in the drains.

Results: There is positive correlation to the lower incidence of seroma in Scarpa's fascia preservation abdominoplasty and placement of quilting sutures abdominoplasty than the traditional, while the comparison between the effectiveness of each of the two modifications has come out insignificant.

Conclusions: Using either of the two modifications is effective in decreasing the incidence of seroma formation in comparison with using the classic technique.

Key Words: Abdominoplasty – Comparison – Effectiveness – Prevention – Quilting sutures – Scarpa's fascia – Seroma.

Key Words: Abdominoplasty – Prevention – Quilting sutures – Scarpa's fascia – Seroma.

Ethical Committee:

Disclosure: No disclosure.

Introduction

Abdominoplasty has been one of the most common procedures done in plastic surgery practice as a solution for abdominal skin redundancy problems [1]. As any surgical procedure, abdominoplasty is related to various risks and complications; it carries a moderate complication rate 20%-34% including: unfavorable scars, dog ears, wound healing complications, loss or mal-positioning of the umbilicus, seroma, hematomas, pulmonary embolism, deep venous thrombosis [2]. Seroma formation is the most commonly occurring complication with an incidence rate of 10%-15% amongst all other complications [3]. Understanding the cause of seroma formation following abdominoplasty is vital to the development of preventative measures. Shearing forces between the flap and fascia, the risk is greatest where either or both of the opposing surfaces are a natural gliding surfaces seen in traditional abdominoplasty. The flap is raised just superficial to the external oblique aponeurosis, a gliding surface. Fat on the undersurface of the abdominoplasty flap does not adhere well to the shiny aponeurosis and this promotes seroma. Lymphatic drainage of the serous fluid produced at the surface of the undermined tissue is hypothesized to be further compromised by violation of the deep lymphatic veins that run just superficial to the abdominal wall muscle fascia [4]. Moreover, Fluid drainage to the cavity is increased by the dead space volume that is produced during

Correspondence to: Dr. Mustafa Ahmed Seddik,
E-Mail: m.seddik.7@googlemail.com

surgical undermining [5]. Preservation of Scarpa's fascia and the deep layer of fat compartment during abdominoplasty have been pointed out as a way to decrease in seroma formation. This allows preserving deep lymphatic system. Scarpa's fascia preservation has shown to highly significantly reduce drainage output and seroma formation down to 0–2.5%. As previous anatomical studies show that the abdominal wall lymphatic structures seem to be located in the area deep to the Scarpa fascia. The other mechanism in Scarpa's fascia preservation in decreasing complication may be due to better tissue healing and adhesion due to presence of two healing surface with better vascularization than the one is left after traditional abdominoplasty which is known to produce profound devascularization of the anterior abdominal wall. Studies were also in favor for quilting sutures, to be safe and effective way where it decreases the incidence of seroma formation, as these have been sutures used to attach the undermined upper flap to the abdominal wall fascia, closing the dead space between them [6].

In this study, we were targeted at two of the most popular proposed modifications aimed at tackling seroma, as we will compare using a supra Scarpa's plane, preserving the Scarpa's fascia; to the classic supra-fascial pre-muscular plane, with and without using quilting sutures. We aimed to assess the effectiveness of each of these two modifications. The aim of this research had been to compare the incidence of abdominoplasty associated seroma formation when using the Suprascarpa's plane; and using the conventional supra-fascial pre-muscular plane with and without placement of quilting sutures.

Patients and Methods

This randomized prospective controlled comparative research had been conducted on 30 studied cases complaining of various degrees of abdominal wall laxity, in the period from February 2019 to July 2019 for correction of abdominal redundancy. Cases were operated on from Feb. 2019 to April 2019 and close follow-up three times per week continued for three months afterwards when no symptoms or complications were recorded. Follow-up was once per month after that for routine checkup. Age ranged from 23 years to 46 years, with Mean of 33.27.

The sample population was divided randomly into three equal groups, arranged by patient consequent presentation to the clinic. The first patient presented was put in group A, the 2nd in group B, the 3rd in group C, the fourth in group A etc.

The first group, group A, comprising of 10 patients, were performed using the supra Scarpa's plane, preserving the Scarpa's fatty layer and its covering fascia.

The other two groups, B and C, were done using the classic supra fascial pre-muscular plane. The second group, group B, comprising of 10 patients, was done using the classic supra fascial pre-muscular plane where quilting sutures were placed during the inset of the upper flap in its new position.

The third group, group C, comprising of 10 patients, were done using the traditional supra fascial plane without any modifications.

In all patients, two abdominal negative suction drains were applied and removed when the drainage amount is less than 30–50 mL over a 24-hour period. Postoperative seroma diagnosis had been approved with the existence of clinical signs and symptoms along with the net exudate collected in the drains.

Inclusion criteria: Studied cases complaining of numerous degrees of abdominal wall laxity, studied cases with BMI (body mass index) 18–30, studied cases with significant amounts of abdominal skin and fat excess that has not been limited to the infra-umbilical region indicated for abdominoplasty and patients with age from 18 to 50.

Exclusion criteria: Patients with BMI above 30, previous history of abdominal surgery, patients with abdominal hernias, any history of medical comorbidities as history of asthma, DM (diabetes mellitus), HTN (hypertension), sleep apnea, cardiac diseases, patients on anticoagulant drugs or on immunosuppressive therapy, active smokers and patients who have lymphadenopathies or lymphangiopathies.

Pre-operative evaluation:

Preoperative evaluation included collecting a complete history, performing a general and local examination, ordering laboratory tests, evaluating photographs, making notes, and documenting all studied cases.

History taking: The history covered the following aspects: Age, name and sex, complaint of the patient, previous abdominal surgery, number of previous pregnancies (in females), possibilities of recent pregnancy (contraceptive method) or desire of future ones, medical co-morbidities as diabetes, hypertension, current use of medication as anticoagulant, aspirin, smoking, previous history of DVT (deep venous thrombosis), recent chest infection

and measuring the weight and height of all patients to calculate the BMI.

Local examination: Examination of the patients was done in the standing; supine and diver's positions and it covered the following aspects: Degree of skin redundancy detected by pinching test.

Evaluation of the degree of abdominal lipodystrophy, skin laxity, striae, pigmentation, and musculo-aponeurotic flaccidity, as well as the abdominal wall's entire "layers" (skin, subcutaneous fat, and underlying fascia/muscle) the existence of ventral wall hernias, the degree of the recti's divarication, and the scars from prior abdominal surgery.

Pre-operative investigations: Labs: Complete blood picture, liver and kidney function, Coagulation profile, fasting blood sugar, HCV (hepatitis C virus), HBV and HIV (human immunosuppressive virus) virology, ECG (electro-cardiogram) was done if the patient was above 40 years and abdominal ultrasound.

Consent: Every studied case received information regarding the research, the photos, the procedure, the type of anesthesia, the risks involved, and any potential complications. They signed the consent, both written and oral. The studied case was marked in a standing position on the day of operation.

Preoperative marking: On the day of surgery, the patient was marked in standing position. (1) Mark the midline from the xyphoid process running by umbilicus to the pubis. (2) References are marked initially which includes identification of the pubic bone and ASIS (anterior superior iliac spine) bilaterally, groin lines, central midline, parallel lines to the central midlines that crosses the flanks. With the patient standing, the lateral aspects of the abdominal fold are marked. This is a guide to the lateral extension of the incision. (3) Traction is placed by the assistant upward on the abdominal skin and a low transverse supra-pubic incision is marked 6-8 cm from the vulvar commissure/penile eminence then extending the mark toward the right and left anterior superior iliac spine below them and 1-2 cm below the abdominal fold. (4) Another transverse mark was made just above the umbilicus which was almost the estimated amount needed to be excised.

Operative approach: All procedures had been done under general anesthesia, one gram of prophylactic antibiotic Ceftriaxone had been given, all studied cases laid supine, and Foley's catheters had been applied to all studied cases, the extremities were well padded and positioned, compression stockings were placed, disinfection and draping

were done, and all incision lines had been injected with a solution of saline, lidocaine and epinephrine. Minimal liposuction for the flanks was done using wet technique in all cases.

Incision: A Full traditional abdominoplasty procedure was done, and the procedures started by a lower abdominal incision.

Dissection: In group A: Dissection is taken straight down to the supra Scarpa's fascia overlying the deep adipose layer above the rectus sheath. In group B and C: Dissection has been taken straight down to the supra fascial pre-muscular plane overlying the rectus sheath directly. Flap elevation was performed with wide undermining of the skin and subcutaneous tissue from the underlying fascia in a loose areolar plane in an inverted "V" type fashion and laterally only to the extent necessary to achieve wound closure without tension till reaching the umbilicus in the midline and up to the costal margin laterally. Preservation of a tiny quantity of fat in the ASIS's muscle fascia to shield the lateral femoral cutaneous nerve was done. 2 traction sutures with asymmetric tails are placed in the umbilicus at the six and twelve o'clock positions. The umbilicus is made of a circular incision, and the abdominal skin and fat are cut away from it until the rectus sheath is exposed using dissecting scissors.



Fig. (1): Umbilical dissection.

Avoiding skeletonizing the umbilical stalk, this leads to compromised vascularity of the umbilicus. Throughout the course of the dissection, meticulous hemostasis was done. The inferior flap was split to facilitate subsequent upward dissection. Peri-umbilical perforators were identified and controlled with either electro cautery or suture ligature. Adequate hemostasis was done. After complete dissection of the skin and fat, the extent of divarication of the recti was detected. Marking line of plication by Methylene blue to the rectus sheath elliptically as a proposed area to be imbricated.

Only vertical plication of the rectus fascia using continuous sutures (PDS1) supported by interrupted sutures (Vicryl 0) from the xiphoid process to the umbilicus and from the umbilicus to the symphysis pubis was used to address the laxity of the abdominal wall. Without tying a knot, the suture was 1st fastened at the xiphoid by passing the needle through the pre-existing loop. Continuous myofascial plication was restarted at the inferior margin of the umbilicus while suturing continued in a running way down 1 side of the rectus sheath only at the upper edge. Buried was the knot that was knotted at the level of the pubic symphysis, where the plication met the skin. To ensure that all suture strands have been among the plication margins, this was accomplished by drawing the suture out among the medial edges of the plication and then inserting the needle into the opposing rectus sheath, going from deep to superficial and back again. After the plication the peak inspiratory pressure was monitored

to ensure that inspiratory pressure did not increase by more than 10mmHg or that it is not greater than 35mmHg. Dermofat excision: The bed was flexed, bringing the studied case to a seated position, flexed at the hips and placed in a Trendelenburg position 45 degrees. Once more, the pre-marked level or the quantity of skin and fat that may be removed from the abdominal wall to enable a tension free closure was marked, or adjusted the 2 sides were measured and checked for symmetry. In the midline, a temporary staple was inserted. The flaps were moderately tensioned and towel clips were positioned at their tips, which needed to be respected. After that, the abdominal flaps were removed. The wound was copiously irrigated, and a second hemostasis was done. The long umbilical stalk was dealt with by plicating the umbilicus to the rectus sheath by an interrupted 4-0 monocryl dermal to fascial sutures which were placed every 90degrees (at the 12, 3, 6 and 9 o'clock positions) around the umbilicus.

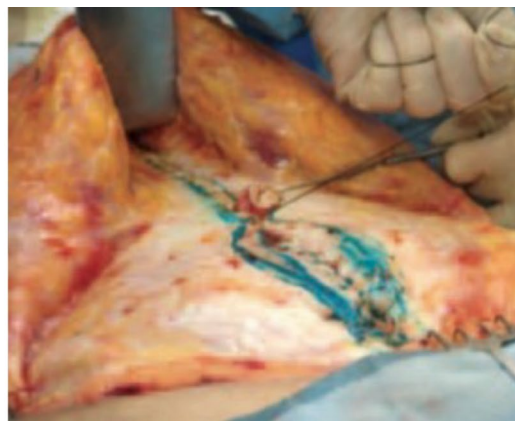


Fig. (2): Starting with the xiphoid, the plication continues all the way to the symphysis pubis.

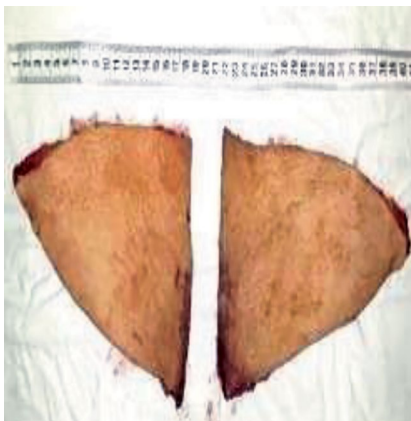


Fig. (3): Dermo fat excision.

Drains: In all groups, application of two 18 gauge closed negative suction drains through the supra pubic area was done. Beneath the bilateral incision and bound with silk sutures.

Before Closure: In Group (B): Using 2-0 Vicryl simple sutures, quilting sutures were placed, leaving at least two inches among each stitch. The upper abdominal flap was sutured to the abdominal fascia with quilting sutures along the midline to the level of the umbilicus. The process of suture placement begins with the surgeon using their nondominant hand to advance the flap. The dominant hand places the suture into the flap at the highest point of the midline and then into the deep fascia about 1–2cm beyond the flap's advanced position. This is to account for the deep fasciae laxity and elasticity. The assistant then replaces the surgeon's hand to maintain the flap in the advanced position while the surgeon ties the suture. This process is repeated in a vertical manner leaving 4cm between each suture until the umbilical stump is reached. More flap progress with equally distributed sutures is anticipated. Midline quilting sutures also helped in creating an attractive groove and in setting the umbilicus at the proper level. Then proceeding in the infra umbilical area by sewing the deep fascia (rectus sheath) to the superficial fascia on the underside of the flap, tension on the flap was evenly distributed till the abdominal flap touched the inferior wound margin.

Inset of the Umbilicus: The new site of the navel had been revealed by projecting the position of the umbilical stalk upon the surface of the dermofat flap. This had been done first by temporarily a temporary staple closing the dermofat flap to the lower edge of the lipectomy incision at the midline, and then the umbilical stalk was felt under the dermofat flap by the index finger exerting slight pressure in a cranial direction along the midline marking a point corresponding to the tip of the finger with a marking pen using the other hand. Then the marked site was incised as a vertical ellipse and a small amount of defatting was performed in the flap around the new umbilical site. Umbilical stalk plication together between the rectus sheath around the umbilical stalk and the deep dermis at the edge of the new umbilical site helped to provide a desirable periumbilical depression. The navel was sutured in two layers, interrupted absorbable vicryl 3/0 in the deep dermis and a running absorbable monofilament 4/0 subcuticular for skin closure.

Closure: Closure of the deep dermal layer with vicryl 2-0 continuous sutures to be followed the superficial fascial system was closed with vicryl 0 interrupted sutures, with the superior edge of the SFS

having advanced relative to the lower edge. PDS 3-0's subcuticular layer of closure.

Postoperative care: In the operating room, compression clothing was placed on each studied case, and it remained in place for 6 weeks. Before leaving the OR, the urinary catheter was taken out. For the first forty-eight hours, place the patient on semi-sitted bed rest. On the evening of the procedure, all studied cases were told to walk around while leaning forward. After surgery, all studied cases took oral antibiotics for one week.

The patients were discharged on the second day postoperative and came back for regular follow up visits. In all groups the drain was evacuated every 24 hours, the amount and the color were recorded. The drains were removed when drainage output was <50cc in twenty-four hours. Follow-up was done one, two, four weeks and three months after discharge. In case of detection of seroma, the patient was followed-up clinically, with examination and repeated aspiration. Positive cases were then followed up and aspirated every two days for one week, except for one case that was aspirated for a month duration till it resolved completely without any complications.

Results

Statistical analysis: Data had been entered into the computer, and IBM SPSS version 20.0 had been utilized for analysis. (Armonk, NY: IBM Corp.) The qualitative data had been explained using numbers and percentages. The Kolmogorov-Smirnov test had been used to confirm that the distribution had been normal. Quantitative data had been defined using the terms range (minimum and maximum), mean, standard deviation, median, and interquartile range. The significance of the findings had been evaluated at the fifth percentile.

The used tests were Chi-square test: Comparing categorical variables across various groupings. F-test (ANOVA): Comparing more than 2 groups for quantitative variables with a normally distributed distribution.

These tables reveal that there had been statistically significant difference among the studied groups as regard drain data. Regarding the drain data, there had been no statistically significant difference among groups A and B. Regarding the drain data, there had been a statistically significant difference among groups A and C. Regarding the drain data, there had been a statistically significant difference among groups B and C.

Table (1): Comparison between daily drain collection in each group.

	Group						<i>p</i> -value
	Group A		Group B		Group C		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
Drains d0	203.00	72.12	233.00	38.02	345.00	43.78	<0.001
Drains d1	148.00	55.14	155.00	36.89	260.00	56.76	0.001
Drains d2	105.00	42.23	109.00	21.83	195.00	55.03	0.001
Drains d3	72.22	26.35	80.00	34.96	140.00	61.46	0.012
Drains d4	62.50	25.00	60.00	22.36	111.11	60.09	0.118
Drains d5	50.00	–	50.00	–	91.67	20.41	0.143
Drains d6	–	–	–	–	50.00	0.00	–

Table (2): The Net volume of drains and the time of removal.

	Group						<i>p</i> -value
	Group A		Group B		Group C		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
Time of drain removal (days)	4.40	0.84	4.60	0.70	6.00	1.15	0.006
NET drain volume	551.00	211.42	607.00	118.33	1100.00	289.64	<0.001

Table (3): Comparison between mean Net volume of drain exudate in all groups.

	<i>p</i> -value
Group A VS group B	1.000
Group A VS group C	0.001
Group B VS group C	0.003

Table (4): Comparison between mean time of drain removal in all groups.

	<i>p</i> -value
Group A VS group B	1.000
Group A VS group C	0.009
Group B VS group C	0.035

Table (5): Demonstration of incidence of complication in each group.

	Group						<i>p</i> -value
	Group A		Group B		Group C		
	Count	%	Count	%	Count	%	
<i>Complication (seroma)</i> <i>post op:</i>							
Yes	0	0.0	0	0.0	4	40.0	0.023
No	10	100.0	10	100.0	6	60.0	
<i>Complication (seroma)</i> <i>post month 1:</i>							
Yes	0	0.0	0	0.0	1	10.0	1
No	10	100.0	10	100.0	9	90.0	
<i>Complication (seroma)</i> <i>post months 3:</i>							
Yes	0	0.0	0	0.0	0	0.0	—
No	10	100.0	10	100.0	10	100.0	

Table (6): Group A data.

Patient no.	Age	Gender	BMI	Drain removal	Net volume	Seroma formation
A01	32	F	25	D5	850	No
A02	34	F	25	D5	700	No
A03	30	M	25	D4	280	No
A04	39	F	29	D4	430	No
A05	35	F	25	D5	650	No
A06	45	F	30	D4	550	No
A07	28	M	21	D4	550	No
A08	34	F	29	D4	350	No
A09	32	F	22	D5	800	No
A10	46	M	24	D4	300	No

Table (7): Group B data.

Patient no.	Age	Gender	BMI	Drain removal	Net volume	Seroma formation
B01	45	F	25	D4	550	No
B02	23	M	25	D5	700	No
B03	30	F	25	D5	700	No
B04	33	F	25	D5	550	No
B05	36	M	20	D4	580	No
B06	28	M	25	D4	500	No
B07	32	F	25	D4	550	No
B08	34	F	24	D5	650	No
B09	40	F	20	D6	800	No
B10	42	M	24	D4	450	No

Table (8): Group C data.

Patient no.	Age	Gender	BMI	Drain removal	Net volume	Seroma formation
C01	31	F	21	D5	900	Yes
C02	28	F	20	D4	700	Yes
C03	26	M	25	D7	1550	Yes
C04	30	F	25	D5	750	No
C05	28	M	25	D7	1450	Yes
C06	30	F	25	D7	1150	No
C07	30	F	25	D7	1350	No
C08	32	F	25	D7	1200	No
C09	34	F	25	D6	950	No
C10	45	F	25	D5	1000	No

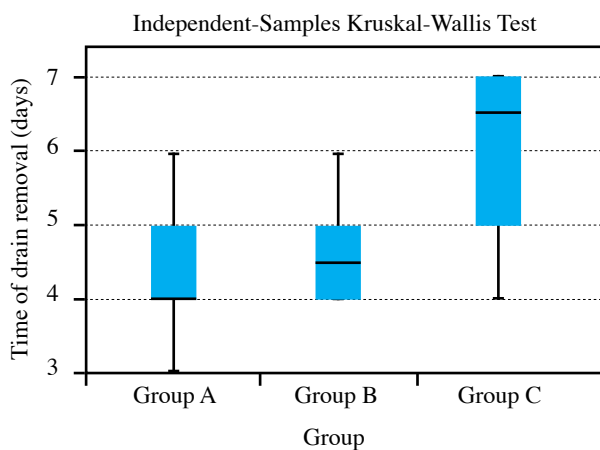


Fig. (4): Comparing among the studied groups as regard drain duration.

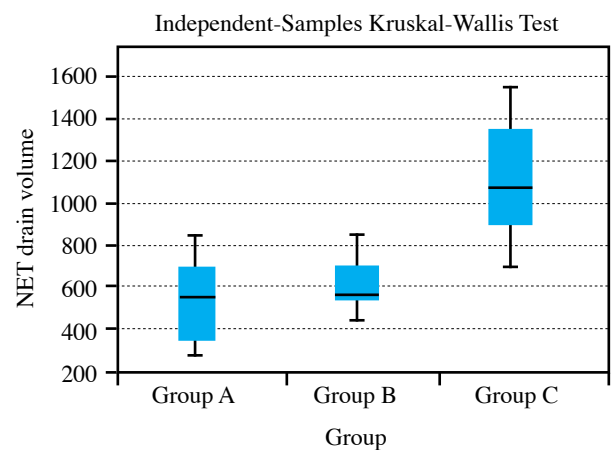


Fig. (5): Comparing among the studied groups as regard Net drain Vol.

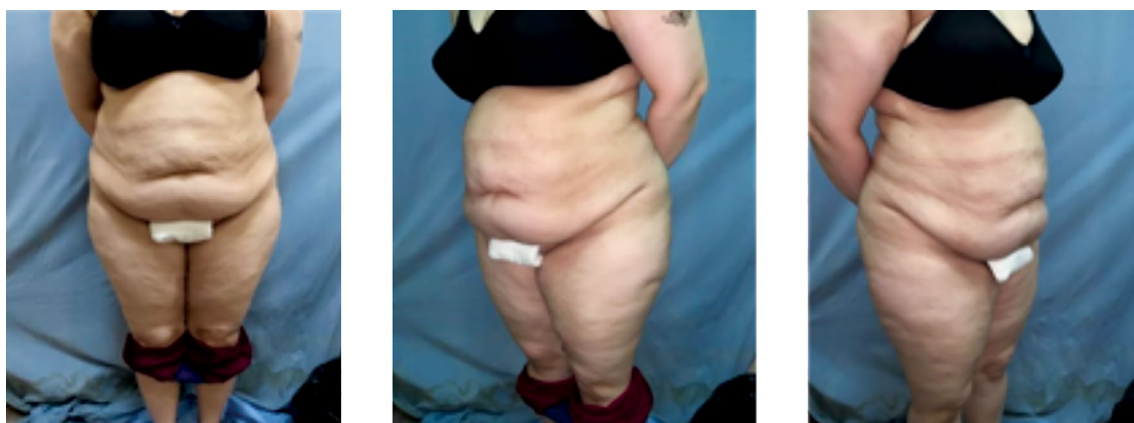
Case Presentation

Case (1):

36 years old female patient, presented with redundant skin of the abdomen with divarication of recti muscles after 3 cesarean sections.

The pre-operative workup was done according to the established protocol. Operative A Full traditional abdominoplasty procedure was done, and the procedures began by a lower abdominal incision.

Fig. (6): 36 years old female, with redundant abdominal skin and divarication of recti muscles.



(6-A): Pre-operative pictures anterior, left anterior oblique and right anterior oblique views.



(6-B): One month post-operative anterior, left anterior oblique and right anterior oblique views.

Discussion

We demonstrated in this research that there had been a statistically significant difference in drain data among the groups under investigation.

In study to compare among Supra-Scarpa's Fascia Abdominoplasty and Traditional Abdominoplasty, Rahal et al. [7] found that Group A's average drain output was 206.3ml, whereas Group B's average drain output was 390.5ml. A statistically significant difference had been discovered ($p < 0.05$).

In the El Wakeel et al. [8] Comparing the research employing a supra Scarpa plane of dissection (group) to the conventional rectus sheath dissection plane (group A), there was a significant decrease in drainage volume and early drain removal ($p < 0.001$).

These outcomes agree with Shahin et al., [9] who performed comparative research between classic abdominoplasty and Scarpa's fascia preservation (38 patients, 18 of them with Scarpa's fascia preservation) and demonstrated that the mean total drain output in Scarpa's fascia preservation group was 171.5ml, which had been much lesser than classic abdominoplasty (702ml). Moreover, drains were removed earlier at the third postoperative day with Scarpa's fascia preservation as compared with 6days in patients of classic abdominoplasty. This agreed with Costa-Ferreira et al., [3] who presented a randomized clinical trial examining the safety and effectiveness of Scarpa's fascia preservation following abdominoplasty. The results demonstrated a highly significant decrease in the total drain output 65.5 percent and the time required for drain removal three days for the Scarpa fascia preservation group.

We showed in this research that there had been a statistically significant difference in the production of seroma within the first month among the groups under investigation.

Using Scarpa fascia and deep fat preservation, 112 lipoabdominoplasty surgeries were retrospectively analyzed, Ali et al. [10] revealed a mean of two days for drain clearance and a low seroma rate of 3.6 percent. The phrase “huge abdomen” used by the authors to describe the instances was justified because of the high BMI of the examined patients (mean of 35.2), together with considerable lipodystrophy, diastasis, large abdominal panniculus, and severe pubis ptosis. In Hammad et al. [11] forty-five individuals in the research underwent abdominoplasty using the flap elevation technique with strong lateral tension. In the infraumbilical region, fifteen cases had undergone the superficial plane of dissection. In the infraumbilical region, fifteen patients underwent subcarpal plane dissection. In the same area, the remaining fifteen cases underwent supracapular plane dissection. They discovered that there has been a statistically significant difference between the percentage of seroma formation among cases in group I (twenty percent) and groups II and III (0% and 0%, respectively).

Koller, [12] The supra Scarpa plane had been described to considerably lower the seroma risk and drainage volume in prospective research comparing 2 classic abdominoplasty groups (twenty-five patients each) utilizing either the supra muscle plane or the supra Scarpa plane. According to his report, the drain removal time was nearly the same. Both groups underwent flap dissection with an ultrasonically activated scalpel, a procedure that is suggested to lower the drainage/seroma rate in comparison to electrocautery.

Our outcomes were supported by the results of Shahin et al. [9], they reported that seroma was detected in three (15%) studied cases who underwent classic abdominoplasty, whereas all patients with preservation of Scarpa's fascia (18 patients) passed without seroma.

Our outcomes agree with Ardehali and Francesca, [13] who investigated the impact of abdominoplasty changes on seroma incidence. They reported that of the 228 studied cases (2.63 percent) who underwent Scarpa's fascia preservation, 6 cases got seroma, while of the 224 studied cases (6.69 percent) in the standard abdominoplasty group, fifteen cases experienced seroma.

Conclusion:

We have concluded that this study adds to growing body of evidence supporting the safe and successful placement of quilting sutures or preservation of Scarpa's fascia, both of which will reduce the seroma rate, the overall amount of drain output, the time required for drain removal, and any problems. It results in a less dramatic and safe recovery phase.

References

- 1- Peter A., Kreymerman, Raymond Isakov M.Z. Siemionow and M.E. Isenmann Klein: Plastic and Reconstructive Surgery, 645.
- 2- Jeroen H., Uchelen J.H., Werker P.M. and Kin M.: Complications of abdominoplasty in 86 patients, *Plast. Reconstr. Surgery*, 107: 186.
- 3- Costa-Ferreira A., Rebelo M., Silva A., Vasconez L.O. and Amarante J.: Scarpa fascia preservation during abdominoplasty: Randomized clinical study of efficacy and safety. *Plast. Reconstr. Surg.*, 131 (3): 644–51, 2013.
- 4- KHAN U.D.: Risk of seroma with simultaneous liposuction and abdominoplasty and the role of progressive tension sutures. *Aesthetic Plast. Surg.*, 32: 93–99, 2008.
- 5- Najera R.M., Asheld W., Sayeed S.M. and Glickman L.T.: Comparison of seroma formation following abdominoplasty with or without liposuction. *Plast. Reconstr. Surg.*, 127 (1): 417-22, 2011.
- 6- Pollock T. and Pollock H.: Progressive tension sutures in abdominoplasty: A review of 597 consecutive cases. *Aesthet. Surg. J.*, 32: 729-42, 2012.
- 7- Rahal A., Alboudi S., Alhilbawi M. and Alhassanieh A.: A Comparison between Supra-Scarpa's Fascia Abdominoplasty and Traditional Abdominoplasty: Effect of Caesarian Section, 2021.
- 8- El Wakeel H., Abouarab M. and Kholosy H.: Scarpa Fascia versus Rectus Sheath Plane in Lipoabdominoplasty Flap Dissection: Comparative Study. *The Egyptian Journal of Plastic and Reconstructive Surgery*, 45 (3): 113-119, 2021.
- 9- Shahin M., Hagag M. and El-Meligy M.: Outcome after preservation of Scarpa's fascia in abdominoplasty. *The Egyptian Journal of Surgery*, 37 (2): 260-264, 2018.
- 10- Ali A., Elbarbary A., Farag M. and Saleh M.A.: Technical Considerations in Abdominoplasty of Huge Abdomen. *The American Journal of Cosmetic Surgery*, 29 (4): 252-259, 2012.
- 11- Hammad A. and Aliyev V.: *BAOJ Surgery*, 2017.
- 12- Koller M. and Hintringer T.: Scarpa fascia or rectus fascia in abdominoplasty flap elevation: A prospective clinical trial. *Aesthetic Plastic Surgery*, 36: 241-243, 2012.
- 13- Ardehali B. and Fiorentino F.: A meta-analysis of the effects of abdominoplasty modifications on the incidence of postoperative seroma. *Aesthetic Surgery Journal*, 37 (10): 1136-1143, 2017.