Abdominoplasty Flap Elevation in a More Superficial Plane: Decreasing the Need for Drains

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Background: Abdominoplasty has continued to become more frequently performed in the post–bariatric surgery and aesthetic patient populations. With the increase in these procedures, there is a need to decrease the length of drains for patient comfort and postoperative recovery. The authors' hypothesis was that a more superficial plane of abdominal flap elevation during abdominoplasty would decrease the postoperative need for drains.
Methods: The authors reviewed 202 consecutive abdominoplasties with 99 procedures performed using a standard suprafascial dissection (group I) and 103 procedures using a modified plane of flap elevation that preserves the thin areolar tissue along the abdominal wall (group II). Patient demographics, perioperative complications, and drain data were recorded.
Results: Patient characteristics did not differ significantly, with the mean age of group I and group II (44 ± 8.9 years and 44 ± 9.6 years, respectively) and body mass index of group I and group II (24 ± 3.8 and 24 ± 3.8, respectively) being similar. Perioperative complications included seven seromas in group I and two seromas in group II. There were two minor hematomas in group I and two minor hematomas in group II. The drains for patients in group II met criteria for removal 3 days earlier than those for group I ($p < 0.0001$). On average, patients in group II had drains removed at postoperative days 4 to 5.
Conclusions: Flap elevation in a plane superficial to the standard suprafascial approach during abdominoplasty may decrease the length of time required for drains in the postoperative period in the abdominoplasty patient. Decreasing the length of time for postoperative drains may improve patient comfort and expedite recovery. (*Plast. Reconstr. Surg.* 125: 677, 2010.)

In recent years, abdominoplasty and related body contouring procedures have continued to increase in number both in aesthetic and in post–bariatric surgery patients. Specifically, the 2008 American Society for Aesthetic Plastic Surgery Cosmetic Surgery National Data Bank reported that the number of abdominoplasty procedures had increased more than 300 percent over the past decade.[1,2]

Postoperative seroma formation remains the most frequent complication following an abdominoplasty procedure.[3] The overall incidence of seromas has not changed dramatically in the modern era of abdominoplasty procedures. A number of investigators have reviewed the frequency of postoperative seromas over the past 30 years, reporting incidences between 5 and 50 percent.[4–9]

The most frequently used method for decreasing seroma frequency has probably been the use of closed suction drains. Despite this known proven technique, there remains room for improvement in the reduction of postoperative seromas. Some authors have reported refinements

to contemporary abdominoplasty techniques, such as the placement of quilting sutures to reduce the dead space, in an attempt to decrease the occurrence of postoperative seromas.[4,7,10] Fibrin glue has also been used as a potential solution for decreasing the incidence of seromas.[11] Furthermore, both the avoidance of electrocautery and the substitution of the harmonic scalpel to reduce thermal injury have been reported to be beneficial.[12]

The anatomy and physiology of lymphatic vessels in the abdominal wall have been described to be an important factor in the status of the abdominal wall following abdominal lipectomy.[13] Violation of the deep lymphatic vessels that run just superficial to the abdominal wall muscular fascia is thought to further compromise lymphatic drainage of the serous fluid produced at the surfaces of the undermined tissue. One technical modification to flap elevation is the dissection of a more superficial plane, which can be found just below the Scarpa fascia in thin patients. In patients with thicker adipose tissue, this loose areolar tissue and a thin layer of deep fat should be preserved to avoid disturbing the major lymphatic vessels against the abdominal wall. Le Louarn had described a similar technique, in which he used a superficial dissection plane below the umbilicus and limited dissection centrally above the umbilicus. In this report, he presented a series of 65 patients without a single occurrence of seroma.[14]

We reviewed the experience of the senior author (T.A.M.) in studying this more superficial dissection plane of flap elevation during abdominoplasty. Before this technical addition, the senior author had performed abdominoplasties using a modified high-lateral-tension technique with a standard plane of elevation immediately above the abdominal wall muscular fascia for development of the abdominal skin flap.[15] The senior author made the single modification in his technique in April of 2006, inspired by the report of Le Louarn[14,16]; subsequently, every patient underwent the procedure with use of the superficial dissection plane. We hypothesized that abdominal flap elevation in this modified plane decreased seroma rates and decreased the need for postoperative closed-suction drains.

PATIENTS AND METHODS

Patient Selection

This study was approved by the Northwestern University Feinberg School of Medicine Institutional Review Board. We completed a retrospective chart review of 202 consecutive abdominoplasties performed by the senior author between January 1, 2004, and January 1, 2008. This group of patients consisted of a cohort of 99 consecutive individuals who underwent abdominoplasty performed with a standard suprafascial dissection above the abdominal wall muscular fascia (group I) and a cohort of 103 consecutive individuals who underwent abdominoplasty performed with the modified plane of elevation for the abdominal wall skin flap (group II).

By physical examination, the preoperative classification of the patients consisted of class II and III deformities under Matarasso's classification of abdominal wall laxity.[8] All patients were American Society of Anesthesiologists class I or II.

Surgical Technique

The first 99 abdominoplasties (group I) were performed before April 1, 2006, using the standard suprafascial dissection immediately above the abdominal wall. Intraoperative dissection was performed using infiltration of tumescent solution and sharp dissection with the scalpel. Concerted efforts were made to preserve as many perforators along the costal margin as possible. The rectus diastasis was plicated in the usual fashion, and the umbilicoplasty was performed using a simple vertical slit technique as described previously.[17] Supplemental lipoplasty of the hips and waist was included in the procedure in most patients, and liposuction of the upper abdomen near the costal margin was performed selectively in a few patients.[15]

The subsequent 103 abdominoplasties (group II) after April 1, 2006, were performed with a modified plane of dissection deep to the Scarpa fascia and preservation of the thin areolar tissue just superficial to the muscular fascia for elevation of the skin flap. This loose areolar tissue plane was defined reliably by infiltration of local anesthetic just above the rectus muscle fascia. In patients with more adipose tissue, the plane was found well below the Scarpa fascia to leave a thin layer of fat on top of the muscular fascia (Figs. 1 and 2). In the region of the linea alba, the dissection plane was transitioned to the conventional suprafascial dissection to allow a standard rectus sheath plication for rectus diastasis correction. All other technical aspects of the procedure remained consistent between these two groups, such as infiltration of tumescent solution, rectus plication, umbilicoplasty, and lipoplasty.

Unless general anesthesia was necessitated by a concurrent procedure or desired by the patient,
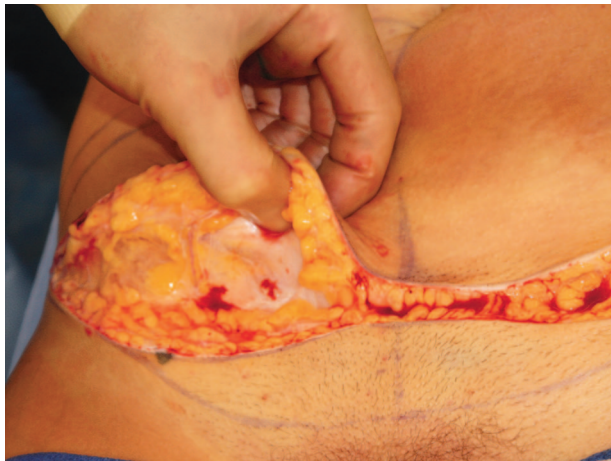
Fig. 1. The dissection plane of the abdominal wall skin flap is developed just deep to the Scarpa layer in thin patients. In heavier patients, infiltration with a wetting solution helps to identify the loose areolar layer that should be preserved.

Fig. 2. Intraoperative view of the completed elevation of the skin flap. Note the layer of deep adipose tissue that has been preserved along the muscular fascia.

all of the abdominoplasties were performed under conscious sedation on an outpatient basis.[18] The combined procedure cases included mostly concurrent urogynecologic procedures and constituted 24 percent of the cases before April of 2006 and 11 percent of the cases after April of 2006.

Postoperative Care

All abdominoplasty patients were followed postoperatively in a similar and consistent manner. Patients were instructed to record drain outputs daily, and the first postoperative visit was scheduled within 1 week after surgery.

Closed-suction drains were left in place until their outputs were below 30 ml/day. If the drains

had not been removed by the first follow-up appointment, a subsequent follow-up appointment was then scheduled on the day when the outputs had dropped below 30 ml/day. For group II, it had become evident to the senior author that the drainage was decreasing more rapidly; therefore, the first regular postoperative visit was moved up to postoperative days 4 to 6, depending on when the weekend fell. The drains frequently could have been removed sooner and often met criteria for removal before postoperative day 3 in this group. However, a conservative decision was made to leave the drains in place for at least 4 days, even if the outputs had apparently fallen below the 30-ml/day threshold. This decision was made after one earlier drain removal had resulted in a seroma. With the exception of the minimum duration restriction applied in group II, the drain removal criteria remained constant between the two groups.

Outcome Measures and Statistical Analysis

Baseline characteristics, including age, weight/height, body mass index, and male-to-female gender ratio, were recorded from the two groups of patients. The outcomes measured in this study included the incidence of seromas, the duration of closed-suction drainage, and the incidence of other complications (i.e., hematoma, superficial wound infection, minor skin loss, unacceptable scarring, suture reaction/ingrown hairs, wound dehiscence, and major complications such as deep venous thrombosis/pulmonary embolism).

Statistical analysis to test for differences in the baseline characteristics of the two patient groups was performed using unpaired t tests for all parameters, except for age, for which a Mann-Whitney test was used. The Fisher's exact test was used to test for differences in the number of seromas and other complications between the two groups. Finally, a Mann-Whitney test was performed to analyze the drain duration data.

RESULTS

Patient characteristics did not differ significantly between group I and group II, with the mean age (44 ± 8.9 years and 44 ± 9.6 years, respectively) and body mass index (24 ± 3.8 and 24 ± 3.8, respectively) being similar (Table 1).

Perioperative complications included seven seromas in group I and two seromas in group II. There were two minor hematomas in group I and two minor hematomas in group II. These were all

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Table 1. Patient Data

	Standard (group I)	Superficial (group II)	p
No. of patients	99	103	
Age, years			0.98
Mean	44	44	
Range	35.1–52.9	34.4–53.6	
Height, cm			1.00
Mean	164.6	164.0	
Range	157.6–171.4	157.6–170.4	
Weight, kg			0.84
Mean	63.9	63.6	
Range	53.4–74.4	52.4–74.8	
Body mass index			1.00
Mean	24	24	
Range	20.2–27.8	20.2–27.8	
Male sex, n	1	1	—
Total, n	99	103	

Fig. 3. Patients undergoing the modified technique of flap elevation (group II) met criteria for closed-suction drain removal 3 days earlier than those undergoing the standard technique (group I). Data are expressed as mean ± SD.

managed by observation or drainage in the office, and none required operative intervention. The number of superficial wound infections at the incision line was greater in group I[5] than in group II,[3] although the difference was not statistically significant. All other perioperative complications such as minor skin loss, suture reaction/ingrown hairs, or partial wound dehiscence also did not differ significantly between the two groups (Table 2). None of the complications required hospital admission or operative intervention, except for scar revision, which has remained below 5 percent.[18] There were no major complications in either group.

Patients in group II met criteria for drain removal 3 days earlier than those in group I ($p < 0.0001$). On average, patients in group II had drains removed on postoperative days 4 to 5, as opposed to day 8 for those in group I (Fig. 3).

DISCUSSION

Contemporary abdominoplasty procedures began evolving and gaining popularity in the 1960s with the advent of techniques that involved the elevation and resection of a superior skin flap, umbilical transposition, and rectus musculofascial plication.[3,19] Numerous refinements to the standard techniques have since been introduced, leading to improved outcomes and applicability to a greater range of deformities.[20–22]

The most frequent complication following an abdominoplasty procedure remains the occurrence of seromas.[3] The incidence of clinically detectable fluid collections has been reported to range from 5 to 50 percent.[4–9] Although seromas usually resolve uneventfully with multiple aspirations, some can often become frustrating in their persistence and can lead to the development of a pseudocyst or pseudobursa. Progression to this chronic state generally requires reoperation for successful management.

The exact pathogenesis of postabdominoplasty seromas remains unclear. Elevation of the skin flap necessarily results in a large elevated surface area that produces serous fluid secondary to the inflammatory stimulus of injury. Both the process of flap elevation and redundant skin resection also disrupt lymphatic vessels, resulting in a compromised state of lymphatic drainage in the immediate postoperative period. In addition, the presence of any dead space promotes the formation of acute fluid collections. A recent study by Andrades and Prado analyzed the composition of postabdominoplasty seromas and concluded that the accumulation of seroma fluid does indeed resemble that of an inflammatory exudate secondary to the trauma of surgery.[23] Some have noted

Table 2. Complications

	Standard (group I)	Superficial (group II)	p
No. of patients	99	103	
Seroma	7	2	0.10
Hematoma	2	2	1.00
Superficial wound infection	5	3	0.49
Minor skin loss*	5	3	0.49
Unacceptable scarring	8	5	0.40
Suture reaction/ingrown hairs	4	2	0.44
Wound dehiscence	1	0	0.49
Major (e.g., DVT/PE)	0	0	—
Total	32	17	

DVT, deep venous thrombosis; PE, pulmonary embolism.
*Superficial areas of wound-healing problems directly along no more than 2 cm of the incision line. All of these areas healed without any specific intervention other than routine wound care.
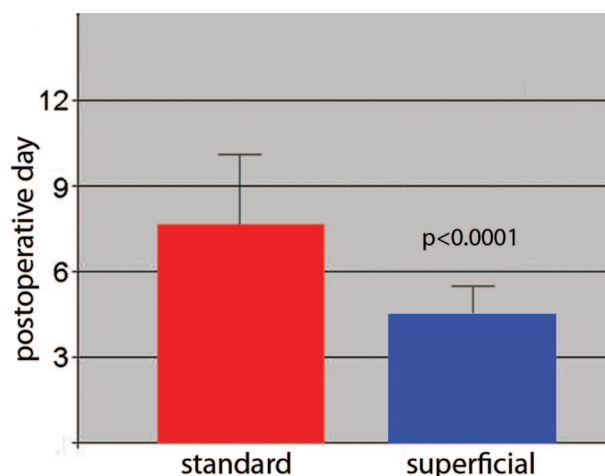
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that certain groups of individuals, such as those with a higher body mass index, previous supraumbilical incisions, and massive weight loss, may have a higher risk than the average population for developing postabdominoplasty seromas.[24]

In terms of techniques directed at reducing the incidence of seromas, there have been several published reports on the benefits of dead space reduction with either quilting sutures or progressive tension sutures.[4,7,25] Also, there have been reports of the benefits of using the harmonic scalpel and fibrin glue.[11,12]

However, there have been few studies focusing on approaches that may better preserve the lymphatics. In general, there has been a paucity of anatomical studies of the abdominal wall lymphatics. Rouviere had described the lymph node anatomy of the abdominal wall as early as 1932.[26] In the contemporary literature, we found only one anatomical study, by Felmerer et al., that attempted to demonstrate the lymphatic structures within the abdominal wall.[27] These authors were able to delineate both a superficial system of lymphatic structures within the superficial fat and a deep system of lymphatic vessels along the muscular fascia, typically situated near perforators. Le Louarn had reported on his experience of 65 cases using a modified dissection plane for the skin flap, which he described as an anatomically more appropriate approach with regard to the course of the deep lymphatic vessels in the anterior abdominal wall.[14,16] He theorized that the preservation of a thin layer of deep adipose tissue along the muscular fascia not only minimized injury to these lymphatic vessels but also maintained a bed of well-vascularized tissue as the foundation for the skin flap.

In our series, a modification of the Le Louarn technique was used. We similarly preserved the thin, almost areolar layer of deep subcutaneous fat found just superficial to the muscular fascia. In thin patients, this dissection plane was found immediately below the Scarpa fascia, as there is not much deep fat present. In heavier patients, infiltration of a suprafascial wetting solution using a standard blunt infiltrating needle allowed an easy dissection above the loose areolar tissue overlying the abdominal fascia but below most or all of the sub-Scarpa fascia fat (deep fat). This dissection plane appeared to be equally effective in allowing earlier drain removal as a more superficial dissection plane.

Our analysis of the outcomes between the patient groups revealed a significant decrease in the postoperative drain duration, and we also observed a trend toward a decreased seroma rate. With our already low seroma rate, we may have been limited by the sample size in this study to detect a difference. We also noted that none of the seroma occurrences correlated with patients who underwent a concurrent procedure and general anesthesia. We did not find any significant differences in the other complications, although sample size may again have been a limiting factor. Although we did not focus specifically on the aesthetic outcomes in this study, we did note that there were no complaints regarding the contour of the abdominal wall with respect to the lymphatic-preserving technique. We would refer the reader to our prior publication on this technique for a more detailed discussion of the aesthetic outcomes and postoperative follow-up.[15]

Although our study was limited by its retrospective nature, we found our results to be unequivocal. The main parameter of drain duration was based on a metric (i.e., drain removal criteria) that remained constant between the two groups, allowing us an objective analysis of the data despite not having additional parameters such as drain output volume. Additional data such as drain output volume or further anatomical studies would certainly be useful for investigating the underlying physiology of our findings in greater detail.

These findings present a compelling case for the role of abdominal wall lymphatics in decreasing the need for drains and likely the reduction of the seroma rate. Other factors, such as the use of sharp dissection without electrocautery, have resulted in what we believe is less inflammation and have contributed to an overall low seroma rate. The unique aspect of the senior author's experience, in which the only significant change between the two patient groups was the plane of dissection, allowed us to compare two otherwise very similar groups of patients. Continued studies to further define the nature of the deep lymphatic structures along the muscular fascia would contribute to the understanding of the physiology underlying our findings.

CONCLUSIONS

The use of a more superficial skin flap elevation plane during abdominoplasty may decrease the time required for closed-suction drains. In the senior author's experience, this modification in abdominoplasty technique has decreased not only the need for postoperative drains but also the seroma rate in these patients.

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