Aesth. Plast. Surg. 30:1–8, 2006
DOI: 10.1007/s00266-004-0084-7

Aesthetic Plastic Surgery

Original Articles

Lipoabdominoplasty: Liposuction with Reduced Undermining and Traditional Abdominal Skin Flap Resection

Ruth Graf, M.D., Ph.D., Luiz Roberto Reis de Araujo, M.D., Ms.C., Ronald Rippel, M.D., Ms.C., Lincoln Graça Neto, M.D., Ms.C., Daniele Tanuri Pace, M.D., Ms.C., and Gilvani Azor Cruz, M.D.

Paraná, Brazil

Abstract. Abdominoplasty surgery has spread universally, as both an aesthetic and a reconstructive procedure, and new techniques are appearing with the goal of minimizing ischemic complications of the flap and bettering body contour. The purpose of this article is to demonstrate that an abdominoplasty technique with limited undermining and preservation of the flap perforator vessels makes it possible to reduce the complication rate attributable to flap necrosis and seroma in abdominoplasty. Doppler flowmetry color study of the abdominal wall was performed before the surgical procedure and on postoperative day 15 after lipoabdominoplasty for a series of 20 patients to evaluate the blood supply of the abdominal wall. This study confirmed the preservation of perforator arteries in the periumbilicus area and right upper quadrant after abdominoplasty with liposuction and reduced undermining.

Key words: Abdominoplasty—Lipoabdominoplasty—Liposuction

The increasing demand for plastic surgery of the abdomen has also increased the number of complications, some of them very difficult to manage [8]. Among the most dramatic are flap ischemia and necrosis.

Different approaches for avoiding these complications [1, 12–14] have been proposed, and adequate flap blood supply is the basis for all these treatments. At the same time, many studies and technical advances have been accomplished with proper knowledge of the postoperative flap's blood irrigation, which have helped to predict outcomes.

Three branches of the femoral artery supply the lower abdominal wall. Cranial-caudally, they are the superficial iliac circumflex artery, the superficial epigastric artery, and the superficial external pudendal artery [6]. The superficial epigastric artery connects to the contralateral branch, and each artery has connections with its deep branches. The deep branches, located between the tranversus abdominus muscle and the internal oblique muscle [5,6], are the 10th and 11th posterior intercostal arteries, the anterior branch of the subcostal artery, the anterior branches of the lumbar arteries, and the deep circumflex iliac artery. The rectus abdominus muscle sheath is nourished by the superior epigastric artery, which has its origin in the internal thoracic artery and the inferior epigastric artery that comes in turn from the external iliac artery immediately above the inguinal ligament. The superior epigastric artery penetrates the proximal extremity of the rectus sheath in the inner portion of the muscle at the level of the seventh rib cartilage through the sternocostal triangle. Myocutaneous branches perforate the anterior rectus sheath to supply the skin above, and they are closer to the lateral edge of the rectus abdominus muscle [10].

The inferior epigastric artery, with its origin in the external iliac artery, is the lateral border of the inguinal triangle. At first, it is within the preperitoneal connective tissue penetrating posteriorly to the rectus sheath at the level of the semilunar line running between the muscle and the posterior rectus sheath. Anastomosis between the superior and inferior epi-

Correspondence to Ruth Graf, M.D., Ph.D., Rua Solimões 1184, Curitiba, PR 80810-070, Brazil; *email:* ruthgraf@losi.com.br

Fig. 1. Patient in the dorsal decubitus position. Landmarks are remarked, and liposuction in upper abdomen is realized except in the area with dashed lines above the umbilicus.

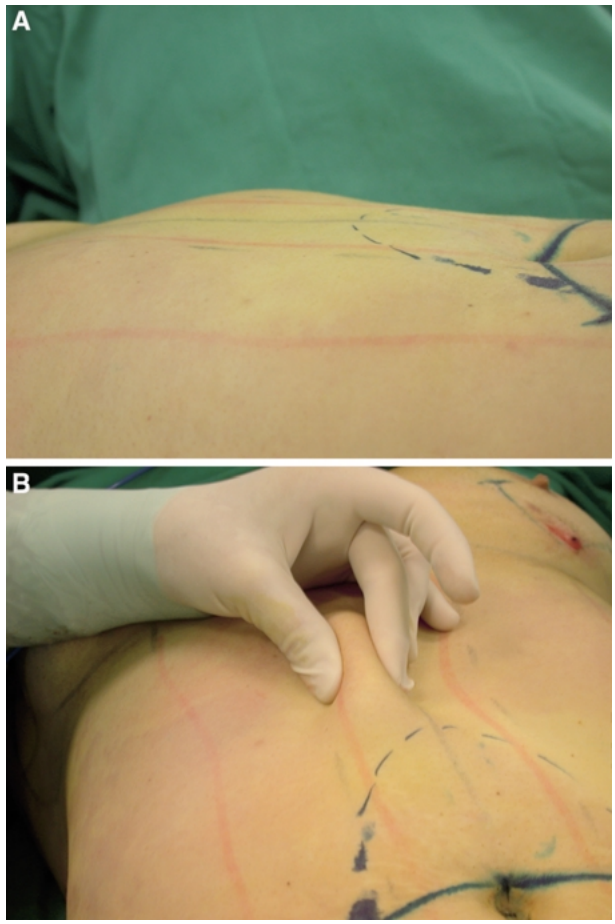

Fig. 2. (**A**) Liposuction in the right abdomen showing reduction of the fat layer (left) and (**B**) a pinching maneuver to evaluate flap thickness after liposuction (right).

gastric arteries creates a collateral circulation between the subclavian and external iliac arteries. The deep iliac circumflex artery has its origin in the external iliac artery, running above the deep portion of the anterior abdominal wall, parallel and posterior to the inguinal ligament, along the iliac crest, between the tranversus abdominus and external oblique muscle [5,6,10].

Avelar [1], in 1985, described a technique of liposuction associated with abdominoplasty for patients who have a prominent abdomen with supra- and infraumbilicus fat deposits and muscular laxity. In 2002 [2], the same author described abdominoplasty without undermining and removal of fat through liposuction, with skin resected surgically only down to the dermis in the lower abdomen. In 2000, Matarasso [11,12] described liposuction used with abdominoplasty as a way to preserve the blood supply of the abdominal flap.

One of the most interesting among the new techniques, developed by Saldanha et al. [13], is abdominoplasty without undermining of the abdominal flap associated with liposuction of the entire abdomen and flanks. This technique involves suctioning of the subcutaneous tissue over the entire abdomen, resection of skin from the lower abdomen, undermining of the midline between the medial edges of the rectus abdominus muscle, and plication, therefore preserving most of the blood supply to the abdominal wall.

Bozola [7] clinically classified the abdomen, suggesting a specific treatment for each type. The lipoabdominoplasty technique with traditional abdominal flap resection is indicated for types 3 to 5, according to Bozola's classification, as follows. Type 1 patients present with fat deposits, a normal musculoaponeurotic layer, and no excess skin. Type 2 patients present with mild skin excess, a normal musculoaponeurotic layer, and either excessive or normal fat. Type 3 patients present with mild skin excess, laxity of the infraumbilical area of the musculoaponeurotic layer, and fat or no fat. Type 4 patients present with mild skin excess, laxity of the infraumbilical area of the musculoaponeurotic layer, and excessive or normal fat. Type 5 patients present with large skin excess, laxity of the musculoaponeurotic layer with or without hernias, and excessive or normal fat.

The Doppler flowmetry study is an important noninvasive method of diagnosis for evaluating the flow capacity of the vessels that nourish the abdominal flap [9]. Ultrasound associated with Doppler flowmetry combines the technology of ultrasound and the Doppler effect to detect, evaluate, and quantify blood flow. The evolution of the technique

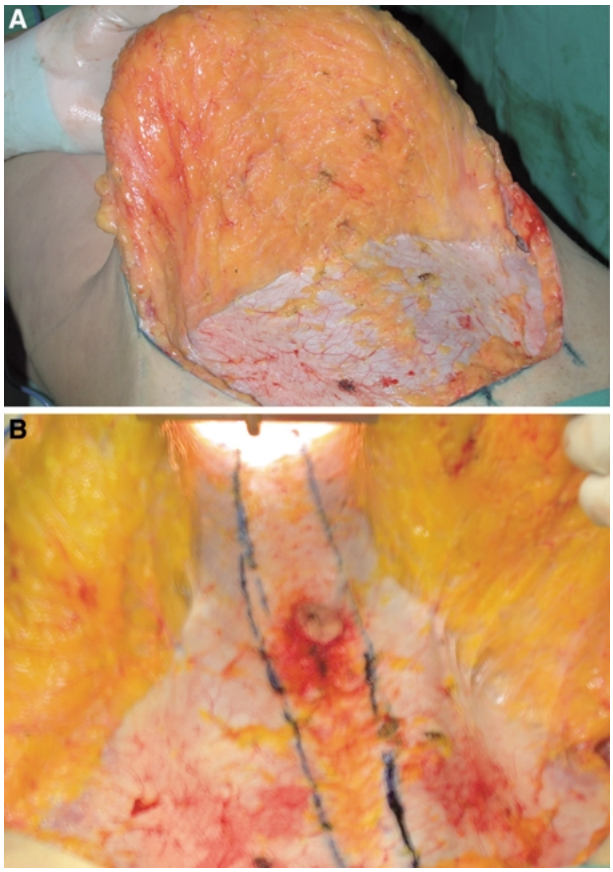

Fig. 3. (**A**) Lower abdomen flap undermining between the rectus abdominus fascia and the fat layer, performed using traditional abdominoplasty (left). (**B**) Undermining of the midline in the upper abdomen proceeding laterally 1.5 cm over the medial border of the rectus abdominus muscle (dark lines) up to the xiphoid appendix (right).

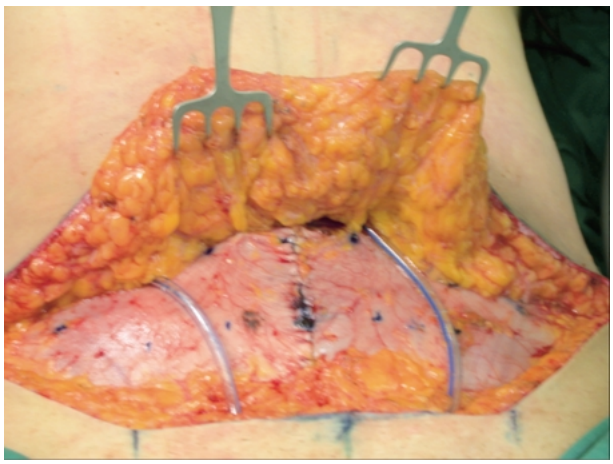

Fig. 4. Plication of the rectus abdominus fascia from the xiphoid appendix down to the pubis.

with color flowmetry has made possible the evaluation of vascular pathologies for several specialties, including plastic surgery, that use these techniques to identify and describe vascular pedicles of flaps such as the latissimus dorsi and some fasciocutaneous leg flaps, and to identify perforators in the lower limbs and the periumbilicus of the rectus abdominus muscle flap.

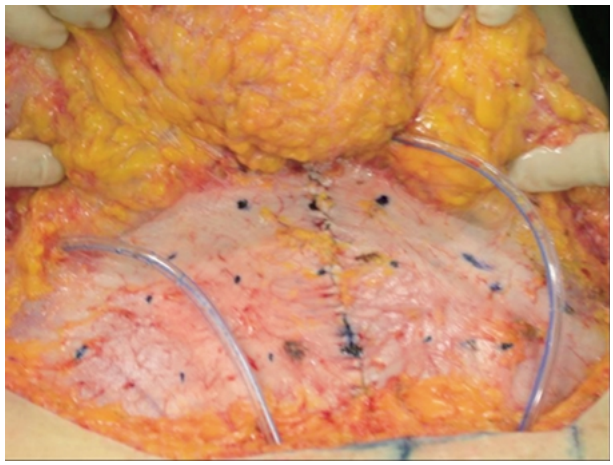

Fig. 5. Previous demarcation of Baroudi sutures in the fascia. Upper abdomen sutures between the fat layer of the flap and the fascia underneath.

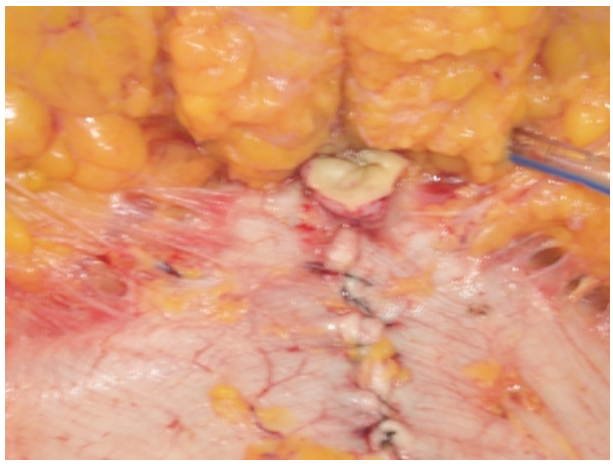

Fig. 6. Umbilicus in the new position with suture in the dermis of the umbilicus and flap dermis for fixation.

Surgical Technique

The skin is marked with the patient in the standing position. The midline and suprapubic inferior lines are marked and extended laterally toward the anterior superior iliac spine. Previous scars and natural creases are noted for placement of future scars. The superior line is marked according to the technique of Baroudi and Ferreira [3,4], known as the bicycle handlebar incision. The areas to be suctioned are marked up to the inframammary crease superiorly and laterally to the flanks (Fig. 1).

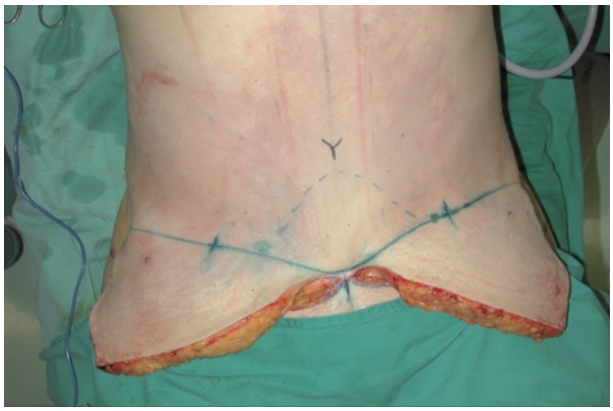

Fig. 7. (**A**) Patient in the Fowler position with traction of the flap and demarcation of the area to be resected (left). (**B**) After resection of the flap excess (right).

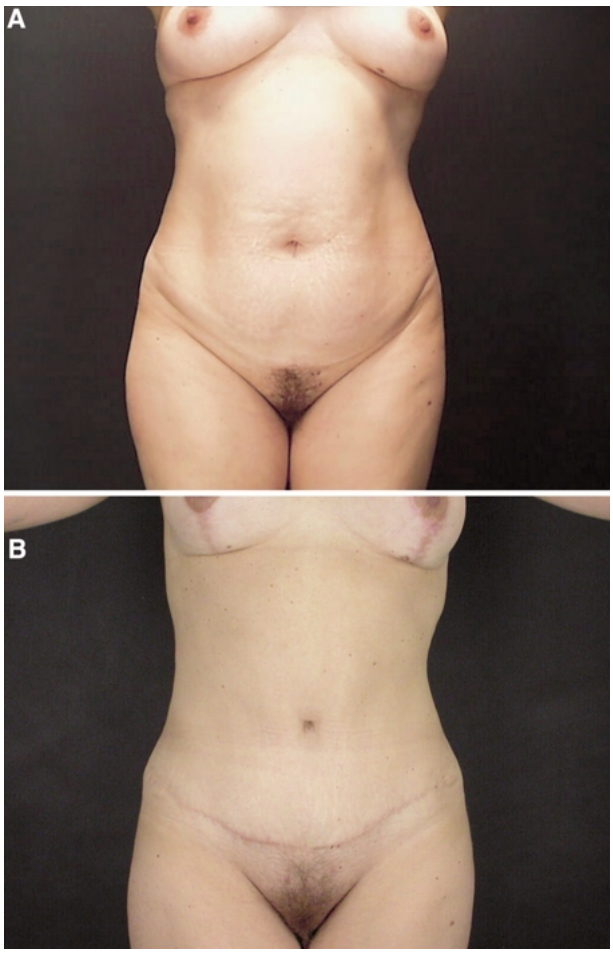

Fig. 8. (**A**) A 47-year-old patient with fat deposits in the abdomen, flanks, and dorsum, and abdominal wall laxity (**B**) The same patient 9 months after liposuction of the flanks and dorsum associated with lipoabdominoplasty.

Surgery is performed with the patient under epidural anesthesia in most cases, with some selected patients under general anesthesia. Infiltration for

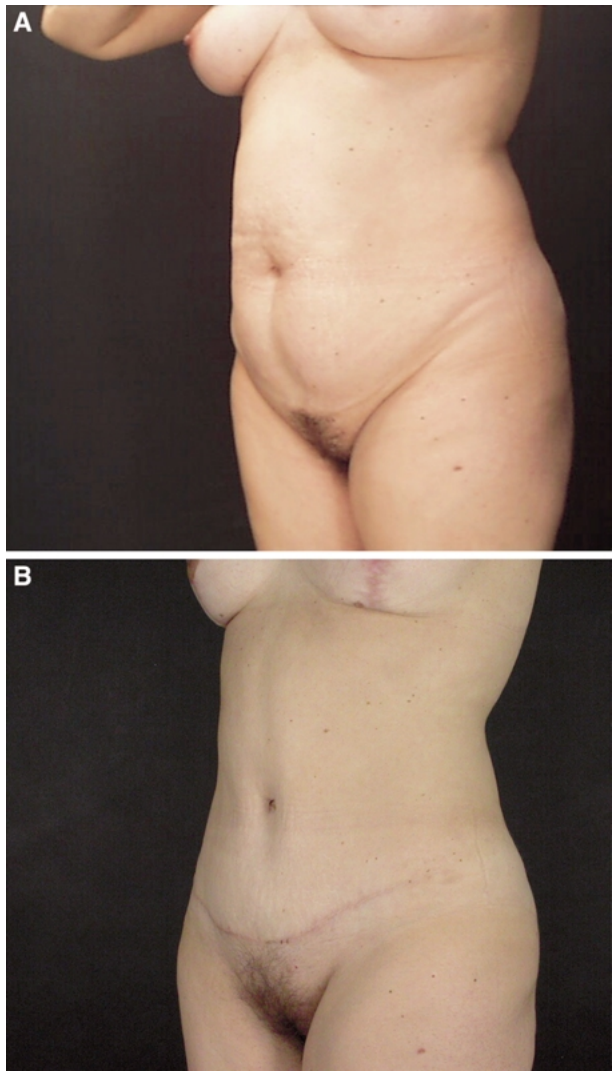

Fig. 9. (**A**) Preoperative oblique view of the same patient as in Figure 8. (**B**) The same patient 9 months postoperatively.

liposuction is performed with adrenaline solution 1:500.000, and the superwet technique is used. The procedure is performed with 3.0- and 3.5-mm Mercedes cannulas, beginning first in the deep layer of fat and later superficially in the flanks and upper abdomen, except for the area above the umbilicus (Fig. 2). After the liposuction, the lower abdomen flap is undermined up to the umbilicus (Fig. 3, left), and the skin around it is incised as well.

The reduced supraumbilical undermining is performed in the midline, proceeding 1.5 cm laterally to the medial border of the rectus abdominus muscle up to the xiphoid appendix, allowing adequate fascia placation, and preserving perforators (Fig. 3, left and Fig. 4). In the lower abdomen, plication also is performed with black nylon 2.0 interrupted sutures down to the pubis.

The patient is placed in the Fowler position (semiseated), and sutures from the flap's fat layer

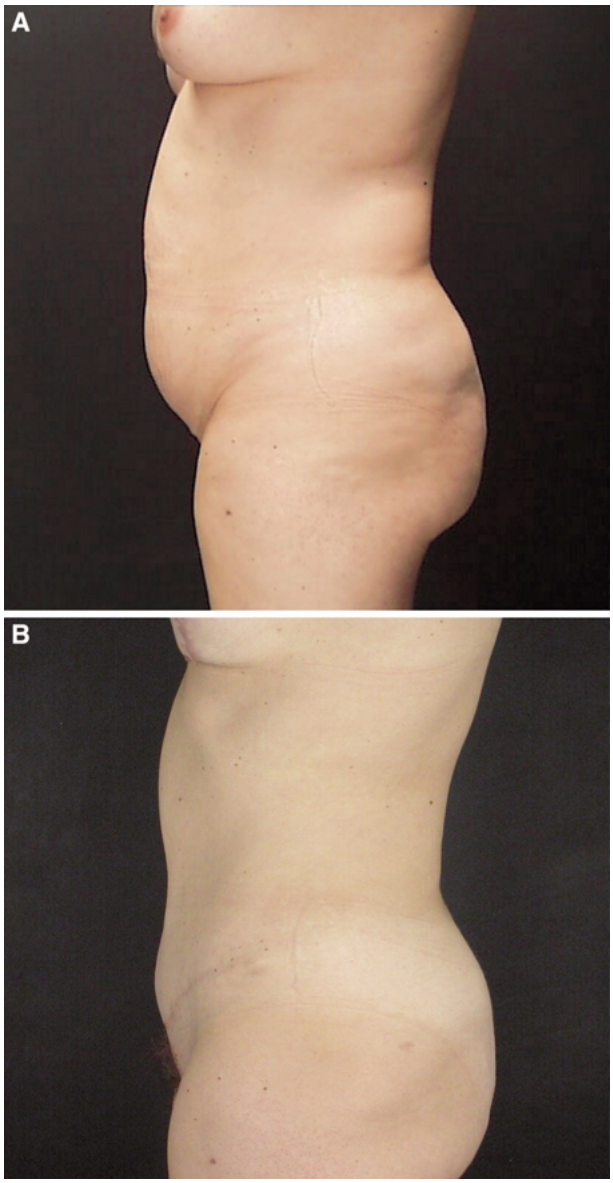

Fig. 10. (**A**) Preoperative profile view of the same patient as in Figure 8. (**B**) The same patient 9 months postoperatively.

down to the fascia for flap fixation in the abdominal wall, as in the technique of Baroudi and Ferreira (Fig. 5), are performed from the xiphoid appendix down to the umbilicus in the midline. Next, abdominal flap traction is performed and the umbilicus is positioned and fixed (Fig. 6). After this fixation, the flap resection is performed (Fig. 7). Baroudi's sutures are also performed down to the pubic area. This approach helps the flap fixation, and thereby the maintenance of the final scar in a lower position. It also prevents seromas.

The wound edges are sutured in a layer-by-layer fashion with 3.0 monocryl, and the skin is closed with 4.0 colorless monocryl and also Dermabond. Suction drainage is established in every patient, as well as compressive dressings and the Fowler posi-

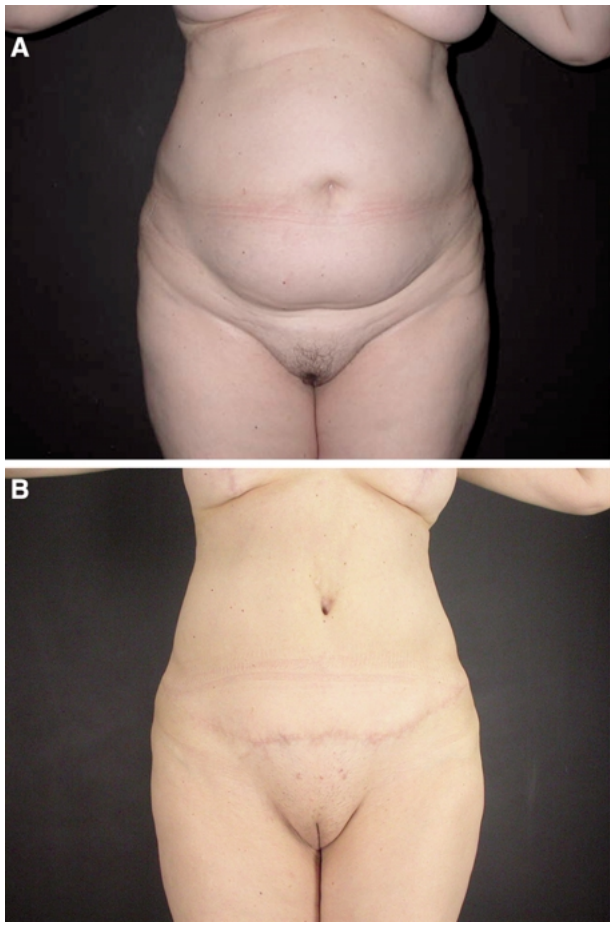

Fig. 11. (**A**) A 52-year-old patient with fat deposits in the abdomen, flanks, and dorsum, and abdominal wall laxity (**B**) The same patient 1 year after liposuction of the flanks and dorsum associated with lipoabdominoplasty.

tion at home. Dressings are changed at 24 h in the postoperative period, during which time suction drainage also may be withdrawn if it is less than 50 ml/day.

Because of the reduced undermining, the postoperative evolution of most patients is very good, and because the perforators also are left intact, the blood supply is excellent. For 2 weeks, edema is observed, after which it starts to decrease in 1 to 2 months, improving body contouring significantly. Also, complications such as flap necrosis and seroma associated with abdominoplasties are likely to decrease with wide undermining (Figs. 8–13).

Doppler Flowmetry Study

Doppler flowmetry color study of the abdominal wall was performed before the surgical procedure and on postoperative day 15 after lipoabdominoplasty for a series of 20 patients to evaluate the blood supply of the lower and upper abdominal wall and also of the superior and inferior epigastric arteries and their

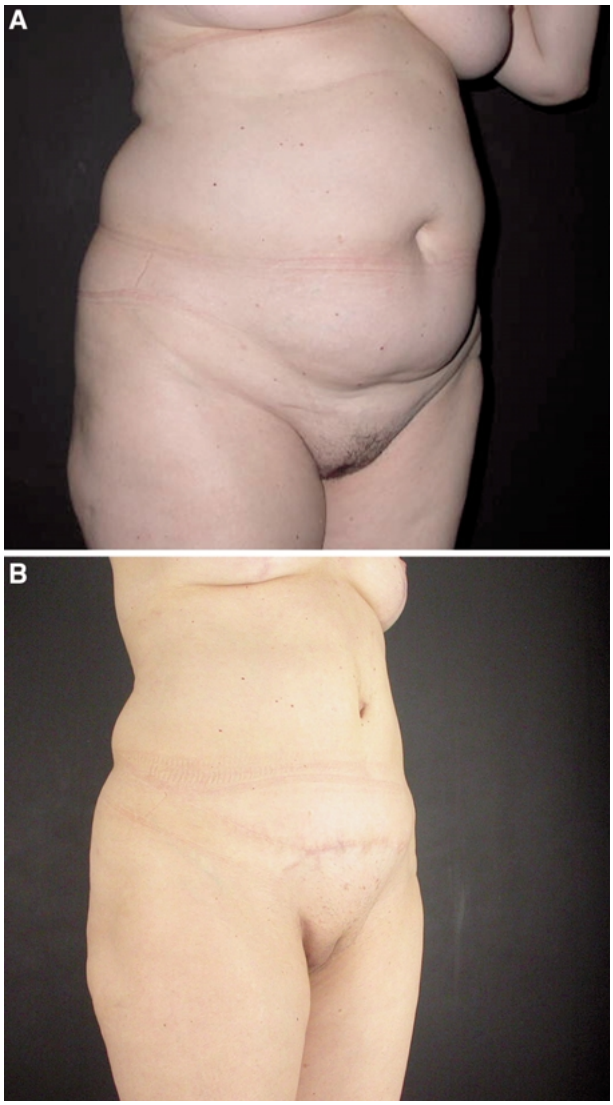

Fig. 12. (**A**) Preoperative oblique view of the same patient as in Figure 11. (**B**) The same patient 1 year postperatively.

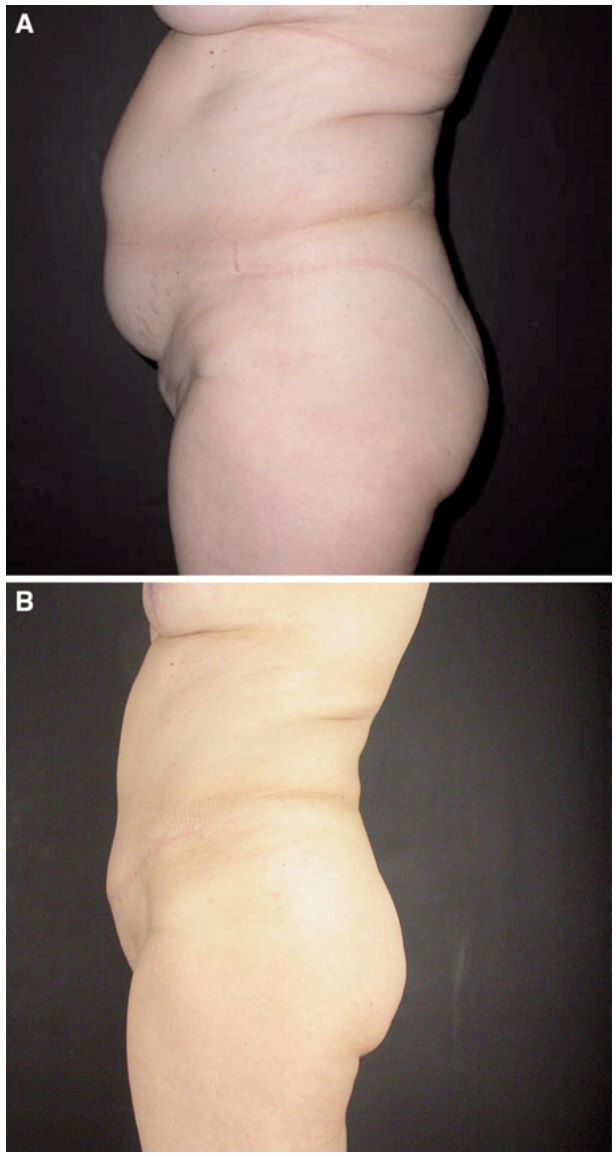

Fig. 13. A. Oblique preoperative view of the same patient as in Figure 11. (B) The same patient 1 year postoperatively.

respective myocutaneous perforators [9]. Patients of Bozola classification types 3 and 5 (abdominal laxity, fat deposits mainly in the upper abdomen, low umbilicus and skin excess for flap descent without tension) were selected for this study. Every patient underwent traditional liposuction using the superwet technique in the upper abdomen and flanks [13]. Flap undermining was performed as described earlier. Arteries and myocutaneous perforators were identified and described in terms of quantity, diameter, flow, and position according to the midline and umbilicus in the pre- and postoperative periods, as shown in Table 1 and Figs. 14 and 15. The average flow of perforators in the pre- and postoperative periods was also measured (Table 2 and Fig. 16). Doppler flowmetry identified the presence of permeable perforators greater than 1 mm in caliber, with flow mainly in the periumbilicus area.

In the preoperative study, an average of 5.36 perforators on the right and 4.92 on the left were identified, and in the postoperative period, 3 perforators on the right and 3.10 perforators on the left were identified, confirming preservation of the arterial branches above the undermined area and under the rectus abdominus muscle, distributed in the periumbilicus area and right upper quadrant. The branches showed an increase in caliber, from 1.55 mm in the preoperative period to 1.69 mm in the postoperative period (9%), as shown in Table 1. The average flow was 21.8 ml/minute preoperatively and 34.3 ml/minute postoperatively, showing a 56% increase in blood volume (Table 2). This flow increase is attributable to a vasodilatory effect caused by surgical trauma and a decrease in the total number of perforators,

Table 1. Average number and caliber of perforators. Pre and post-operative period.

Average number of perforators- Pre-operative		Average number of perforators- Post-operative		Average caliber of perforators- Pre-operative mm		Average caliber of perforators- Post-operative mm	
Right	Left	Right	Left	Right	Left	Right	Left
5.36	4.92	3.0	3.10	1.52	1.58	1.68	1.69
Average 5.14		Average 3.05		Average 1.55		Average 1.68	

Table 2. Average flow of perforators, pre and post-operative period (ml/min).

Average flow of perforators- Pre-operative ml/min		Average flow of perforators- Post-operative ml/min	
Right	Left	Right	Left
21.1	22.5	34.2	34.5
Total average 21.8		Total average 34.3	

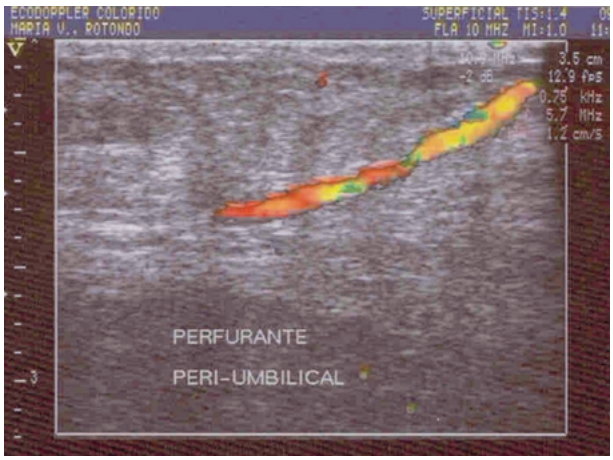

Fig. 14. Doppler flowmetry showing a perforator artery in the postoperative period.

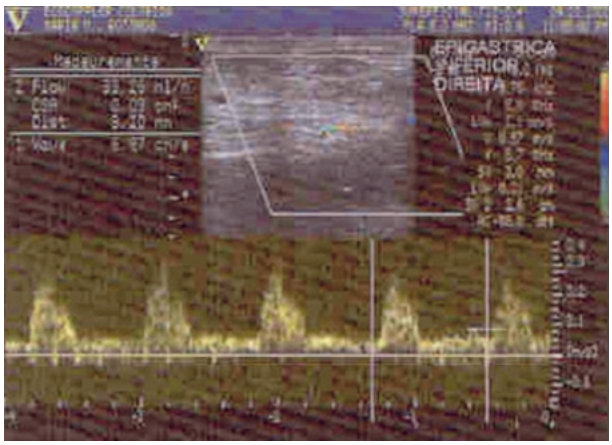

Fig. 16. Doppler flowmetry showing flow measurements of a perforator in the postoperative period.

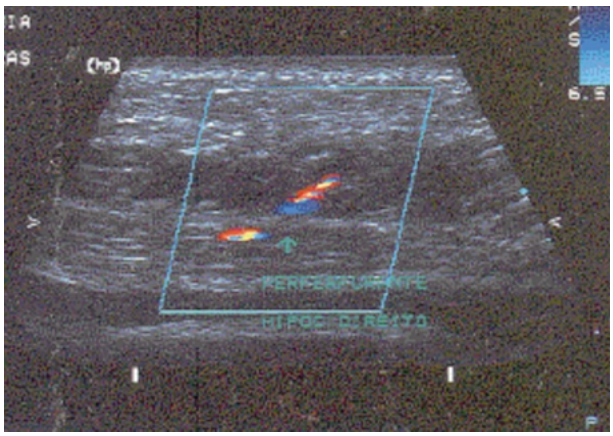

Fig. 15. Doppler flowmetry showing a perforator artery in the postoperative period with a gap (arrow) in the fascia.

overloading the residual vessels. During the examination, perforators may be visualized above the umbilicus (Figs. 14 and 15) and their path oriented caudally because of flap traction indicating perfusion of the distal part of the flap. A flow measurement is shown in the examination (Fig. 16), attesting to active flow in the postoperative period.

This study confirmed the preservation of perforator arteries in the periumbilicus area and right upper quadrant after abdominoplasty with liposuction and reduced undermining. Liposuction did not injure perforators larger than 1 mm, as demonstrated by Doppler flowmetry in the postoperative period, allowing descent of the flap during traction. There was a 9% increase in the caliber of arteries, and a flow increase of 56% in the branches identified. This increase may have occurred as a result of surgical

trauma that generated vasodilation and a decrease in minor perforators.

Conclusion

The main complications of abdominoplasty can be reduced using an abdominoplasty technique with limited undermining and preservation of the perforator vessels of the flap. The abdominal perfurator vessels, mainly the periumbilical vessels, are kept intact, leaving a better blood supply to the flap. Patients end up with a better body contour as liposuction is simultaneously performed with abdominal surgery, reducing the revision rate in the postoperative period.

References

1. Avelar JM: Abdominoplasty: A new technique without undermining and fat layer removal. *Arq Catarinense Med* **29:**147–149, 2000
2. Avelar JM: Fat suction versus abdominoplasty. *Aesth Plast Surg* **9:**265–276, 1985
3. Baroudi R, Ferreira CA: Seroma: How to avoid it and how to treat it. *Aesth Surg J* **18:**439, 1998
4. Baroudi RA: Bicycle handlebar type of incision for primary and secondary abdominoplasty. *Aesth Plast. Surg* **19:**307–320, 1995
5. Bostwick J III, Hartramp F, Nahai F: The superiorly based rectus abdominus flap: Predicting and enhancing its blood supply based on anatomic and clinical study. *Plast Reconstr Surg* **81:**713, 1988
6. Boyd BJ, Taylor GI: The vascular territories of the superior epigastric and deep inferior epigastric systems. *Plast Reconstr Surg* **73:**1, 1984
7. Bozola AR, Psilakis JN: Abdominoplasty: New concept and classification for treatment. *Plast Reconst Surg* **82:**983–993, 1988
8. Dillerud E: Abdominoplasty combined with suction lipoplasty: A study of complications, revisions, and risk factors in 487 cases. *Ann Plast Surg* **25:**333–343, 1990
9. Fisher M, Bark A, Loureiro ALRS, Pianoswski R, Graf R, Furuta M, Cruz GA: Doppler flowmetry in the flap of abdominoplasty. *Arq Catarinense Med* **32:**173–178, 2003
10. Hamdy H, El-Mrakby , MD, Richard H, Milner MD: The vascular anatomy of the lower anterior abdominal wall: A microdissection study on the deep inferior epigastric vessels and the perforator branches. *Plast Reconstr Surg* **109:**539–543, 2000
11. Matarasso A: Abdominolipoplasty: A system of classification and treatment for combined abdominoplasty and suction-assisted lipectomy. *Aesth Plast Surg* **15:**111–121, 1991
12. Matarasso A: Liposuction as an adjunct to full abdominoplasty revisited. *Plast Reconstr Surg* **106:**1197–1206, 2000
13. Saldanha OR, Souza Pinto EB, Matos WM, Lucon RL, Magalhães F, Bello EML: Lipoabdominoplasty without undermining. *Aesth Surg J* **21:**518–526, 2001
14. Shestak KC, Walgenbach KJ, Azari K: Marriage: Abdominoplasty and short scar technique. *Aesth Surg J* **22:**294–301, 2002