The aesthetic and functional treatment of the abdominal region has always been one of the main concerns of plastic surgeons.

Abdominoplasty was performed using a vertical incision until the end of the 1950s, probably because some of the most popular general surgery procedures of the abdomen, such as the Caesarean section, were also performed through a vertical incision.

As plastic surgery has always had a connection with the fashion industry and its demands, some surgical techniques have been designed specifically to hide the scars within clothing. When bathing suits covered the abdomen, vertical scars were acceptable. When the bikini became popular, plastic surgeons had to create a technique with smaller incisions that could be hidden under smaller amounts of fabric. In the 1950s and 1960s the Saint Tropez bikini with a very low waistline was fashionable, and the abdominoplasty incision was made almost horizontal. When the French-line bikini became popular, with its high leg cut, the incision line had to be altered to accompany the inguinal fold.

Plastic surgery changed in 1980 with the advent of liposuction, allowing us to reshape the body through minimal incisions. In Brazil, abdominoplasty is the procedure most commonly associated with lipoplasty (in 73% of all procedures), and mammoplasty is second (in 25% of all procedures) [1].

With the advent of superficial liposuction in 1989, the indication for skin resection became less common, and the limits of skin retraction changed. However, there is a point where we cannot rely on superficial liposculpture alone, and we should not try to solve the problem of skin excess by removing fat and not skin.

Some patients always fall into a “gray area” where there is no clear indication of which technique to apply. The decision then usually depends on individual factors, such as the patient’s lifestyle, financial conditions, and ability to stay away from work for a short or long recuperation period. There are also objective factors. One is the patient’s age; another might be the preference for a smaller lipoplasty procedure with no apparent scars, which will result in an acceptable contouring of the abdomen without improving muscle-aponeurotic laxity or skin flaccidity. Another patient might prefer an abdominolipoplasty procedure that will remove flaccid skin and excess fat and correct muscle-aponeurotic laxity, but with a long incision.

What is this “gray area,” and what are the limits of liposuction today?

Classification

There are several classifications, some of which are outdated and do not take into account the techniques performed today. This is how the author prefers to classify the abdomen:

- A Type I abdomen has excess fat, with no excess skin and no muscle-aponeurotic laxity. The flanks and waist should be treated in an aesthetic unit with the abdomen, when indicated.
- A Type II is the abdomen with a high umbilicus and moderate suprapubic excess skin, with or without excess fat and muscle-aponeurotic flaccidity.
• Type III is the abdomen with a normally placed umbilicus and moderate excess skin in the epigastrium and hypogastrium—but not enough excess to perform a classic abdominoplasty—with or without excess fat and muscle laxity.
• Type IV is the abdomen with mostly muscle-aponeurotic flaccidity, with excess skin and minimal excess fat.
• The Type V abdomen has obvious excess skin in the epigastrium and hypogastrium, which can be easily removed through the classic abdominoplasty resection, and muscle-aponeurotic flaccidity, with or without excess fat.
• The Type VI abdomen is one that has severe circumferential skin laxity, usually secondary to a massive weight loss, with muscle laxity and residual excess fat.

Discussion

Abdominal contour surgery should be indicated based on individual variations in anatomy. Types II, III, and IV are considered to be in the “gray area” because they permit us to use different approaches and techniques, based not only on this classification but also on patients’ preferences.

Type I

These patients—the majority at 80%—are treated with lipoplasty alone. Young patients with good skin tone will be treated with deep liposculpture (Fig. 1). Patients with some skin flaccidity can also undergo superficial liposculpture, which will not only remove the excess fat but also cause skin retraction. Superficial liposculpture in the abdominal region should be used with great care to avoid irregularities, skin dyschromia, and skin necrosis and should be applied only in the areas where retraction is needed. Ideally the abdomen and the flanks should be treated as a unit, with the flanks treated in the lateral position and the abdomen in the supine hyperextended position, to avoid perforation of the abdominal wall and viscera. To check for irregularities or depressions, the author wets the skin and changes the position of the lights, allowing for immediate treatment either by aspirating fat from the high points or reinjecting fat into the depressions [2].

Type II

This patient can be approached with a combination of liposuction and suprapubic skin resection. The amount of skin to be resected varies from case to case. The suprapubic incision is usually a little longer than the Caesarean Pfannenstiel incision, with small extensions into the inguinal fold. If necessary the umbilicus is “floated,” or repositioned a few centimeters lower and resutured in the linea alba. Excess fat will be removed through lipoplasty. If there is a need for plication, it can be done through a space created by blunt dissection of the midline, either through the suprapubic or the umbilical incision (Fig. 2).

Type III

Type III can be treated by resecting just the excess skin through a suprapubic incision and removing fat through lipoplasty. The combination of liposuction and dermolipectomy increases the risk of complications such as infection, dehiscence, seroma, hematoma, and skin necrosis [3]. The Avelar technique [4–6], a combination of liposuction with the removal of a small wedge of suprapubic skin, was developed to substitute for the mini-abdominoplasty (Fig. 3). It decreases the incidence of seroma and tissue necrosis and has the advantage of treating the panniculus with precision in a closed manner. The technique also reduces irregularities, abdominal above-scar fat folds, and the incidence of dog-ears, which can be as high as 27.9% [7]. Another treatment option for Type III patients (usually patients who wear bikinis and want shorter scars, preferably with preexisting horizontal inframammary incisions) is to maintain the umbilicus in place, remove a smaller fuse of skin from the hypogastrium through a short suprapubical incision, and fix the epigastrium by removing two separate fuses of skin below each submammary fold (Fig. 4). Excess fat can be aspirated and muscle plication performed if necessary [8].

One of the most common and difficult problems in the abdomen is the treatment of the supraumbilical wrinkling that may develop in the linea alba, after pregnancies or due to aging, flaccid skin, or excessive fat aspiration (Fig. 5). Excessive aspiration of the epigastrium can cause skin flaccidity and provoke a defect called “sad umbilicus.” The excess skin over the umbilicus can be misinterpreted as excess fat. Aspiration of this area will provoke supraumbilical wrinkling. This problem may be present alone or together with lipodystrophies. The author has tried resecting the wrinkled skin above the umbilicus through a circular periumbilical incision and with a horseshoe-shaped incision, leaving the lower pedicle of the umbilicus untouched. He does not suction above the umbilicus to loosen the skin. The results
Fig. 1. (A,B) A 25-year-old Type 1 patient before and (C,D) one year after syringe liposculpture of the flanks, waist, and abdomen. This is a young patient with good skin tone who can benefit from lipoplasty alone, without need for skin resection. Her abdomen and flanks were treated by deep lipoplasty, and only her waist needed some superficial lipoplasty to improve skin retraction.
Fig. 2. (A–D) A 36-year-old Type II patient preoperative and 2 days postoperative. After three pregnancies and Caesarean sections her abdominal skin was flaccid and was fixed with a combination of liposuction and suprapubic skin resection. She underwent reduction liposculpture of the arms, axilla, waist, flanks, sacral region, and abdomen. She also had augmentation liposculpture of the buttocks, with the injection of 500 mL of fat on each side. (E,F) A suprapubic fusiform skin resection was performed. The excess fat was removed through liposuction.
Fig. 3. (A) In a Type III abdomen the skin excess excision is marked within the limits of the bikini. (B) The skin is dissected and removed. (C) The excess fat is aspirated. (D) The midline is dissected bluntly. (E) The umbilicus stalk is freed from the abdominal wall. Midline plication can be performed. (F) The umbilicus is repositioned lower and resutured to the abdominal wall. (G) The wound is closed, and any excess fat is aspirated with a syringe. (H–K) Pre- and 6-month postoperative views of a 32-year-old Type III patient. The umbilicus was repositioned 4 cm lower.
were not encouraging. Some patients may present with a lack of adipose tissue in the supraumbilical area that can benefit from fat injection, in small amounts. When the patient does not want any incision around the umbilicus, the surgeon can combine the suprapubic skin resection and liposuction, preserving the perforators. This procedure involves dissecting the midline with a blunt cannula, freeing the umbilical stalk, and replacing it 2 cm to 3 cm lower than the original position. The midline can be plicated through the same access. This method will flatten the abdomen, remove the excess skin, reposition the umbilicus, and eliminate the supraumbilical skin excess.

If there is flaccidity in the epigastrium with the need for skin resection, the author uses superficial liposculpture combined with a removal of submammary skin flaps. The epigastrium is dissected with a blunt cannula; suction can be combined, if necessary. Suction can be performed in the whole epigastrium. No dissection of the panniculus should be performed, to maintain the perforators. The skin is stretched upward, and the superficial fascia is sutured to the submammary fold and—when the fascia is not strong enough—to the rib periosteum, to prevent the descent of the breast. If necessary, epigastric midline plication can be performed through these incisions, combined with the umbilical incision approach. This approach is suitable only for small skin excesses. Whenever it is necessary to join the submammary incisions in the midline, it is usually possible and preferable to perform a classic abdominoplasty and remove the excess through the suprapubic incision, repositioning the umbilicus.

Type IV

The surgeon needs to do an abdominoplasty through a suprapubic incision (and, if necessary, a suprapubic skin excision), a midline dissection, and muscle-aponeurotic plication, with or without umbilical repositioning [9]. Flap dissection areas are sutured back to the abdominal fascia with the quilting method.
The length of the incision will vary according to the excess skin to be removed (Fig. 6). Sometimes, when the skin excess is not sufficient to remove the flap from umbilicus to pubis, it may be necessary to close the old umbilical scar implantation site with a small vertical scar and reposition the umbilicus. This scar is seldom well accepted by patients, who may prefer to have their own umbilicus reinserted in a lower position.

Type V

These patients are not in the “gray area” of classification and should be treated using the classic abdominoplasty (Callia technique [10]) with umbilical repositioning (Fig. 7). The skin and fat flap from the hypogastrium is resected, and excess fat in the epigastrium and flanks is removed through lipoplasty. When abdominoplasty is combined with lipoplasty,
the dissected flap is also sutured to the abdominal wall aponeurosis with a quilting suture to avoid seromas [11].

Type VI

Type VI patients are also not in the “gray area” and should be treated with a complete circumferential abdominoplasty, with umbilical repositioning and flankplasty. Again, if dermolipectomy is combined with lipoplasty, the dissected flap is sutured to the aponeurosis with a quilting suture to avoid seromas.

Special Type I

There are cases that do not fit into this classification. If the patient already has a vertical abdominal scar, it is best to use the same scar to remove excess skin and combine the procedure with lipoplasty, when indicated (Fig. 8). The author believes that vertical skin excision in a patient with a previous scar produces a good shape in the waist. The surgeon must carefully plan how much skin to excise. Too much excision can result in wider postoperative scars: moderation is crucial here.

Special Type II

If the patient is a Type II to IV but does not want to remove excess skin or to correct the lax muscle, preferring lipoplasty alone to the abdominoplasty, this can be done. The patient should be informed that the result will not be optimal. The patient’s reasons for taking this option may be financial concerns, fear of
the longer abdominoplasty procedure and its extended recovery time, age, or disease that could compromise the result of the abdominoplasty (Fig. 9).

The classic abdominoplasty technique has improved over the years to avoid the usual complications, such as seroma and long scars. Some techniques that have been developed to provide better results are (1) Baroudi’s suture (“quilting”), which fixes the abdominal flap to the rectus aponeurosis, and (2) the abdominoplasty without panniculus undermining and resection, developed by Avelar.

Despite reduced incidence of complications with these techniques, there is one rule to which the surgeon must adhere: the classification of the abdomen based on the degree of skin and muscle laxity and fat excess (Types I–VI). Liposuction alone is performed in the majority of Type I patients; in Types II to IV, the “gray area” lipoplasty is combined with modifications of abdominoplasty. Type V has an indication for abdominoplasty, and Type VI for abdominoplasty with circumferential flankplasty. These two procedures can be combined with lipoplasty. Abdominoplasty alone is employed today only when there is no excess fat to be aspirated.

**Technique**

For liposculpture the author uses 60-mL Toomey tip syringes, with zirconium-fused cannulas. For the anesthesia injection he uses a 2-mm or 3-mm gauge and a 35-cm long multiholed tip needle. Fat is aspirated with “Pyramid tip” cannulas with a 2-mm to 4.6-mm gauge, 25 cm to 35 cm long. The author treats irregularities and releases old scars with the
3-mm gauge V-tip Toledo dissector-cannula. He also uses a 5-mm gauge cannula to suction areas of fibrotic fat.

To treat only a small adiposity with syringe liposculpture, the author uses oral sedation with midazolan, 15 mg. For larger cases the anesthesiologist will perform intravenous sedation with midazolan (0.1 mg/kg IV), fentanyl (50 µg slowly), and propofol (15–30 µg/kg/min). Midazolan’s action is antagonized with flumazenyl (0.2 mg–1.0 mg IV).

For local anesthesia the author uses a modification of the Klein tumescent solution [11], which contains 20 mL of 2% lidocaine, 5 mL of 3% sodium bicarbonate, 1 mL adrenaline 1:1000, and Ringer’s lactate qsp 500 mL [12]. He injects up to 2 L of this solution at body temperature into the abdomen and begins succioning after 10 to 15 minutes. He infiltrates one area at a time, and only after succioning this area does he infiltrate the other side. If the flanks are going to be treated in the same procedure, they should be treated first, in the lateral position.

When the author has to resect skin or plicate muscle, he injects a stronger solution into the area: 40 mL 2% lidocaine, 1 mL adrenaline, 2 mL sodium bicarbonate, and Ringer’s lactate qsp 200 mL. After succioning the abdomen in the hyperextended position, the surgeon can place the table in the horizontal position to perform the abdominoplasty. If there is difficulty in suturing the flap to the pubis, he can help by bending the table. After the procedure, the patient will have to maintain this curved position for the first postoperative week and slowly go back to the normal

Fig. 6. (A,B) Preoperative view of a Type IV patient, with mostly muscle-aponeurotic flaccidity and excess skin. (C,D) Six-month postoperative view after an abdominoplasty with muscle-aponeurotic midline plication, umbilical repositioning, and removal of the excess skin through the suprapubic incision.
orthostatic position. Suction drains are placed for 2 to 3 days when the author combines suction and abdominoplasty. The lipoplasty incisions are not sutured. A sterilized diaper is used to collect the oozing of the anesthesia solution in the first 24 hours. The quilting suture is performed with 3-0 catgut. The abdominoplasty incision is closed subcutaneously with mononylon 3-0 or 4-0 and with a subcuticular suture of 4-0 monocryl. Dressing with micropore is applied over the abdominoplasty incision. A support girdle should be worn for 20 to 30 days. Antibiotics are injected during the procedure—2 g cephalosporin IV every 2 hours—with a total of 8 g in the first 24 hours and, after that, 2 g a day orally for a week. Analgesics and anti-inflammatory are prescribed as needed. Manual lymphatic drainage treatment can begin 48 hours postoperatively and reach a total of ten sessions, one every other day.

Fig. 7. (A,B) Preoperative view of a 44-year-old patient with excess skin and fat, plus muscle-aponeurotic flaccidity. (C,D) Immediately postoperative view after a combination of classic abdominoplasty (Callia) with umbilical repositioning, plus reduction liposculpture of the waist, flanks, and abdomen, and augmentation liposculpture of the buttocks and trochanteric area. (E) The excess fat is removed through lipoplasty. (F) The recti muscles’ diastasis is marked. (G) The recti muscles’ diastasis is sutured. (H) The new position of the umbilicus is marked. The dissected flap is sutured to the abdominal wall with a quilting suture to avoid seromas. (I) The excess skin and fat are removed.
Fig. 8. (A) A 29-year-old patient who had an extensive and wide vertical abdominal scar and excess fat in the abdomen, flanks, and waist. Under local anesthesia and sedation we aspirate the excess fat from the flanks in the lateral position and from the abdomen in the supine hyperextended position. (B) The excess skin and the old scar are removed, without dissection of the panniculus. (C) The wound is closed. The old scar from the drain was also revised. (D,E) Pre- and 30-day postoperative views after a modified Avelar abdominoplasty, plus reduction liposculpture of the waist, flanks, and abdomen, and augmentation liposculpture of the buttocks.
Fig. 9. (A,B) Preoperative views of a 31-year-old patient. This patient, an obvious Type V, preferred to be treated by liposculpture alone, which is indicated for a Type I patient. She had an obvious excess of skin and fat and should have been treated by a classic abdominoplasty, but she did not want to remove the excess skin or to correct the muscle-aponeurotic flaccidity, preferring lipoplasty. She was informed that the result would not be optimal, but accepted it. (C,D) One-year postoperative view after superficial liposculpture of the flanks, waist, and abdomen, with a good skin retraction. The flaccidity was not improved with this technique.
References


