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Abdominolipoplasty: A System of Classification and Treatment for Combined Abdominoplasty and Suction-Assisted Lipectomy

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Abstract. Criteria for diagnosing abdominal contouring candidates and a new classification system for procedures are presented. The surgical techniques for each of four patient categories of abdominolipoplasty are reviewed: type I—suction-assisted lipectomy alone, type II—mini-abdominoplasty, type III—modified abdominoplasty, and type IV—abdominoplasty with suction-assisted lipectomy. With the combination of suction-assisted lipectomy and abdominoplasty, the majority of patients can actually be treated with a limited abdominoplasty procedure or suction lipectomy. Complications noted in a series of 75 consecutive patients operated on by one surgeon are presented. The blood supply that is relevant to a combination of suction lipectomy with abdominoplasty is outlined. Specific guidelines for these combined procedures are recommended in order to safely combine full abdominoplasties with suction-assisted lipectomies.

Key words: Abdominoplasty—SAL—Combined classification system—Blood supply—Complications

The origins of abdominal and body contouring procedures emanate from man's earliest awareness of self. Presently, abdominal contouring is performed primarily for aesthetic purposes in order to correct deformities of the skin, fat, and the musculofascial system. The etiologies of such problems include adiposity, weight gain or loss, pregnancies, and previous surgical incisions [17, 20, 23]. Furthermore, the absence of the posterior rectus fascia below the arcuate line of Douglas and a tendency toward lower abdominal fat accumulation accentuate abdominal wall disfigurement (Fig. 1A,B). The configuration of the abdominal wall depends on the intrinsic bony architecture [5, 10] and soft tissue carpet. Patterns of fat distribution that vary with race, sex, and age [3] will also affect abdominal proportions.

While abdominoplasty has long been recognized as involving a group of procedures that should depend on individual problems, traditional abdominal contouring surgery has been limited to the standard abdominoplasty performed through a variety of surgical incisions and with minimal variations in technique. Standard procedures have both limited applicability for less significant abdominal deformities and the drawback of lengthy incisions [1, 2, 4].

The addition in the early 1980s of suction-assisted lipectomy to the surgical repertoire significantly enhanced the ability to tailor approaches to abdominal contour surgery. Combining modified abdominoplasty techniques with advances in suction-assisted lipectomy achieves time-honored goals with less extensive incisions and scarring. By diagnosing and treating patients based on their physical exam, an individualized surgical procedure is possible [18].

Abdominolipoplasty refers to a collective group of procedures that combines liposuction with modifications in traditional abdominoplasty techniques.

Method

Seventy-five consecutive patients requesting aesthetic improvement of their abdomens were reviewed. Fifteen of these patients were male and 13 of those were type I patients; the remainder were females divided into all four (I–IV) categories of

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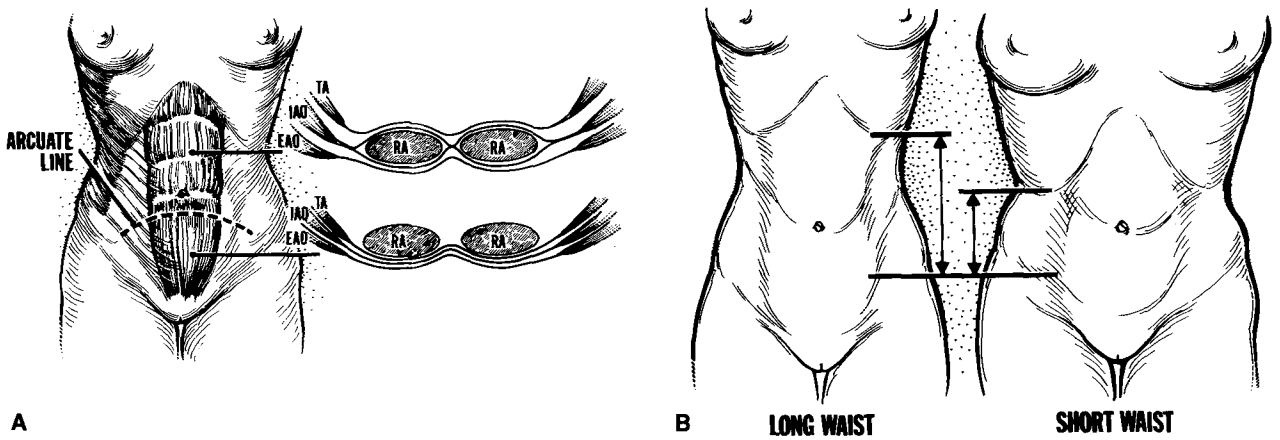

Fig. 1(A) Surgical anatomy of the anterior abdominal wall. Note the lack of the posterior rectus fascia below the arcuate line of Douglas, contributing to the lower abdominal bulging. **(B)** The intrinsic anatomy varies according to individual characteristics (reprinted from Clin Plast Surg, April 1989, with permission)

Table 1. Abdominolipoplasty classification system based on evaluation of the skin, fat, and musculofascial system[a]

Category	Treatment	Skin	Fat	Musculofascial system
Type I	SAL alone	Minimal laxity	Variable	Minimal flaccidity
Type II	Miniplasty	Mild laxity	Variable	Mild lower abdominal laxity
Type III	Modified abdominoplasty	Moderate laxity	Variable	Moderate lower or upper abdominal flaccidity
Type IV	Standard abdominoplasty with SAL	Severe laxity	Variable	Significant lower or upper abdominal flaccidity

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treatment. The preoperative evaluations focused on the skin, fat, and musculofascial systems. Patients were examined in the supine, standing, sitting, and lateral hip flexed or diver's positions. "Pinch and roll" evaluations were useful pre- and intraoperatively to assess excess skin and fat accumulation. Skin laxity of the entire abdomen, the quality, tone, and contractility of the skin, and any other pre-existing conditions were noted. Based on the results of the examinations, patients were categorized (Table 1) and treated with the appropriate technique (Fig. 2). These categories (I–IV) serve only as a general guideline in order to organize an approach to abdominal surgery and not as an unyielding classification system.

Surgical Procedures

The surgical technique is based on the classification system. After classifying patients as types I–IV, further adjustments within each category can be made as necessary and intraoperatively.

Type I: Suction-Assisted Lipectomy as a Sole Procedure

The indications for suction-assisted lipectomy alone appear in type I patients and serve as the initial approach in all four categories of abdominal contour treatment [14, 15].

With the patient standing, the areas to be suctioned are marked from costal margins to pubis, including the flanks. Prior to scrubbing, the patient is injected with 0.25% lidocaine with 1/400,000 epinephrine to diminish intraoperative bleeding, postoperative bruising, and discomfort. Spontaneous ventilation general anesthesia is preferred for all four categories. Suctioning is performed in quadrants through a periumbilical and pubic incision, crisscrossing the treated areas. The entire abdomen from costal margin to inguinal area, including flanks, is suctioned. Males (females when indicated) are turned to the prone position and are suctioned circumferentially. Peripheral undermining with the aspirator on for the purpose of redraping is beneficial. Attention to umbilical fullness and careful evaluation of each serially suctioned quadrant is helpful in

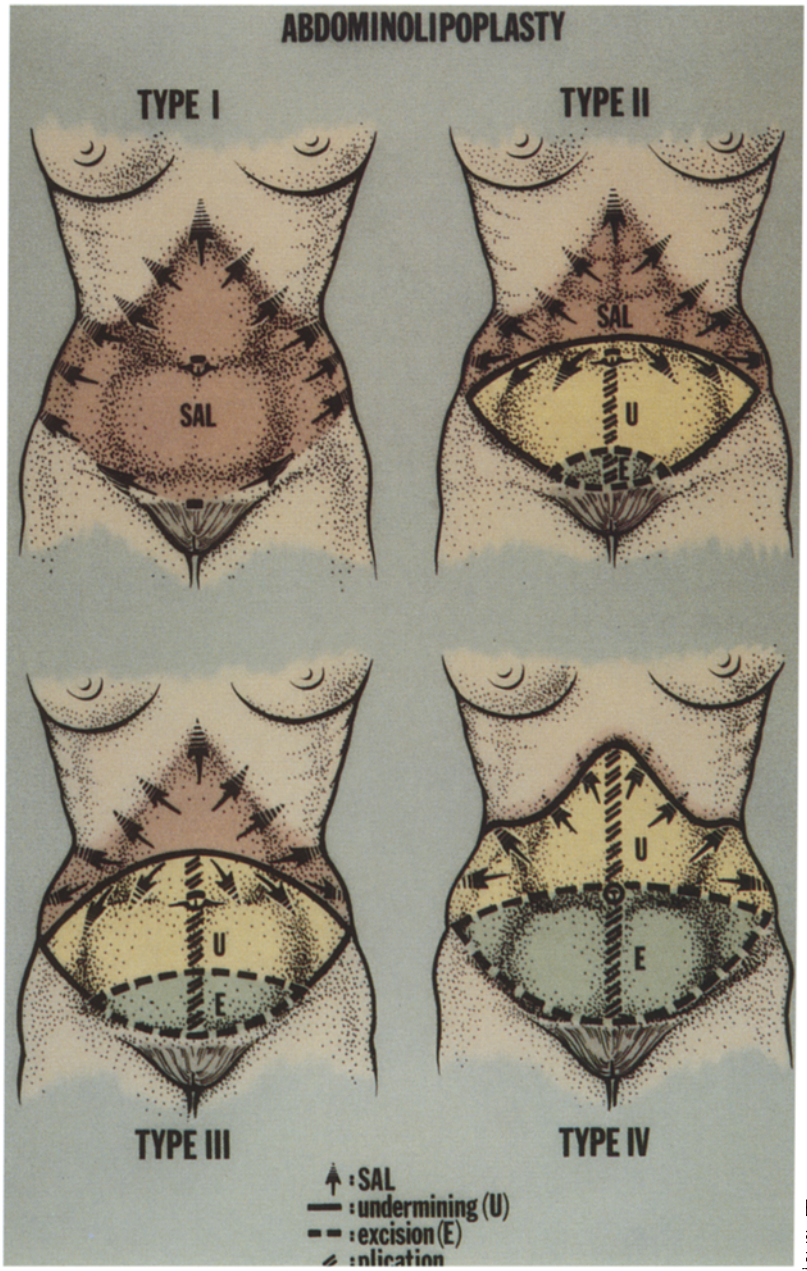

Fig. 2. Abdominolipoplasty types I–IV surgical technique (reprinted from Clin Plast Surg, April 1989, with permission)

diminishing residual fatty deposits. Suctioning in the deep subcutaneous plane leaves a protective superficial fatty layer. A triangular-shaped cannula, with three lumina on the undersurface, aids in minimizing persistent surface irregularities. No drainage is required.

The wound is dressed postoperatively with a strip of nonadherent dressing, and a compressive elastic abdominal binder is used for two weeks. Broad-spectrum perioperative antibiotics are recommended. Activity begins immediately postoperatively, with ambulation and full activity resumed at two to three weeks postoperatively (Fig. 3).

Type II: Miniabdominoplasty

The ideal candidate for miniabdominoplasty is a patient with distortion limited to the lower abdomen that cannot be corrected by suctioning alone. There is a combination of excess skin, subcutaneous fat, or relaxation of the musculofascial system that contributes to lower abdominal disfigurement [26]. The diver's view assists in emphasizing the differences between types I and II patients.

The procedure begins with suctioning, similar to a type I case. A curvilinear incision, approximately 12–14 cm in length and confined to the pubic hairline,

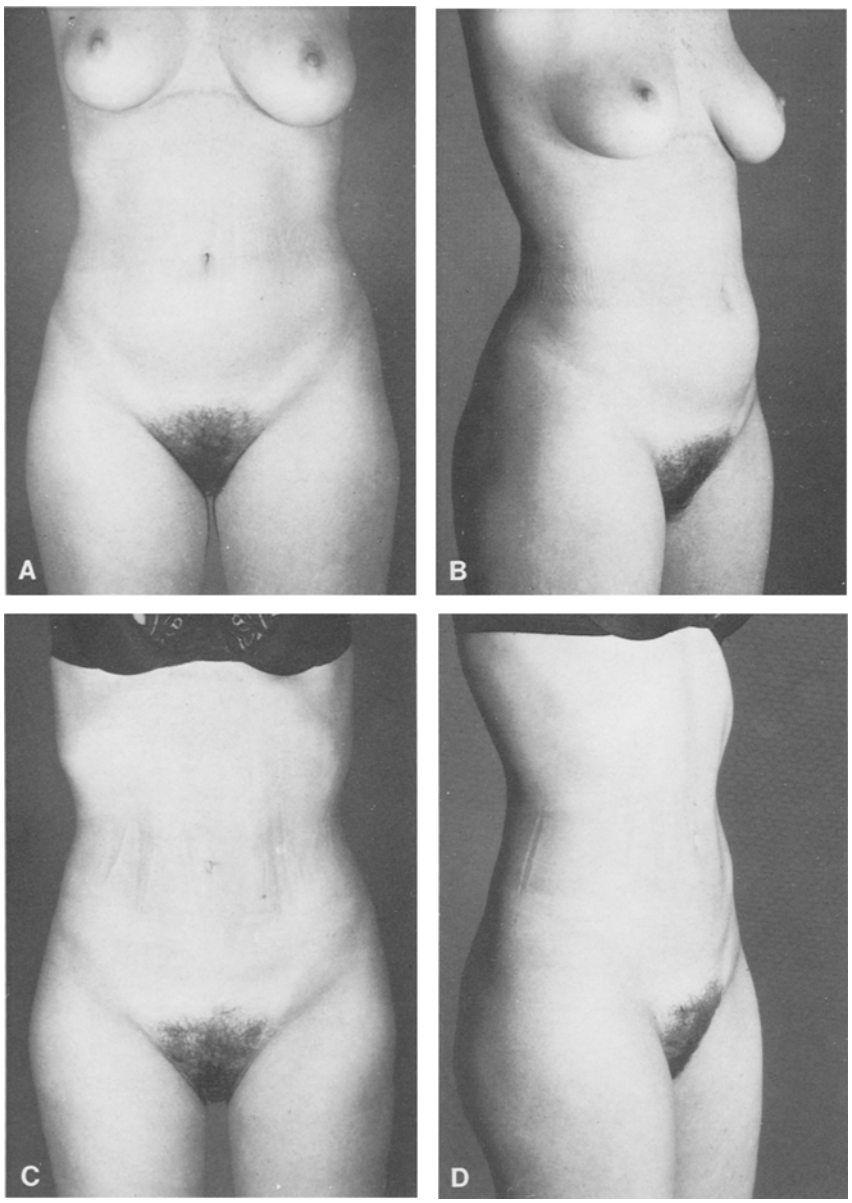

Fig. 3(A,B) Preoperative front and oblique views of 32-year-old female before removal of 550 cc by abdominal suction-assisted lipectomy and suctioning of the buttocks, love handles, and thighs. **(C,D)** Postoperative front and oblique views

is made down to the level of the muscular fascia; the flap is raised to the umbilicus. The laxity in the lower rectus musculoaponeurosis is estimated with tissue forceps and marked with ink. The rectus muscle is plicated vertically in an elliptic fashion, from the pubis to the umbilical stalk, using 2/0 Neurolon® (Ethicon, Somerville, New Jersey) suture in a buried figure-eight fashion.

The flap is advanced and split in the midline. A tacking suture of 3/0 Prolene® (Ethicon, Somerville, New Jersey) secures the flap without tension. Countertraction is placed on the excess abdominal flap, the flap is marked, and symmetric wedges of skin are excised. Jackson–Pratt drains are brought out through the pubic escutcheon. The wound is closed in layers without tension (Fig. 4).

Adjacent areas for suctioning or other areas to be tailored may be treated at this time; suction lipectomy of the lower extremity can be performed prior to the abdominal procedure. At the completion of the procedure, the patient is transferred to a stretcher. A compressive elastic abdominal binder is utilized, to be worn continuously for two weeks.

Type III: Modified Abdominoplasty

Patients who are ideal candidates for a modified abdominoplasty present with more significant skin excess and flaccidity of the musculofascial system,

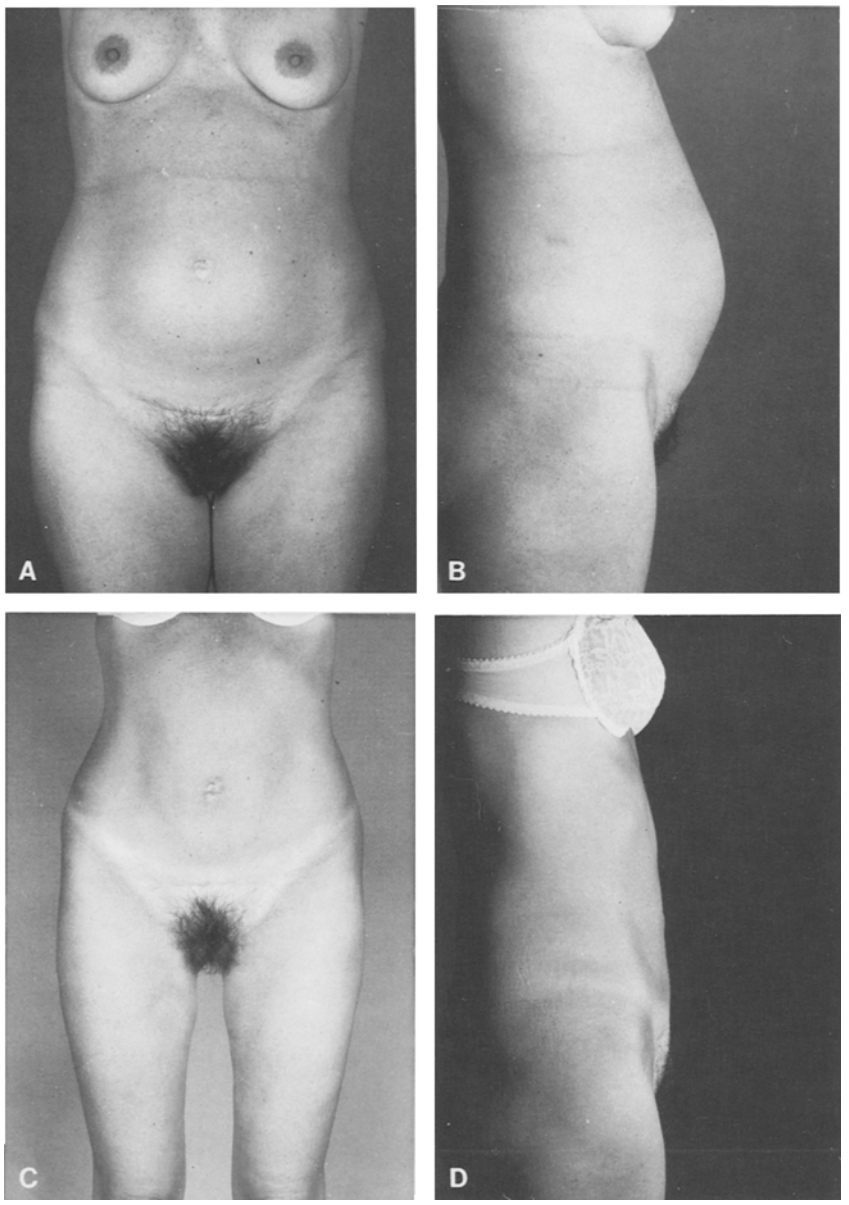

Fig. 4(A,B) Preoperative frontal and side views of a 37-year-old female before a miniabdominoplasty with 900 cc of abdominal SAL removed. **(C,D)** Postoperative front and side views of the same patient. Previous Cesarean section scar was used

that may not be confined to the lower abdomen. A modified abdominoplasty is also a good alternative for patients who have abdominal scars that limit the extent of safe flap undermining routinely employed in a full abdominoplasty [11].

A curvilinear incision is marked preoperatively in a natural skinfold, with the patient in the lateral hip-flexed position. Briefs aid in placing the incision in a concealed region. In order to excise more skin, the length of this incision exceeds a miniplasty but is confined within the anterior superior iliac spines. The entire skin excision may be premarked.

Closed abdominal liposuction is performed first. The flap is then elevated in the supraponeurotic plane to beyond the level of the umbilicus. The lower rectus fascia is assessed for laxity and plicated vertically from the umbilical stalk to the pubis. The wider exposure also allows any residual laxity to be plicated with oblique transverse plication sutures from the rectus to external oblique fascia between the anterior superior iliac spine and the umbilicus, or above the umbilicus.

The upper abdomen and waistline, which may appear wider following an abdominoplasty, can be further reduced by plicating above the umbilicus or by elevating external oblique flaps [22]. Thin patients and those with long, vertical abdomens benefit most from these additional procedures.

Although not routinely recommended, the umbilicus may be transected at the time of undermining,

the fascial defect repaired, and the translocated umbilicus carried down with the flap. If this is done, minimal downward displacement of the umbilicus should take place to not more than 2–3 cm lower than the previous position (using routine landmarks) and generally to a distance 10 cm above the top of the pubic hairline. To create an aesthetically pleasing downward pull and superior hooding of the umbilicus, the free stalk should be reinserted with 4-0 nylon suture into the fascia at a slightly higher level than where it lies, so that when the skin is stretched and closed the slight pull will create the desired appearance.

The operating table is flexed 30°; the flap is advanced and split in the midline. A tacking suture of 3/0 Prolene® (Ethicon, Inc., Somerville, NJ) is used to secure the flap to the pubic escutcheon. Symmetric traction is placed on the two remaining triangles of skin with Alice clamps. The triangles are then measured, marked, and excised. Jackson–Pratt drains are brought out through a stab wound in the pubic hairline and removed when drainage permits. Excess fat may be trimmed along the flap edges to equilibrate any discrepancies between upper and lower flap thickness.

Closure is performed in layers with 4/0 Vicryl, 3/0 subcuticular Prolene, and 5/0 nylon sutures. As a minimal amount of tension is placed on the wound, it is not necessary to anchor the flap to the fascia when closing. The skin is reinforced with Steri-strips and dressed with a nonadherent dressing. The patient is then transferred to his/her own bed and an abdominal binder is secured (Fig. 5).

Type IV: Abdominoplasty with Suction-Assisted Lipectomy

A type IV patient is the ideal candidate for a standard abdominoplasty combined with suction-assisted lipectomy. These patients have pronounced skin laxity and usually a diastasis of the rectus muscle in the upper and lower abdomen. Incisions are designed with the patient in a flexed position to reduce the abdominal apron maximally and to conform sufficiently to clothing styles. According to the surgeon's preference, flap elevation and rectus plication is performed. The umbilical transposition is treated in a routine fashion (Fig. 6).

Suction-assisted lipectomy is usually performed before but can be done during or after flap elevation. Prior to elevating the flap, suctioning the lower abdomen is useful to equilibrate the wound edges or to debulk the upper flap. Following closure of the abdomen, suction-assisted lipectomy can be performed as an adjunct to abdominoplasty, to minimize "dog-ears," to treat flank fullness, or to extend areas of treatment. When suctioning the peripheral arcade from the inframammary to the inguinal area in a type IV patient, the remaining blood supply must be considered.

Postoperative Care

Postoperative care of types II and III patients involves an elastic abdominal binder worn continuously for the first two weeks. Broad-spectrum perioperative antibiotics are administered. Patients are encouraged to transfer to a chair the first postoperative day and to ambulate with assistance the following day. Adequate hydration and pulmonary care are essential. A Foley catheter may be used in large volume suctions. Patients may require overnight hospitalization, and are given nothing by mouth until bowel sounds are present. Diet begins with liquids and is advanced as tolerated. Type IV patients require standard abdominoplasty postoperative care. In patients who have suction-assisted lipectomy as well, increased bruising can be expected. Volume is replaced at approximately 3 cc of crystaloid per cc of fat removal.

Postoperative pain and discomfort are more common with abdominal suctioning than in many other body areas and increase with muscular plication; however, unusual pain is often associated with a hematoma. Postoperative fluid collections can generally be aspirated, although it is common for these to require multiple aspirations before they resolve.

Bathing is permitted when the patient is discharged. All sutures are removed within ten days. Progressive activity is allowed, and full activity is resumed by the third postoperative week.

Complications in Abdominolipoplasty

Complications noted for types I–III in this series are

Type I:
- Persistent contour irregularities
- Remaining areas of localized fat
- Delayed and transient abdominal firmness
- Scrotal edema and discoloration
- Errors in diagnosis and classification

Types II and III:
- Bleeding
- Seromas
- Pseudobursa formation
- Complications associated with SAL
- Scars requiring revision
- Errors in diagnosis and classification

The abdomen is an unforgiving area for contour irregularities. Preoperative evaluation and intraoperative assessment of localized fat deposition are

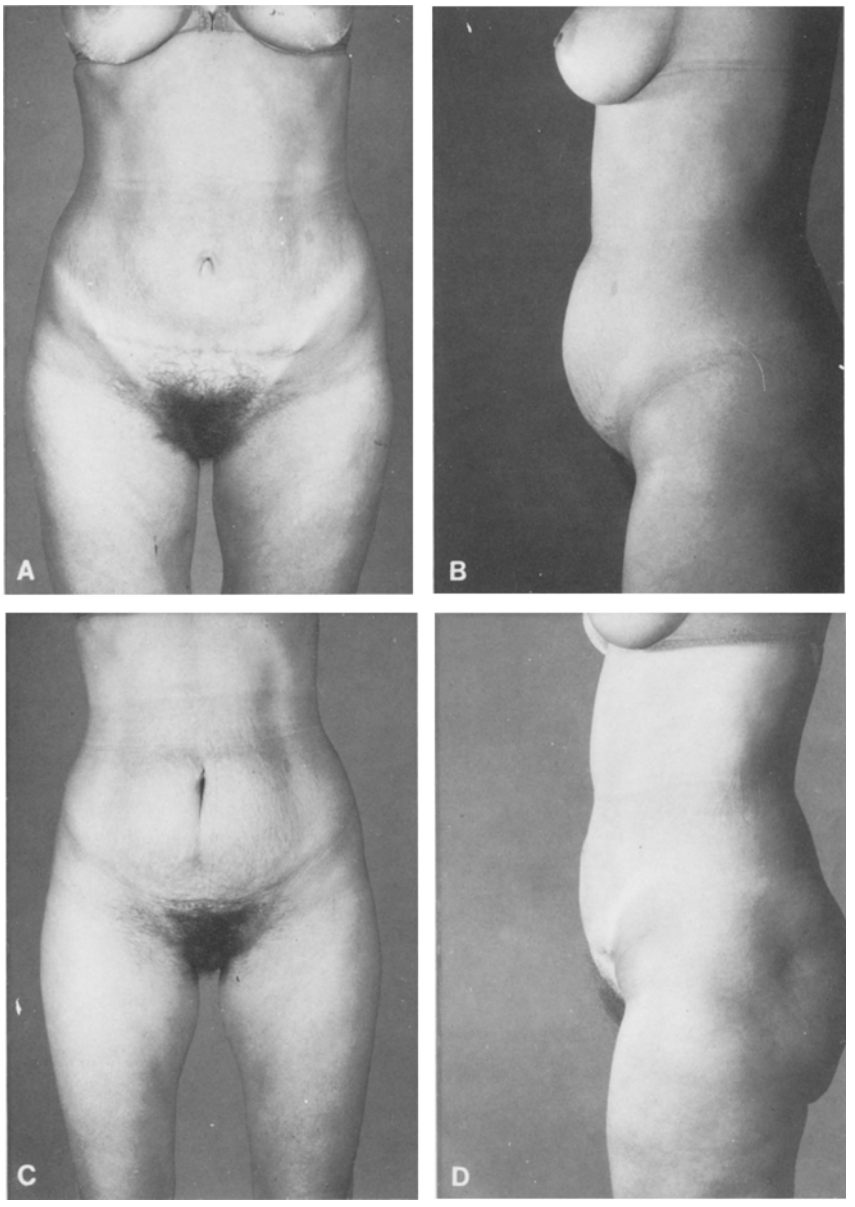

Fig. 5(A,B) Preoperative front and side views of a 38-year-old female before a modified abdominoplasty that removed 600 cc of SAL in the adjacent arc. The umbilicus was detached, translocated downward and reattached. **(C,D)** Postoperative front and lateral views

important, particularly in the thin individual. The superficial layer of fat is protective, and it is the deep layer, which varies regionally in thickness, that should be suctioned to achieve optimal results. Remaining areas of fat and contour irregularities are the most common postoperative complaint [8, 25].

Seromas are a particular concern in types II and III patients who seem to have a higher incidence of seroma formation when the procedures are combined with larger volumes of suction-assisted lipectomy. The etiology of seromas include interruption of lymphatic and vascular channels, creation of dead space, wide undermining (dissection), wider partial undermining (SAL), and the release of inflammatory mediators from traumatized tissue [16]. The consequences of seroma formation can be prolonged drainage, delayed healing, infection, skin necrosis, and pseudobursa formation. They may be prevented by limiting areas of peripheral undermining (SAL), suturing layers (in combined procedures), and ultimately by staging (six weeks) the procedures [7]. By leaving the drain in the wound until the patient ambulates and drainage subsides, the incidence of seromas decreases. Should a seroma form, the treatment may include prolonged or repeated drainage, fibrin glue, or tetracycline hydrochloride sclerotherapy. Incomplete or untreated seromas can result in pseudobursa formation. In the early postoperative period, these can mimic a contour irregularity. The pseudocapsule must be excised, the tissue approximated, and the wound drained.

Studies by Grazer and Goldwyn [9] and Pitanguy

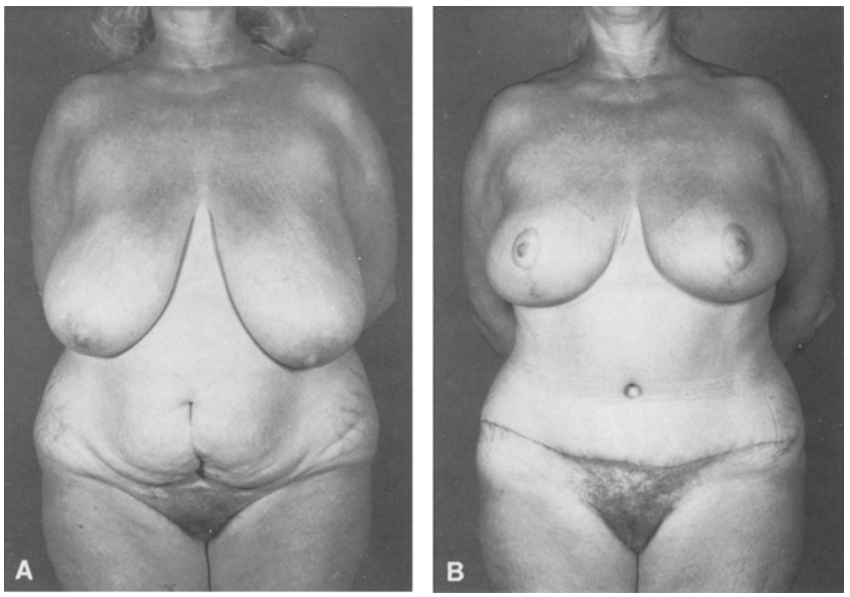

Fig. 6(A) Preoperative view of a patient before a standard abdominoplasty using a low transverse incision, combined with removal of 700 cc of SAL within the adjacent arc and a breast reduction. **(B)** Eight months postoperative, with some residual fullness in the upper abdomen commonly seen in the early postoperative period with SAL of this region

have documented the common complications of abdominoplasty. Teimourian and Rogers [24] compared specific and overall complication rates for abdominoplasty (2%), dermatolipectomy (0.9%), and major suction-assisted lipectomy procedures (0.1%). Numerous complications may occur with an extensive operation such as an abdominoplasty. Major tissue loss with abdominoplasty is a particularly dreaded complication. This is a multifaceted problem, which might be expected with increased frequency in adominoplasty with its wide tissue undermining and flap elevation. Pulmonary embolism is another significant problem and is increased in obesity (2.5%). Conflicting studies report a variable incidence of pulmonary embolism when an abdominoplasty is combined with intra-abdominal procedures [12].

The Abdominal Blood Supply in Abdominolipoplasty

Previous reports by Nahai, Brown, and Vasconez [19] have detailed the abdominal wall blood supply and have advised placement of a second incision. Huger [13] subsequently designated three involved vascular zones and the blood supply that remains following standard abdominoplasty.

Regardless of the technique employed, when performing abdominoplasties vascular territories are interrupted. Awareness of the remaining blood supply is essential in planning suctioning of adjacent areas. The three regions most commonly suctioned in conjunction with abdominolipoplasties extend in an imaginary arc from the lateral inframmary crease to the anterior superior iliac spine and into the inguinal crease (lateral costal margin, flank—III, and hip—II) (Fig. 7).

In type I patients, there is no flap elevation and concomitant suctioning in the arc is considered safe. Types II and III patients have sequentially higher flaps elevated; however, most of the blood supply to the flap remains intact, particularly the internal mammary arteries. In order to insure flap integrity, suctioning of the adjacent arc should not be excessive.

In type IV patients, when an incision to the anterior superior iliac spine and routine flap elevation are performed, the remaining blood supply to the abdominal flap is from retrograde collateral flow from the deep circumflex iliac artery posterior to the anterior superior iliac spine (zone II), and the dominant supply from zone III. As much as zone I has already been interrupted by flap elevation, it is relatively safe to defat the flap either with scissors or by suction-assisted lipectomy, to the extent that it can be tolerated by skin circulation.

However, it is the adjacent areas within the inframammary to inguinal arc (lateral costal margin, flank, hip), where the remaining flap perfusion originates, that must be treated cautiously in full abdominoplasty patients. In order to preserve maximum blood supply to the flap, suction-assisted lipectomy should not be performed more than approximately 5–10 cm beyond the area of undermining and performed vigorously in no more than one of the three regions (lateral costal margin, flank, hip). By suctioning these regions judiciously and not crisscrossing the suction lipectomy, maximum blood supply to the flap is preserved.

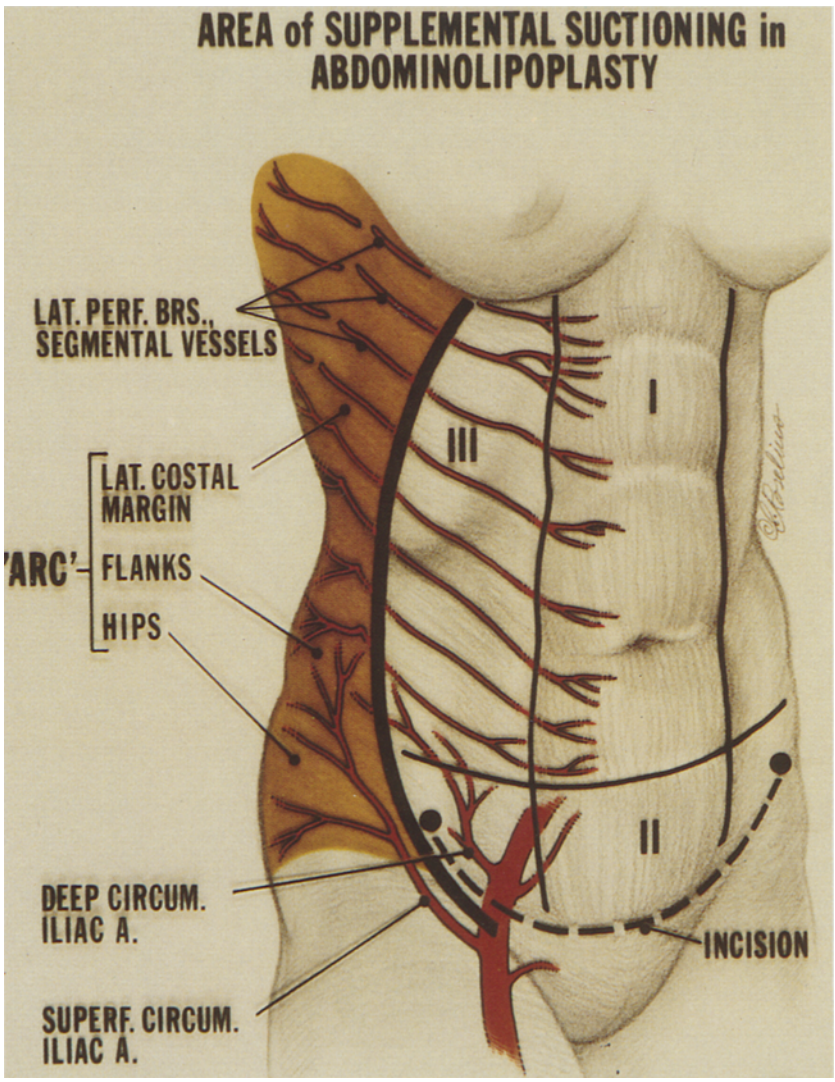

Fig. 7. The abdominal wall blood supply based on zones I–III as described by Huger, and the vessels perfusing the flap following a full (IV) abdominoplasty. The "arc" from the inframammary crease to the inguinal crease is the area most commonly suctioned in conjunction with abdominoplasty. The lower dotted line indicates a full abdominoplasty incision

Following these guidelines, combined abdominoplasty and suction-assisted lipectomy of the adjacent arc can be performed safely. Suction-assisted lipectomy is advantageous because it extends the treatable areas, facilitates undermining, and allows final tailoring and flap definition. However, only generally healthy patients should be considered for a combined full abdominoplasty and suction-assisted lipectomy. Preoperatively, smokers (smoking must be discontinued at least two weeks before and after suction-assisted lipectomy), the obese, elderly, diabetics, hypertensives, and patients with respiratory, cardiac, or thromboembolic history are at greater operative risk. Intraoperatively and postoperatively, extensive unguided flap undermining handling and thinning, fluid accumulation, and infection are also risk factors.

Finally, it appears that combined incisions (vertical closure) [6], extensive flap undermining, and smokers are at the highest potential risk of flap necrosis in a combined full abdominoplasty and suction-assisted lipectomy procedure.

Discussion

In this series of 75 consecutive patients requesting abdominal contour procedures, it was found that a majority could be treated through a limited surgical approach, tailored to the individual deformity. In 1987, Pitanguy [21] noted a similar trend when he compared a retrospective group of patients between 1980 and 1985 with a series from 1986. He reported a near reversal in the number of patients initially undergoing dermatolipectomies compared with those requiring liposuction surgery alone.

Suction lipectomy greatly reduces the need for conventional abdominoplasty procedures. In fact, suction lipectomy as a sole procedure was the treatment of choice in a significant percentage of patients

requesting abdominal contouring. Of the remainder, a large number with limited abdominal wall weakness and skin or adipose excess were treated successfully with the limited abdominoplasties (types II and III). The breakdown of the type of procedure used on the 75 patients is as follows:

Type I: 37.52%
Type II: 29.48%
Type III: 14.74%
Type IV: 18.76%

The advantages of classification and treatment using the abdominolipoplasty system are that it addresses the localized deformity with a limited concealed incision, and, for the majority of patients, there is a reduction in time required for surgery and hospitalization and a faster recovery. Type III procedures avoid the untoward sequelae of umbilical transposition and can be performed in patients in whom traditional abdominoplasty is contraindicated (or who would have a residual vertical umbilical scar closure) with less risk of flap necrosis and a faster recovery period.

As expected, the average age of patients increased with each category: type I—34.2 years, type II—42.4 years, type III—44.8 years, and type IV—50 years.

In previous reports, breast reductions were the most common concomitant aesthetic surgery procedures performed with abdominoplasty surgery. However, it currently appears that suction-assisted lipectomies in other areas are the most common simultaneously performed procedures:

SAL of lower torso (with type I)
Breast augmentation (with types II and III)
Breast reduction (with type IV)
Dermatolipectomy
Facialplasty
Rhinoplasty

Breast augmentations often accompanied types II and III, and breast reduction type IV patients. When combining procedures in which suction lipectomy is anticipated, a quantitative preoperative assessment of blood loss should be made and autologous blood stored prior to surgery for transfusion in the perioperative period.

Summary

Genetic fat maldistribution and lower abdominal deformities can be improved only to a limited degree by the individual. Due to an increase in leisure activities, society's current emphasis on fitness and a youthful appearance, and revealing fashion trends, there is a growing interest in abdominal contour surgery.

Traditional abdominoplasty techniques have had limited applicability for less significant deformities. Diagnosis and classification of abdominal wall deformities, as in the setting up of types I–IV patients and procedures, provide the foundation for an individualized approach to abdominal contour surgery.

Simultaneous suction lipectomy can indeed be performed with all types of abdominoplasties when following the appropriate guidelines.

Abdominolipoplasty includes that group of procedures combining suction-assisted lipectomy with modified abdominoplasties and addresses the individual deformity as well as insures incisions consistent with the goals of plastic surgery.

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