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High Tension Abdominoplasty 2.0

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KEYWORDS

- Abdominoplasty • High lateral tension abdominoplasty
- Body contouring • Weight loss surgery

The abdominoplasty can at once be deceptively easy to perform and maddeningly inconsistent in its results. The plastic surgeon is challenged to excise all the anterior trunk and fat, through the shortest possible incision, and to ensure per primum healing with an inconspicuous scar. To begin to rise to this challenge requires one to become a student of the abdominoplasty. By continuously honing one's surgical planning and execution, a more "balanced" technique can be realized that is both reliably safe and aesthetically successful. High lateral tension abdominoplasty (HLTA), with some 2.0 modifications, is such a technique.

Traditionally, the primary goal of any abdominoplasty has always been to excise the central lower abdominal excess skin or pannus and plicate the abdominal fascia through a suprapubic incision. Unfortunately, this classic abdominoplasty may often fall short of this goal: a scar that may ride too high; persistent skin and lipodystrophy at the pubis, thighs, flanks, and hips; and unfortunately a consistent incidence of midline skin necrosis or wound dehiscence.

HLTA addresses these shortfalls. It may be defined as a more complete treatment of the trunk aesthetic unit from the abdomen to the pubis, hips, and thighs, with a greater overall aesthetic result and margin of vascular safety. This article outlines the techniques and tools to accomplish these superior results safely and consistently.

THE EVOLUTION OF THE MODERN ABDOMINOPLASTY

The abdominoplasty technique has evolved significantly in the last 4 decades. The modern abdominoplasty technique was developed in South America in the 1960s.¹ The basic surgical tenets have always been to conduct a rectus plication, with maximal excision of the central skin excess by extensive undermining of the entire abdominal wall. The closure is often under some tension and is therefore, per force, conducted with the patient in significant flexion. When liposuction was introduced in the 1980s, it soon became apparent that blithely and aggressively adding this modality to abdominoplasty was fraught with an unacceptable incidence of flap ischemia and skin necrosis. Liposuction then evolved into a more conservative adjuvant treatment.² Although there were indeed less physiologic problems with this technique, the aesthetic results were also, once again, more constrained.

Then, in the early 1990s Lockwood³ published a series of seminal articles that single handedly changed the tack of the abdominoplasty technique. Based on his extensive experience with body-contouring surgery, he decisively demonstrated and definitively modified the surgical principles of abdominoplasty and reported greater safety and improved aesthetics. He enumerated several surgical tenets that were in many ways

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diametrically opposed to those of the classic or traditional abdominoplasty: the undermining of only the **central** skin flap to facilitate plication with discontinuous dissection elsewhere (to enhance vascularity and allow for judicious concomitant liposuction) and the initial resection of the **lateral** excess skin, with more conservative resection of the central skin flap (to accomplish a more complete and natural repair) by using a planned and controlled **high-tension** closure (with the diligent use of the underlying superficial fascial system). And so HLTA was borne.

HLTA: A 2.0 VERSION

In the past 12 years, I have become a diligent student of these Lockwood principles and applied them to a large series of several hundred patients.⁴ The application of these principles and the critical analysis of the results have driven a successful evolution of the HLTA procedure. For a result to be called truly successful, strict standards were balanced equally: the case had to demonstrate the greatest degree of safety (zero tolerance for complications), with the maximal aesthetic result (correction of all deformities) and with a consistent reliability of the technique (regardless of patient presentation). Several important expanded principles of the HLTA may be distilled from this experience to define a true 2.0 advancement in technique.

1. The abdominal procedure should not be a slave to the otherwise arbitrary mandate that all the skin between the pubis and the umbilicus must be excised. This approach only truly works in the patient with an enormous pannus. Otherwise, the excisional marking must be, per force, placed above the pubic hairline to accomplish wound closure, that despite the harnessing of the excess pubis, remains overly tight. That result may be an excessively high scar and superiorly retracted pubis, an unnaturally flat hypogastrium and more seriously, an exaggerated rate of wound dehiscence and skin necrosis. Instead, any redundant pubis should be excised, rather than aid in the closure of harnessed. The pubis is then closed under no tension and rests in a lower, more inconspicuous location. However, except for the most "redundant" cases, this approach often deliberately leaves some of the skin between the pubis and umbilicus intact. This necessitates that the original umbilical site be closed. The surgeon must resist the temptation to remove even a few centimeters of intervening
2. Any abdominoplasty should consider not only what is above the future incision (the traditional pannus) but also what is below: that is, the excess pubis, anterolateral and medial thigh redundancy, as well as buttocks laxity. Otherwise, the tissues below the incision may be distractingly untreated postoperatively and the full effect of the HLTA may not be realized. This tenet underlines one of the greatest benefits to HLTA not normally considered possible with traditional abdominoplasty: one can realize a true body lift effect through an anterior incision only. In essence this approach is actually a "global" tension abdominoplasty, with sequential tension placed fully from lateral to medial.
3. It has always been important to evaluate the magnitude of excess skin to be excised. But to actually design the most efficient length and direction of the incision, it is critical that the extent and orientation of the skin left behind is also assessed. The surgeon must ensure that the remaining skin is both sufficient to close the defect and efficiently relieved of its own redundancy. This principle may be applied equally to the central and lateral closure. Specifically, laterally, the excess skin at the hip and thigh is often neglected by traditional abdominoplasty. This primarily obliquely oriented excess tissue is efficiently removed through the oblique incision/vector of the HLTA. Centrally the superfluous skin at the epigastrium constitutes primarily horizontal excess (that has migrated from the chest), that can neither be efficiently removed nor should be used to close a lower abdominal defect, through the horizontal incision. Therein lies the essence of the potential flaw in traditional abdominoplasty and the efficacy of the high lateral tension technique. That is, an incongruent consequence may occur: the wound closure may be too tight despite the apparent epigastric redundancy, which can, in turn, be left behind and the lateral excess cannot be effectively treated because the remaining abdominal flap has been primarily used for the central closure. Instead to reconcile this paradox, less skin should be excised centrally but more laterally, through an HTLA-oriented incision and repair. These concepts are illustrated in **Figs. 1** and **2**. Using vector analysis, the lateral tissue above and below the incision is redundant in a more oblique vector and so should be removed through an opposing oblique incision. Serendipitously, this matches the

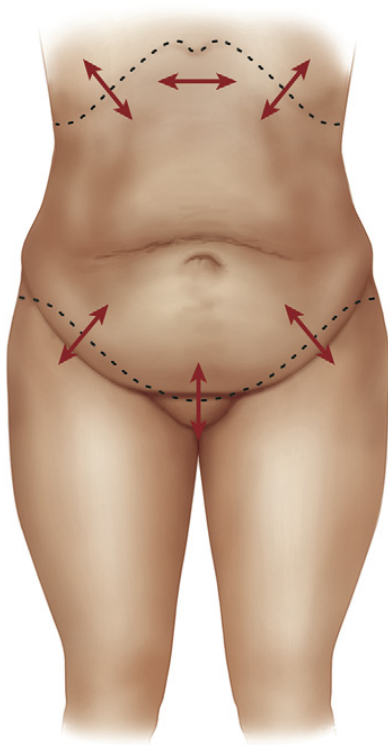


Fig. 1. The more a procedure follows the vectors of excess of both what is taken and what will remain, the more efficient the treatment of redundant skin.

relative direction of the desired HTLA lateral scar placement. In addition, this oblique vector also treats the predominantly horizontal excess in the epigastrium. Applying this vector of

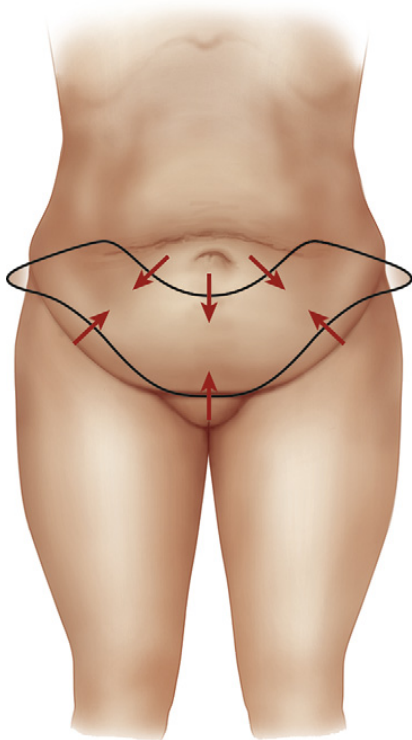


Fig. 2. Applying this vector of excess principle, the necessary direction of the most desirable HTLA central and lateral incision placement is easily understood and defined.

excess principle, the necessary direction of the most desirable HTLA central and lateral incision placement is easily understood and defined. Thus, the more a procedure follows the vectors of excess of both what is taken and what will remain, the more efficient the treatment of redundant skin.

4. As a corollary of this aforementioned principle, it may be stated that, as long as there is excess tissue, the longer the scar, the more far-reaching the tension effect and the more dramatic the results. In fact, as will be shown in this chapter, a “virtual” lower body lift can be accomplished, when indicated from this entirely “supine” operation. Clearly, the most posterior buttocks and thighs cannot be addressed, but this approach can and does satisfy the majority of properly selected patients who, in fact see this effect as a significant bonus. And inherently, this, albeit, “conservative” body lift does reduce the surgical time and operative risks as compared to a full truncal lift procedure.
5. Lockwood, originally, and rightfully so, emphasized the “lateral” tension nature of this technique. That is, that the surgeon, contrary to the traditional approach, must begin the resection from lateral and work medially. This admonition emanated from his original observation that there was actually more redundancy laterally at the hip, thigh and buttock than centrally. Indeed, if the surgeon respects and executes this principal, they will indeed realize a superior correction beyond the central abdomen. Hence the “lateral” tension eponym. However, it is more instructive and indeed more efficacious to instead, consider the entire length of the wound as tension. That is, it is also possible to accomplish as much correction centrally, at the redundant pubic and inner and anterior thighs, if the tension principle is honored here as well.
6. The goal of the design and placement of the future scar should primarily be to hide it. Lockwood originally described a very high (French cut) lateral closure, probably because that style of clothing was more fashionable at the time and a more oblique vector of pull does more efficiently treat the upper abdominal excess as described earlier. However, considering how fashion changes, and that a hidden scar will usually trump some residual excess skin, the surgeon should mark the patient within their preferred clothing. This philosophy becomes particularly relevant when working with the low-cut jean fashion.
7. The location and extent of the remaining subcutaneous fat must also be evaluated and

respected. This assessment represents an age-old plastic surgical battle between beauty and blood. That is, at what cost to the blood supply does the surgeon attempt to remove all remaining excess subcutaneous fat? Lockwood originally described a reasonable detente: liposuction should only be conducted beneath tissues that have not been undermined. However, most recently, the proverbial pendulum has swung backward: more recent publications are giving permission once again to conduct more aggressive full truncal liposuction at the time of the abdominoplasty.⁵ This recommendation is predicated on the notion that if one follows the original Lockwood admonition to restrain the flap dissection only as much as needed to conduct a fascial plication, then enough perforators are preserved to allow for this aggressive liposuction. However, as has been stated earlier, Lockwood did also warn that despite this conservative undermining, liposuction of the remaining central skin flap should not be entertained for fear of skin flap necrosis. (And realistically, some of these same precious perforators are often sacrificed to repair the more protuberant abdomen.) This principle should be respected in light of Lockwood's prodigious experience.

8. If the premise is to preserve the central flap's blood supply by undermining only centrally to allow for fascial plication, it may indeed be self-defeating to then disrupt the very same flap with liposuction. Ironically, the only patients who might be candidates for such an aggressive approach would be those without a significant amount of fat in the first place: that is, the patient with a low body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters). Otherwise, in the usually higher BMI abdominoplasty patient, liposuction should be restricted to the waist and hip rolls with a planned secondary liposuction centrally, some 6 to 12 months later. Only then, can a zero tolerance for skin flap necrosis and dehiscence be honored.

PATIENT ANATOMY

The general abdominal anatomy is well described in this issue by Farzad Nahai. Therefore, the specific anatomy most relevant to the understanding and application of HLTA is highlighted in this article.

There are 3 critical anatomic points that should be understood and respected when planning and performing HLTA:

1. The superficial fascial system: This layer must be identified and used fully to both harness the maximal lift that this technique can proffer and prevent wound dehiscence.
2. The perforator blood supply: The abdominal flap's viability is predicated on the preservation of as many fascial perforators as possible.
3. The zones of adherence: These various points of skin attachment must be released, at least bluntly, to realize the maximum translation of pull of the remaining skin envelope, particularly at the anterolateral thigh region. There is often also what may be called a waist band of adherence at the patient's midsection that can significantly inhibit the skin's mobility. (see later discussion).

PATIENT ASSESSMENT

A comprehensive examination is mandatory to enable the surgeon to properly prepare the patient and accurately plan the surgery.

Physical

The physical examination should include evaluation of all layers of the abdominal wall: the skin, the subcutaneous fat, and underlying fascia/muscle (with an indirect assessment of the extent of intra-abdominal fat).

Skin

The skin examination should be much more than just the assessment of the classic pannus of excess lower abdominal skin above the pubis.

Striae Their boundaries are assessed. The extent of the striae that may not be included in the resection should be duly noted and explained to the patient (particularly those above the umbilicus).

Excess skin The extent of obvious anterior redundant skin (width of the pannus) is noted first. This evaluation most accurately defines the length of the incision. However, a proper assessment must be made beyond the obvious excess lower abdominal pannus if a more complete correction is to be made of the entire anterior trunk aesthetic unit; that is, the extent of redundancy is evaluated not only above the inguinal area but also below the incision, at the hips, thighs, and pubis. If there is particular excess at the lateral thighs, then the incision will, by definition, be appreciably longer, if the HLTA approach is to be properly applied. In fact, in these patients, it may be stated that the longer the incision made, the better the results. On the other hand, if the patient demonstrates minimal excess laterally, then significant tension should not be planned, to avoid making the

incision unnecessarily longer. Note should also be made of excess skin at the upper abdomen. Here there may be what I call a secondary roll or wall of cascading skin, which really represents a migration of redundancy from the chest rather than the abdomen. Consequently, all of this upper abdominal skin cannot usually be removed from the suprapubic approach. It is of great value to conduct this examination not only with the patient in the supine and standing positions but also with the patient sitting and bending over. This is often the only posture in which one can see the areas of redundancy in the patient who demonstrates what appears to be primarily abdominal wall protrusion (**Fig. 3**). Of equal importance, the mobility or what may be called the translation of the skin, is very telling: the looser the skin, the better the potential result.

Adhesions Note should be taken of any adhesions of the skin at the thighs and abdomen proper. Although not previously described, adhesion can also be found at the level of the waist, particularly laterally: a waistline zone of adherence and contraction. There is most often what one may call a second roll of excess skin resting above this valley, most notably in the larger patient or after weight loss (**Fig. 4**). This band essentially divides the abdominal excess skin into superior

and inferior segments. The surgeon must be aware that this adhesion of tight skin will resist efforts to efface the upper abdominal excess. Because this zone harbors vital perforators, only a judicious release of the area by discontinuous undermining should be attempted. Otherwise, the upper abdominal redundancy is best addressed with either a fleur-de-lys type abdominoplasty or a second-stage reverse abdominoplasty.

Scars All scars at the abdomen are assessed. Of greatest concern are those at the subcostal and midline areas. These scars require the surgeon to map out the safest and most effective surgical approach. For the subcostal scar, it is best to restrict one's undermining in this area and if possible even include this scar within the resection of a fleur-de-lys pattern. Similarly, the upper midline scar presents a challenge. Either a fleur-de-lys type pattern or a reverse abdominoplasty should be considered. Otherwise, the risk of abdominal flap necrosis is potentially too high. If there is a full-length midline scar, the fleur-de-lys template is ideal.

Subcutaneous fat

Thickness of the envelope A topographic sense of the extent of underlying fat must be defined. This mapping guides where liposuction should be



Fig. 3. It is valuable to examine the patient not only in the supine and standing (A) positions but also in the sitting (B) and bending over (C) positions.

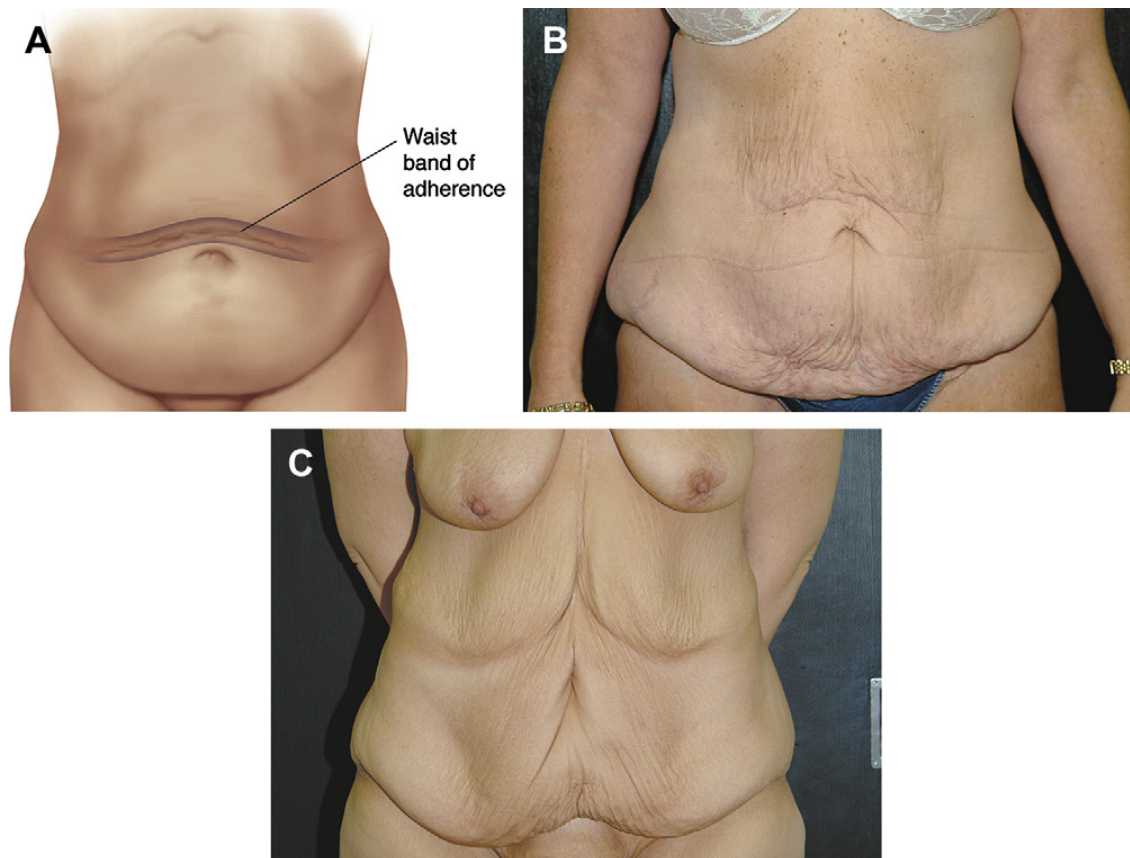


Fig. 4. Adhesion (A, B, C).

conducted and just as importantly, where it should not be performed. Usually the contouring of the waist, hips, and lateral thigh assists the HLTA by facilitating the translation of pull of the skin with its liposuction-induced discontinuous dissection and accentuates the abdominoplasty's shaping effects. If the central flap is very thick with fat, then it is best to inform the patient that a second-stage liposuction surgery may be necessary to complete the repair safely.

Abdominal wall

The location and extent of protrusion Assess the degree of lower abdominal wall relaxation with the patient lying down with knees bent, as well as when standing. Also ask the patient, while standing, to make a conscious effort to relax the abdominal wall. The additional extent of protrusion that occurs is surprising and informative (**Fig. 5**). In addition to the obvious lower abdominal wall protrusion, one should assess the magnitude of laxity at the upper abdomen. Compressing the lower abdominal wall and watching for herniation of the epigastric area will accomplish this task.

The presence of hernia The examination should explore for incisional, epigastric, and periumbilical hernia. This is particularly relevant, not only so that the surgeon may plan to repair the defect but also

to avoid any liposuction in these areas before abdominal flap elevation to prevent intra-abdominal penetration of the cannula.

The shape of the waist If the waist is more square with fat blunting its shape, then an aggressive liposuction can be very salutary.

PATIENT SELECTION

The patient criteria to be considered must be exhaustive if the surgeon is to avoid major complications or patient disappointment.

The ideal patient criteria:

- **Weight:** not grossly overweight (BMI <30 kg/m²) and stable for more than 6 months, if significant weight lost.
- **Medical condition:** no major medical issues such as labile hypertension, diabetes, coronary disease, nutritional deficiency, and so forth.
- **Psychological state:** well motivated and realistic (eg, postpregnancy or gastric bypass patients).
- **Habits:** regular exercise, reasonable diet, no smoking or excess alcohol.
- **Anatomy:** absence of multiple abdominal scars, no extreme abdominal protrusion

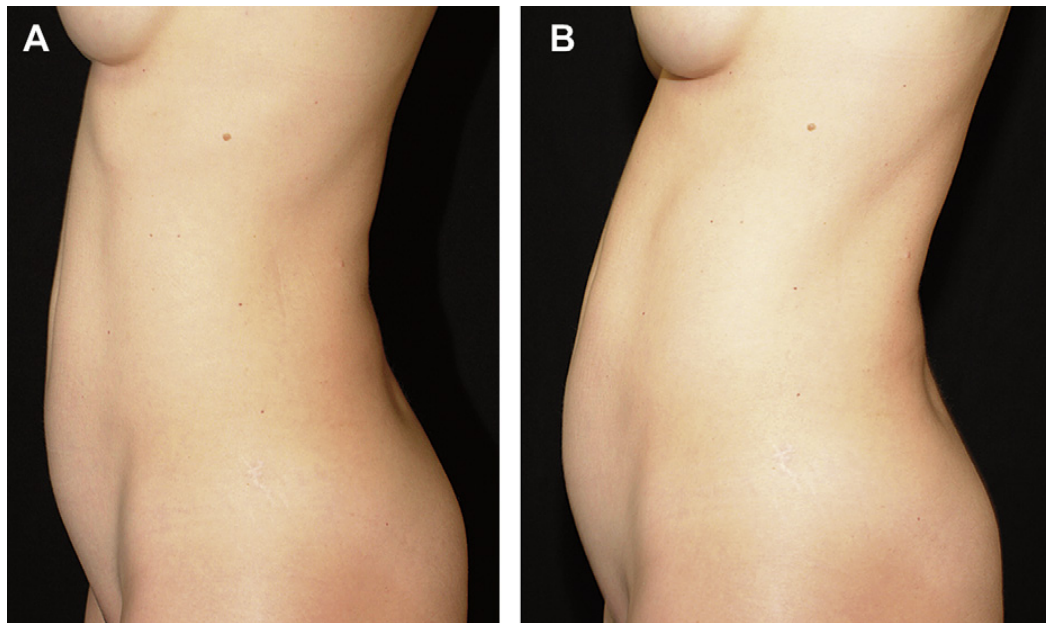


Fig. 5. Location and extent of protrusion. (A) Before relaxation and (B) after relaxation.

(secondary to intra-abdominal fat accumulation), moderate subcutaneous fat layer, and easily mobile/translatable redundant skin.

PATIENT INFORMED CONSENT

The surgeon must clearly define for the patient the extent and limitations of the planned surgery:

- The excess skin that cannot be fully removed. Including the potential dog ears at the lateral margins and, the inevitable residual skin or even rolls at the upper abdomen, above the zones of adhesion
- The possible scar at the lower midline abdomen, representing the site of the original umbilicus, when all the lower midline skin is intentionally not excised
- The fact that the scar may extend laterally depending on the amount of excess skin (the longer the scar, often the better the result).

PATIENT PHOTOGRAPHY

It is critical to procure a consistent and complete set of photographs. This should include 2 sets (arms down and raised) with quarter turn views. All pictures should encompass not only the anatomic area of concern (abdomen) but also the adjacent anatomic zones (thighs/buttocks and lower chest/epigastrium) so that the far-reaching effects of HLTA may be documented. Additional views should be taken to further assist in accurate diagnosis and outcome assessment:

1. With the patient sitting and bending over to illustrate the true excess skin that is often hiding in front of a protuberant abdomen
2. With the patient grasping the excess hip skin superiorly to demonstrate the potential treatment of the thigh excess by the lateral tension surgery.

PATIENT MARKING

The marking starts and is driven by the delineation of the final position of the scar. The 2.0 modification ensures that the scar rests within the patient's underclothes. Next marking outlines the extent of excess skin below the incision (if any) relative to the final scar, with the final marking simply an estimate of the excess skin above the incision.

1. Mark the patient in the upright position against a wall so that patient can be supported as necessary during the tension marking.
2. Discuss the placement and length of the lateral scar. This decision should be made by balancing the merits of the best surgical approach to treat the problem with the patient's preferences of clothing styles. The surgeon must consider the planned procedure with the patient wearing her most revealing clothing: underwear, 1- or 2-piece bathing suit, and low-cut jeans. The incision will rise or fall at the hip markings, depending on the style of clothing (**Fig. 6A**).
3. Mark the location of the eventual scar.
 - Boundary marking: First, draw the outline of the patient's preferred clothing (underwear, low-cut jeans, or bathing suit) (**Fig. 6B, C**)

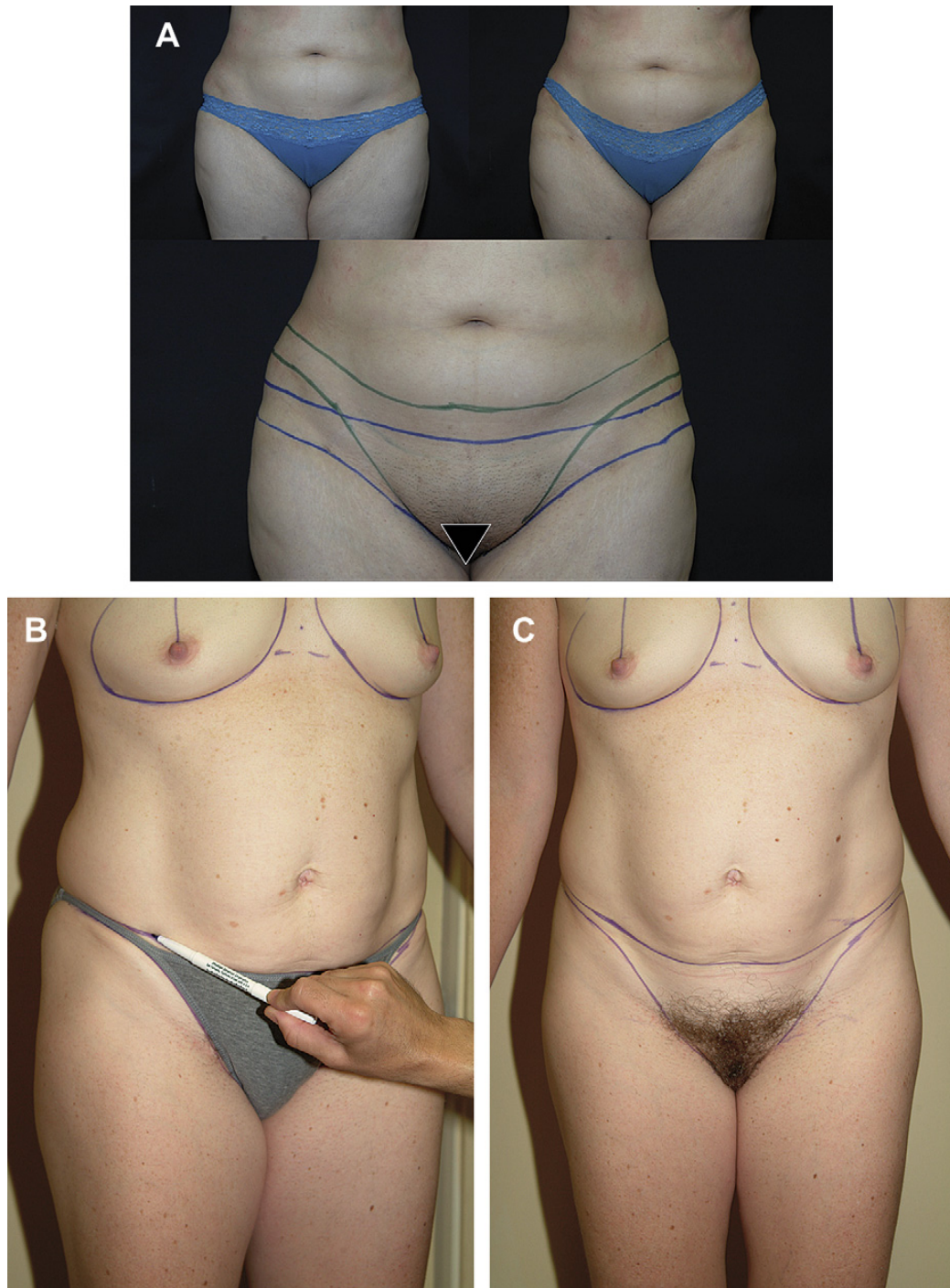


Fig. 6. Patient marking *within* the patient's desired clothing.

- **Suprapubic marking:** Next, place a point 6.5 to 7.5 cm measured superiorly from upper incisura of the vagina or base of the penis with a mark made on the skin as it rests (**Fig. 6D**)
- **Lateral limit marking:** Next, place a vertical line on each side at the most lateral extent of the excess skin (pannus)
- **Closure marking:** Move the pen from this suprapubic mark, superolaterally on each side to meet somewhere along the aforementioned lateral mark, always staying

within the borders of the outlined clothing. This line usually rests between the natural inguinal and abdominal wall gullies (**Fig. 6E**)

One can take a measurement of the distance between the fixed point (anterior superior iliac spine) and this marking to aid in an intraoperative cross check and adjustment of the final resting place of the closure (**Fig. 6F**).

To ensure a harmonious scar, particularly in the very ptotic patient, it is useful to extend the

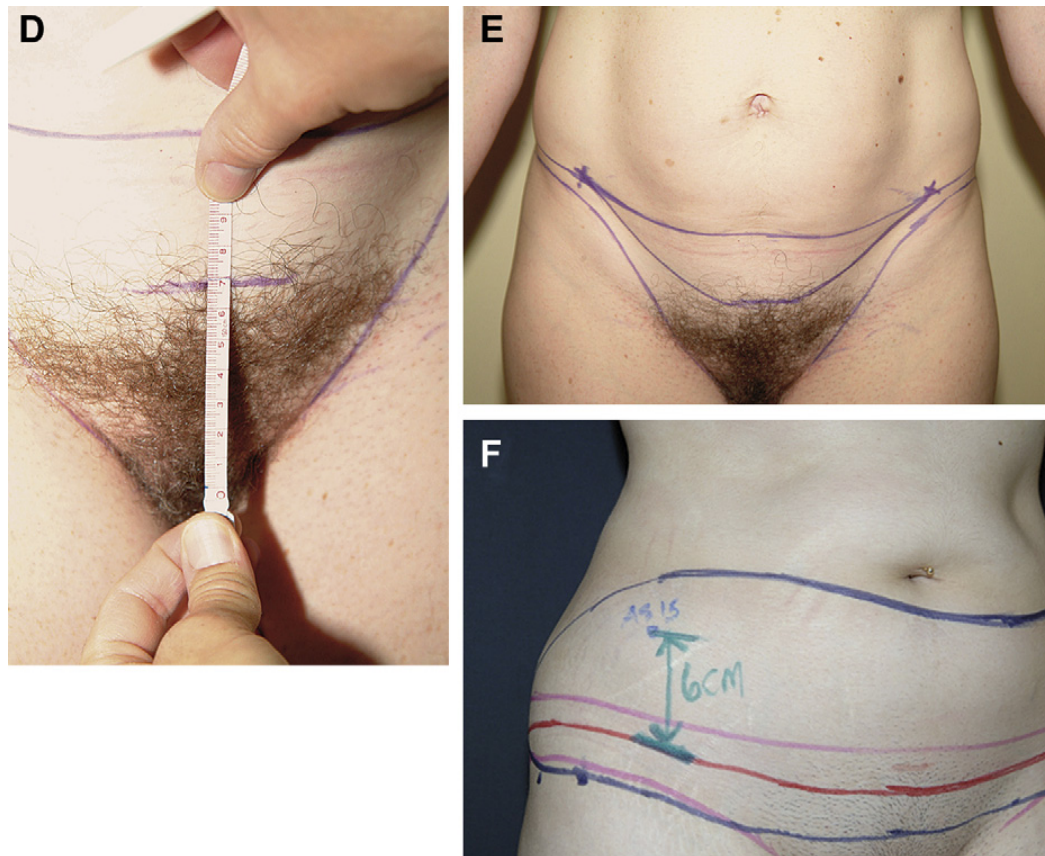


Fig. 6. (continued)

marking to include the design of a posterior body lift that may be planned or desired in the future.

4. Define the lower margin of excision next. The key maneuver:

- Place marking pen over the line of future closure and maintain this position while pulling the excess skin upward vigorously (this is the tension in the HTLA), until taut, then mark the skin that is now below the tip of the pen (**Fig. 7A**)
- Perform this maneuver across the width of the abdomen as needed to define the lower incision (**Fig. 7B, C, D**)

NOTE: Because the maneuver can and should be quite forceful, it is helpful to have the patient lean against a wall during the marking.

5. Estimate upper margin of excision. The key maneuver:

- Pinch the excess skin with the thumb on the lower incision line and the fingers at the superior extent of the excess while trying to maintain the premarked final closure line visible at the middle of the skin roll. Start marking laterally and work your way medially (**Fig. 7E**)
- The resultant line will usually rest several centimeters above the level of the umbilicus

laterally and a few centimeters below the umbilicus centrally.

6. Decide the treatment of the umbilicus. Basic principles:

- Guiding coordinates:
 - The umbilicus should be roughly 9 to 12 cm above the superior margin of the pubis, depending on the patient's habitus
 - The umbilicus should rest slightly above the latitude of the superior margin of the iliac crests (But in the final analysis, like many challenges in plastic surgery, one's critical eye should ultimately drive the surgeon's decision.)
- The treatment of the umbilicus is determined by 2 factors:
 - The amount of excess skin above and below the umbilicus: that is, in the upper and lower poles of the abdomen and
 - The location of the umbilicus in conjunction with the length of the abdomen and waist
- If there is no excess above and mild excess below, the excision may be conducted with the umbilicus left intact, as a mini-abdominoplasty
- If there is a moderate excess below the umbilicus and little to no excess above, and the umbilicus appears high riding on

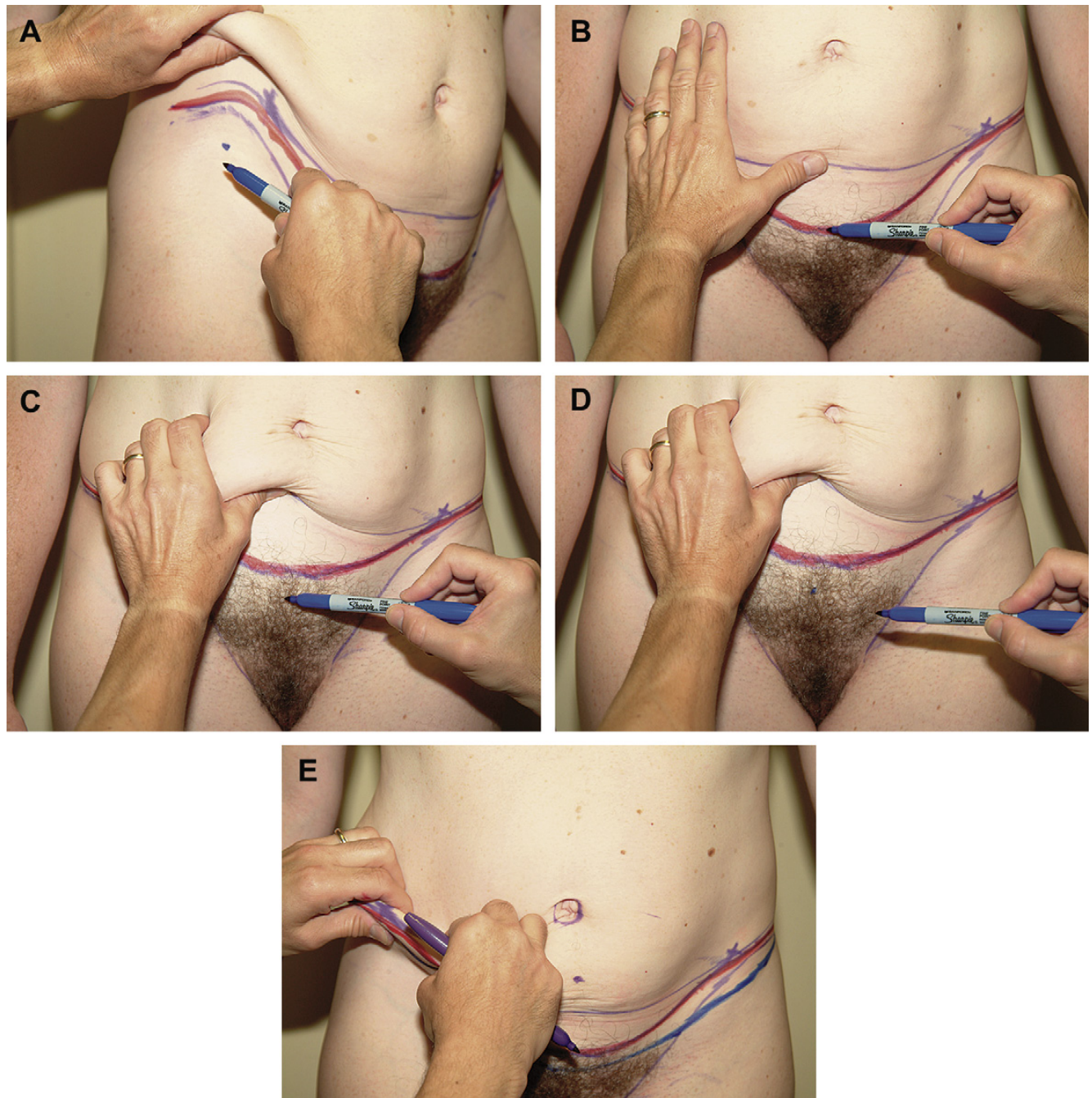


Fig. 7. (A–D) Marking the lower margin of excision. (E) Marking for upper margin of excision.

the abdomen, then it could be maintained in situ and stretched on its stalk for a couple of centimeters

- If there is moderate excess of skin below and above the umbilicus is relatively high riding, the umbilicus may be floated inferiorly with release of its stalk, again for a few centimeters
 - If there is a large excess, above and/or below the umbilicus, then it must be circumscribed and translocated.
7. Mark the areas for liposuction as needed including the hips, waist, pubis, and thighs. To check your surgical plan (markings) and reconcile the patient's expectations, simply instruct

the patient to reproduce the desired result by performing an examination room "lift". This maneuver is particularly valuable with the patient who presents with voluminous skin excess (**Fig. 8**).

8. Final marking represented in **Fig. 9**. Green line: estimated upper incision; red line: defined location of final closure; blue line: marked lower incision.

HLTA: SURGICAL TECHNIQUE

Procedure

Place patient supine on warmer, with antiembolic compression device applied, and Foley catheter

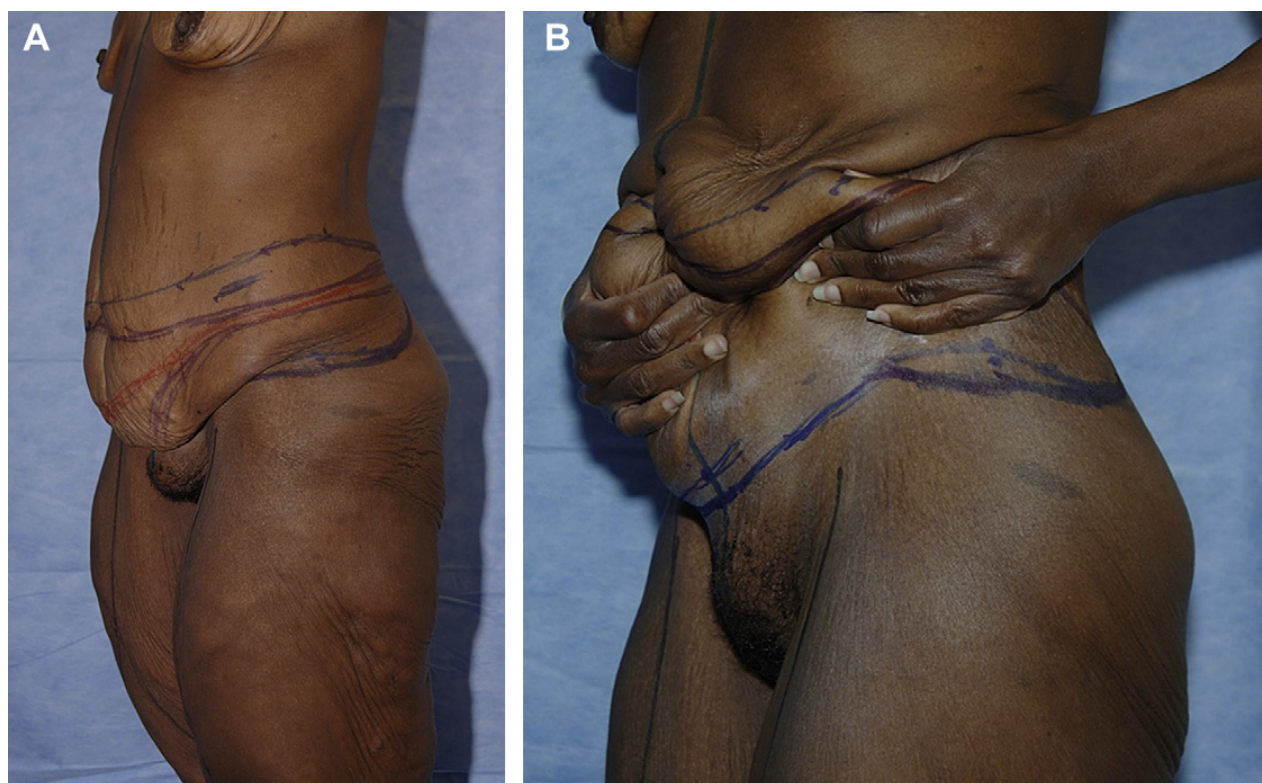


Fig. 8. "Examination room" lift.

inserted. Mark, with needle and dye, the quadrants of the umbilicus, the center point of the pubis and the estimated location of the future umbilical site. Incise the lower markings and elevate the skin flap off the deep fascia just widely enough to allow for plication of the rectus fascia. (One should also attempt to leave behind as much of the inguinal lymphatic tissue as possible) (**Fig. 10A**). Plication of the midline abdominal wall fascia is then accomplished using a heavy stitch (0 or 1-0 polydioxanone sutures [PDS]) in running fashion. (Try to avoid capturing any of the underlying muscle.) A second running suture is performed to both reinforce and allow further plication of the fascia as necessary. Additional plication may be conducted in an oblique or horizontal vector at the anterolateral abdominal wall to narrow the waist and further flatten the abdominal wall (**Fig. 10B**). Further mobilization of the flap and release of the skin flap adhesions may be conducted cautiously beyond the midline. This must be performed with one guiding principle in mind: to preserve as many perforators as possible. The surgeon could either use a measured, vertically oriented spreading of large mayolike scissors, or the gentle penetration of one or more fingers, oversized suction cannula, or, as is my preference, a Lockwood underminer cannula (**Fig. 10C, D**). Using the Lockwood abdominal demarcator (a modified D'Assumpcao-type clamp), the excess

skin is marked for resection. This must be performed from the lateral aspect of the abdomen toward the center to truly carry out a high lateral tension resection. Also, as an insurance maneuver, the preoperatively determined desired distance between the anterior superior iliac spine (ASIS) and the future closure can be checked intra-operatively and appropriate adjustments made (with more or less skin removed). First, Kochers are placed on the upper flap and the skin clamp tongs are secured into the edge of the lower margin of the incision. Then with simultaneous pulling of the Kochers on the flap and the pushing of the Lockwood instrument at the lower incision, the excess skin is marked. The vector of pull of the flap is decidedly inferior and lateral (**Fig. 10E, F, G**). Also, pull the tip of the demarcator back a centimeter or so and skive the incision to maintain a little more skin than subcutaneous tissue. In this way, when the deep closure is conducted, the tension will be preferentially on the fascia and will cause the skin to heap up displaying virtually no wound tension (**Fig. 10H**). (An effort should be made to avoid closure over the ASIS itself to prevent additional tension to the wound.) Contrary to the traditional approach, it is not necessary to place the operating room table in a lawn chair position. This is because the Lockwood technique does not mandate the excision of all the infra-umbilical skin and as such, prevents excess

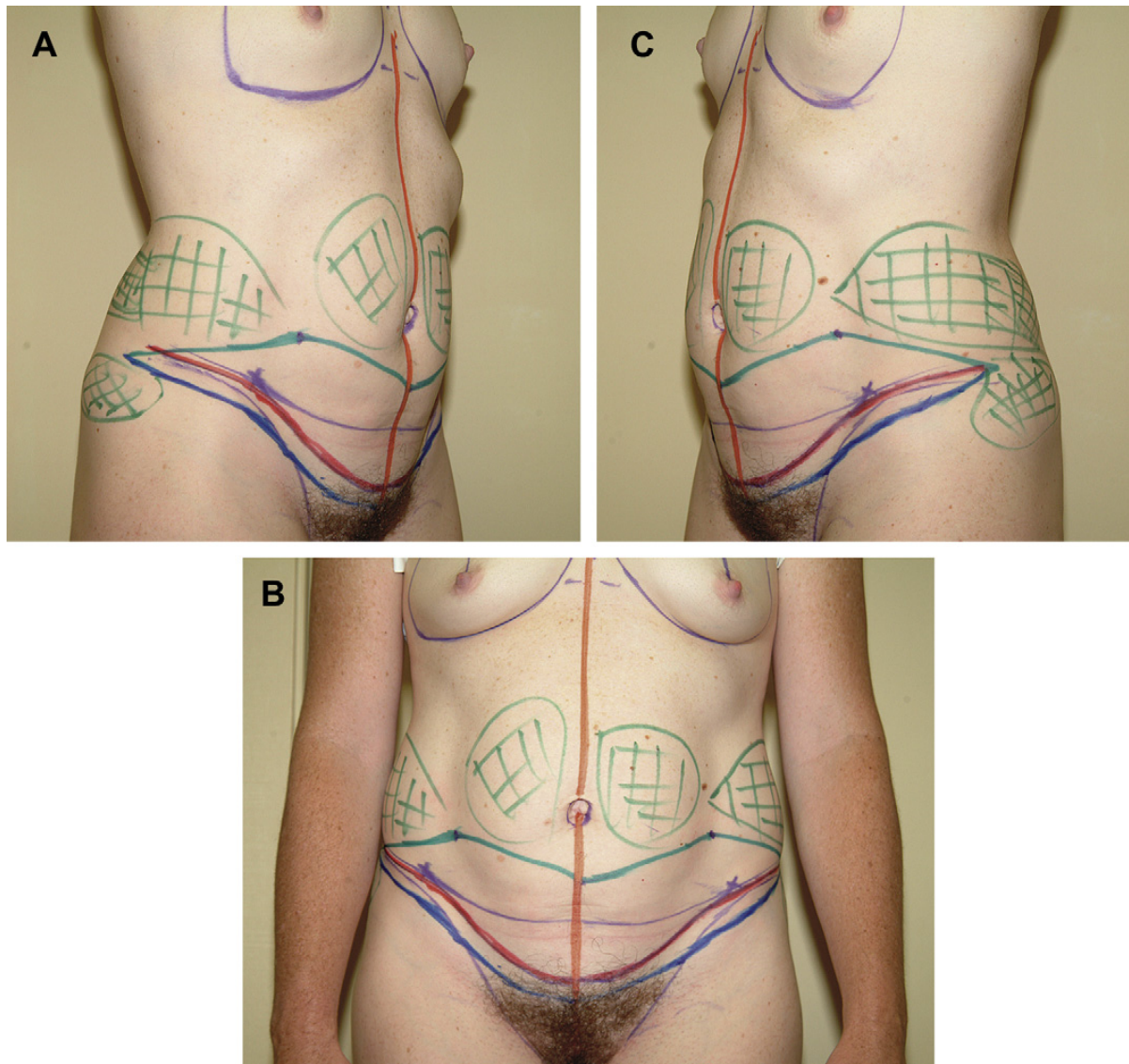


Fig. 9. Final marking.

tension on the suprapubic closure. As planned, not all the skin between the umbilicus and the pubis is usually excised with this technique, so depending on the amount of skin resection, the umbilicus can be stretched in place, allowed to float, or circumscribed and translocated with the original umbilical site closed vertically when mandated. As needed a triangular segment of mons pubis can be also excised if there is significant horizontal excess. Once the excision of skin is conducted and tacking sutures are placed, tumescent fluid is suffused and liposuction conducted as necessary at the waist, hips rolls, pubis, and thighs as planned. The areas that deliver the greatest reward, yet are most often neglected, are the waist and the pubis. The new umbilical site, when needed, is then incised in a vertical direction because this wound will be pulled open to an appropriate shape with the significant lateral pull of the high-tension approach. A small elliptical excision of skin on either side of the vertical incision may be

conducted to increase the width of the umbilicus. Three to four 10-mm flat drains are placed prior to closure along with a marcaine pump catheter for postoperative pain control. Marcaine may also be injected directly into the fascia for immediate postoperative relief. Using 1-0 or 0 PDS type suture, the superficial fascial system (SFS) is reapproximated every few centimeters (**Fig. 10I**). This is probably one of the most important steps in the whole operation. The more confident the surgeon is of the fascial closure, the more definitive and aggressive the skin traction/resection can be, and ultimately the better the results realized. The final closure is then made with 2-0 vicryl for deep dermis and 3-0 monocryl for superficial dermis. The closure should demonstrate a decidedly rolled border indicating no skin tension (**Fig. 10J**). Shortened steri-strips (to prevent edema-induced blisters) are placed. Fluffs are applied along with a snug abdominal binder to complete the dressing.

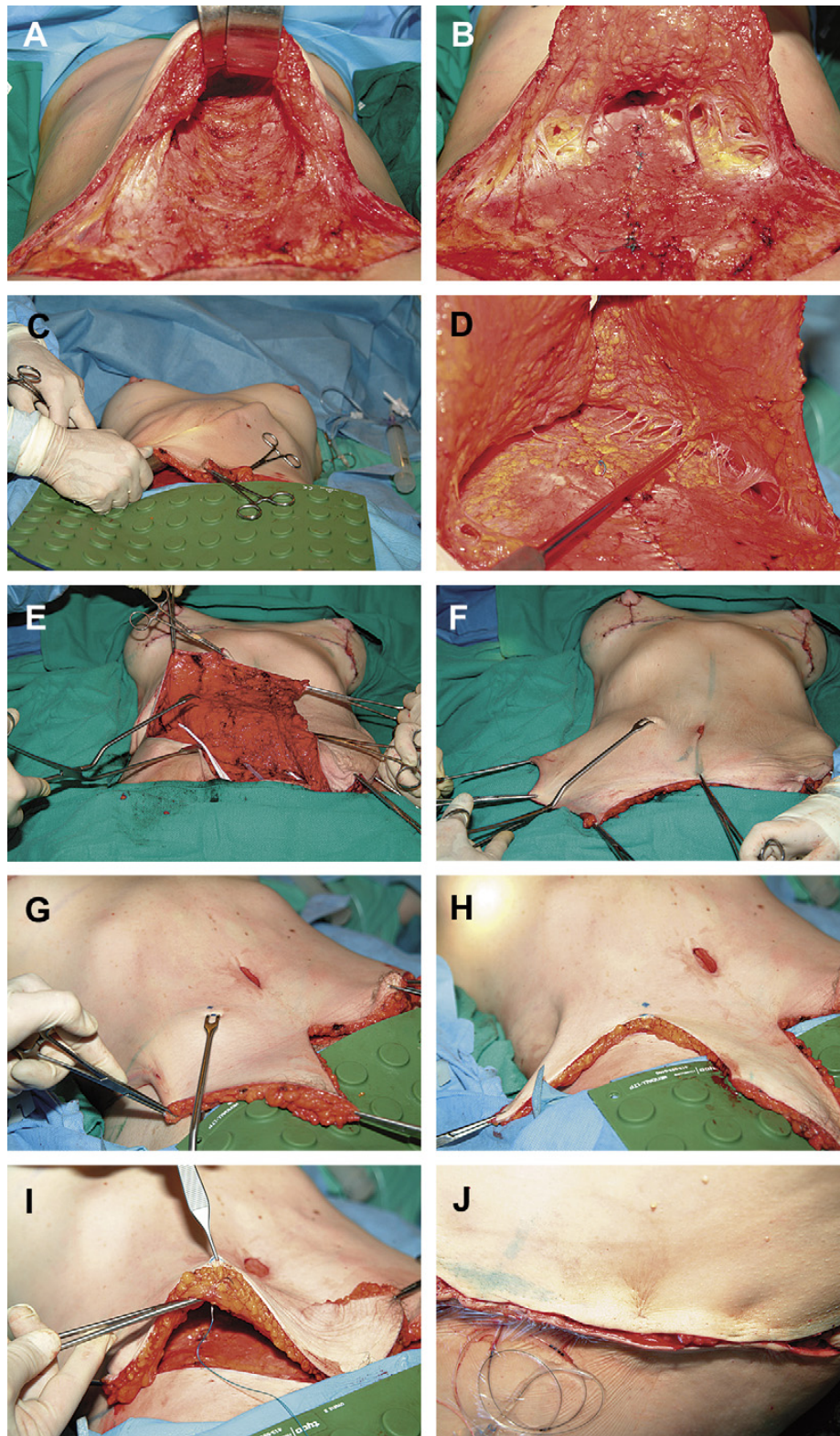


Fig. 10. HTLA surgical technique.

HLTA: RESULTS

Assessment of Results

1. The essential advantage of this technique is the ability to deliver consistently superior and safer results:

- The incision is maintained low and hidden within the patient's clothing.

- More skin can be removed below the incision laterally (which, in effect results in a significant lift of the anterolateral thighs) and centrally (which promotes a lift of the pubis and anteromedial thighs). In effect, a "virtual" postero-lateral body lift can be accomplished through an extended anterior incision (from "beside to beside").

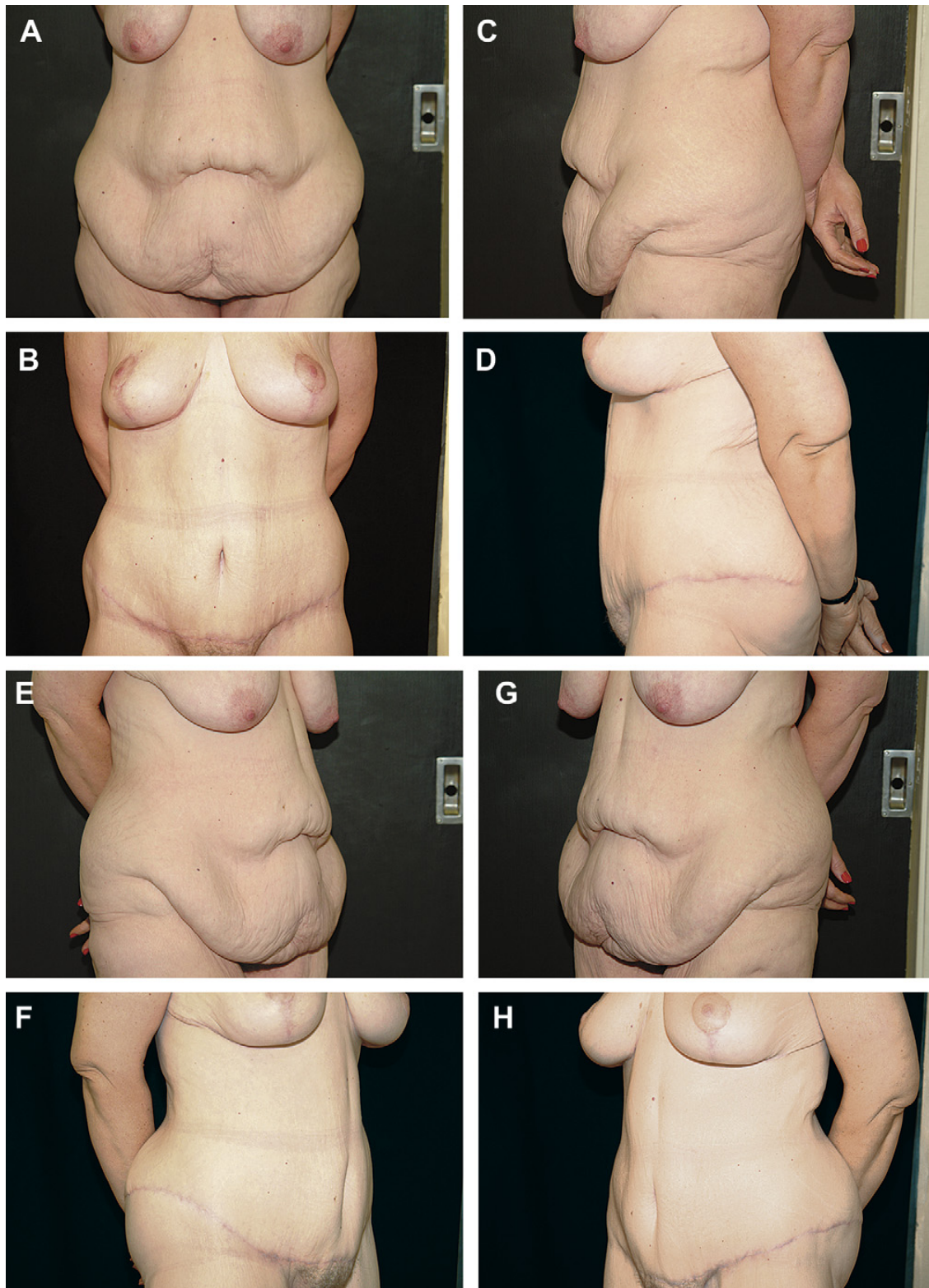


Fig. 11. HTLA with liposuction of the hips and lateral thighs with breast reduction after gastric bypass surgery.

- There is little opportunity for flap ischemia because of the maintenance of maximum blood supply: local perforators are preserved with judicious and discontinuous undermining and its integrity is respected with the restraining of any liposuction or direct fat removal from the flap itself.
- There is less tension at the lower central abdomen, resulting in a lower incidence of flap ischemia, and a more aesthetically pleasing mild convexity at the hypogastrum.
- The excess skin in the horizontal plane of the abdomen, particularly in the upper

poles, is more effectively treated with the oblique vector of excision.

2. Any residual fat, particularly within the abdominal flap itself, can be treated aggressively, with relative impunity and equanimity, as a second-stage procedure within 6 to 12 months of the abdominoplasty.
3. Any residual skin resting laterally and posteriorly can be addressed at a second stage with a posterior extension of the abdominal incision for a completion posterior body lift.
4. The residual skin resting at the upper epigastric and subcostal areas can be treated later with either excision through submammary incisions or with a proper reverse abdominoplasty.
5. Should the lateral scar rest slightly outside the patient's preferred clothing; the scar, under local anesthesia, can be easily moved up or down by excising the appropriate amount of skin.

Photographic Results

Fig. 11 shows a 46-year-old, gravida 0, para 0 woman who was seen after losing 66 kg (145 lb) following a gastric bypass. She preferred to avoid a midline scar, but still desired as much improvement as possible. She underwent HLTA with liposuction of the hips and lateral thighs. A mastopexy was accomplished at the same surgery. Note the presence of the supraumbilical line of demarcation buttressing the more redundant skin above. Therefore, dissection was

deliberately discontinuous in this area and the patient was informed of the likelihood of some residual epigastric excess postoperatively. She healed without complications. These photographs were taken at about 8 months postoperatively. Note the correction of the abdominal deformity, even in the epigastric area on account of the aforementioned oblique vector of its excision. Also, by extending the incision postero-laterally, the HTLA's body lift effect is realized in the anterolateral thigh and buttock areas.

Fig. 12 shows a 57-year-old woman, gravida 2, para 2, who lost about 45 kg (100 lb). She underwent HLTA with liposuction of the hips and thighs and breast reduction. Note the reconstitution of an aesthetic abdomen and how far posteriorly the incision can be extended to realize a rewarding buttock lift with the patient.

Fig. 13 show a 39-year-old woman, gravida 0, para 0, who lost 90 kg (200 lb) by diet and exercise alone. She demonstrated the most desirable skin envelope: thin and mobile. The patient underwent HLTA with an extended posterior incision to realize the more complete excision and lift of the lateral trunk, while still properly treating the central tissues. Liposuction of the hips and lateral thighs as well as mastopexy with implantation were also accomplished.

Fig. 14A, B, C, D shows a 43-year-old woman, gravida 0, para 0, who lost 66 kg (145 lb) after gastric bypass. She subsequently underwent HLTA and is seen here 9 months postoperatively.

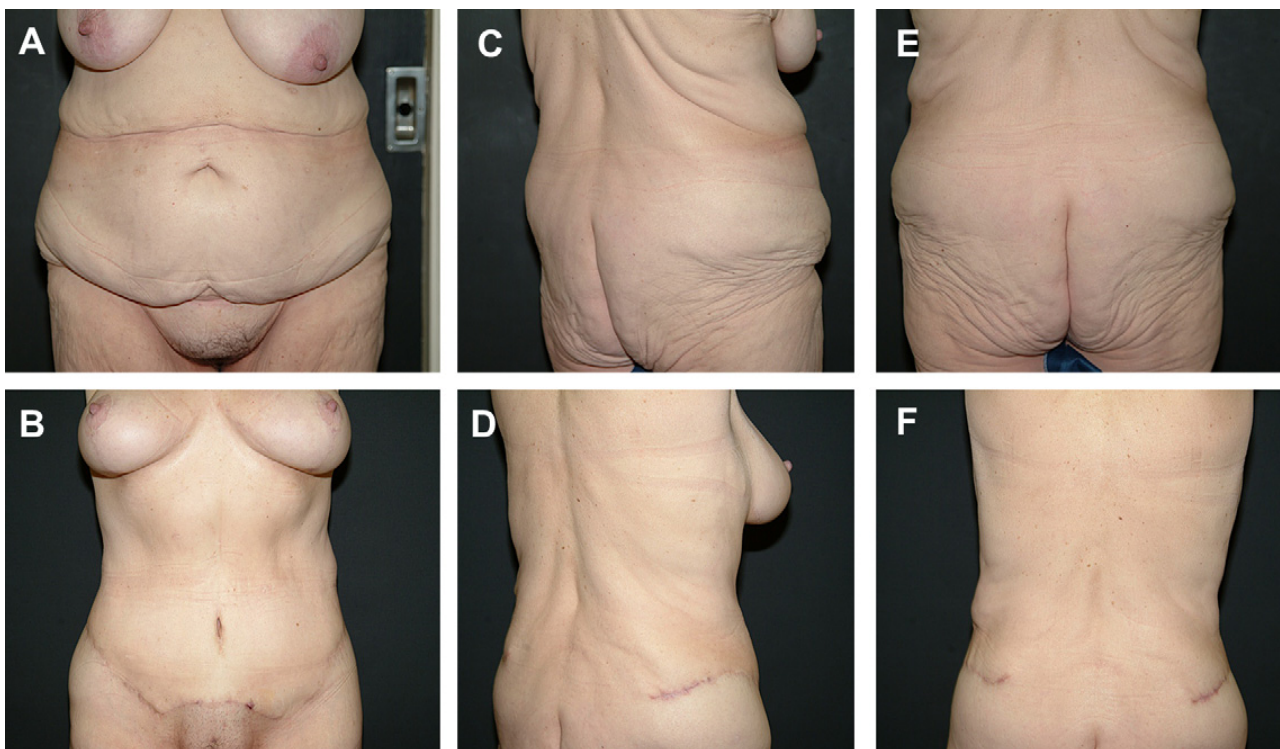


Fig. 12. HLTA with liposuction of the hips and thighs and breast reduction.

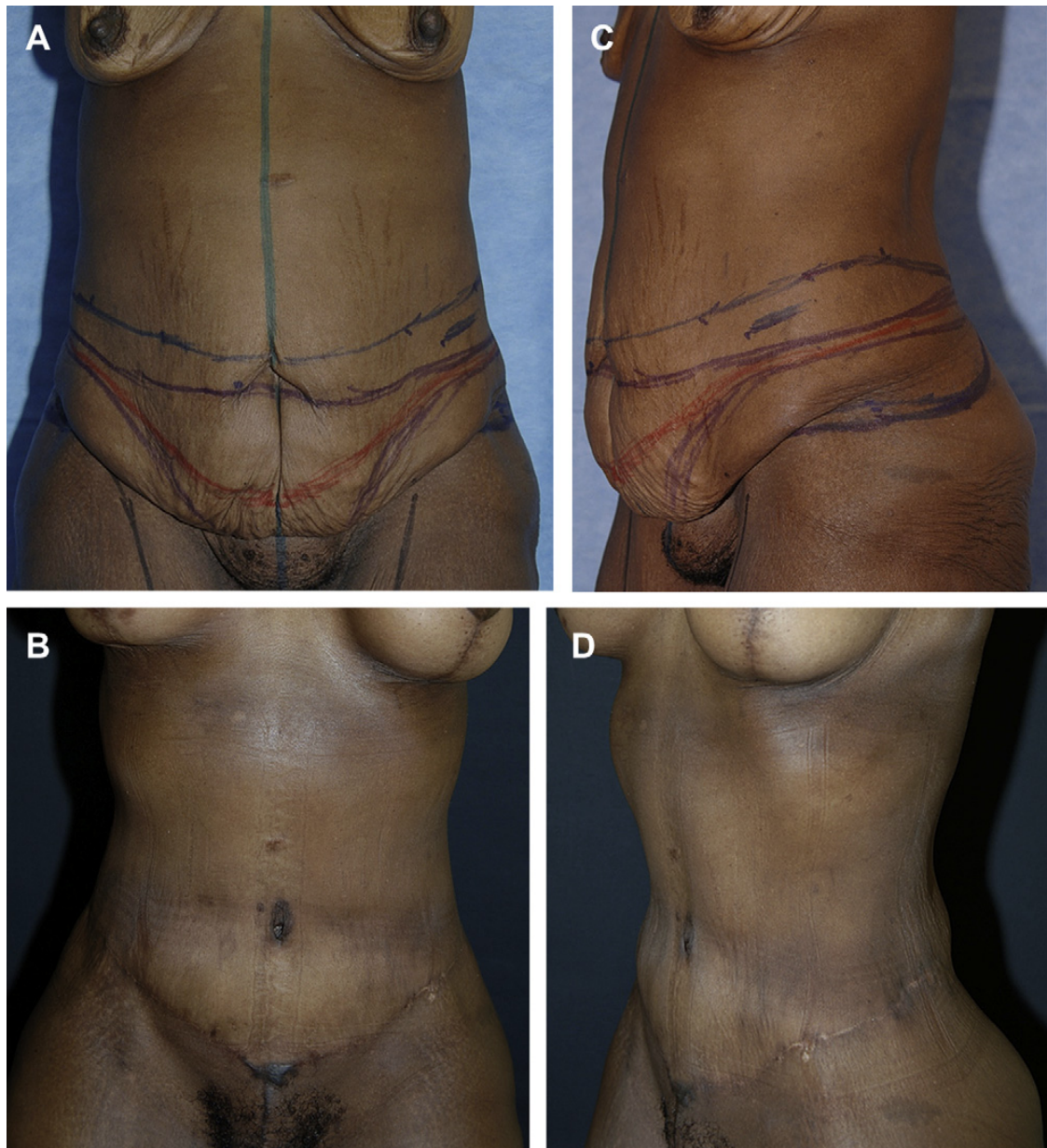


Fig. 13. HTLA with liposuction of the hips and lateral thighs as well as mastopexy with implantation.

The hallmarks of the HTLA effects are evident: the scar rests in a hidden position, the suprapubic skin is not overly tight, and the thigh and hip regions have been lifted. The closeup picture of the thigh reveals the qualitative improvement in the skin extending practically to the knee.

Fig. 15 shows a 50-year-old woman, gravida 1, para 1, who desired rejuvenation of her abdomen. She underwent HTLA with liposuction of the hips and lateral thighs and augmentation mammoplasty. The pleasing aesthetic of the abdominal repair is realized with a well-placed scar, a not overly tight suprapubic region, and an improved hip/thigh contour. Note the “stealth” skin redundancy, visible when the patient is sitting and bending, and its repair post-operatively. And yet, as can be preordained,

there is residual skin persists in the epigastric area postoperatively.

Fig. 16 shows a 35-year-old woman, gravida 1, para 1, who presented for correction of her abdominal protrusion. She demonstrated a similar excess of skin when bending or sitting. HTLA was performed with liposuction of the hips and thighs. The benefits of this technique are demonstrated with the return of a prepregnancy contour. As planned, the scar is properly hidden within the patient’s underclothes.

Fig. 17 shows a 43-year-old woman, gravida 0, para 0, who lost more than 45 kg (100 lb) after a gastric bypass. She elected to have HTLA with liposuction of the hips and thighs. Again note the lift and correction of the lateral thigh/buttock region through a well-placed scar.



Fig. 14. HTLA after 66 kg (145 lb) weight loss. Note skin quality improvement extending to the knee.

Fig. 18 shows a 36-year-old woman, gravida 3, para 3, who presented with the complaint of residual abdominal deformity despite aggressive diet and exercise. She is 1.6 m (5 ft 3in) at 70 kg (155 lb). The patient underwent HTLA with aggressive liposuction of the hips and thighs. Note the relative lift at the buttocks and thighs. As planned, the productive, albeit lengthy incision is hidden within her underwear.

Fig. 19 show a fit 65-year-old woman, gravida 2, para 2, who desired a better contour with maximal correction of her abdominal redundant skin and protrusion. This case demonstrates the power of integrating the fleur-de-lys design into the HTLA approach to more fully improve her shape. Note the excess stealth skin that becomes more obvious with change in position or when put on tension. Her aesthetic habitus afforded the full effect of the fleur-de-lys to be expressed with a particularly dramatic improvement in her pubis,

waist, upper abdomen, and back folds. In addition, the patient's posture appears to have improved.

Fig. 20 shows a 46-year-old woman, gravida 4, para 4, who presented for abdominal repair after child bearing. HTLA was performed, along with a mastopexy/augmentation. The patient is seen 4 years postoperatively, revealing significant lateral excision with this technique, as evidenced by the removal of the entire tattoo. The benefits of HTLA with a more aesthetic waistline and smoother epigastric zone are apparent.

HTLA: COMPLICATIONS

The *raison d'être* of the HTLA design is to deliver as much correction as possible with the least complication rate. Just as with Lockwood's original opus on the subject, the 2.0 upgraded version described here is predicated on zero



Fig. 15. HTLA with liposuction of the hips and lateral thighs and augmentation mammoplasty.

tolerance for complications. Many of these outcomes are not really complications but rather planned trade offs for either better or safer results. When a patient is informed of an expected residual deformity, they consider it part of the surgical plan rather than a complication. And if any secondary surgery is needed, the

patient will then appreciate it as a stage rather than a revision. These complications include aesthetic mistakes, which may be irreversible, as well as the physiologic misadventures, which can be devastating. These are listed in the following sections with a brief description of methods of prevention and treatment.

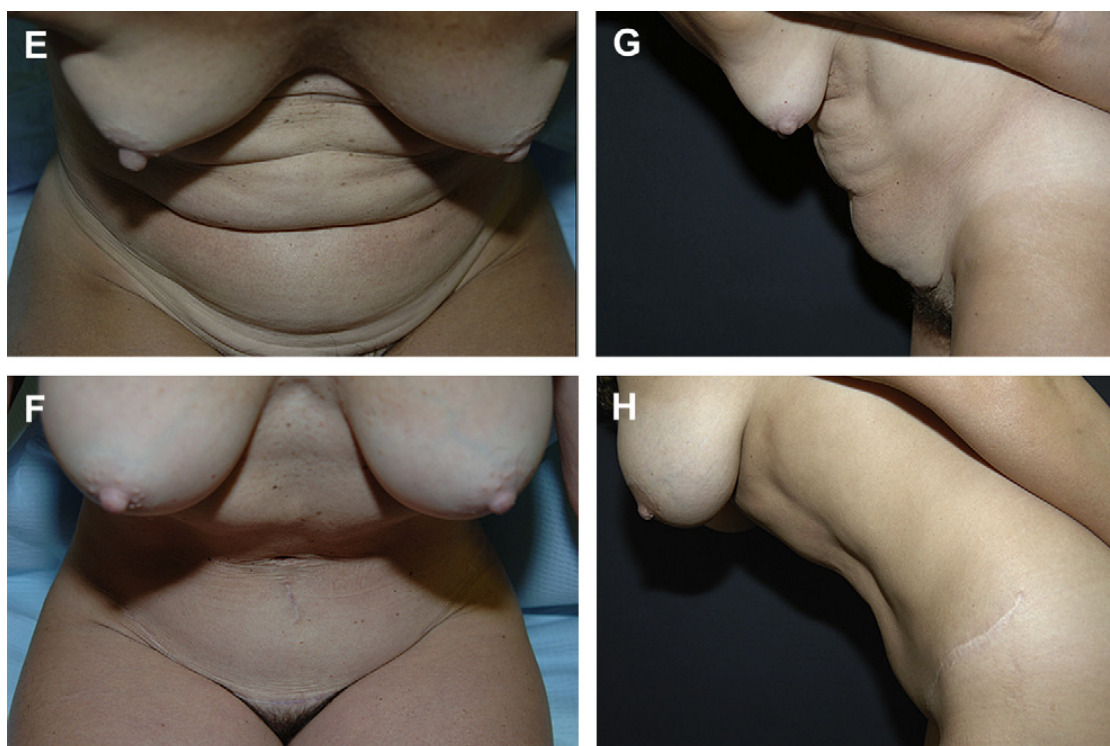


Fig. 15. (continued)

Aesthetic Complications

Abdominal scar too long

The scar can only be considered too long if the patient was not clearly informed of its often requisite length. The lateral scar is the primary literal “foot print” of HTLA. If any tension lifting is attempted at the lateral thigh and hip area, the incision will per force, grow longer. Therefore, the surgeon should critically evaluate this anatomy preoperatively and decide, with the patient’s input, whether there is enough laxity to warrant extending the incision. Otherwise, experience would indicate that as long as a scar is of good quality, corrects the deformities, and most importantly is hidden, a patient will always be accepting of a lengthier repair.

Lateral scar too high or too low

In general, the greater the excess skin present, the more unpredictable the scar placement can be. This outcome is usually caused by poor marking design: that is, an over- or underestimation of the magnitude of skin redundancy below the incision. There are several ways to help avoid this problem depending on the magnitude of redundant skin:

- If there is significant excess below the incision, then there is a real danger of an unpredictable scar placement (usually riding too high) and the surgeon must be sure during the marking, to place the skin on maximum tension and like any good tailor, measure

twice and cut once. That is, recheck your markings, and test them by having the patient recreate the lift by pulling up the excess tissues to their desired location.

- If there is not a notable excess below the incision (usually in the thicker, less mobile skin envelope), then the scar could be predictably too low if too much inferior skin is removed. The surgeon should therefore place the skin on less tension when marking.
- Also, intra-operatively, the aforementioned preoperative measurement of the distance between the fixed ASIS and the desired level of the final wound may be used as a guide. It is best to be conservative with any additional resection (especially in the thicker patient), because the thigh skin below may drift inferiorly postoperatively.

Pubis disproportionate

This is usually caused by an inaccurate estimation of the true redundancy of the pubic area. The surgeon must put the pubis on maximum stretch during marking but leave at least 6.5 cm of pubic height to avoid creating a too tall or short pubis. The pubis can also be left too wide, with the tension surgery potentially worsening this aesthetic. If necessary, to prevent this appearance, a wedge resection of the pubis can be conducted simultaneously to the HTLA or at a later

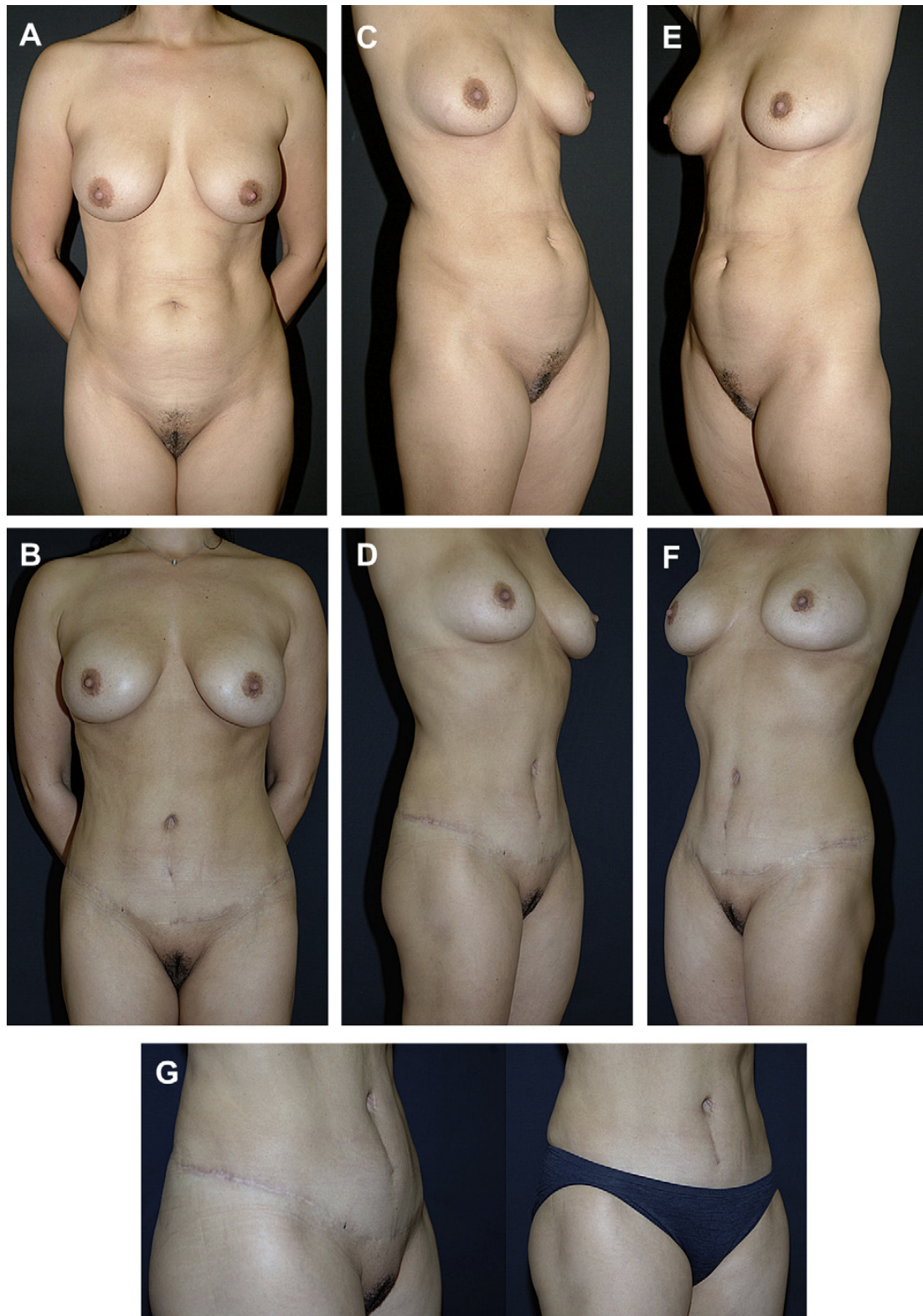


Fig. 16. HLTA with liposuction of the hips and thighs.

stage. However, overcorrection must be avoided by maintaining a pubic width of at least 6.5 cm.

Poor umbilical closure scar

This problem is often most feared (more by the surgeon than the patient), but least realized. These

scars uniformly resolve into short, thin, white lines. Rarely, a steroid injection or revision will be necessary. Even so, as the patient is made aware, this 2.5-cm scar is a small price to pay for the alternative: an ectopic abdominoplasty scar residing too high pulling the pubis along with it.

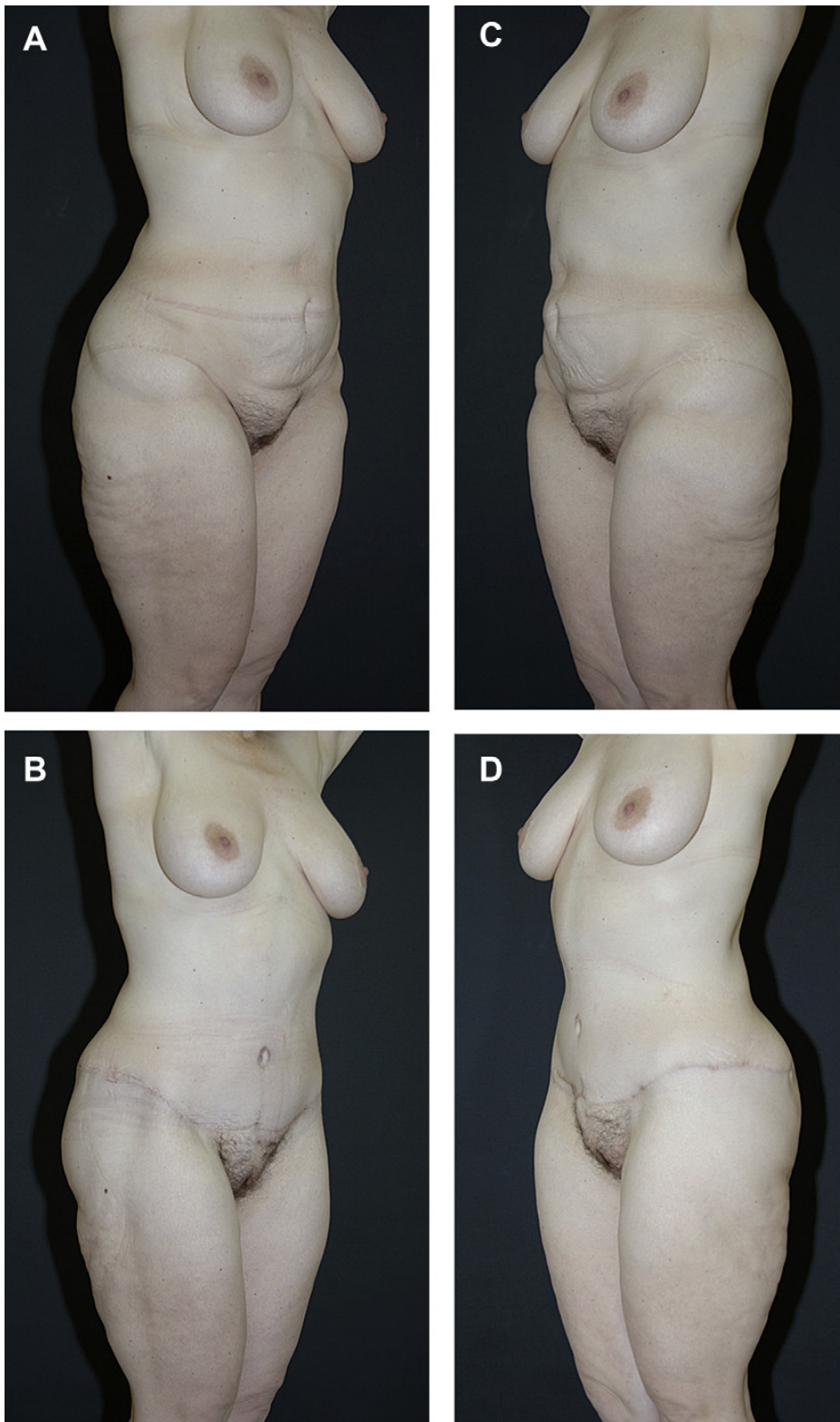


Fig. 17. HTLA with liposuction of the hips and thighs after gastric bypass surgery.

Residual fat at the central and superior abdomen (the T)

This outcome should more accurately be considered the deliberate neglect of the subcutaneous tissue in an effort to preserve the maximum blood supply to the central flap. The surgeon must

decide what their individual tolerance is for the very real complications that may ensue if they attempt to remove this fat. Otherwise, the patient is simply informed that they may be best served with a second-stage, unfettered abdominal liposuction.

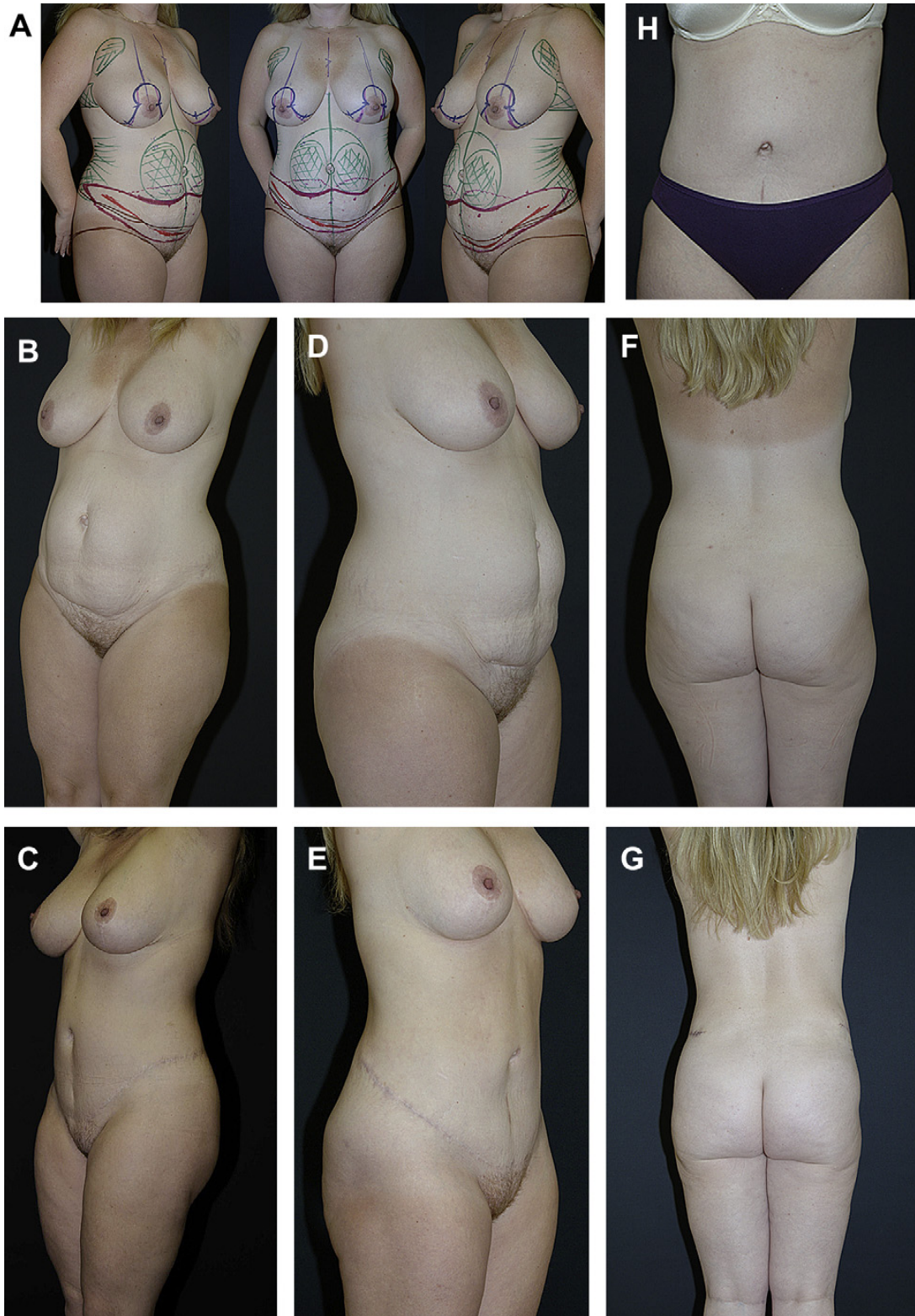


Fig. 18. HLTA with aggressive liposuction of the hips and thighs.

Residual skin at upper abdomen

This is really not a unique complication of HLTA. There is a good argument that because this technique delivers a more oblique vector of pull, more of this redundancy can actually be effaced.

However, the patient with a significant upper abdominal excess (a “second” pannus) should be informed of its probable persistence postoperatively. Otherwise, only a fleur-de-lys or reverse abdominoplasty can treat this zone definitively.

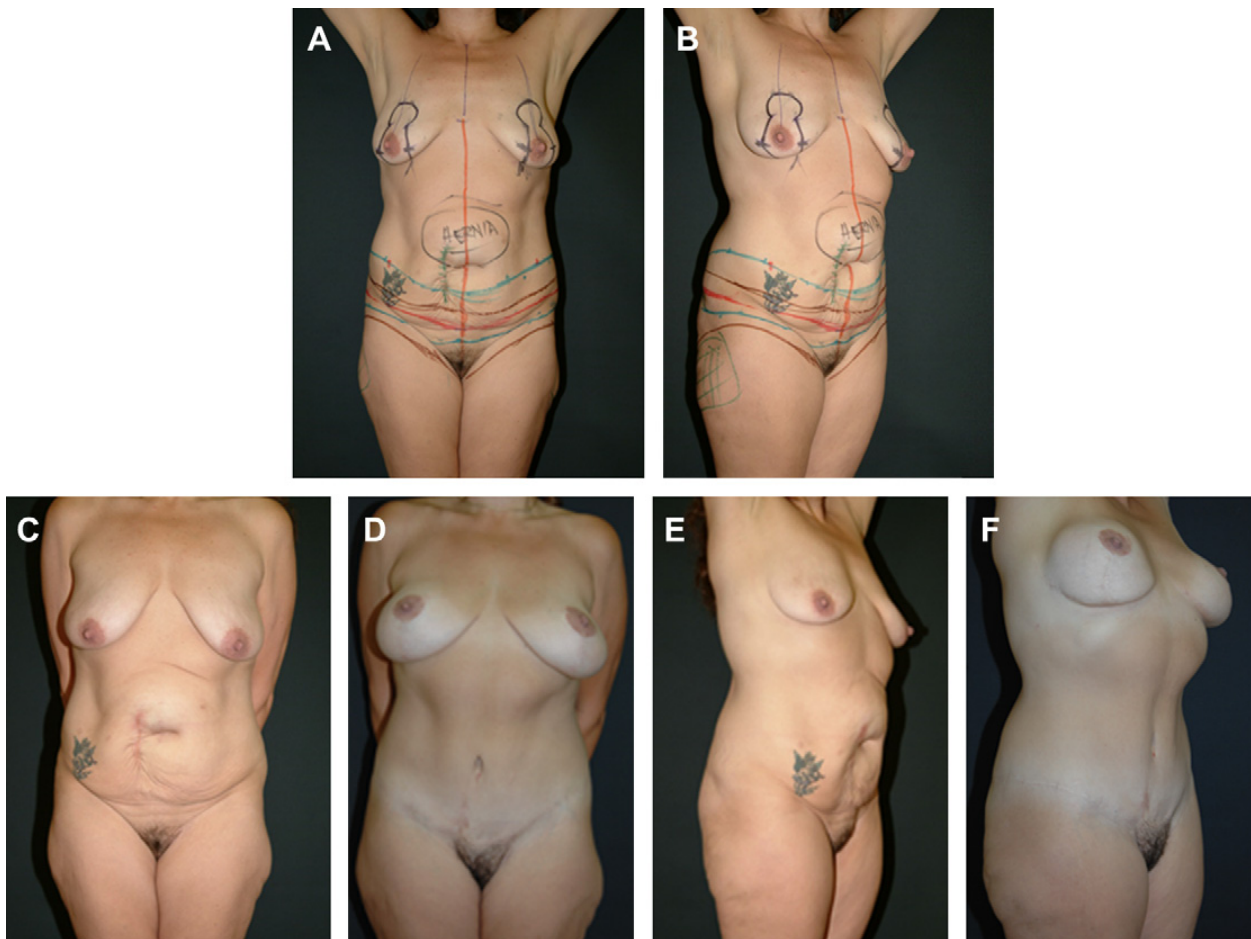


Fig. 19. HTLA with mastopexy/augmentation.

Lateral dog ears

The best way to avoid this problem is to fully liposuction this area and to intrepidly extend the incision as much necessary.

Epigastric recurrent/residual protrusion

On account of the deliberately more conservative dissection in the upper abdomen with HTLA, in the very protuberant patient, an commensurately more constrained plication is necessary. Consequently, there can be a degree of epigastric recurrence/residual deformity postoperatively.

Physiologic Complications

SFS stitch abscesses

The stitches used for the tension closure of the fascia are, per force, of large caliber with abundant knots. Therefore, stitch abscesses may arise postoperatively often (surprisingly late) if permanent suture is used. This problem is far less likely if an absorbable suture is utilized.

Seroma

Because far less dissection and no central liposuction is conducted with the HTLA, this annoying problem should be rare. For the same reason, the concept of flap adhesion stitches is not really

applicable to HTLA. However, when a seroma does occur, a consistent set of aspirations usually solves the problem within a couple of weeks. The primary modes of prevention otherwise include maintaining the web of lymphatic-containing tissue overlying the fascia when elevating the flap and placing multiple drains at least (3).

Deep vein thrombosis and pulmonary embolism

Tomes of analysis and advice have been written on this subject, particularly in the last few years. Clearly, with good patient selection, consistent use of antiembolism pumps, and early mobilization, the incidence of this problem should remain rare. As for chemical prophylaxis, considering the still unsettled status of this modality, the surgeon should refer to the latest recommendations in the literature.

Skin necrosis

This dreaded complication can occur if the surgeon goes too far during the surgery: overly aggressive flap mobilization in an effort to remove the maximum amount of redundant skin (particularly from the upper half of the abdomen) and excessively zealous flap fat removal (by liposuction or direct excision) to thin the flap as much as possible.



Fig. 20. Fleur-de-lys abdominoplasty with a marriage to the high lateral tension principle.

Unfortunately, the patients who would rightfully need these extreme measures to be taken are also often the riskiest candidates (high BMI or massive excessive skin). And, for all other patients there is no reliable metric to accurately stratify those who will do well with these more invasive techniques; the surgeon must decide between the proverbial conflicting forces of blood and beauty.

CONCLUDING PRINCIPLES

The key principles with HLTA:

1. HLTA is driven by the concerted effort to treat not only the tissues above the incision but also those below. This treatment is as much excision of redundancy as it is a far-reaching body lift through an albeit extended

- anterior incision. The pubis and anteromedial thighs as well as the hips and anterolateral thighs and even buttocks can be aesthetically improved by this technique.
2. This procedure is fundamentally and philosophically different in that the skin is considered more redundant at the lateral trunk than in the midline. Therefore, the anterolateral thigh is treated more effectively. In addition, the redundant upper abdominal skin is seen as emanating more from the chest and demonstrating more of a horizontal laxity in opposition to the vertical laxity of the lower pannus. As such, the relatively oblique pull of HLTA can treat this epigastric excess more effectively.
 3. This approach, in contradistinction to the traditional abdominoplasty, is not driven by the usually mandatory excision of all the skin between the pubis and umbilicus. Therefore, the pubic/median portion of the incision can be naturally lower and more hidden and the closure under less tension, improving the chances for per primum healing and a more natural-looking result.
 4. HLTA often mandates that the incision be longer laterally. However, it is also true that the longer the lateral incision, the better the result. This approach allows the excision of a greater extent of skin and more importantly, affords an impressive body lift of the surrounding tissues. This balance between scar length and result must be negotiated with the patient.
 5. As a corollary, if there is a less redundant skin envelope at the lateral thigh, then HLTA should be tempered and the scar can and should be shorter.
 6. This technique, although often more effective at treating the upper abdominal skin excess, should still be supplemented by a second-stage reverse abdominoplasty procedure, when necessary.
 7. HLTA is predicated on the preservation of flap blood supply first and foremost. As part of this philosophy, for the patient with a medium to high BMI, the surgeon should seriously consider a staged liposuction of the central and superior abdominal flap instead of either liposuction or direct excision. Only then can a zero tolerance for skin necrosis be truly practiced.

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