

High lateral tension abdominoplasty

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Key Points

- The high lateral tension abdominoplasty rejuvenates not just the anterior abdomen, but also the inguinal region, proximal thighs, mons, buttocks, and even posture.
- There is only undermining where skin will be excised or for plication, thereby permitting simultaneous liposuction. Tension is reduced on the mons with less central excision, and the greatest load is carried on the lateral limbs of the incision, thereby increasing the frequency at which the umbilical site will not be closed. The incision will be longer, and the lateral portions of the incision will rise obliquely more than with a traditional abdominoplasty.
- Abdomens differ and since final tension can only be felt intraoperatively, there is no diagram that can demonstrate exactly how to mark either the initial or the final incision. The surgeon must understand the distinguishing principles of this approach and apply them to each patient individually.
- An abdominoplasty is an entirely elective, cosmetic procedure. However, DVT, PE, and even death can occur. Their incidence can be reduced but not eliminated.
- Patients' primary objections are the location, length, and width of the scars. This should be a major focus during the preoperative discussion with the patient.

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INTRODUCTION

The high lateral tension abdominoplasty (HLT) accomplishes far more than a flatter anterior abdomen: it is a modified lower body lifting procedure. Lockwood¹ noted that his body lifting procedure improved the abdomen more than did an abdominoplasty. He attributed this to his observation that the greatest laxity is lateral, and therefore a greater amount of excision should occur in those areas (Table 25.1).

Two years later Lockwood published his HLT paper,² which was the anterior component of his body lift. He

ascribed four key characteristics to the HLT. First, only areas to be excised or necessary for rectus plication would be undermined. Second, simultaneous liposuction would therefore be safe. Third, he used permanent sutures to close the superficial fascial system (SFS) as a means to reduce the widening of scars and to improve skin contour far away from the incision. Finally, he emphasized the importance of putting the greatest tension on the lateral part of the incision.

Though it is the basis for the name of this procedure, the notion of placing high tension laterally remains elusive. That is because it is not something that can be shown in a drawing. Rather, it is a principle that must be understood while marking the patient, and even more so when determining the extent of skin resection intraoperatively.

Instead of being called "high lateral tension" it should have been called "higher lateral tension" because the point is not that the lateral tension is high per se, but that it is merely greater than the central tension.

The higher lateral tension concept also forces us to pay more attention to the scar location. There is a natural tendency to expect the final scar to correspond to the initial incision. But the initial incision has no more to do with the location of the final scar than does the final incision. Both equally determine the amount to be excised, and each needs to be planned carefully (Fig. 25.1).

PREOPERATIVE PREPARATION

Figure 25.2 shows the preoperative markings. Any abdominoplasty has the potential to correct three separate anatomical structures: skin, fat, and muscle. Each is evaluated separately in order to preoperatively plan the operation and give the patient reasonable expectations.

Skin Excess

One of the signatures of the high lateral tension abdominoplasty is that it requires the greatest tension to be placed on the lateral part of the incision. This means that the umbilical site might not get excised, leaving a vertical scar from its closure. While this usually heals well, and accepting that

TABLE 25.1 Comparison of HLT to Standard Abdominoplasty

	HLT	Standard
Objective	Rejuvenation of abdomen and trunk	Rejuvenation of central abdomen
Anatomical basis	Greatest laxity is lateral	Greatest laxity is central
Incision	Lower centrally, raising laterally obliquely, usually longer	More superior and horizontal, usually shorter
Umbilicus management	Better to close site vertically than to pull tighter to excise	Better to pull tighter to excise than to close vertically
Areas of improvement	Central abdomen as well as flanks, inguinal region, buttocks	Mostly central abdomen
Simultaneous liposuction	Can be more liberal	Should be more reserved
Location of tension	Greatest tension on lateral limbs of incision along inguinal crease; less tension centrally on the mons	Greatest tension is centrally over mons; progressively looser along inguinal crease
Direction of pull	In two oblique directions, perpendicular to the lateral limbs of the incision	In one superior-inferior direction, perpendicular to the central incision

the presence of this scar may be considered the sine qua non of a true HLT philosophy, this scar does not always heal perfectly, and many patients want to avoid it. If there is any question as to whether the site can be excised, the patient should be warned that there are three choices: proceeding with a classic HLT (Fig. 25.3) and accepting a vertical scar if necessary, placing the incision more superiorly on the abdomen so that there is a greater chance of excising the old umbilical site (though the necessity for elevating the lateral limbs of the flap may make the lateral scar more likely to rise above pants), or abandoning the HLT principles and placing as much central tension as is necessary to remove the site.

Patients frequently ask for a “mini” tummy tuck, wanting the horizontal extent of the incision to be as short as possible, perhaps even as narrow as their C-section scar. Few individuals have vertical laxity so slight and horizontal laxity so centrally focused that a short scar removes all the troubling laxity and attractively recontours the abdomen (Fig. 25.4). The patient should always be evaluated sitting straight upright or even bending forward, as

this demonstrates the amount of vertical excess as well as the extent to which the laxity extends laterally. Placing patients in this most unflattering of positions helps them to see the extent of their laxity (Fig. 25.5). They can understand that if there is laxity at the anterior axillary line, then an incision that stops at the midclavicular line will be inadequate to create a nice contour. It can also be demonstrated that if there is a significant amount of vertical excess to be excised, a significant length of the incision is obligatory to avoid a dog-ear. Given that the HLT has greater lateral tension and seeks removal of lateral skin excess, the incision must go even more laterally. Lockwood’s drawings show the superior and inferior incision joined at a 90° angle, but in his discussion he says that the incision needs to be lengthened to eliminate a dog-ear. (This is a reminder that the highest tension is not at the very lateralmost extent of the incision, but is usually located at about the midclavicular line.) An HLT incision will invariably be at least as wide as the anterior axillary line, and often to the posterior axillary line. The philosophy of the standard tummy tuck is to excise the old umbilical site at whatever tension is necessary. The length of the scar is essentially that which is necessary to recontour the abdomen without a dog-ear. But the HLT concept is that the greatest laxity is more lateral, and that it is essential to excise that to optimally tighten the thighs. Placing more tension centrally raises and distorts the mobile mons, oftentimes shortening the distance from the top of the pubic hair to the umbilicus. Since the mons is more vertically mobile than the skin along the inguinal crease, high central tension causes the mons to rise, making the incision more flat and horizontal, and it is the angle of the lateral limbs that most helps flatten the epigastrium. The HLT concept is that it is better to have a vertical scar from the old umbilical site, with the mons/pubic hair left lower with a greater distance between it and the umbilicus. That is because the standard tummy tuck is essentially an exercise in “excising the umbilicus”; the width is only that which is necessary to remove that vertical excess without creating a dog-ear. But the HLT considers that lateral excess the most important area for excision. By pulling down and out laterally, a greater degree of flattening of the epigastrium occurs than simply pulling straight inferiorly. The greatest laxity on the trunk of the postpartum or weight loss patient is also laterally, so this area needs the greatest amount of excision (Fig. 25.6).

FIG 25.5, 25.6 APPEARS ONLINE ONLY

But the incision often needs to be modified to suit patient expectation. Patients usually want the scar low, horizontal, and the umbilical site excised, despite the fact that it creates a less attractive abdomen. The surgeon is left to negotiate these tradeoffs with the patient. Since many

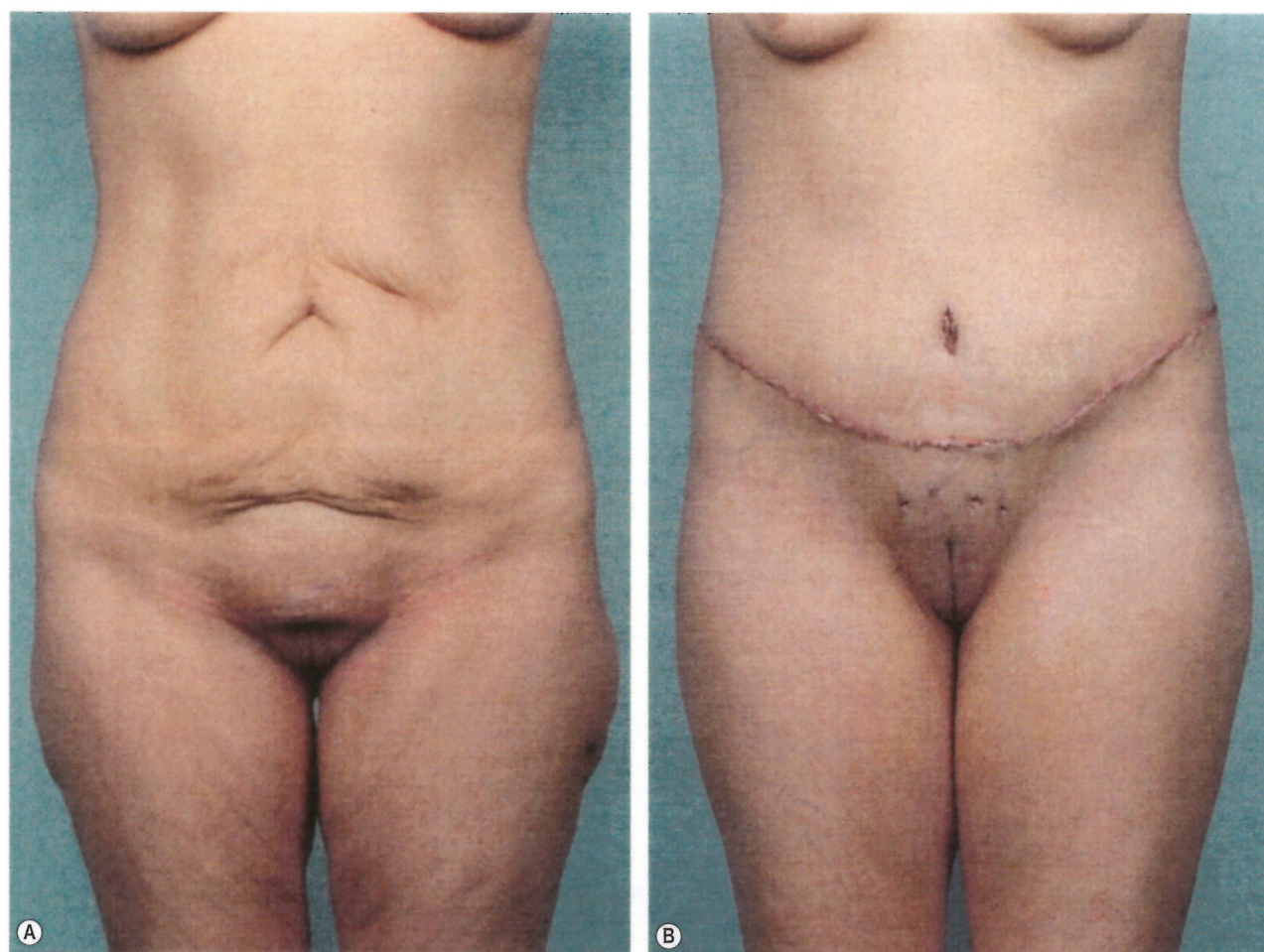


FIG. 25.1 Origins of the HLT. Before and after a high lateral tension abdominoplasty (HLT).

patients do not want a pure HLT, the reader should consider this HLT description as a way of thinking while marking and closing, even if it is not carried out to completion (Table 25.2).

Despite the greatest efforts to keep the scar low, invariably the scar will rise above current underwear and bikini fashions in many patients when the patient stands (see Fig. 25.2). In reality, surgeons excise more skin than is truly redundant in most situations lest the patients perceive too much laxity when sitting upright. But the tension necessary to keep a patient tight when sitting upright often leads to a scar that will migrate superiorly when the patient stands (Fig. 25.7).

Skin Quality and Texture

As with all excisional procedures such as facelift and breast lift, damaged skin is what is left behind, even after a generous excision. The ultimate quality of the result and appearance will be based upon the characteristics of the patient's skin. Do stretch marks still exist superior to the

likely line of resection so that many will remain, or are they likely to be excised? Is the skin thin and/or sun-damaged, likely to loosen again to a significant degree or have notable lines or wrinkles? These issues must all be addressed with the patient preoperatively in order to set their expectations. The presence of pre-existing abdominal scars must be assessed as they may have affected blood supply in such a way as to necessitate modification of the HLT design, or to limit dissection even more. There are also sometimes transverse lines of adhesion, usually between umbilicus and xiphoid between the midline and the anterior axillary line that prevent transference of pull above them. It can take substantial undermining to free these up, and in doing so the blood supply to the flap can be compromised. These issues need to be discussed with the patient preoperatively.

Excess Fat within Flap

The HLT allows for safe suctioning within the flap. But in most cases the significant extent of resection with an HLT

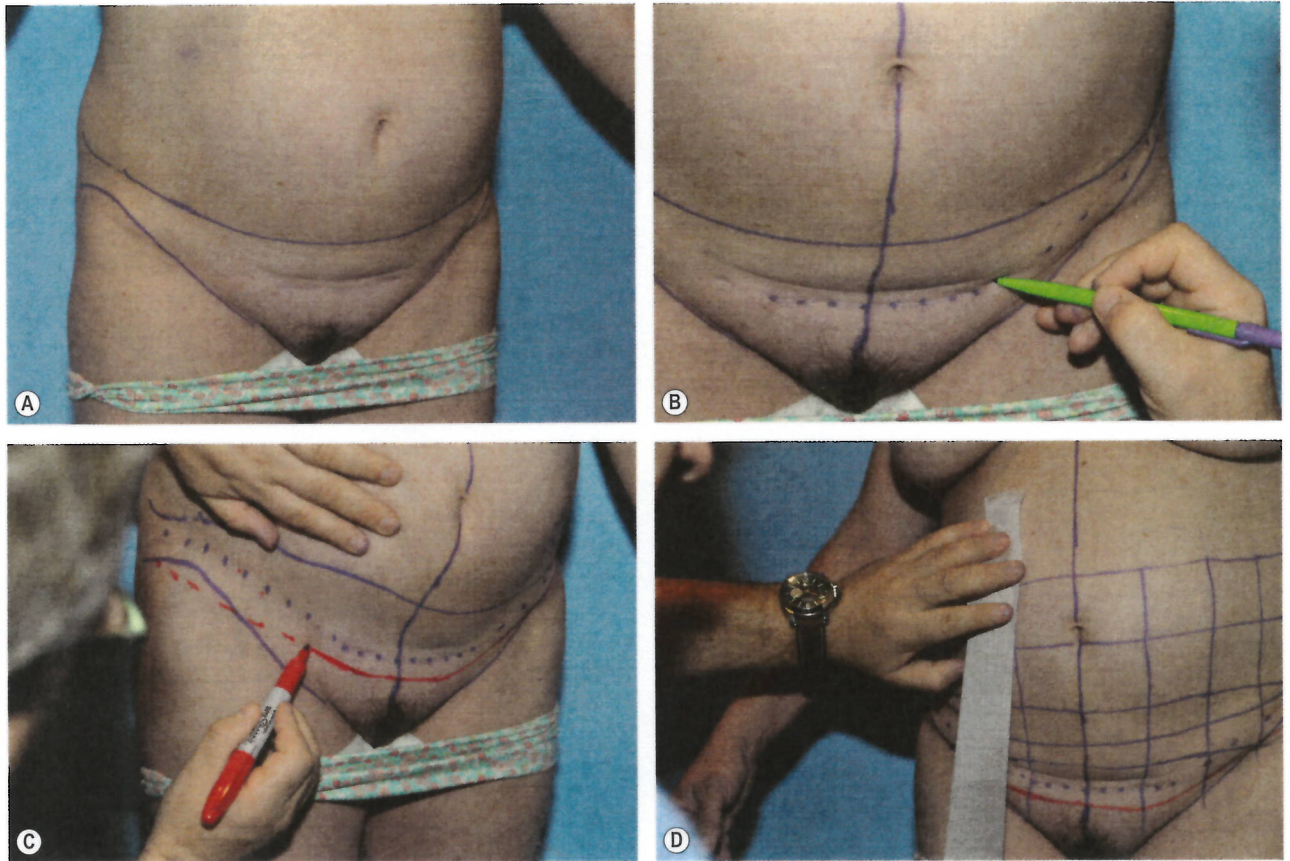


FIG. 25.2 Preoperative marking. (A) Make an outline of the patient's underwear or bikini bottom. (B) Determine the location of the ideal final scar within the underwear. (C) Place vertical force that simulates the tension after excision. The patient should be against a wall so that they are not pushed over. Note that the incision may end up beneath the underwear, but this will rise up with final closure. (D) Make a grid to help make the initial incision and the final line of excision symmetric. It may be helpful to do this before even drawing the intended initial incision.

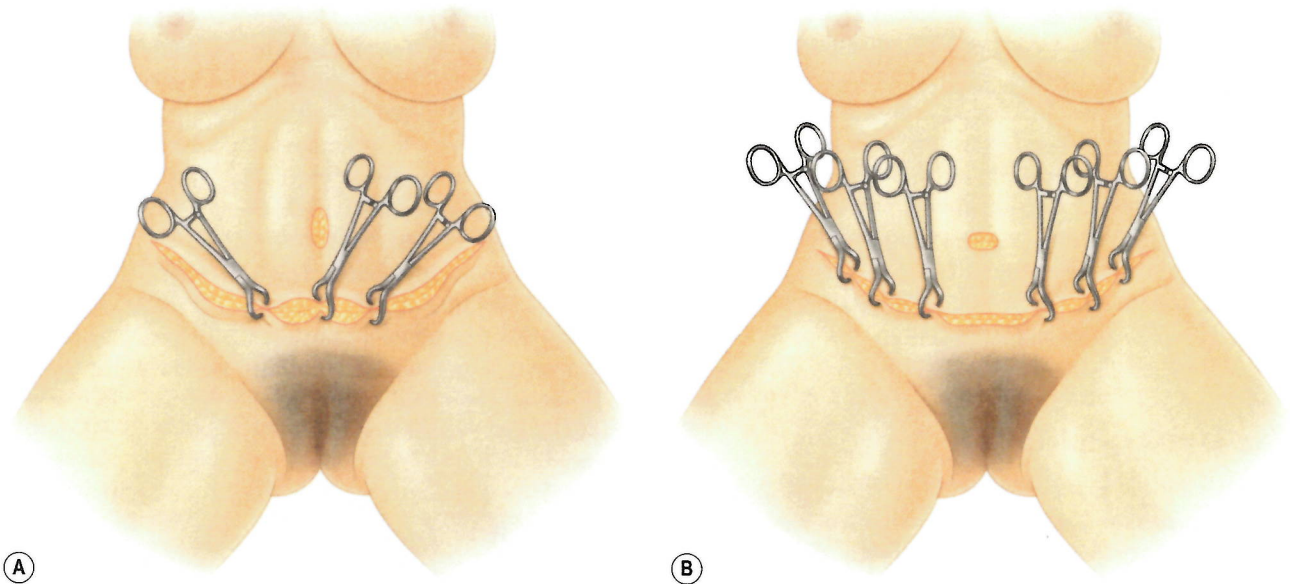


FIG. 25.3 Classic vs. HLT. In the classic abdominoplasty (A), the surgeon is focused on removing the umbilicus and places the greatest tension centrally, potentially elevating and narrowing the mons, exposing the labia, and not maximally tightening the groin and upper anterior thigh. In the high lateral tension shown in (B), the greatest tension is in the groin, enough so that the tissue over the mons is almost approximated once the lateral limbs are closed.

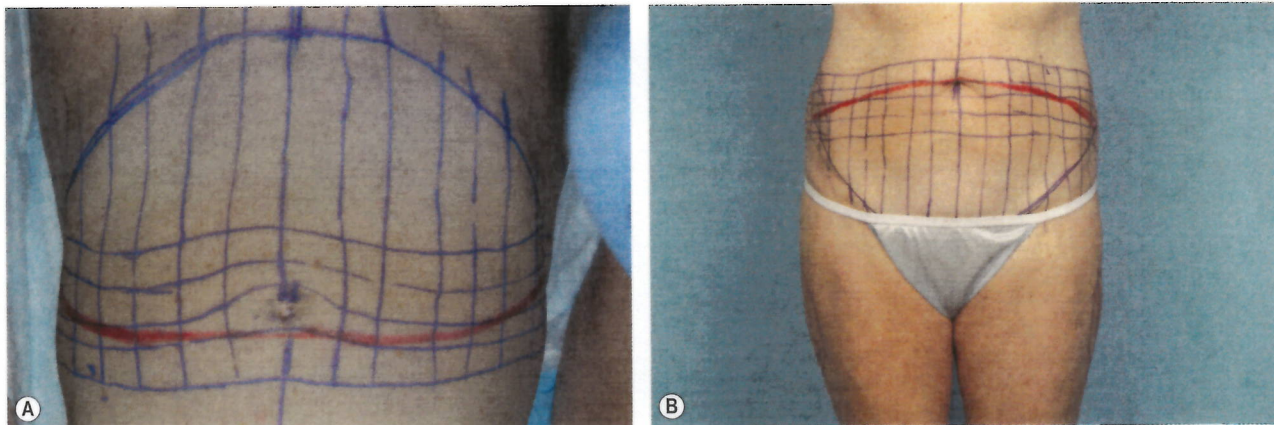


FIG. 25.4 Positional changes. In preoperative photograph (A), note how horizontal the blue lines are. In (B), they diverge up superiorly in the lateral part of the incision when the patient lays supine. Note also the change in position of the red line. The point is to recognize that even in a high lateral excision, the limbs of the HLT excision are rarely higher than would be horizontal.

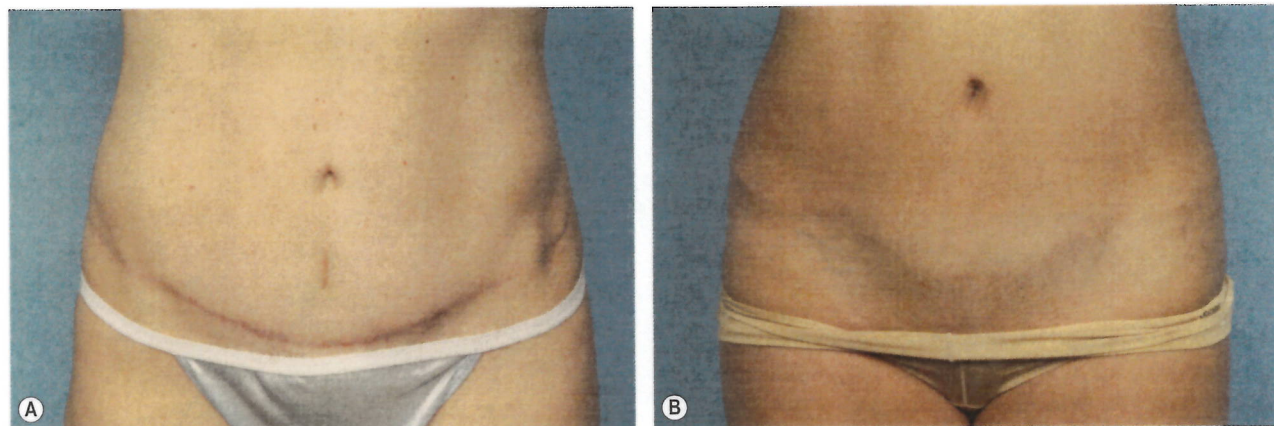


FIG. 25.7 Controlling scar position. (A) shows an ideally positioned scar; low, nice angle that will stay under clothing, and a long distance between umbilicus and scar. Note the vertical scar from the old umbilical site. Had it not been moved, there would have been supraumbilical laxity. Were the umbilicus to have been floated, it would have been too close to the pubic hair. If an attempt were made to excise it, the pubic hair would be raised. (B) Shows a handle-bar appearing scar that is the result of the initial incision being too high, thereby requiring more excision on the flap to create lateral tension, the result of which was to raise the ends of the scar. In planning the initial incision, it is important to place maximum vertical tension on the inguinal area and rather than drawing just a straight line between the proposed end of the incision and the short horizontal area about the pubic hair, make the incision slightly concave up.

creates a flat abdomen, and the tension stretches and effectively thins the abdominal flap. Surgeons should be cautious when assessing whether additional debulking of the flap with liposuction will actually create a more attractive contour or merely a thinner one. Abdominal liposuction results are fraught with over-resection, uneven resection, and contour irregularities. While simultaneous liposuction of the abdominal flap can be safe and is sometimes desirable, more frequently simultaneous liposuction is better done on adjacent areas and the abdomen left alone. The salient question is not whether fat remains within the abdominal fat, but whether this fat is proportional to the patient's overall body habitus and particularly adjacent areas. As the flap is stretched and flatted, there is a

concomitant relative thinning of the fat flap. Consideration should be made as to whether simultaneous liposuction increases drain output or the likelihood of seroma formation.

Excess Fat in Contiguous Areas

An HLT results in a significant excision of abdominal fat along with the generous amount of skin excised. Following this, most patients have a flat abdomen, and it is important to assess whether that flat abdomen will look proportional to the adjacent areas. If there appears to be a lot of fat in the abdomen, it can be removed, and there is usually even more in the hips or the thighs. If liposuction of the abdomen

TABLE 25.2 Determination of Final Line of Resection

1. Plication should be completed first because this affects the amount that needs to be resected.
2. Sit the patient up about 30°.
3. Split the flap incrementally, stopping when closure would distort the mons.
4. With that point held in place with a towel clamp, and with inferior distraction of each side of the flap, use a Lockwood marking clamp to mark the proposed resection. The tension should be higher in the mid-clavicular area than centrally.
5. Using the grid as a guide, mark a symmetric excision. While it will look as if more tissue is being taken laterally, if you look at the grid you will see that it is often a bit less and only occasionally more than the horizontal lines of the grid. When more tension is used in marking the preoperative inferior incision, the final line of excision will be more inferior than if the initial incision was more superior.
6. After resecting the flap, align vertical lines and tack with towel clamps. Examine the incision to assure that it has an attractive, smooth, and gentle sweep. Oftentimes at this stage, the inferior flap may need to be trimmed as it will often be pulled too far superiorly (this step is avoided if adequate tension is placed before the initial incision, though the same result is achieved with this additional maneuver). Rarely, the incision will be too low and the superior flap will need to be trimmed. This final stage is crucial to assure ideal location and contour of the scar.

is even being considered, it is important to look at those areas and consider treating them, lest the surgeon create a disharmonious proportion. With the abdomen flattened from an abdominoplasty, the width that results from excess hip fat can be very apparent. Given the substantial lateral abdominal tightening of the HLT which abruptly stops just beyond the incision, even the preoperatively proportional hip can look wider postoperatively. Narrowing the waist through suction of the posterior hip roll can dramatically improve the appearance of the trunk. Besides recreating a waistline that can be lost from any abdominoplasty, the hip suctioning allows the lateralmost extents of the incision to fall back to the lateral and even posterior parts of the trunk, making the incision look visibly narrower from the AP view. Similarly, excess fat in the mons area is often not noted preoperatively in the patient with a large overhanging pannus. With a smooth and flatter abdomen, the mons can protrude in clothing and be disconcerting. This can be treated with liposuction at the time of abdominoplasty.

Rectus Diastasis/Hernia

The patient should be examined standing, sitting, and laying back flat while raising her shoulders up, as in doing a partial sit-up. This is a good way to test for a rectus diastasis. From this position, one can take the patient's hands and show

them the gap that exists between their muscles. Most patients have an option of plicating any diastasis. While the plication can substantially improve the outcome, so too does it increase the severity and duration of recovery. The umbilicus is always assessed for the presence of a fascial defect that may need to be repaired either separately or at the time of abdominoplasty. The patient should also be examined in profile with her arms at her sides and above her head, asking her to allow her abdominal musculature to relax. During plication, it is all too tempting to tighten her as much as possible by excessive imbrication from pubis to xiphoid. But the goal is only to reunite the paired rectus muscles together in the midline.

Intraabdominal Fat

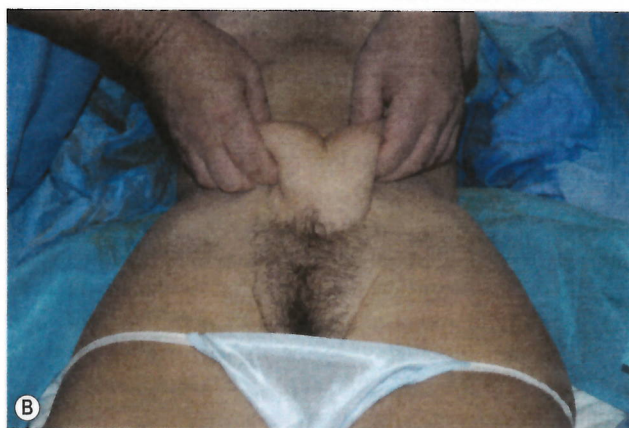
Pressure from the internal organs and intraabdominal fat puts pressure on the diastasis repair. While it is possible for there to be relapse in any situation, patients with significant intrabdominal fat deposits should be warned that they are at a higher risk for some recurrence and generally do not benefit as much from the plication. While there are no parameters that can be measured from which exact standards can be drawn, women with a wide or loose diastasis and less intraabdominal fat are better candidates for plication than women with a smaller or tighter diastasis.

SURGICAL TECHNIQUE

1. All patients should have photos of the entire esthetic area from the shoulder to knee. Photos should always be taken with the patient sitting, as this both demonstrates the full extent of the preoperative redundancy and critically tests the quality of the result. Photos should also be taken in the "diver's position."
2. The patient wears a bikini bottom or underwear that is typical of the style she likes to wear. Frequently, patients are now wearing underwear that is relatively horizontal, preventing the scar from rising laterally as much as desirable to create an ideal result (Table 25.3 and Fig. 25.8). There are two ways to deal with this. First, the issues in Table 25.3 can be understood by most patients. Should the height of swimsuits rise, a low scar would be visible in even one-piece suits. However, a high scar that is optimal for an HLT will always be covered by a one-piece and visible only with a low one-piece. Another option is to make the scar lower in the midline, which still allows the scar to course more superiorly up to the lateral ends of the incision. However, the lower the central incision, the lower the likelihood that the umbilical site will be excised. One must also be careful not to remove too much hair-bearing skin in the pubic region; generally

TABLE 25.3 Rationale for Placing Scar Lower in the Center and Higher Laterally

1. A curved scar in this region is less conspicuous than a horizontal one.
2. A long distance between umbilicus and the top of the mons/pubis hair is more youthful.
3. Since a scar only pulls perpendicular to it, the oblique orientation of the lateral arms of the scar allows greater improvement of the epigastrium.
4. The iliac bones are often too close together to allow adequate scar length.
5. The scar can better fit within a bikini or underwear.
6. There is less of a tendency for dog-ears.
7. A higher lateral incision makes the thigh look longer, more slender, and more youthful.

**FIG. 25.8.** Placement of scars in clothes.

it should be about 6.5–7 cm from the anterior labial commissure to the top of the pubic hair on maximum stretch (Fig. 25.9).

 **FIG 25.9** APPEARS ONLINE ONLY

3. The midline is marked from xiphoid to umbilicus to the labial commissure. Drawing a number of vertical

TABLE 25.4 Considerations and Steps in Preoperative Marking of the Incision

1. Mark the vertical midline, from xiphoid to umbilicus, then umbilicus to labial commissure.
2. Mark a grid across the abdomen; vertical lines of grid should extend inferior to the proposed incision in order to help alignment during closure.
3. Put on panties/bikini bottoms; if too low and horizontal for optimal scar, the need for angulating lateral scar above panties is discussed. Or can lower central incision to allow lateral incision to rise but stay within undergarments, but must avoid over-shortening mons height and discuss increased likelihood umbilical site will not be excisable.
4. Mark the proposed end of the incision; greater length gives a better contour; should end somewhere between anterior and posterior axillary line and within her undergarments; check distance from midline and height for symmetry.
5. Hold pen where you want the scar to be, and elevate the mons until just before it distorts, and make a gentle curved line at that height the width of the mons.
6. Push superiorly on the abdomen to simulate the tension of the flap; connect the dot at the proposed end of the incision to the central line. Check for symmetry.
7. When the patient is supine on the table, push again superiorly to make sure that the lateral line is straight; the central area of this line usually needs to be lowered because it is difficult to place adequate tissue while patient is standing without pushing her over.

lines parallel to the first line from the midline, going out laterally to where the incision is expected to end. Additional horizontal lines are drawn to create a checkerboard on the abdomen. This helps when marking the patient and makes for a much more rapid and accurate determination of final resection (Table 25.4).

4. A line is then drawn for the ideal final scar. The patient must inspect this and any compromises be discussed and made. This line is not where an incision will be made! Because tension will vary along the length of the incision, there are points at which this will be pulled up by the final closure greater than at other areas. So with a pen held horizontally at the level of the desired final scar, the abdomen is pushed up superiorly with the expected tension of the final closure at that point. This will yield a series of dots below the desired scar location. Check for symmetry of width, angle, height, and orientation relative to the iliac crest. Extend the lines for the incision beyond the planned incision to guide lengthening of incision, if necessary.
5. The patient is given a general anesthetic. A pillow is placed behind the knees to increase venous flow and to take tension off the abdomen. The legs are slightly “frog-legged” to further reduce tension on the lateral

part of the incision. The most critical perioperative decision revolves around DVT prophylaxis. Compression boots are used in all cases; consideration must be given to chemoprophylaxis. The ASPS guidelines should be referenced, as recommendations are likely to change.

6. Incision is made and dissection continued with an electrocautery. Superficial epigastric vessels are identified and ligated. Dissection proceeds up towards the umbilicus. A periumbilical incision is made and dissection is carried widely down and around the umbilicus to its base. If the site is likely not going to be excised, one may consider leaving less tissue around the umbilicus as it can result in a depression deep to the closure of the old umbilical site.
7. If it is obvious that the umbilical site will be removed, the flap should be split to allow for easier dissection up towards the xiphoid. Dissection should be no wider than necessary to complete the plication.
8. Marcaine with epinephrine is injected along the rectus sheath. Towel clamps are used to approximate the rectus closure. Simple interrupted #1 Nurodon sutures soaked in Betadine are used to place the first row. Figure-of-eight sutures can also be used. Figure-of-eight sutures will shorten the vertical height of the rectus muscle by the cumulative effect of the compression created between the upper and lower bites of each of the sutures. Following the interrupted sutures, a running 0 Prolene suture is placed, starting at the umbilicus, and run all the way to the umbilicus; at the umbilicus, it is run along one side of the umbilicus and once below it, the repair again continues.
9. The flap is irrigated, debris is washed away, and hemostasis is achieved. The Plasma Jet can be used for improved hemostasis and to seal lymphatics in an effort to reduce seroma formation.
10. The patient is sat up only about 25 or 30°; sitting up more than that makes it too easy to over-resect centrally, and it does not allow for significantly more lateral resection, which is where resection is emphasized. Start by determining the amount of resection that can be done centrally. Do not have the mons completely draped off, as the amount of resection is determined by mons distortion. No more than a small of distortion should be accepted and the extent to which the pubic hair is pulled cephalad is also noted, as there must be an adequate distance left between the umbilicus and the top of the pubic hair. Once this is determined, the flap is split up to this point and tacked into place. The Lockwood flap marker is then used to mark the remaining flap, taking note that there should be greater tension laterally than centrally (Table 25.5).

TABLE 25.5 Rationale for Higher Lateral Tension and Reduced Midline Tension

1. Mons is mobile; central tension elevates pubic hair, makes hair pattern less dense, shortens distance between mons and umbilicus, narrows and flattens mons, can distort urinary stream, can expose labia minora.
 2. There is greater lateral than central laxity.
 3. High lateral tension creates greater rejuvenation of inguinal region.
 4. Since tension is perpendicular to the incision, with high lateral tension on each side the epigastrium is better flattened with oblique inferolateral pull from each lateral incision.
 5. It allows for a greater amount of skin excision.
 6. The tissues caudal to the lateral arms are more robust, immobile, and have a more developed Scarpa's fascia than the central portion of the incision, thereby allowing for greater tension on the abdominal flap.
 7. Greater lateral tension transmitted through Scarpa's fascia rejuvenates the proximal anterior thigh.
11. The excision is done with a knife in the skin and then a cautery, pulling on the discarded part of the flap to assure that the cut is done perpendicular to the cut edge. Lockwood advocated back-cutting the flap in order to create a redundancy in the skin by the closure of the SFS; I have only had devascularization of the skin edges when I have done this, so it should be done with care and caution.
 12. Drains are placed and a pain pump if desired. The patient is sat back up, tacked shut, the umbilicus is matured, and closure is done.

POSTOPERATIVE CARE

The Foley catheter is removed at the conclusion of the operation to ensure that the patient walks on the night of surgery. Pain pumps can be used, but their efficacy has not been conclusively shown. One of the most common reasons for flap loss is a tight dressing, which can worsen as swelling increases. Sometimes IV fluids are continued to assure hydration and blood flow to the flap. Compression boots can be used as long as a patient is in a hospital or recovery center.

OPTIMIZING OUTCOMES

Planning of the location of the incision, the distance between umbilicus and scar, the height of the mons, and extent of improvement in the inguinal region and thighs is very important for the outcome. These points of finesse can lead to the most beautiful results. Scars will fade with time. However, all patients must be shown "bad" scars, because

there is always a possibility that any patient could develop an unsightly scar. But so long as it is properly situated and the overall contour is excellent, patients usually will accept the scars.

COMPLICATIONS AND THEIR MANAGEMENT

Venous thrombotic events (VTE) remain threats following abdominoplasty, and they can occur despite chemoprophylaxis, compression boots, and early ambulation. Early recognition is critical. Leg swelling, pain, shortness of breath, anxiousness, should be treated as serious until proven otherwise. The entire office staff must be alert for these complaints and understand the importance of immediate management.

Hematomas, infections, seromas, minor flap necrosis, constipation, and urinary retention can all occur after abdominoplasty.

CONCLUSION

The HLT abdominoplasty is not distinct from the “standard” abdominoplasty in the same way that, for instance, a vertical mastopexy is different from a periareolar mastopexy. The surgeon should be aware of the principles of the HLT abdominoplasty and apply them as desired for each abdominoplasty patient.

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Fig. 25.5, Fig. 25.6, Fig. 25.9 can be found online.