

A Paradigm Shift for Abdominoplasty: Transverse Hypogastric Plication Without Supraumbilical Dissection, Unrestricted Liposuction, Neoumbilicoplasty, and Low Placement of the Scar (TULUA)

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15.1 Introduction

Plastic surgery is a constant battle between blood supply and beauty. Sir Harold Gillies [1].

In its beginnings, abdominoplasty was limited to a direct resection of redundant tissues; later, additional treatment of the muscular wall was added. Extensive separation of the muscular fascia and fat layers above the navel by direct dissection was required to perform vertically oriented plication of the muscular aponeurosis from the xiphoid to the pubis. The navel left attached to its abdominal stem, in some way compressed or modified by the fascial sutures, was exteriorized by contraincision.

For a long time during the evolution of the abdominoplasty technique, simultaneous liposuction was deemed unsafe because of

complications such as necrosis of the abdominal flap due to devascularization by flap detachment, liposuction trauma, and to the deleterious effect of wound closure under tension. For these reasons, the introduction of abdominoplasty combined with liposuction was slow and with restrictions, until the idea of limited dissection above the navel appeared, preserving most of perforators of the flap, giving rise to the new lipoabdominoplasty era [2].

In the course of the evolution of techniques in abdominoplasty, the main idea has been the same: to achieve a normal appearance, acceptable scars, within a security setting, and with minimal complications [3]. Although there have been great advances, major drawbacks still remain as necrosis of skin and fat, wound dehiscence, high location of the transverse scar, and deep, stenotic, necrotic, or misplaced navels near the transverse scar. In the same way, less than optimal results are perceived because of redundancy of tissues due to limited or absent liposuction, as well as the “dome” effect formed by tissue translation and accumulation toward midline in the upper abdomen, because of vertical plication performed through a central tunnel (Figs. 15.1 and 15.2).

Therefore, the biggest surgical challenge despite abdominoplasty evolution is vascular flap safety, to attain a flat abdominal surface without

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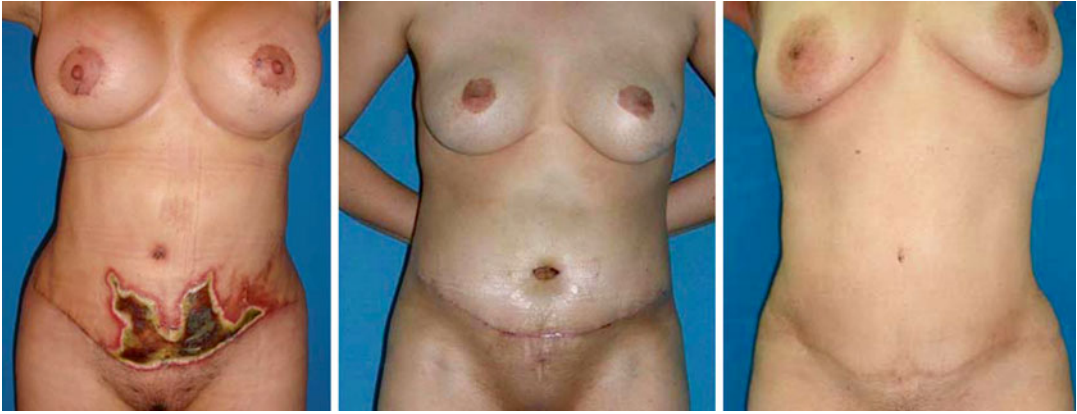


Fig. 15.1 Despite technical advances, vascular insufficiency, shape and positioning of the umbilicus, and scar location are still major problems after abdominoplasty. (Left) Skin, fat, and umbilical stalk necrosis after conventional lipoabdominoplasty as was observed 2 weeks after

surgery. (Center) Poor result and displeased patient after conventional abdominoplasty, she complains of high scar and umbilicus that is wide and low. (Right) Stenotic umbilicus after abdominoplasty with associated problems as irritation, infection, poor hygiene, and bad odor



Fig. 15.2 “Dome effect” after vertical plicature through an epigastric tunnel during conventional lipoabdominoplasty. (Left) Outline of vertical plicature during lipoabdominoplasty, most of the flap is attached to underlying muscles and vessels. During plicature, tissues are brought to midline. (Center) Poor result after lipoabdominoplasty,

skin epigastric redundancy is observed, despite liposuction. Tissues are brought together in midline by the underlying plicature. (Right) Same patient demonstrates her desire to attain a flat epigastrium doing bimanual skin traction

redundancies especially in epigastrium, to locate the transverse scar sufficiently in low position to hide it within the underwear or bathing suit limits, and to obtain an umbilicus of good appearance and location.

Continuing in the evolutionary way to solve the historical challenges of abdominoplasty, several modifications to the technique have been made since 2005, grouped under the acronym TULUA [4]:

1. Transverse abdominal wall plication, instead of vertical
2. Abolition of flap detachment above the navel, rather than wide dissection or undermining restricted to a tunnel
3. Liposuction without restrictions, rather than limited or conditioned liposuction
4. Amputation of the original belly button followed by neoumbilicoplasty with a skin graft, rather than exteriorization umbilicoplasty

Table 15.1 TULUA abdominoplasty modifications compared with lipoabdominoplasty and conventional abdominoplasty

Lipoabdominoplasty and conventional abdominoplasty		Modifications in TULUA abdominoplasty
Vertical plicature	T	Transverse (plicature)
Wide dissection	U	Undermining halted at umbilicus (no epigastric flap detachment)
Without liposuction or limited (danger zones)	L	Liposuction (without restrictions)
Umbilicoplasty by stump exteriorization	U	Umbilicoplasty with a skin graft
Abdominoplasty with no very low scar location due to flap tension	A	Abdominoplasty with low transverse scar localization

Previously published [5, 6]

- Adequate and low-level location of the transverse scar in all cases, instead of random location or where the tension of the flap permitted (Table 15.1) [5, 6]

This chapter is a description of the paradigm shift that TULUA modifications do to the conventional philosophy in abdominoplasty. This different way of thinking may be an alternative for those who are involved in making plastic surgery safer and more reliable.

15.2 Surgical Technique

15.2.1 Patient Selection

TULUA abdominoplasty can be applied to any patient; nevertheless as in the conventional surgery, it has relative contraindications in smokers, obese, and in the presence of comorbidities. It definitely cannot be used if there is significant diastasis recti above the navel and hernias or epigastric eventrations, which have been determined by physical examination or imaging. However, some cases of umbilical hernias or eventrations in the lower abdomen could be treated simultaneously with this technique.

TULUA is especially indicated in patients in whom flap detachment of the epigastrum is con-

sidered risky or inappropriate due to vascularity concern as well as in obese, smokers and in cases of previous liposuction. Obese patients in whom it is not possible or there is no indication of bariatric surgery are particularly benefited from this type of surgery, without having to deal with extensive dissection to reposition the umbilical stalk which is elongated and is hard to accommodate in some cases. For the same reasons, the technique has special advantages for massive weight loss patients. The modifications would have application when there is redundancy of skin and epigastric fat, where accumulation of tissue in the midline of the upper abdomen with vertical plication is anticipated. Probably some cases of vertical excess of skin, in whom a “fleur-de-lis” resection is considered to leave a final anchor-shaped scar, can be beneficiaries of TULUA, avoiding perhaps the vertical scar component (Fig. 15.3). In conclusion, TULUA technique can be applied to any patient who has no significant diastasis or hernia in the epigastrum, most of patients in whom has been used have been selected in an intuitive manner, in cases where is deemed inconvenient or unsafe a wide flap dissection (Table 15.2).

Once the patient has been selected and other surgical options discussed, informed consent for surgery is mandatory in which sufficient clarity about modifications to the technique is emphasized.

15.2.2 Surgical Markings

With the patient standing, demarcation is similar to conventional abdominoplasty, taking care to place the transverse incision as low enough at the time of surgical wound closure about 5–7 cm above the anterior vulvar commissure, and the incision should be planned sufficiently to avoid lateral dog ears.

In no case, the preexisting lower abdominal crease is used to plan the incision; subsequently, this leads to high location of the scar. By contrast during demarcation, the patient is asked to pull up firmly and symmetrically with both hands the skin and fat from the hypogastrium, noticing a shift of the mons veneris and the vulva to a higher and anterior placement; in this situation of transient traction, a midline mark point is placed

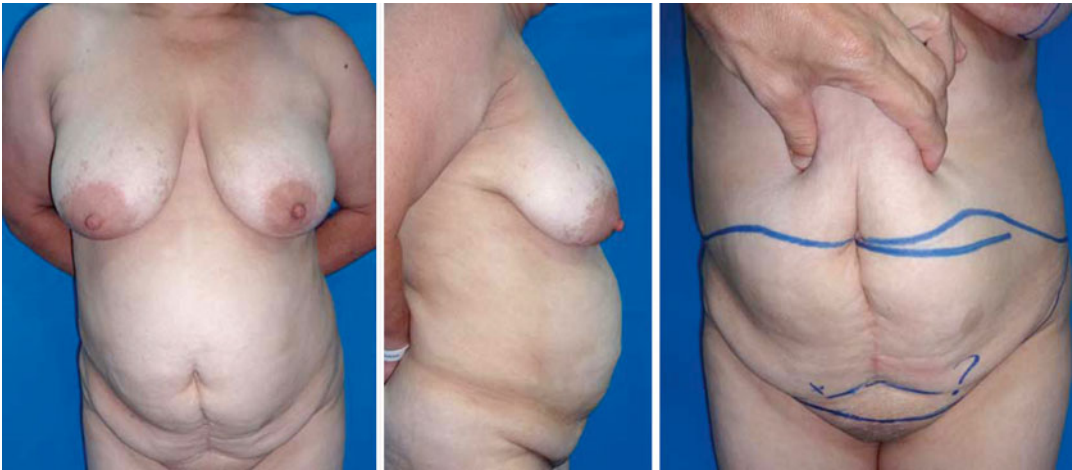


Fig. 15.3 Patient selection for TULUA abdominoplasty. (Left) 45-year-old obese patient with BMI 32, a passive smoker, with skin and fat redundancy at the epigastric level, intuitively judged as a good candidate for TULUA. (Center) Abdominal bulge observed in lateral view, epigastric hernia, and significant diastasis were ruled out by

physical exam. (Right) Digital pinch test demonstrates fat deposits to be removed with unrestricted liposuction of the epigastric. Skin excess will be evenly distributed with the downward traction of the flap, no skin excess in epigastric midline will be observed after surgery

Table 15.2 Indications of TULUA abdominoplasty in 42 patients

Primary cases	32
Revisional cases	10
Obesity	22
Smokers	3
Epigastric skin and fat redundancy	10

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5–7 cm above the anterior vulvar commissure, bimanual traction is then released, and the outline proceeds all the way of the transverse incision starting from the central point to the most lateral end, frequently exceeding the anterior iliac spines. An ellipse is completed drawing a joining line between the lateral ends with the navel; the upper and lower outlines of the ellipse should be approximately of the same length to facilitate the closure without dog ears, rotation cones, or lateral deformities (Fig. 15.4).

15.2.3 Surgical Procedure

Under general anesthesia, infiltration with saline and adrenaline 1: 500,000 is completed to achieve tumescence in the anterior abdomen and all areas

in which there will be liposuction that usually involve the back, flanks, and medial thighs. Average infiltration of the abdomen is 2000 mL, which is complemented to 3000–8000 mL in all additional operative areas.

Through four ports of 5 mm in hypogastrum, one in the navel and two in the inframammary crease, full deep and superficial liposuction is carried out, above the navel, abdominal flanks, and mons veneris using cannulas of 5 mm. Liposuction is done without any restriction as recommended in other techniques, leaving the flap thin and uniform, about 2–3 cm in thickness with multiple crisscrossed cannula tunnels. Additional ports are used, according to the surgical plan, to complete liposuction in the back and remaining areas under treatment; liposuction of the hypogastrum is not considered necessary because it will be resected en bloc afterward (Fig. 15.5).

A bistoury skin incision is performed on the delineated transverse line, down to the subcutaneous fat. With an electrocautery, dissection in a surgical plane immediately above the muscular aponeurosis is carried out. The hypogastric flap is detached up as far as the umbilicus, halting at its level, creating a limit of upper dissection that

Fig. 15.4 Typical presurgical markings for TULUA. (Left): Skin redundancy and fat excess at the epigastrium were the main indications of TULUA. (Right) Bimanual upward traction allows exact placement of the scar 5–7 cm above the anterior vulvar commissure. Lateral prolongations are necessary to avoid dog ears

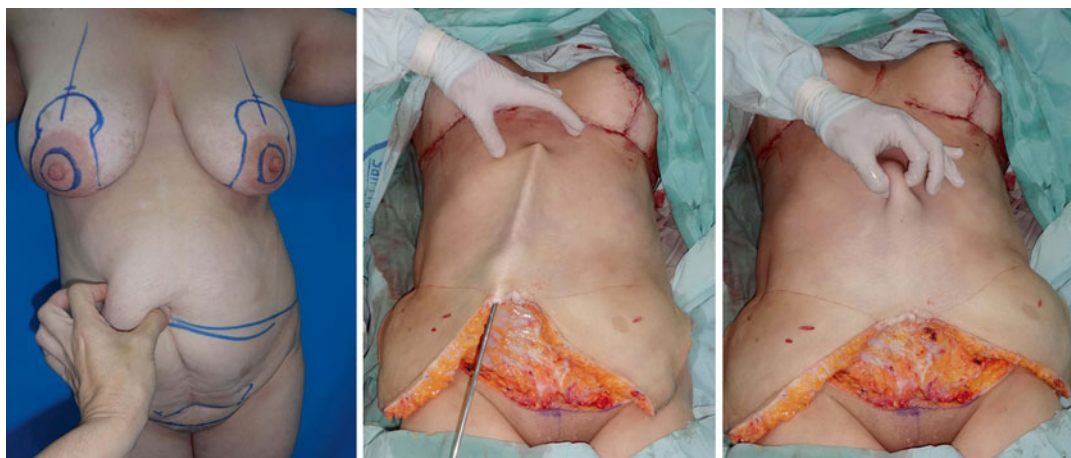


Fig. 15.5 Full unrestricted tumescent liposuction is permitted during TULUA abdominoplasty. (Left) Obese patient with a thick epigastric flap as demonstrated by digital pinch maneuver. (Center) No epigastric flap

elevation was performed. After tumescence ample liposuction was accomplished with a 5 mm cannula. (Right) Digital pinch test demonstrates flap thinning and skin mobility with liposuction

unites the iliac spines with the navel in the midline. In no case, direct flap elevation must progress above the navel. It is recommended to leave a little fat over the pubic bone doing an oblique or step cutting after the initial skin incision, forming a subcutaneous triangle about 6 by 4 cm where the thinner part of the supraumbilical flap will be accommodated (Fig. 15.6).

After complete dissection of the hypogastrium, a horizontal ellipse is drawn with a surgical marker on the anterior musculature of the abdomen from the iliac spine to the other, passing

through the umbilicus and pubis. To determine if the size of the drawn ellipse is correct for the plication, an active maneuver is performed sinking the wall with four fingertips extended in the center of the elliptical mark, to observe how the top and bottom lines come together to almost touching; if there is some lateral redundancy over the oblique muscles on the iliac crest, the plicature could extend laterally about 4 cm more on each side.

With the patient under muscle relaxation and the operating table in a position of moderate

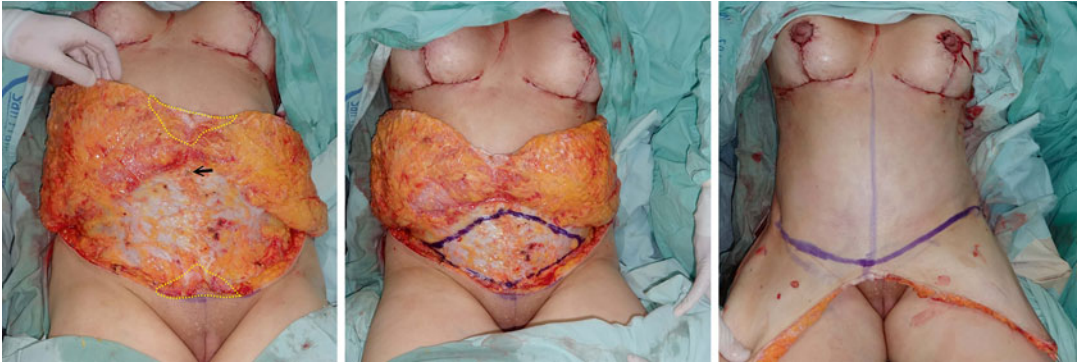


Fig. 15.6 During TULUA procedure, the umbilicus is amputated. Direct dissection of the hypogastric flap is halted at umbilical level. (Left) Black arrow demonstrates wall defect of the amputated umbilicus. Direct flap dissection is stopped at this level. Yellow dotted lines on the suprapubic area delineate a beveled dissection in order to preserve some tissues to fill the fat defect observed

around the umbilicus in the flap border (see delineated triangular area with additional yellow dotted line). (Center) A 30 by 11 cm ellipse is outlined on the anterior hypogastrium. (Right) Liposuction tunnels and transverse plicature allow easy downward flap sliding to permit a tension-free closure

flexion, transverse plication of the anterior wall of the abdomen is carried down joining the edges of the drawn ellipse, with interrupted 0 polypropylene stitches with inverted knots, which are reinforced by running suture of the same suture type (Fig. 15.7).

This plication reaches 30 per 10 cm, and it can be extended while it is made if, laxity or on the contrary, excessive tension is observed. This surgically created fold produces umbilical descent reaching the pubis in some cases. The navel is then amputated, and its abdominal wall opening is closed with 0 polypropylene stitches.

The fat and skin previously elevated of the hypogastrium are resected, which in all cases is a similar block of tissues than is resected in conventional surgery. The wound is closed by planes emphasizing to avoid dog ears using additional liposuction and lateral prolongation of the incision as necessary. This wound closure is much easier and under less tension than in conventional abdominoplasties as tension on the suture line is not exerted directly on the skin, but it is mitigated by the pulling effect of the aponeurosis and the accompanying downward displacement of all tissues during the transverse plication.

The wound closure is done with 2-0 polyglactin stitches at the subcutaneous planes, superficial

aponeurosis, and dermis. The skin is sutured with 3-0 poliglecaprone or 3-0 polypropylene intradermal continuous suture. Wound dead space is reduced performing this careful closure, and the flap gently reaches almost without tension to the bottom edge of the wound (Fig. 15.8).

A closed suction drainage is left in place for 7 days through two incisions at mons veneris.

In secondary cases, the subcutaneous tissues and superficial fascia of the upper border of the incision, are set with slowly absorbable sutures to firm pubic spots and iliac spines to prevent, or correct the superior migration of the scar.

At this moment in surgery, there have been significant changes in the anterior abdominal wall, which must be seen flat, without irregularities, with tense aponeurosis due to transverse plication and the skin without redundancies or abnormal accumulations (dome effect), as sometimes seen in cases of abdominoplasties with plication in the midline.

On the abdominal skin now sutured, a vertical midline is drawn from the xiphoid to the vulva. The measured distance from the surgical wound to the top part of the vulvar commissure must continue being 5–7 cm (distance V) as was planned, this distance is multiplied by 1.5–2, and the measurement is translated in the midline

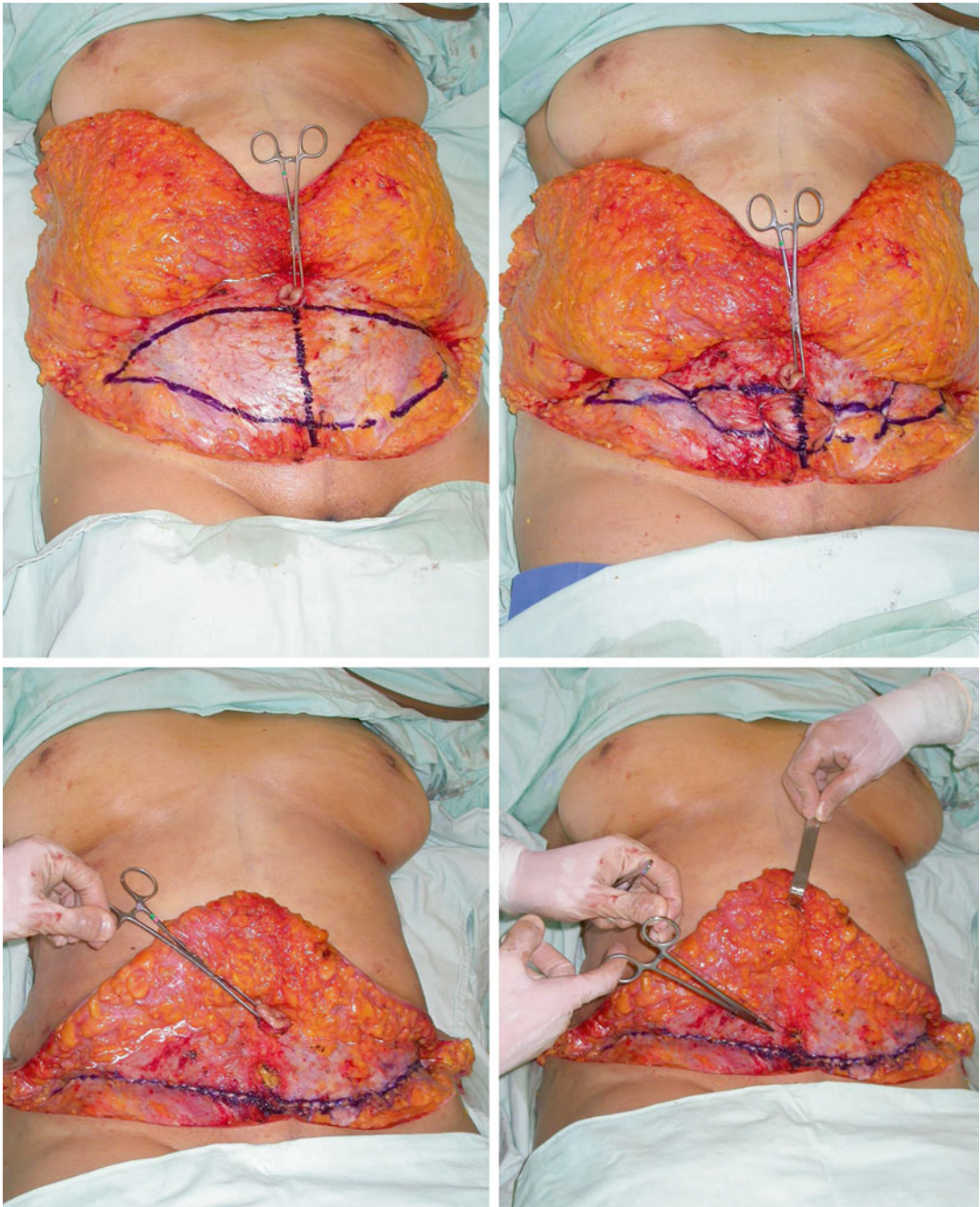


Fig. 15.7 Transverse plicature and original umbilicus amputation are major distinctive steps during TULUA abdominoplasty. (*Top left*) A hypogastric ellipse 34 by 12 cm is outlined. Skin and fat from the lower abdomen have been detached to the umbilicus; a midline partition of the detached flap facilitates upward folding over the epigastrium. (*Top right*) Individual sutures of 0 polypropylene are placed to start the aponeurotic folding; full

muscle relaxation under general anesthesia and mild flexed position of the operating table facilitate this step. (*Bottom left*) 1300 g of skin and fat has been removed from the hypogastrium, an Allis clamp is holding the amputated umbilicus, and a second uninterrupted layer of 0 polypropylene completes the transverse plicature. (*Bottom right*) Umbilicus defect must be closed with additional sutures

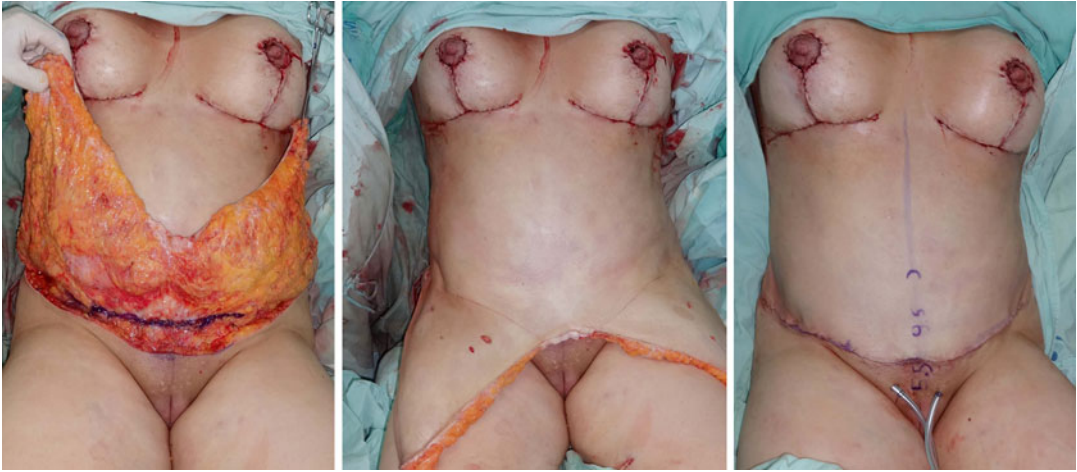


Fig. 15.8 After transverse plicature and full liposuction, the tension-free closure is facilitated. (*Left*) Transverse plicature has been completed in two layers, original umbilicus has been sectioned at its base, and the resulting defect closed; no flap elevation has been performed above the umbilicus. The hypogastric flap to be resected is folded over. (*Center*) Gentle traction of the abdominal flap demonstrates how easy the closure is. Note the uniform distribution of the tissues on the new abdominal wall; no

distortions and irregularities due to residual adherences to deep tissues (“dome effect”) are observed. Epigastric skin excess is evenly distributed. (*Right*) After wound closure in layers, a midline has been traced, and a new umbilicus position determined 9 cm above the transverse incision (H: 9); note the low positioning of the transverse scar 5.5 cm (V: 5.5) from the anterior vulvar commissure (V/H ratio: $5.5/9=0.6$)

above the abdominal incision to help to choose the best position of the new umbilicus 7.5–14 cm (distance H). Once determined the ideal umbilical position, an inverted U incision, is made 1.5 cm in diameter; fat trimming with scissors is performed down its periphery to the muscular fascia and linea alba, creating a depression of 2.5 cm.

For best viewing of the linea alba, curettage of fat can be performed with a Yankauer cannula with its olive tip temporarily removed by hand unscrew. Sloped walls of the umbilicus are formed joining the dermis of the inverted U incision to the abdominal aponeurosis, with six to eight polyglactin 2-0 sutures. Senn-Miller retractors are used for easier setting of sutures in such a small space; traction from the bottom of the wound with a temporary suture can also help during the process; stitches are placed all first, leaving them unknotted and repaired with mosquito forceps, to be all tied to the end, resulting in a closure with lost inverted knots between the fascia and skin.

A full-thickness skin graft, triangular shaped of 1.5 cm, perfectly defatted, is harvested from

the hypogastrium-resected specimen, to be attached to the abdominal wall with three sutures of 3-0 plain catgut, to create the bottom of the neoumbilicus. The skin graft must be in intimate contact for its dermal side with the aponeurosis of the abdominal midline. Additional sutures can be placed if necessary. Graft must be flat; in no case it is tubular, and the recipient area is never a fatty tissue. An antibiotic ointment dressing is used forming a ball of 1.5 cm to help give form to the new navel (Figs. 15.9 and 15.10).

After the surgery is completed, a postsurgical elastic garment is worn to produce moderately elastic compression of the abdomen and operated areas. The patient is transferred to standard postoperative room to be discharged the next day with home care of wound and drain. The drain is usually removed after a week regardless of their production; in the few cases that seromas are seen, they are drained aseptically by needle and syringe puncture during postoperative consultations once or twice a week until complete remission of the collection (Table 15.3).



Fig. 15.9 Neoumbilicoplasty with a skin graft. (*Left*) After determining the new umbilicus position, an inverted U incision is performed. Perimetric fat trimming creates a periumbilical depression; borders of the U incision are sutured with 2-0 polyglactin interrupted sutures to the abdominal fascia, forming a central hole with surrounding depression and beveled walls. (*Center*) A small 1 cm full-thickness skin graft is firmly sewed with 3-0 plain catgut

on the linea alba of the abdominal wall to create the bottom of the new navel. (*Right*) Late result in the same patient, a relatively high umbilicus is observed with a V/H ratio of 0.46; however, this result demonstrates the total freedom in umbilicus positioning. Careful umbilicus positioning with a better V/H ratio is important to achieve constantly good results, as was performed in subsequent cases

15.3 Prior Publication

In a previous publication by the author, data from 42 women were reported operated with TULUA technique from January 2005 until June 2011. Although it was a case report series, results were objectively measured for greater accuracy [7]. Demographics of the series, follow-up, and operative data are as follows: age 22–64 years (average 47 ± 12). The main consultation complaints were esthetic, but in one case, it was after weight loss and one more as hygienic panniculectomy. In ten patients, the primary indication was epigastric excess of skin and fat. Average body mass index (BMI) was 30 ± 3.6 (range 22–38). Twenty-two of 42 patients were obese with a BMI >30.

Most of the patients had during surgery liposuction of additional areas without measurement of extracted fat for the isolated abdominal area. The total amount of the aspirate was quantified without separation of the liquid components of fat and blood, being on average 4255 mL (range 1000–7000 mL).

The resected ellipse of skin and fat from the hypogastrium was in average 1375 g with

variations from 540 g up to 5000 g (Table 15.4). The size of the transverse elliptical plication was 24–34 cm wide (average 30.7 ± 2.3) and 6–13 cm high (average 9.8 ± 2.1). The area of the plication calculated by the formula of the area of an ellipse ($\pi \times r1 \times r2$) was on average 236 ± 55 cm² with 118 cm² minimum and maximum of 337 cm².

Follow-up average was 53 weeks, which was 3 weeks in three patients, with a range of 3–389 weeks. Results were graded as excellent, good, fair, or bad, according to a scale of values from 0 to 18 points. Six variables were rated with scores 0–3 points. Each variable measured:

1. The presence of bulging wall in the epigastrium.
2. Redundancy of epigastric skin.
3. Proportion of the navel and scar (h/v ratio).
4. Umbilical shape.
5. Location of the transverse scar.
6. Esthetic appearance of the abdomen.

In this scale of values, there were no bad results; the worst outcome had scored 6 (fair), while 20 results were judged as excellent (0 points) and 21 as good (1–5 points).

Fig. 15.10 Graft take after neoumbilicoplasty in TULUA. (Top row and bottom left) Successive steps for new umbilicus creation. (Bottom right) In the same patient, graft take at day 7 after surgery, no signs of flap ischemia or wound dehiscence are noted at the transverse incision

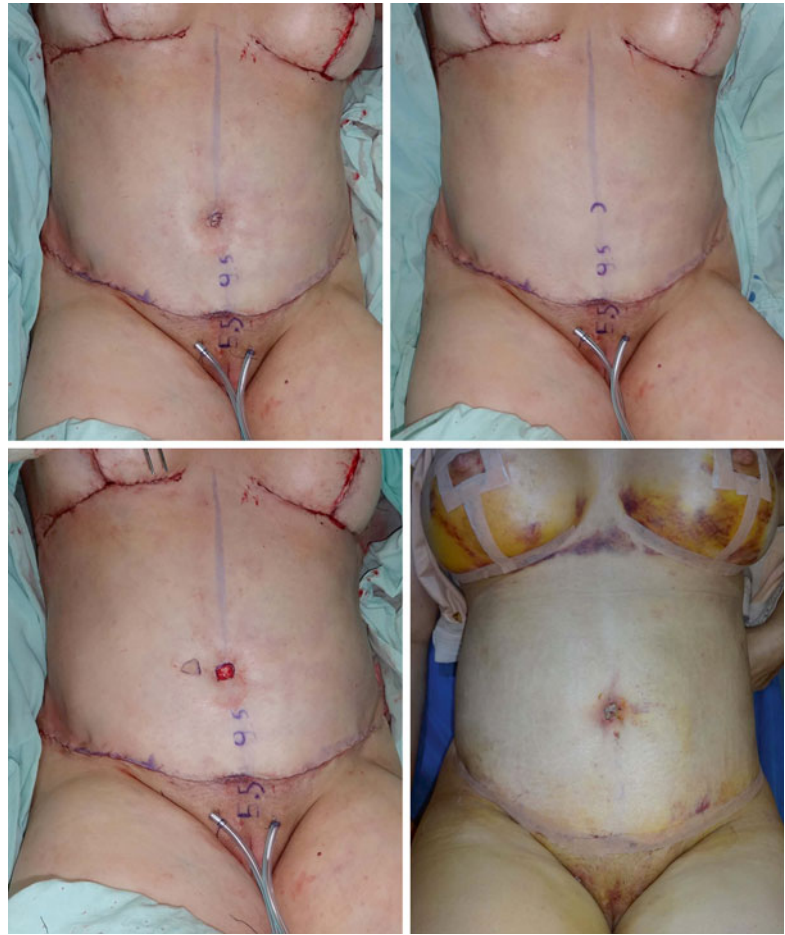


Table 15.3 Technical details in TULUA abdominoplasty

Patient selection	Obese, massive weight loss, postbariatric, epigastric redundancy, smoking (active, passive), revisional cases (any patient according to surgeon's "intuitive" criteria)
Surgical markings	Strong bimanual traction, central point 5–7 cm above the anterior vulvar commissure
Liposuction	Tumescent, without restriction to the upper anterior abdomen, midline, and flanks
Excision of abdominal panniculus in hypogastrium	En bloc resection, no liposuction, no Scarpa's fascia preservation
Plicature	Transverse, from navel to pubis, or less if excessive tightness does not allow. Between anterior iliac spines or wider if necessary
Wound closure	No tension. Scarpa's, subcutaneous fat and dermis closure
Neoumbilicoplasty	Small skin graft, only to create the bottom of navel 1.5 cm. inverted U-shaped incision, U borders of skin attached to fascia with sutures
Drains	Closed for 1 week

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During postoperative follow-up, a proportional measurement (H/V ratio) was determined. H (hypogastrium) spans from the incision to the new navel, and V (veneris) goes from the anterior

vulvar commissure to the transverse incision of the tummy tuck. This proportion demonstrated the adequacy of transverse scar and umbilicus positioning [8].

Table 15.4 Patient data and operative parameters

	Mean \pm SD	Maximum	Minimum
Age (years)	47 \pm 12	64	22
Follow-up (weeks)	53 \pm 83.7	389	3
Body mass index (BMI, kg/m ²)	30.1 \pm 3.6	38.3	22.0
Lipoaspirate (ml)	4250 \pm 2020	8000	1000
Dermolipectomy specimen (g)	1375 \pm 1109	5000	540
Transverse dimension of plicature (cm)	31 \pm 2.34	34	24
Vertical dimension of plicature (cm)	10 \pm 2.15	13	6
Area of plicated ellipse cm ² ($\pi \times r_1 \times r_2$)	235.7 \pm 55.8	337.7	118

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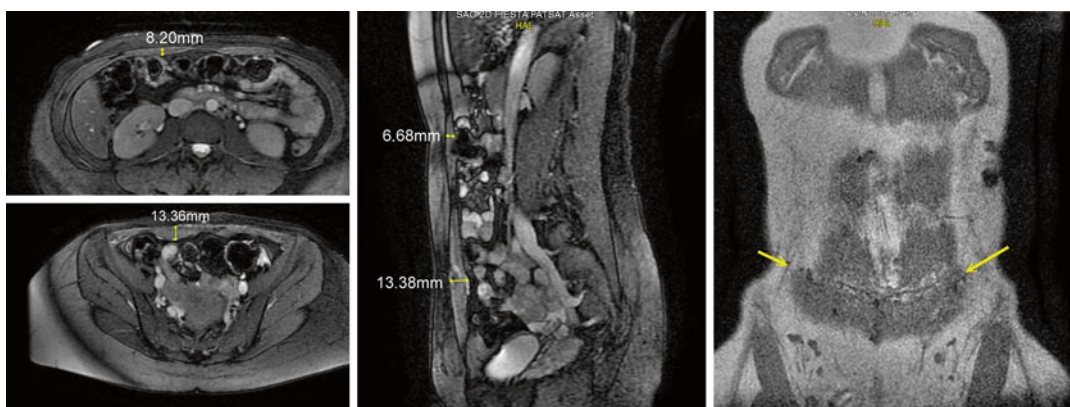


Fig. 15.11 Magnetic resonance imaging demonstrates significant and permanent changes of the abdominal wall at the plication zone. (*Left top*) Axial MRI slice at the epigastrium level, abdominal wall muscle thickness is 8.2 mm. (*Left bottom*) Axial slice at the plicature level,

wall thickness is consistently bigger. (*Center*) Sagittal slice in a paramedian area demonstrating the effect of the transverse plicature on the abdominal wall. (*Right*) In a coronal slice, between yellow arrows, the suture line of the transverse plicature can be observed

V measured in average 6.7 ± 1.4 cm and in 30 cases was less than 7 cm. H/V ratio was 1.9 ± 0.5 , i.e., on average the distance H (from the navel to the incision) was almost twice the distance V.

To evaluate anatomical changes of the abdominal wall and its persistence, four patients underwent magnetic resonance imaging (MRI), in different periods of their postoperative evolution from 6 months to 6 years. MRI images in all slices demonstrated significant changes consistent with thickening and visible scarring in the muscle and fascia of the plication area. Imaging changes were interpreted, in each case as directly caused by surgery.

Twelve thickness measures in the area of the surgically created fold averaged 14 ± 3.5 mm, and the average of comparable measurements in areas

not affected by the plication was 6 ± 2.3 (2.35 times thicker at plicature level, $p < 0.0000015$). The modifications described in the case with longer follow-up of 6 years suggest persistence through the time of the plication effect (Fig. 15.11).

Partial skin graft take in the new umbilicus and healing retardation were seen in 10 of 42 cases. However, the form and size of the newly created navel were considered adequate, and no one required reoperation. In the scale of values from 0 to 3 wherein zero was the ideal, 41 of 42 umbilici had ideal qualifications (Table 15.5).

There were no fatal complications. Major necrosis of the abdominal flap, necrosis on its edges, or sutures dehiscence was not observed. Unilateral seroma in the lateral region of the

Table 15.5 Clinical outcome scoring of 42 TULUA abdominoplasty patients

Score indices	0	1	2	3
Epigastric bulging (wall)	Flat epigastrium	Bulging in sitting position	Bulging in standing position	Surgical revision required or performed
	<i>n</i> = 39	<i>n</i> = 3	None	None
Epigastric skin redundancy	No redundancy	Demonstrated by pinch test	Visible without pinch	Surgical revision required or performed
	<i>n</i> = 41	<i>n</i> = 1	None	None
Hypogastrium/veneris (H/V) ratio (38 measurements, 1.9 ± 0.5)	Ideal H/V: 1.5–2.0	–	High umbilicus H/V >2.0	Surgical revision required or performed
			Low umbilicus H/V <1.50	
	<i>n</i> = 23	–	High: <i>n</i> = 11 Low: <i>n</i> = 4	None
Umbilical shape	Inconspicuous	Some deformity	Abnormal or absent	Surgical revision required or performed
	<i>n</i> = 41	None	<i>n</i> = 1	None
Transverse scar position (38 measurements, 6.3 ± 1.4 cm)	5–7 cm from anterior vulvar commissure	7.1–10 cm from anterior vulvar commissure	>10 cm, not concealed by underwear	Surgical revision required or performed
	<i>n</i> = 30	<i>n</i> = 7	<i>n</i> = 1	None
Esthetic appearance	Esthetically pleasing	Irregularities, redundancies, retractions, without skin necrosis	Skin loss, extensive scarring, esthetically unpleasant	Surgical revision required or performed
	<i>n</i> = 37	<i>n</i> = 4	<i>n</i> = 1	None

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Overall scoring of outcome: excellent (0 points), 20 cases; good (1–5 points), 21 cases; fair (6–9 points), 1 case; poor (10 or more points), 0 case

incision over the iliac crest was detected in four patients. Each seroma was treated with repeated puncture until remission; one of them required five sessions. Subcutaneous collections in other areas of the hypogastrium or abdominal wall were not detected. Reoperation or new hospitalization because of the operation was not required in any case (Fig. 15.12).

15.4 Discussion

TULUA modifications to the conventional abdominoplasty and lipoabdominoplasty are in concordance with most significant evolutions; however, the introduced change is a paradigm shift, a revolution about the surgery as a transformation from one way of thinking to another [9]. It could have at the author's discretion, several possible advantages, and disadvantages, requiring critical judgment of each reader for

better interpretation. Scientific follow-up of the technique with sufficient validity studies would clarify the following comments:

15.5 Advantages of TULUA Technique

15.5.1 Vasculature Preservation

On its origins, abdominoplasty was a resective procedure treating skin and fat only, progressing to a complete treatment of the musculature with umbilical transposition, and recently abdominal liposuction with some limitations and recommendations [10, 11]. Extensive dissection to the xiphoid and rib cage borders in the first cases evolved to a restricted dissection, limited to the center of the epigastrum, creating a tunnel in order to preserve segmental intercostal arteries [12, 13]; in this way, the combination of

Fig. 15.12 Results after TULUA in a typical case. (Left) Preoperative frontal and oblique views of a good candidate for TULUA. Her BMI was 32; epigastric skin and fat excess, besides obesity, were the main indications to choose the technique. (Right) 6 years after surgery. Concomitantly, a vertical, non-alloplastic mastopexy was performed. Total liposuction aspirate was 6000 mL, hypogastric en bloc resection was 4750 g, and transverse plication measured 34 × 12 cm. Postoperative period was uneventful. Despite weight regain, results persist over the time, epigastric bulging was corrected. Note acceptable outcome with adequate positioning and proportionality between the scar and neoumbilicus (V/H ratio was 8/13=0.6). No skin irregularities, laxity, and “dome effect” in the upper abdomen are observed



liposuction and abdominoplasty ever banned or used with certain restrictions was becoming safer [14, 15]. However, the threat of necrosis by devascularization is a common problem with current techniques and is more imminent when liposuction is associated with extensive dissection and undue tension on the flap.

Following this line of thought, it is possible that not to do epigastric dissection as proposed with TULUA abdominoplasty would be safer from the vascular point of view, since it preserves the segmental intercostal vessels but also perforator vessels from the deep epigastric artery circulation passing through the rectus muscles above the navel. Additionally, the traction exerted on

deep layers by transverse plication from the navel to the pubis advances the attached flap from the epigastrium in an easy way down, reducing skin tension on the suture line, since most of the tension falls into the deep layers of muscle and fascia.

15.5.2 Effective and Durable Abdominal Wall Tightening

Besides the advances in management of skin and fat, abdominal wall treatment has made progress, almost always including a vertical midline plication above and below the umbilicus, which in

theory can correct permanently the diastasis of the rectus muscles [16]. Other types of plication have been described to enhance the waistline and to correct vertical sagging with sutures shaped in letters H, L, or J. Besides, oblique and transverse epigastric and hypogastric folding sutures have been used. These plicatures may require large flap detachment, which would have an adverse effect on its vascularization [17, 18], although conventional vertical, transverse, and anchor plications have been described through limited dissection in mini abdominoplasties and abdominoplasties [19–21].

The transverse plication (30.7 ± 2.3 by 9.8 ± 2.1 cm) is at least visually bigger than the area of vertical plication (30–34 cm by 4–7 cm). Hypothetically, transverse plicature could be better and produce more tension on the wall; however, this would have to be shown with other studies. In any case, the new transverse plication is sufficient to correct the general laxity of the abdominal wall, helping to get proper appearance and flattening without compensatory bulging of the epigastrium.

MRI evaluation of the plicature in vertical lipoadominoplasty has been published [22]. Although MRI assessment in TULUA just had four patients arbitrarily selected, statistical analysis of the results showed significant changes in the plicature area, which in one case persisted 6 years after surgery. These MRI studies did not demonstrate adverse effects of the transverse plication such as secondary protruding, epigastric herniation, new hernia apparition, collections between the edges of the plication, dehiscence of sutures, and so on, as could be suspected.

15.5.3 Correction of Epigastric Skin and Fat Excess

Skin and fat redundancy in the epigastrium is a problem frequently noticed during the postoperative period, especially in cases where liposuction is not made or when a midline detachment is limited to a tunnel restricted laterally to the edge of the rectus abdominis muscles.

Rapprochement of the rectus muscles toward the midline with sutures drags the attached skin and fat to the middle of the upper abdomen, which in some cases creates redundancy in the area, producing sagging skin, bulging, and vertical folds, which damage the results (“dome effect”). No upper abdomen direct dissection, thinning of the epigastrium by liposuction and downward traction of the flap by plicature, avoids the effect of redundancy in the epigastrium during TULUA, which was demonstrated by objective evaluation in 42 cases.

15.5.4 Lower Scar Placement

The gentle downward advancement of the flap to the pubis and the low scar location are provided by crossed tunnels and the effect of mesh detachment that liposuction produces. Besides, the traction exerted by the aponeurosis folded over itself toward the pubis must be added, so it is likely that the closure of the skin will be under less tension, having hypothetically benefits in terms of vascularization, less chance of dehiscence, and less scar widening. Clinically, almost a tension-free wound closure is achieved in every case, allowing a lower location of the incision, as quantitatively was demonstrated by distance “V” that almost always measured less than 7 cm.

15.5.5 Less Dead Space in the Wound

The epigastric skin and fat without other detachment than liposuction tunnels descend smoothly to the pubis accompanying the plication of the wall, so dead space during wound closure is significantly reduced; this situation could explain the minor presence of seroma in the hypogastrium.

15.5.6 Umbilicus Shape and Location

The idea of not to transpose the umbilical stalk and make a new one is not recent [23]. Its main

benefits are not having to dissect the flap to make the transposition of the stump and the complete freedom of choice of the position of the new navel. To get a symmetric abdomen, the new navel should be placed in the midline. With respect to the umbilical height, several parameters can be applied for its location during the surgical act. Although still there is no ideal formula, some authors think that it should be placed at the level of a line passing through the iliac crests; however, this is a rigid reference which has an effect on mobile structures that are arranged differently in supine than in decubitus and operative flexion position [24]. It might be more logical that the umbilical location would be determined by proportional relationships between the mons veneris length and its distance to the navel according to the reference, and this ratio should be 1.5–2 [25].

Other proportional measurements taken with references as the xiphoid and pubis have been described herein [26, 27]. If proportional harmony is guaranteed, the downward displacement of the navel in some techniques could be tolerated [28].

In a previous description by the author [8], measurements of segments V and H were conducted in 40 frontal photographs of nulliparous women, 18–30 years of age, with normal body mass index, without abdominal surgery, in standing position. The V/H ratio averaged 0.498, i.e., that at least in 90 % of the measurements, the distance H between the navel and the natural abdominal crease was 1.5–2.5 times the length of the V span, between the lower abdominal crease and anterior vulvar commissure. This parameter of easy application during surgery is the primary tool at the time to decide the new navel position and was one objective evaluation criteria of described results.

Although there are various ways to create a new umbilicus with local flaps, a technique with an inverted U flap 1.5 cm in diameter was used. It makes the effect of a hole and a cap to which small triangle of full-thickness skin graft is added firmly sewed to the abdominal fascia with absorbable sutures to create the bottom of the

neoumbilicus. Umbilical walls and periphery will have a cone-shaped form with smooth slopes and are formed by the abdominal skin around the inverted U incision attached to the fascia with sutures [29, 30].

Freedom choosing where to place the new navel is a theoretical advantage that allows to adjust the final result. However, it should be noted that this proportion was in ten cases greater than two, which led to observe relatively high appearance of the umbilicus in some instances, situation that has been corrected subsequently.

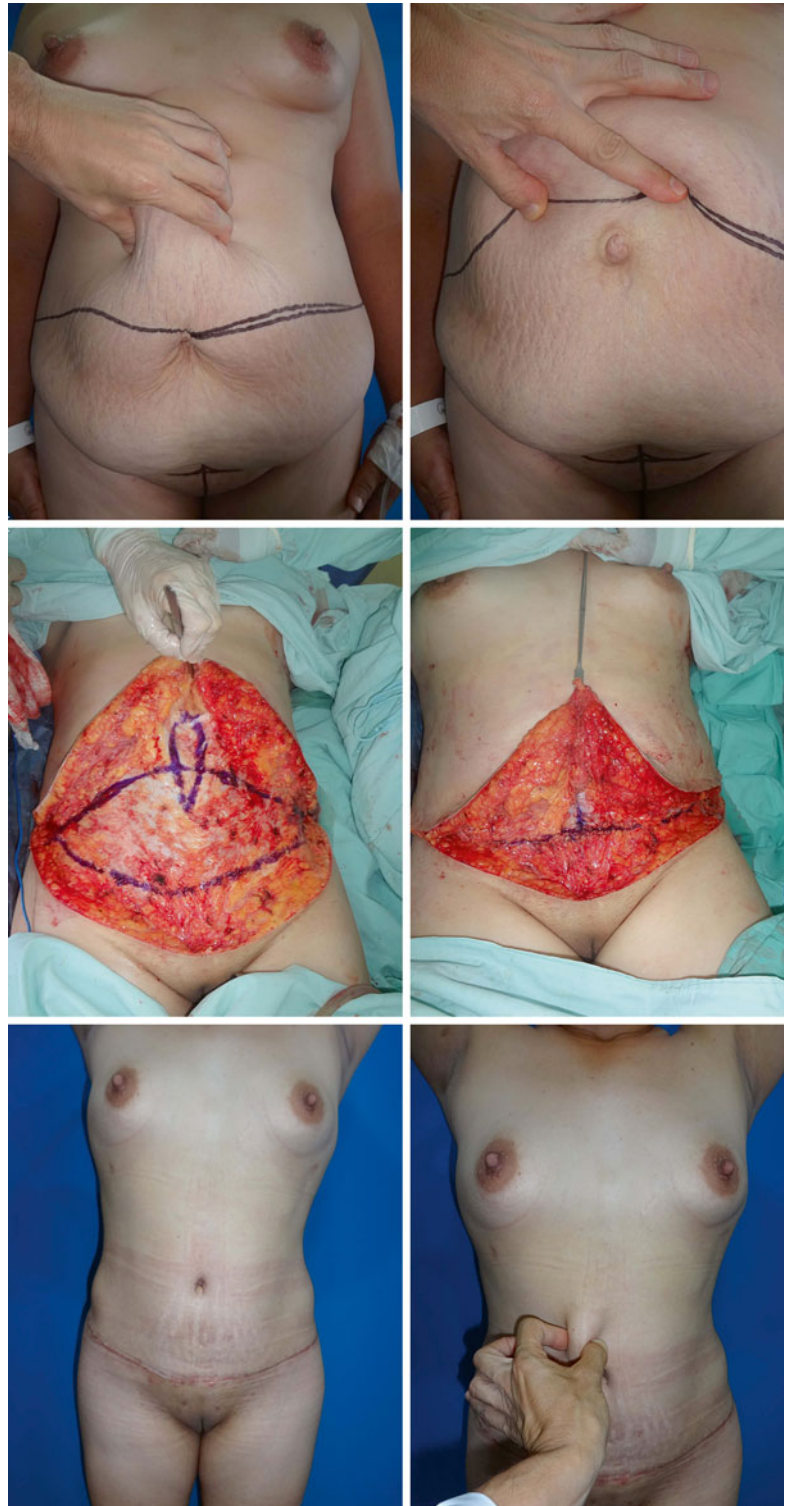
The main advantages of neoumbilicoplasty with a skin graft would be:

1. Avoiding the epigastric dissection required to transpose the umbilical stalk. No flap detachment by direct cutting up could lead to additionally mentioned benefits as more vascularity preservation and less dead space.
2. Complete freedom to select the new position of the navel, avoiding a low placement.
3. Almost all umbilical scars are hidden because they are located in the navel bottom, and umbilical side walls are created again with the adjacent skin of the inverted U-shaped hole.
4. In obese patients, excessively deep navels due to a long umbilical stem are avoided.
5. Funicular and stenotic umbilici are also prevented.
6. Neoumbilicoplasty outcomes are excellent and at least as good as in conventional cases.
7. Umbilical hernias can be repaired safely without worries about stalk necrosis due to dissection and strangulation by sutures (Fig. 15.13).

15.5.7 In Secondary and In Difficult Cases

TULUA could be applied to secondary cases with unsatisfactory outcomes, especially when excessive tissues at mons veneris, high scars, and low navels are their primary complaints. A transverse plication through the old scar displaces down the new closure line, allowing to resect

Fig. 15.13 TULUA abdominoplasty and umbilical hernia repair. (*Top*) Epigastric flap redundancy and a big umbilical hernia were the indications of the technique; clinically significant epigastric diastasis or eventrations were ruled out. (*Central*) Intraoperative views demonstrating transverse plication, umbilicus amputation, and hernia repair; no flap detachment above the navel was performed. (*Bottom*) Results 12 weeks after surgery, epigastric redundancy, and hernia were corrected; there is good proportionality between scar and umbilicus. Transverse scar is located in a low position enough to be hidden by underwear. Pinch test demonstrates flap thinning by unrestricted liposuction in midline



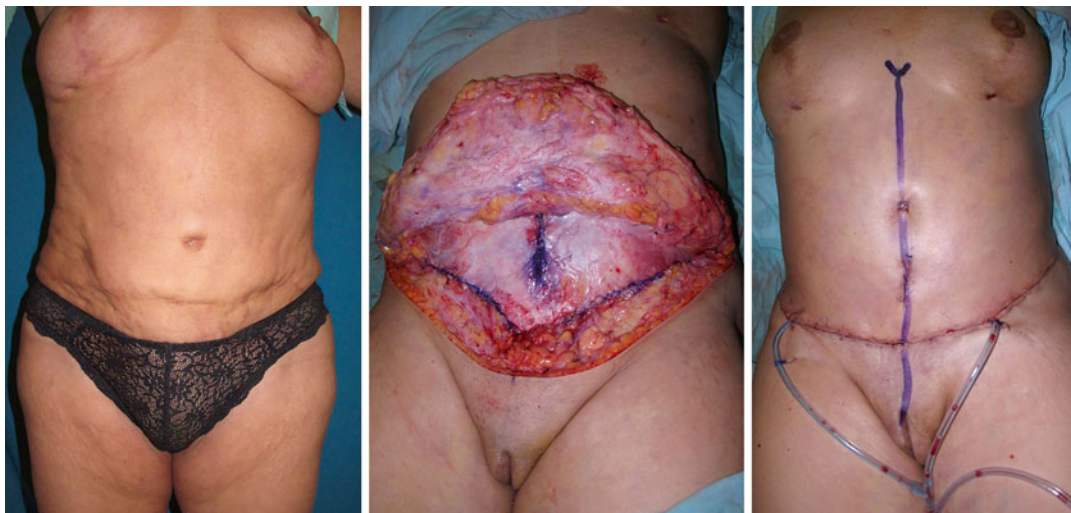


Fig. 15.14 TULUA is useful in correcting secondary difficult cases. (Left) 60-year-old patient, with unsatisfactory results after conventional abdominoplasty. High difficult to hide scar and disproportioned V/H ratio were her primary concerns. (Center) Subcutaneous scarring is visible after flap elevation precluding or impeding flap advancement.

Dissection halted at the navel level. The umbilicus has been amputated and a moderate sized (34 × 6 cm) transverse plication performed. (Right) At the end of revision, incision level has been lowered about 6 cm, despite flap rigidity. A neoumbilicus has been created anew

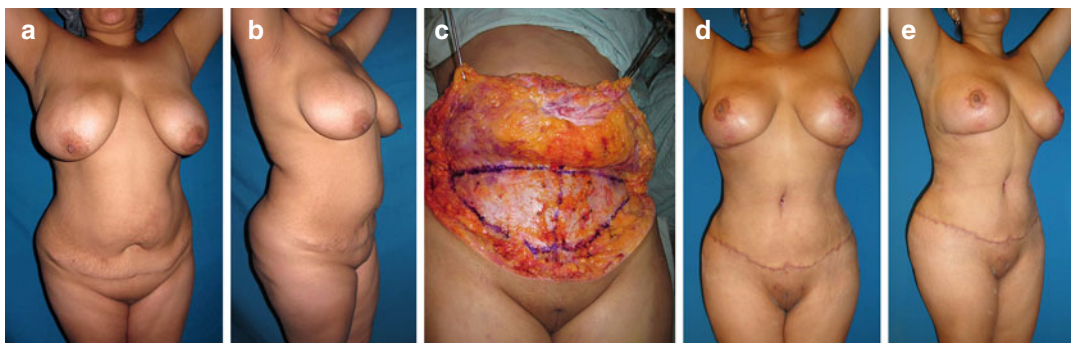


Fig. 15.15 TULUA indication in residual deformity after abdominoplasty or miniabdominoplasty. (a, b) Preoperative 32-year-old patient, BMI 31, complaining of residual redundancy of fat and skin after a miniabdominoplasty procedure 3 years before; epigastric fat excess and obesity were primary indications of the technique. (c) Intraoperative transverse plication, no flap elevation above

the navel, and flap thinning by unrestricted liposuction and neoumbilicoplasty, altogether, were performed. Surprisingly big amounts of residual tissues were resected. (d, e) Reasonable revisional results. Epigastric bulge has been corrected; umbilicus and scar are well placed. No “dome effect;” neither redundant epigastric skin is observed

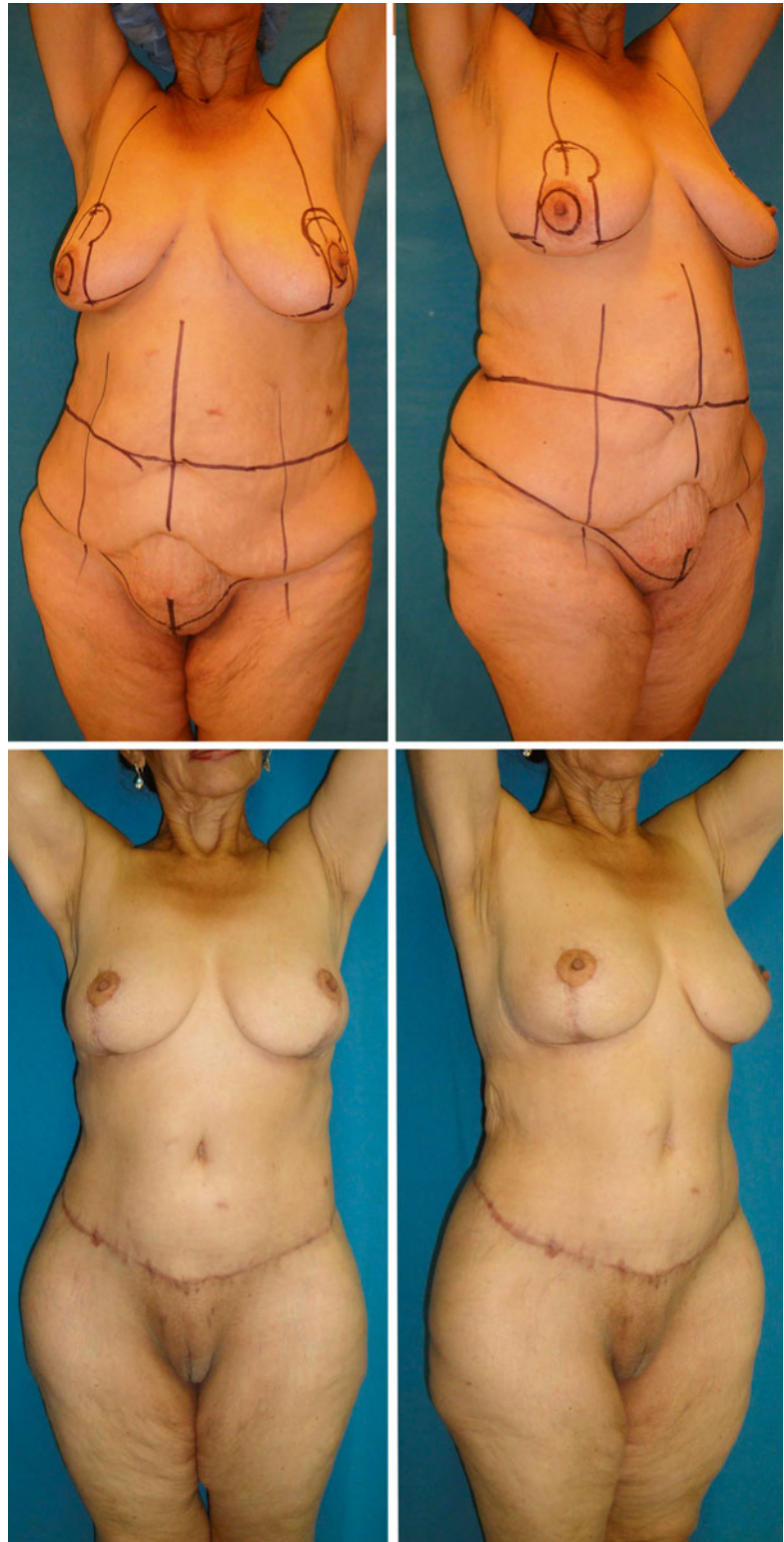
disproportionate mons veneris. Old umbilicus is amputated, the skin closed, and a neoumbilicoplasty performed (Fig. 15.14).

In residual redundancy of the skin and fat as seen in miniabdominoplasty cases, transverse plication, flap thinning with unrestricted liposuc-

tion, and neoumbilicoplasty altogether would allow to resect surprisingly big amounts of residual tissues attaining reasonable revisional results (Fig. 15.15).

If skin irregularities and excessive scarring after isolated liposuction are observed, TULUA

Fig. 15.16 TULUA in massive weight loss patients is a good alternative. (*Top*) TULUA has been planned as a part of multiple postbariatric procedures, belt lipectomy, gluteoplasty, and mastopexy. Note how low the incision is planned on the mons pubis to facilitate the correct placement of the final scar. (*Bottom*) At 14 weeks postsurgery, there were no skin redundancy at the epigastrium, good abdomen contour, and proper umbilicus and scar positioning. A vertical incision (fleur-de-lis) could be avoided by the technique



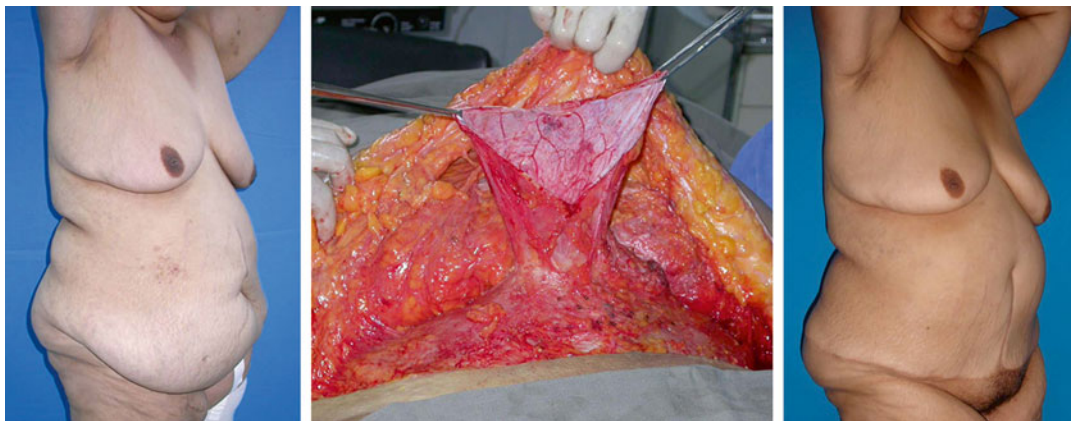


Fig. 15.17 TULUA permits a safer way to perform panniculectomy, liposuction, hernia repair, and abdominal wall plication without flap elevation. (*Left*) A 60-year-old patient has a vertical scar below and above the umbilicus; a hypogastric herniation is present; obesity, diabetes, and varicosity were her comorbidities. (*Center*) The ventral hypogastric eventration was corrected through the wide

transverse incision, abdominal wall was reinforced with the transverse plication, no flap elevation above the umbilicus was done, and neither vertical incision was performed. The long umbilicus was amputated and a neoumbilicus was created. (*Right*) One year after surgery. Vertical infraumbilical scar is due to the previous vertical scar

can be considered as a good corrective option, getting skin and abdominal wall tightening.

In relative contraindications of conventional abdominoplasty, as in obese and passive or active smokers, TULUA permits a safer way to perform panniculectomy, liposuction, and abdominal wall plication without flap elevation.

TULUA has a good indication after massive weight loss and after bariatric surgery; it is possible to do simultaneous belt lipectomy, permitting full liposuction, correcting directly the relaxed hypogastric wall and avoiding dealing with the frequently cumbersome umbilicus placement seen in these cases. Eventually, the set of modifications prevents the use of the vertical component of the resection avoiding anchor scars as seen in “fleur-de-lis” or skate panniculectomy performed in postbariatric cases (Fig. 15.16).

Patients with umbilical hernias in whom vascular impairment of the umbilical pedicle is possible during repair, as well as other defects of the abdominal wall in the hypogastrium, may be beneficiaries of TULUA technique (Fig. 15.17).

Currently, TULUA method has also been applied successfully in the male abdominoplasty (Fig. 15.18).

15.5.8 A Simplified Procedure

The notion of an easier procedure, reduced complications, costs, and enhanced results has led to several changes. Ideas as no flap elevation, to make molding liposuction allowing safely skin resection at the same time, were successfully described. However, in many cases, plication of the wall was forgotten or it was left only for pathological cases [31–37]. TULUA does not forget plication as a primordial part of the technique as required in contemporary abdominoplasty.

TULUA also incorporates several aspects of the logical historical development of abdominoplasty, to simplify the surgery, to increase its results, to improve recovery times, and to reduce costs and complications (Fig. 15.19).

15.6 Disadvantages

Although the sum of changes has advantages, also should be noted are the potential disadvantages that would be: absent direct approach to the diastasis of the rectus muscles in the epigastrium

Fig. 15.18 Male TULUA abdominoplasty. (*Top left*) Before surgery. (*Top right*) After surgery. Note abdominal wall flattening (including epigastrium) and low placement of the transverse scar (lower than the presurgical natural abdominal crease). The umbilicus has been created anew in a higher position to enhance results giving a proportionate appearance. To use the natural abdominal crease to do the incision is a mistake and can result in an excessively high transverse scar. (*Center*) Intraoperative demonstrating a middle-sized transverse plicature, enough to modify the entire abdominal wall. (*Bottom left*) Preoperative. (*Bottom right*) Six weeks postoperative



Fig. 15.19 TULUA

incorporates various aspects of historical development of abdominoplasty, to simplify the surgery, to increase its results, to improve recovery times, and to reduce costs and complications. (Left row) Preoperative 32-year-old female, BMI 31, epigastric bulge was present without epigastric hernia. (Central) Depicts wide en bloc resection, full liposuction, no flap elevation above the navel, transverse hypogastric plication, and tension-free closure, followed by neoumbilicoplasty. (Right) Six months after surgery



and unknown physiological long-term effect of transverse plication and its durability. The lack of integration of skin graft could leave small belly button, scarring, and not ideal results. There has

been a trend to upward migration of new navel in several cases, perhaps due to a progressive elongation of the transverse plication still not determined. Quantifications of waist-level changes

have not been conducted, and it is possible that accumulation of tissue at the vertices of the incision makes the treatment of dog ears more difficult.

Conclusions

TULUA technique can be applied in any patient with indication of abdominoplasty, but for now, it is recommended in some selected cases in which flap elevation above the umbilicus is considered intuitively a vascular risk or in patients in whom the vertical plication would produce redundant skin in the center of the epigastrium.

It would have several hypothetical advantages such as more preservation of vessels and nerves which would give more vascular safety and recovery of sensitivity, less suture line tension, less scar widening, less dead space during wound closure, less seromas, non-accumulation of skin and fat in the epigastrium, low scar location, and total freedom in the selection of the new position of the umbilicus. The liberal use of liposuction at all levels showed security allowing additional molding of the flap in critical zones such as epigastrium, inframammary, subcostal, and waistline, with vascular flap security feeling, avoiding revisions or liposuction in a second time (downstaging) recommended elsewhere [38].

TULUA technique is a paradigm shift that changes established technical concepts with scientific sense and in consonance with the evolutions of the procedure. It can be an interesting alternative to apply in many abdominoplasty cases with indications and contraindications to delimit, with potential benefits of vascular safety, consistent results, and simplicity in its execution.

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