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THE ULTIMATE ART OF SCULPTURE ABDOMINOPLASTY

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ABSTRACT

Standard abdominoplasty includes a transverse lower abdominal incision, wide undermining of the skin and subcutaneous tissue to the costal margins, tightening of the abdominal musculature with correction of rectus muscle diastasis, resection of redundant abdominal skin and subcutaneous tissue, umbilical repositioning, and skin closure with hips flexed. Classic abdominoplasty, particularly in cases where fatty excess is substantial above the line of proposed direct excision, has considerable cosmetic limitations; residual localized epigastric adiposity, peri-incisional step-transitions at the transverse suture line, suboptimal periumbilical contour, often with a "pasted-on" appearance of the neoumbilicus, dog ears, and flank and other regional excess are commonly seen in the absence of additional contouring, either by direct fat excision or by suction lipectomy. Despite being considered a safe procedure, abdominoplasty (like other operations) is not free of complicationsincluding skin necrosis, umbilical necrosis, hematoma, seroma, and prolonged edema. Numerous authors have proposed various recommendations or procedures for decreasing local complications. We present the sculpture abdominoplasty technique which is a logical summation of various surgical steps addressing each of the goals set and proven to be effective by various authors. The technique safely combines abdominoplasty with proper lipoaspiration of the whole abdomen without confronting the danger of ischemia or flap necrosis. Consequently, the visible scar of the incision line can be shortened, skin closure can be achieved with minimal or no tension with adequate thinning out the fatty tissue of the epigastric, costal, flank, and peri-incisional areas.

INTRODUCTION

Abdominoplasty in its most primitive form has existed for more than 100 years [1]. Functional abdominoplasty was first described by Kelly [2,3] in 1899 and later popularized by Pitanguy [2,4] who introduced the low transverse (i.e., bikini line) incision for cosmetic purposes in 1967. following this period, abdominoplasty became a routine operation with growing popularity [2,5].

Multiple objectives have to be considered when performing an abdominoplasty: (1) removal of excess fat, skin, and striae; (2) short, hidden scar, ideally placed within the bikini line;(3) flattening and tightening of the abdomen while concomitantly creating a harmonious contour of the periumbilical area and flanks. Furthermore, the conducted technique should provide a tension-free closure, especially

in the midline, as this area displays an alarming low rate of perfusion [6,7], resulting in skin necrosis when subject to tension upon closure [6]. Modern abdominoplasty techniques were developed during the last 40 years [8] addressing not only skin and subcutaneous tissue, but also the muscular abdominal wall to maximize aesthetic outcome [1]. Despite the multiple modifications and variations, the surgical principles have remained largely alike [9]. Standard abdominoplasties include a transverse lower abdominal incision, wide undermining of the skin and subcutaneous tissue up to the costal margins, tightening of the abdominal musculature with correction of rectus muscle diastasis, resection of redundant abdominal skin and subcutaneous tissue, umbilical repositioning, and skin closure with hips flexed [8,9].

Classic abdominoplasty has considerable cosmetic limitations particularly in cases where fatty excess is substantial above the line of proposed direct excision, residual localized epigastric adiposity, peri-incisional step-transitions at the transverse suture line, suboptimal periumbilical contour, often with a "pasted-on" appearance of the neoumbilicus, dog ears, and flank and other regional excess are commonly seen in the absence of additional contouring, either by direct fat excision or suction lipectomy [10,11]. In fact, problems that generate dissatisfaction and complaints from patients with classic abdominoplasty are primarily fullness of the flanks and epigastric areas, hanging skin over the incision line, and visible scars over the flanks and beyond underwear or swimming suit coverage [11].

Although the surgical principles of classic abdominoplasty have certainly stood the test of time, they are based on two theoretical assumptions that may be proven inaccurate. The first one stating that wide direct undermining to costal margins is essential for abdominal flap advancement. The second is that with aging and weight fluctuations (including pregnancy), abdominal skin relaxation occurs primarily in the vertical direction from the xyphoid to the pubis [9]. In fact, discontinuous undermining is sufficient for effective loosening of the abdominal flap while preserving vascular perforators. Furthermore in most patients, notwithstanding that the midline vertical relaxation may be true in the lower abdomen, a strong superficial fascial system adherence to the linea alba in the epigastrium limits vertical descent. Epigastric laxity frequently results from progressive horizontal loosening secondary to relaxation of the tissues along the lateral trunk [9].

The introduction of liposuction has certainly revolutionized the treatment of aesthetic deformities of the trunk and extremities [8] and

added a powerful dimension to body contouring procedures [12]. It has somewhat reduced the need for classic abdominoplasty, allowing more aesthetic sculpting of the entire trunk [9]. Patients with minimal cutaneous and musculofascial laxity may be good candidates for liposuction as the sole contouring procedure [12]. Suction-assisted lipectomy (SAL) in combination with abdominoplasty has long been regarded with trepidation and considered a controversial topic [8,9,10,13]. Caution concerning the advisability of such a combined approach was based on the belief that the traumatic forces of liposuction would hamper the vascularity of the flap, thereby increasing complications [2], raising concerns of flap ischemia, with skin or soft-tissue necrosis and wound dehiscence as potential dire consequences [8,9,10]. Combining both procedures has also been reported to magnify the potential for thrombotic or fat embolic problems [8,14,15]. It has been associated as well with increased complications when performed in patients with comorbidities, such as obesity, smoking, and diabetes mellitus [8]. In order To improve contouring, liposuction has been initially offered to abdominoplasty patients as an independent procedure spaced by at least 6 months [2,11].

Despite being considered a safe procedure, abdominoplasty (like other operations) is not free of complications with an overall complication rate ranging from 4 to 80 percent, depending on multiple factors [16,17]. Among which are patient body mass index, extension of flap undermining, surgical technique and combination with liposuction or other procedures [16,18,19,20]. Immediate complications of surgery can be catastrophic and include the development of deep vein thrombosis, pulmonary emboli, fat emboli, and hematoma [8]. Early complications include infection, skin necrosis, umbilical necrosis, seroma, and prolonged edema [8]. Late complications may be caused by a technical error made at the time of surgery including asymmetry of the abdominal contour, recurrent diastasis of the rectus abdominis muscles, and hypertrophic scarring [8]. The most commonly reported complications are seroma (10%–15%) and skin flap necrosis/wound complications (3%–15%) [21]. Major complications (hematoma requiring surgical intervention, seroma requiring aspiration or surgical drainage, cellulitis or abscess requiring hospitalization and intravenous antibiotics, deep vein thrombosis, and pulmonary embolism) are reported in 16% of patients. The rate of minor complications (hematoma or seroma requiring no intervention, epidermolysis, small-wound dehiscence, neuropathic pain, and minor cellulitis) is 27%. Overweight at the time of abdominoplasty clearly and adversely affect the results of the surgery. [22]. corpulent patients have a significantly

increased risk of developing major complications as compared to nonobese patients [17]. Yet, complication rates between overweight and normal-weight patients are identical. A significant difference is noted only when the patient is considered obese [22].

Numerous authors have proposed a variety of recommendations and procedures for decreasing local complications [21] including prolonged closed suction drainage, use of abdominal compression devices, avoidance of concomitant liposuction, limited undermining during abdominoplasty, quilting sutures, restricting postoperative early ambulation, and use of fibrin glue. Most of these proposals have either little or no effect on the occurrence of complications or are associated with inherent risks that limit their practicality [21,23]. Alternative abdominoplasty techniques have included limiting the undermining to a central triangle in standard abdominoplasties and limited undermining with or without liposuction of truncal fat deposits in procedures known as mini-, limited, en bloc, and modified abdominoplasties [9]., There has been a recent paradigmatic shift from the classical wide abdominoplasty flap undermining to a more selective approach to the extent of dissection, preserving an increasingly rich blood supply [10,11,19,24,25,26]. Undermining is restricted to the area of diastasis of the rectus abdominis [27] allowing more liberal contouring by liposuction and ultimately enhanced esthetics [10].

The purpose of this report is to present what we believe is a safe technique combining abdominoplasty with proper lipoaspiration of the whole abdomen without confronting the danger of ischemia or flap necrosis. Consequently, the visible scar of the incision line can be shortened, skin closure can be achieved with minimal or no tension with adequate thinning out the fatty tissue of the epigastric, costal, flank, and peri-incisional areas.

SCULPTURE ABDOMINOPLASTY TECHNIQUE

Surgical technique

Markings for a standard W abdominoplasty are made with the patient in the standing position then adjusted in the supine position to achieve symmetry as much as possible. The abdominal wall is then infiltrated with small amounts of a hemostatic solution (1 l LR + 50 cc 1% xylocaine + 1 mg adrenaline). Total deflation of the infraumbilical area is performed by liposuction similar to the brachioplasty technique described by Pascal and Le Louarn [28]. Sculpturing of the flanks,

costal margins and midline supraumbilical area is then performed by both superficial and deep suctioning as necessary. Deep suctioning of the remaining abdominal flap is subsequently undertaken to achieve appropriate thinning and discontinuous undermining (fig.1). Following the markings, the skin incision is made and cephalad dissection is easily achieved, with minimal blood loss at the level of the honeycomb layer produced by deflation liposuction (fig. 2). The umbilicus is circumcised and the infraumbilical flap split in the midline. Supraumbilical undermining can then be undertaken, creating a narrow tunnel from the umbilicus to the xyphoid. This tunnel is widened enough to accommodate the extent of planned plication, restricted usually to the area of diastasis. Undermining can be extended laterally over the medial 1/3 of the rectus muscles, when further plication is needed, avoiding injury to the vascular perforators which are invariably lateral to this set boundary (fig. 3). Wider undermining than the degree of diastasis in the subxyphoid area is rarely needed because the midline plication is restricted by the fixed costal margins. Only midline plication is performed (fig. 3). Occasionally it is extended beyond the margins of the diastasis, particularly in the periumbilical area in order to achieve proper abdominal wall tension and better waist line definition. The two "tuxedo flaps" created by incising the infraumbilical skin flap in the midline together with the abdominal flap are advanced distally and anchored temporarily to the mons pubis in the midline. The neoumbilcus position is then determined and resection of the "tuxedo flaps" is performed after exertion of an inferomedial pull as described for the "rising-sun-technique" abdominoplasty, recently describedin detail by other authors, approximating the skin from lateral to medial [6]. Skin closure is acheived in layers, by placing strong absorbable sutures, approximating scarpa's fascia to achieve adequate flap advancement and support. Further refining liposculpture is performed at this stage to achieve better lateral rectus border and supraumbilical midline groove definition. Additional liposculpture of the perincisional area, lateral incisional edges and flanks is then performed as required.

Evolution of the technique and patients

The sculpture abdominolasty technique evolved from standard W abdominoplasty in quantum increments over more than 10 years. The first attempt of limited supraumbilical undermining and abdominal flap advancement with discontinuous undermining by tunneling we have performed using urethral dilators was in a patient with a large right subcostal cholecystectomy scar., The technique was Subsequently extended to high risk smoker and obese patients. With time, the

urethral dilators were substituted by standard large metallic suction canulas, followed by liposuction canulas without performing any suctioning. Discontinuous undermining by tunneling was then applied to all abdominoplasty patients. Liposuction of the flanks and costal margins in conjunction with abdominoplasty was adopted first, soon extended to sculpturing the supraumbilical area. Liposuction of lateral dog ears and of peri-incisional step-transitions rapidly became a standard step in the refinement of the abdominoplasty technique and was coupled with liposculpturing of areas other than the abdomen in many patients. Sharp undermining with electrocautery of the infraumbilical flap by leaving a thin layer of fat and intact deep fascia over the abdominal wall was recently abandoned. Total deflation of the area was instead performed by liposuction, markedly improving the ease with which the infraumbilical area could be dissected and ressected. There were few major clinically relevant complications All through this long technical evolution period. Only one seroma, two hematomas requiring drainage and one minimal infraumbilical skin necrosis associated with a hematoma were described, occurring in a heavy smoker patient and healed by secondary intention. Scar revision under local anesthesia was subsequently performed. Suction drains for 24 hrs were placed in all patients. All patients had compression garments post-operatively, ambulated the same day of the surgery, at the latest the following morning. All patients were fitted perioperatively with elastic stockings, but antithrombotic prophylaxis was given only to obese high risk patients or whenever abdominoplasty was associated with other procedures requiring prolonged anesthesia time more than 2.5-3 hrs. Over the last 6 months the final modifications of the procedure were applied in 8 patients satisfactorily with no incidence of skin necrosis and seroma formation, achieving optimal abdominal wall sculpturing and rejuvenation. One patient had a large subcostal cholecystectomy scar. In Another patient, the procedure was coupled with a circular lower body lift. The same principle of liposculpturing and discontinuous undermining was coupled with a fleur-de-lys abdominoplasty in a patient with multiple abdominal scars.

DISCUSSION

In the pursuit of elevating our craft to an art form, we are charged with achieving excellence in aesthetic results for our patients, while maintainingand increasing the safety level [10]. Unfortunately, classic abdominoplasty may be responsible for the most severe complications encountered in the field of aesthetic surgery [29]. Proper understanding and assessment of these complications is necessary for

proper design of surgical steps to reduce or even eliminate these complications [29]. Although inconspicuous scars and a high rate of patient satisfaction are reported with the classical procedure, the complication rate associated with this kind of surgery is considerable [7]. An occurrence of minor complications of 32 percent and an overall revision rate of 43 percent are reported. In smokers without additional risk factors a complication rate as high as 52 percent is reported [7]. Complications are primarily related to wound healing including hematomas, seromas, skin sloughing, infection, and wound dehiscence almost always involving the abdominal skin below the new umbilicus [7]. Unfortunately, ischemia of the abdominal flap and subsequent wound healing problems are inherent to the operative procedure itself and not associated with technical errors or surgical failure [7].

Good appreciation of the blood supply of the abdominal wall is critical for safe abdominoplasty. Blood supply of the abdominal wall is divided into three zones: zone I, in the midabdomen supplied by the deep epigastric arcade; zone II, in the lower abdomen supplied by the external iliac artery; and zone III, consisting of the flanks and lateral abdomen supplied by intercostal, subcostal, and lumbar arteries. Classic abdominoplasty sacrifices the blood supply in zones I and II, leaving the flap perfused by perforators in zone III and from collateral flow from the superficial circumflex iliac artery in zone II [8,30,31]. Based on these vascular zones, the abdomen is divided anatomically into low- and high-risk areas for suctioning [11,18]. With the classical abdominoplasty, the central flap is rendered "least safe" [7,10,18,32]; ironically, this is often the region that requires the most contouring from an esthetic standpoint [10]. Although with the classical abdominoplasty a certain hypoperfusion of zone I is assumed, results of quantitative assessment of perfusion are alarming [7]. Reduction of skin perfusion in the infraumbilical area is 68 % to 95 % when compared with the perfusion of surrounding skin not undermined and uninvolved in surgery. This substantial compromise of the abdominal flap circulation probably reflects the division of the dominant vessels including the musculocutaneous perforators from the epigastric artery, the superficial epigastric, superficial circumflex iliac and external pudendal arteries. Moreover, unavoidable tension on wound closure and eventual thinning of the abdominal flap might accentuate the ischemia and precipitate skin necrosis [7]. Fortunately, although a significant perfusion deficit of zone I occurs invariably in all patients subjected to classic abdominoplasty, only a minority develop ischemia-related complications with skin slough and wound dehiscence [7]. Apparently, even a substantial perioperative ischemia does not necessarily predispose to wound healing problems during the

postoperative course [7]. Absence of ischemia-related complications in patients with critically low perfusion indices indicates a postoperative recovery of ischemic skin areas. Whether or not this recovery is a result of compensatory vasodilation caused by systemically released transmitters during the period of maximal ischemia obviously remains speculative [7].

For combination therapy to be predictably safe, either the liposuction or the flap undermining should be limited [9]. Safe zones for liposuction in combination with standard abdominoplasty are lateral and superior, whereas it is suggested that the central medial flap should be suctioned with caution [8] if not at all. When liposuction is necessary, it has been recommended that the superficial fat compartment be avoided and that one stays below Scarpa's fascia to limit vascular compromise and contour irregularities [8]. No increase in complications has been reported following limited lipoaspiration beyond the epigastric and mesogastric areas combined with transverse abdominoplasty [33]. Some have even reported reduced rate of complications with more extensive liposuction throughout these areas [2,24,34]. The key step to this lower complication rate is limited midline undermining of the abdominal flap thereby preserving lateral intercostal artery perforators [2] in addition to the epigastric system perforators. In fact, SAL achieves discontinuous undermining of the abdominal flap creating a more mobile flap that can be easily closed with less suture line tension, simultaneously maintaining vascular perforators and preserving flap perfusion [2]. Moreover, It is claimed that the application of tumescent technique and use of small blunt-tipped cannulas over the past decade has further improved liposuction safety [2]. Tumescent infiltration with epinephrine solution reduces blood vessel caliber and decreases vascular and lymphatic damage during the liposuction procedure [2]. It is reported that tumescent technique produces little lymphatic injury among patients compared with a 50 % rate of injury in patients who were operated on using the dry technique [2].

Despite the study investigating the effect of liposuction on perforator vessels by color and spectral ultrasound, demonstrating that one half of the perforators that were detected preoperatively could not be detected postoperatively both at 2 weeks and 3 months, concluding that the decrease in number of perforators was neither progressive nor reversible and was attributed to the direct repetitive trauma caused by movement of the cannula and continuous negative pressure [35,36], and despite the report that neither ultrasound-assisted liposuction nor conventional liposuction is less damaging to perforator vessels of the

lower abdominal wall [35,37], it has been demonstrated by other investigators that liposuction does not damage most of the perforating vessels [35,38]. In fact, liposuction dissects between free fibrous neurovascular mesenteries, preserving most perforators during the process of fat removal, creating a more pliable sliding flap. [2,39,40]. In a study on cadavers, where histologic examination of abdominal perforator vessels was performed after liposuction, Teimourian et al [41] concluded that these vessels remained intact. It was also reported following endoscopic observation that perforators remain intact during liposuction [35,39]. It seems also that initial superficial liposuction with thin cannulas in the subdermal plane, followed by an extended liposuction to all adipose layers in a massive way (MALL liposuction) may be less traumatic to subcutaneous tissues than traditional liposuction and ultrasound- assisted liposuction due to the use of small cannulas with increasing diameters [35,42].

Several reports confirm that extended dissection of the abdominal flap is not obligatory and that similar results can be obtained using limited undermining [7,9]. Discontinuous undermining technique by dissection of the supraumbilical abdominal flap using liposuction with minimal undermining of the supraumbilical midline in situations where abdominal plication needs to be performed are sufficient and result in adequate flap mobility while maintaining adequate abdominal flap perfusion by preserving arterial perforators [43]. The utility of this abdominal flap mobilization technique has been confirmed by several authors [7,13,18,32]. It has been also demonstrated that selective dissection and preservation of one or more perforator vessels from the superior epigastric artery may eventually change the blood supply of the abdominal flap from a random pattern into an axial pattern blood supply, thereby improving skin perfusion in zone I [7,44]. There are on the average 6 perforating vessels per rectus muscle located in medial and lateral rows [35,45]. By limiting supraumbilical midline undermining to the medial third of both rectus muscles, which is amply adequate for good abdominal wall plication, at least one or more big perforators can be easily preserved while achieving good flap mobility [46]. In a recent experimental study, viability of the majority of the abdominal skin of the rat was assured on the basis of a single musculocutaneous perforator vessel [46]. This confirms the clinical experience with the deep inferior epigastric perforator flap [7,44]. It is well established now that selective direct undermining and discontinuous lateral undermining preserve abundant zone III (lateral) and a number of zone I (superior epigastric) perforators. Moreover, with liberal liposuction of the abdominoplasty flap, the “turgor” of the flap is decompressed, allowing more flap mobility and inferior

transposition. The resulting increased laxity in the flap, in conjunction with umbilical "anchoring" of the flap ultimately results in the ability to position the final transverse suture line further inferiorly under minimal or no tension in the suprapubic region [10].

One of the most frequent post abdominoplasty complications that continues to be a frustrating problem for both surgeons and patients [12] is seroma formation [16,47,48,49]. The latter is considered an early, local, and relatively minor complication. Its incidence after abdominoplasty varies enormously as reported in the literature with an accepted standard of 10 percent [16,47,48,49].Being considered as a minor complication, seroma formation is probably underestimated in retrospective studies probably due to the fact that the listed information may be incomplete on some of the patient's files [49]. The etiology englobes many probable mechanisms, such as vascular and lymphatic channel disruption, dead space formation and the presence of shearing forces between the flap and fascia caused by movement of two raw surfaces against each other coupled with the release of inflammatory mediators [16,21,23,50,51]. It has been found that both an elevated body mass index and an large dead space increase the risk of seroma formation [12,23,50,52,53]. The latter is usually a self-limited phenomenon that can occasionally cause significant problems. The presence of a liquid collection between the abdominal wall and the flap increases the pressure transmitted to the flap, iniatting wound dehiscence and flap necrosis [8,16,25]. It can be also contaminated, predisposing to infection. Rare secondary effects such as chronic liquid accumulation with pseudocyst formation and systemic inflammatory response syndrome have also been reported [16,54]. Fluid collections greater than 20 cc may induce capsular formation and a consequent secondary deformity of the abdominal wall [49]. An extensive operation is necessary to correct such complication [49].

The best treatment of seroma seems to be its prevention [16,48]. An effective preventive method should be able to maintain lymphatic integrity, seal lymphatic and vascular tissue channels, minimize and obliterate dead spaces, provide strength to the overlying skin flap, decrease shearing forces, promote wound healing with an uneventful recovery, and treat the high-risk patient in a conservative fashion [16,48,50,55]. Multiple preventive measures have been proposed, such as avoidance of electrocautery, long-term distant exit drains, pressure dressings, sclerotherapy, endoscopic techniques, fibrin glue, and internal fixation techniques [16,48,55]. More recently, urethane surgical adhesive was shown to be effective in preventing the formation of seroma in a canine abdominoplasty model. Importantly,

the low tissue reactivity and nontoxic degradation products of this material may make it potentially safe and useful in the clinical setting [48]. Unfortunately, none of the proposed techniques, alone or in combination, has proved to be completely effective and free of complications [16,48,55].

It has been suggested that lymphatic effusions and seromas may be avoided by preserving the large lymphatic vessels due to specific undermining in three well defined zones [50]. Lower abdominal incision reaching the rectus abdominis fascia is to be avoided. Superficial undermining above Scarpa's facia is performed in the area above the pubis preserving the deeply located lymphatic trunks [2,5,29]. Undermining in the hypogastric area should be beneath the superficial fascia and parallel to the aponeurosis of the rectus abdominal muscles, leaving a thin trellis of tissues containing the lymphatic trunks. Limited pre-aponeurotic undermining is performed in the epigastric area at the level of the aponeurosis in order to avoid damaging to the lymphatic vessels, keeping them within the flap [5,29]. Use of the electric cutting current is to be avoided as well since it increases the risk of seroma formation [31,56]. The method described for dealing with the infraumbilical tissue excess with extensive liposuction theoretically precludes the necessity for undermining whether with a scalpel or with the cutting electric current while preserving the vascular and lymphatic network. On the other hand, specific zone undermining, as suggested, would leave a thick layer of fat over the infraumbilical abdominal wall which may result in residual unwarranted fullness in this area as well ashinder abdominal wall plication. This can be totally avoided by performing extensive liposuction and lower abdominal flap deflation.

The use of closed suction drains in surgery to prevent seroma formation is a standard practice and is believed to be effective; yet, seromas still frequently occur [8,23,25,51]. Seromas usually develop between postoperative days 10 and 20 [54] it is thus difficult to understand how the use of drains in the first 48 hours could reduce seroma formation [49]. Drains used in the early postoperative period are effective for preventing hematoma but not seroma formation [49]. Internal fixation techniques consisting of placing sutures at periodic intervals attaching the undersurface of the adipose tissue of the abdominal flap to the anterior surface of the underlying muscular fascia [8,16,57] have also been considered in closing dead space. Anecdotal evidence exists suggesting that these sutures may reduce seroma formation in abdominoplasty as well as after latissimus dorsi muscle and musculocutaneous flap elevation [23,49]. Mladick [58] was

the first author to briefly refer to them in the literature but not in the context of aesthetic abdominoplasty. One of the first authors to describe this fixation in abdominoplasty was Hamra [59]. He raised four parallel lines of continuous suture, thereby obliterating the dead space [60]. Baroudi and Ferreira [61,62] described more extensively the attachment of the abdominal flap to the aponeurosis with sutures, referring to them as "quilting sutures", in combination with suction drains to prevent seroma formation, reduce the dead space as well as the shearing forces. Other authors followed with good clinical results [49]. Pollock and Pollock [57,63] renamed this technique as "progressive tension sutures" (PTS) because it also allows tension-free advancement of the abdominal flap in a proximal to distal direction [16]. Moderate traction is needed on each suture in order to descend the abdominal flap and decrease the supra-pubic tension [5]. In fact the PTS technique and principles are different than the simple "quilting" sutures, that are only meant to eliminate any dead space [21,61] representing only one of the intended benefits of PTS [21]. The PTS technique also achieves broad distribution of wound tension along the entire abdominal flap rather than concentration of tension along the abdominal incision and reduces the effect of shear forces on the healing of two raw surfaces by suture fixation [21]. Variations of this technique have also been described with lesser points, even with a single continuous suture, which would have the advantage of saving tying time [60]. With high superior tension abdominoplaty, para-umbilical sutures between the abdominal flap and the aponeurosis are placed in such a way to exert more tension on the upper supraumbilical portion of the abdominal flap, further reducing tension on the advanced lower portion to the hypogastric area [5]. It has been claimed that PTS, either as originally described [8,57] or using only one midline row of PTS [21], is a relatively simple technique that can be used to prevent the development of seromas and local wound complications in abdominoplasty [21]. Fewer sutures, however, have not been effective in reducing dead space and decreasing sufficiently abdominal flap mobility postoperatively [23]. A minimum of efficient sutures should be used [5]. On the other hand, undesired tension on continuous sutures can be applied to the fat layer and cause tissue ischemia and fat necrosis. Patient movement can also loosen the tension in one end and strangle the opposite side [60]. Although quilting sutures are important to consider in closing dead space and appear to be an efficient technique with which seroma formationcan be prevented [49], it seems that drains, internal fixing sutures, or both have the same clinical incidence of seroma , overall complication rate, and aesthetic outcome [16,23]. It is rather the patient selection which is the most important factor in protecting against seroma formation

[12,50,]. In a study concerning seroma outcome in patients who underwent abdominoplasty and/or liposuction of the flanks, it was found that although obesity increased the risk of seroma, liposuction did not. [12,50,]. Nevertheless, the best prevention of seroma formation remains minimizing dead space and avoiding wide undermining as can be achieved by the described sculpture abdominoplasty technique.

Multiple techniques are described to address the musculoaponeurotic layer during abdominoplasty. The classic Pitanguy technique plicates the fascia in the midline [1,4]. Some surgeons consider plication of the anterior rectus sheath as being aimed uniquely to correct the diastasis, advocating lateral plication of the external oblique aponeurosis, or elevation and advancement of the external oblique muscles for patients with rectus diastasis and poor waistline definition or those who present rectus diastasis secondary to pregnancy and do not have adequate tension of the lateral and infraumbilical areas of the myoaponeurotic layer becoming evident by persistent laxity after midline plication [54]. H-shaped, T-shaped and two vertically oriented fusiform plications have also been described [1]. Transverse plication of the rectus sheath with bilateral crescent-shaped plications of the external oblique fascia has also been described as a better option to achieve a more youthful appearance of the abdomen [1]. Others, however, performwider plication of the aponeurosis than the area of diastasis during abdominoplasty. It is claimed that this may lead to tension on the aponeurotic tissue and may promote suture dehiscence, ultimately leading to diastasis recurrence [54]. This claim, however, does not seem to be well founded. In our technique we do plicate at the level of the umbilicus wider than the area of diastasis whenever indicated to achieve better waist line definition. Further definition is also achieved by the medial advancement of the abdominal flaps as advocated by the W abdominoplasty design in addition to liposculpture.

Key to prevention of postoperative wound healing problems is avoidance of tension along the suture line, especially along the medial flap portion [6]. The grid/staple technique is designed to minimize problems with excessive tension, asymmetry, and scar placement [64]. It allows the redundant tissue to be resected from side to side without having been first elevated as a flap. Little or no lateral undermining is required. Undermining is performed only centrally to permit diastasis recti repair [64]. If more tissue can be safely removed compared to what was originally estimated, it is stapled and marked as before and the additional tissue is ressected [64]. PTS is certainly

another method to achieve a relatively tension free closure [21]. High-lateral-tension abdominoplasty described by Lockwood [9] has the same objective. The key principle that differentiates the Lockwood technique from the traditional approach, based on the principle that abdominal laxity occurs primarily in the midline and therefore the maximum resection of the abdominal flap should occur centrally [9], is to shift more of the skin resection from the central region to the lateral region [8,9]. It also limits direct undermining and preserves blood supply to the abdominal wall flap emphasizing extensive discontinuous undermining thus enabling surgeons to use liposuction more liberally in conjunction with abdominoplasty [8,9,24,65]. This technique is mostly useful for those patients with excess skin at the lateral abdomen, lateral hip and thigh, pubis in addition to the anteromedial thighs [8]. However, contrary to the method we are describing, it results in a longer scar extending more laterally. Shorter scars may be achieved with the W-technique of Regnault [66] which shifts the maximum resection and subsequent wound closure tension from the midline to the outer border of the mons pubis [9].despite being a step in the right direction, the central third of the incision was still responsible for the majority of wound closure tension [9]. Combining the W incision with discontinuous undermining and contouring by extensive abdominal flap liposuction as we are describing allows skin closure with minimal or without any tension since abdominal flap tension is not required as for classic abdominoplasty to achieve optimal contour. The technique effectively minimizes tension in the medial third of the incision, shifts skin flaps medially to optimize flank contouring, shortens the scar by approximating the skin in a medial direction ,avoiding dog ears as well as tension at the lateral thirds of the incision, the hallmark of the lateral tension abdominoplasty [9]. On skin closure, only minimal tension is exerted at the inferior points of the W on either side of the mons in the inguinal area which are elevated to achieve a more undulating and harmonious scar free of tension except at these two points. Any residual fat laterally or even at the level of the closed incision as well as exaggerated skin pleating due to medial gathering can be effectively corrected by superficial liposuction, further contributing to skin retraction. This manoeuver eliminates the need for subcutaneous trimming of flap margins with scissors in particular along the lateral edges of the abdominal wound to remove any residual subcutaneous adipose tissue, correct dog ears, and allow skin shrinkage as advocated by some [6].

Though Pulmonary embolism (PE) is considered as an important and sometimes catastrophic complication of surgery that causes significant morbidities and deaths every year, few studies have focused on its

occurrence in plastic surgery [67]. A recent survey conducted on 334 plastic surgeons outlined that combined operations of abdominoplasty with liposuction had the greatest incidences of deep vein thrombosis/ pulmonary embolism (DVT/PE: 12.6% of cases), even when surgeons adopted a correct DVT prophylaxis for their patients (preoperative and postoperative mechanical elastic stockings and low-molecular-weight heparin) [67,68]. A recent emerging concept, supported by the American Society of Plastic Surgeons, stated that the amount of fat removed during surgery is an important risk factor for the occurrence of DVT/PE. Indeed, large volume liposuctions have an increased risk for serious complications when combined with abdominoplasty [67]. The duration of surgery is also an important factor for the occurrence of PE [67]. In one recently reported study, the incidence of PE in patients undergoing abdominoplasty with flank liposuction was 2.9%, even when a correct prophylaxis was adopted, all occurring after great resections (> 1500g) that lasted more than 140 minutes. The Results of this study would suggest that patients prone to develop PE could be identified preoperatively by an estimation of the amount of fat to be removed as well as from the duration of surgery [67]. Total fat removed = fat resected with abdominoplasty + fat aspirated (fat aspirated with liposuction is 30% of the total fluid aspirated and adipose tissue density is 0.95 g/ml [67]). With the technique we are describing, most of the fat is rapidly aspirated first with a 4 mm canula, then with a larger canula from the infra umbilical area. Liposculpture is performed in other aspirated areas with a 4 mm canula. Only skin flaps with minimal fat residual are excised. A Safe aspiration volume would therefore be 5 l, largely enough for most abdominoplasties and the surgical time rarely exceeds 2 ½ hours. However, our experience with this technique is relatively recent involving a small number of patients, thus we cannot at present comment about the incidence of DVT and PE.

CONCLUSION

Abdominal contouring is a result of the shape dictated by the underlying muscles, the overlying adipose layer, and the skin. The youthful abdominal contour is not flat or board-like. Instead it shows the contour of the underlying muscle layer [1]. The visible fullness of the rectus muscle is separated by a midline depression. A contour depression is present at the top of the rectus muscles and the lateral muscles of the abdominal wall in addition to a roundness in the lower part of the abdomen around the umbilicus [1].

It must be remembered that the abdominoplasty should be always individualized [64] and that the keys to advances in both abdominoplasty esthetics and safety when combined with liposuction have been careful patient selection and careful and selective undermining of the abdominoplasty flap [10]. With this in mind, there are no limitations to performing full abdominoplasty even with liposuction of the abdomen with previous scarring, as long as certain technical aspects are considered. First, the midline abdominal flap undermining should only be extended laterally to allow the plication of the musculoaponeurotic tissues [69]. A narrow tunnel is the key point to protect the perforating epigastric vessels and cautious undermining preserving the perforator vessels above the umbilicus is the safeguard for having a viable flap and prevention of segmental necrosis [9,25,19,11]. Theoretically, limited undermining at the epigastric region eventuates less damage to intercostal nerves and preserves better sensation at hypogastric areas. [11,70]

It has been reported that the combined abdominoplasty/liposuction procedure has less dissatisfaction and revision rates than the classic abdominoplasty with either transverse or W-pattern incisions [2]. In 2006, the most recent survey of 497 surgeons revealed that 56 percent of surgeons perform some sort of liposuction with a full abdominoplasty [2]. Differing from the classic abdominoplasty with wide undermining to the costal margins, the abdominoplasty with broad lateral subcostal perforator preservation allows liberal flap contouring with suction. With this technique, liposuction can be safely used in abdominoplasty to maximize esthetic outcomes [10]. When the two procedures are combined, the results are counterintuitive to current dogma. A reduction in overall complications was observed when liposuction was combined with abdominoplasties compared with traditional abdominoplasties. This may be attributable to limited undermining from the midline and thus greater preservation of flap vasculature [2]. It must be also mentioned that liposuction of the abdominal wall and/or flanks is followed by breast enlargement in a significant number of patients (40 percent), a risk that is significantly higher when compared with patients who had undergone the classic abdominoplasty [71]. It is thought that extensive liposuction of the abdominal wall may result in reduced production of circulating 5α-reduced androgens, which results in a relative increase in the estrogento- androgen ratio. Breast tissue growth is said to be influenced by this ratio [71].the later is a largely unrecognized but not necessarily an unpleasant side effect [71].

The sculpture abdominoplasty technique we are describing is a logical summation of various surgical steps addressing each of the goals set and proven to be effective by various authors. Extensive liposuction of the flap to be excised has been demonstrated to eliminate the necessity of more laborious sharp excision associated with blood loss. It preserves the lymphatics in brachioplasty avoiding lymphedema and seroma formation [72]. The W abdominoplasty helps to redistribute tension favorably, avoids lateral dog ears, achieves better flank contour, and limits scar length [66]. Discontinuous undermining was demonstrated to allow adequate flap advancement while eliminating the need for wide undermining of the abdominal flap with all its associated complications from creation of a dead space for potential fluid accumulation as well as jeopardizing blood supply of the abdominal flap [9,43]. It allows at the same time safe liposculpturing for better aesthetic results [10]. Wide lipoaspiration at the time of abdominoplasty and removal of the flanks and epigastric fullness result in a shorter incision line and more natural-looking abdomen [11]. Moreover, sharp defatting of the flap at the neo-umbilical position in the sub-Scarpa's plane, combined with further suction lipectomy in the region in addition to anchoring the para-umbilical abdominal flap to the aponeurosis result in a more pleasing periumbilical concavity [10] as well as reduce hypogastric tension, though we believe that anchoring in a similar way to high superior tension abdominoplaty is not necessary. Certainly, liposuction combined with abdominoplasty maintaining lateral vascular perforators can be a winning combination "in the battle between beauty and blood supply" [10,73].

The Sculpture abdominoplasty technique evolved over more than 15 years by added increments to reach its final stage, the one we are presenting in this report. However, though theoretically possible, this technique may be applicable with difficulty in type C abdominal deformity in which congenital rectus diastasis could require undermining of both rectus muscles exposing the posterior recti sheaths for proper plication and correction of the rectus diastasis [54]. We believe that when all the various surgical steps and maneuvers of which the technique is composed are combined together, the art of abdominoplasty can be taken to a higher state of safety and aesthetic excellence. Similar to comparable techniques, sculpture abdominoplasty provides a more harmonious silhouette in addition to the contouring properties of liposuction, and it reduces the rate of local complications (such as seroma, skin necrosis, and hematomas) since the abdominal flap is only partially detached by the blunt dissection of the cannulae, theoretically preserving the lymphatic and perforater vessels [27]. The added complete deflating by liposuction of the

infraumbilical area aids in more lymphatic preservation and affords easier excision of the infrumbilical skin. A limitation of this study is the small sample size. Certainly a controlled prospective study needs to be conducted to validate what we have already observed empirically and larger series would be helpful for obtaining more accurate conclusions regarding the efficacy and safety of sculpture abdominoplasty.

REFERENCES:

1- Yousif NJ, Lifchez SD, Nguyen HH (2004) Transverse Rectus Sheath Plication in Abdominoplasty. Plast Reconstr Surg 114:778-784.

2- Heller JB, Teng E, Knoll BI, Persing J (2008) Outcome Analysis of Combined Lipoabdominoplasty versus Conventional Abdominoplasty. Plast Reconstr Surg 121: 1821-1829.

3- Kelly HA (1899) report of gynecologic diseases (excessive growth of fat). Johns Hopkins Med J 10:197-201.

4- Pitanguy I (1967) Abdominal lipectomy: An approach to it through analysis of 300 consecutive cases. Plast Reconstr Surg 40:384-391.

5- Le Louarn C , Pascal JF (2000) High Superior Tension Abdominoplasty. Aesth Plast Surg 24:375–381.

6- Momeni A, Heier M, Bannasch H, Torio-Padron N, Stark GB (2008) The "Rising-Sun-Technique" in Abdominoplasty. Ann Plast Surg 60: 343–348

7- Mayr M, Holm C, Ho¨fter E, Becker A, Pfeiffer U, Mühlbauer W (2004). Effects of aesthetic abdominoplasty on abdominal wall perfusion: a quantitative analysis. Plast Reconstr Surg. 114:1586 –1594.

8- Friedland JA, Maffi TR (2008) MOC-PSSM CME Article: Abdominoplasty. Plast. Reconstr. Surg. 121: 1-11

9- Lockwood, T (1995) High-lateral-tension abdominoplasty with superficial fascial system suspension. Plast Reconstr Surg 96: 603-615.

10- Kolker AR (2008) Improving Esthetics and Safety in Abdominoplasty With Broad Lateral Subcostal Perforator Preservation and Contouring With Liposuction. Ann Plast Surg 60: 491–497.

11- Hafezi F, Nouhi A (2006) Safe Abdominoplasty With Extensive Liposuctioning Ann Plast Surg 57:149–153.

12- Kim J, Stevenson TR (2006) Abdominoplasty, liposuction of the flanks, and obesity: Analyzing risk factors for seroma formation. Plast Reconstr Surg 117:773-779.

13- Matarasso A (1991) Abdominolipoplasty: A system of classification and treatment for combined abdominoplasty and suctionassisted lipectomy. Aesthetic Plast Surg 15: 111-121.

14- Vogt PA (1989) Abdominal lipoplasty techniques. Clin Plast Surg 16: 279-288.

15- Clayton DN, Clayton JN, Lindley TS, Clayton JL (1989) Large volume lipoplasty. Clin Plast Surg 16:305-312.

16- Andrades P, Prado A, Danilla S, Guerra C, Benitez S, Sepulveda S, Sciarraffia C, De Carolis V (2007) Progressive Tension Sutures in the Prevention of Postabdominoplasty Seroma: A Prospective, Randomized, Double-Blind Clinical Trial. Plast. Reconstr. Surg. 120: 935-946

17- Neaman KC, Hansen JE (2007) Analysis of Complications From Abdominoplasty A Review of 206 Cases at a University Hospital. Ann Plast Surg 58:292–298

18- Matarasso A (1995) Liposuction as an adjunct to a full abdominoplasty. Plast Reconstr Surg 95:829–836.

19- Saldanha OR, De Souza Pinto EB, Mattos WN Jr, Pazetti CE, Bello EML, Rojas Y, Santos MRD, de Carvalho ACO, Filho ORS (2003) Lipoabdominoplasty with selective and safe undermining. Aesthetic Plast Surg 27:322–327.

20- Matarasso A (2000) Abdominal dermolipectomies: Early postoperative complications and long-term unfavorable results (Discussion). Plast. Reconstr. Surg. 106: 1619-1623.

21- Khan S, Teotia SS, Mullis WF, Jacobs WE, Beasley ME, Smith KL, Eaves FF III, Finical SJ, Watterson PA (2006) Do Progressive Tension Sutures Really Decrease Complications in Abdominoplasty? Ann Plast Surg 56: 14–21

22- Rogliani M, Silvi E, Labardi L, Maggiulli F, Cervelli V (2006) Obese and Nonobese Patients Complications of Abdominoplasty. Ann Plast Surg 57: 336–338

23- McCarthy C, Lenox P, Germann E, Clugston P (2005) Use of abdominal quilting sutures for seroma prevention in TRAM flap reconstruction: A prospective, controlled trial. Ann Plast Surg 54: 361-364.

24- Lockwood T (1993) Lower body lift with superficial fascial system suspension. Plast Reconstr Surg 92: 1112-1122.

25- Saldanha OR, Pinto EB, Matos WN, Lucon RL, Magalha˜es F, Bello E´ ML (2001) Lipoabdominoplasty without undermining. Aesthetic Surg J 21:518-526

26- Graf R, Reis de Araujo LR, Rippel R, Neto LG, Pace DT, Cruz GA (2006) Lipoabdominoplasty: liposuction with reduced undermining and traditional abdominal skin flap resection. Aesthetic Plast Surg 30:1– 8.

27- Saldanha OR,(2004) Lipoabdominoplasty: Saldanha's technique. International Abstracts of Plastic and Reconstructive Surgery. Plast Reconstr Surg 113:126e.

28- Pascal JF, Le Louarn C (2005) Brachioplasty. Aesthetic Plast Surg 29:423-429.

29- Le Louarn C, Pascal JF, Levet Y, Searle A, Thion A (2004) Complications des abdominoplasties Abdominoplastic complications. Ann Chir Plast Esthet 49 :601–604.
30- Huger WE Jr (1979) The anatomic rationale for abdominal lipectomy. Am Surg 45: 612-617.
31- Persichetti P, Simone P, Scuderi N (2005) Anchor-Line Abdominoplasty: A Comprehensive Approach to Abdominal Wall Reconstruction and Body Contouring. Plast Reconstr Surg 116: 289-294.
32- Matarasso A (2000) Liposuction as an adjunct to full abdominoplasty revisited. Plast Reconstr Surg 106:1197–1206.
33- Chaouat M, Levan P, Lalanne B, BUISSON T , NICOLAU P, MIMOUN M, MATARASSO A (2000) Abdominal dermolipectomies: Early postoperative complications and longterm unfavorable results. Plast Reconstr Surg 106: 1614-1623.
34- Hensel JM, Lehman JA Jr, Tantri MP, Parker MG, Wagner DS, Topham NS (2001) An outcome analysis and satisfaction survey of 199 consecutive abdominoplasties. Ann Plast Surg 46:357-363.
35- Salgarello M, Barone-Adesi L, Cina A , Farallo E (2005) The Effect of Liposuction on Inferior Epigastric Perforator Vessels A Prospective Study With Color Doppler Sonography. Ann Plast Surg 55:346–351.
36- Inceoglu S, Ozdemir H (1997) Investigation of the effect of liposuction on the perforator vessels using color Doppler ultrasonography. Eur J Plast Surg 38–42.
37- Blondeel PN, Derks D, Roche N, Van Landuyt KH, Monstrey SJ (2003) The effect of ultrasound-assisted liposuction and conventional liposuction on the perforator vessels in the lower abdominal wall. Br J Plast Surg. 2003;56:266 –271.
38- Emeri JF, Krupp S, Doerfl J (1993) Is a free or pedicled TRAM safe after liposuction? Plast Reconstr Surg 92:1198.
39- Teimourian B, Kroll S (1984) Subcutaneous endoscopy in suction lipectomy. Plast Reconstr Surg 74: 708-711.
40- Ozcan G, Shenaq S, Baldwin B, Spira M (1991) The trauma of suction-assisted lipectomy cannula on flap circulation in rats. Plast Reconstr Surg 88: 250-258.
41- Teimourian B, Adham MN, Gulin S, Shapiro C (1983) Suction lipectomy: a review of 200 patients over a six year period and a study of the technique in cadavers. Ann Plast Surg 11:93–98.
42- Fodor PB (1995) Wetting solutions in aspirative lipoplasty: a plea for safety in liposuction. Aesthetic Plast Surg 19:379-380.

43- Illouz YGA (1992) a new safe and aesthetic approach to abdominoplasty. Aesthetic Plast Surg 16:237-245.
44- Craigie, JE, Allen RJ, DellaCroce FJ, Sullivan SK (2003) Autogenous breast reconstruction with the deep inferior epigastric perforator flap. Clin Plast Surg 30:359-369.
45- Carramenha e Costa MA, Carriquiry C, Vasconez LO, Grotting JC, Herrera RH, Windle BH (1987) An anatomic study of the venous drainage of the transverse rectus abdominis musculocutaneous flap. Plast Reconstr Surg 79:208 –217.
46- Oksar HS, Coskunfirat OK, Ozgentas HE (2001) peforator-based flap in rats: A new experimental model. Plast Reconstr Surg 108:125-131 .
47- Zimman OA, Butto CD, Ahualli PE (2001) Frequency of seroma in abdominal lipectomies. Plast Reconstr Surg 108: 1449-1451.
48- Gilbert TW, Badylak SF, Gusenoff J , Beckman EJ, Clower DM, Daly P Jr, Rubin P (2008) Lysine-Derived Urethane Surgical Adhesive Prevents Seroma Formation in a Canine Abdominoplasty Model. Plast Reconstr Surg 122: 95-102
49- Nahas FX, LM Ferreira, Ghelfond C (2007) Does Quilting Suture Prevent Seroma in Abdominoplasty? Plast. Reconstr. Surg. 119: 1060-1066.
50- Shermak MA, Rotellini-Coltvet LA, Chang D (2008) Seroma Development following Body Contouring Surgery for Massive Weight Loss: Patient Risk Factors and Treatment Strategies. Plast Reconstr Surg 122: 280-288.
51- Chang DW, Wang BG, Robb GL,Reece GP, Miller MJ, Evans GRD, Langstein HN, Kroll SS (2000) Effect of obesity on flap and donor-site complications in free transverse rectus abdominis myocutaneous flap breast reconstruction. Plast Reconstr Surg 105:1640 –1648.
52- Arthurs ZM, Cuadrado D, Sohn V (2007) Post-bariatric panniculectomy: Pre-panniculectomy body mass index impacts the complication profile. Am J Surg 193:567-570.
53- Kuroi K, Shimozuma, Taguchi T (2006) Evidence-based risk factors for seroma formation in breast surgery. Jpn J Clin Oncol. 36:197-206.
54- Nahas FX (2001) An Aesthetic Classification of the Abdomen Based on the Myoaponeurotic Layer. Plast Reconstr Surg 108:1787-1795.
55- Iglesias M, Bravo L, Chavez-Mun˜oz C, Barajas-Olivas A (2006) Endoscopic Abdominoplasty An Alternative Approach. Ann Plast Surg 57:489–494.

56- Porter KA, O'Connor S, Rimm E, Lopez M (1998) Electrocautery as a factor in seroma formation following mastectomy. Am J Surg 176:8-11.
57- Pollock H, Pollock T (2000) Progressive tension sutures: A technique to reduce local complications in abdominoplasty. Plast Reconstr Surg 105: 2583-2586.
58- Mladick R (2001) Progressive tension sutures to reduce complications in abdominoplasty. Plast Reconstr Surg 107: 619 .
59- Hamra ST (1999) Circumferential body lift. Aesthetic Surg. J. 9: 244-251.
60- Dini GM, Ferreira LM (2007) Fat Necrosis and Dermolipectomy. Plast Reconstr Surg 119:1970-1971.
61- Baroudi R, Ferreira CA (1996) Contouring the hip and the abdomen. Clin Plast Surg 23:551-572.
62- Baroudi R, Ferreira A (1998) Seroma: How to avoid it and how to treat it. Aesthetic Surg J 18:439-441.
63- Pollock H, Pollock T (2004) Progressive tension sutures in abdominoplasty. Clin Plast Surg 31:583-589 .
64- Pechter EA (2006) The Grid/Staple Adjunct to Abdominoplasty. Plast Reconstr Surg 118: 1624-1630.
65- Teitelbaum S (2006) Demystifying high-lateral-tension abdominoplasty. Aesthetic Surg J 26: 325-329.
66- Regnault P (1975) Abdominoplasty by the W technique. Plast Reconstr Surg 55:265-274.
67- Gravante G, Araco A, Sorge R, Araco F, Nicoli F, Caruso R, Langiano N, Cervelli V (2008) Pulmonary Embolism After Combined Abdominoplasty and Flank Liposuction. A Correlation With the Amount of Fat Removed. Ann Plast Surg 60: 604–608
68- Broughton G II, Rios JL, Rohrich RJ, Brown SA (2007) Deep venous thrombosis prophylaxis practice and treatment strategies among plastic surgeons: survey results. Plast Reconstr Surg 119:157–174.
69- El-Khatib HA, Bener A (2004) Abdominal Dermolipectomy in an Abdomen with Pre-Existing Scars: A Different Concept. Plast Reconstr Surg. 114: 992-997.
70- Brauman D (2003) Liposuction abdominoplasty: an evolving concept. Plast Reconstr Surg 112:288 –298.
71- van der Lei B, Halbesma G, Van Nieuwenhoven CA, van Wingerden JJ (2007) Spontaneous Breast Enlargement following Liposuction of the Abdominal Wall: Does a Link Exist? Plast Reconstr Surg 119: 1584-1589.
72- Aly A, Soliman S, Cram A (2008) Brachioplasty in the massive weight loss patient. Clin Plast Surg 35:141-147

73- Heppe H (2001) Combined liposuction with abdominoplasty. Plast Reconstr Surg 108:577–578.

Fig. 1: Identical preoperative surgical planning in a patient with no abdominal scars (A) and in another patient with a right oblique cholecystectomy scar (arrow) (B).
Zone A: Liposculpture and narrow midline tunnel undermining
Zone B: Deep liposuction and intermittent tunneling undermining
Zone C: Superficial and deep liposculpture
Zone D: Complete fat deflating by liposuction

Fig. 2: (A,B,C) Complete deflation of infraumbilical flap. (D) Midline liposculpture of the supraumbilical area.

Fig. 3: (A,B) Elevated deflated infraumbilical skin flap.

Fig. 4: (A) Narrow midline supraumbilical tunnel. (B) "Tuxedo flaps" created by splitting the infraumbilical skin flap in the midline (arrows) with intermittent tunneling undermining of cephalad abdominal flap. (C) Completed midline placation leaving minimal residual dead space.

Fig. 5: Patient with cholecystectomy scar. (A,B) preoperative, (C,D) early result at 1 week demonstration full flap survival, (E,F) postoperative result at 4 weeks with residual edema of abdominal flap.