Five and a Half Years’ Experience With the Avelar Lipoabdominoplasty Procedure: Analysis of Complication Rates

Quita Lopez, MD
ORIGINAL ARTICLE

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Introduction: The Avelar lipoabdominoplasty procedure has been described in the literature as a safe procedure with fewer complications than traditional abdominoplasty because of limited upper abdominal dissection, which spares the superior neurovascular bundles along with the lymphatics. In the author’s published article in 2008, 80 patient charts were evaluated retrospectively, and the complication rates were compared with other studies presented in the literature. The purpose of this study is to compare the complication rates of the first 2 years to the subsequent 3½ years since the procedure was adopted. The Avelar mini-lipoabdominoplasty procedures were also reviewed, and the complication rates were compared with those of the full Avelar procedures.

Materials and Methods: A retrospective review was performed of records of patients who underwent a full or mini-Avelar lipoabdominoplasty procedure from July 1, 2007 to December 31, 2010.

Results: A total of 89 patient charts were reviewed. There were 73 full lipoabdominoplasty and 16 mini-lipoabdominoplasty procedures performed by the author. The mean age of the patients was 42 years; 46% had general anesthesia and 54% had conscious sedation. In the 89 patients who underwent both types of procedures, there was 1 case of skin necrosis (1.1% incidence compared with a 3.7% incidence the first 2 years), 4 seromas (4.5% incidence compared with 12.5% incidence in the original study), and no deep venous thromboses or hematomas. For the full lipoabdominoplasty procedures, the skin necrosis rate was 1.4% compared with 3.9% in the 2008 study, and the seroma rate was 5.5% compared with 13.0%. There were 9 small skin dehiscences (10% incidence), and there were 4 postoperative infections (4.5% incidence). The mini-lipoabdominoplasties had none of these complications.

Conclusions: The complication rates have decreased in the subsequent 3½ years compared with the first 2 years. This is probably due to increased surgeon experience, not operating on smokers in the second part of the study, and using the Erchonia EML (Erchonia Medical Inc, Mesa, Ariz) on all patients pre- and postoperatively. The rates were lower than those reported for traditional abdominoplasties. There were none of the above complications for the mini-abdominoplasties using the Avelar technique.

Abdominoplasty is a common procedure for abdominal contouring. Since Avelar described his technique of combining liposuction with lipectomy and avoiding large upper flap undermining, the complication rates for the procedure have been shown to be lower than with traditional abdominoplasty. Lipoabdominoplasty and Avelar abdominoplasty are terms that are often used synonymously by some surgeons. There have been subtle variations on the technique described by various surgeons. A common theme among all is liposuction along with limited dissection in the upper abdomen and sometimes lower abdomen when a mini versions are performed. The Avelar lipoabdominoplasty technique is becoming more popular among surgeons who do abdominal contouring procedures. It is possible to salvage at least 80% of the blood supply to the abdomen. Graf et al showed that 60% of the perforators were preserved with a modified technique that involved limited upper flap dissection with full en bloc dissection of the lower flap where there was transection of the inferior epigastric and external iliac vessels. The size and flow rate are increased in the remaining vessels due to hypoxic stimulation. This is a technique that the author employs with patients with larger body mass index (BMI) who have a large inferior pannus. Patients with smaller BMIs...
have only the dermis excised, salvaging most of the blood supply along with the lymphatics and nerves.

With the mini-lipoabdominoplasty procedure, liposuction is performed in the deep and superficial layers, and the excess skin in the lower abdomen is excised just below the dermis. There is usually no dissection of the lower flap except when lower diastasis is present. The midline is then dissected up to the umbilicus to allow plication for correction of a diastasis. The umbilicus is not transposed; hence, a small amount of dead space is created, and there is the preservation of an even greater amount of blood supply, nerves, and lymphatics; this probably accounted for there being no complications in the parameters studied.

Methods

A retrospective review of medical charts was performed between July 2007 and December 2010. There were 73 full Avelar lipoabdominoplasties and 16 mini-lipoabdominoplasties performed. All of the patients were women. The mean age was 42 years, with a range from 21 to 72 years. The average BMI was 28.6 kg/m² (range, 20–41 kg/m²). The mean BMI for patients undergoing mini-lipoabdominoplasty was 25.8 kg/m² (range, 20–31 kg/m²). Forty-four patients had liposuction of other body parts along with the abdominoplasty, and 14 patients had concomitant breast surgery. This included implant placement, implant with simultaneous lift, or just mastopexy. Fat grafting to the face was done in 9 patients, and 5 had simultaneous fat grafting to the buttocks. One patient had a labioplasty procedure at the same time, and another had a brachioplasty procedure. Hence, all of the patients undergoing mini-lipoabdominoplasty had other procedures performed. The overall incidence of concomitant procedures was 75%. All surgery was performed in an accredited office surgery center.

Surgical Technique

The patient was marked preoperatively, and tumescent anesthesia consisting of 0.05% lidocaine was used. In a liter of normal saline, 0.8 mg of 1:1000 epinephrine and 10 mg of 8.4% bicarbonate were also placed. Forty-six percent of the patients had general anesthesia and 54% had conscious sedation. In the original study, 41% had general anesthesia and 59% had conscious sedation. The Erchonia EML Laser (Erchonia Medical Inc, Mesa, Ariz) was used during infiltration to facilitate liquefaction of fat prior to liposuction. The Mangubat disruptor was also used before liposuction was initiated. Liposuction was performed below and above Scarpa’s fascia in the upper abdomen to allow sliding of the flap. Liposuction is also performed aggressively in the lower flap, and Scarpa fascia is usually not well preserved in the author’s opinion. Patients with larger BMIs who have significant fat in the lower flap had an en bloc dissection of the lower abdomen and drain placement horizontally in the lower abdomen. Here, the inferior epigastric and external iliac vessels, which are zone 1 and 11 vessels as described by Huger,5 are transected, and there is also injury to the lymphatics in this region. The excess skin is then measured and marked, and it is tested before excision by pulling together with Koeker clamps. The excess skin is excised, the umbilicus is released, and the stalk is tagged. The vertical midline is also released up to the xyphoid process if needed. This vertical tunnel is mostly limited to the internal borders of the rectus abdominal muscles. A Saldanha retractor is placed in the midline, and the author has made more aggressive releases in the latter 3½ years to better plicate the superior fascia for better correction of a diastasis defect. The retractor stretches the midline and allows for better visualization of the fascia. The vessels will be located more laterally on stretched-out abdominal muscles; hence, a larger tunnel can be dissected safely. Fat is resected in the lower midline to expose the fascia, and it is plicated if needed. The incision is closed in 2 or 3 layers, and the umbilicus is transposed. A Jackson-Pratt drain is placed horizontally in patients with full-thickness excision of the lower flap. Activated platelet-rich plasma (PRP; Harvest Technologies, Plymouth, Mass) is sprayed in the flap prior to closure and along the incision after closure. PRP has been shown in the literature to promote wound healing.6-11 All patients wear pneumatic compression stockings if they have general anesthesia, and they also have their knees flexed during surgery. All patients wear knee-high compression hose for 14 days, and Lovenox (Aventis Pharmaceuticals Inc, Bridgewater, NJ) is given to high-risk patients for 3 days. Compression garments are worn for a minimum of 2 weeks.

The mini-lipoabdominoplasty procedure is similar, but the umbilicus is not translocated, and there is almost no dissection of the lower flap. Only the midline is dissected up to the umbilicus if plication is needed for lower diastasis repair. Drains are not placed in these procedures.

Prior to performing the skin excision, liposuction is performed in the other areas, usually the flanks. As
Table 1. Postoperative Complication Rates (%)

<table>
<thead>
<tr>
<th></th>
<th>Skin Necrosis</th>
<th>Seromas</th>
<th>Deep Venous Thromboses</th>
<th>Hematomas</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 study (n = 77)</td>
<td>3.9</td>
<td>13.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Current study (n = 73)</td>
<td>1.4</td>
<td>5.5</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

noted, 50% of the patients had liposuction of other areas done in addition to the Avelar lipoabdominoplasty. All of the mini-lipoabdominoplasty patients had additional liposuction for improved body contouring. Patients undergoing other procedures had those procedures performed prior to the abdominoplasty, except for fat grafting to the face, which was done last.

Results

In the original study, the author performed a retrospective review of the charts between June 2005 and June 2007. There were 80 patients, with 77 having full lipoabdominoplasties and 3 having mini-lipoabdominoplasties. The mean age of the patients was 44 years (range, 24–76 years). The average BMI was 30.1 kg/m² (range, 20–42 kg/m²). There was an overall 3.7% skin necrosis rate, and the full lipoabdominoplasties had a 3.9% rate, which was lower than most studies found in the literature (range, 1.2–20%). In the second part of the study, the overall rate decreased to 1.1% and to 1.4% for the full lipoabdominoplasties (Table 1). This occurred despite more aggressive release of the stromal structures in the midline to allow for better fascial plication. No smokers were operated on in the second study.

The overall seroma rate decreased from 12.5% to 4.5%. The full lipoabdominoplasty rate decreased from 13.0% to 5.5% (Table 1). The decreased rate probably reflects better selection of patients who need drain placement. With full-thickness excision of the lower flap, the lymphatic tracks in this area are usually damaged along with the lower part of zone 1 and zone 2 vessels. Hence, the author now places drains routinely in these patients. The Erchonia 635-nm low-level laser was also used on all patients postoperatively in the second series. Most patients were not treated with the low-level laser in the 2008 study. Only patients in the last 2 months of the first study were treated, which amounted to about 12 of 80. The low-level laser has been shown to enhance wound healing and increase vascularization after surgery. PRP on his abdominoplasty procedures and showed less seroma formation, and drains were used for a shorter amount of time. PRP was used on most patients in the first and second study.

There were no deep venous thromboses or hematomas in either series (Table 1). There was an overall 4.5% infection rate and 10% dehiscence rate in the second series. Most of the infections were minor and were treated with oral antibiotics, and all dehiscences were small. Please see Figures 1 to 9 for before and after photos.

Discussion

The lipoabdominoplasty procedure as described by Avelar has been shown to be safe and have decreased complications compared with traditional abdominoplasty procedures. Avelar started performing these procedures in 1998 after doing cadaver studies and research for 10 years. In his studies, he found that liposuction below Scarpa’s fascia allowed sliding of the superior flap and that the neurovascular bundles were able to be preserved because of limited dissection. He

Figure 1. Sixty-year-old patient (height: 150 cm; weight: 84 kg) had liposuction of waist and hips with an Avelar abdominoplasty (side view).
measured the length of the preserved vessels and found them to stretch 4 times their length. Fat above Scarpa’s fascia was retained to maintain a uniform thickness and avoid irregularities. He also closed Scarpa’s fascia to avoid indentations and decrease the tension on the scar. Initially, the excess skin was removed suprapubically and in the inframammary region. The fascia was not plicated in his original studies. Avelar later modified his procedure and plicated in the midline and transposed the umbilicus. Liposuction has allowed the surgeon to improve patient contouring along with salvaging the neurovascular bundles and lymphatics. This allows the flap to be closed without the usual undermining up to the costal margins. Saldanha et al showed that the upper flap was undermined only 30% compared with standard abdominoplasties. In their article, Brauman and Capocci discussed skin-retaining ligaments, which caused skin creases on patients in the upper abdomen. They felt that these were vertical layers of fascia that attach the skin to the deep fascia and make the downward advancement more difficult. The skin will usually retract back later, making the result less aesthetically pleasing. They used scissors or blunt dissection in lateral tunnels to release the ligaments selectively. With their experience, they were able to preserve the perforators while releasing the ligaments. The authors also felt the release of the skin-retaining ligaments decreased the tension on the skin incision, which is a cause of flap necrosis. They showed a 1.7% necrosis rate in their series of 337 patients (Table 2).
Samra et al\textsuperscript{19} compared complication rates in 161 patients who underwent a lipoabdominoplasty \((n = 93)\) versus a traditional abdominoplasty \((n = 68)\). They found the lipoabdominoplasty had a complication rate of 4.30\% compared with 11.76\% \((P = .126)\). These were what they called perfusion-related complications, including skin necrosis, wound infection, and wound dehiscence. In the patients who were at high risk, which included smokers and patients with significant upper abdominal scars, the complication rates were not statistically significant.

There are numerous studies in the literature in which wound healing, postoperative pain, and inflammation are improved with the low-level laser.\textsuperscript{16,20-22,25,26} Bensadoun and Nair\textsuperscript{23} performed a meta-analysis on 33 relevant articles, which showed that low-level laser therapy reduced the risk of oral mucositis (relative risk, 2.45). Treatment also reduced the severity of oral mucositis and decreased the duration to 4.38 days. This was clinically significant \((P < .0009)\). The authors concluded that there was moderate-to-strong evidence in favor of low-level laser therapy for treating cancer therapy–induced oral mucositis. It was well tolerated and relatively inexpensive.

The author’s decreased skin necrosis rate during the second study probably reflects the use of the low-level laser, which has shown to improve flap survival by 50\% in rats. Tenehaus et al\textsuperscript{24} produced random-pattern skin flaps on mice. Since the low-level laser at 635 nm is known to increase mitochondrial activity and adenosine triphosphate production in cells, it was used to treat half the animals. Perfusion was measured by laser Doppler before and after surgery. Mean flap loss was 25\% in the nontreated group and 9\% in the treated group. There was more than a 50\% reduction in ischemia or apoptosis in the zone of stasis in the low-level laser–treated group. This was statistically
significant ($P < .01$). The perfusion measured at the distal flap showed an upregulation at day 4, which was statistically significant between the tested group and control group ($P < .05$). There was about a 50% increase in blood perfusion in the group treated with the low-level laser.

No smokers were operated on in the second series. The mini-lipoabdominoplasty maintains the most blood supply; hence, there were no cases with skin necrosis.

Overall seroma rates decreased from 12.5% to 4.5%, and full lipoabdominoplasty rates decreased from 13% to 5.5% (Table 1). Modification of Avelar's original technique involving en bloc dissection of the lower flap causes more dead space formation and injury to the inferior vessels and lymphatics. Huger\(^5\) noted that the lymphatic drainage follows the vascular blood supply pretty closely. When a full-thickness excision is performed, there is routine placement of drains in the lower abdomen. The Avelar mini-lipoabdominoplasty procedures have limited dissection and almost no injury to the vessels and lymphatics. There were no seromas in the 16 cases the author performed. In summary, the potential mechanisms for a decreased seroma rate in the second series is probably due to avoiding injury to the upper and lower abdominal lymphatic vessels. When the lymphatics are injured during an en bloc dissection in patients with larger BMIs, drains are now placed routinely until the serous output is less than 30 mL/24 h. Reducing the exposed rectus fascia and having a fat-to-fat interface during closure of the flap might also help. Eliminating the amount of dead space is also a factor. The use of PRP in the lower flap has been shown by Jackson\(^15\) to decrease seroma formation. The low-level laser\(^10,11,13\) has been shown to improve wound healing. This might also have contributed to the decreased rate, but more studies are needed to confirm this.

There were no deep venous thromboses or hematomas in either series (Table 1). This is probably in part due to the use of the tumescent solution that contains epinephrine, which causes vasoconstriction, and to the use of compression garments after surgery, along with meticulous dissection and careful control of bleeding. Patients also ambulate the evening of surgery and are mobile and wear compression stockings. Lovenox prophylaxis is also given to high-risk patients.

Table 3 is a statistical analysis of the complication rates between the 2 studies. Even though they are not statistically significant to the $P > .05$ level, there is a trend toward decreased rates. Having a higher sample size might have shown statistical significance.

Please review Table 2 for complication rates published by different authors on the abdominoplasty procedure.

<table>
<thead>
<tr>
<th>Table 2. Complication Rates (%) as Reported in the Literature</th>
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<tbody>
<tr>
<td><strong>Skin Necrosis</strong></td>
</tr>
<tr>
<td>Lonergan and Mangubat(^17) ($n = 67$)*</td>
</tr>
<tr>
<td>Rodriguez and Borsand(^18) ($n = 100$)*</td>
</tr>
<tr>
<td>Saldanha et al(^3) ($n = 445$)*</td>
</tr>
<tr>
<td>Brauman and Capocci,(^16) ($n = 337$)(\dagger)</td>
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<tr>
<td>Current study ($n = 150$)*</td>
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*Lipoabdominoplasty performed.
\(\dagger\)Lipoabdominoplasty with selective release of skin-retaining ligaments.

<table>
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<tr>
<th>Table 3. Results of the $z$ Test Comparing the Complication Rates in the Current Study to the Complication Rates in the 2008 Study*</th>
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<tbody>
<tr>
<td><strong>Complication</strong></td>
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</tr>
<tr>
<td>All</td>
</tr>
<tr>
<td>Skin necrosis</td>
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<tr>
<td>Seromas</td>
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*Statistical analysis of the complication rates from the 2 studies showed that the complication rates between the 2 studies were not statistically significant to the $P > .05$ level, but there was a trend for decreased rates in the current study.
Conclusion

The Avelar lipoabdominoplasty has been shown to be a safe and effective procedure for treating skin laxity and localized adiposity and for correcting diastasis recti. In the author’s first published study, she showed a decreased complication rate compared with traditional abdominoplasty procedures reported in the literature. Comparing a similar case number in the subsequent 3½ years showed a further decrease in complication rates, probably due to the author’s increased experience with the procedure and the use of PRP and the low-level laser to increase skin perfusion after surgery.

Mini-lipoabdominoplasty procedures using the Avelar technique were performed with other concomitant procedures for better body sculpting, and there were no noted complications in this series. The author opines that most blood supply is spared since there is very little undermining with the procedure. The additional procedures performed on these patients did not increase the complication rates.

References


24. Tennhaus M, Bhavsar D. Efficacy of LLLT for reduction in TNF alpha, cellular apoptosis, and tissue necrosis following induction of a partial thickness burn and ischemic skin flap. Photonics in Dermatology and Plastic Surgery Meeting and SPIE Symposium on Biomedical Optics; 2008; San Jose, Calif.
