The recent increase in the demand for gluteal augmentation in the United States is likely a result of changing demographics, improvement in body contouring techniques, and an evolution of aesthetic preferences and fashion norms. This article describes techniques that are more appropriate than gluteal implants for massive weight loss (MWL) and other lower body lift patients. These procedures are designed to conform with current patient preferences, as well as ideal gluteal aesthetics described elsewhere in this volume. MWL and aesthetic lower body lift patients have major deformities in the region of the buttocks. The results obtained with autologous tissue in combination with the circumferential body lift (CBL) cannot match those typical of gluteal augmentation in patients who are not overweight and have little skin excess. Nevertheless, the gluteal aesthetics can be significantly enhanced by using autologous tissue in the massive weight loss and aesthetic patient undergoing CBL.

As one ages, anatomic changes occur in the gluteal region that contribute to platypygia. Several changes may coexist, including accumulation of subcutaneous adipose tissue around the gluteal region, loss of adipose volume in the buttock, postmenopausal accumulation of intra-abdominal fat coupled with rectus diastasis, skin laxity and buttock ptosis, increased hip width, and lengthening of the infragluteal fold [1–3]. All of these natural changes contribute to decreased buttock projection and ptosis, and any one of them may prompt aesthetic patients to seek consultation for body contouring procedures. The CBL effectively addresses many of these concerns and is often recommended. Unfortunately, significant flattening of the buttocks can occur if aggressive lifting is performed to improve contour of the thighs and buttocks. Any pre-existing platypygia that is worsened by a CBL may...
erode satisfaction among both aesthetic and MWL body lift patients (Fig. 1).

MWL patients are another group greatly affected by platypygia. Weight loss secondary to diet and exercise or gastric bypass surgery often occurs in an uneven manner. Data suggest that certain areas of adipose tissue on the body are more resistant to weight loss than others [4]. The genetic programming of the resistant adipocytes differs from more responsive areas, which may mean that genetics influence different somatotypes, or body types. Following weight loss, the “Apple” somatotype seems to have less adipose tissue in the gluteal region, while the “Pear” tends to retain more tissue in the gluteal region. Regardless of body type, however, many MWL patients tend to lose volume in the gluteal region.

Massive weight loss patients also develop skeletal changes that may contribute to platypygia (Fig. 2). Morbid obesity is by definition a restrictive lung disease. It also has an obstructive component that is more pronounced in the supine position. Expiratory flow limitation in the supine position may lead to pulmonary hyperinflation and intrinsic positive end-expiratory pressure (PEEP). This is thought to play a role in the positional orthopnea reported by obese patients [5,6]. Over time, the thoracic skeleton expands in obese patients to accommodate the increased need for functional reserve capacity and to accommodate hyperinflation. Thoracic kyphosis secondary to thoracic spine compression and anterior inclination of the pelvis also occur [7]. Inadequately treated post–gastric bypass hypocalcemia and vitamin D malabsorption, secondary hypoparathyroidism, and independent negative bone remodeling modulated by either sex hormone alterations or serum telopeptides may also worsen these weight-related skeletal alterations [8]. These changes appear to be permanent and tend to exacerbate any preexisting primary or secondary platypygia caused by loss of adipose tissue in the gluteal region.

Fig. 1. Gluteal flattening effect of a circumferential body lift. (A, B, C) This 46-year-old woman had typical gluteal deformities following massive weight loss. Her preoperative photos illustrate preexisting platypygia. (D, E, F) The postoperative views demonstrate how buttocks lifting can exacerbate this platypygia. In addition, the straight incision makes her buttocks appear shorter, more square, and masculine after her CBL.
Evolution of techniques

As the author’s clinical experience with the various forms of alloplastic and autologous gluteal augmentation grew, it became apparent that gluteal implant designs have limitations, especially in the context of MWL patients and cosmetic treatment of pronounced platypygia. In addition, whether gluteal augmentation with implants will be widely accepted in the United States remains in doubt because the types of implants available here are limited to silicone elastomer, and complications are not uncommon. Despite this fact, augmentation with implants is still applicable in certain subsets of carefully selected and well-informed patients. Implant augmentation can be very successful in enhancing gluteal aesthetics, but the complication rates limit their widespread adoption and reduce patient satisfaction. Consistent problems with implant augmentation procedures inspired my interest in and development of autologous techniques for gluteal augmentation.

The severe nature of skeletal deformities, skin laxity, and platypygia encountered in MWL patients was the natural place to start. MWL patients, with their significant skin excess and buttock ptosis, are not ideal candidates for alloplastic augmentation in any of the three accepted planes: subfascial, intramuscular, or submuscular. Combining excision with the complications associated with augmentation procedures, especially infection, could be catastrophic [9–13]. Similarly, autologous fat transfer is not an ideal option for these patients. They must be repositioned several times during and after surgery, including the supine position. Lying on transferred fat may decrease the overall survival of the transfer, although no data definitively address this issue. Furthermore, the wisdom of combining extensive liposuction with excisional procedures in this nutritionally compromised population is debatable. Excisional procedures (such as CBL) are often characterized by a higher than average rate of minor complications such as delayed wound healing [14–23].

The fact that gluteal implantation in conjunction with posterior excisional procedures seemed imprudent—along with growing experience with the well-vascularized tissue encountered in the posterior portion of a CBL—led to a review of the literature. Depithelialized flaps have been used in gluteal contouring for some time [24–26]. Published references to the use of autologous tissue in preventing gluteal deformities with CBL were also reported, although they lacked significant detail and did not substantiate their potential for augmentation [27,28]. Descriptions of the superior gluteal artery, inferior gluteal artery, and transverse lumbosacral back flaps and their vascular supplies also bolstered the clinical viability of using autologous tissue flaps for enhancing gluteal volume [29].

The natural evolution of what was learned in the literature review combined with experience in alloplastic augmentation led to the concept of using available, well-vascularized autologous tissue in the buttock region. Instead of discarding this existing tissue, it could be molded into the shape of an

Fig. 2. Skeletal deformities encountered in MWL patients include a “barrel chest” from long-term expansion of the rib cage (A), pelvic rotation (B), and kyphosis (C).
implant and inset beneath the skin flaps of a CBL. Three autologous flap designs emerged over time. The first flap design, called an Island AGA Flap, simulated the round, non-anatomic design of submuscular gluteal implants (Fig. 3). This flap produces good results (Figs. 4 and 5), but long-term augmentation was modest with the Island flap.

Some drawbacks of the Island flap led to the evolution of a second flap design, the Propeller AGA Flap (Fig. 6). Other reasons for developing this design included the need to address the postsacral pain reported by MWL patients owing to a paucity of sacral tissue while also recruiting additional tissue for augmentation purposes as suggested by Pascal and Le Louarn [27]. However, the Propeller flap had its own disappointments: the amount of volume that could be added with this flap was minimal and the gluteal projection it did produce was located in a higher than ideal location, as shown in Fig. 7.

Although neither the Island nor the Propeller flaps could be considered complete failures, the aesthetic results were less than optimal and the amount of volume they delivered was insufficient to overcome the gluteal flatness produced by a CBL in MWL patients. However, experience with these two early flap designs was valuable because it led to development of the author’s preferred technique, the Moustache AGA Flap (Fig. 8). The Moustache flap uses the back and lateral flank tissue as a partial island and partial transposition flap based on perforators from the superior gluteal artery and lumbar perforators [30]. Superior-medial transposition of the “handle-bar” portions of the Moustache flap allows recruitment of additional tissue for augmentation purposes to produce greater projection and also lower the point of maximum buttock projection to the level of the mons pubis, which is considered the aesthetic ideal. In addition, imbrication of the flap with sutures permits formation of a more anatomically shaped tissue mound that is reminiscent of anatomic gluteal implants. Because resection of tissue from the central area of the flap to allow easier insetting would likely decrease projection, the tissue volume in the central area of the flap is included to decrease symptoms and prevent lateral flap displacement. This final evolution of flap design, the Moustache flap, is currently my procedure of choice when significant, long-lasting aesthetic augmentation is desired (Figs. 9 and 10).

### Technique selection

Selection of a technique for gluteal contouring in the MWL or aesthetic patient begins by determining the status of the subcutaneous adipose tissue in the gluteal region and the surrounding areas of the

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Fig. 3. Island flap design. (A, B) The Island flap is outlined and de-epithelialized. (C) The flap dissection is beveled down through the dermis, SFS, the lumbosacral and gluteal fascia, and surrounding excess tissue is removed down to the level of the lumbosacral fascia. This creates the two dermal *islands* of tissue. (D) The superior half of each island is imbricated (dermis to SFS), and the inferior aspects of the islands are anchored to the gluteal fascia at the desired level. As the inferior CBL skin flap is elevated and advanced over the AGA flap, the overlying CBL and underlying AGA flaps are attached together with #1 Vicryl Plus quilting sutures to reduce dead space.
torso and lower extremities. A lack or an excess of subcutaneous volume serves as the starting point for technique selection. Next, the quality and laxity of the skin of the abdomen, flanks, hips, back, and buttocks, as well as the anterior, lateral, and posterior thighs are noted. The results of this physical examination are then used as a guide through the “Lower Trunk Algorithm” for body contouring presented in Fig. 11. If, based on the algorithm, a circumferential body lift is indicated and gluteal augmentation is also desirable, then an AGA flap is included as part of the CBL.

The Gluteal Augmentation Algorithm shown in Fig. 12 illustrates the preferred choices for gluteal augmentation under various conditions. In our practice, the safest results are obtained with the use of autologous tissues, either as a flap or as transferred fat. However, the Moustache flap has made supplemental procedures such as staged fat transfers or alloplastic implants almost irrelevant because of the significant augmentation achieved with this flap. The high complication rates experienced with various forms of implant augmentation have relegated these procedures to the last resort for our patients—and only for those who are well informed and compliant [31].

**Autologous flap indications**

Once AGA with CBL is chosen, selection of the appropriate flap design is the next step (Table 1). The Island AGA Flap design produces the smallest volume of tissue and consequently the least amount of augmentation. However, it is indicated for minimizing the gluteal flattening effects of a CBL in patients who have sufficient preoperative buttock projection or do not desire increased gluteal volume. This flap should be used only for patients with adequate tissue overlying the sacrum. Inadequate postsacral tissue typically elicits complaints of pain in the coccyx or sacral area when sitting, especially from MWL patients. The Island flap’s point of maximum projection usually lies slightly above the transposed level of the mons pubis, a location

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Fig. 4. Island flap results. (A, B, C) Preoperative views of a weight loss patient who wanted a CBL with an Island flap. (D, E, F) Although these postoperative views show that her scar has not completely settled and is widened in some areas, the patient is apparently able to hide them beneath a small bikini.
that is often preferred by African American and Asian women as well as male patients [31]. See the article by Roberts and colleagues elsewhere in this issue for further exploration of this topic.

The Propeller flap was originally designed for patients who had mild preoperative platypygia, those who desired modest augmentation, and those with a symptomatic paucity of postsacral tissue. The Propeller flap produces more volume than the Island flap, as well as a central bridge of tissue that can be used for "padding" the postsacral area to decrease symptoms. However, this flap’s design places the point of maximum projection significantly higher than the transposed level of the mons pubis, and the inferior pole of the buttocks looks “empty.” This flap design quickly fell out of favor in the author’s practice and has since been abandoned. For this reason, it is not shown as an option in Table 1.

The Moustache AGA Flap is the design of choice when definitive augmentation is desired. It yields the greatest amount of volume, produces superior aesthetic results, and the augmentation achieved seems to be long lasting. The flap is quite flexible in that both its height and width can be adjusted to produce the amount of volume desired by the patient. Thus, the flap can be easily “down-staged” during surgery as the clinical situation demands. It potentially addresses the symptoms of postsacral tissue deficiency by maintaining a central bridge of tissue, which also serves the purpose of maintaining appropriate flap position and reducing the risk of delayed wound healing in the central “water-shed” area of the posterior CBL incision. Because it recruits lateral trunk tissue inferio-medially, the final point of transposed maximum projection is at the level of the mons pubis, which is the most generally accepted gluteal ideal. Patients with a post–weight loss body mass index (BMI) below 25, skin laxity, buttocks ptosis, and platypygia are ideal candidates for a Moustache flap. Higher BMI patients also benefit from the Moustache flap, but the results are less aesthetically pleasing.

Regardless of the flap design chosen, the volume of the flaps described can be adjusted as required by the clinical situation and the patient’s wishes. Although larger flaps produce more augmentation, smaller ones are sometimes desired, especially if it becomes apparent that an increased margin of safety
is needed to guarantee tissue perfusion, or if a larger flap places excessive tension on the posterior CBL flaps. The only limitation to larger flap volume is the upper border of the skin marking pattern used for a CBL. All three types of flaps can be “downstaged” intraoperatively or resected if an AGA flap cannot be positioned appropriately or accommodated when the upper and lower buttock lift flaps are brought together. If there is any concern about tissue perfusion, excessive tension on the CBL closure, or inability to close the flaps over the autologous tissue mound, the autograft should be abandoned so as not to compromise the safety of the lift procedure.

**Clinical anatomy**

The integrity of superficial anatomic structures of the lateral trunk, posterior trunk, and gluteal region are most at risk of injury during the posterior portion of a CBL or buttock-flank lift. (See the article on gluteal anatomy earlier in this volume.) The iliohypogastric and ilioinguinal nerves are both branches of the L1 nerve root and originate in the sacral plexus. These nerves travel inferio-medially between the transversus abdominis and internal oblique muscles. The iliohypogastric nerve divides into lateral and anterior cutaneous branches to supply the skin above the pubis and overlying the lateral gluteal region. Circumferential body lift incisions made at or below the inguinal crease can put these nerves at risk.

The lateral cutaneous branches of the iliohypogastric and the intercostal nerves also can be entrapped laterally during a CBL. This can occur if aggressive lateral plication of the external oblique muscle is performed to enhance waist definition or if “3-point” or quilting sutures are used laterally to close “dead space.” Sensation to the gluteal region and lateral trunk has several sources: the dorsal rami of

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**Fig. 7.** (A, B, C) A massive weight loss patient who still had subcutaneous fat but not the skin and tissue wrinkling evident in the patient seen in Fig. 5. (D, E, F) After undergoing a CBL with a Propeller flap, it is evident that the point of maximum gluteal projection is much higher than ideal, the amount of augmentation is minimal, and the inferior buttocks look “empty.” These photos were taken approximately 1 month after surgery and areas of delayed wound healing are present. This may be because she was a smoker. Her incision eventually healed well.
sacral nerve roots 3 and 4, the cutaneous branches of the iliohypogastric nerve arising from the L1 root, and the superior cluneal nerves originating from the L1, L2, and L3 roots and then passing over the iliac crest. The protective cutaneous sensation transmitted by these nerves is temporarily disrupted during a CBL, with or without autoaugmentation. Patients should be counseled about the need for frequent positional changes and avoidance of heating pads and electric blankets to prevent pressure necrosis or burns.

Perfusion to the skin overlying the gluteal region is supplied by perforating branches of the superior and inferior gluteal arteries, both of which branch from the internal iliac artery. The lumbosacral region is also supplied by lumbar perforators. Some of these perforators must be sacrificed during the posterior portion of a CBL, an AGA with CBL, or a buttock-flankplasty; however, the abundant vascular supply of the gluteal region provides robust perfusion to surrounding tissue flaps [29,30,32].

The fascial anatomy of the gluteal region greatly affects the aesthetics of the aging buttock. In addition to volume loss and skin laxity, relaxation of the fascial “apron” contributes to gluteal ptosis. Resection and tightening of this superficial fascial “apron” not only improves gluteal ptosis, but also plays a significant role in the CBL procedure and AGA with CBL. This fascial apron is analogous to the superficial fascial system (SFS). Similar to the role played by the deep gluteal fascia as a strong retaining fascia in the subfascial approach to augmentation with implants, it also serves as a fixation point in AGA with CBL. The superficial apron and the deep gluteal fascia fuse and become tightly adherent to form the infragluteal fold, a structure that should not be violated because it is exceedingly difficult to re-create [2].

**Flap design and markings**

Preparing a patient for an AGA with CBL begins with the CBL markings. However, the posterior markings are placed lower than usual to allow for autologous augmentation in the lower pole of the buttock and to conform to the gluteal aesthetic units illustrated in Fig. 13 [33]. The patient should be standing for the initial flap markings. Autologous gluteal augmentation may be performed independent of a CBL but requires, at a minimum, the markings for a buttock-flank lift. The point of maximum gluteal projection is transposed from the level of the mons pubis onto the buttocks, with...
this point used to identify the center of the augmentation flap for each buttock.

The desired flap design markings begin at the most inferior resection mark in the gluteal region. This is achieved by outlining a circle that measures 11 to 15 cm so the inferior edge of the circle sits at the line denoting the most inferior extent of tissue to be resected (Fig. 3). This circle is centered from medial to lateral over each buttock. The size of the circle is determined by the preoperative gluteal dimensions, the amount of augmentation desired, and the limits of the CBL or buttock-flank lift markings. If indicated, as in the Moustache flap, a central bridge of tissue over the postsacral region is drawn to connect the two circles. The lateral portions of the flap, or “handle-bars” of the Moustache, are then drawn according to the desired width and length of the flap (Fig. 8). Starting at the lateral aspect of the circle outline, use a towel or string to determine adequate superio-medial transposition of the “handle-bars” of the Moustache flap pattern.

The marked point of maximum gluteal projection serves as a guide for final tissue flap positioning.

The patient is marked for the central portion of the resection while bending forward to simulate the tension placed on the incision when the patient is placed postoperatively in the semi-Fowler’s position [17]. This bending maneuver is important in the author’s opinion because the central fascial attachments at the spinal column are fixed and do not allow much cranio-caudad movement of the skin flaps.

When the patient is placed on the operating room table in the prone position (with adequate padding of the face, trunk, and extremities), the superior and inferior markings for the posterior portion of the CBL can then be adjusted to accommodate the autologous tissue flaps, to ensure the safety and adequacy of the resection, and to conform to gluteal aesthetics as much as possible. Once the patient is in the prone position, the markings for the superior incision in the lumbosacral area usually need to be moved

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Fig. 9. Before (A, B, C) and after (D, E, F) photos illustrate results of the Moustache flap combined with a CBL in a MWL patient who requested gluteal augmentation. The patient is less than 1-month postop, but her wound is healing well, and her gluteal volume is greatly enhanced.
inferiorly by 2 to 3 cm so the incision will form an “inverted-dart” shape that ends just above the inter-gluteal crease (Fig. 14A). This “V” shaped incision will preserve the important “sacral triangle” gluteal aesthetic unit (Fig. 14B). If preferred, this central portion of the superior marking may be left unmarked until the patient is brought into the operating room and placed in the prone position.

This “inverted dart” adaptation was developed because traditional descriptions of posterior CBL markings produce an incision—and scar—that is either aesthetically too high, violates the gluteal aesthetic units, or gives the buttock an elongated or square appearance [14, 15, 17–19, 21, 34–36]. The final placement of markings for the posterior portion of a CBL with AGA represents somewhat of a compromise. To develop a flap that adds volume in the middle and lower pole of the buttocks and does not violate the gluteal aesthetic units, the markings must be lower than traditional descriptions.

In addition to this inverted dart design, we have recently made another modification to the posterior CBL incision that creates a “sacral triangle plateau.” This modification was added because there is a possibility that the inverted dart might diminish skin perfusion. To prevent this, a well-vascularized,
de-epithelialized bed of tissue is now preserved centrally in all AGA flap designs and CBL procedures to reduce dead space in the medial area and provide perfusion to the overlying skin to enhance wound healing (Fig. 15; also see Fig. 4 in the article on gluteal anatomy earlier in this volume). Preserving this central plateau of tissue has the added benefit of increasing the soft tissue padding over the sacrum and coccyx, a lack of which can be painful for MWL patients. The sacral triangle plateau plays another role in CBL and AGA procedures by greatly enhancing aesthetic unit #3 in the posterior-anterior view and possibly the lumbosacral curvature in the lateral view for patients with soft tissue paucity in the sacral/buttock region. Results of this sacral triangle plateau modification are illustrated in Fig. 16.

Placing the inverted dart incision at the junction between several gluteal aesthetic units improves the appearance of the buttocks in the PA view, but the waist appears to be widened (Fig. 17). This problem can be overcome by performing adjunctive liposuction and avoiding aggressive plication of the rectus muscles during the abdominal component of a CBL. In contrast, a high posterior CBL incision can enhance lumbar lordosis, raise the point of maximum gluteal projection, and better define the waist in the PA view. However, this comes at the expense of a permanently elongated buttock on the PA view and an incision that may be visible above normal underwear or clothing (Fig. 18).

### Operative technique

Creation of an AGA flap begins with de-epithelialization of the flap design that has been marked. The sacral triangle plateau is also de-epithelialized and the dermis is incised. Both the Island and Moustache flaps are dissected in a beveled fashion with electrocautery down through the dermis, SFS, gluteal fascia, and lumbosacral fascia. The sacral fascia is left intact. Next, the surrounding tissue is resected as planned to complete the CBL or buttock lift, with the lateral extent of the incision resected in a “V shape.”

The portion of the inferior CBL flaps that will be centered over the buttocks are symmetrically dissected below the SFS but above the gluteal fascia down to, but not beyond, the infragluteal fold. These areas centered over the buttocks will form two pockets to hold the tissue mounds created in the AGA. At the lateral aspect of each pocket, a tissue bridge is left in place to prevent lateral displacement and postoperative malposition of the AGA flap. Drains are then placed bilaterally in the inferiormost aspect of the dissection pocket, coiled, and temporarily buried in the lateral aspects of the

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### Table 1: Indications for flap designs in AGA with CBL

<table>
<thead>
<tr>
<th>AGA Island flap</th>
<th>AGA Moustache flap</th>
<th>Sacral triangle plateau</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention of CBL flattening</td>
<td>Prevention of CBL flattening</td>
<td>Presacral pain</td>
</tr>
<tr>
<td>Normal/mild platypgia</td>
<td>Moderate/severe platypgia</td>
<td>Normal/mild platypgia</td>
</tr>
<tr>
<td>Upper pole projection desired</td>
<td>Mons pubis level projection desired</td>
<td>Absent lumbosacral curve??</td>
</tr>
<tr>
<td>African American, Asian, and male patients</td>
<td>All ethnic groups and both sexes</td>
<td>All ethnic groups</td>
</tr>
<tr>
<td>Normal postsacral tissue without symptoms</td>
<td>Postsacral tissue deficit with symptoms</td>
<td>Postsacral tissue deficit with symptoms</td>
</tr>
</tbody>
</table>

**Abbreviations:** AGA, autologous gluteal augmentation; CBL, circumferential body lift.
wound. The lateral “V-shaped” extent of the incision is temporarily closed with staples bilaterally.

A Moustache flap essentially incorporates an Island flap with the “handle-bars” wrapped around it. To create the island portion of a Moustache flap or an Island flap alone, the superior portion of each flap is imbricated from the 9:00 to the 3:00 positions with #1 Vicryl Plus suture from the dermis to the SFS to form a rounded mound of tissue that will improve buttock projection. If a Moustache flap is being performed, the “handle-bar” extensions of the Moustache are dissected from the posterior thoracic fascia until superior-medial rotation reaches the medial extent of each half of the flap. The dermis of the “handle-bar” is anchored to the dermis of the medial extent of the flap and to the gluteal fascia superio-medially. Next, the Moustache flap is imbricated from the dermis to the SFS from the 4:00 position to the 1:00 position. The central oblique line that results from the superiomedical rotation of the “handle-bar” is then imbricated to itself from dermis to dermis to form a well-shaped anatomical autologous tissue mound that will increase projection and add fullness to the lower pole of the buttock.

Both AGA flaps are anchored inferio-medially to the most caudal aspect of the pocket from the dermis to the intact gluteal fascia with 1 to 3 #1 Vicryl Plus sutures. As the inferior CBL skin flap is advanced over the AGA flap, the overlying CBL and underlying

![Fig. 13. Ideal gluteal aesthetics include eight aesthetic units that should be incorporated into the planning of a CBL, especially with autologous augmentation. The eight units are two symmetrical “flank” units (1 and 2), one “sacral triangle” unit (3), two symmetrical buttock units (4 and 5), one infragluteal “diamond” unit (6), and two symmetrical thigh units (7 and 8).](image)

![Fig. 14. (A) Illustration of the low “inverted-dart” incision modification of the posterior circumferential body lift. (B) Postoperative view of a CBL patient with a well-placed inverted dart and lowered CBL incision.](image)
AGA flaps are attached together with #1 Vicryl Plus quilting sutures to reduce dead space. The CBL or buttock lift incision is temporarily closed with towel clips. Once symmetry is confirmed, the SFS is closed with #1 Vicryl Plus. The deep and superficial dermis are closed with 3-0 PDS Monocryl interrupted sutures and subcuticular sutures, respectively. The incision is dressed with Dermabond and allowed to dry. The posterior CBL incision is reinforced with a sparse row of temporary staples, which are removed in 3 to 5 days.

Complications

Complications directly related to autologous gluteal augmentation in our 21 patients who have had the procedure in association with CBL are shown in Table 2. None were major complications. The incidences do not seem to be significantly different from (and may be lower than) complications reported for CBL alone. For circumferential body lifts, the reported rates of delayed wound healing, epidermolysis or skin necrosis widely range between 0% and 77%, with overall complication rates in the range of 10% to 80% [14–23].

The robust vascularization of an AGA flap and limitation of flap dissection to no more than two contiguous angiosomes seem to provide good flap perfusion and viability. One case of minor fat necrosis among our patients likely resulted from an excessively long "handle-bar" lateral extension of the Moustache flap into the "posterior-intercostal" angiosome as described by Taylor [30]. Because this lateral extension is undermined to allow supero-medial transposition of both halves of the Moustache flap, the "two adjacent angiosomes" limitation of perforator flap perfusion may have been exceeded.

Delayed wound healing is among the most common complications following CBL, and minor delayed wound healing occurred in 24% of our 21
CBL with AGA patients. However, this frequency is similar when patients receiving CBL alone are compared with those receiving AGA with CBL. The majority of patients undergoing AGA are MWL patients, who are likely to be at greater risk for surgical complications than typical, healthy aesthetic patients. Nonetheless, the undermining of the inferior CBL flap and tension on the closure is greater when AGA is added to the CBL. This can lead to wound-healing problems especially in the central aspect of the incision, which is the “watershed” region of tissue perfusion.

Careful preoperative planning to avoid over-resection and beginning with conservatively sized flaps are helpful in preventing serious wound-healing problems, skin necrosis, and dehiscence. While this may limit the quality and aesthetics of a surgeon’s early results, significantly better outcomes can be achieved after more experience is gained.

Large, clinically significant seromas because of dead space can be reduced by putting drains in the most dependent portion of the gluteal pockets. Quilting sutures are now routinely used to further reduce dead space. Doxycycline sclerosis is the procedure of choice for managing postoperative seroma or excessive drain output in CBL patients. Tissue sealants are not currently used owing to cost considerations and the absence of convincing data regarding their effectiveness. As the collective experience with sealant products continues to accumulate, they may play a future role in the management of seromas in patients undergoing CBL with or without AGA.

Ano-rectal hypersensitivity or maceration due to overexposure of the anus has occurred in two of our patients. In both cases the problem was self-limited as the expected skin laxity relapse and skin creep occurred. Until this problem resolves, it can be
managed with topical anesthetics such as Anusol, skin protectants, “donut” cushions for sitting, frequent positional changes, a high-fiber diet, sitz baths, and “baby wipes” for cleansing the area. Patient reassurance about the temporary nature of the problem is imperative.

**Perioperative care and safety considerations**

MWL patients who undergo multiple body contouring procedures are subjected to a great deal of physiological stress and require attentive postoperative management. On average, AGA with CBL patients prefer 2 to 3 days of hospitalization. Blood loss, temperature, electrolytes, fluids, and deep vein thrombosis/pulmonary embolism (DVT/PE) prophylaxis issues are routinely monitored from the perioperative period to discharge.

Thirty minutes before anesthesia is to be administered, patients are pre-warmed with a forced-air warming blanket, intravenous prophylactic antibiotics are administered, and intermittent pneumatic compression devices are started. Every effort is made to maintain normothermia: the operating room temperature is raised to a maximum of 73°F, core temperature is carefully monitored and maintained at least to 36°C, exposed areas of the patient are minimized, intravenous and tumescent fluids (if used) are warmed to between 37° and 43°C, and body temperature is managed with “on table” as well as upper and lower body forced air warming blankets. This minimizes the impact of hypothermia on the coagulation systems while also reducing the risks of postoperative wound infections.

The patient is placed in the prone position on an operative bed covered with a full-length gel mattress. Adequate padding of the face, eyes, and peripheral nerve pressure points is confirmed to prevent injury. Hemodynamic and ventilatory stability are

**Fig. 18.** (A, B, C, D) High incision placement enhances waist definition and lateral projection at the expense of elongating the buttocks.
confirmed once the patient is in the final operative position [45,46]. Intraoperative FiO2 is increased to 80% and continued with a “non-rebreather” mask in the PACU for 2 hours postoperatively because evidence indicates that both interventions reduce the incidence of postoperative infection and nausea [41,47–49].

Routine postoperative laboratory studies include a complete blood count and basic metabolic panel, serum calcium, magnesium, and phosphate. Other studies such as glucose monitoring, total protein, albumin, and coagulation studies are performed as indicated [50]. Foley catheter placement for monitoring urine output is also routine. Prophylactic antibiotics are used for 24 hours unless grafts are in place, in which case antibiotics are continued for 5 to 7 days.

DVT/PE prophylaxis includes the use of intermittent pneumatic compression devices until discharge, with their removal for and reapplication after ambulation. Ambulation begins the morning after surgery and its necessity is stressed throughout the postoperative period. Postoperative low molecular weight heparin (such as Lovenox) or fondaparinux (Arixtra), and possibly warfarin, are used synergistically with compression devices and ambulation for patients at high risk for DVT/PE or with a history of previous DVT/PE. Most MWL patients are in a high-risk category so DVT/PE prevention must be taken seriously [51]. The dosing of these medications often needs to be adjusted for obese patients [52]. Patients are routinely typed and cross-matched if chemoprophylaxis is anticipated because transfusion rates anecdotally appear to be slightly elevated. Postoperative hematomas, while possible, are not common. A low index of suspicion should be maintained and appropriate diagnostic studies ordered when postoperative anticoagulation is used.

Gastric bypass surgery patients can be placed on a low concentrated sweets “bariatric” liquid diet once alert. Consultation with a dietician is ordered to plan a postoperative diet that will meet the needs of bariatric patients and ensure adequate protein intake to support wound healing. Attention to protein intake in a suitable form and avoidance of concentrated sweets also reduces postoperative gastrointestinal symptoms associated with an inappropriate diet. Communication with the bariatric surgeon facilitates consultation if a gastrointestinal issue becomes apparent.

Compression garments are not routinely used postoperatively. Concerns about skin perfusion and pressure necrosis over drains relegates their use to the late postoperative period. Traditional dressings have been replaced by tissue glues, such as DermaBond, to allow monitoring of skin perfusion and to reduce blistering caused by shear forces and postoperative edema. Sparse placement of reinforcing skin staples on the posterior aspect of the CBL incision seems to reduce the incidence of superficial wound dehiscence caused by excess tension because of flexed posture and postoperative edema. The staples are removed as early as the first postoperative visit, as skin tension allows, to prevent scarring.

Drains are removed once the output is less than 50 cc in 24 hours. If drainage is excessive or prolonged, sclerosis can be performed with a high-concentration doxycycline solution (500 mg in 50 cc 0.9% normal saline solution) by infusing it through the drain, clamping for 15 to 30 minutes, and then returning to suction. Before performing sclerosis, local anesthesia may be given by infusing a weight-appropriate dose of 0.5% Marcaine into the seroma cavity. Because post-procedure pain may last for 8 to 24 hours after sclerosis, oral narcotics are recommended. This procedure may need to be repeated several times before a significant reduction in drainage output is observed. The inflammatory properties of doxycycline make this concentration higher than the recommended intravenous dosage; thus, this sclerosis procedure is an “off-label” use of the medication, and patients must be informed of this status. If a seroma occurs after drain removal, the seroma cavity may be injected with doxycycline. Special precautions should be taken to ensure that the solution is not injected into the subcutaneous tissue because fat and skin necrosis may develop. Pain is usually indicative of subcutaneous infusion; if it occurs, the procedure should immediately be stopped.

### Table 2: Complications occurring in 21 patients

<table>
<thead>
<tr>
<th>Complications</th>
<th>AGA with CBL, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seroma requiring drainage</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Superficial wound dehiscence</td>
<td>3 (14)</td>
</tr>
<tr>
<td>Major wound dehiscence</td>
<td>0</td>
</tr>
<tr>
<td>Minor delayed wound healing</td>
<td>5 (24)</td>
</tr>
<tr>
<td>AGA flap malposition</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Infection</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Palpability</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Minor fat necrosis</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Major fat necrosis</td>
<td>0</td>
</tr>
<tr>
<td>Skin necrosis</td>
<td>0</td>
</tr>
<tr>
<td>Pressure sores</td>
<td>0</td>
</tr>
<tr>
<td>Temporary anal overexposure</td>
<td>2 (10)</td>
</tr>
<tr>
<td>DVT/PE</td>
<td>0</td>
</tr>
</tbody>
</table>

**Abbreviations:** AGA, autologous gluteal augmentation; CBL, circumferential body list; DVT/PE, deep vein thrombosis/pulmonary embolism.
Summary

Autologous gluteal augmentation with CBL or buttock-flank lift in the MWL or aesthetic patient is a useful adjunct in body contouring surgery. The techniques described represent an alternative to alloplastic augmentation and other less applicable autologous techniques (such as fat transfer) for improving gluteal contour in both the MWL and the aesthetic patient for whom an excisional procedure is indicated. AGA with CBL seems to achieve long-lasting correction of platypygia with an acceptable safety profile. Further refinement of these techniques, adjunctive procedures, and improved patient selection will likely lead to fewer complications and improved aesthetic outcomes.

References