

A Review: Insights of Aesthetic Refinement after Bariatric Surgery and Massive Weight Loss

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ABSTRACT

Obesity, defined as a condition with a body mass index (BMI) greater than 30 kg/m², is a global epidemic. The rates of obesity have been rising in many countries, including the United States, Australia, China, and also in our country Indonesia. Bariatric surgery has seen a rise in rates worldwide in tandem with rising obesity rates in the world. Our literature review highlights the number of bariatric surgeries performed and the various procedures like gastric sleeve, Roux-en-Y gastric bypass, and gastric banding, available for patients. Furthermore, our review provides insights how combining bariatric surgery with body contouring procedures such as abdominoplasties, thighplasties, mastopexies, and brachioplasties improves quality of life.

KEYWORDS: obesity, bariatric surgery, body contouring surgery, excessive weight loss, gastric sleeve, Roux-en-Y gastric bypass, gastric banding, liposuction, abdominoplasty, brachioplasty, thighplasty.

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INTRODUCTION

Obesity, which is defined by body mass index (BMI) greater than 30 kg/m², seems to be a global epidemic.¹ Based on data from the Indonesian Ministry of Health, one in three Indonesian adults is obese, and one in five children aged 5 to 12 years is overweight or obese. The 2018 Basic Health Research (Riskesdas) in Indonesia showed the prevalence of obesity among Indonesian adults has almost doubled from 19.1 percent in 2007 to 35.4 percent in 2018.² In comparison to other countries, obesity affects about 35% of persons in the United States, and it is projected that three-fourths of American adults is overweight or obese.³ In Australia, as of 2017, 8% of children are obese⁴ and 2 in 3 (67%) Australians aged 18 and over were overweight or obese (36% were overweight and 31% were obese) --it equals to around 12.5 million Australian adults.⁵ Data taken during 2015 to 2019 in China revealed 6.8% population of children younger than 6 years were overweight while 3.6% were obese, 11.1% population of children and adolescents aged 6–17 years were overweight while 7.9% were obese, and 34.3% of adult (≥18 years) population were overweight while 16.4% were obese.⁶ Obesity also has impact in a country's medical expenses, for example annual medical expenses of an obese person in US

is \$1,429 higher than those of a person of ordinary weight.³

BARIATRIC SURGERY

Bariatric surgery is one of the solution that overweight people seek to help them improve their weight adjustment and its rates have risen globally in tandem with rising obesity rates in the world. The total number of bariatric procedures performed worldwide in 2013 was 468,609, and 95.7 % was carried out laparoscopically. The highest number (n = 154,276) was from the USA/Canada region.⁷ The American Society for Metabolic and Bariatric Surgery (ASMBS) officially reports that there were 179,000 bariatric operations performed in 2013. Gastric sleeve (see **Figure 1**) made up 42.1% of the procedures, Roux-en-Y gastric bypass (see **Figure 2**) made up 34.2%, and gastric banding (see **Figure 3**) made up 14%, the remaining numbers were revision surgery which made up 6%, other surgery like one anastomosis gastric bypass (see **Figure 4**) and duodenal switch made up 2.7% and 1%.⁸ Due to a rising prevalence of obesity, the figure rose more than 40% in the 5 year span to 196,000 in 2015 and 252,000 in 2018, with significant shifting trend of chosen procedures that gastric sleeve became the most commonly performed bariatric

A Review: Insights of Aesthetic Refinement after Bariatric Surgery and Massive Weight Loss

surgery with its number rose to 51.7% in 2015 and 61.4%.^{8,9} The International Federation of Surgery for Obesity and Metabolic Disorders - Asia-Pacific Chapter (IFSO-APC) officially reports that there were a total of 49,553 patients underwent bariatric/metabolic surgery in 2020; this number significantly increased from 18,280 in 2010 (see Figure 5).

The same report stated sleeve gastrectomy were the popular choice in the region, accounted for 75.7% of the procedures, while Roux-en-Y gastric bypass accounted for 9.1% and one-anastomosis gastric bypass procedure (see Figure 4) accounted for 5.5%.¹⁴



Figure 1. Sleeve gastrectomy surgery.¹⁰



Figure 2. Roux-en-Y gastric bypass surgery, first introduced in 1967 by Mason and Ito.¹¹

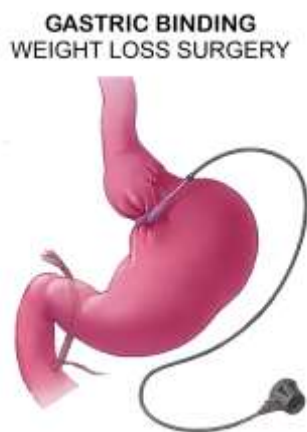


Figure 3. Gastric binding, first introduced in 1990 by Kuzmac and Yap.¹²



Figure 4. One-Anastomosis Gastric Bypass first introduced in 2004 by Carbajo and Garcia-Caballero.¹³



Figure 5. Numbers of bariatric/metabolic surgery in Asia-Pacific from 2010 (left) to 2020 (right).¹⁴

In terms of excess weight loss (EWL) among the most common bariatric surgeries, the United Kingdom National Bariatric Surgery Registry (NBSR) official report showed that one-anastomosis gastric bypass procedure produced excess weight loss at one year of 73.7% and Roux-en-Y gastric bypass produced excessive weight loss at one year of 71.3%, which compares favorably against 61.5% with sleeve gastrectomy and 38.8% with gastric banding.¹⁵

Skin appearance after bariatric surgery and massive weight loss

Major weight loss after a bariatric surgery often results in loose skin. For some people, this may lead to feelings of self-consciousness and discomfort that may be significant enough to interfere with quality of life.

The innermost layer of human skin consists of proteins, including collagen and elastin. Collagen, which makes up 80% of human dermal structure, provides firmness and strength. Elastin provides elasticity and helps skin stay tight. During weight gain, skin expands to make room for increased growth. For expansion during a certain short period of time, like a pregnancy, the expanded skin typically retracts within several months after the expansion stops. By contrast, when skin has been significantly stretched and remains that way for a long period of time, collagen and elastin fibers become damaged. As a result, they lose some of their ability to retract.¹⁶ Consequently, when someone loses a lot of weight, excess skin may hang from the body. In general, the greater the weight loss, the more pronounced the effect of loose skin. What's more, many studies reported that people who have weight loss surgery form less new collagen, and its composition is not as strong as the collagen in young, healthy skin.¹⁷⁻¹⁹

Loose skin from a massive weight loss may cause physical and emotional challenges. Excess skin may be uncomfortable and possibly interfere with normal activity. One longitudinal study found a possible increase in self-consciousness after weight loss.²⁰ While one study found that weight loss encouraged more people to exercise, excess skin was found to interfere with exercise in some people after bariatric surgery.²¹ One study found that of 124 people who requested plastic surgery to tighten skin after weight loss surgery, 44% had reported skin pain, ulcers, or infections due to the loose skin.²² Loose skin from massive weight loss may also pose negative effects on body image and mood.²³⁻²⁴

Staying well hydrated is a simple way to improve the skin appearance. One study found that women who increased their daily water intake had significant improvements in skin hydration and function.²⁵ While proper research is not currently available, many experts considered that an increase in muscle mass may help improve the appearance of loose skin. Engaging in regular strength training is one of the most effective ways to build muscle mass in both young and older adults.^{26,27}

A proper dietary program may also help improving the skin condition after weight loss. Adequate protein is vital for healthy skin. The amino acids lysine and proline play a direct role in collagen production. Another substance is collagen hydrolysate, also known as hydrolyzed collagen, it is a processed form of the collagen found in the animal connective. Although it hasn't been tested in people with loose skin related to massive weight loss, several studies suggested that collagen hydrolysate may have a protective effect on dermal collagen.²⁸ In a controlled study, skin elasticity, along with texture and hydration, increased significantly after 12 weeks of taking a liquid collagen supplement.²⁹ Vitamin C is essential for collagen synthesis,³⁰ and consuming enough amount of vitamin C provide support for collagen synthesis. Consuming omega-3 fatty acids, found in fatty fish, may also help increase skin elasticity.³¹ Many "firming" creams containing collagen and elastin claim they may give a boost to skin tightness. However, we understand that collagen and elastin molecules from the external milieu are too large to be absorbed through human skin, so logically collagen synthesis process happens from the inside out.

All the aforementioned modalities may improve skin elasticity and tightness in a certain level. For a more severe skin dysmorphism due to a massive weight loss, one may consider and seek solution in a body contouring surgery.

Combo-procedure of bariatric surgery and body contouring surgery

Published studies have shown that combining bariatric surgery with body contouring surgery improves quality of life over time.³² According to other studies, people who had body contouring after having bypass surgery had improved long-term weight control.³³

Similarly, in recent years, the combination of bariatric surgery with body contouring procedures such as abdominoplasties, thighplasties, mastopexies, and brachyoplasties increased significantly. Data in 2014 showed that, in order to rectify matters brought on by weight reduction surgery, over 45,000 individuals decided to get plastic surgery refinement. In 2014, the American Society of Plastic Surgeons (ASPS) reported significant growth (9%) in five years for thighs and upper arm lifts, abdominoplasties grew by 4% while mastopexy procedures saw an increase of 10%, marking the biggest one-year increase since the ASPS started keeping track of procedures carried out on patients who had undergone significant weight loss.³⁴

A person who loses 50% or more of their excess weight is described to have massive weight loss.³⁵ Rapid massive weight loss may leave a patient with extra skin, fat, and lack of skin elasticity, which can lead to stretch marks or striae. These individuals provide particular complications and challenges to plastic surgeons since they have major functional and aesthetic problems as a result of the excess skin. The face, breasts, and buttocks are among the body parts that aesthetic plastic surgeons and patients frequently

A Review: Insights of Aesthetic Refinement after Bariatric Surgery and Massive Weight Loss

describe as "deflated."

In the upper torso, massive weight loss can result in upper and mid-back rolls, breast droopiness or ptosis, and extra skin on

the arms. In the lower torso's mid abdomen, lower abdomen, and pubic region, a pannus or apron, as well as extra tissue in the flanks may form unpleasant body appearance.



Figure 6. Apron belly.

Additionally, excessive skin develops on the inner side of the thighs, resulting in cellulite on the thighs and hips (see **Figure 7**) and extra skin in both the vertical and horizontal directions. Patients may have intertrigo (see **Figure 8**), discomfort, or

irritation as a result of the newly developed skin folds. The majority of these complication symptoms do not respond to topical treatment.



Figure 7. Cellulite



Figure 8. Intertrigo, a skin condition that happens when folds of skin rub against each other.

Patient selection for body contouring surgery

Body contouring surgery following massive weight loss surgery is a developing subject that is constantly evolving. The needs of such patients cannot always be met by conventional methods as patients with massive weight loss

after bariatric surgery typically come with appearance problems which require more extensive surgery than non-bariatric surgery patients undergoing comparable procedures. Furthermore, plastic surgeons need to consider the possibility that patients with massive weight loss after bariatric surgery

A Review: Insights of Aesthetic Refinement after Bariatric Surgery and Massive Weight Loss

frequently have comorbid conditions like hypertension, diabetes, potential malnutrition, hygienic problems, and persistent obesity, and consequently they are more risky to experience complications.

A patient who has constant weight for at least three to six months following weight loss surgery are a suitable candidate for combo-procedure of bariatric surgery with body contouring surgery, which is ideally scheduled and performed around a year after the constant weight duration. Ideal candidates are people who come with a body mass index (BMI) less than 30 kg/m² at the time of presentation, have few or no medical concerns, do not smoke,³⁶ and have realistic expectations. Poor candidates include people with a body mass index of 35 kg/m² or more, smokers who are still actively smoking,³⁶ patients with current anticoagulant therapies, and those with excessive expectations.

Patients with massive weight loss should be mindful that their result from a body contouring procedure comes from a process rather than an instant event. They should fine-tune their worries as well as their expectations, and comprehend the circumstance that they might need two or even three methods to address all of their issues. Sometimes it is not physically possible or economically feasible to achieve a desired body goal, thus a compromise might have to be made. A simple thing that a surgeon have to address in patients with massive weight loss is patients should have good thoughtfulness to accept post-procedural scars in exchange for a better and desirable shape. Appropriate patient selection, good surgical technique, and accurate pre-surgical marking are critical in ensuring that post-procedural scars are favorable.

Risks in combo-procedure of bariatric surgery and body contouring surgery

Risks in combo-procedure of bariatric surgery and body contouring surgery are related to the amount of procedures performed, surgery timing and duration, surgeon's experience, and patients' co-morbidities. Common risks are bleeding, hematomas, seromas, infection, wound dehiscence, skin necrosis, deep venous thrombosis, pulmonary embolism, and death.³⁷⁻⁴¹ In general, there is valid information demonstrating elective operative times should be restricted to no more than six hours in healthy patients.⁴² Longer operative duration may lead to increased risk of bleeding and the need of transfusion, risks of infection, deep vein thrombosis and pulmonary embolism.³⁷⁻⁴¹

In anticipating the risk of infection, plastic surgeons give their patients a dose of perioperative intravenous antibiotic – preferably prior to surgery, and prepare the surgical areas with antiseptic.⁴³⁻⁴⁵ It is highly recommended for operating team to set up sequential compression devices on patients' legs prior to induction to avoid risk of deep vein thrombosis. During the procedure, surgeons should performed good hemostasis and bleeding control, then put drains wherever necessary in any significant skin excision procedure and keep it in place for a week or two –depending on its production.

Patients should be ambulated immediately post-operatively and most are able to go home immediately after surgery or the next day. Plastic surgeons must assess pre-existing scars from the past carefully and put them in high attention for operative planning as they pose a threat to tissue viability during intraoperative undermining process.

TYPES OF BODY CONTOURING PROCEDURES

Liposuction

Liposuction is a procedure in which plastic surgeons remove excessive subcutaneous fat tissue with the aid of a tiny cannula that is inserted under the skin through a small incision after administering a certain amount of lidocaine and/or epinephrine. As the infiltrated epinephrine as a vasoconstrictor reduces intraprocedural bleeding, it also aids the effective duration of lidocaine to be longer and consequently reduces the amount of general anesthesia required. Massive weight loss patients with previous body mass index greater than 30 kg/m² may benefit from liposuction because removal of excess skin alone may still leave certain body areas with bulks of remaining fat tissue. Liposuction can be used to improve the neck, arms, thighs, flanks, and back. This can be accomplished either at the same time with removal of excess skin or in stages --starting with liposuction first, then removal of excess skin several months later.⁴⁶⁻⁴⁹

Reshaping the abdomen

A pannus or apron frequently develops as a result of massive weight loss (see **Figure 6**). Such an unpleasant formation can be found at the lower abdomen at the level of the pubis, mid-abdominal at the umbilicus or above the umbilicus. Existing lower transverse scars due to previous weight reduction surgery make the appearance worse since they result in a "fixed" scar where the tissue of the lower abdomen seemingly hangs over and covers the pubic region. Plastic surgeons must pay attention when their patients have previous scars that can impair the surgery and complicate the outcome, as previously explained. Rectus muscles diastasis (separation of the rectus muscles as a result of the intraabdominal pressure exerted by being obese or having multiple pregnancies) must be corrected, and any herniation, if present, must be carefully addressed.

A surgical procedure to repair a pannus is called a panniculectomy. During the procedure, the lower abdominal pannus is removed without compromising the abdominal wall or separating the skin and fat from it. Plastic surgeons start this procedure by drawing two parallel incision lines; the higher incision line is located below the umbilicus, and the lower incision line is made inside the mons pubis. This procedure does not address the rectus muscle diastasis, the flank areas, and the upper abdomen. The umbilicus is left in place, or occasionally "hovered"; surgeons undermine and release it from the abdominal wall then move it lower than its natural position. Surgeons usually leave two drains for one to two weeks.⁵⁰



Figure 9. Panniculectomy. Note there is no new umbilicus as the umbilicus is left in place.

On the other hand, an abdominoplasty address the entire abdomen. Abdominoplasty reshaped the abdomen by removing the lower abdomen tissue. Plastic surgeons start this procedure by drawing two incision lines for guidance; the first incision is at the lower line which is typically created inside the mons pubis to lift the ptotic mons. Surgeons undermine the entire abdomen all the way up. At the point of umbilicus, surgeons circumcise the periumbilical margin to preserve the umbilicus, then continue the undermining all the way up to the level of the costal margin and subxiphoid. Depending on the degree of tissue laxity, the upper incision

line for the superior margin of the later-to-be-excised abdominal skin and subcutaneous soft tissue may extend above the umbilicus. Sutures are applied to plicate the rectus muscles, the remaining abdominal skin is pulled downward and subsequently closed in layers. Surgeons mark and incise a new umbilical site with a knife, then bring out the umbilicus to the skin and secure it with sutures. Surgeons usually insert one to two drains and keep it for one to two weeks. Liposuction may be incorporated on the flanks to improve contouring.^{51,52}

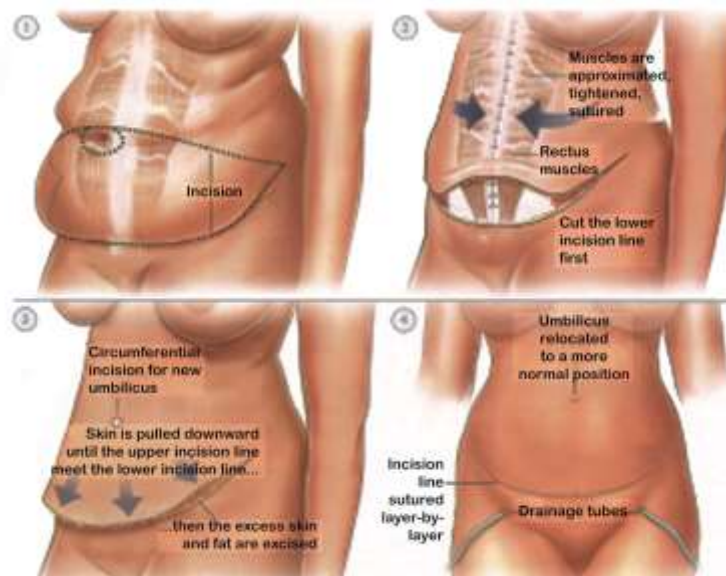


Figure 10. Abdominoplasty. Note there is relocated umbilicus.

RESHAPING THE ARMS AND THIGHS

Upper arm deformities are common after massive weight loss following bariatric surgery, therefore a growing number of massive weight loss patients are undergoing arm reshaing procedure (brachioplasty).^{53,54} It is an effective method of treating upper arm dysmorphic condition in the massive weight loss patient. Although patients with greater weight loss are likely at higher risk for wound-healing complications, studies showed such complications occur most frequently in areas other than the arms so brachioplasty is a relatively safe procedure.⁵³ In patients with enormous amount of skin and

soft tissue excess, the sheer volume and its laxity can be anatomically disorienting. Careful preoperative preparation and thorough mathematical measurement during surgical marking can result in good contour correction and avoid unwanted results such as webbing of the axillae and widened scars. One of the most used brachioplasty technique is the 'fish-incision' brachioplasty (see **Figure 11**), it is a simple method that is easy to follow and optimizes aesthetic results.⁵⁴ In some cases, liposuction may be used in conjunction with the brachioplasty to achieve the desired results.⁴⁹

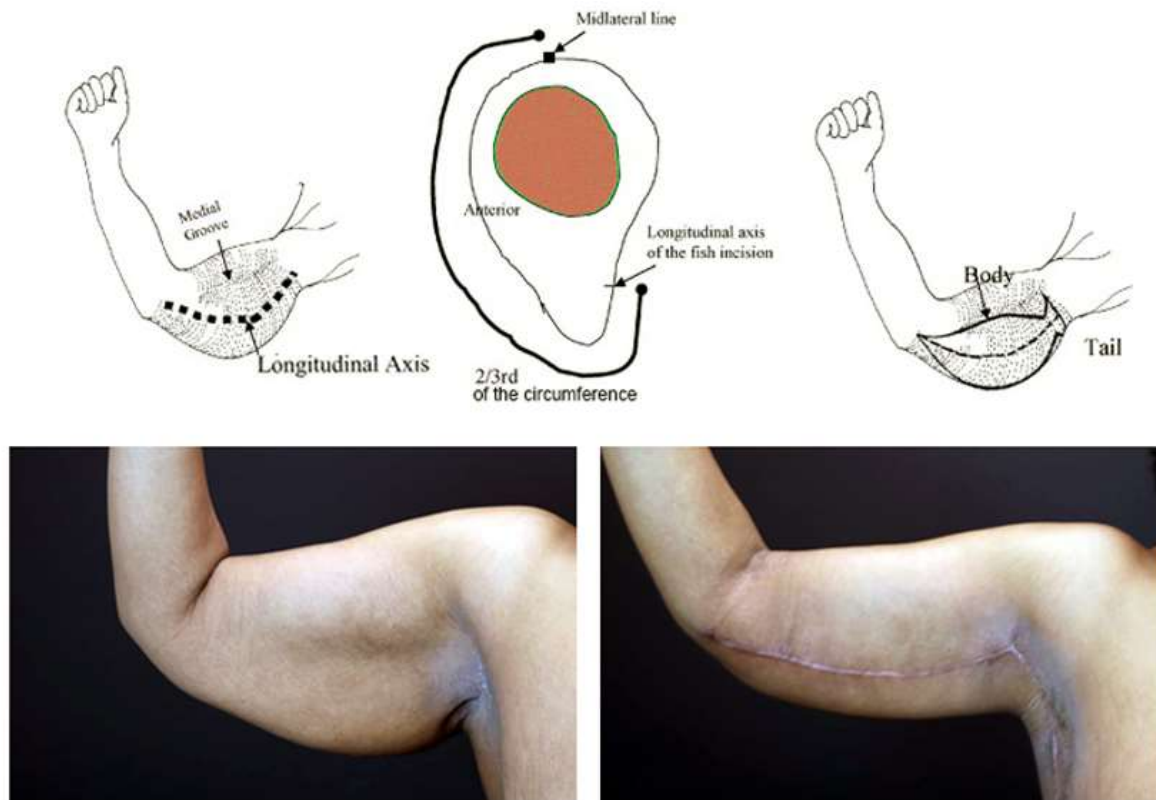


Figure 11. Fish-incision brachioplasty. Note the surgical scar is on the inside of the upper arm.

Massive weight loss achieved by a bariatric surgery also leaves skin and soft tissue redundancy at the thigh areas. A thigh lift procedure, also known as thighplasty, is an aesthetic surgery procedure that aims to improve the appearance of the thighs by removing excess skin and fat from the medial thigh areas and subsequently improve the quality of life.^{55,56} Like any surgical procedures, a thighplasty may carry risks and this surgical procedure may have less favorable complications than a brachioplasty. Since 'medial thigh lift' was first described by Lewis in 1957,⁵⁷ it has not received unanimous acceptance because of the various postoperative complications, such as bleeding and blood clot, infection,

delayed wound healing, inferior migration of the scar, vulvar distortion in females, and lymphatic system alterations.^{58,59} However, when performed by a qualified and experienced plastic surgeon, the risks can be minimized.

The technique used for a thighplasty after bariatric surgery will depend on the patient's individual needs and the surgeon's preferences. The most common technique involves making an incision in the groin area and extending it down the inner thigh, allowing the surgeon to remove excess skin and fat. In some cases, liposuction may be used in conjunction with the thighplasty to achieve the desired results.

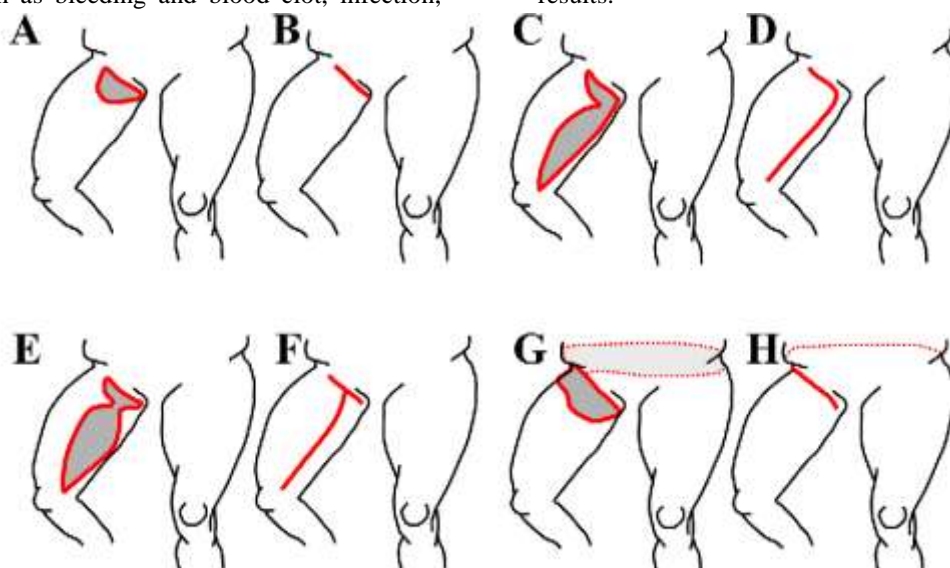


Figure 12. Thighplasty. Note that there are various designs depending on individual needs.⁶⁰

RESHAPING THE FACE AND NECK

Face and neck are the least commonly anatomical areas which patients seek improvements after massive weight loss, because skin laxity in those areas is not as severe as in other areas like the abdomen. Reshaping the face and neck in patients with massive weight loss are similar to common patients with two exceptions: the amount of deflation present from the loss of fat tissue in the face is often more visually significant and the eyebrows tend to be more ptotic. The aim of facial reshaping in patients with massive weight loss is to remove their excess facial skin, restore structures to their anatomic position and augment the volume of the subcutaneous tissue. This can be done via face, neck and brow lifting enhanced with the use of temporary fillers or permanent fat injections to restore the volume in the cheeks.³⁷

SUMMARY

Globally, bariatric surgery alone and as combo-procedure of bariatric surgery and body contouring surgery are both increasing in popularity. People with massive weight loss have a more complex skin and anatomical dysmorphism which later require more complex surgical procedures than patients without massive weight loss. A crafty and skillful plastic surgeon can provide satisfying aesthetic surgery refinement and proper perioperative care to patients with massive weight loss, and customize the necessary treatment to produce a quicker recovery, better results, and fewer complications.

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