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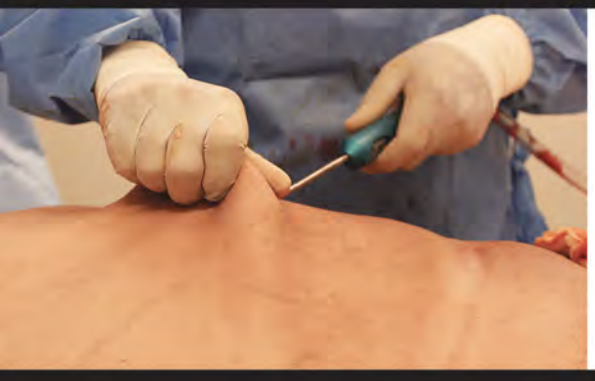
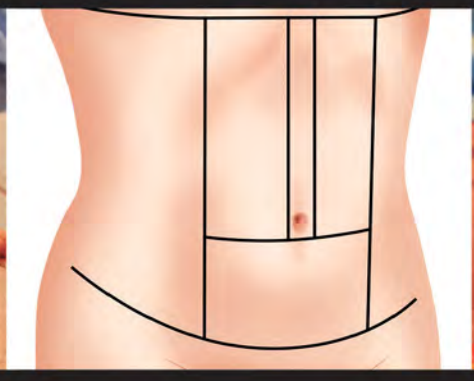
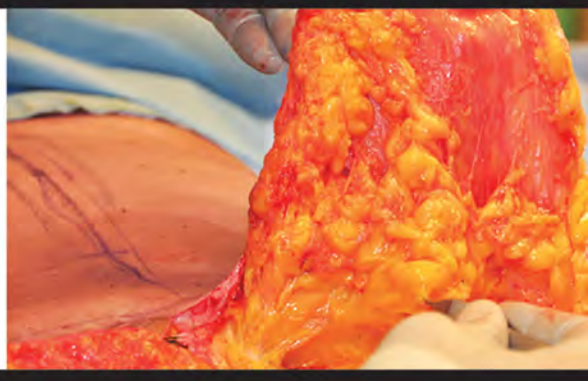
Art of
ABDOMINAL CONTOURING
Advanced Liposuction



Sanjay Parashar







Forewords
Luiz S Toledo
Ashok Govila

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Contents

1. History 1

- Energy-Based Liposuction *1*
- Superficial Liposuction *2*
- High-Definition Liposuction *2*
- History of Abdominal Aesthetics *3*

2. Abdominal Wall Anatomy 4

- Relevant Anatomy *4*
- Abdominal Skin *5*
- Superficial Fascia *5*
- Abdominal Muscles *6*
- Transversalis Fascia *9*
- Huger's Zones *10*

3. Aesthetic Subunits of Abdomen 14

- Anatomical Variation of Abdominal Region *14*
- Aesthetic Units of Abdomen *19*

4. Abdominal Fat Pathophysiology 21

- Location of Abdominal Fat *21*

5. Clinical Conditions 25

- How to Evaluate the Patient for Abdominal Contouring? *25*
- Counseling *26*
- Physical Examination *26*
- Measurements *26*
- Decision-Making Liposuction or Abdominoplasty *29*
- How to Manage the Abdomen in Different Patient Categories? *30*

6. Concept and Technique of Liposuction 37

- Liporeduction or Debulking Liposuction *37*
- High-Definition Liposculpturing *40*
- Liposuction and Lipodissection *41*
- Four-Dimensional Liposculpturing *41*
- Abdominal Etching *42*
- Technique of Liposuction *43*
- Medical Facility for Liposuction *43*
- Anesthesia for Liposuction *43*
- Technique of Infiltration *45*
- Selection of Cannulas *45*
- Technique of Liposuction *45*
- Guideline for Good Outcome *45*
- Liposuction Movements/Maneuvers (Strokes) *47*
- Superficial and Deep Liposuction *49*
- End Point of Liposuction *50*
- Postoperative Dressing and Compression *50*

7. Technology-Assisted Liposuction **52**

- Basics to Understand *52*
- Conventional Liposuction *54*
- Energy Based *58*

8. Preoperative Analysis and Protocol **71**

- Documentation *71*

9. Three-Dimensional Liposculpturing **84**

- Preoperative Marking *85*
- Emulsification and Pretunneling *85*
- Liposuction *87*
- Lumbar Aesthetic Unit *87*

10. Waist Sculpturing **91**

- Anatomy of Waist *91*
- Technique of Waist Sculpting *94*
- Postoperative Dressings *99*

11. Nonsurgical Technologies **100**

- Fat Reduction Methods *100*
- External Ultrasound *100*
- Injection Lipolysis *101*
- Low Level Laser Therapy *102*
- Cryolipolysis *102*
- Radiofrequency *102*
- Carboxytherapy *102*
- Combination of Technologies *103*
- Indications and Clinical Application *103*

12. Postoperative Management **108**

- Discharge Criteria *108*
- Protocol for Postoperative Visit *109*
- Drainage *111*
- Compression Garment *111*
- Manual Massage *112*
- Equipment-Based Therapies *112*

13. Complications of Liposuction **114**

- Bleeding *114*
- Seroma *114*
- Infection *116*
- Preoperative Protocol *116*
- Infection Control Policy *116*
- Postoperative Follow-up *116*
- Necrosis *117*
- Thromboembolism *117*
- Fat Embolism *117*
- Pulmonary Embolism *118*
- Scars *118*
- Contour Deformities *118*
- Lidocaine Toxicity *118*

14. Abdominoplasty **121**

- History *121*
- Types of Abdominoplasty *122*
- Conventional Lipoabdominoplasty *122*
- Miniabdominoplasty (Short Scar) *122*
- Extended Abdominoplasty *127*
- Circumferential Abdominoplasty *128*
- Reverse Abdominoplasty *128*
- Fleur-De-Lis Abdominoplasty *129*
- Horseshoe Abdominoplasty *129*
- Selection of Patient and Planning of Abdominoplasty *129*
- Case 1 *131*
- Case 2 *132*
- Case 3 *134*
- Case 4 *136*
- Conventional Abdominoplasty (Lipoabdominoplasty) *137*
- Infiltration and Liposuction *139*
- Postoperative Care *145*
- Umbilical Reconstruction in Abdominoplasty *145*
- Incision Techniques *146*
- Complications of Abdominoplasty *146*

Index *151*

CHAPTER 4

Abdominal Fat Pathophysiology

"There is a most intimate interdependence of physiology, pathology and surgery. Without progress in physiology and pathology, surgery could advance but little, and surgery has paid its debt by contributing much to the knowledge of the pathologist and physiologist, never more than at the present". —*William Stewart Halsted (1852–1922).*

INTRODUCTION

This chapter is important to understand the fat deposition pattern, predict long-term outcome of body contouring procedure, and to educate patient to understand the concept of fat distribution. Please do not miss this chapter!

Generally speaking, abdominal fat is either visceral (surrounding the abdominal organs) or subcutaneous (lying between the skin and the abdominal wall). Fat located behind the abdominal cavity, called retroperitoneal fat, is generally considered as visceral fat. Several studies indicate that visceral fat is most strongly correlated with risk factors such as insulin resistance, which sets the stage for type 2 diabetes. Some research suggests that the deeper layers of subcutaneous fat may also be involved in insulin resistance (in men but not in women). From clinical and basic investigations, aging, sex hormones, excess intake of sucrose, and lack of physical exercise have been suggested to be determinants for visceral fat accumulation. Since intra-abdominal fat (mesenteric and omentum fat) has been shown to have high activities of both lipogenesis and lipolysis, its accumulation can induce high levels of free fatty acids, a product of lipolysis, in portal circulation that go into the liver.[1]

LOCATION OF ABDOMINAL FAT

Visceral Fat (Fig. 4.1)

Fat accumulated in the lower body or upper body is subcutaneous, while fat in the abdominal area can be intra-abdominal (visceral) and subcutaneous in varying proportions.

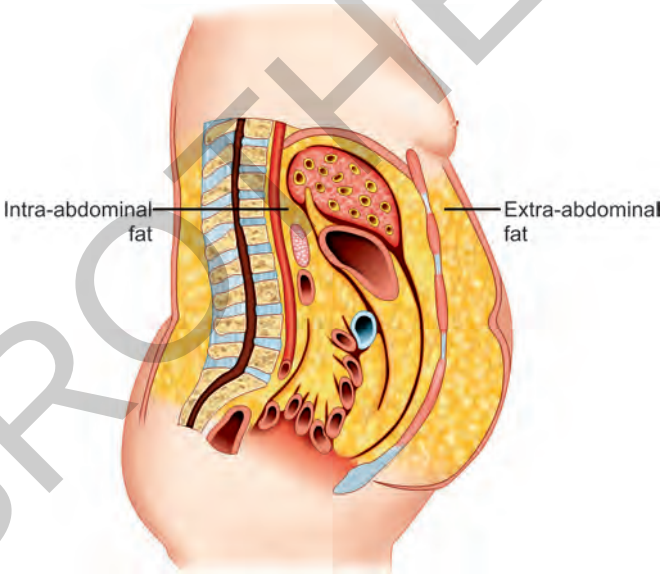

Fig. 4.1: Distribution of fat: Intra-abdominal or visceral fat and extra-abdominal or subcutaneous fat.

This distribution of abdominal fat is influenced by several factors. Heredity is one: scientists have identified a number of genes that help determine how many fat cells an individual develops and where these cells are stored.[2] There is evidence of genetically programmed developmental differences in adipocytes and their precursors in different regions of the body. This plays an important role in obesity, body fat distribution, and potential differences between internal and subcutaneous adipose tissue.

Recent advances have demonstrated that white adipose tissue plays a central role in the regulation of energy balance and acts as a secretory organ that mediates numerous physiological and pathological processes such as immunological responses, vascular diseases, and appetite regulation. Leptin, the obese gene product, is a hormone that is primarily secreted by mature adipocytes. Leptin plays a crucial role in the regulation of energy balance. Resistin is another adipocyte-secreted product that potentially links obesity to diabetes.[3]

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During recent years, it has become evident that adipocytes express and secrete a number of hormones involved in the regulation of energy and substrate metabolism including leptin, adiponectin, resistin, and acylation stimulating protein. Acylation stimulating protein is a hormone produced by adipocytes and is of importance for the storage of energy as fat.[4]

Although there have been considerable recent insights into the control of appetite and energy expenditure as contributing factors to obesity, little is known about the genetic basis for determination of adipocyte number and differences in body fat distribution.

Studies have revealed that both body mass index and waist–hip ratio are inheritable traits, and have some variability. In addition, individual humans observe differences in their own body fat distribution as they gain or lose weight such as in some ethnic groups (Africans) who have been noted for excessive accumulation of fat in the buttocks, a condition known as steatopygia. Some lipodystrophies appear to have segmental or dermatomal distribution.[3]

The rate of lipolysis in adipose tissue taken from subcutaneous sites is lower than that of adipose tissue from visceral sites. Furthermore, the lipolytic effect of catecholamines is weaker and antilipolytic effect of insulin is more pronounced in subcutaneous than in visceral adipose.[5,6] This is evident by the fact that intra-abdominal fat can be reduced by exercise and diet management more easily as compared to subcutaneous fat. Visceral fat is more easily stored and faster to be burned. This is because it has a greater blood supply and is more sensitive to the fat metabolizing hormones (catecholamines) compared to subcutaneous fat.

Brown adipose tissue, previously known to be found only in small mammals and neonates, has only recently been shown to contribute significantly to the metabolic signature in adults. The detection of brown adipose tissue in adults has led to a renewed interest and is now considered to be a potential therapeutic target to prevent excess white fat accumulation in obesity.[7]

Role of Hormones in Fat Distribution and Correlation with Dieting and Exercise

Insulin plays a major role in fat metabolism, and the single biggest influence over the levels of insulin is from starchy and sweet foods. Cortisol (stress hormone) is another important hormone that influences fat storage.[8] Cortisol influences both lipoprotein lipase and hormone-sensitive lipase (HSL). Lipoprotein lipase is responsible for storage of fat and HSL is activated when the body needs to mobilize energy stores, and so responds positively to catecholamines, an adrenocorticotropic hormone. Insulin activity inhibits fat-releasing activity of cortisol.[9,10]

Starch and sugar combined with fat may represent the worst combination for fat gain. Starches and sugar raise insulin levels while fat supplies calories by itself.

Protein and vegetables does not stimulate insulin production. This means less calorie deposition. Adequate sleep aids in fat metabolism by lowering cortisol and increasing human growth hormone (HGH)—a fat-burning and muscle-building hormone. Intense exercise is known to stimulate cortisol and HGH (and testosterone in men).

What Happens in Women?

Sex hormones strongly influence body fat distribution and adipocyte differentiation. Estrogens and testosterone differentially affect adipocyte physiology. Estrogens and estrogen receptors regulate various aspects of glucose and lipid metabolism. Disturbances of this metabolic signal lead to the development of metabolic syndrome and a higher cardiovascular risk in women. Estrogen hormone is insulin sensitizing and helps in metabolizing the fat causing fat loss.

At menopause, estrogen production decreases and the ratio of androgen (male hormones present in small amounts in women) to estrogen increases and that has been linked to increased abdominal fat after menopause. Some researchers suspect that the drop in estrogen levels at menopause is also linked to increased levels of cortisol, a stress hormone that promotes the accumulation of abdominal fat.

What is Wrong with Abdominal Fat?

Adipose tissue is no more just energy-saving structure but research suggests that fat cells—particularly, abdominal fat cells—are biologically active. It is more accurate to think of fat as an endocrine organ or gland, producing hormones and other substances that can profoundly affect our health. As we have seen, leptin is normally released after a meal and dampens appetite. Fat cells also produce the hormone adiponectin, which is thought to influence the response of cells to insulin.

Visceral fat secretes immunogenic chemicals called cytokines—e.g. tumor necrosis factor and interleukin-6—that can increase the risk of cardiovascular disease by promoting insulin resistance and low-level chronic inflammation. Considered to be excess visceral fat is so harmful

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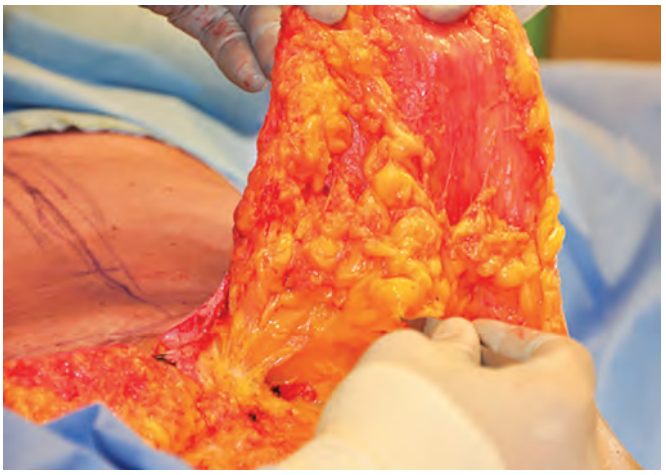

Fig. 4.2: Subcutaneous fat.

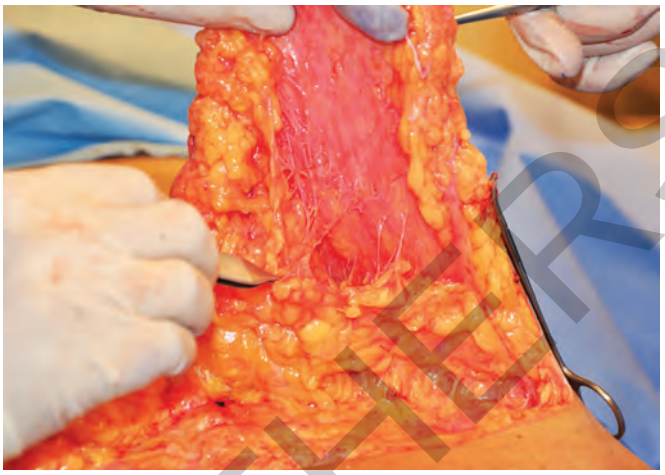

Fig. 4.3: Fat layers below and above Scarpa's fascia.

possibly due to its location near the portal vein, which carries blood from the intestinal area to the liver. Substances released by visceral fat, including free fatty acids, enter the portal vein and travel to the liver, where they can influence the production of blood lipids. Visceral fat is directly linked with higher total cholesterol and low-density lipoprotein (bad) cholesterol, lower high-density lipoprotein (good) cholesterol, and insulin resistance—major risk factors for heart disease and stroke.[11,12] An excess of visceral fat is known as central obesity, or "belly fat," in which the abdomen protrudes excessively. Excess visceral fat is also linked to type 2 diabetes, insulin resistance, inflammatory diseases, and other obesity-related diseases.[13]

The good news is that visceral fat yields fairly easily to exercise and diet, with benefits ranging from lower blood pressure to more favorable cholesterol levels. Subcutaneous fat located at the waist can be frustratingly difficult to reduce. High-intensity exercise is one way to effectively reduce total abdominal fat.[14,15]

Bariatric surgery has been proved not only to reduce the weight of the body but also to correct the metabolic problems associated with obesity.[16]

There are a few studies by Berntorp et al.,[17] Giese et al.,[18] and Gonzalez-Oritz et al.[19] that show liposuction can help in facilitating glucose utilization, increasing insulin sensitivity, thus reducing blood pressure and other metabolic derangement, at least in short-term.

Subcutaneous Fat (Nonvisceral Fat) (Fig. 4.2)

The subcutaneous tissue is also called as hypodermis. The hypodermis consists primarily of loose connective tissue and lobules of fat. It contains larger blood vessels and nerves than those found in the dermis.

The fat globules are grouped together and held firmly by stromal fibrous network. They are arranged in layers forming superficial fat and deep fat. In the lower abdomen, the two layers are separated by Scarpa's fascia (Fig. 4.3), whereas in the upper abdomen there is no distinct fascial layer. In the upper abdomen, the fat is firmly arranged with compact fibrous network with more dense vascular and neural network.

In the upper abdomen, it is more painful to infiltrate fluid if liposuction is performed under local anesthesia. The areas of underlying adhesions have compact tough fibrofatty tissue.

On the other hand, in the lower abdomen the fat layers are less compact and less neurotized. The fat above the Scarpa's fascia is more compact and vascular than below.

Enlargement of these fat cells causes various abdominal protuberances, cellulites, folds, rolls, and panniculus.

Abdominal Roles/Panniculus

There is not much literature about the description of panniculus except that it is layer of fatty tissue occurring in lower abdomen and can hang at various levels from pubic area to knees.

Classical description for panniculus is apron of skin and fat formed at the lower abdomen. Small panniculus is fold of skin that covers the upper part of the pubis. Moderate panniculus extends beyond the pubic area and covers the external genitalia where as large panniculus extends into the thigh region.

It is not uncommon to see upper abdomen folds particularly in patients who have undergone massive weight loss.

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Fig. 4.4: Obese patient with lower abdominal panniculus, side rolls, bra rolls and upper abdominal protuberance.



Fig. 4.5: Abdominal rolls formed by flexion creases and underlying tough fibrofatty attachments inferior to the rolls.

Abdominal rolls are formed by disproportionate fat deposits that are surrounded by compact fibrous network causing either circular or oblong bulges, such as upper abdomen protuberances, bra rolls and waist rolls (Fig. 4.4). Abdominal rolls/panniculus are formed by excess adipose tissue deposition and expansion of skin. However, there are deep adhesions that form a firm constriction ring at the lower part of the fold. If the fat continues to deposit the skin fold hangs over the constriction ring. In some patients, their are tight fibrous rings superiorly and inferiorly to the fold. The tight fibrofatty tissue ring needs to be addressed in abdominal contouring procedures (Fig. 4.5). Skin-retaining ligaments, major, and minor anchors the skin to the hypodermis and some fibers run deep to musculoaponeurotic fascia (as described earlier). Disrupting these retaining ligament will help to mobilize the overlying skin and unroll the folds.

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The book begins with a history of liposuction and abdominoplasty beginning in ancient times. It not only covers the modern methods of liposuction but also contains the use of technology for invasive and noninvasive body contouring. The information is state-of-the-art and incorporates the most current information on virtually every aspect of body contouring.

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There are extensive discussions on essentially all problems and potential complications of body contouring surgery.

I am sure our colleagues will find this new offering to be not only the most extensive and convenient compilation of information in our field but also the most clinically practical and up-to-date resource in aesthetic surgery.



Sanjay Parashar MS (Gen. Surgery) DNB (Plast) MCh (Plast) FICS (Plast) is one of the most respected Plastic and Aesthetic surgeons in the region, and among the very best in the world. He is a highly skilful and ambidextrous (can work with both hands) surgeon. He has spent several years around the world watching great plastic surgeons at work. He comments that plastic surgery offers him the luxury of being both a physician and an artist. He takes his obligations as a doctor very seriously, wanting to give his patients the best possible result while minimizing their exposure to risks.

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He has conducted more than 10,000 cosmetic procedures with very high success rate, highlight being minimal complication rate. He has performed thousands of Liposuction procedures using the latest and traditional techniques. He is a pioneer in three-dimensional body contouring, waist sculpting, extensive lipoabdominoplasty (tummy tuck) and post weight loss body lift. He is a very popular breast surgeon in Dubai and has performed numerous breast surgeries for implantation, breast lift and breast reduction. His background in craniofacial surgery has helped him to perfect the art of face lift, eyelid surgery, rhinoplasty, chin implants, botox and filler injections for face.

Dr Parashar is internationally renowned for being much more than a surgeon. He is regularly invited around the world to train, teach and share his secrets of success with his colleagues. He is unquestionably one of the world's most highly regarded Aesthetic and Plastic surgery innovators.

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