

Autologous Fat Injection into the Pectoralis Major as an Adjunct to Surgical Correction of Gynecomastia

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Abstract

Background: Correction of gynecomastia in males is a frequently performed aesthetic procedure. Various surgical options involving the removal of excess skin, fat, or glandular tissue have been described. However, poor aesthetic outcomes, including a flat or depressed pectoral area, limit the success of these techniques.

Objectives: The authors sought to determine patient satisfaction with the results of upper chest augmentation by direct intrapectoral fat injection in conjunction with surgical correction of gynecomastia.

Methods: In this prospective study, 26 patients underwent liposuction and glandular excision, glandular excision alone, or Benelli-type skin excision. All patients received intramuscular fat injections in predetermined zones of the pectoralis major (PM). The mean volume of fat injected was 160 mL (range, 80–220 mL per breast) bilaterally. Patients were monitored for an average of 16 months (range, 8–24 months).

Results: Hematoma formation and consequent infraareolar depression was noted in 1 patient and was corrected by secondary lipografting. Mean patient satisfaction was rated as 8.4 on a scale of 1 (unsatisfactory) to 10 (highly satisfactory).

Conclusions: Autologous intrapectoral fat injection performed simultaneously with gynecomastia correction can produce a masculine appearance. The long-term viability of fat cells injected into the PM needs to be determined.

Level of Evidence: 4

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Gynecomastia is the unilateral or bilateral enlargement of breast tissue in males. Although it is a benign condition, the feminine appearance of gynecomastia may lead to severe psychosocial problems in affected males.¹ In 1973, Simon et al² described a graded classification for gynecomastia based on mammary volume and cutaneous excess (Table 1). Historically, hormone therapy and radiotherapy were performed to treat gynecomastia, but these approaches were associated with unfavorable aesthetic outcomes and adverse health events. Surgical removal of excess tissue is regarded as the most effective treatment for gynecomastia. Current techniques to correct gynecomastia depend on the Simon grade of the breast and may involve skin or glandular excisions with or without liposuction.³

The combination of surgical excision and liposuction is a popular approach that produces satisfactory results.⁴⁻⁷

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Open excision of excess tissue to treat gynecomastia originally was described by the physician Paulus Aeginata (635-690 AD), and the first reports of gynecomastia surgery involved a submammary incision.⁸ Since then, various incision types have been reported, although the semicircular subareolar incision suggested by Webster⁴ in 1946 is performed most frequently. In 1990, Benelli⁵ proposed a transareolar approach to remove excess skin in mild cases of gynecomastia. For severe cases, Wray et al⁹ proposed an

inverted T incision for cutaneous glandular excision with free nipple transplantation. Despite numerous techniques for removing excess glandular or cutaneous tissue, unfavorable outcomes of gynecomastia surgery remain a problem. The primary reason for patient dissatisfaction is the flat, underprojected, and depressed appearance of the breast after surgery.

To reduce or eliminate the appearance of gynecomastia and achieve a more masculine appearance, enhancement of the pectoralis major (PM) by fat grafting may be considered. In this study of 26 patients with gynecomastia, we augmented the PM by autologous fat injection.

Table 1. Classification of Gynecomastia

Grade	Description
1	Little augmentation of mammary volume without cutaneous excess
2a	Moderate augmentation of mammary volume without cutaneous excess
2b	Moderate augmentation of mammary volume with moderate cutaneous excess
3	Significant augmentation of mammary volume with cutaneous excess

Classification system described by Simon et al.²

METHODS

Study Design

This prospective study was approved by the Ethics Committee of the Bagcilar Research and Training Hospital in Istanbul, Turkey. Between July 2010 and February 2013, consecutive

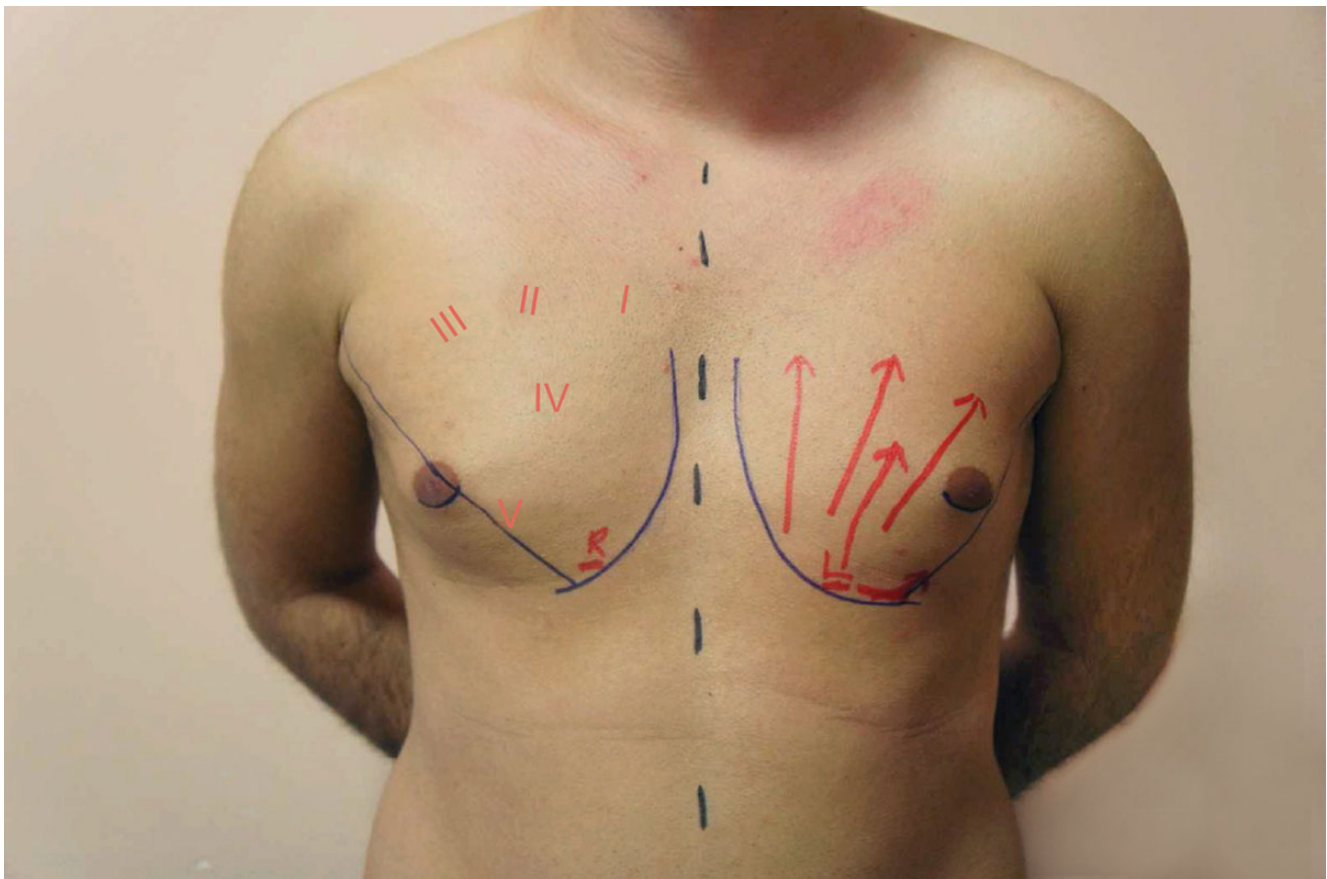


Figure 1. A-26 year old patient with Simon grade 2a gynecomastia. He underwent a glandular excision through a semicircular infraareolar incision together with liposuction and intramuscular (PM) fat transfer. The 5 zones bordering the pectoralis major (PM) that were targeted for autologous fat injection are indicated. I and II, superior PM; III lateral; IV, medial; V, inferior. Vertical dotted line indicates the midline. Straight lines indicate the anterior axillary lines. Curved lines indicate the inframammary sulci. Dissection (curved lines at areolae) and liposuction (arrows) borders are depicted. R, right breast; L, left breast.

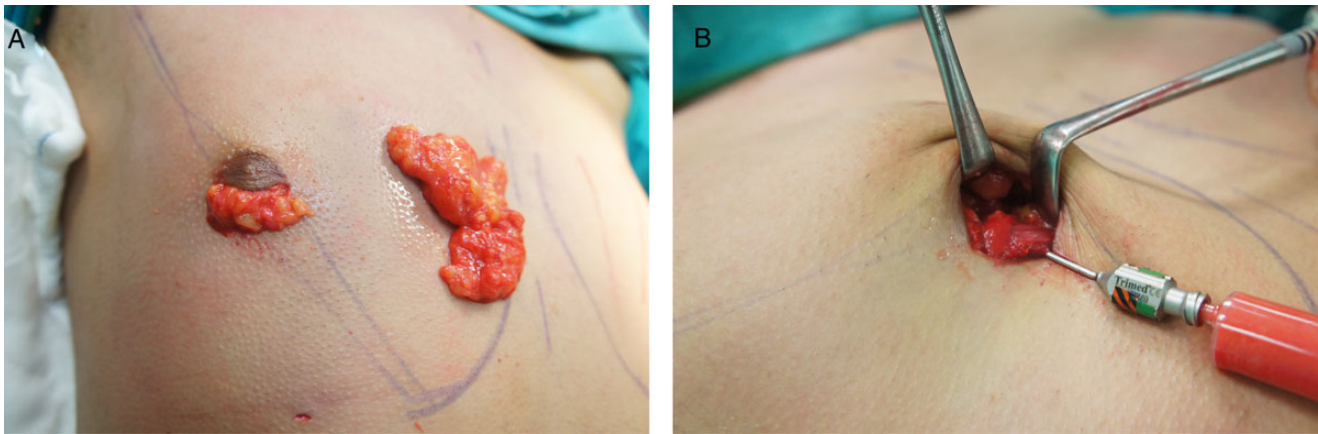


Figure 2. A-26 year old patient with Simon grade 2a gynecomastia. He underwent a glandular excision through a semicircular infraareolar incision together with liposuction and intramuscular (PM) fat transfer. (A) Fibrofatty tissue from glandular resection in this 26-year-old patient. (B) Fat injection into the PM.

patients with gynecomastia were enrolled in the study. Excluded from the study were patients with Simon grade 3 gynecomastia and patients undergoing liposuction alone as treatment. Obese patients (body mass index [BMI] > 30 kg/m²) also were excluded from the study because of the difficulty evaluating PM enhancement by fat grafting. All patients provided written informed consent. CT or MRI scans were also performed to visualize fat grafts in PM of selected patients.

Preoperative Planning

The preoperative evaluation included an ultrasound to detect a possible breast mass and an endocrinology consultation to rule out an abnormal hormonal profile. Preoperative markings were made with the patient sitting upright. Dissection and liposuction borders were drawn, and routine markings indicating the midline, anterior axillary line, and inframammary sulcus were made (Figure 1). The PM was palpated, and 5 zones corresponding to the superior (zones I and II, Figure 1), lateral (III), medial (IV), and inferior (V) borders of the PM were marked for autologous fat grafting. The cannula entrance and fat-harvesting sites also were marked (Figure 1).

Surgical Technique

The patient was placed under general anesthesia and was positioned supine with the arms abducted and secured at 90°. Subsequently, 500 mL of normal saline with 25 mL of 1% lidocaine and 1 mg of epinephrine (1:1000) was infiltrated into the abdomen through an umbilical incision. A predetermined amount of fat was aspirated by means of a 4-mm blunt cannula connected to a 60-mL syringe. Machine-assisted liposuction was not performed. Syringes containing the lipoaspirates were left on the nurse's table for 30 minutes to allow for separation of infranatant fluid

from supernatant fat. The infranatant was removed, and the fat was transferred into 10-mL syringes for injection.

A semilunar infraareolar incision or a periareolar incision for a Benelli-type skin excision was made. When required, liposuction was performed with a 3-mm cannula inserted through 2 small incisions. During glandular excision, a small amount of fibrofatty tissue was left intact beneath the areola to avoid postoperative depression of the skin (Figure 2). Other types of incisions (eg, periareolar/Benelli-type, vertical, or Wise) were considered based on patient characteristics.

Through the semilunar incision, a skin-fat flap was raised in the mastectomy plane. The dissection continued craniocaudally and was limited horizontally by the breast borders. This approach enabled visualization of the PM fascia. Glandular tissue was excised by blunt dissection along the PM fascia and by sharp dissection underneath the skin. The precise amounts of tissue to be excised were not determined preoperatively. Instead, excision amounts were decided intraoperatively and were refined with experience.

Table 2. Patient Demographics (N = 26)

Characteristic	Mean	Range
Age, y	22.3	19-36
BMI, kg/m ²	25.2	21-28
Follow-up, mo	16	8-24
Excised tissue, ^a g (R/L)	85/85	55-200/55-200
Volume of fat grafts, mL	160	80-220
Patient satisfaction ^b	8.4	4-10

BMI, body mass index; R/L, right breast/left breast. ^a226 patients required a glandular excision; ^bpatient satisfaction was assessed on a scale of 1 (unsatisfactory) to 10 (highly satisfactory).

Injections of autologous fat occurred primarily in zones I and II (Figure 1; Figure 2B) that corresponded to the superior border of the PM. Nearly 80% of the injections (up to 150 mL) were made in the superior and lateral borders of the PM (zones I-III; Figure 1) to achieve the intended masculine appearance. The least-injected area was the inferior border (zone V; Figure 1). To prevent fat necrosis, small clusters of fat grafts were injected in multiple layers.

After hemostasis was achieved, the remaining tissue under the areola was reattached to the PM fascia with 3 single 3-0 poliglecaprone sutures at the 4:00, 6:00, and 8:00 positions. A Hemovac drain (Zimmer, Warsaw, IN) was placed through the axilla, and the incisions were closed with 4-0 absorbable subcuticular sutures. Patients were instructed to wear a compression garment for 4 weeks after the procedure. All excised tissues were sent to a pathologist for histopathologic evaluation.

Assessment of Outcomes

Study participants completed an oral survey of patient satisfaction. A senior resident who was unaffiliated with this study asked patients to rate their results after surgery on a scale of 1 (unsatisfactory) to 10 (highly satisfactory). Surveys were conducted an average of 11 months (range, 8-14 months) after surgery.

RESULTS

A total of 26 patients (52 breasts) were included in this study. The mean age of the patients was 22.3 years (range, 19-36 years). Patient demographics are presented in Table 2. Most of the patients presented with Simon grade 2a gynecomastia (19 of 26 patients; 73%). Five patients (19%) had grade 2b gynecomastia, and 2 patients (8%) had grade 1 gynecomastia. The mean follow-up period was 16 months (range, 8-24 months). The mean body mass index of the patients was 25.2 kg/m² (range, 21-28 kg/m²). In 21 patients, isolated glandular excisions were made through a semilunar incision; a periareolar incision for a Benelli-type skin excision was chosen for 5 patients. No Wise or vertical skin incisions were performed. Ten of 26 (38%) patients required liposuction in addition to glandular excisions. Liposuction was performed when a contour correction was planned in the entire chest wall, including the peripheral area of the excision. The remaining 16 patients (62%) underwent direct excisional lipectomy. Regardless of whether liposuction was performed, each patient's chest was infiltrated preoperatively with a wetting solution to achieve a bloodless surgery. The mean volume of injected fat was 160 mL (range, 80-220 mL; Table 2).

One patient presented with a hematoma on the first postoperative day; this was resolved by secondary hemostasis. Two patients complained of a lump that subsequently

disappeared with gentle massage during the follow-up period. One patient developed a depression beneath the areola late in the monitoring period. He underwent additional lipografting during the 11th postoperative month, which produced a favorable outcome. Although 5 patients experienced hypoesthesia during the early follow-up period, these patients had complete sensory recovery by the end of the monitoring period. None of the patients complained of scarring.

Results of the patient satisfaction survey yielded a mean score of 8.4 (range, 4-10; scores from 8-10 were considered highly satisfactory). The lowest reported score was 4 and corresponded to the patient who underwent revisional surgery. Two patients scored their surgical results as 6. The highest score was 10 and was reported by 5 patients (Figures 3-5; Supplemental Figures S1 and S2, available online at www.aestheticsurgeryjournal.com).

DISCUSSION

Although many causative factors have been listed in the literature, the majority of gynecomastia cases are idiopathic.¹⁰ Established criteria for the diagnosis of gynecomastia, especially moderately severe cases, are unavailable. Instead, the diagnosis of gynecomastia is based on subjective complaints by patients. The results of postmortem studies have indicated a 40% incidence of gynecomastia.¹¹

Several methods for the treatment of gynecomastia have been described, but surgery remains the primary treatment option. Surgical treatment of gynecomastia must be individualized, with the presence of cutaneous ptosis and the amount of excess skin regarded as determinants of the optimal surgical approach. Techniques such as excision, liposuction, or a combination of these through open or closed approaches have been described for the removal of excess breast tissue in males.^{2-7,12-14} Each of these methods has specific advantages, but also may cause certain complications. The main goals of gynecomastia surgery are effective removal of excess breast tissue and the avoidance of a conspicuous scar.

Liposuction is another major component of gynecomastia treatment and is effective for breast removal only if the majority of the breast mound consists of adipose tissue. In patients with a fibrous component of the breast parenchyma, the pull-through technique described by Morselli⁷ can be applied, whereby traditional liposuction is combined with direct excision through a small incision. Hammond et al¹³ advocated ultrasonic liposuction to dispel fibrofatty tissues in the treatment of gynecomastia. Prado and Castillo¹⁴ recommended combining liposuction with an electrically powered endoscopic-arthroscopic cartilage shaver for the removal of fibroglandular tissue. By employing techniques to correct gynecomastia that involve liposuction, surgeons can achieve successful outcomes with less scarring and

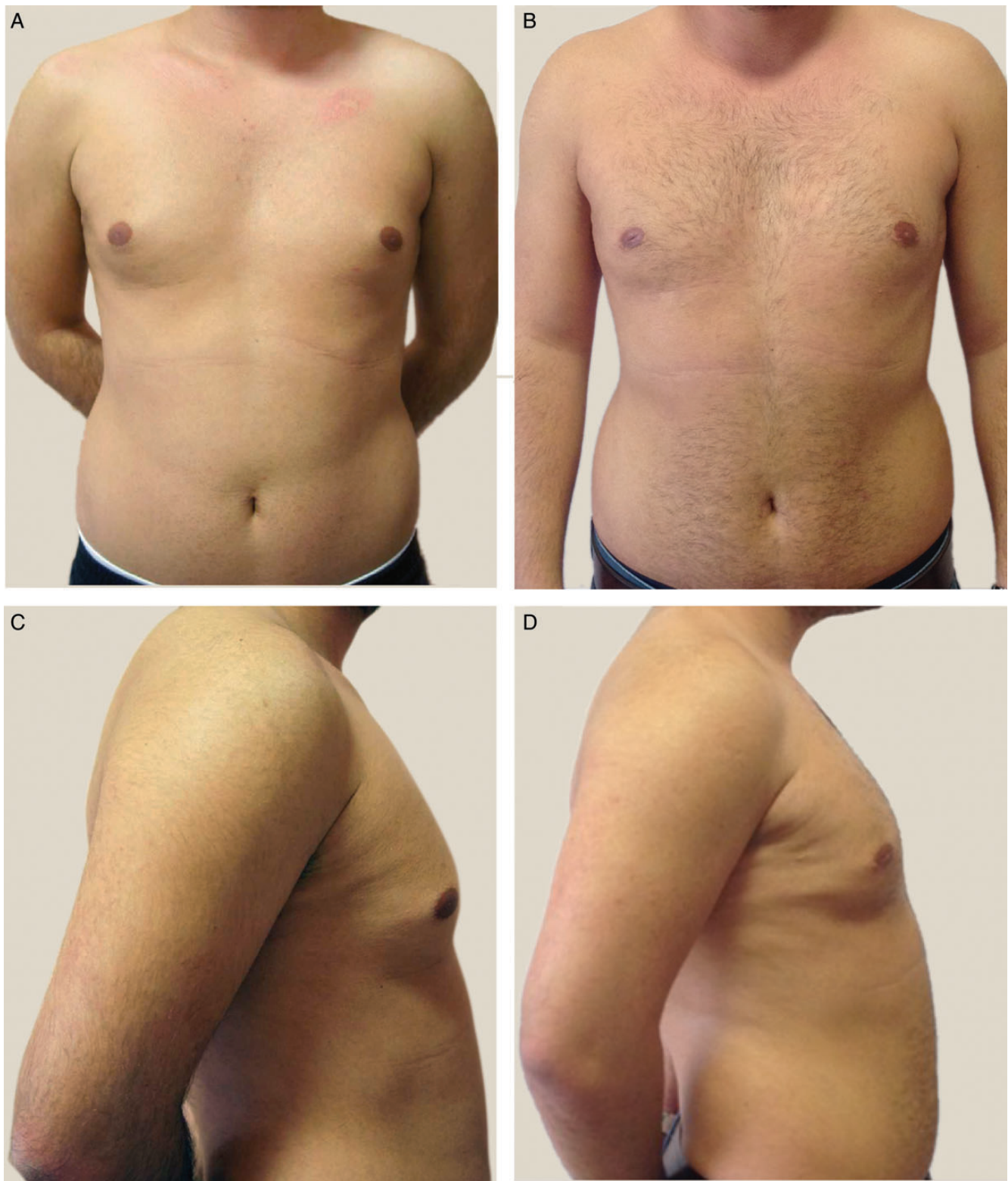


Figure 3. This 26-year-old man presented with enlarged breast tissue diagnosed as Simon grade 2a gynecomastia. He underwent liposuction (120 mL of fat aspirated) and subsequent excision of 80 g of breast tissue through a semilunar incision. A total of 120 mL of fat was injected into each PM. Preoperative (A) anterior, (C) lateral, and (E) oblique views, and 14-month postoperative (B) anterior, (D) lateral, and (F) oblique views are shown. (G, H) Postoperative computed tomography images of the patient confirmed viability of the fat grafts (blue arrows, blue areas). This patient may have benefited from lipocontouring of the lateral chest, but this was not performed.

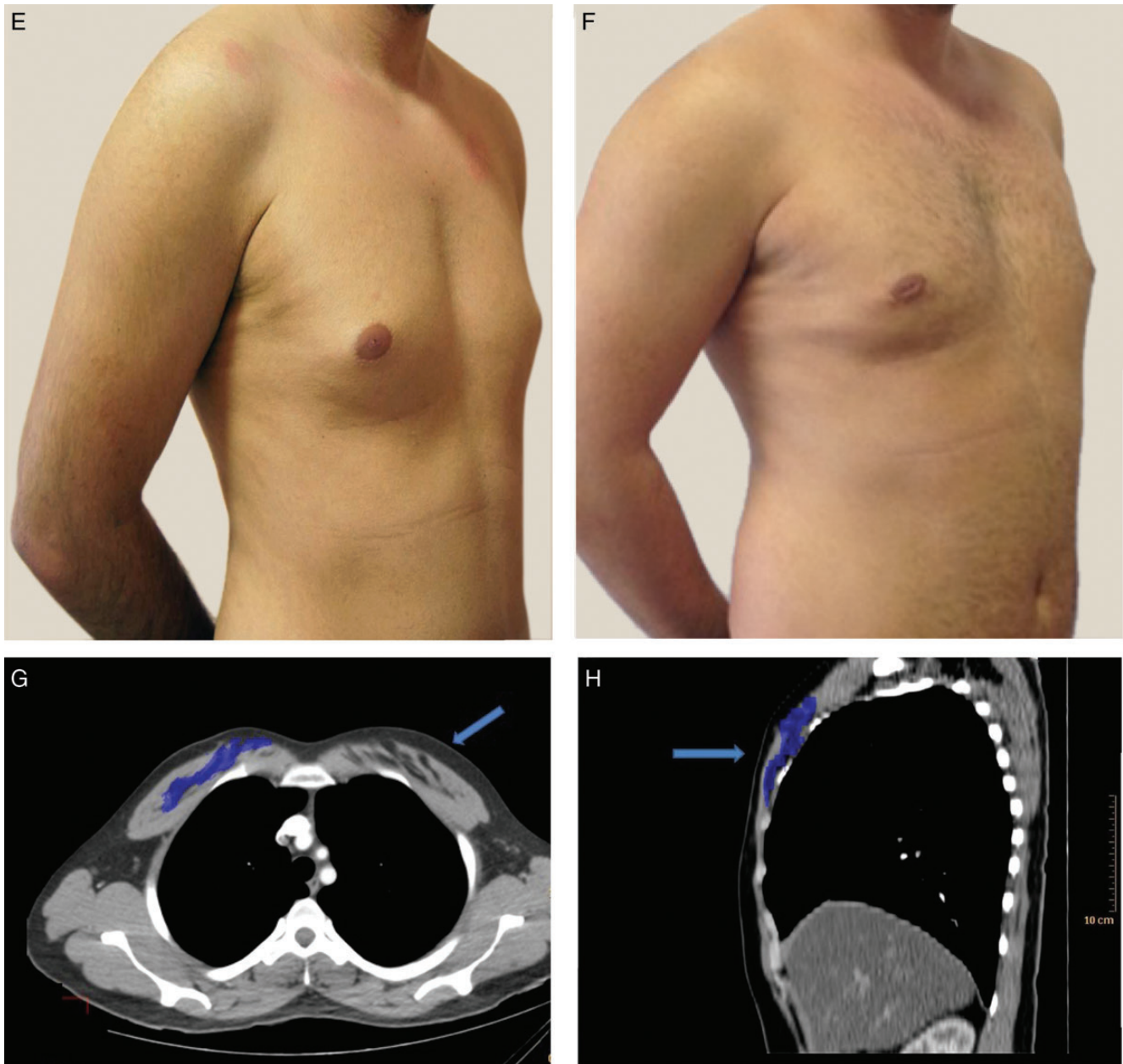


Figure 3. Continued.

satisfactory cosmetic results even in patients with moderate skin excess.

Intramuscular fat grafting for female breast contouring has increased in popularity during the past 2 decades. De Blacam et al¹⁵ combined fat extraction and grafting to improve contour deformities resulting from lumpectomy in female breasts. Coleman and Saboeiro¹⁶ suggested lipografting into the pectoral area and the retropectoral and prepectoral spaces for augmentation mammoplasty. Lipografting in the female gluteal region also has become popular with satisfactory results for contouring or enhancement of the buttocks.¹⁷ Aygit et al¹⁸ demonstrated successful uptake of

intramuscular fat grafts in rabbit muscle with >50% of fat grafts surviving at 45 days postplacement. In a clinical study, Herold et al¹⁹ employed magnetic resonance imaging (MRI) volumetry to evaluate fat grafts and documented a mean persistence volume of 64% within the pectoral muscle at 6 months posttransplantation.

To our knowledge, no studies have addressed intramuscular fat grafting specifically in male patients with gynecomastia. Recently, Hoyos et al²⁰ published results of a clinical series in which they combined fat extraction and grafting to achieve a well-defined masculine chest in patients with slim, athletic, or obese body types and in

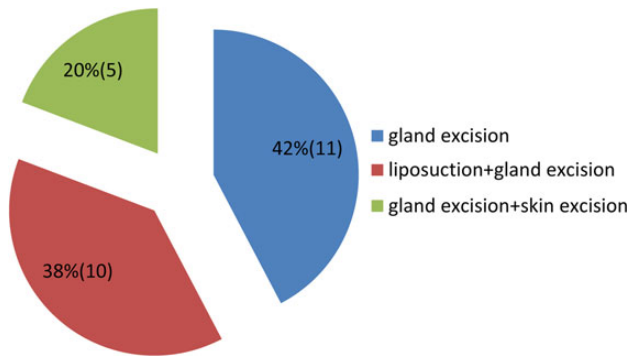


Figure 4. Types of procedures performed to correct gynecomastia in this study (N = 26). Ten patients underwent excisions combined with liposuction, 16 patients underwent direct excisional lipectomy.

patients with gynecomastia. These authors noted satisfactory aesthetic results with submuscular and intramuscular fat injections in the PM, and they were able to inject larger volumes. We performed autologous fat injection solely in patients with gynecomastia with a technique that involved visualization of the PM. We believe this approach is safer than injection guided by ultrasound without direct observation of the PM. Intramuscular or submuscular fat injections without incision may be considered (eg, in patients undergoing liposuction alone) if the surgeon has sufficient experience.

The details of a patient's surface anatomy are essential for determining fat injection zones. We selected 5 zones for lipoinjection, which we believed would produce optimal aesthetic results. However, it may be preferable to specifically consider the patient's surface anatomy in the area below the PM and in other breast regions as lateral breast border, inframammary region when planning the surgical approach. The aesthetically pleasing male chest includes a prominent superior PM. We primarily targeted 2 zones (I and II; Figure 1) corresponding to the superior border of the PM for lipografting to enhance volume and definition in this area. Injections into the lateral, medial, and inferior borders of the PM were performed to a lesser extent. Liposuction may be considered as an adjunct to lipografting for contouring the chest area adjacent to the PM and breast structures.

A major goal in this study was to avoid the poor surface aesthetic typically observed after surgical correction of gynecomastia. Depressions of the skin surface are especially common when large volumes of fat or glandular tissue are removed from a patient with gynecomastia. In such cases, simultaneous fat injection into the upper PM should be considered. Small amounts of fat grafted in distinct areas of the PM produce a masculine appearance that is pronounced in lateral views. The amount of fat to be injected varies across patients. In the present study, up to 220 mL per breast was injected.

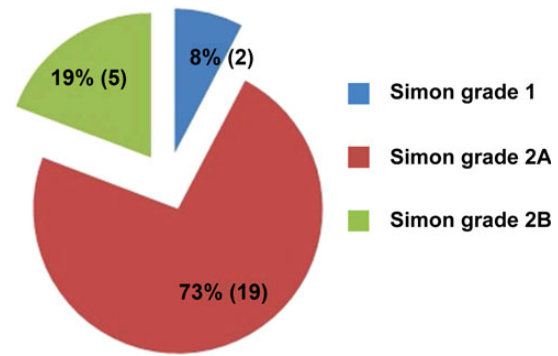


Figure 5. Distribution of patients (N = 26) by Simon gynecomastia grade. Nineteen patients presented with Simon grade 2a gynecomastia, 5 had grade 2b, and the remaining 2 patients had grade 1. Patients with Simon grade 3 gynecomastia were not included in this study.

The surgical approach described in this study has several advantages. Autologous fat injection is a relatively cost-effective technique that involves standard equipment and can easily be added to a cosmetic surgeon's armamentarium. Because of the uptake and survival of fat grafts in muscle tissue,^{18,19} a single transplantation session usually is sufficient. In addition, the technique can be applied to any grade of gynecomastia. Although patients requiring only liposuction for the correction of gynecomastia were excluded from our study because of the difficulty in determining fat transfer sites, the experienced surgeon may consider fat grafting in these patients. The present study included patients aged 19 to 36 years, but this technique is equally applicable to older patients. This method may not be preferred for athletic patients with distinct pectoral hypertrophy or for very underweight patients, in whom fat grafts may be difficult to obtain.

There are several limitations to fat grafting into the PM during primary surgery. The quantity of fat cells that survive in the muscle is an important consideration. Numerous experimental and clinical studies have addressed the efficiency of intramuscular fat grafting, but precise changes in the size and volume of the PM have not been documented.^{18,19} We demonstrated the viability of injected fat cells with MRI and computed tomography. However, the outcomes of fat grafting should be determined more objectively, potentially in an animal model. In addition, a photographic analysis of the survival of transplanted fat is warranted. Long-term changes in muscle tissue may occur after fat grafting. To assess this possibility, clinical or experimental studies with longer follow-up periods are needed.

CONCLUSIONS

Autologous fat injection into the PM in conjunction with gynecomastia correction may be a valuable method for achieving a masculine and natural-looking aesthetic

appearance. More prolonged monitoring of patients and precise evaluation of fat cell survival are needed to demonstrate the overall efficacy of this technique.

Disclosures

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