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Original Article

Reproducible, minimally invasive and safe: Comprehensive aesthetic corrections of gynecomastia

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ABSTRACT

Background: Minimally invasive access and fast recovery are trends of gynecomastia surgery. We placed great importance on liposuction and modified original pull-through technique. The purpose of this study was to present a refined surgical strategy for gynecomastia in grade I and II.**Methods:** The refined strategy embraced enhanced liposuction to remove the intraglandular fat sufficiently, followed by open resection of gland using the pull-through and bottom-up technique with adjuvant liposuction in the end. Surgical data were recorded and satisfactory questionnaires with 5-point scales were administered during follow-up.**Results:** Between January 2017 and May 2022, 165 patients underwent enhanced liposuction combined with the pull-through and bottom-up technique for gland excision. Age ranged from 12 to 56 years. The median length of surgery was 100 min. A median of 300 ml of fat was aspirated and a median of 20.8 g of gland was excised. Seventy-seven patients (46.7%) responded the questionnaires at least 6 months postoperatively, and the average overall satisfaction was 4.68 ± 0.52 points. Thirteen sides of breasts developed complications with a rate of 4.0%.**Conclusion:** Enhanced liposuction combined with pull-through and bottom-up technique proved effective to treat grade I and II gynecomastia with minimal scarring and high satisfaction. The refined strategy was simple and safe, and would obtain optimal outcomes even for inexperienced surgeons.© 2023 Asian Surgical Association and Taiwan Robotic Surgery Association. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Subcutaneous mastectomy via a semicircular areola incision had been the mainstay of surgical techniques to treat gynecomastia until Teimourian and Perlman introduced suction-assisted liposuction combined with open excision of the residual glandular tissue in 1983.^{1,2} Since then, this strategy has been widely accepted as the gold standard for correction of gynecomastia in Simon's grade I and II and is still used today. For higher satisfaction and faster recovery, gynecomastia surgical treatment is seeking a shift from the traditional semicircular approach to the minimal

invasiveness. As a pathfinder of minimal access excision techniques, Morselli proposed the pull-through technique in 1996 and removed the fibroglandular tissue through 10 to 12-mm inframammary fold and anterior axillary fold incisions used for liposuction.³ Over the last decades, various modified methods emerged and proved their effectiveness and satisfactory outcomes.^{4–10} Despite this, the original pull-through technique is characterized by excision in piecemeals which may be time-consuming. Besides, the procedure must be performed meticulously relying on accurate palpation, and it is prone to contour abnormality. Since 2017, our team have refined on the classic pull-through technique and initiated the pull-through and bottom-up technique. This method combined the benefits of excision of glandular tissue in direct vision uniformly along with the minimal scarring incision, most importantly, it is based on the premise that we perform enhanced liposuction prior to open resection. We placed importance on liposuction and adopted the conventional suction assisted

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liposuction without power or ultrasound assistance, and obtained equivalent satisfactory results.

Herein, we introduce our experience with the refined surgical strategy for gynecomastia in Simon's grade I and II and report our results. We expect this simple and safe strategy to be helpful to optimal outcomes, even for those in experienced surgeons.

2. Patients and methods

2.1. Patients

A total of 165 gynecomastia patients in grade I and II undergoing enhanced liposuction combined with the pull-through and bottom-up technique for excision of gland between January 2017 and May 2022 were included in this study. All patients were diagnosed on the basis of history and breast examination and had a history of more than 2 years. Most of the included patients had sonography to rule out the presence of malignant tumor. Simon's classification for gynecomastia was used for grading.¹¹

We retrospectively reviewed preoperative and postoperative photos of these patients. Length of surgery, volume of aspirated fat, weight of removed gland and rate of complication were documented. Postoperative satisfactions were assessed during the follow-up of at least 6 months after surgery by means of the questionnaire on a social media app. The questionnaire consisted of 7 items: chest appearance, flatness, symmetry, nipple-areolar complex (NAC) position, scarring, skin tightness, and overall satisfaction. Each item was evaluated by a 5-point Likert's scale, in which 1 was very dissatisfied, and 5 was very satisfied.

This study was approved by the Institutional Review Board of our hospital. Photos were obtained with written informed consent according to the principles in the Declaration of Helsinki.

2.2. Surgical procedures

Preoperative markings are made in a standing position. Three zones are marked on the chest (Fig. 1A). Zone 1 is the primary region of gland hypertrophy and fat deposits where enhanced liposuction must be fulfilled. Zone 2 is similar to the accessory breast in females caudal to the axillary area. Zone 3 is the extension of Zone 1 to the lateral chest wall. These two zones usually require liposuction for contour transition.

2.2.1. Step 1: Infiltration

Under general anesthesia, the patient is placed in a supine position with his arms along the body for reappearance of the enlarged breast in a standing position. A stab incision is made slightly below the inframammary fold close to the anterior axillary line for infiltration. We use the superwet technique with a 1:1 ratio of infiltration to estimated fat aspiration. The tumescent solution contains 20 ml of 2% lidocaine and 1 ml of epinephrine in 1000 ml of normal saline. We start the infiltration in the superficial layer underneath the dermis followed by the deep layer within the fibroglandular framework of breast. The amount of the gland can be judged preliminarily by the extent of ease when an injection cannula passed through the breast. Infiltration into the retroglandular layer is not necessary. We wait for at least 10 min until the solution distributes evenly and the skin turns pale before liposuction is initiated.

2.2.2. Step 2: Enhanced liposuction

The aim of enhanced liposuction is to remove the intraglandular fat and isolate the glandular tissue to facilitate the resection. In this step, another stab incision is placed at the 6-clock position of the inferior border of areola. Cannulas inserted in these two incisions can cover all the regions of the breast including Zone 2 and Zone 3

with a dominant hand on both sides. A sheath is fixed onto the incision for skin protection. Picking up the palpable dense mass and holding it away from the deep fascia, we use a 3-mm sharp-tip cannula for easily piercing through the fibers to aspirate the intraglandular fat (Fig. 1B). This is performed in a fanlike pattern, starting from the deep fat and proceeding superficially. Notably, a substantial thickness of retroglandular fat is maintained. Meanwhile, fat deposits in Zone 2 and Zone 3 are also aspirated. After sufficient removal of the fatty component within the fibroglandular framework, the retroareolar mass decrease in size, and the real amount of pure glandular tissue can be evaluated. Subsequently, we insert a 2.5-mm sharp-tip cannula for superficial liposuction to thin the subcutaneous fat and disrupt the fibrous tissue from its superficial attachment. The end point of the enhanced liposuction includes a consistent pinch thickness of 1–2 cm and a fully isolated gland moving smoothly along with the motion of a cannula (Fig. 1C) (see supplemental Video 1).

Supplementary video related to this article can be found at <https://doi.org/10.1016/j.asjsur.2023.07.147>

2.2.3. Step 3: Pull-through and bottom-up technique for gland excision

After evaluation of the real size of glandular mass, the incision at the 6-clock position of the inferior border of areola is extended to 1 cm. Residual attachments of glandular tissue such as gland fibers and Cooper's ligaments are dissected and divided with tissue scissors (Fig. 2A). A vascular forceps is then introduced through the incision to clamp the isolated glandular mass and pull it out (Fig. 2B). At this time, the gland is inverted with the only attachment to the areola and flattened upside down (Fig. 2C). We excise the gland from the bottom and put it back (Figs. 1D, 2D). When extensive gland is still present, we repeat the pull-through motion and trim the gland in slice in a bottom-up fashion until a flattened appearance is achieved. In this way, enough glandular tissue can be preserved to avoid depression of the NAC to the maximum extent. When a large gland is encountered, the peripheral part of gland is reduced first, and then the same procedures are performed. For most cases, placement of the drainage tube is not required. If needed, the stab incision below the inframammary fold is left for drainage. The incision is closed by layers, and then Steri-Strips and compressive dressing are applied (see supplemental Video 2).

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2.2.4. Step 4: adjuvant liposuction

After open excision of the gland, adjuvant liposuction is performed to feather the peripheral area and disrupt the inframammary fold particularly to achieve a more natural transition from the breast to the abdomen using a 2.5-mm sharp-tip cannula through the areolar incision. Besides, the regional contour bulge can be detected when the patient is placed in a sitting position intraoperatively. Further trimming for extra fat is needed to obtain a smooth and optimal contour.

2.3. Postoperative care

The majority of patients are allowed to be discharged on the day of surgery or stay for 1 day. Examination on the first day after surgery is important to detect the occurrence of hematoma. Sutures are generally removed 7 days after surgery. Patients are instructed to wear a pressure garment for at least 4 weeks to promote the breast skin retraction. They are able to return to the daily activities immediately after surgery. Exercise of the shoulder is allowed after 4 weeks, but intensive pectoral muscle training should be postponed until 3 months postoperatively.

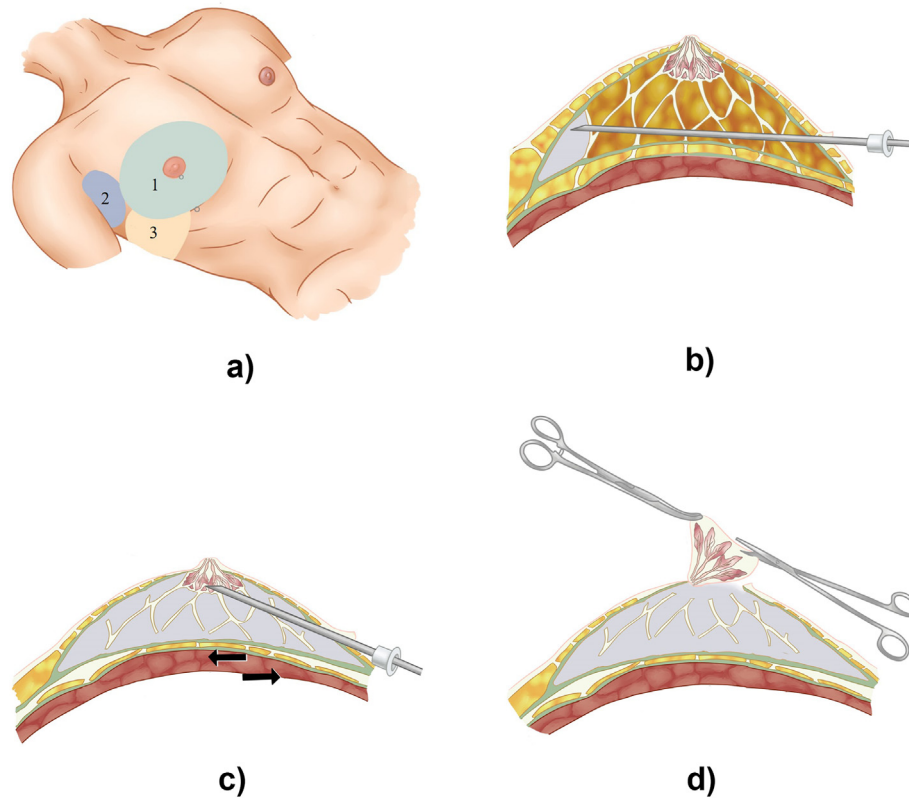


Fig. 1. Illustration of enhanced liposuction combined with the pull-through and bottom-up technique. A: Preoperative illustration of the three zones and two stab incisions. B: Aspirating the intraglandular fat from the deep layer. C: The end point of the enhanced liposuction showing a fully isolated gland. D: Gland excision using the pull-through and bottom-up technique.

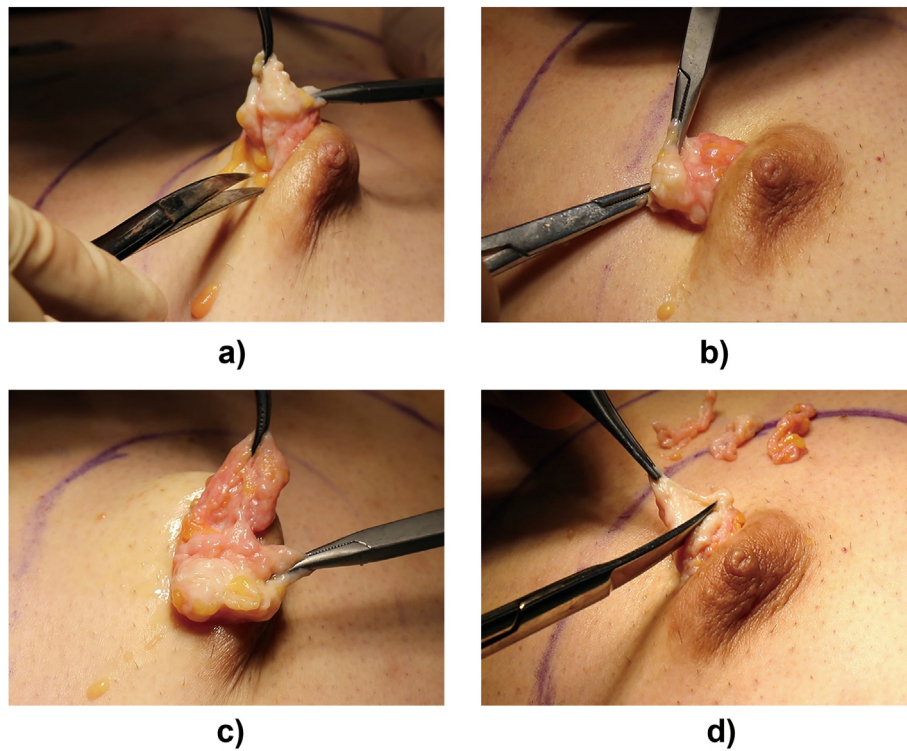


Fig. 2. Surgical procedures of the pull-through and bottom-up method in a 25-year-old male patient with gynecomastia. A: Dissection of residual attachments of gland. B: Pulling the isolated gland through a small incision. C: Inversion of the gland to an upside-down position. D: Resection of the gland from the bottom.

3. Results

The ages of 165 patients undergoing enhanced liposuction combined with the pull-through and bottom-up technique for gland excision ranged from 12 to 56 years, with an average of 26.5 ± 8.8 years. Among these patients, 46 presented with gynecomastia in grade I, 93 was in grade IIa, 26 was in grade IIb. The median length of surgery was 100 min. A median of 300 ml of fat was aspirated by enhanced liposuction. A median of 20.8 g of gland was excised using the pull-through and bottom-up technique.

Seventy-seven patients (46.7%) answered the questionnaires, and the period of follow-up ranged from 6 month to 58 months, with a median time of 12 months. The average point of overall satisfaction was 4.68 ± 0.52 (chest appearance: 4.62 ± 0.54 , flatness: 4.53 ± 0.55 , symmetry: 4.64 ± 0.55 , NAC position: 4.71 ± 0.51 , scarring: 4.69 ± 0.49 , skin tightness: 4.64 ± 0.56), reflecting a high satisfaction and very good surgical outcomes (Figs. 3, 4, 5). During follow-up, complications occurred on 13 sides of breasts (4.0%). Hematomas were found in 3 breasts, 1 was treated conservatively by compression bandage, and 2 underwent surgical evacuation. Other complications were shown in Table 1.

4. Discussion

The goal of surgical treatment for gynecomastia is not only removal of hypertrophic gland but also masculinizing the chest, positioning the NAC, and retracting the skin to achieve aesthetic appearance. In recent years, pursuing a smaller incision, lower rate of complication, and faster recovery has been the higher goal of gynecomastia surgery. To achieve this goal, it is necessary to establish a simple and safe surgical strategy, especially for those surgeons without much experience.

Unlike the female breast, the male breast has predominantly fatty tissue with few ducts and stroma.¹² In gynecomastic breasts with history of more than 1 year, ducts become hyperplastic and

dilated, periductal tissue and surrounding stroma undergo fibrosis and simultaneously intraglandular fat increased.¹³ Given this, liposuction is always regarded as the most important adjuvant approach to treat true gynecomastia. Its value has been approved owing to the nature of minimal invasiveness and better contouring. In this study, liposuction was occupied an important position in our surgical strategy, and we performed liposuction in almost all gynecomastia patients except for body builders. Different parts of fat are managed specifically. The intraglandular fat is aspirated sufficiently to facilitate the resection. The retroglandular fat needs to be preserved to avoid direct adhesion between the flap and the deep fascia, resulting in muscular contraction deformity (Fig. 6) (see supplemental Video 3).¹⁴ The subcutaneous fat superficial to the gland is thinned evenly to promote skin retraction with a pinch thickness of 1–2 cm.¹⁵ For overweight patients, the thicker flap allows a more suitable contour according to their chest profile.¹⁶

Supplementary video related to this article can be found at <https://doi.org/10.1016/j.asjsur.2023.07.147>

Technical tips for enhanced liposuction include: 1) using a sharp-tip cannula. New surgical equipment such as power-assisted liposuction, ultrasound-assisted liposuction led to an advancement of aspiration efficacy, making it possible to remove the dense fat tissue within the fibroglandular framework.^{4,8,14,17–21} However, these techniques depended on advanced equipment are less popular than conventional suction assisted liposuction in most hospitals. Intraglandular dense fat could be also effectively removed by conventional liposuction.^{9,22–24} No comparative studies concluded that it is inferior to conventional liposuction in terms of complication rate, surgical outcomes as well as satisfaction.²⁵ We used a sharp-tip cannula to penetrate through the fibroglandular framework for removal of the intraglandular fat and disrupting the superficial fibers for better skin retraction, which also obtained equivalent satisfactory results. 2) establishing an end point of liposuction. Hammond assessed the endpoint of liposuction by pinch test, by the quality and quantity of aspirate, and by resistance

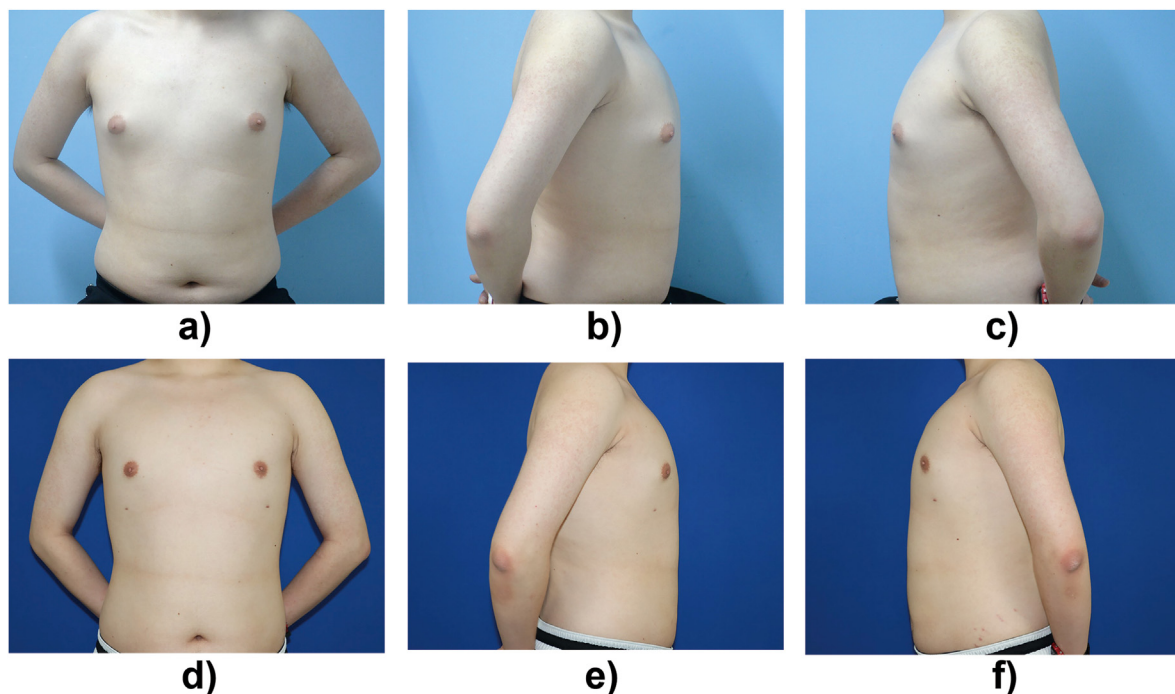


Fig. 3. Photographs of a 16-year-old male with gynecomastia in grade I undergoing bilateral enhanced liposuction combined with gland excision by the pull-through and bottom-up technique. A, B, C: Preoperative view. D, E, F: View of follow-up at 12 months after surgery.

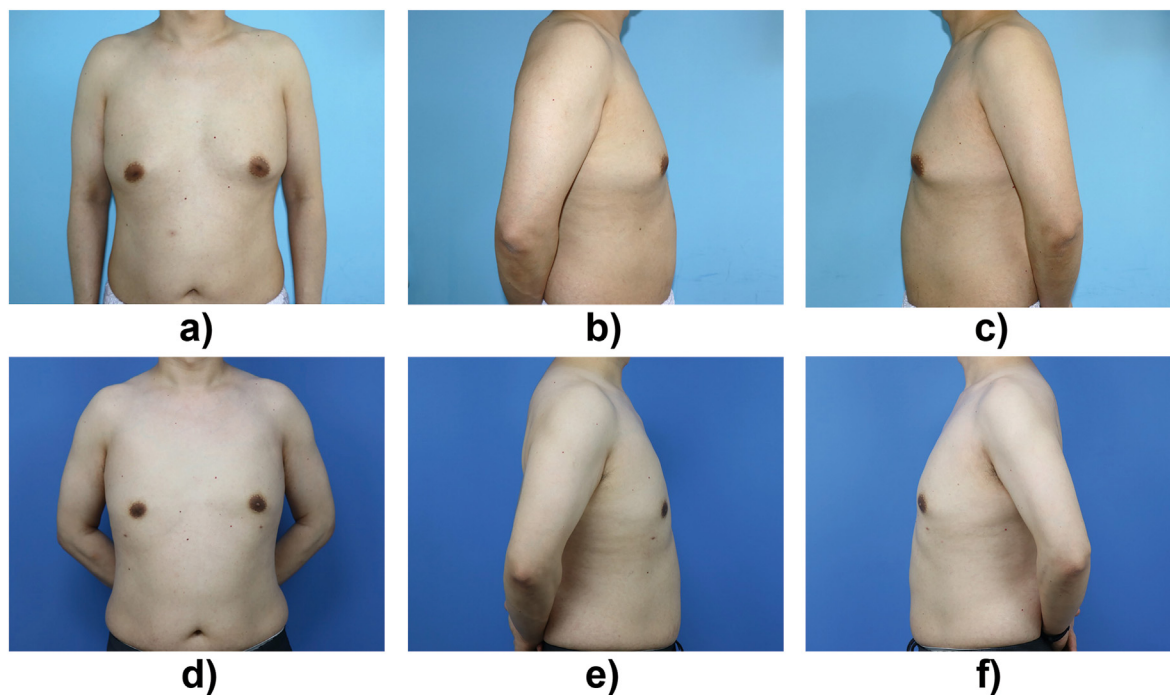


Fig. 4. Photographs of a 42-year-old male with gynecomastia in grade IIa undergoing bilateral enhanced liposuction combined with gland excision by the pull-through and bottom-up technique. A, B, C: Preoperative view. D, E, F: View of follow-up at 15 months after surgery.

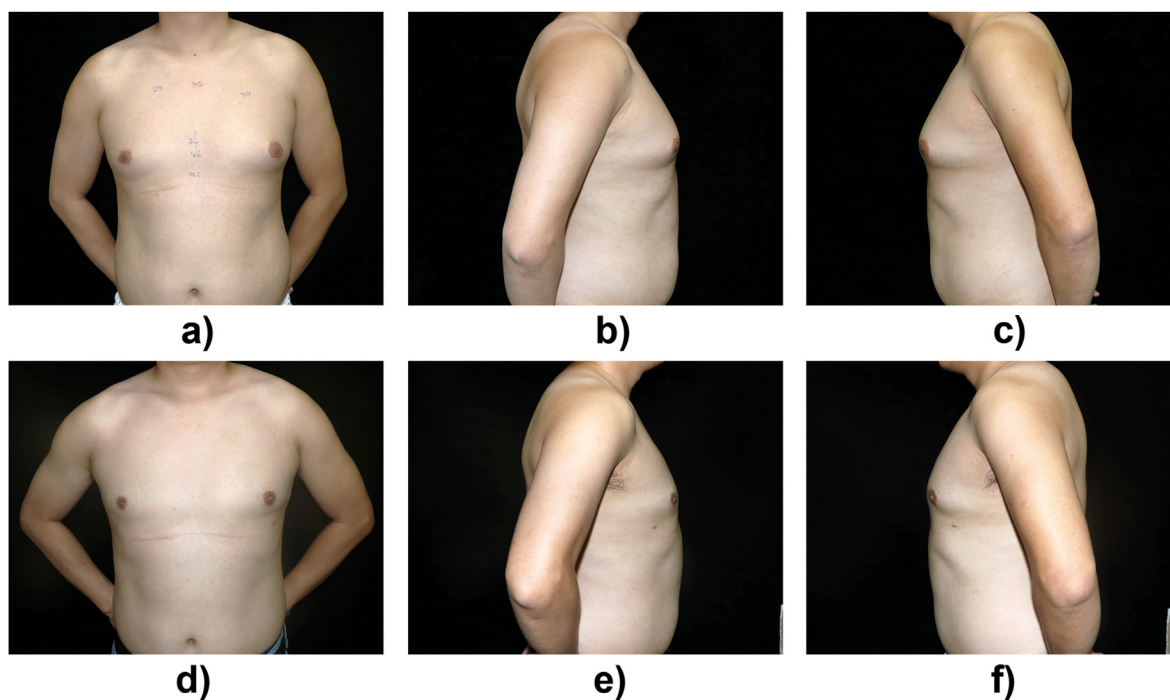


Fig. 5. Photographs of a 27-year-old male with gynecomastia in grade IIa undergoing bilateral enhanced liposuction combined with gland excision by the pull-through and bottom-up technique. A, B, C: Preoperative view. D, E, F: View of follow-up at 13 months after surgery.

to passage of the cannula.⁴ These parameters in our viewpoint were nearly subjective, ambiguous and difficult to implement. The end point established in this study seemed more practical because it presented a concrete pinch thickness and a detectable phenomenon reflecting fully isolated gland.

In the past decades, the trend has undergone a shift from

subcutaneous mastectomy via the semicircular periareolar incision to minimally invasive approach. The classic “pull-through” technique described by Morselli was performed by pulling the gland through the remote incisions and removing in piecemeals.³ Our pull-through and bottom-up technique is different from the original one. First, like Hammond and Henry,^{4,7} the gland is pulled

Table 1
Complications.

	n = 326 breasts (165 patients)
Complication	13 (4.0%)
Hematoma	3 (0.9%)
Seroma	1 (0.3%)
Contour irregularity	5 (1.5%)
Scar hypertrophy	2 (0.6%)
Nipple-areola complex necrosis	0 (0.0%)
Nipple hypesthesia	0 (0.0%)
Residual glandular tissue	2 (0.6%)
Revision	3 (0.9%)

through the small single periareolar incision rather than two incisions at the axillae and the inframammary fold. Because the core component of gland is located underneath the areola, the periareolar incision can offer a more direct vision and a more precise control of removal. Although Morselli left the scar away from the breast aesthetic units, remote manipulation increased risks of bleeding due to blind traction. Second, the glandular mass can be pulled out in entirety easily in most patients after enhanced liposuction. Excision of the gland in slice from the bottom to the top ensures uniformity and avoids saucer deformity completely (Fig. 7). This deformity tends to occur in inexperienced surgeons. Excision in piecemeals during the traditional pull-through technique must be performed cautiously and repeated for many times depending on accurate palpation, which was supposed to be time-consuming and made it difficult to assess the precise amount of tissue removal.^{10,26}

The pull-through and bottom-up technique combined with enhanced liposuction offered a simple and safe strategy to treat grade I and II gynecomastia and obtained satisfactory aesthetic outcomes with a low complication rate. Most importantly, this procedure could compromise the modest flattening of the frontal chest contour with invisibility of unwanted scars. Adequate



Fig. 7. A Photograph of a 37-year-old male with severe contour irregularity and muscular contraction deformity after gynecomastia surgery in another hospital 19 years ago.

treatment of all involved zones would address gynecomastia to maximize chest virilization.²⁷ We simplified previous aesthetic zoning of male chest. Fullness in zone 1 is the most desired problem to be solved and is associated with gland hypertrophy and fat deposits where enhanced liposuction must be fulfilled sufficiently. Zone 2 and Zone 3 usually require liposuction for contour transition. Lista indicated this extended contouring of the chest led to better breast contour and blending of the nipple-areola complex with the surrounding breast.⁸ Periareolar incisions have been preferred by surgeons for a variety of breast surgeries with aesthetic requirements. To prevent visible scarring within or outside the areola, the incision should be made exactly at the

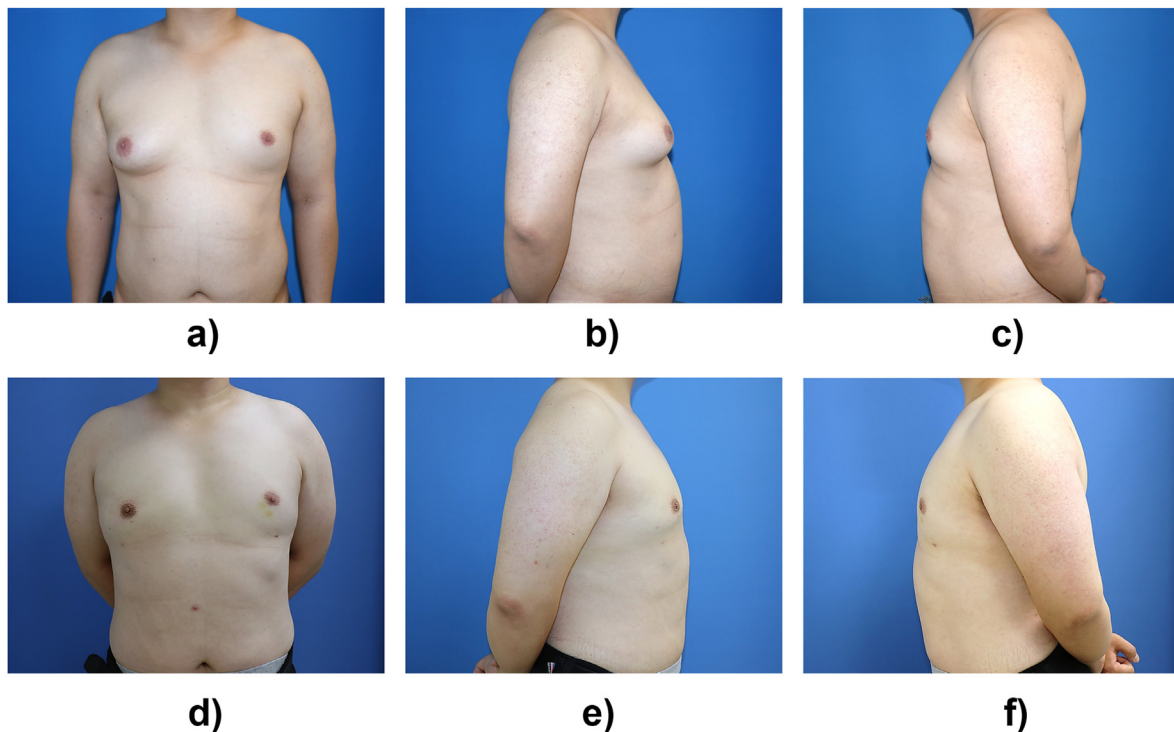


Fig. 6. Photographs of a 31-year-old male with gynecomastia in grade IIb undergoing bilateral enhanced liposuction and gland excision by the pull-through and bottom-up technique on the right side. A, B, C: Preoperative view. D, E, F: View of follow-up at 6 months after surgery.

junction of the areola and surrounding skin. Numbers of authors reported that a minimal periareolar incision in a color-changing area was almost invisible from a long term.^{4,7,10,28–30} Despite a sheath was inserted into the stab incision to protect the surrounding skin from friction injury, we found the scars of the stab incision appeared more conspicuous in most cases.

One limitation is that body builders are not appropriate candidates for this strategy. Because the pectoralis major in body builders are extremely developed and hypertrophic with very minute amounts of subcutaneous or glandular fat which are different from body types of gynecomastia patients.³¹ These anatomical differences necessitate direct excision as opposed to the use of liposuction. Besides, mastectomy with skin resection is still the most common surgical approach to correct grade III gynecomastia.³² In some severe cases, it is necessary to combine liposuction with other techniques including skin-sparing mastectomy, pedicled NAC flap and free NAC graft to achieve satisfactory results.

5. Conclusions

Enhanced liposuction combined with the pull-through and bottom-up technique is a simple and safe strategy to treat grade I and II gynecomastia with the minimal scarring incision and has satisfactory aesthetic outcomes. This strategy could be applied in most hospitals to undertake gynecomastia surgery successfully.]

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Declarations of competing interest

All authors state that they have no conflicts of interest or financial disclosures.

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