

## Comparative Study between Reconstruction of Grade III Gynecomastia in Single Stage versus Two Stage Reconstruction

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### ABSTRACT

**Background:** The difficulty of treating severe grades of gynecomastia lies in the resection of excess skin. This resection can result in extensive scars located in conspicuous sites. To reach the optimum results, excess skin should be excised and the excess fat and gland should be managed too. Managing the excess fat, enlarged mammary gland, together with excision of excess periareolar skin with nipple-areola transposition in single-stage is associated with higher risk of injuring the vascular pedicle of nipple-areola, and also associated with excessive pleating of periareolar skin due to the sudden reduction in the size of areola which don't allow for skin retraction to occur. Staged-reconstruction will allow for gradual reduction in the size of areola allowing for skin adaptation leading to minimal pleating of periareolar skin, and also preserve the nipple-areola vascularity.

**Aim of Work:** Is to compare between reconstruction of grade III gynecomastia in single-stage versus two-stage, as regard the complications rate.

**Patients and Methods:** Twelve patients with severe (grade III) gynecomastia with enlarged ptotic nipple-areola, underwent surgery over a 2-year period. All patients were marked pre-operatively. Under general-anesthesia, traditional liposuction of the peri-glandular area was performed, followed by de-epithelialization of excess peri-areolar skin to elevate the nipple-areola. The glandular tissue was delivered by "pull-through" technique, through a lateral trans-dermal peri-areolar incision. Study performed on two groups, group I, surgery was performed in single-stage, while in group II, surgery was performed in two-stages, with liposuction of excess fat and resection of excess peri-areolar skin with elevation of nipple-areola in the first stage then, three months later, patients underwent minimal liposuction just to facilitate delivery of the gland, with its delivery using the "pull-through" technique.

**Results:** Follow-up period was 6 months. No hematoma, seroma, breast skin necrosis, breast asymmetry, or nipple-areola malposition were detected post-operative in both groups. Results were reported as "uniformly good to excellent" on a patient satisfaction scale, as all patients were satisfied with their breasts contour and nipple-areola position postoperative. Transient hyposthesia of nipple-areola occurred and improved spontaneously at 6 months post-operative. By comparing the complications rate between both groups, results showed that single-stage reconstruction in group I was associated with higher complications rate as regard the nipple-areola vascularity, and as regard the presence of excessive pleating of

periareolar skin than in group II. One case in group I show complete loss of nipple-areola. Another case of nipple-areola vascular compromise and partial necrosis were also detected in group I. While, no cases showed compromised vascularity of nipple-areola in group II patients with two-stage reconstruction.

**Conclusions:** Two-stage reconstruction is considered as safe procedure for correction of severe (grade III) gynecomastia, which preserve nipple-areola vascularity, and permits broad resection of excess skin and mammary tissue, while avoiding unattractive scars on the patient's chest, with minimal pleating of periareolar skin.

**Key Words:** Severe – Grade III – Gynecomastia – Staged reconstruction – Pleating – Areola vascularity.

### INTRODUCTION

Gynaecomastia is the most common benign breast pathology among male adolescent [1], and it causes considerable amount of psychological and social discomfort which push them to seek medical advice [2]. Amongst the different grades of gynaecomastia, high-grade gynaecomastia (Simon grade IIb and III) has the problem of skin excess along with enlarged ptotic nipple-areola, which can only be managed surgically [3].

The growth of male breast tissue depends mainly on the balance between serum estrogen and androgens. Any physiologic or pathologic factor that interferes with this balance can result in gynecomastia [4,5]. Advances in elucidating the pathophysiology of gynecomastia have been made, though understanding remains limited. Medical management has had limited success; however, surgical removal of the hypertrophic breast tissue remains the accepted standard in treatment [6-10].

Gynecomastia composed of three components pathologically which are adipose tissue, mammary gland, and excess skin. With the appearance of the era of post-bariatric surgery, in which most of the patients have a bad skin quality, grade III gyneco-

mastia become associated with severe degrees of skin redundancy [11].

Among various classifications of gynecomastia, the one by Simon et al., in 1973 [12] based on hypertrophic skin, is most useful: Grade I: Small breasts without hypertrophic skin. Grade IIa: Moderate breasts without hypertrophic skin. Grade IIb: Moderate breasts with hypertrophic skin. Grade III: Large breasts with hypertrophic skin, similar to female breasts, with enlarged nipple-areola complex.

For patients with moderate to severe skin and soft tissue excess requiring nipple-areola elevation, liposuction alone is not adequate [13,14]. Reconstruction should include liposuction of excess fat, excision of glandular tissue, excision of excess skin, and repositioning of nipple-areola. The difficulty of treating severe grades of gynecomastia lies in the resection of excess skin. This resection can result in extensive scars located in conspicuous sites [9,12].

The available skin reduction techniques are periareolar, lateral wedge, elliptical, inverted T, and LeJour [11,15-17]. The concentric peri-areolar technique is the most popular because of less noticeable scarring [15,16].

Over the years, surgical techniques for management of high-grade gynaecomastia have evolved a lot. Malbec in 1945 [18] suggested breast amputation with free nipple-areolar graft for management of breast ptosis and skin excess, but the procedure had its own limitations as there may be total loss of the graft, there may be hyposthesia of the nipple-areolar, or these patients may develop hypertrophic scars over chest. The use of the transverse elliptical incision on a supero-lateral pedicle has been described as an alternative to amputation and free nipple grafting [19,20]. This technique involves a scar that crosses the mid-chest passing around the areola, the need to maintain a glandular pedicle can lead to excess remaining tissue, leading to a contour deformity and undercorrection [21].

Scar-less techniques like glandular excision through periareolar and intra-areolar incision was described by Leon Dufourmentel in 1928 [22] and latter by Jerome Webster in 1946 [23], and remain a mainstay of treatment [1,12,23]. These incisions affords a better access to all quadrants of breast tissue and gives a good aesthetic appearance. With this technique, the hypertrophied gland could be removed without leaving a significant scar, but in cases of grade III gynaecomastia, this intra-areolar

incision may be too small, a lateral and medial extension may be needed [3].

Previously, different researchers like Persichetti et al., [24] and others [25,26] had described 'peri-areolar skin reduction with purse-string suturing' technique to reduce the skin and areolar excess. Along with skin reduction, the excess breast parenchyma was removed by making a 'reverse omega' incision in the inferior border of the de-epithelialized area from 3-9 o'clock position (180 degree incision).

Tashkandi et al., in 2004 [27], Sarkar et al., in 2014 [3], and Brown et al., in 2015 [21] described single-stage glandular excision and peri-areolar concentric skin reduction with de-epithelialization in grade III gynaecomastia. However, in Tashkandi et al., study [27], reported that the main disadvantage of the technique was the mild residual skin redundancy. While, Sarkar et al., [3] and Brown et al., [21] studies reported excellent results with a single-stage procedure, with liposuction and glandular excision done through the same lateral peri-areolar incision.

Disadvantage of the concentric peri-areolar skin reduction technique is the excessive pleating of periareolar skin, because performing liposuction, peri-areolar de-epithelialization, skin excision, and delivery of the mammary gland in a single-stage, leads to sudden reduction in the size of areola which don't allow for skin retraction and recoil to occur gradually leading to excessive wrinkling and pleating of periareolar skin post-operative [21,27,28].

In addition that, performing the peri-areolar de-epithelialization, and delivery of the mammary gland in a single-stage, leads to excessive thinning of subdermal pedicle of the nipple-areola, results in high rate of vascular compromise to nipple-areola with its possible total or partial loss [21,27,28].

While, two-stage reconstruction with liposuction of fat, and resection of excess skin with elevation of nipple-areola in the first stage then, delivery of the gland in a second stage three months later. May be associated with less pleating of periareolar skin, because staged reconstruction allows for skin retraction and contraction to occur staged and gradually, leading to minimal pleating of periareolar skin post-operative. In addition that in staged reconstruction, the nipple-areola vascularity will be preserved.

No previous studies found in the literature described two-stage reconstruction of grade III gynecomastia, and hence, no previous studies



compared between single-stage and two-stage reconstruction of high-grades of gynecomastia.

*Aim of work:*

Is to compare between reconstruction of grade III gynecomastia with skin excess and enlarged displaced nipple-areola in single-stage versus two-stage, as regard the complications rate. Specially pleating of periareolar skin, and nipple-areola vascular compromise.

## PATIENTS AND METHODS

The current study performed from September 2016 to September 2018, the study included 12 patients who underwent surgical reconstruction for bilateral grade III gynecomastia. Their ages ranged from 18 to 40 years. On physical examination, all patients exhibited enlarged breasts with large areolar diameters, and ptotic nipple-areola Figs. (1A-15A). Patients with small areolar diameter are excluded.

After a written consent. Surgical reconstruction done in the form of traditional liposuction of both breasts through trans-axillary incisions, concentric peri-areolar de-epithelialization for reduction of excess skin and nipple-areola transposition, and delivery of mammary gland by "pull-through" technique through lateral peri-areolar incision. The study patients divided into two groups, in group I, six patients underwent gynecomastia reconstruction in a single-stage, while in group II, six patients underwent staged-reconstruction. In the first stage, liposuction was done, with transposition of the nipple-areola through concentric peri-areolar de-epithelialization of excess skin, and in the second stage, which performed three months later, delivery of the gland was done using the "pull-through" technique through a lateral trans-dermal peri-areolar incision at the lateral margin between the skin and de-epithelialized area, with some minimal liposuction just to facilitate the delivery of the gland.

*Pre-operative markings:*

After thorough evaluation of each patient, including a detailed history and physical examination, markings were made to outline the boundaries of the area to be suctioned. The infra-mammary fold was marked pre-operatively while the patient is standing. The planned elevation of nipple-areola was marked with the new position at 19cm from the sternal notch. In cases with significant increase of areolar diameter, the areolae were marked to be reduced to 2.5 to 3.0cm, i.e. the average diameter of male areola as proposed by Beckenstein et al., [29]. In addition to its reduction, the nipple-areola

should be positioned in an appropriate site at the chest. The nipple position was estimated at the mid-humerus level just medial to the mid-clavicular line [3]. Pre-operative photos were taken for the patient before and after markings Figs. (1A-15A).

*Surgical technique:*

The procedure was performed under general-anesthesia, with the patient in supine position and the upper limbs abducted 90 degrees from the trunk. Trans-axillary incision 3-4mm was made with a no. 15 blade scalpel in the upper most part of the anterior axillary folds bilaterally for optimal access to the dense breast parenchyma. This route also provides access to the infra-axillary and lateral chest area.

Subcutaneous infiltration of wetting solution in the intermediate fat layer over the area of the breast and the surrounding chest wall including the infra-axillary area bilaterally, with infiltration of the glandular tissue was performed using a standard infiltration 3.0-mm cannula. A "superwet" technique, with a 1:1 ratio of infiltrate to estimated aspirate, was used with a solution containing 500ml of saline or lactated Ringer solution mixed with 1 ampules of 1mg/ml (1:500.000) epinephrine.

After a period of 20 minutes, trans-axillary traditional liposuction started for the pre-marked area using liposuction 4 and 5-mm blunt-tip titanium cannula. Stroke technique involves constant, deliberate passes of the cannula through the intermediate fat layer in a radial fashion from the trans-axillary incisions were done, with fanning movement to obtain a uniform results.

The periphery was treated for feathering and contouring. Disruption of the infra-mammary fold is essential in achieving a more gradual transition of the breast to the abdomen, which is characteristic in men. Liposuction of the glandular tissue were also performed to detach the glandular tissue both from the deep plane and the superficial one to facilitate its delivery.

Concentric peri-areolar skin reduction technique was used to treat skin excess and nipple-areola ptosis, de-epithelialization of excess skin at the peri-areolar area was done, extending from the nipple-areola border to the previously marked limit. In cases with significant increase of areolar diameter, the areolae were marked to be reduced to 2.5 to 3.0cm. A small transdermal incision 1cm in extension was made at the lateral margin of the circular de-epithelialized area. It preserves the subdermal neurovascular plexus of the nipple-

areola and were found to be the least to affect the vascularity of the areola [30].

The author used the “pull through” technique to deliver the mammary gland which is the preferred technique by the senior author (Elshahat A). The gland was sharply dissected from the overlying skin and the nipple-areola complex. There is no need to do sharp dissection on the undersurface of the gland. The mammary parenchyma is clamped using a Kokher forceps and pulled-out through the small lateral peri-areolar incision in a piece meal manner. The gland can be easily avulsed from the underlying pectoral fascia without injuring the pectoralis fascia or muscle, this is mandatory to prevent future seroma and hematoma formation. No diathermy or scalpel needed in this technique. Any further liposuction especially at the infra-mammary area was performed through “cross-thoracic approach” using the lateral periareolar incision of one side to reach the infra-mammary fold of the other side.

After delivery of the gland, “purse-string suture” of concentric periareolar skin incision was performed for periareolar closure which was accomplished in layers, with interrupted sutures, using 2/0 Vicryle suture for subcutaneous layer, and 4/0 Monocryle sutures for skin closure. This “purse-string suture” maintain the width of the areola postoperative and prevent its widening to maintain long-lasting results. Liposuction incisions are closed with 4/0 rapidly-absorbing Vicryle sutures. No drains were used. A compressive vest was applied immediately after the surgery. All patients underwent the operation as a 1 day surgery.

Six patients in group I, were operated upon in single-stage with liposuction, delivery of mammary gland, concentric peri-areolar skin resection, and nipple-areola transposition Figs. (1-5). While, the other six patients in group II, underwent staged-reconstruction, with liposuction of excess fat, and concentric peri-areolar skin resection, and nipple-areola transposition in the first stage Figs. (6-10) then, three months later, patients underwent minimal liposuction just to facilitate delivery of the gland, with pull-through of the gland in the 2<sup>nd</sup> stage Figs. (11-15).

#### *Post-operative:*

Post-operative broad spectrum antibiotic, analgesic, and anti-edema medications were prescribed. Semi-sitting position were recommended for three weeks post-operative. A compressive vest was worn for 6 weeks continuously, followed by 4 weeks at nighttime only. Patients were advised to

limit their physical activities for one month post-operative.

Post-operative photos were taken at 6 weeks, 3 months, 6 months post-operative visits, with anterior, oblique lateral, and dead lateral views (Figs. 1B-15B).

## **RESULTS**

Fellow-up period was six months post-operative. No hematoma, seroma, breast skin necrosis, breast asymmetry, contour irregularities, inadequate resection, disruption or dehiscence of peri-areolar suture line, keloid or hypertrophic scarring, infection, nipple-areola malposition or retraction were detected post-operative in both groups.

Results were reported as “uniformly good to excellent” on a patient satisfaction scale in both groups, as all patients were satisfied with their breasts contour and nipple-areola position post-operative. Hyposthesia of nipple-areola were observed in most patients immediately post-operative, but it was transient and resolved spontaneously within 6 months. Excessive gland removal or excessive liposuction can lead to irregularities of the skin surface, but we don't have any in our patients.

Complete nipple-areola necrosis and loss happened in one case of group I, which managed with purse-string suture under local anesthesia and frequent dressings, and completely healed with secondary intension within 2 weeks. One case of nipple-areola vascular compromise and partial necrosis were also detected in group I, which managed conservatively in an out-patient clinic with minimal debridement and frequent dressings, and also completely healed. While, no cases showed compromised vascularity of nipple-areola in group II patients with two-stage reconstruction.

Pleating of peri-areolar skin were detected and was very apparent in patients of group I (Figs. 1B-5B). While, this skin pleating were much less apparent in patients of group II (Figs. 11B-15B). On a patient satisfaction scale, patients of group I complained of noticeable pleating in comparasion to group II patients, who reported less noticeable and accepted degree of pleating.

By comparing the complications rate between both groups, results showed that single-stage reconstruction in group I was associated with higher complications rate as regard the nipple-areola vascularity, and as regard the presence of excessive pleating of periareolar skin post-operative than in group II.

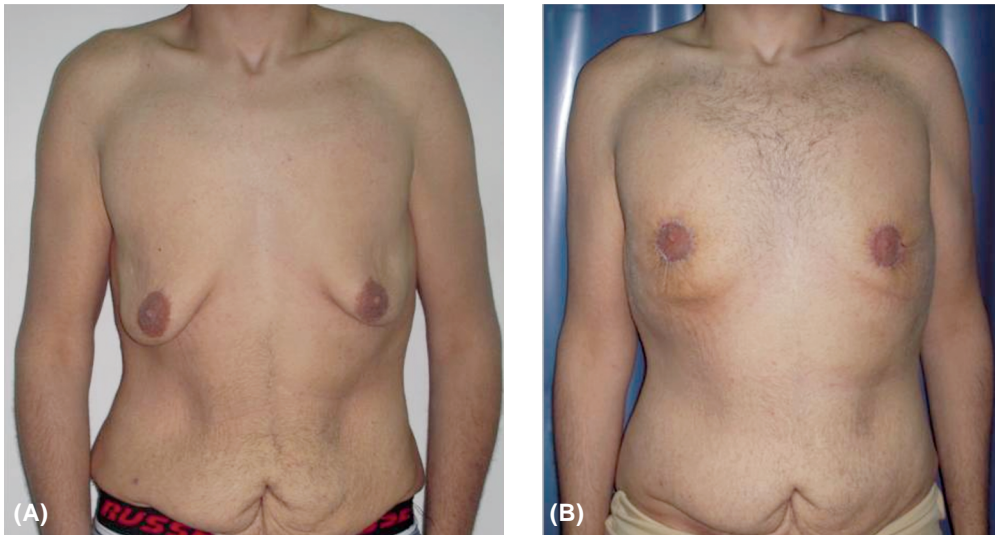


Fig. (1): Anterior view for a patient of group I:  
(A) Pre-operative. (B) Post-operative, with single-stage reconstruction.

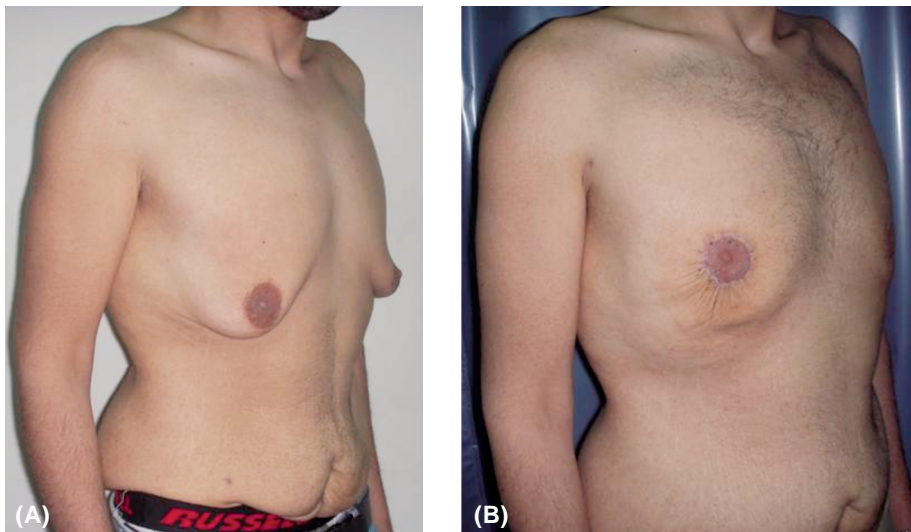


Fig. (2): Right oblique lateral view for the same patient of group I:  
(A) Pre-operative. (B) Post-operative.

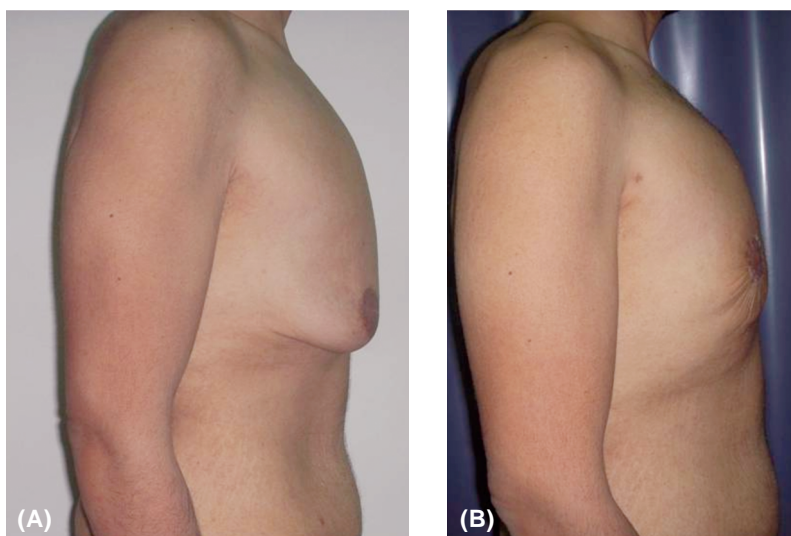


Fig. (3): Right dead lateral view for the same patient of group I:  
(A) Pre-operative. (B) Post-operative.





Fig. (4): Left oblique lateral view for the same patient of group I:  
(A) Pre-operative. (B) Post-operative.

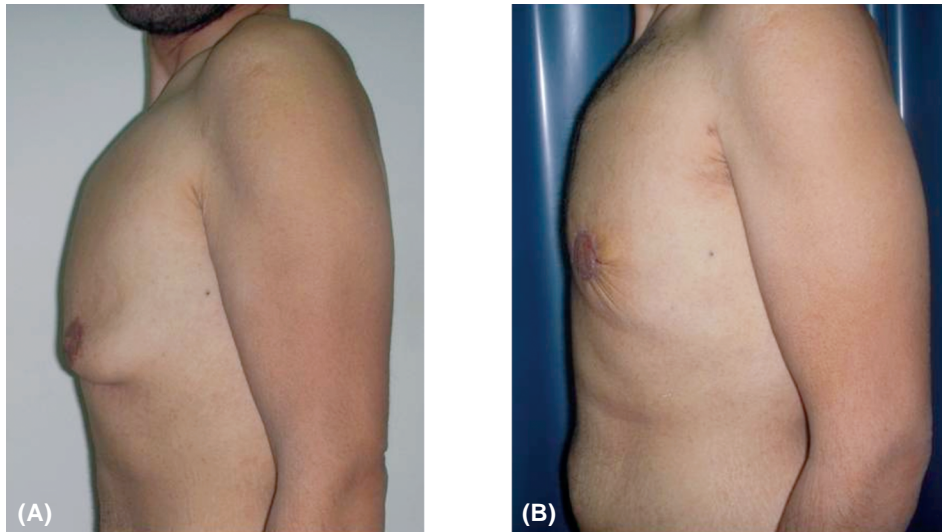


Fig. (5): Left dead lateral view for the same patient of group I:  
(A) Pre-operative. (B) Post-operative.

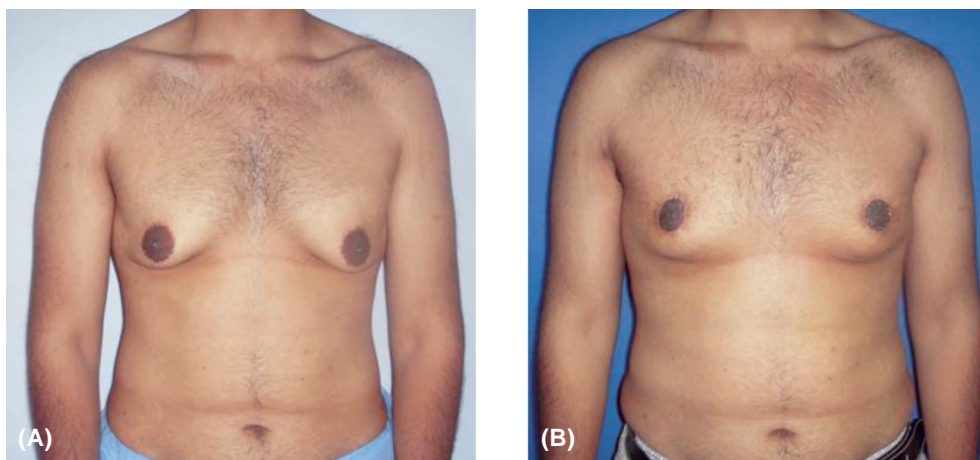


Fig. (6): Anterior view for a patient of group II:  
(A) Pre-operative. (B) Post-operative, with two-stage reconstruction, after the 1<sup>st</sup> stage.



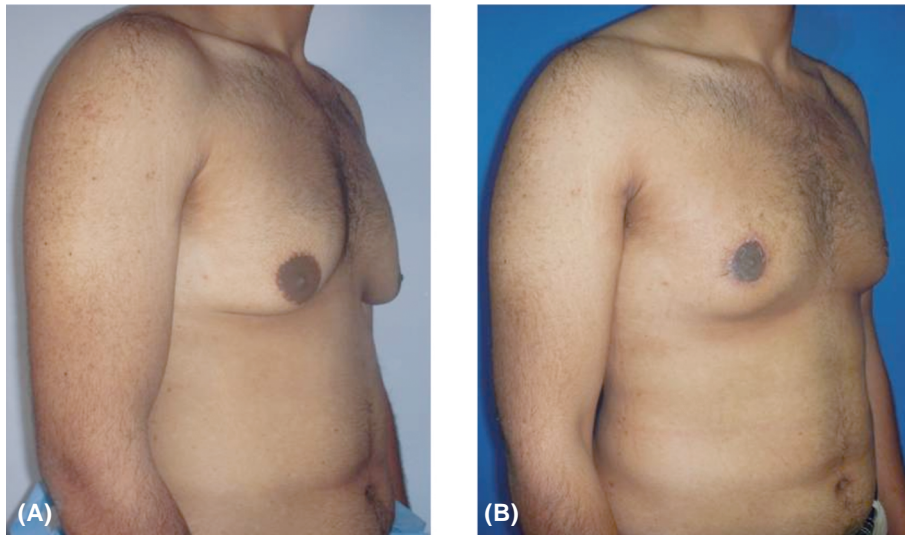


Fig. (7): Right oblique lateral view for the same patient of group II:  
(A) Pre-operative. (B) Post-operative, after the 1<sup>st</sup> stage.

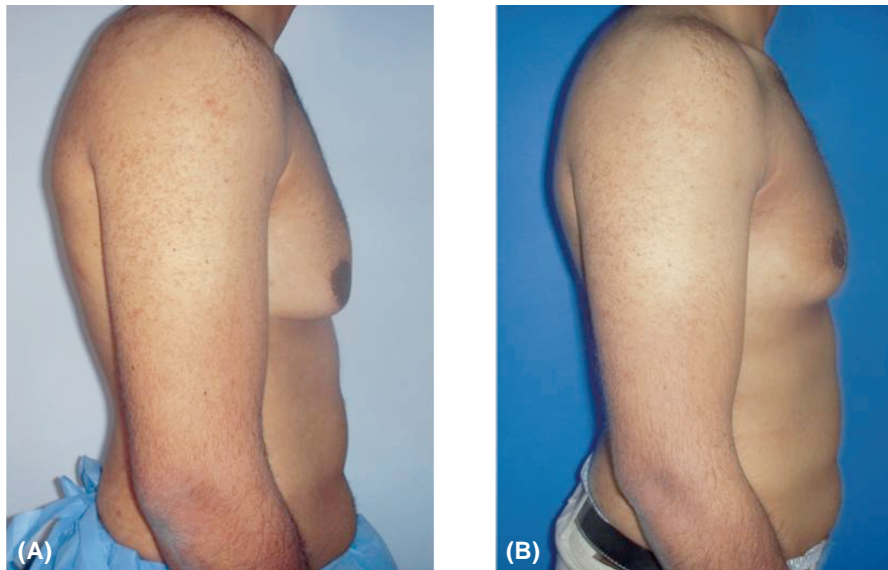


Fig. (8): Right dead lateral view for the same patient of group II:  
(A) Pre-operative. (B) Post-operative, after the 1<sup>st</sup> stage.

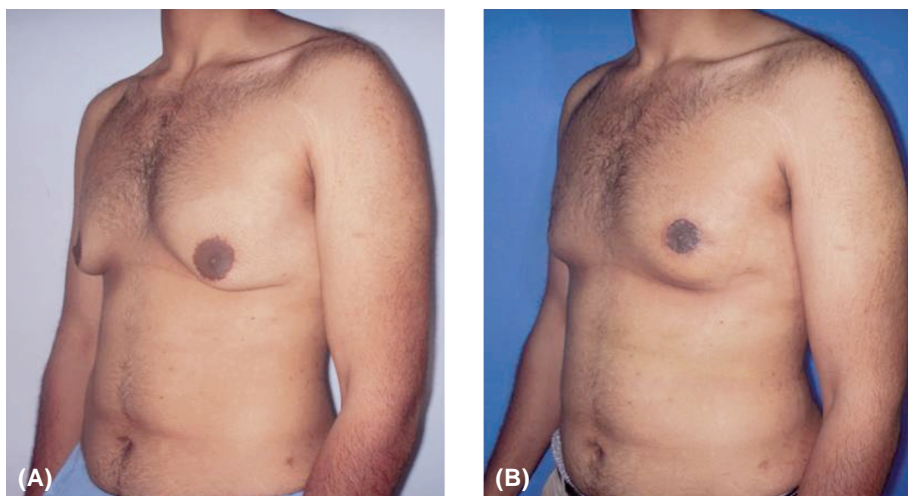


Fig. (9): Left oblique lateral view for the same patient of group II:  
(A) Pre-operative. (B) Post-operative, after the 1<sup>st</sup> stage.

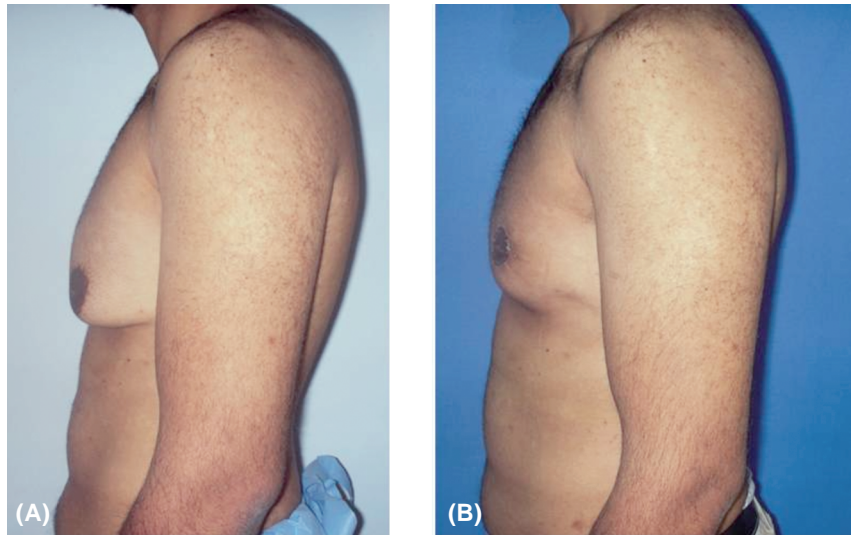


Fig. (10): Left dead lateral view for the same patient of group II:  
(A) Pre-operative. (B) Post-operative, after the 1<sup>st</sup> stage.

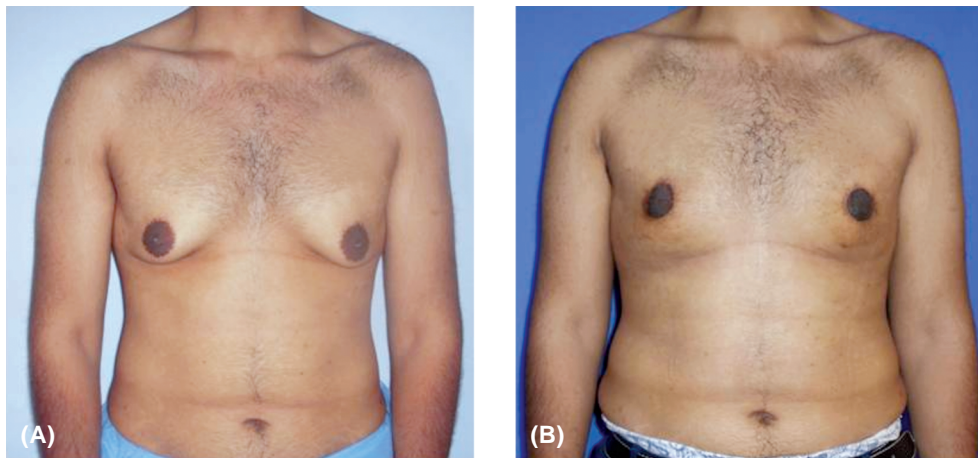


Fig. (11): Anterior view for the same patient of group II:  
(A) Pre-operative. (B) Post-operative, with two-stage reconstruction, after the 2<sup>nd</sup> stage.

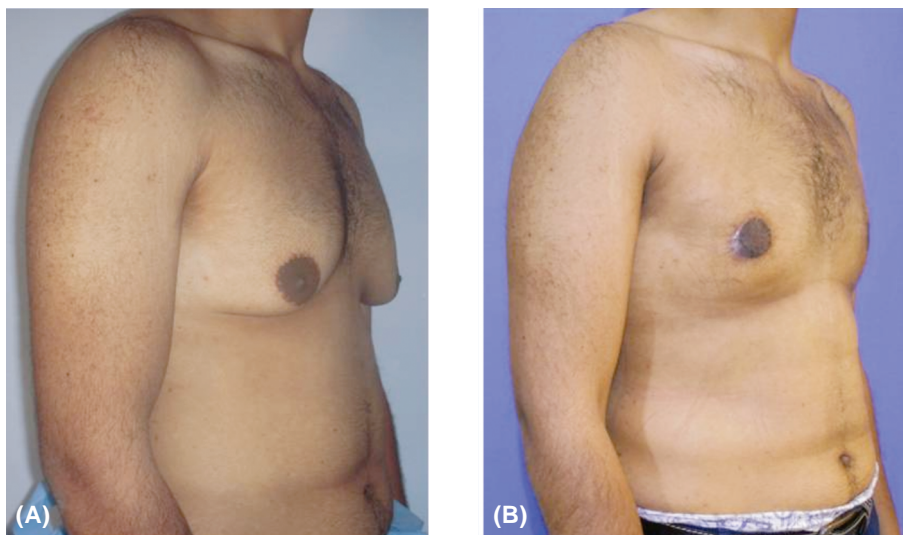


Fig. (12): Right oblique lateral view for the same patient of group II:  
(A) Pre-operative. (B) Post-operative, after the 2<sup>nd</sup> stage.



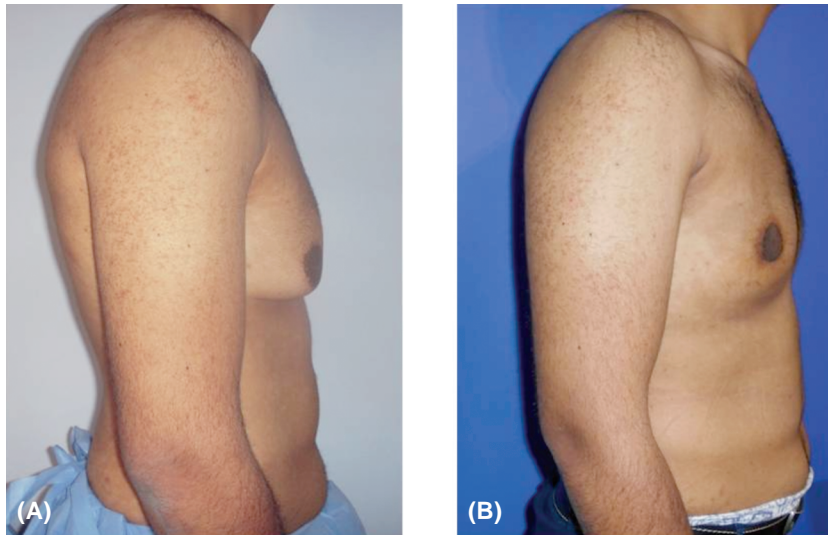


Fig. (13): Right dead lateral view for the same patient of group II:  
(A) Pre-operative. (B) Post-operative, after the 2<sup>nd</sup> stage.

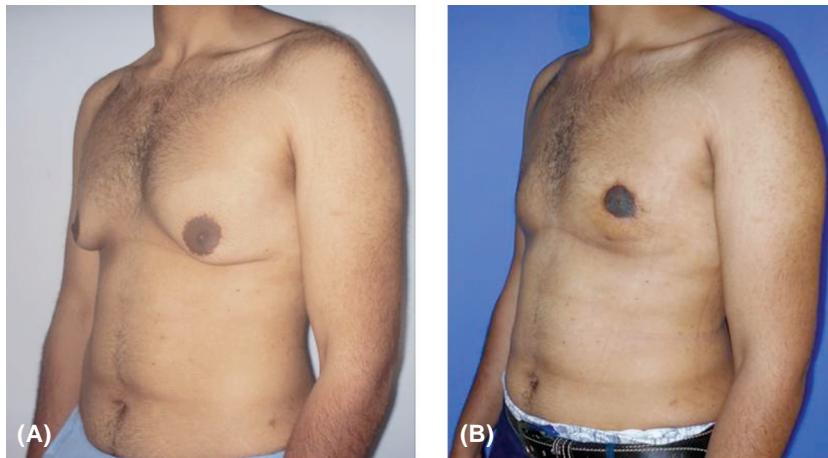


Fig. (14): Left oblique lateral view for the same patient of group II:  
(A) Pre-operative. (B) Post-operative, after the 2<sup>nd</sup> stage.

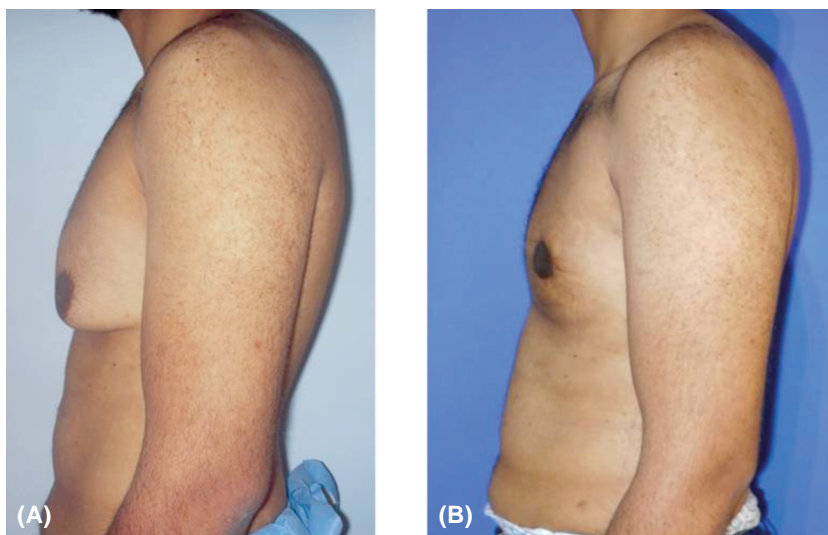


Fig. (15): Left dead lateral view for the same patient of group II:  
(A) Pre-operative. (B) Post-operative, after the 2<sup>nd</sup> stage.

## DISCUSSION

Most of the patients with grade III gynecomastia had not only skin excess, but also had enlarged and infero-medially displaced nipple-areola complex. These patients need both skin and nipple-areola complex reduction to achieve a good aesthetic result [21]. Surgical techniques for grade III gynecomastia, however, have been largely limited in their inability to address significant skin excess and nipple-areolar ptosis [21].

In the most severe cases, breast amputation with free nipple grafting remains an effective option, but this technique is associated with multiple complications most importantly the extensive scarring, possible depigmentation of nipple-areola, loss of nipple-areola sensitivity, possible total loss of free graft, and hypertrophic scars over chest [18]. For patients unwilling to accept loss of nipple sensation or possible depigmentation seen with free nipple graft techniques, elliptical excision patterns allow for significant skin excision while still maintaining NAC viability on a pedicle [11,20]. Its disadvantage is the need to maintain a glandular pedicle which can lead to excess remaining tissue, leading to a contour deformity and undercorrection [21]. So, less invasive techniques were proposed for management of such cases.

Skin reduction techniques other than elliptical excision, are periareolar, lateral wedge, inverted T, and LeJour [11,15-17]. The concentric peri-areolar technique is the most popular because it enable excision of excess skin and nipple-areola transposition with the least noticeable scarring, and its simplicity while provide good access to the gland, leading to better extraction of fibrous fat, better contour control, and increased skin contraction postoperatively [16,17].

The "pull-through" technique, first described in 1996 by Morselli [31]. Morselli & Morellini in 2012 [32], combined the "pull-through" technique with liposuction that is performed on two planes, subcutaneous and subglandular to detach glandular tissue completely both from the deep plane and the superficial one, and sharp parenchymal excision using a scalpel or electrocautery through the small liposuction incisions hidden in the inframammary fold and behind the anterior axillary pillar was done as a single-stage procedure.

Sarkar et al., [3], Brown et al., [21], and El-Sabbagh [33], reported excellent results with a single-stage procedure too using a combination of traditional liposuction in Sarkar et al., [3] and El-Sabbagh study [33], and UAL in Brown et al., study

[21] with direct glandular excision but, through the same lateral peri-areolar incision, with periareolar skin excision in Sarkar et al., [3] and Brown et al., [21] studies. But, patients with the most severe skin redundancy in Brown et al., study [21] underwent an elliptical skin excision or breast amputation with free nipple grafting. In El-Sabbagh study [33], which included 14 patients, 4 of them were grade III, the author didn't do excision of excess skin except in older patients with poor skin quality, and he did it with vertical skin excision technique [34], which leaves an evident scar. In Sarkar et al., study [3], which included 12 patients. The margin of the areola was fixed at mid-humerus level with pectoralis fascia.

The current study which included 12 patients of severe grade III gynecomastia, traditional liposuction and delivery of gland were performed from two separate incisions, transaxillary incision for liposuction and lateral peri-areolar incision for glandular excision. Because liposuction through a periareolar incision combined with removal of residual breast tissue (through this same incision) has several drawbacks, like the possibility of a friction burn at the incision site.

All patients of our study were very satisfied with the results, and even in the most severe cases, we didn't need to do vertical skin excision unlike El-Sabbagh study [33], or elliptical skin excision, or breast amputation with free nipple grafting unlike Brown et al., study [21] to avoid extensive chest scarring. The technique of skin excision with concentric peri-areolar scar used in the current study leaves a well concealed scar. As well as in the current study, we didn't fix the areola to the pectoral fascia unlike Sarkar et al., study [3], however the nipple-areola position was good in all patients.

Complications of peri-areolar scar may include changes to nipple sensation, NAC asymmetry, hypertrophic or keloid scarring, and nipple-areola necrosis [35,36]. However in the current study, it didn't show any of these complications except for nipple-areola necrosis which occurred in 2 patients of group I with single-stage reconstruction, and transient hyposthesia, which improved spontaneously within 6 months.

In Morselli & Morellini study [32], hypertrophy and/or hyperpigmentation of inframammary scar were recorded in 2% of cases, wide scars in 3%, 4% had skin irregularities, 1% nipple-areola complex impairment, 2% excessive post-operative bleeding and in 1% showed subcutaneous hemato-



ma. Advantages of this technique are avoiding risk of retraction, distortion, and sensory impairment of nipple-areola. While, the major disadvantage is that this technique do not allow for skin excision and will not improve the enlarged ptotic nipple-areola. Although 30% of their patients are grade III.

El-Sabbagh study [33] included 3 patients with seroma, 2 patients with partial superficial epidermolysis of areola, infection in one patient, and nipple retraction in 3 patients. There were no cases presented with nipple-areola complex necrosis, and all the patients were satisfied with the results.

Complications in Sarkar et al., study [3], included two patients with seroma, one patient with hematoma due to sharp dissection of the glandular tissue, peri-areolar pleating of skin, no nipple-areola necrosis occurred. However, all patients expressed their satisfaction post-operative.

In the current study sharp dissection only used superficially, while blunt dissection on the under-surface of the gland was performed, so no patients developed hematoma post-operative. The purse-string peri-areolar suture secure and maintain the size of areola post-operative and prevent its widening in the long-term follow-up. But the peri-areolar pleating is evident in patients of group I with single-stage reconstruction as in Sarkar et al., study [3].

We didn't use either a scalpel nor electrocautery, because the peri-areolar incision allow direct visualization of the parenchyma, this allows a more extensive and radical removal of breast tissue with no or minimal risk of relapses, because the most common late complication of gynecomastia is inadequate resection of glandular tissue or skin [21], which doesn't happened to any of our patients.

Peri-areolar incision also allow direct control of bleeding reducing the incidence of post-operative hematoma, than the remote infra-mammary incision described in Morselli & Morellini technique [32]. So, we didn't use any drains in the current study, unlike Morselli & Morellini [32], Sarkar et al., [3] Brown et al., [21] and El-Sabbagh study [33], who are performing sharp parenchyma dissection using scalpel or electrocautery, leading to increase incidence of post-operative bleeding and post-operative hematoma formation. Average hospital stay was 2.41 days (range 2-4 days) in Sarkar et al., study [3]. In the current study, all patients discharged at the same day of surgery, same as Brown et al., [21] and El-Sabbagh study [33].

The vascular pedicle below the NAC, originating from the intercostal vessels, has been considered by some authors [37-39] as fundamental for the blood supply of the NAC. Neither we nor Persichetti et al., in 2001 [40] agree with this statement, since the blood supply from the subdermal plexus by itself is capable of maintaining the NAC, enabling execution of the lateral peri-areolar technique for delivery of the mammary gland as we did in the current study, with the least possible complications to the vascularity of nipple areola.

No previous studies found in the literature described staged reconstruction of grade III gynecomastia, and hence, no previous studies compared between single-stage and two-stage reconstruction of severe gynecomastia. In the current study, we found reconstruction of grade III gynecomastia with liposuction of fat, delivery of the gland, resection of excess skin, and transposition of nipple-areola in single-stage is associated with excessive pleating of periareolar skin Figs. (1B-5B), because the sudden reduction in the size of areola don't allow for skin retraction and recoil to occur gradually leading to excessive wrinkling and pleating of periareolar skin post-operative [27,28]. While, two-stage reconstruction with liposuction of fat, and resection of excess skin with nipple areola transposition in the first stage, then delivery of the gland in a second stage three months apart, is associated with less pleating of periareolar skin, because staged reconstruction gives a chance for skin reduction to occur staged and gradually, and give a chance for skin retraction and contraction to occur, leading to minimal pleating of periareolar skin (Figs. 11B-15B).

Also, reconstruction of grade III gynecomastia in single-stage is associated with higher rate of vascular compromise to NAC [21], because de-epithelialization and resection of peri-areolar skin together with delivery of the mammary gland in the same stage put added risk to the supporting vascularity of the areolar pedicle, leading to areolar vascular compromise with possible partial or complete loss of the areola. While, in staged reconstruction, with de-epithelialization and resection of peri-areolar skin in one stage, then delivery of mammary gland in a separate stage, the areolar pedicle vascularity will be preserved, leading to less vascular compromise and complication rate to the nipple-areola.

In the current study, we included the patients with enlarged ptotic nipple-areola only, because if the areola is originally small, the areolar diameter may be enlarged post-operative with this peri-

areolar technique. In addition that, the smaller areolar diameter is associated with excessive pleating of periareolar skin post-operative. So, in the current study, we excluded patients with small areolar diameter.

#### Conclusion:

Two-stage reconstruction for correction of grade III gynecomastia, allows the surgeon to achieve an aesthetic result while avoiding serious complications. It is considered a safe procedure which preserve nipple-areola vascularity, and permits broad resection of excess skin and submammary tissue, while avoiding unattractive scars, with minimal pleating of periareolar skin post-operative. Using this technique, good results were reported as regard breast symmetry, contouring, accepted pleating of skin surrounding the areola, and nipple-areola position, with complete satisfaction of patients. Single-stage reconstruction is associated with higher complication rate as regard nipple-areola vascularity, and as regard excessive pleating of peri-areolar skin.

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