



Gynecomastia: Ultrasound-Confirmed Classification Pertinent to Surgical Correction

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Abstract

Background Gynecomastia is the most common form of breast alteration in men, due to proliferation of the gland ducts and stromal components, including fat. In addition to the most obvious indications (weight loss, pharmacotherapy, and drugs suspension), the surgical treatment is needed for long-standing gynecomastia, combining liposuction, adenectomy, partial mammary adenectomy, periareolar skin resection, and round-block suture.

Materials and Methods A retrospective study was conducted on 148 patients undergoing gynecomastia correction from May 2012 to April 2018. Follow-up ranged from 9 to 14 months. The authors propose a new ultrasound-confirmed classification system, dividing patients into six categories. The authors analyzed immediate complications,

revision, recurrence, and minor aesthetic problems (retracted/depressed areas) and introduced a way to correct the irregularities with fat grafting and needles.

Results The total complication rate was 11.5% (17/148). Most of the complications (11) were observed in patients who underwent glandular resection and 3 after liposuction only. Retrospective surveys about patients' and surgeons' satisfaction were performed, showing excellent feedbacks regarding the results accomplished.

Conclusions The simple classification helps surgeons choose the most suitable approach, avoiding insufficient or invasive treatments and undesirable scars. Moreover, the analysis of the type of sequelae and their correction allow high patients' satisfaction.

Level of evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

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Introduction

Gynecomastia represents the most common pathology of male breast and is characterized by a symmetrical or asymmetrical volumetric enlargement of breast, supported by a benign proliferation of glandular and stromal tissue.

The term gynecomastia was introduced by Galen in the second century A.D. as an unnatural increase in the breast fat in males.

The first description of the surgical treatment of gynecomastia was attributed to Paulus Aegineta (625–690 A.D.).

Historically, surgical treatment has been subcutaneous mastectomy with or without direct skin incision, which was very successful at removing the subareolar fibrous disk but often left unacceptable scars. Common incision patterns include circumareolar, partly circumareolar with transverse extension (Webster technique), and inframammary [1–4]; in certain cases, an adenectomy is performed with transposition of the nipple–areola complex, free nipple grafting, or with a transverse elliptical incision pattern [5, 6].

In 1980s, Courtiss advocated extensive removal of the fat with suction lipectomy and used knife or scissors to remove the subareolar breast bud [7].

Multiple classification systems have been published throughout the years to classify different forms of gynecomastia, depending on the type of alteration, position of the nipple–areola complex (NAC), position of the inframammary fold (IMF), skin excess/ptosis, and breast volume. Tanner [8, 9] first proposed an anatomical/clinical classification, mainly focused on the stages of breast development. Simon [10], in 1973, proposed one of the most renowned classification systems, considering both the breast volume and the skin redundancy. Rohrich [11], in 2003, proposed an excellent classification based on breast volume (expressed in grams) and breast ptosis, which also included correlated surgical treatments. Cordova [12], in 2008, introduced another classification system, which included the breast volume and the position of the NAC compared to the IMF.

Histologically, gynecomastia is characterized by a benign proliferation of subareolar ducts and periductal stroma, with the elongation and branching of lactiferous ducts; ducts epithelium becomes pluristratified. Connective tissue becomes hyperplastic, thicker, and hypercellular [7, 13].

Etiology of gynecomastia contains a wide-range spectrum including physiologic, endocrinologic, metabolic, neoplastic, and drug-induced causes.

Although the prevalence ranges from 90% in neonates to 50–70% in adolescents and elderly men, people requiring a surgical correction for cosmetic purposes are mainly adolescents and adults [14–17].

In recent years, gynecomastia has become increasingly common and clinically important.

There are many studies in the literature related to the etiology, the prevalence, and the physiopathology of the gynecomastia; nevertheless, major gaps in knowledge regarding its modern epidemiology exist.

In our clinical practice, we noticed an increasing number of requests for gynecomastia correction, although no real increase in cases has been demonstrated. Nonetheless, over

recent decades, there have been substantial increases in the use of anabolic steroids and food contamination with xenoestrogens or estrogen-like substances that, at least theoretically, can stimulate glandular proliferation of the male breast [18, 19].

A myriad of medical treatment options (testosterone, dihydrotestosterone, danazol, clomiphene citrate, testolactone, and tamoxifen) are available; in other cases, it is important to stop taking drugs, but if gynecomastia persists, surgery is the best option for cosmetic improvement [20, 21].

Materials and Methods

Ultrasound-Confirmed Classification System

Attention of the authors is focused on performing an accurate preoperative examination, supported by breast ultrasound.

Although gynecomastia is a clinical diagnosis, ultrasound is a documented modality of choice in the evaluation of male breast enlargement; for this reason, we always require a bilateral breast sonography to all the patients before undergoing surgery. Sonographic examinations are performed with a linear transducer in a standard supine position with arm above the head. This examination is useful not only to identify possible abnormal findings (i.e., suspect nodules), but to confirm the clinical findings (fat or glandular tissue prevalence) and classify the patient with our new classification system.

Classification is based on the tissue quality of gynecomastia related to skin excess and ptosis of the breast.

It is directly related to surgical indications (Fig. 1).

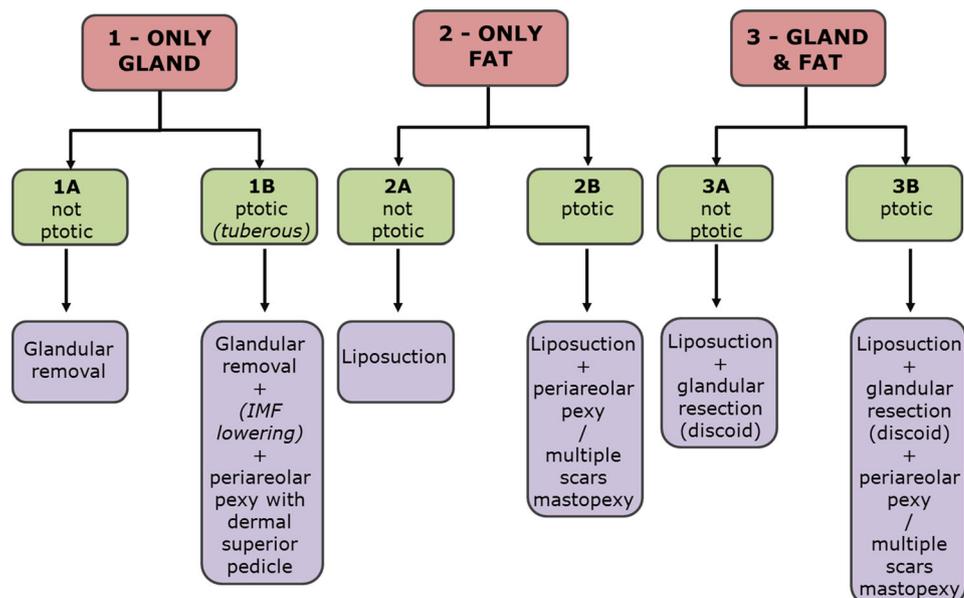
Study Design

A retrospective analysis was conducted on 148 patients (285 breasts) with a median age of 29 years (range 18–65 years) undergoing surgery for gynecomastia correction from May 2012 to April 2018 in the Department of Plastic Surgery at Humanitas Research Hospital (Rozzano, Milan) and in the Department of Plastic Surgery at MultiMedica Hospital (Sesto San Giovanni, Milan).

Preoperative grading of gynecomastia was performed making use of our new ultrasound-confirmed classification system.

Most of our patients were healthy, except one who had a history of hypogonadism and another one with hyperprolactinemia. After clinical examination, a preoperative ultrasonography (within 6 months before the procedure) was performed in all patients to confirm fat or glandular tissue prevalence and to exclude other breast diseases.

Fig. 1 New ultrasound-confirmed classification system for gynecomastia and suggested surgical algorithm, based on the most represented component in gynecomastia (fat tissue, glandular tissue, or both) and the presence of ptosis



The resected specimens underwent histological analysis. All patients received a compressive dressing for 5 days/1 week after the operation and a compressive T-shirt for 1 month.

The following data were analyzed: immediate complications, revision, recurrence, and tardive minor aesthetic problems (related to fibrous retractions or depressions).

Between 6 and 9 months after the procedure, all patients were asked to retrospectively complete a satisfaction self-assessment questionnaire consisting of linear analog scales (10-point scale) for three categories (overall satisfaction, breast contour, and scars quality). The same questionnaire was completed by two experienced surgeons (who did not perform the procedure) to evaluate the surgical outcome.

Surgical Technique Gynecomastia

All patients are treated under general anesthesia.

With the patient in upright position, preoperative markings of the breast area and its boundary are drawn. Peri-operative antibiotic prophylaxis with 2 g cefazolin is administered.

The patient is positioned supine with arms abducted.

- *Type 1A* The total or subtotal glandular resection is the only procedure, via the infra-areolar access 4–8 o'clock. The initial plane of dissection is at the subcutaneous level separating the gland from subcutaneous tissue from upper-medial to upper-lateral pole. The retroareolar dissection preserves a 0.5–1.5 cm of tissue to prevent a concave final aspect. Then, after undermining of the inferior pole, the gland is elevated from the pectoralis fascia (possibly with blunt

dissection), taking special care not to leave any peripheral fragment.

In thin patients, the small amount of gland under the areola is sufficient to reach a homogeneous result.

In different patients, a necessary amount between 5 and 10% is preserved, depending on overall patient contour, amount of fat, pectoralis muscle hypertrophy, and asymmetry.

The remaining gland is useful to guarantee a good retroareolar salience and areolar vascularization.

In some cases, the retroareolar volume is fixed to the pectoralis fascia to reduce the possibility of areolar displacement in the immediate postoperative period.

Finally, hemostasis is checked, a drain positioned in the dissection plane, and the incision closed in multiple layers with absorbable sutures.

- *Type 1B* When the glandular gynecomastia is ptotic, it can be normal or tuberous.

In the first case, a periareolar mastopexy [22–24] maintaining a dermal superior pedicle is performed, to reach with the consistent skin retraction a good position of the nipple–areola complex (NAC).

In tuberous cases, the fibrous tissues of the four poles (particularly the inferior ones) are entirely detached from the pectoralis fascia following the previously determined drawings [25, 26].

Needles are employed to release the “scar-like” tissue of the inferior pole responsible for the unnatural development [25, 27–31].

The NAC is repositioned at a higher level with the superior dermal pedicle periareolar mastopexy after the removing of the constricted gland (Fig. 2).

- *Type 2A* An infiltration of 500mL of Klein solution is performed through a small 4-mm incision behind the inframammary along the anterior axillary line. The Klein solution contains 1 ampoule of 1:1000 adrenaline in 1 L of saline and in addition to hemostasis facilitates the suctioning in tissue dense area with hydrodissection.

Liposuction is performed in the predetermined area with the conventional suction machine and normally with a 4-mm blunt-tip cannula in the deep and subdermal way passing from the previous incision or adding a more comfortable one.

As in the normal practice, the left hand guides and checks the cannula in the right level. Once the breast region is flat and regular, dressing for 3–4 days is positioned.

- *Type 2B* After the same liposuction procedure of type 2A, a periareolar mastopexy is performed interrupting completely the dermis around the areola if necessary [32].

This maneuver allows to easily increase the NAC, not forgetting the possibility of normal skin retraction after liposuction at the same time.

The authors believe that the periareolar technique [33] is a potential first choice to leave few scars on the breast.

- *Type 3A* After the initial liposuction procedure useful to reduce the fat volume and to fragment part of the gland, an incision is made in the infra-areolar line (4–8 o'clock).

A small amount (0.5–1.5 cm) of gland is preserved, and a discoid of underlying gland is isolated and excised, to give the right flatness to the zone.

Hemostasis, drain, and sutures, as previously described, are arranged (Fig. 3).



Fig. 2 (Left) Preoperative oblique view of an 18-year-old patient presenting with a bilateral tuberous true gynecomastia (Type 1B, according to our classification system). (Right) Postoperative view 6 months after glandular resection through periareolar access, areolar diameter reduction, and correction of the ptosis with skin excision



Fig. 3 (Left) Preoperative frontal view of a 21-year-old patient presenting with a mixed bilateral gynecomastia (Type 3A, according to our classification system). (Right) Postoperative view 6 months after inferior periareolar glandular resection and liposuction

- *Type 3B* After liposuction and partial glandular resection (as described above), a mastopexy is evaluated on the basis of the remaining ptosis [34, 35].

The lateral one is to be considered especially for post-obese patients with important breast and lateral thorax skin excess.

Hemostasis, drain (1A, 1B, 3B), multiple-level sutures, and tapes are administered.

A compressive dressing is worn for 5–7 days, followed by 1 month of tight shirt to facilitate tissue accommodation.

Results

There was bilateral involvement in 92.6% (137/148) of the patients and unilateral in 7.4% (11/148, 4.1% on the right and 3.3% on the left).

96% (142/148) of the patients were healthy and without any pathologic etiology for their gynecomastia.

Preoperative grading of gynecomastia was performed using our previous described ultrasound-confirmed classification system (Table 1).

The total complication rate was 11.5% (17/148). Complications were hematoma (13), seroma (1), dystrophic scars (1), and partial areola necrosis (2). Only 3 patients with hematoma required surgical revision. Most of the complications (11) were observed in patients who underwent glandular resection (1A, 1B, 3A, 3B) and 3 after

Table 1 Number of patients treated for each category

Classification category	Number of cases treated
1A	21
1B	12
2A	38
2B	19
3A	35
3B	23

liposuction only (2A, 2B). Transient nipple hypoesthesia was noted postoperatively in 10 patients. There were 7 cases of gynecomastia recurrence, all of them after liposuction (5 unilateral and 2 bilateral). Eight patients required secondary revision surgery (Table 2).

A retrospective survey of patient satisfaction by means of a questionnaire was performed (average score was 9.2 for overall satisfaction, 9 for breast contour, and 9 for wound scars). The surgeon's satisfaction rate was also assessed using the same rating (overall satisfaction 9, breast contour 8.9, and wound scars 8.8).

Sequelae

Minor aesthetic problems (retracted areas, depressions, old inframammary fold memory, and other fibrotic alterations of the breast contour) was observed in 9 patients and were treated with secondary surgery under local anesthesia. First, we harvested fat from flanks, we prepared it with Coleman technique, and then we injected fat graft into the retracted area with needles with a retrograde deposition.

Discussion

Gynecomastia is a disabling problem, in particular in the western population. In a normal situation, the male breast has to have a right salience, but if it is too much developed it is considered a sign of lack of virility and may cause suffering, especially in the case of young boys.

Multiple classifications have been published throughout the years to classify different forms of gynecomastia, depending on the type of alteration, position of the nipple–areola complex (NAC), position of the inframammary fold (IMF), skin excess/ptosis, and breast volume. Tanner [8, 9] first proposed an anatomical/clinical classification, mainly focused on the stages of breast development, that, however,

Table 2 Number of complications after surgery for each new classification category; most of the complications (14) were observed in patients who underwent glandular resection. We report in the table also recurrence case (both monolateral and bilateral) and data of reversible nipple hypoesthesia

Complication (bolt)	1A	1B	2A	2B	3A	3B
Seroma	0	0	1	0	0	0
Hematoma	2	4	1	1	2	3
Wound dehiscence	0	0	0	0	0	0
Dystrophic scars	0	0	0	0	0	1
Complete/partial NAC necrosis	0	1	0	0	0	1
Recurrence (monolateral)	2	1	0	0	2	0
Recurrence (bilateral)	0	0	1	1	0	0
Transient nipple hypoesthesia	3	2	0	1	2	2

does not offer any hint for surgical treatment. Simon [10], in 1973, proposed one of the most renowned classification systems. We took inspiration from it for the elaboration of our classification; however, it does not consider important surgical maneuvers such as liposuction and periareolar mastopexy, that have been introduced afterward. Rohrich [11], in 2003, proposed an excellent classification that included correlated surgical treatments. We believe that our classification allows a more aggressive approach, given our experience in the treatment of stenotic breasts [25] and the periareolar approach in oncoplastic breast conservative surgery [22]. Cordova [12], in 2008, introduced another classification system that, despite being very useful for guiding surgical maneuvers, does not distinguish between fat and glandular tissue gynecomastia. In our classification, we take into consideration the difference between fat and glandular tissue gynecomastia, which can be furtherly evaluated by ultrasonography. The importance of using ultrasound before the surgical correction of gynecomastia is twofold. First of all, it allows to identify possible abnormal findings (i.e., suspect nodules) that would require further attention. Besides, it guides the surgeons to confirm and quantify what type of tissue is prevalent within the breast, allowing to choose the best surgical intervention.

Ultrasound has shown to be an easy, harmless, low-cost, noninvasive, and fast method to study the breast tissue before the surgery, confirm clinical findings, classify the patients based on our new classification, and guide the surgical treatment.

Over recent decades, we are noticing an increasing number of requests for gynecomastia correction, maybe due to environmental contamination or diet rich in estrogen substances, although no scientific researches demonstrated this phenomenon [36].

The female breast changing detected in the last few years (stenotic breast) applied to man would probably confirm the phenomenon.

Treating men chest, more frequently naked on the beach and sometimes at work, has the objective to solve the problem without conspicuous visible scars.

Historically, surgical approach has been subcutaneous mastectomy with or without direct skin incision, which was very successful at removing the glandular component but often left unacceptable and depressed scars, or unnatural hollow areas [37]. Nowadays, liposuction [38, 39] has already demonstrated the possibility of a less invasive intervention [40–42] with optimal results with minimal scars, trauma, and complications (hematoma). Some types of cannula allow the gland fragmentation, even if partial, in particular in less strong and strict glands, reducing, however, convexity and projection.

In most patients considered in our study, liposuction permits to reduce the right quantity of parenchyma,

inducing the expected skin retraction (Type 2A, 2B, 3A, and 3B).

Needles subdermal use in retroareolar region and in inferior pole [30, 43] produced even more skin retraction and areolar diameter reduction in the female population and also in male population.

When the gynecomastia is characterized by adipose tissue and retroareolar gland enlargement, it is necessary to proceed with liposuction of the breast poles and with resection of a retroareolar glandular discoid to reduce convexity at all (3A e 3B).

The most difficult categories to treat are 1A, 1B, and 3B.

An appropriate subcutaneous mastectomy (1A) is fundamental to reduce the risk of producing a concave central area, fading away the edges. It is important to preserve a small portion of gland (0.5–1.5 cm) behind the areola to guarantee its vitality and sensibility and reach the natural breast convexity.

In some cases, when we have to do a periareolar mastopexy after liposuction and adenectomy, we have to entirely or partly preserve the dermis to avoid NAC necrosis.

In 1B category, in tuberous breast, the surgical operation consists in lowering inframammary fold with needles and cannula or detaching the gland from the fascia with an inferior periareolar approach. The areola repositioning is done with a periareolar mastopexy with a superior dermal pedicle after resection of the pathological gland.

Considering that male dermis is thicker and harder than the female one, treating the 1B, 2B, and 3B categories, the periareolar approach will be different and will not suitable to do wide periareolar incision to reduce the risk of diastased, hypertrophic, or pleating scars. It is mandatory to perform conservative periareolar incision with a 2–3 cm internal–external discrepancy.

The scars are pressed with wound closure strips for 20 days.

The L or T inverted incisions, even if with optimal scars, represent a stigmata of the previous problem and an emotional trauma for the patient. So the authors introduced a different approach with an anterior axillary pillar skin resection to leave the chest free from scars. In the series considered in this study, we have never used L or T inverted incisions, because in all cases we were able to use a periareolar approach.

The postsurgical complications are immediate (bleeding); in few cases, minor aesthetic problems such as retracted areas, depressions, and poor scar quality are visible after months or years from surgical intervention. Lipofilling and needles [30], under local anesthesia, are useful to treat these breast irregularities and hypertrophic scars [27–29], eventually preparing them for surgical trimming. Needles are fundamental to release the fibrous

tissue and the old inframammary fold, especially in types 1B, 2B, 3A, and 3B. Needleotomy experience derives from scars treatment and tuberous breast reshaping [25, 30, 31].

Taking into account the main points described in this discussion and planning the best surgical approach, the authors think that we could reach rewarding results for the patient and the surgeon.

The main limitation of our study is that our classification system cannot be used on the totality of the gynecomastia cases. Indeed, this new classification system does not fit to severe forms of gynecomastia, with severe ptosis and skin excess (i.e., after massive weight loss, post-bariatric surgery). In these situations, liposuction alone is not enough, and skin reducing techniques need to be employed (such as vertical, L or T incision, or lateral/axillary scars). However, we consider classification system as a great tool, since it is an excellent guide to plan the best surgical procedure for most of our patients.

Conclusions

The simple ultrasound-confirmed classification we proposed is useful to guide the treatment, avoiding insufficient or invasive surgical approach and undesirable scars, and synthetically includes all types of clinical presentation.

Moreover, the presence of cutaneous ptosis, the amount of excessive skin, and a high inframammary fold as a tuberous breast are decisive in guiding the choice between surgical treatment methods and in using special surgical approach (mastopexy, round-block suture, and disruption of inframammary fold).

Especially in tuberous breast, the key is the transection of the stenotic fibrous ring of the footprint, the NAC centralization, and the release of inframammary fold.

Finally, following the patients through a long follow-up, we can manage patients over time and treat the possible sequelae to reach high patients' satisfaction.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval Approval was obtained from the ethics committee of Humanitas Clinical and Research Hospital and MultiMedica Holding Spa. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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