

Overview of Gynecomastia in the Modern Era and the Leeds Gynaecomastia Investigation Algorithm

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Abstract: Gynecomastia is a benign enlargement of male breast glandular tissue. At least a third of males are affected at some time during their lifetime. Idiopathic causes exceed other etiologies and relate to an imbalance in the ratio of estrogen to androgen tissue levels or end-organ responsiveness to these hormones. Assessment must include a thorough history and clinical examination, specific blood investigations and usually tissue sampling and/or breast imaging. Management consists of a combination of measures that may include simple reassurance, pharmacological manipulation, medical treatment or surgery. Hormone therapy may help to abort the acute proliferative phase of gynecomastia with a 30% response rate but should not be considered in chronic established cases. Surgical treatment may comprise simple liposuction for a predominant fatty component or direct excision when glandular tissue is predominant. The main aim is to control the patient's symptoms and to exclude other etiological factors. ■

Key Words: breast tissue sampling and imaging, gynecomastia, investigation algorithm, management, surgery

Gynecomastia is a common clinical condition in men consisting of a benign progressive enlargement or proliferation of male breast glandular tissue. It often presents as a diffuse or a discrete retro-areola lump.

It may be an incidental finding on routine examination. More commonly it presents as an acute, unilateral or bilateral, tender swelling beneath the areola region. The vast majority of cases of gynecomastia are considered to be idiopathic. However, in some patients, for teenagers and young men in particular it may lead to significant embarrassment and social impediments leading to decreased participation in physical activities, social activities, and even formation of relationships.

It is critical to recognize those patients who may have an underlying pathological condition or who do not have gynecomastia but other causes for a male

breast lump. If the gynecomastia is not idiopathic, referral to a specialist is often warranted. This can be achieved in the majority of cases by taking a thorough history, performing a comprehensive clinical examination and checking a few screening laboratory tests where indicated.

In this era of increasing levels of obesity, primary and secondary care is seeing increasing numbers of patients with pseudogynecomastia. For these cases only simple reassurance coupled with advice on dieting and exercise may be needed (1,2).

In a number of cases psychological counseling, medical intervention and/or surgical intervention may be required (3).

When referral to secondary care occurs, teenagers will usually be reviewed initially by a pediatric endocrinologist, although adults are commonly seen by specialist breast surgeons.

PREVALENCE

Depending on the criteria used for diagnosis, gynecomastia or excessive male breast development may have prevalence between 32% and 65% of the

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male population; autopsy studies suggest a prevalence of 40% (4–7). The reported prevalence in the literature varies widely, due to different methods of assessment and the assessments of different ages and groups of individuals. The associated embarrassment of gynecomastia contributes to the complaint remaining unreported or reported only after a considerable delay. The prevalence rate increases to more than 60% in those in the seventh decade of life (8–10).

Men with a body mass index of 25 kg/m² or more are far more likely to develop gynecomastia or pseudo gynecomastia, with a reported prevalence as high as 80% (11).

CLASSIFICATION

Webster, in 1934, has classified gynecomastia into three subtypes according to nature of the proliferated tissues (*Webster GV. Gynecomastia in the Navy. Mil Surg. 1944*). This is glandular, fatty glandular, and simple primarily fatty in nature (10).

Simon, in 1973, has classified patients into three categories according to the size of the gynecomastia (12). Group 1 is considered minor and where there is visible breast enlargement without skin redundancy. Group 2A refers to moderate breast enlargement without skin redundancy. Group 2B refers to moderate breast enlargement with minor skin redundancy. Group 3 is represented by gross breast enlargement with skin redundancy that simulates a pendulous female breast.

PATHOPHYSIOLOGY

Gynecomastia has long been considered the result of an imbalance between estrogens, which stimulate breast tissue, and androgens, which antagonize this effect.

Although the main sex hormone in men is testosterone derived from the testes, and in women it is estrogen, served from the ovaries, both hormones are actually secreted in both sexes—some production of estrogen occurs in the testes, and some production of testosterone occurs in the ovaries. In addition, the metabolism of both hormones leads to a degree of cross-over of effect.

The basic mechanisms of true physiological gynecomastia is thought to comprise either a relative decrease in androgen production, an absolute increase in estrogen production, an increased availability of estrogen precursors for peripheral conversion to estra-

diol, or an increased end-organ sensitivity to estrogen metabolites (13,14).

Estradiol acts as a growth hormone of the breast and therefore an excess of estradiol in men leads to the proliferation of breast tissue. Under normal circumstances, most estradiol in men is derived from the peripheral conversion of testosterone and adrenal estrone.

ETIOLOGY

Please refer to Figure 1 which is a summary list of causes behind a male breast lump. This is not an exhaustive list but it is helpful as a reference in relation to the clinical review and in planning the necessary investigations to establish the correct diagnosis of the breast mass.

1. Idiopathic/Physiological gynecomastia accounts for approximately 75% of cases which can occur in adolescent, elderly, and in newborn patients. Gynecomastia in newborns is due to the in utero action of maternal estrogens, placental estrogens or both in concert. This usually disappears in the early postpartum period (15).

2. Secondary causes of Gynecomastia may arise from a broad array of uncommon pathological conditions. These are well described elsewhere and may include conditions such as: congenital anorchia, Klinefelter's syndrome, testicular feminization, hermaphroditism, adrenal carcinoma, hepatic disease (8%), primary hypogonadism (8%), secondary hypogonadism (2%), testicular tumors (3%), hyperthyroidism (2%), renal disease (1%), and malnutrition (16).

3. Carcinoma of the male breast is a rare cause of breast enlargement which is not classified as a cause of gynecomastia, but needs to be differentiated from it. It is extremely uncommon under the age of 50 years. Male breast cancer accounts for less than 1% of all breast cancers and about 0.2% of all cancers in male patients (17).

4. Many pharmacological agents can cause gynecomastia. Doctors who deal with patients with gynecomastia should consult a comprehensive list of medications that are associated. Medications that cause gynecomastia are broadly categorized by their hormone-like action. Type-1 drugs act like estrogens; this includes diethylstilbestrol, oral contraceptive pills, digitalis, and estrogen-containing cosmetics. Type-2 drugs enhance endogenous estrogen formation, and include the gonadotrophins and clomiphene. Type-3

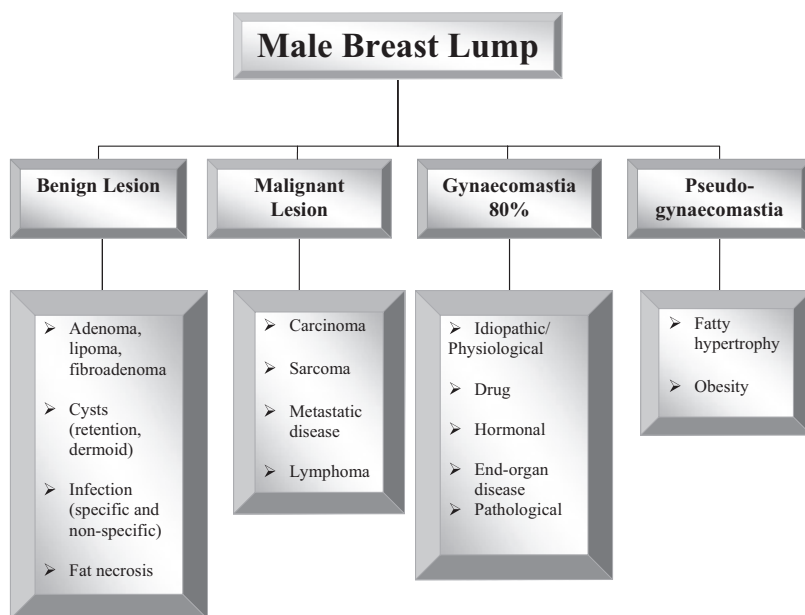


Figure 1. Showing the possible etiology of a male breast lump.

drugs inhibit testosterone synthesis and its action. These include ketoconazole, metronidazole, and cimetidine. The final type represented by several drugs that act by unknown mechanisms, such as isoniazid, methyldopa, captopril, tricyclic antidepressants, diazepam, heroin, and cannabis. Anti-androgen induced gynaecomastia resulting from a deliberate treatment is a frequently encountered side effect in the hormonal treatment of patients with prostatic cancer. This is typified by therapy with Zoladex, flutamide, and cyproterone acetate. Although fenofibrate induced gynaecomastia appears to be less common, patients receiving these medications should be carefully monitored (18).

DIAGNOSIS

A detailed understanding of the etiologies and a directed history are essential to establish the correct diagnosis by asking about the related symptoms of the disease. This is particularly true in relation to the use of both prescribed medication and recreational drugs.

Clinical examination should include both a systemic review and a thorough gynaecomastia-specific examination. This includes proper bilateral breast examination for diffuse or discrete swelling, nipple discharge, and skin changes in addition to the examination of axillary and regional lymph node territories. Furthermore, testicular examination should be performed to assess for signs of testicular tumor. Experi-

ence plays a significant part in the evaluation and in particular differentiation of gynaecomastia from male breast cancer in elderly men.

The use of *Hematologic investigations* is controversial as few cost-effective studies have undermined the significance of the regular use of those tests. However, many other centers are still recommending the use of those screening tools in the majority of adults with gynaecomastia. There is no evidence base for any specific biochemical profile for the investigation of gynaecomastia. In our unit, we use the tests suggested in this paper based on a literature review (19) and on advice from our consultant biochemist and endocrinologists who have a special interest in this area. We recommend performing those investigations especially for adolescent patients, those with suspected endocrine dysfunction or tumors, suspected alcohol excess and finally for patients who are on long-term medical treatment. The recommended screening protocol should include the following: urea and electrolytes, liver function tests, follicle-stimulating hormone, luteinizing hormone, beta-human chorionic gonadotrophin, thyroid-stimulating hormone, estradiol, testosterone, sex hormone-binding globulin, prolactin, alpha feto protein, and lactate dehydrogenase levels. Abnormalities are routinely investigated further by the endocrine team.

Imaging investigation: Although the vast majority of diagnosis of gynaecomastia will be made on clinical grounds, further confirmation may be considered from ancillary investigations. This may be from breast

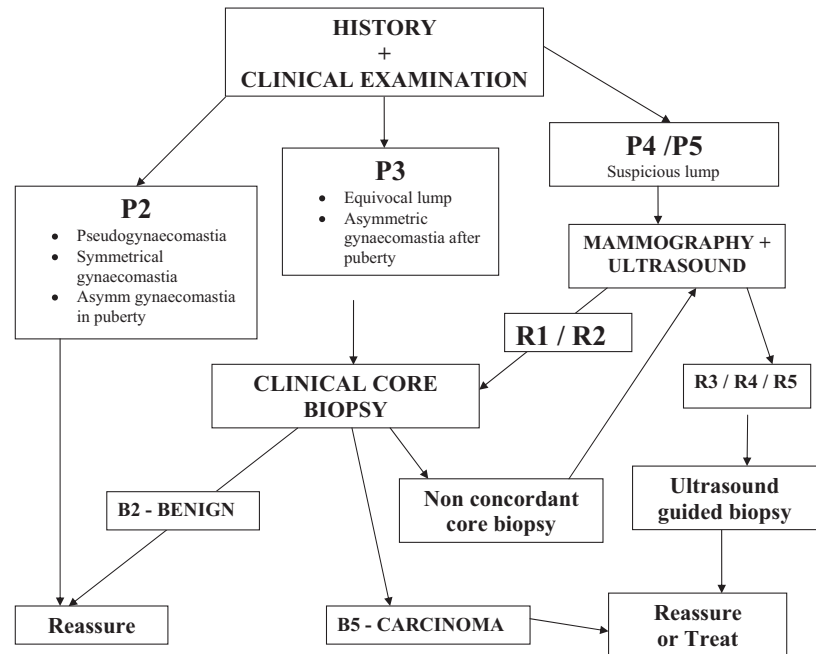


Figure 2. Showing details of the Leeds Gynaecomastia Investigation algorithm to diagnose a male breast lump. *Algorithm alters if patient has atypical criteria.

imaging and/or biopsy. The threshold for initiating such tests varies widely between different units and will likely be dictated according to local custom, expertise, and resources.

Most patients with gynecomastia have a visible sub-areolar density on *mammography* (MM) (20). As fat is radiolucent, pseudo gynecomastia is easily confirmed on mammography. *Ultrasound examination* (USS) is a sensitive diagnostic modality that differentiates the majority of benign and malignant male breast lesions and is a more comfortable investigation for men (21,22).

Furthermore, it is a relatively cost-effective imaging tool and is readily available in most one stop breast clinics. The use of both modalities can improve the diagnostic accuracy (23,24).

Tissue diagnosis: This can be performed with either *fine needle aspiration cytology* (FNAC) or by *core biopsy* (Bx).

Please refer to Figure 2 which details the Leeds Gynaecomastia Investigation algorithm that we recommend is followed to facilitate the diagnosis of a male breast lump, while avoiding excessive investigations.

TISSUE SAMPLING VERSUS IMAGING IN THE DIAGNOSIS OF GYNAECOMASTIA

Although some units routinely perform breast imaging and breast biopsy of all patients with gynecomas-

tia, others may utilize a clinical diagnosis algorithm alone.

To avoid missed diagnosis of male breast cancer, lymphoma or other pathologies; consideration should be given to tissue sampling or imaging in most cases of gynecomastia that present after puberty. FNAC of the male breast can present problems of diagnosis because the cytologic assessment is often “inadequate” or occasionally can be confused with that of adenocarcinoma which might lead to unsatisfactory and repetitive investigations (25). Although unilateral male breast swelling is relatively common, a definitive cytologic diagnosis is infrequently obtained. Bx is a quick, safe, and cost-effective method of diagnosing unilateral male breast swelling when performed in a breast clinic. It is the investigation of choice for suspicious lesions which is associated with a lower false-negative and false-positive rates (26) as well as low incidence of pneumothorax (27).

Unlike female breast, the male breast comprises variably sized ducts devoid of mammary lobules (Fig. 3). Histologically, there is a proliferation of male-type mammary ducts, which show variable degrees of epithelial hyperplasia. The latter can be florid giving rise to micropapillary architecture (Fig. 4). When associated with cytologic atypia, the cytologic appearances might be mistaken for breast carcinoma particularly on needle aspirates. At the early stage of gynecomastia formation, the stroma is

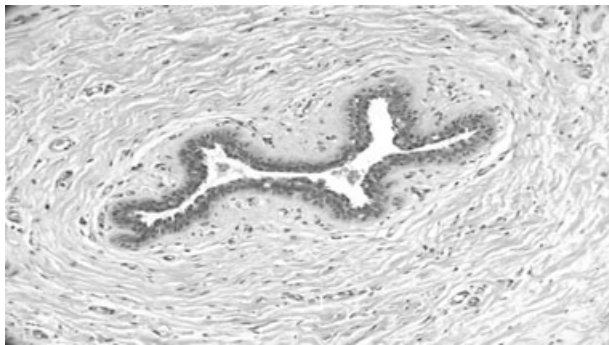


Figure 3. Male duct X20.

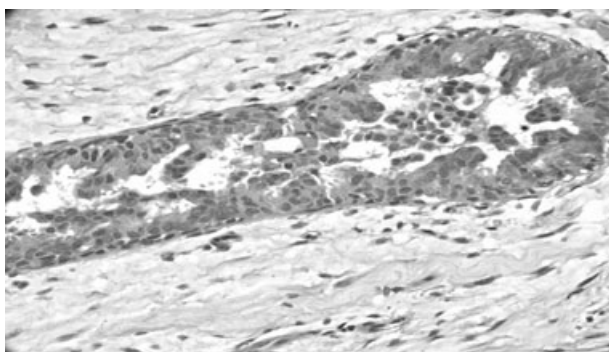


Figure 4. Gynaecomastia hyperplasia.

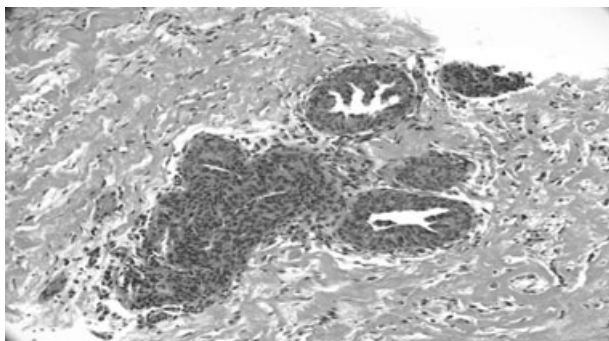


Figure 5. Gynaecomastia with HP and pseudo angiomatous stromal hyperplasia (PASH).

rather cellular, edematous, and commonly shows pseudo angiomatous stromal hyperplasia (PASH). Later, the stroma becomes progressively dense and fibrous (Fig. 5). These well developed lesions present clinically as a more solid mass.

The routine role of MM in the evaluation of male patients presenting with breast lump is controversial. In Leeds we have found that most men referred for breast radiology who presented with palpable lumps,

fatty breast enlargement, or tenderness had benign conditions. Where male breast cancer is suspected on clinical grounds or after an inconclusive biopsy, MM and USS can accurately evaluate further, to characterize or distinguish between malignant and benign male breast disease. In all other patients whose clinical presentation and findings suggest benign disease, breast imaging could obviate the need for routine Bx (28).

Patients with suspicious findings on clinical examination warrant appropriate clinical management and a tissue biopsy confirmation regardless of mammographic findings (Fig. 2). MM and USS in men are therefore sometimes considered to be of benefit for image guidance of percutaneous biopsy of a suspicious mass (29).

At the Leeds Breast Unit, we use the The Breast Imaging Reporting and Data System classification (R1-5) set by the American College of Radiology to describe all breast imaging findings (30). Our recommendation is to follow the treatment algorithm shown in Figure 2. We do not need to perform any routine breast imaging for gynaecomastia in patients under the age of 50 years unless one of the atypical criteria is met as illustrated in Table 1. Male patients with unilateral gynecomastia over the age of 50 years will need at least a biopsy of the palpable lesion and/or imaging with MM and USS, except for typical bilateral gynecomastia which might need active observation only (31).

MEDICAL TREATMENT OF GYNAECOMASTIA

The first principle of treatment for suspected iatrogenic gynecomastia is the *withdrawal* of any nonessential drug therapy (or change to an alternative) in cases of ongoing pharmacologic-induced gynecomastia.

Reassurance alone is all that is needed for most cases of physiologic gynecomastia as they are often transient.

In adolescents, with normal hematological screening tests, active *monitoring* for a period of 12–24 months will suffice for most, and intervention reserved for those that fail to regress spontaneously after 2-years.

Because gynecomastia is usually caused by an imbalance of androgenic and estrogenic effects on the breast, medical therapies have traditionally involved anti-estrogens, androgens, or Aromatase Inhibitors to block or lower the estrogen level.

Tamoxifen is an estrogen antagonist. It is a treatment associated with a good safety profile which is

Table 1. Atypical Criteria That Trigger Breast Imaging in Male Patients

A	Suspicious neoplastic lesion is evident on clinical examination which can be coded as P4 and P5 (suspicious of breast cancer or clinically malignant lesion)
B	Abnormal fine needle aspiration cytology (FNAC) or Bx result.
C	Patient age >35 years plus a breast lump which is clinically indeterminate (P3) and strong family history of breast or ovarian cancer
D	Patient age >35 years plus a breast lump which is clinically indeterminate (P3) and persisting as a unilateral focal lump for more than 3 months duration.

relatively nontoxic and well tolerated (32). It rapidly relieves associated tenderness (33). It should be considered as a first line treatment for cases of acute gynecomastia that fail to resolve spontaneously and are symptomatic. The typical dose of Tamoxifen that has been used in men in various trials range from (10–20 mg/po/od) for 2–4 months (34). It is less effective in established or chronic gynecomastia.

Testosterone derivative treatment with *Danazol* (400 mg/po/od) has been tried with variable success (35). The response rate is less than that seen with Tamoxifen, but the relapse rate is perhaps higher for Tamoxifen (36). The side effect profile is not as good as other treatments.

Anastrozole (ARIMIDEX), a potent and highly selective Aromatase inhibitor, decreases estrogen concentration in men. Anastrozole treatment of (1 mg/po/od) has been shown to be well tolerated and more effective in patients with pubertal gynecomastia (37).

Clomiphene citrate has been used in a dose of (50 mg/po/od) to treat gynecomastia but with limited reports of success. In persistent pubertal conditions, one study reported that it resulted in only a small decrease in gynaecomastia size and was not a satisfactory medical therapy for the disease (38).

SURGICAL TREATMENT

The surgical treatment of gynecomastia has risen year on year in the UK. Over 16,000 procedures for gynecomastia reduction were performed in 2005, an increase of 17% compared with the previous year in the United Kingdom (*National Gynaecomastia Audit*).

The aim of surgical treatment is to achieve a normal appearance of the masculine thorax with the smallest possible scar, but alternative treatments, limitations, and potential complications should always be discussed. Not all primary care trusts will fund gynecomastia surgery on the national health service and many still consider it to be cosmetic. Surgical technique will mainly depend on the degree of the

gynecomastia and on the distribution and proportion of the different components of the breast (fat, parenchyma, and looseness of skin envelope).

Surgical intervention is usually considered for cases of Simon's grade II b and III and gynecomastia with clinically noticeable large lumps or asymmetry.

However, even small amounts of breast enlargement in some men will significantly interfere with quality of life and cause embarrassment and might be considered for surgical treatment (3).

Simple or mild gynecomastia is mainly treated surgically with *Webster's method* (39,40). The operation is performed through a short infra-areolar incision placed at the inferior hemisphere (Fig. 6). This incision may be enlarged by lateral and medial extensions where required (Fig. 7). The transverse nipple-areola incision is less popular, as it is associated with limited exposure and the potential for more adverse scarring (Fig. 8).

The above methods include removal of the male breast tissue whilst preserving the overlying nipple areola complex. Resections can easily be performed up to around 100 g (41,42). Patients need to be

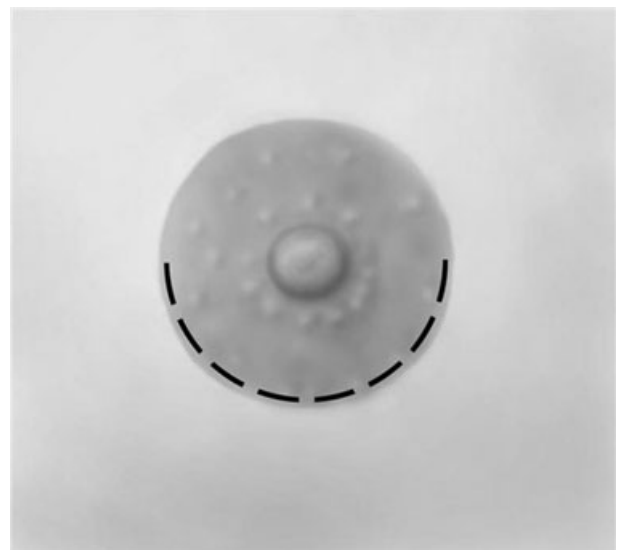


Figure 6. The Webster infra-areolar incision is placed in the inferior hemisphere.

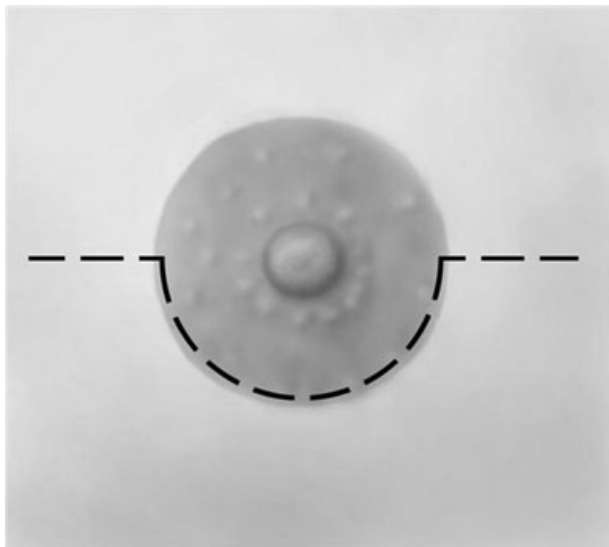


Figure 7. The Webster intra-areolar incision may be enlarged by lateral and medial extensions.

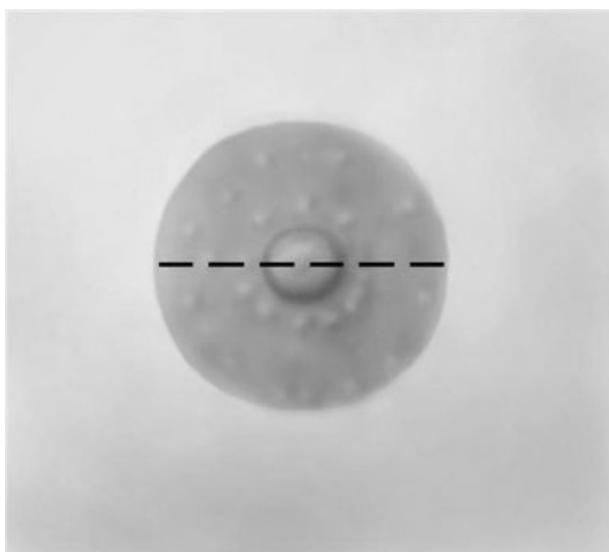


Figure 8. The transverse nipple-areola incision.

informed that surgery may be associated with complications such as doughnut (saucer shape scalloping) deformity, asymmetry, nipple necrosis, nipple flattening, and loss of sensation, hypertrophic or broad scars.

A circumareolar incision provides good exposure, but at the expense of additional more noticeable scars. The technique is more reliable with less risk of nipple necrosis if the pedicle is dissected 2 mm wider than the areola and dissection under the pedicle is avoided. Postoperative circumareolar scarring can be problematic if excess skin is removed, or the wound is closed

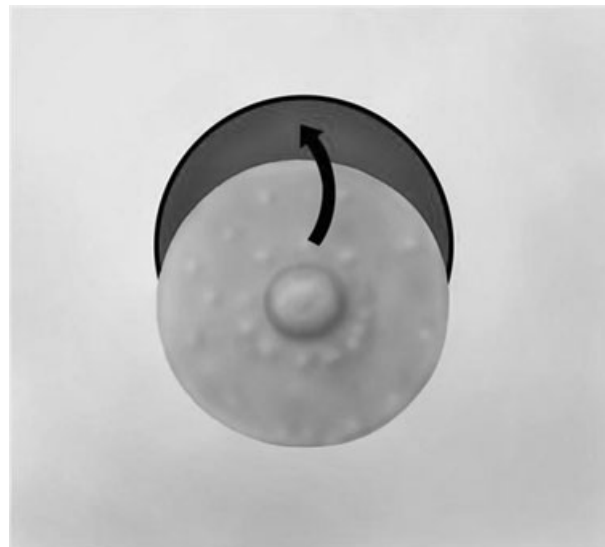


Figure 9. The triple-V incision offers maximum exposure.

under excess tension. The nipple-areola sensation is also preserved in most cases. Experience is needed to determine the pedicle girth because a wide pedicle leads to sub-areola bulk, whereas a thin pedicle may cause partial areola necrosis (43,44).

It is broadly considered that Webster's method has more limitations in the over-weight patients, or in patients with excessive skin redundancy. Treatment should be deferred if possible until a body mass index of at least <28 is achieved (45).

An alternative approach is the *triple-V incision*. This is an inferior pole, periareolar-transareolar-perithelial incision (Fig. 9). It appears to offer greater exposure. However, it is technically difficult, especially in patients who require a considerable subcutaneous tissue resection. The most common late postoperative sequelae with this technique are inverted areola, hypertrophic scar, and hyperesthesia of the areola region.

In moderate gynecomastia, skin resection and nipple transposition techniques may be considered "*Let-terman technique*" (46). After the redundant skin is resected, the nipple-areola complex is rotated superiorly and medially based on a single dermal pedicle (Fig. 10). Hypertrophic scar and distortion of the nipple areola complex are more common with larger resections.

In cases of larger gynecomastia, a superiorly based chest wall flap (nipple-areola flap) in conjunction with *suction-assisted lipectomy* can facilitate restoration of a more normal male chest wall. This avoids more

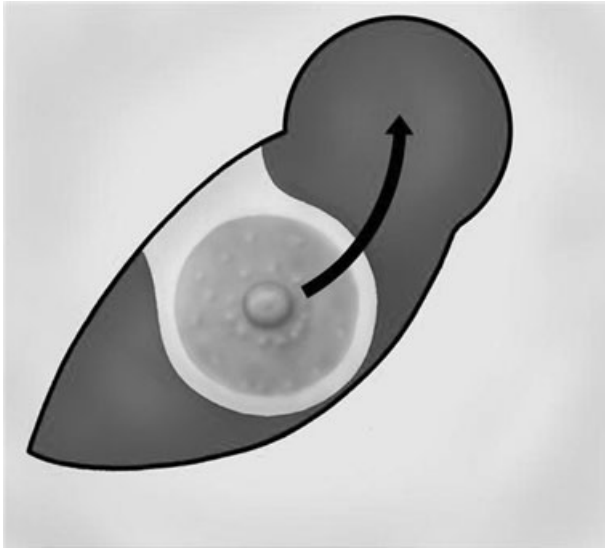


Figure 10. The most common technique for skin resection and nipple transposition is the Letterman technique.

noticeable breast mound scars, and leaves a more modest periareolar and inframammary scar (47).

Massive gynecomastia with tissue droop and nipple ptosis can be much more challenging to correct. The limitations and detrimental scars must be discussed, so that realistic expectations are achieved. A useful approach to correct this most severe type of gynecomastia is en-bloc resection of excessive skin and breast tissue and free nipple grafting. Some patients may prefer or accept a subcutaneous mastectomy or even a simple mastectomy (with removal of the nipple areola complex), and this option should be discussed in this scenario.

Over the last 30 years, there has seen a shift in the surgical treatment of male breast problems to less invasive and more conservative treatment options, where suitable.

One such technique is a *lighted retractor-assisted transaxillary approach*. Dissection, excision, and haemostasis can be performed under direct vision by using the lighted retractor. This is a feasible approach for those who have grade I-IIA-IIB gynecomastia according to Simon's classification and also for those who do not want to have scars on their breasts or patients with high risk of developing keloid (48). With limited access, this is a more technically demanding approach, and perhaps more difficult to obtain even thickness of the resected tissue.

Liposuction has emerged as one of the most useful techniques to treat fatty gynecomastia. It is especially

suitable for the treatment of fatty type true gynecomastia as well as pseudo gynecomastia (49). Judgment is required to assess whether it is likely to succeed alone or in combination with a resection of any associated fibrous/glandular component.

Both tumescent and super tumescent techniques are an effective treatment modality in patients with homogenous soft to moderately firm gynecomastia, giving good cosmetic results and a high level of patient satisfaction (50). The author, Mr EPLT, favors the tumescent and super tumescent approach as it facilitates greater removal of tissue than a dry technique and minimizes blood loss, bruising, and post-operative pain.

Ultrasound-assisted liposuction (UAL) is another modified method that may facilitate the removal of tougher sub-areola glandular tissue at the time of liposuction. Care is needed with this technique to avoid the potential complication of thermal injury to the overlying skin.

Standard liposuction or UAL in combination with gland resection through a minimal caudal semicircular periareolar incision and conventional liposuction effectively corrects most grades of gynecomastia. This combination has little morbidity, requires no skin excision, and leads to uniformly good esthetic results (23). Excisional techniques are reserved for severe gynecomastia with significant skin excess after attempted ultrasound-assisted liposuction (56).

An alternative modification to the simple liposuction is the *power-assisted liposuction* technique. This is performed to contour the breast tissue without having to exert as much physical force as standard liposuction with a syringe and cannula. The cannula reciprocates at a controlled but surgeon adjustable rate, with separate precise control of the suction pressure. This technique works very effectively in combination with a tumescent and super tumescent approach.

A further variation is to use *power-assisted liposuction and a key hole pull-through* technique. This involves the use of power assisted liposuction to remove fatty breast tissue. The pull-through technique is performed utilizing a small incision and several instruments, which might include endoscopic assistance, to incise the subdermal attachments of fibroglandular breast tissue; this tissue can then be removed through the same incision used for liposuction. (51–53).

The aspirate volume from liposuction can range from 50 to over 1,000 mL. In contrast the excision of

the fibroglandular tissue can range from a few grams to over 1,000 g. This illustrates the different degrees of gynecomastia for which surgery is used.

Further more recent advances in surgery also include use of the mammotome. This is an instrument used for taking tissue biopsies from the breast. Advances in technology have extended its role to therapeutic procedures including the excision of small volume gynecomastia. The mammotome device (using an 8-gage needle) can be inserted through a cosmetically placed 4-mm scar at the edge of the breast under USS guidance and small amounts of sub-areolar breast tissue can be resected sequentially using a suction facility without the need to repeatedly remove the biopsy device. Mammothome is an emerging minimal invasive tool that appears safe and ensures reasonable cosmesis and patient satisfaction rates, although there are only limited reports of its use in gynecomastia and no long-term follow-up data (54).

CONCLUSION AND RECOMMENDATIONS

The main aim in the management of gynecomastia is to obtain a satisfactory diagnosis, control the patient's symptoms and treat any visually obvious breast enlargement or deformity. This should be achieved by treating any underlying cause to prevent further breast enlargement, by reassurance after making a correct diagnosis and then choosing the correct treatment modality. Biopsy must be performed in all questionable cases or as an alternative to breast-imaging modalities.

Mammography appears unnecessary in most men particularly in young male patients and should not be used as a routine imaging procedure. However, mammography is indicated in all clinically suspicious breast lumps or indeterminate cases after core biopsy (55). Where medical treatment is to be used, Tamoxifen is preferred as the safest and most cost-effective option although the drug is not licensed for use in this condition. Surgery is the most effective definitive treatment but is not without limitations or risks of complications. The indications for surgery include failure of medical treatment, failure of noticeable gynecomastia to resolve spontaneously, and the presence of moderate or large gynecomastia. The spectrum of modern surgical treatment varies from a minimally invasive technique and simple liposuction to the extremes of mastectomy. All patients should be thoroughly counseled before surgery and cautioned about potential complications to minimize morbidity and potential litigation.

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