

# A Study of Fat: Gland Ratio as an Indicator for Predicting Appropriate Surgical Modality in Gynaecomastia

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## ABSTRACT

**Introduction:** Gynecomastia is the commonest condition of male breast in male population. A number of diagnostic modalities are in use nowadays with each having its indications. Diagnosis of gynecomastia is usually evident with clinical examination but the different proportions of gynecomastia are difficult to assess clinically.

Current protocol of gynecomastia in lower grades is to start with liposuction and assessment of breast after finishing liposuction. If any residual lump felt then excision done. So there is always an uncertainty in preoperative planning. A number of studies are available about the excisional and liposuction techniques but very little written about the quantitative estimation of fat and gland volume.

**Materials and Methods:** We utilized ultrasonography to assess gland volume and Anthropometric method to obtain breast volume and both were used to decide the appropriate surgical modality preoperatively.

**Results:** Gland volume obtained by ultrasound was different in two study groups with p value being <0.05 suggesting its significance. Similarly breast volume obtained by anthropometry was different in two groups with p value<0.05. There was found strong positive correlation between gland volume and breast volume as the breast size increase. Cut off value of gland volume 5.5cc and breast volume 250 cc can be used to predict excision or liposuction followed by excision. Fat/ Gland ratio was not found significant.

**Conclusion:** We recommend this method to be used routinely to predict the appropriate surgical modality. We present a grading system of gynecomastia and treatment algorithm on the basis of gland volume and breast volume.

**Key words:** Gynecomastia, Breast, Volume, Liposuction, Gland, Excision

## INTRODUCTION

The term Gynaecomastia was introduced by Galen during the second century A.D. and the surgical resection was first described by Paulus of Aegina<sup>1</sup> in the seventh century A.D.

Gynaecomastia is defined as benign enlargement of the male breast. Based on the pattern of fat and parenchyma it can be of two types- predominantly fatty or glandular.<sup>2,4</sup> Usually it presents as bilateral breast enlargement and is most common breast condition in males<sup>4</sup>. A related condition 'Pseudogynaecomastia' which is characterised by the presence of only fatty element and no evidence of glandular part and is most frequently seen in overweight and obese male<sup>4,5</sup>. Asymptomatic gynaecomastia present with trimodal pattern of distribution with peaks in neonatal, pubertal, and in elderly males. Prevalence of asymptomatic gynaeco-mastia is 60%-90% in neonates, 50%-60% in adolescents, and up to 70% in men age 50-69 years (6-9). Whereas symptomatic gynaecomastia is

lower as compared to asymptomatic cases. Symptomatic gynaecomastia causes a sense of anxiety, discomfort in dress up, and concern about the malignant potential of nodule that leads the patient to seek for medical attention. Although incidence of male breast cancer is rare with incidence of less than 1%<sup>10</sup>. Three types of gynaecomastia have been described: florid, fibrous, and intermediate<sup>11</sup>.

The most common cause of gynaecomastia is an imbalance between the hormonal level including increased estrogen that exerts stimulatory effect and decreased testosterone activity which have inhibitory effect at the breast level. Several medical conditions are associated with gynaecomastia such as primary or secondary gonadal failure, androgen resistance syndromes, hyperthyroidism, chronic liver disease, use of some medications such as spironolactone, digoxin, bicalutamide, cimetidine and drugs of abuse such as alcohol and marijuana.<sup>2,12</sup> In addition, increased use of anabolic steroids and environmental contamination with xenoestrogens or estrogen-like substances may stimulate glandular proliferation in male breast tissue.<sup>10</sup> Diagnosis of gynaecomastia requires the detailed medical history, a thorough physical examination and precise assessment of the breast and testicular glands, and also of hormone levels which includes LH, FSH, PRL, Testosterone, Estradiol and TSH. These should be supported with radiological investigations like ultrasound, mammography, MRI to assess the constituents quantitatively.

In mild cases treatment can be simple reassurance along with advice on diet and exercise may be adequate. However, with increasing severity, medical and/or surgical intervention is required<sup>12</sup>. A number of techniques are available for the correction of gynaecomastia including liposuction, excision and a combination of two. Aesthetic consideration is central in choosing the operative modality in these cases.

Although liposuction is the most desired option, but many a times due to presence of significant glandular elements surgeon has to give skin incision for its excision. Quite often the decision to give skin incision is taken per-operatively. This is sometimes at variance to the preoperative counselling in which the patient may have been told only about liposuction. In order to avoid such situation an objective indicator is needed, which can guide us preoperatively whether only liposuction will suffice or in combination with excision or only excision is indicated? It will also help the surgeon in counselling the patient regarding the surgical option based on an objective parameter. Ultrasound breast is used in gynaecomastia and it was found prudent to utilize this modality to provide an objective parameter in form of volumetric fat gland ratio.

Gynecomastia is defined as benign enlargement of male breast. It accounts for more than 65% of male breast abnormalities<sup>13</sup>. "Gynecomastia" is derived from the Greek terms gynec (female) and mastos (breast) and was first coined by Galen in the second century AD.

Histologically, the normal male breast comprised of only major mammary ducts, which rarely branch.<sup>11</sup> In early gynecomastia (the "florid" phase) the ducts proliferate and a richly vascular surrounding connective tissue forms. The ductal system dilates, lengthens, and increases in number of branches and typically shows epithelial hyperplasia. This phase usually last for 4 months.

Later, ductal structures start showing evidence of fibrosis and hyalinization ("intermediate phase") gradually encroaches on them. It extends from 5 months to one year. Gynecomastia is reversible if the causal factors are removed in the early proliferative stages.

However, once gynecomastia has evolved to the stage of extensive fibrosis ("Fibrous" phase), the process may be irreversible. Duration is more than 1 year.

A related condition 'Pseudogynaecomastia' which is characterised by the presence of only fatty element and no evidence of glandular part and is most frequently seen in overweight and obese male<sup>4,5</sup>.

Embryologically the development of mammary gland, nipple and areola and surrounding stroma is alike in both sexes. Breast develops as a secondary sexual character in the females under the influence of hormones that is estrogen and progesterone being the major one. Estrogen is the primary hormone which stimulates the growth of breast and is very high during pregnancy. For this reason, breast development is frequently present at birth in the both sexes. Furthermore, several growth factors (EGF, TGF $\alpha$ , IGF-1), progesterone, and GH have also been implicated in mammary growth. However, mechanisms modulating differentiation and development of the mammary gland in fetal life are still under research<sup>14</sup>.

In males gonadal activity of the embryonic and fetal testes with their high secretion of testosterone does not generate a sexual dimorphism in the breast development of the newborn. This is interesting, because it has been speculated that in the absence of androgen action, such as in the complete form of the androgen insensitivity syndrome, mammary over development is observed<sup>15</sup>.

Experimental evidence indicates that testosterone inhibits estrogen-induced mammary epithelial cell proliferation and suppresses estrogen receptor expression<sup>16</sup>.

It is the imbalance between estrogen and testosterone causes gynecomastia rather than absolute increase in estrogen<sup>17,18</sup>.

The normal serum estrogen levels of boys in the presence of high testosterone concentrations do not usually stimulate mammary tissue development. However, a transient imbalance of estrogens and androgens might be present during normal puberty.

### **Classification of Gynecomastia**

With understanding of etiology and advancement in technology various classifications of gynecomastia was proposed.

➤ In 1934, Webster proposed classification of gynaecomastia into 3 types on the basis of its constituents<sup>1</sup>:

- glandular,
- fatty glandular,
- Simple fatty.

➤ In 1973 Simon classified gynecomastia according to the size of the gynaecomastia<sup>19</sup>. Currently it is the most accepted and practical classification and is followed in our study.

- Grade 1: Small enlargement, no skin excess
- Grade 2a: Moderate enlargement, no skin excess
- Grade 2b: Moderate enlargement with extra skin
- Grade 3: Marked enlargement with extra skin.

➤ Letterman and Schuster<sup>20</sup> classification of gynecomastia based on the type of incision or corrective procedure as follows:

- 1: Intra-areolar incision with no excess skin
- 2: Intra-areolar incision with mild redundancy corrected with excision of skin through a superior periareolar scar
- 3: Excision of chest skin with or without shifting the nipple

➤ Rohrich<sup>21</sup> discussing the usefulness of ultrasound-assisted liposuction, developed the following classification:

- Grade I : Minimal hypertrophy (<250 g of breast tissue) without ptosis
- Grade II : Moderate hypertrophy (250 to 500 g of breast tissue) without ptosis
- Grade III: Severe hypertrophy (>500 g of breast tissue) with grade I ptosis
- Grade IV: Severe hypertrophy with grade II or III ptosis

### Clinical Presentation

Asymptomatic gynaecomastia present with trimodal pattern of distribution with peaks in neonatal, pubertal, and in elderly males. Prevalence of asymptomatic gynaecomastia is 60%– 90% in neonates, 50%-60% in adolescents, and up to 70% in men age 50-69 years. There is increased reporting of asymptomatic case to the OPD due to appreciation of psychological, physical and social problem associated with the condition. Bilaterality varies in literature from 25 to 75 %.<sup>6-9</sup>

**Causes and frequency of Gynecomastia<sup>23</sup>**

Idiopathic	25%
Sexual maturity	25%
Medications	10–20%
Hepatic cirrhosis or poor nourishment	8%
Primary hypogonadism	8%
Orchidopexy	3%
Secondary hypogonadism	2%
Hyperthyroidism	2%
Kidney diseases	1%
Others	6%

### Neonatal Gynecomastia

Newborn gynecomastia is relatively frequent, approximately 60 %<sup>6,8,9</sup>. As discussed in development of breast, mammary gland enlargement may be seen due to increased hormones during pregnancy. It is a benign condition and needs only observation as the condition resolves in few weeks, may last for several months. Fluid discharge may be there due to the hormonal effect by fetoplacental unit. On physical examinations, symmetrical bilateral palpable gland present. It could be an abnormal nodule, particularly if it is not symmetric or with different consistency. During follow up mammary nodules should disappear.

### Prepubertal gynecomastia (2 months to 11 years),

It is not frequent, but when present, it is a sign of concern. Patient should be evaluated for precocious puberty and its various etiologies. Enquiry about the family history, endocrine disorders should be done. Excessive tenderness of the breasts is a frequent complaint. It is possible that the palpable mass is not mammary gland. Indeed, some tumours, lipoma or vascular

tumours, might grow below the areola. An ultrasound study might be of help in these cases Garcia<sup>24</sup>.

### Pubertal Gynecomastia (11 to 20 years)

Different from prepubertal gynecomastia, breast development in boys occurs frequently at puberty. During the testicular sexual maturation there occurs a transient imbalance of testosterone and estrogen causing enlargement of mammary gland. It is usually transient and moderate, not requiring medical or surgical intervention. Prevalence studies are variable, but most estimation indicates that it is present in around 30 to 60 % of adolescent boys<sup>23</sup>. If it persist for more than 4 months then should be evaluated as per the protocol to rule out various aetiologies before labelling as idiopathic.

### Senile Gynecomastia

The incidence of gynecomastia rises again in older men (older than age 65 years). This is thought to be the result of a decline in testosterone and a shift in the ratio of testosterone to estrogen.

### Presentation

Patients present to clinician with symptoms of breast enlargement. It creates a psychological disturbance in males of having this “feminine” body characteristic and a sense of embarrassment. People are uncomfortable while dressing the tight clothes and start to avoid the places which need exposure of body like gymnasium, swimming and changing rooms in public. They develop a negative and depressive attitude and not able to give their full potential in society.

The clinical aspects characterising gynaecomastia are:

- increase in areolar diameter
- breast swelling altering profile of chest
- presence of palpable nodule
- anomalous presence of inframammary fold
- tenderness
- cutaneous ptosis

### **Diagnosis of Gynecomastia**

Diagnosis of gynecomastia is mainly clinical based on history and physical examination. Some authors accept that the presence of breast tissue measuring at least 2 cm in diameter is sufficient for the diagnosis of gynecomastia<sup>8,25</sup> but others require the presence of breast tissue measuring at least 0.5 cm in diameter<sup>26,27</sup>

However, apart from the study by Ramadan et al<sup>26</sup>, all these studies were conducted using clinical observations alone. Ramadan et al. found that a diameter of 5 mm was required for the diagnosis of gynecomastia in patients evaluated via Ultrasound. When the diagnosis is in doubt radiological imaging like mammography, ultrasound, MRI is used rationally. Literature is scarce about imaging of male breast as it is a rudimentary organ and its limited volume and mainly focused on carcinoma. Few studies advocating their routine use and showing their merits and demerits while one study<sup>28</sup> questioning their use and labelling their routine as a waste of resources. In one study advocated use of color Doppler for staging of gynecomastia by establishing correlation between increased vascularity and development of gynecomastia<sup>26</sup>. Mammography is also used to determine the volume of breast.<sup>24,29</sup>

Mammographic findings were categorized on the basis of the parenchymal pattern as

- described<sup>30</sup>-
  - nodular
  - diffuse
  - combination
- Ultrasonography findings are categorized into<sup>31</sup>-
- Nodular – discrete round or oval retroareolar density.
  - Poorly defined- vague hypoechoic area in retroareolar region
  - Flame shaped- irregular hypoechoic area with extensions into surrounding tissue
  - Non mass lesions

Evans et al<sup>32</sup> found mammography has a sensitivity and specificity of at least 90% and a negative predictive value of 99%. Given the small number of carcinomas found in men, a low-cost, accurate diagnostic test such as mammography could be an adjunctive tool to physical examination

Mammography and ultrasonography (US) are as effective for evaluating the male patient as for the female patient. The imaging characteristics of the different lesions are fully comparable and have been described.<sup>33</sup>

In men under the age of 30, ultrasonography is considered the imaging method of choice. In addition, it has the advantage of avoiding radiation. Additional Ultrasound is, of course, always indicated if the mammogram does not provide satisfactory information with regard to the patient's symptoms.<sup>28</sup>

Athwal<sup>34</sup> highlighted the dilemma between the ultrasonography and mammography in diagnosis of gynecomastia. It states that ultrasonography is as good modality as mammography and should be used in evaluation of gynecomastia. Mammography to be used as the 1<sup>st</sup> line imaging only when there is suspicion of malignancy to rule out the micro calcifications or malignancy.

To simplify, if clinical diagnosis is in doubt, ultrasound or mammography can be proven useful whichever is available and feasible.

### **Management**

Before beginning treatment, the patient must be informed that these cases are usually benign and self-limiting and that over time fibrotic tissue replaces the symptomatic proliferation of glandular tissue, meaning that the pain and tenderness will resolve. In addition new onset gynecomastia <6 months usually resolves in 2 years in adults and requires only follow up.

Specific treatment of the enlarged breast is indicated if gynecomastia causes

sufficient pain, instances of complete regression are low due to predominance of fibrotic tissues,<sup>3,30</sup> embarrassment or emotional discomfort to interfere with the patient's daily life.

Treatment focuses on eliminating the etiology and restoring the masculine chest profile. The choice of surgical modality governed by-

- Quantity of fat,
- Quantity of glandular and fibrous tissue.
- Likelihood of skin redundancy and presence of inframammary fold

As per the review numerous techniques are available for the correction of gynaecomastia including conservative measures on diet modification and exercises to surgical management via liposuction, excision, skin reduction or combination of various techniques.

Traditionally excision used to be the commonest method of treatment of gynecomastia which involves removal of various constituents of gynecomastia namely fat and gland. Various incision in use prone to leave large scars on exposed area of chest serving the purpose of an aesthetic surgery in vain. With the advent of liposuction in 1980, trend shifted away from the excisional Surgeries. Braunstein GD had proposed algorithm for the practical approach of surgical management.<sup>22</sup>

### **Medical Treatment**

It is effective during the active proliferative phase of gynaecomastia. Danazol, clomiphene, testolactone and tamoxifen have been used. If a trial period of medical therapy is unsuccessful or if the gynecomastia has been present for several years and is bothersome to the patient, then the breast glandular tissue should be removed surgically.<sup>1,10,23</sup>

### **Surgical treatment**

Surgical management has a long history in gynecomastia. It started with the subcutaneous mastectomy developed by Thorek and later by Webster<sup>1</sup>. Subcutaneous

mastectomy for the treatment of gynaecomastia was first remained the treatment of choice until the early 1980s.

Various excisional techniques are

- Webster incision or intra-areolar incision
  - Limited benefit for severe gynecomastia because of skin excess of the ptotic breasts.
- Periareolar circular incision
  - Used in gynecomastia with excess skin.
- Inferior periareolar incision with superior, lateral, and medial extensions<sup>35</sup>
- Triple incision – benefit of maximum exposure
- The transaxillary incision<sup>36</sup>
- “Circum-areolar technique”- advantage of hidden scars on the chest wall, but its disadvantage is that glandular resection being more difficult.
- pull through technique<sup>37</sup>
  - Transaxillary technique used to retrieve fibroglandular structure. Cumbersome to use because small amounts of tissue are removed each time; frequent checking to prevent overresection. Besides, the nipple is inverted when the breast tissue is pulled out through these incisions. Distorting the nipple-areola complex makes it difficult to assess the correct volume of tissue that needs resection. Some modification of pull through technique
    - ✓ Bracaglia et al described pull-through technique through 3 incisions<sup>38</sup>
    - ✓ Lista et al combined it with power-assisted liposuction<sup>39</sup>
    - ✓ Ramon et al associated the PAL technique with endoscopic-assisted pull-through excision<sup>40</sup>

### **Evolution of Liposuction**

Giorgio Fischer introduced the aspiration pump in 1977<sup>41,42</sup> literally inventing liposuction or lipoaspiration, although his different from the modern technique. Yves Gerard Illouz went a step further in 1980 when he performed

liposuction using a blunt cannula in a way that more greatly resembles the current procedure<sup>43</sup>

Initially liposuction met with great success but with accompanying hemodynamic complications of blood loss. With the increasing use of liposuction different techniques came into existence to reduce the complications and morbidity<sup>44</sup>.

- “Dry” liposuction, where no solutions were injected prior to aspiration
- “Wet” and “Superwet” liposuction, depending on the ratio of injected liquid and the liquid expected to be extracted.
- “Tumescent” liposuction.

The content of the injected solution itself has also been the subject of discussion, improvisation, and advancements. The first solutions contained saline, distilled water, and hyaluronidase. Adrenaline and lidocaine were introduced subsequently<sup>45</sup>. In 1984, Teimourian and Pearlman introduced use of liposuction in mastectomy for gynecomastia, and ultrasonic liposuction was developed in the late 1990. In 1987 Jeffrey Klein introduced a solution which also contained bicarbonate<sup>46</sup>. Technological advancement in liposuction has made it today a safe and effective technique, and the “gold standard” for the treatment of localized adiposities.

#### ➤ **Suction assisted liposuction**

SAL was the first technique described in liposuction and remains the most commonly used method.<sup>47</sup>

SAL removes adipocytes and other tissues through mechanical avulsion. SAL is performed starting with larger diameter cannula in the deeper plane and transitioning to smaller diameter cannula in the superficial plane

#### ➤ **Power assisted liposuction**

PAL uses the reciprocating motion of the tip of the cannula to facilitate fat removal. Several studies comparing PAL with SAL have shown

Merits of PAL -less operator fatigue so advantageous in large-volume liposuction

- a. provides a faster rate of fat aspiration
  - b. treatment of fibroglandular areas.
  - c. Difficult secondary cases for release of scarred areas.
  - d. Large Volume/Fat Harvest for redistribution or fat transfer without the use of energy<sup>51</sup>.
- **VASER Ultrasound assisted liposuction**  
It is a 3-staged technique.
    - a. infiltration of wetting solution
    - b. application of ultrasonic energy to emulsify the fat with endpoint being loss of tissue resistance
    - c. evacuation of lipoaspirate manually with suction cannulas
  - **UAL technique has undergone many refinements since its introduction by Zocchi<sup>52</sup> its advantageous are-**
    - a. Can be used in Patients with diminished skin tone,
    - b. liposuction of fibrous areas
    - c. Secondary liposuction to break up adhesions between fascia and dermis due to scarring<sup>53</sup>

Liposuction is an effective technique in treatment of gynaecomastia with predominantly fatty tissue but it is difficult to remove the dense fibroglandular tissue in florid type of gynecomastia. In a study done over 2 years by Fruhstorfer BH1, Malata CM<sup>34</sup> 48 breasts in 29 patients were treated- 31 breasts by liposuction alone (19 by conventional liposuction, 12 by ultrasound-assisted liposuction), eight breasts by liposuction and open excision, and nine breasts by liposuction, open excision and skin reduction (concentric or Lejour mastopexy). The most frequently encountered complication was a residual subareolar lump (five breasts) which was all in patients treated by conventional liposuction alone.

In another retrospective study<sup>54</sup> they have highlighted the fact that there is no objective method for quantitative

assessment of fat and glandular tissue preoperatively and given a morphological classification based on nipple areola complex and inframammary fold position.

Treatment protocol is according to the Simon's grade of mild, moderate, or severe that is too subjective but no quantification of tissue is emphasized. In broad way, proposed algorithm of treatment is liposuction for grade 1 and 2a, with open excision for grade 2b and skin reduction for grade 3.

Sometimes it is difficult on physical examination to differentiate the fibroglandular tissue with adipose tissue in dense breast in grade 1 and 2. It seems logical that if we have qualitative and quantitative estimation of different constituent we can have better preoperative planning and accordingly counselling regarding the procedure. Although Rosenberg used smaller 2.4mm suction cannula that could remove both adipose tissue and dense parenchymal tissue in the breast it is now well accepted that low grades of gynaecomastia are best treated with liposuction alone and combination of liposuction and surgical excision is best suited for the mixed nature of the breast tissue (fat and glandular or fibrous components).

Ultrasound and mammography can very well define the different constituents. An objective documentation of glandular tissue will help in choosing the surgical modality. In literature multiple methods are available to determine the volume of breast including<sup>55-60</sup>.

- Anatomic (anthropometric)
- Thermoplastic casting
- The Archimedes procedure
- Grossman-Roudner device
- Mammography

Out of all the methods available, mammography is the most accurate method. Anthropometric measurement of breast volume is most comfortable, feasible, and less expensive with acceptable degree of accuracy.<sup>28,61</sup>

Since gynecomastia is a benign condition with evidence of malignancy less than 1 %, it is not wise to use ionising radiation. Ultrasound of breast gives information quantitatively and qualitatively about the different constituents of gynecomastia.

To summarize, the treatment algorithm of gynaecomastia revolves around the proportions of the various elements. We felt that there should be some objective parameter for its quantitative estimation which ensures the certainty regarding the procedure to be chosen in spite of starting with liposuction and making plan on table. Studies suggest that ultrasound can be proved significant tool to define the gland volume and anthropometric method to access the breast volume accurately in a patient of gynaecomastia to derive fat: gland ratio which can be used as an indicator for predicting appropriate surgical modality in gynaecomastia.

## MATERIAL AND METHODS

This is a cross-sectional study on gynaecomastia patient reporting to the department of burns and plastic surgery, IPGMER & SSKM Hospital, Kolkata from January 2018 to December 2019

**Study Design:** Cross-sectional Study

**Setting:** Department of Burns and Plastic surgery, IPGMER & SSKM Hospital, Kolkata

**Duration:** 24 months

**Study Frame:** All patients of gynaecomastia patients who were eligible for the study and willing to participate in the study.

**Sample size:** 34 patients of gynaecomastia.

### **Inclusion Criteria**

All patients of idiopathic gynaecomastia whether unilateral and bilateral presenting to IPGMER & SSKM Hospital, Kolkata during a period from January 2018 to December 2019

### **Exclusion Criteria**

1. Gynaecomastia secondary to any disease like chronic liver disease, testicular



failure, hypogonadism, thyroid disorders etc.

2. Pubertal gynaecomastia (13 to 16yrs)
3. Drug induced gynaecomastia.

**Flow of Study:** All patients were subjected to

1. Detailed history including
  - i. Onset and duration of breast enlargement, symptoms of pain, weight loss or gain, change in size, nipple discharge, retraction, virilisation symptoms, medication history (if gynaecomastia is improved following discontinuation of a drug), systemic illness, fertility, sexual function, history of undescended testes and mumps, family history of gynaecomastia, which may suggest androgen insensitivity syndrome, familial aromatase excess, or sertoli cell tumors.
  2. Clinical examination.
  3. Routine blood & urine investigations including liver, kidney function tests.
  4. Hormonal profile including thyroid function, testosterone, Estradiol, prolactin, Luteinizing hormone (LH), Follicular Stimulating hormone(FSH)
  5. Ultrasonography of breast.
  6. The surgical treatment as per the standard of care followed in the department. The end point of the operation was flat chest with no palpable nodule. The protocol was to start with liposuction which was followed by gland excision by semicircular intra-areolar incision in cases with residual gland after liposuction. The procedure finished at liposuction if end point was reached with liposuction only. In the study two possible outcome were recorded:
    - a. liposuction only
    - b. liposuction followed by excision of the residual gland
  7. Histopathological examination

Patients was examined a day before surgery in the sitting or standing posture in good lighting condition. Clinically breast was examined for any asymmetry, swelling,

tenderness, nipple discharge, position of nipple, skin excess. Fat and gland component was assessed by palpation. Ultrasound of affected breast was done by a single radiologist in the radiology department, IPGMER & SSKM Hospital, Kolkata. By using linear 7.5 MHz transducer Volumson E6 model ultrasound machine, the breast was assessed for gland. Then the gland volume was measured by obtaining three dimensions of the gland in both longitudinal and transverse plane. Three greatest dimensions (a, b, c) obtained was used to calculate the volume of the gland as follows-

$$V \text{ (in cc)} = \pi abc / 6$$

Volume of the breast was calculated according to the anatomic (anthropometric measurement) method as proposed by Qiao et al<sup>28</sup>. Breast mound marked and the dimensions were taken as following-

$$V \text{ (in cc)} = \pi/3 \times MP^2 \times (MR+LR+ IR-MP) \\ = 1/3 \times 3.14 \times MP^2 \times (MR+LR+IR-MP)$$

MP-Mammary projection

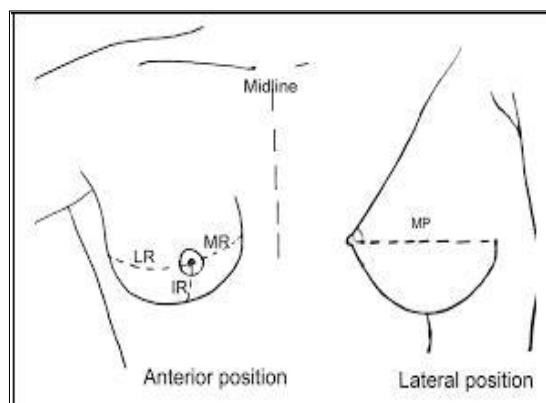
LR -Lateral radius (breast mound to mid-axillary line)

IR-Inferior radius (breast mound to inframammary fold)

MR-Medial radius (lateral border of sternum to breast mound)

Volume of fat was calculated by subtracting the gland volume from total breast volume.

Fat: gland ratio was obtained.



On the day of surgery, marking was done on the breast with a skin marker for the area to be liposuctioned. Prepping with betadine solution for 3 minutes was done. Wetting solution was prepared for

tumescent anaesthesia and infused to the point of tissue turgor or peau d'orange appearance of the overlying skin. Infiltration was about 1:1 with the expected aspiration volume. Composition of the solution was kept as standard. After a waiting period of 10 minutes, liposuction was started with suction pressure of 1 torr. The end point was flat chest and smooth contour with an absence of palpable tissue. In case of any residual gland, excision was done by circumareolar intraareolar incision with size depending on the amount of gland.

Ports were left open for drainage. Compression garment was applied in immediate postoperative period and continued for 1 month.

### Standard Wetting Solution

Table 1: Standard Wetting Solution

Local anaesthesia	General anaesthesia
1 L lactated Ringer solution	1 L lactated Ringer solution
1 mL epinephrine	1 mL epinephrine
50 mL 1% Xylocaine	30 ml 1% Xylocaine

### Statistical Method

Analysis of data was conducted using SPSS ver. 17.0 (SPSS Inc., Chicago, IL, USA). All continuous variables were presented as mean  $\pm$  standard deviation, and the frequencies of categorical variables were presented as percentages. Continuous variables were analysed with the independent t-test when there were normal distributions and with Mann-Whitney U-test when there were no normal distributions. Categorical variables were analysed with the chi-square test. Diagnostic characteristics of fat and gland in gynecomastia were assessed by receiver operating characteristic (ROC) curve analysis. The areas under the curve (AUC) of the ROC plots ranges from 1.0 (perfect separation of test values into two groups) to 0.5 (no distributional difference). An  $AUC > 0.7$  indicates a discriminating strength of statistical significances; an  $AUC > 0.8$  indicates excellent discriminating power for the test. Cut-off value of each biomarker was defined by Youden's index. A P-value under 0.05 is considered statistically significant.

## RESULTS

This was a cross sectional study carried out from January 2018 to December 2019.

Sample size of study was 34 patients.

Simon's classification was followed in the study and all patients were in grade I & II.

Forty nine breasts of 34 patients underwent treatment for gynecomastia.

Forty nine breasts were divided into two groups made according to the type of treatment given.

**Group I:** Liposuction followed by excision.

**Group II:** Liposuction.

Out of the sample of 49 breast, 16 breast were in group I and 33 breast were in group II

### Mode of presentation

Table 2: Mode of presentation

1. Gynecomastia	2. Uni-lateral	3. Bi-lateral
4. No of patients	5. 19	6. 15

As shown in table 2, 44 % (15) patients presented with bilateral gynecomastia and 56 % (19) with unilateral gynecomastia.

### Group distribution

Table 3: Number of breast in each treatment group

	group I	group II
number of breast	16	33

As shown in Table 3 Group 1 consisted of 16 breasts with liposuction followed by excision while Group 2 consisted of 33 breasts with liposuction only.

### Gland volume

Table 4: Comparison of gland volume

	Group I	Group II
Gland Volume	5.82	3.28

Median gland volume: Group I - 5.82cc

Group II- 3.28cc

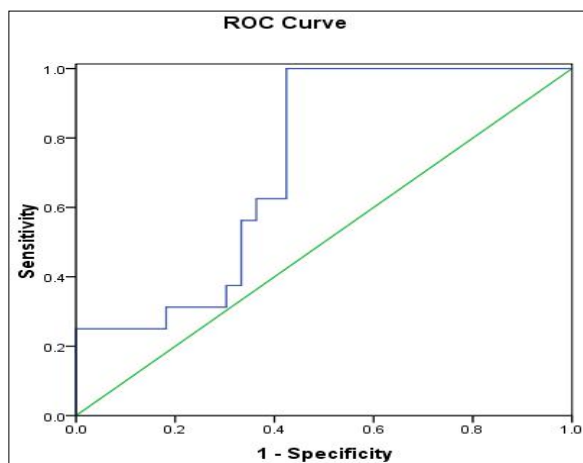
P value =.001 statistically significant

As the gland volume increased chances of excision also increased.

### ROC: GLAND VOLUME

**Table 5: ROC table gland volume**

	Cut Off	AUC	Sensitivity	Specificity
Gland	5.38	72.50%	62.5	60.6
Volume				



**Figure 1: Gland volume ROC curve**

At cut off value of gland volume 5.38cc area under curve is 72.50% with 62.5% and 60.5% sensitivity and specificity respectively.

**Breast volume**

**Table 6: Breast volume in two groups**

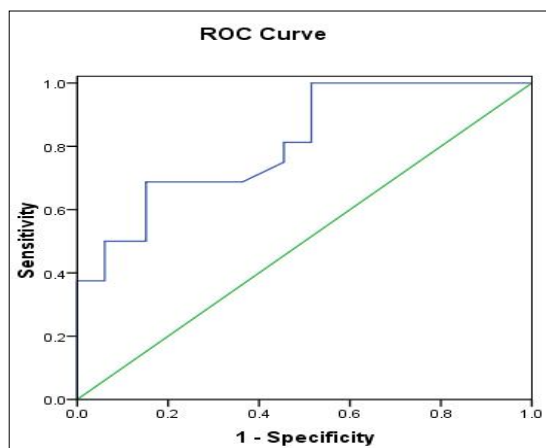
	Group I	Group II
Breast volume	346cc	219cc

Median breast volume in Group I- 346cc  
 Median breast volume in Group II- 219cc  
 Difference in breast volume between two groups is statistically highly significant with p value = 0.000.

**ROC: BREAST VOLUME**

**Table 7: ROC Breast volume**

	CutOff	AUC	Sensitivity	Specificity
Breast Volume	249.63	81.30%	68.8	69.7



**Figure 2: ROC curve**

Cut off value 249.63 has sensitivity & specificity of 68.8% & 69.7% respectively  
 Positive predictive value - 52.38  
 Negative predictive value - 82.14

As the breast volume increases, possibility of excision increases, hence if breast volume is above a particular value it can predict excision. But if it lesser than that volume, can effectively rule out the excision i.e. better negative predictive value.

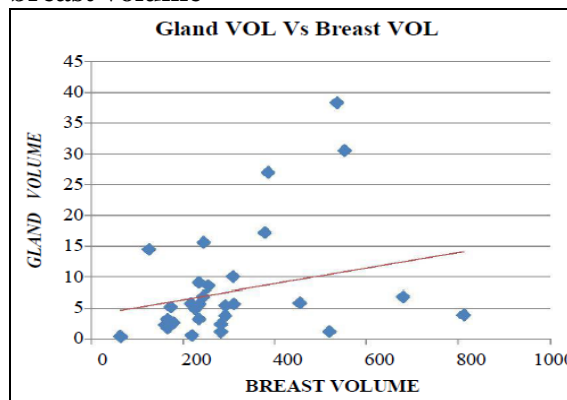
**Fat Gland Ratio**

**Table 8: Fat Gland Ratio**

	Group I	Group II
Fat /Gland Ratio	38.3694	65.2963

Although difference is observed in the numerical value in two groups as shown in table but it is not significant as p value >.05.

**Correlation between gland volume and breast volume**



**Figure 3: Correlation between gland volume and breast volume**

There exists a positive correlation between gland volume and breast volume with correlation coefficient of 0.441 and p value = .002. It is true as the grade of gynecomastia increases.

**Complications**

**Table 9: complications in two groups**

Complications	Group1	Group 2
Hematoma	1	0
NAC superficial desquamation	2	0
Superficial Wound dehiscence	2	0
Saucer deformity	2	0
Residual lump	0	2
Scar complications	0	0

Overall complication rate was 18% (9) out of 49 breasts.

Group I-	7 (14%)
Group II -	2 (4%)

All were minor complications with one patient required hematoma evacuation in theatre.

Wound dehiscence healed without any obvious disfiguration.

Two patients required fat grafting to correct saucer deformity.

## DISCUSSION

Gynecomastia is the commonest condition of the male breast with trimodal distribution of age<sup>13</sup> i.e. Neonatal, adult and senile age. Idiopathic gynecomastia is most common in all age groups.

All the patients in our study were Simon's grade 1 and grade 2.

In our study, 49 breasts (from 34 patients) were divided into two groups according to the treatment received as shown in table 2.

**Group 1** consists of breast treated with liposuction followed by excision.

**Group 2** consists of breast treated with liposuction.

All the patients were evaluated by history, clinical examination, hormonal study, routine blood investigations and ultrasound of breast.

Out of 34 patients 15 (44%) presented bilateral gynecomastia while 19 (55%) with unilateral gynecomastia as shown in table 2. It is in accordance with other studies<sup>6-9</sup>

Most of the patients were in the adult age group (21-40).

31 (91%) patients were in age group of 21-40.

3 (9%) patients were in age group 41-60.

We diagnosed patient by history and clinical examination supplemented by ultrasound with a thickness of more than 0.5 cm.

In most studies reported in literature the deciding factor for treatment of gynecomastia was the relative proportion of fat or gland which was also the basis of many classifications of gynecomastia<sup>54</sup>. After reviewing the literature, we found a continuous ongoing debate on diagnostic work up and a number of algorithm have

been proposed by different authors.<sup>33</sup> Most debatable issue is regarding the use of radiological modality between ultrasonography and mammography. Some recommending its use routinely while some advocated its use only in special circumstances like suspicion of malignancy or if diagnosis is uncertain; and one author labelled it as a wastage of resources for routine cases.<sup>27</sup>

Mammography used to be the investigation of choice in gynecomastia with its plus point of diagnosing any malignant lesion if present. But it is clear from literature that the chance of malignancy in gynecomastia is less than 1 % of male breast. Hence it is unwise to use radiation when alternative safe and equivalent techniques available. Nowadays the trend is shifting towards ultrasound which is more economical and feasible in male breast than mammography and equivalent information obtained.<sup>33</sup>

Hence there is always a dilemma in choosing the appropriate surgical procedure preoperatively in gynecomastia. It is reported by many authors that it is difficult to appreciate the amount of fat and gland clinically. It is generally a practice to obtain the consent for excision preoperatively by explaining the patients that decision regarding excision will be taken after liposuction per-operatively.<sup>34</sup>

Sixteen breasts were treated by liposuction followed by excision (group 1) and 33 breasts were managed with liposuction (group 2) as shown in table 3.

On analysing the data, difference of gland volume obtained by ultrasound between group I and group II was statistically significant with p value = 0.001 as shown in figure 1.

This signifies that as the gland volume increased chances of excision increased.

On plotting an ROC curve, at a cut off value >5.38cc of gland volume, sensitivity/specificity are 62.5 % and 60.6% for excision respectively (table 5 and figure 2).

Use of ultrasound is well known for the diagnostic purpose of gynecomastia but no study is available regarding its use in preoperative planning and choosing the correct surgical modality except one where ultrasound has been used to compare the thickness of fat preoperatively and postoperatively.<sup>62</sup>

In the literature there is neither any study reporting use of gland volume, as a guide for pre-operative selection of operative modality, nor any mention of cut-off value of gland volume above which liposuction needs to be supplemented with excision.

In our study, Breast volume obtained by anthropometry<sup>28,61</sup> was different in two groups i.e.

Group I - 346cc and Group II- 219cc with p value = 0.000 which is highly significant.

This signifies as the volume of breast increased, chances of excision increased. This has been reported in other studies too as the grade of gynecomastia increases, possibility of excision increases.

On plotting the ROC curve, at a cut off value of 249.63cc of breast volume, sensitivity/specificity for excision is 68.8% / 69.7% respectively (figure 3).

Breast volume has been used empirically to grade them into mild, moderate and severe but there has been no attempt to develop any grading system based on numerical values of breast volume<sup>54</sup>. The numerical data of breast volume obtained from this study along with a cut off value can be used to objectively decide preoperatively the operative modality to be used. The existing grading systems can be improved by using numerical values of breast and gland volume instead of subjective terms like mild, moderate severe. Such objective grading system can be of functional value guiding the surgeons to appropriate surgical modality.

The fat/ gland ratio in Group I was 38.36 and 65.29 in group II (table 8). The median fat/gland ratio was lower in Group I signifying higher proportion of gland, hence

higher possibility of excision after liposuction. The ratio was higher in Group II signifying more fatty breasts hence only liposuction sufficed. But the difference of the ratio was not significant as P value >0.05. This lack of correlation is attributed to two findings of the study. First, a positive correlation exists between gland volume and breast volume which signified proportional increase of both fat and gland with the size of breast; hence there was minimal change in ratio as the absolute value of the gland volume and breast size increased. Second in many of cases where gland was diffuse and ratio indicated possibility of excision, reduction was possible with liposuction only.

Thus in this study the absolute values of the gland and breast volume had more predictive value than the ratio itself. Hence it is recommended to anthropometrically assess the breast volume and ultrasonologically determine the gland volume. The decision regarding the surgical modality should be guided by the cut off value of breast volume and gland volume.

Overall complications in our series were 18% (9 breasts) out of 49 breasts similar to reported in other studies<sup>34</sup> as shown in table 9 and figure 10.

Group I- (7) 14%

Group II-(2) 4%

All were minor complications ; in group I there was hematoma in 1 patient requiring evacuation in theatre; superficial wound dehiscence in 2 patients which healed uneventfully ; and superficial desquamation of areola in 2 patients which left discoloration which returned to normal in 3 months.

In group II, 2 patients presented with residual lump that was not there intraoperatively and in ultrasound too. Both patients were excised later on.

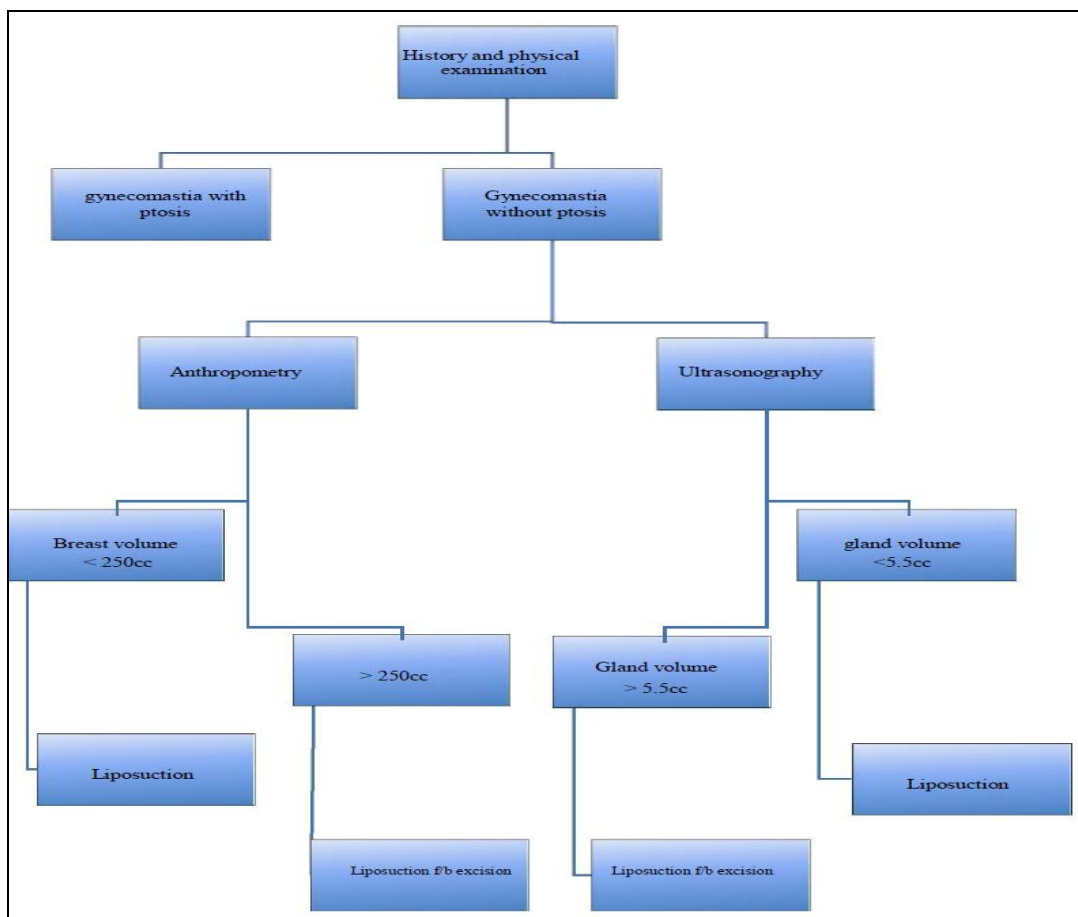
No cases of wound infection, major wound dehiscence or revision surgery were encountered. No patient developed scar complications like hypertrophy or keloid in any group.

Histopathology s/o benign disease with no malignancy (0%). Other studies too show <1 % incidence.

All the patients were satisfied with the aesthetic result 6 months after surgery, which may be attributed to the small size of incision required and its location. Scar did

created a sense of dissatisfaction initially but patient usually being satisfied when they get rid of their primary complaint.

According to our experience we propose a new algorithm that can guide the surgeon a step further towards preoperative planning and better counselling of patient.



Similarly a grading system is presented-

Grade 1a-	Breast Volume < 250 cc	}	Liposuction
	Gland Volume < 5.5 cc		
Grade 1 b-	Breast Volume <250 cc	}	Liposuction or liposuction followed by excision
	Gland Volume >5.5 cc		
Grade 2 a	Breast Volume >250 cc	}	liposuction followed by excision
	Gland Volume <5.5 cc		
Grade 2 b	Breast Volume >250 cc	}	liposuction followed by excision
	Gland Volume >5.5 cc		

## CONCLUSION

The gland volume and breast volume calculated by ultrasound and Anthropometry methods respectively are significantly different in two groups so those can be used to predict excision. Fat / gland ratio was not found significantly different in two groups, because both breast volume and gland volume increase proportionately as breast size increases. However median value was different in two groups. Breast volume is more significant than gland volume to predict requirement of excision. Anthropometry method is easy to perform, less expensive with acceptable level of accuracy. So we infer that anthropometry method is good enough to predict surgical modality, ultrasound can be used to supplement the decision. Cut off value used in this study may be taken high or less depending on the need of a more sensitive or a more specific test.

**Declaration:** The study is in accordance with the ethical standards of the responsible committee on human experimentation (Institutional or Regional) and with the Helsinki declaration of 1975, as revised in 2000

**Conflict of Interest:** NIL

**Funding Source:** NIL

**Informed Consent:** Well Written Duly Informed Consent Was Obtained From All Patients

**Ethical Approval:** Institution Ethic Committee Approval was taken

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How to cite this article: Meheraj SK, Kumar N, Gupta S. A study of fat: gland ratio as an indicator for predicting appropriate surgical modality in gynaecomastia. *International Journal of Research and Review*. 2020; 7(10): 201-218.

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