



Digital breast tomosynthesis of gynecomastia and associated findings—a pictorial review



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ABSTRACT

Men referred for breast imaging most frequently present with a unilateral palpated breast lump or breast enlargement. In the vast majority of these cases, the cause is benign and the most common etiology is gynecomastia. This pictorial review illustrates the appearance by full field digital mammography and digital breast tomosynthesis of gynecomastia as well as additional findings in the male breast including sternalis muscle and hypertrophied pectoralis muscle, lipoma, intramammary lymph node, fat necrosis, breast cancer, and atypical ductal hyperplasia.

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1. Introduction

A unilateral palpated breast lump or breast enlargement with or without tenderness is the most common presentation of men referred for breast imaging [1]. In the vast majority of these cases, the cause is benign and the most common etiology is gynecomastia [2]. Other benign lesions of the male breast include lipoma, abnormal lymph node, epidermal inclusion cyst, subareolar abscess, chronic inflammation, fat necrosis, hematoma, and subcutaneous leiomyoma [3]. Fibroadenomas, while rare in the male breast, have also been reported [4].

While gynecomastia can usually be suspected and accurately diagnosed based on review of the clinical history and physical exam, adult males may be referred to the radiology department for imaging if the diagnosis is uncertain [5]. In such cases, imaging usually reveals benign lesions, but the differential diagnosis also includes breast carcinoma. Mammograms of men with breast cancer usually show an uncalcified subareolar mass which may mimic or be obscured by gynecomastia [6]. Both gynecomastia and carcinoma appear as abnormal dense tissue. Up to 40% of cases of male breast cancer (MBC) have associated gynecomastia [3]. Conversely, a study of 5113 surgical specimens excised for gynecomastia showed a 0.11% prevalence of invasive carcinoma and 0.18% prevalence of in situ carcinoma, occult at time of surgery [7]. Therefore, males referred for

imaging to confirm the diagnosis of gynecomastia must have sufficient imaging to rule out carcinoma.

The most common imaging evaluation for the symptomatic male breast utilizes mammography. A recent study concluded that breast ultrasound added nothing and led to unnecessary biopsy in men whose mammogram showed only gynecomastia or were negative [8]. Digital breast tomosynthesis (DBT) is new mammographic technology in which the breast is viewed in sequential 1-mm slices, in contrast to full field digital mammography (FFDM) which views a summation of the entire breast in one image. DBT thus removes the overlap of dense mammary tissue which could obscure a mass on two-dimensional (2D) mammography. To our knowledge, this article marks the first description of the male breast imaged by DBT. Because DBT will become more ubiquitous, knowledge of the appearance of the male breast using this technology is helpful.

The aim of this pictorial essay is to illustrate the FFDM and DBT imaging appearance of gynecomastia as well as some benign lesions in the male breast: sternalis muscle and hypertrophied pectoralis muscle, lipoma, fat necrosis, intramammary lymph node, and atypical ductal hyperplasia (ADH).

2. Gynecomastia

Gynecomastia is benign proliferation of duct epithelium accompanied by periductal stromal hyperplasia in the male breast. It is a response to a physiologic imbalance between androgen and estrogen levels, which may be idiopathic or associated with an identifiable medical condition or drug use [9]. The three age peaks for gynecomastia are the newborn

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period, puberty, and in men over the age of 60 [2]. Overall, gynecomastia has been noted to be most prevalent under the age of 20 and over the age of 70 [4]. It is usually bilateral and asymmetric [2].

There are numerous causes for gynecomastia [2,3,9,10]. Gynecomastia is the result of an imbalance between estrogen and androgens which results in excessive estrogenic stimulation of the male breast. Whether it is idiopathic or due to endocrine disorder, systemic illness, or drugs, the imaging features are similar. Causes of gynecomastia include physiologic estrogen imbalance seen during infancy; puberty; endocrine causes such as Klinefelter's syndrome, hypogonadism, hypothyroidism, and pituitary adenoma; and diseases such as cirrhosis, adrenal carcinoma, and renal failure requiring hemodialysis. Testicular tumors, both seminomatous and nonseminomatous, have associated gynecomastia reported in up to 7% of cases [10]. Exogenous estrogen; anabolic steroids; and nonhormonal substances and medications such as alcohol, cannabis, thiazide diuretics, digoxin, spironolactone, diazepam, cimetidine, antiandrogen therapy for prostate carcinoma, and antiretroviral therapy to treat HIV are all associated with gynecomastia.

The imaging appearance of gynecomastia is well described on standard 2D mammography which remains the standard imaging modality for diagnosis [1–3,11]. Ultrasound is a good adjunct to mammography when findings are equivocal [8]. Gynecomastia is divided into three types: nodular, dendritic, and diffuse [3]. These subtypes are distinguished by the pattern of the dense tissue on mammography and correlate with histology [3,12]. Another cause for breast enlargement is excess deposition of adipose tissue in obesity called pseudogynecomastia.

2.1. Nodular gynecomastia

Nodular gynecomastia is the acute or florid phase of the condition. It correlates histologically with duct epithelial and myoepithelial hyperplasia and stromal proliferation associated with edema and residual adipose tissue. This phase of gynecomastia has been described as fan- or spherical-shaped tissue of water density located behind the nipple and upper outer quadrant which fades into surrounding adipose tissue [3,12,13]. This acute phase of gynecomastia will resolve if the stimulus is present for no more than 6months (Fig. 1) [9].

2.2. Dendritic gynecomastia

After the acute phase of gynecomastia, at approximately 6months to 1year, there follows a mixed or transitional phase [14] in which there is progressive deposition of dense, collagenous periductal fibrous tissue which obliterates the proliferated ducts. This leads to the irreversible late phase referred to as dendritic gynecomastia [9]. Dendritic gynecomastia correlates histologically with epithelial and stromal hyperplasia surrounded by marked stromal fibrosis with minimal surrounding fat and absent edema. Adipose tissue and edema are displaced by progressive periductal fibrosis. On mammography, dendritic gynecomastia has been described as dense flame-shaped retroareolar tissue with strand-like extensions which radiate into surrounding adipose tissue [2]. These features are well visualized on DBT (Fig. 2). Ultrasound features of dendritic gynecomastia have been described as subareolar hypoechoic tissue which is “star shaped” or “finger like” where it interfaces posteriorly with surrounding adipose tissue [1,3,12,13].

2.3. Diffuse gynecomastia

Diffuse gynecomastia is characterized by heterogeneously dense enlarged breasts appearing similar to a female breast [3]. The usual cause is prolonged exposure to estrogen. The imaging appearance on mammography and ultrasound consists of imaging features of both

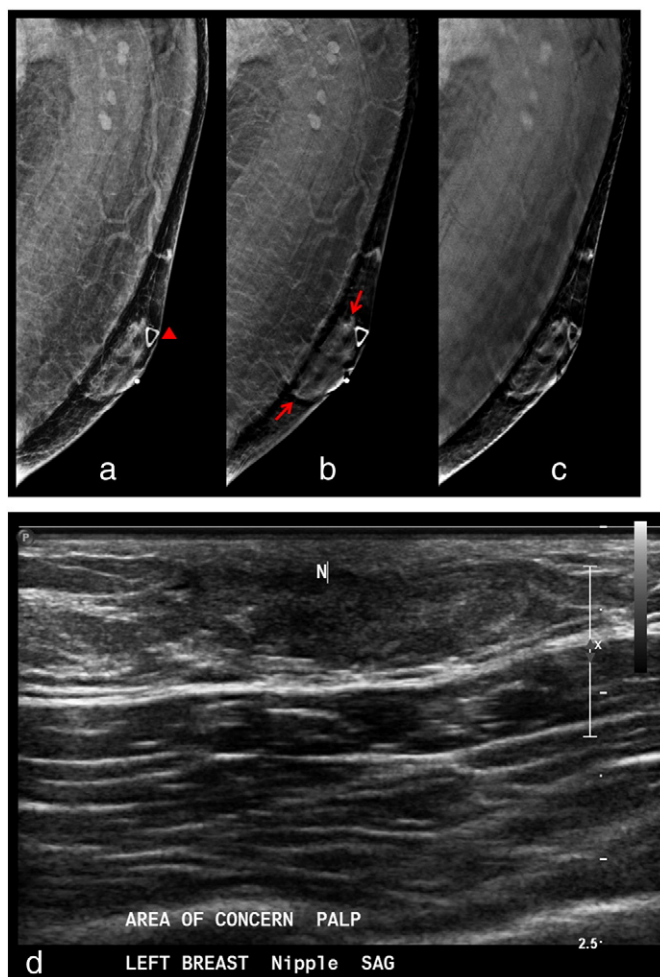


Fig. 1. A 46-year old man complains of enlarged tender breast. Triangular-shaped skin marker is on palpable concern (arrowhead). (a) Mediolateral oblique (MLO) FFDM image shows mild left-sided retroareolar fan- or disk-shaped dense tissue with apex towards the nipple, typical of nodular gynecomastia. (b and c) Two representative DBT mammography slices again show the homogenous water density of combined hypertrophied ducts, stroma, and associated edema (arrows). (d) Ultrasound image of nodular gynecomastia shows hypoechoic, disc-shaped retroareolar tissue with indistinct margins typical of nodular gynecomastia.

nodular and dendritic gynecomastia [1]. By removing the tissue overlap, the combined features of nodular and dendritic gynecomastia are well visualized on DBT (Fig. 3).

3. Sternalis muscle and pectoralis muscle hypertrophy

The sternalis muscle is an uncommon anatomic variant with a prevalence of up to 10.5% in a study observing computed tomographic scans [15]. It is a muscle found superficial to the pectoralis major muscle on the medial parasternal anterior chest wall extending from the infraclavicular region to the caudal end of sternum. It is more common in females and may be unilateral or bilateral, varying in shape and size between individuals [16]. It is rarely visualized during mammographic imaging; however, and when visualized, it may pose a diagnostic dilemma. The sternalis can appear on mammography as a mass at the medial edge of the breast primarily on the craniocaudal (CC) view when the muscle is relaxed and pulled forward into view [17]. In DBT images, however, the sternalis muscle is clearly demarcated medially, and muscle fibers are distinctly seen, making the diagnosis obvious (Fig. 4).

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