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Review

How to approach breast lesions in children and adolescents

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ABSTRACT

Assessment of a pediatric breast lesion always starts with clinical evaluation. When imaging of a pediatric breast is indicated, ultrasound is the mainstay. The vast majority of pediatric breast complaints are of benign etiology, therefore the diagnostic/management approach emphasizes “first do no harm”. Correlation with age and clinical history helps to direct diagnosis. It is essential to be familiar with the imaging appearance of the normal developing breast at various Tanner stages, in order to diagnose physiologic breast findings and to minimize unnecessary biopsies in young breasts vulnerable to injury. Normal anatomic structures, developmental conditions, benign neoplastic and non-neoplastic lesions are common causes of breast complaints in children. Uncommon benign masses and rarely, secondary more than primary malignancies may present in a pediatric breast. Chest wall masses such as Ewing’s sarcoma or rhabdomyosarcoma occur in children and may involve the breast via contiguous growth or locoregional metastasis. In addition, special attention should be given to any breast lesion in a child with risk factors predisposing to breast cancer, such as known extramammary malignancy, genetic mutations, prior mantle irradiation, or strong family history of breast cancer, which usually requires biopsy to exclude the possibility of malignancy.

Conclusion: The developing breast is vulnerable to injury, and because breast malignancy is uncommon in children, diagnostic and management approach emphasizes “first do no harm”. Understanding normal breast development and the spectrum of common and uncommon pediatric breast lesions are key to the correct diagnosis.

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1. Introduction

The relatively high prevalence of adult breast cancer is the source of worry in many parents of children with breast complaints. One in every eight women in the United States develops invasive breast cancer during her lifetime [1]. Yet breast cancer hardly ever afflicts children or adolescents. For example, the reported prevalence of breast cancer in females under the age of 20 is well below 0.1 per 100,000 [2].

With that in mind, a tailored diagnostic and management approach is necessary for pediatric breast complaints. Furthermore, because the developing breast is uniquely vulnerable to iatrogenic injury, which can lead to permanent disfigurement, biopsy should be reserved only for lesions of high suspicion.

Clinical evaluation is an essential component of complete assessment of pediatric breast complaints. With pertinent history and physical exam, many pediatric breast complaints can be correctly categorized as normal developmental processes or physiologic changes, which require only reassurance. Occasionally, imaging can be helpful in confirming a normal finding such as an asymmetric breast bud, or may be necessary when an abnormality is suspected. When necessary, ultrasound is the primary imaging modality used in assessing breast lesions in children, given its diagnostic specificity and lack of ionizing radiation. Mammography is seldom used, but is the modality of choice to visualize calcifications in select cases. Cross-sectional imaging modalities such as CT or MR are usually reserved for evaluation of disease extent and occasionally, problem solving.

The vast majority of pediatric breast complaints are of benign etiology. Normal anatomic structures can mimic breast masses. Non-neoplastic benign entities in the pediatric breast include cyst, hematoma, mastitis/abscess, and galactocele. Clinical history helps clinch the diagnosis in some of these cases. The most common benign solid mass in the pediatric breast is a fibroadenoma.

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A 2–3 cm probably benign mass on ultrasound in a child without atypical features or rapid enlargement is rarely malignant and is safe to follow, as has been shown in multiple studies. Biopsy should be considered however if the mass is larger than 4–5 cm or undergoing rapid enlargement, to exclude the possibility of a phyllodes tumor. Other rare benign masses in the pediatric breast include hamartoma, intraductal papilloma, juvenile papillomatosis (a marker for familial breast cancer), and fibrous nodule. Malignant lesions in the pediatric breast are exceedingly rare, more commonly metastatic disease to the breast and occasionally primary breast malignancy. Phyllodes tumor is the most common primary breast malignancy in children. Invasive ductal carcinoma is rare in children, of which the secretory subtype is the most common. In young people with risk factors predisposing to breast cancer, such as strong family history of breast cancer, known extramammary malignancy, genetic mutations, or prior mantle irradiation, biopsy is often required to exclude malignancy regardless of the imaging appearance of the breast lesion.

In this article, we will review embryology and development of the breast, discuss the appropriate imaging and management approach of pediatric breast complaints, and explore the spectrum of common and uncommon pediatric breast lesions.

2. Imaging approach to the pediatric breast

Because pediatric breast cancer is so rare, diagnostic imaging emphasizes “First Do No Harm”. Evaluation of pediatric breast complaints always begins with clinical assessment, which then determines the need for imaging. Ultrasound remains the primary and often the only necessary modality for the evaluation of breast complaints in the pediatric population, given its high sensitivity for detection of lesions in younger denser breasts [3] and the lack of ionizing radiation. In contrast, the utility of mammography is limited in the pediatric population, both due to low diagnostic sensitivity in young and dense breasts, and radiation risks associated with mammography in this age group. MRI and other cross sectional imaging modalities are generally reserved for assessment of disease extent, for assessment of deep chest wall lesions or vascular anomalies, or occasionally for correlation with ultrasound findings.

Breast Imaging Reporting and Data System lexicon (currently 5th edition) is the gold standard for describing and stratifying breast lesions into categories which correlate with likelihood of malignancy by imaging appearance (Table 1). Although this is used both in adults and in children, because it is based on the likelihood of malignancy, which is exceedingly low in children [2], its utility may be limited in this setting. For example, the vast majority of pediatric breast lesions are benign and will be categorized BIRADS 2 or 3, emphasizing appropriate conservative management to “First Do No Harm”. Highly suspicious lesions or lesions in high risk pediatric patients may warrant biopsy and are categorized BIRADS 4 or above, but are few and far in between.

Table 1
BI-RADS assessment categories and likelihood of cancer. American College of Radiology BI-RADS® Atlas 2013.

BI-RADS category	Assessment	Likelihood of cancer
0	Incomplete – need additional imaging evaluation	N/A
1	Negative	Essentially 0%
2	Benign	Essentially 0%
3	Probably Benign	>0%, ≤2%
4	Suspicious	>2%, <95%
5	Highly suggestive of malignancy	≥95%
6	Known biopsy-proven malignancy	N/A

3. Normal breast development

The breast begins normal development during the 5–6th week of fetal gestation [4], with ectodermal cells invaginating into the deeper mesenchyme to form the mammary ridges or milk lines, which extend symmetrically along the anterior torso from the axillae to the groin (Fig. 1). Over time, there is normal involution of the milk lines except at the level of the 4th intercostal space, where normal breast buds form. If normal involution is incomplete, ectopic or accessory nipples and/or breast tissue may form anywhere along these milk lines. At the 4th intercostal space, the primary breast buds (invaginated epidermal cells) evolve into secondary buds and further branch into lactiferous ducts within the breast parenchyma. Overlying the breast bud at the skin surface, a small depression or mammary pit forms, which further evolves into the nipple–areolar complex (Fig. 2). Prior to puberty, the breast is composed of epithelium lined lactiferous ducts supported by stromal connective tissue [5]. Enlargement of these ducts are a common cause of self-limited bilateral palpable subareolar nodules in both male and female infants in the first 6–12 months of life due to maternal hormonal influence [6].

With the onset of puberty, the breast undergoes further maturation. The term *thelarche* refers to the onset of normal pubertal phase of breast development in females, with estrogen stimulating ductal growth and progesterone promoting lobular and alveolar differentiation, completing the terminal duct lobular unit. The normal age of onset of thelarche in the U.S. ranges between 9 and 10 years of age, with the average onset of thelarche in African American girls generally being earlier compared to that in Caucasian girls [7]. Premature thelarche therefore, is defined as early onset of breast development in prepubertal girls, typically before age 7–8. Thelarche after 12 years of age is considered delayed [8].

Idiopathic premature thelarche generally occurs in younger children between ages 1–3 [6], and is unusual after age 4 [9]. Idiopathic premature thelarche is benign and generally self-limited. This can however mimic a mass when unilateral, and thus frequently comes to clinical attention. The role of ultrasound is to confirm the presence of normal developing breast tissue or thelarche (whether premature or appropriate), in the absence of a discrete mass. Clinical reassurance and followup usually suffice for idiopathic isolated premature thelarche, but occasionally short term imaging followup may be appropriate. Other possible

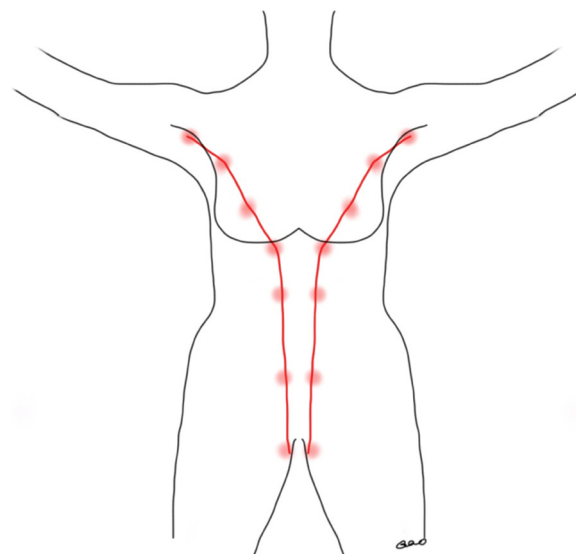


Fig. 1. Milk lines or Milk ridges (Y. Gao).

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