Role of Breast Sonography in Imaging of Adolescents with Palpable Solid Breast Masses

Aruna Vade[1]
Vaishali S. Lafita
Kathleen A. Ward
Jennifer E. Lim-Dunham
Davide Bova

OBJECTIVE. The purpose of this study was to assess the role of sonography in the diagnosis and management of palpable solid breast masses in adolescents and to correlate the sonographic findings with the histopathologic findings and clinical outcome.

MATERIALS AND METHODS. A retrospective study was conducted with the breast sonograms of 20 adolescent girls 13–19 years old who presented with palpable breast masses found to be solid at breast sonography. The Stavros sonographic criteria were used to assess the benignity or malignancy of solid breast masses. All sonographic findings were correlated with histopathologic or clinical follow-up findings.

RESULTS. Sonography showed 21 solid masses in 20 patients (one patient had bilateral solid breast masses). All but six solid masses were presumed benign according to the Stavros sonographic criteria. All solid masses were proved benign at histopathologic or clinical follow-up examination.

CONCLUSION. Sonography was not useful for predicting the histologic diagnosis of all solid benign breast masses in adolescent patients. The Stavros sonographic criteria, however, were useful for predicting benignity in 65% of the breast masses on which histopathologic examination was performed. Tissue biopsy may be performed on solid breast masses that do not meet the criteria for benign masses according to the Stavros sonographic criteria.

Disorders of the breast in adolescents often reflect normal changes related to endocrine function or benign mass lesions [1]. However, because of increased awareness of breast cancer, pediatricians and surgeons are evaluating increasing numbers of children with breast symptoms [2], and sonography often is the first diagnostic imaging technique used. The spectrum of sonographic findings encountered in children and adolescents presenting with breast symptoms and the sonographic findings of biopsy-proven fibroadenoma have been described [2–5]. The purpose of this study was to assess the role of sonography in the diagnosis and management of palpable solid breast masses in adolescents and to correlate the sonographic findings with the histopathologic findings and clinical outcome.

Materials and Methods

Institutional review board approval was obtained for this HIPAA-compliant retrospective study. A waiver of patient informed consent was obtained. Family history of breast cancer and current history of known malignancy were recorded. Breast sonograms were obtained for 20 adolescent girls consecutively presenting over a 6-year period with a palpable breast mass. The mean age of the patients was 14.8 years (range, 13–19 years). All patients presented with a palpable breast mass.

The sonographic examinations were performed with a 7- to 15-MHz linear phased-array transducer and a commercially available scanner (Sequoia, Siemens Medical Solutions). The patients were examined in the supine position. Radial and antiradial real-time images were obtained through the area of the suspected breast lesion. All lesions were evaluated with respect to size, shape, margins, echogenicity, vascularity, presence of calcification, and posterior acoustic enhancement or shadowing. Echogenicity was classified as anechoic, hypoechoic, isoechoic, or hyperechoic. Masses were classified as anechoic when the lesion contained no internal echoes, hypoechoic when low-level echoes were present, isoechoic when echogenicity was similar to that of fat, and hyperechoic when the echogenicity was greater than that of adjacent tissue.

Solid breast masses were assessed for benign and malignant features according to the Stavros

Keywords: adolescents, breast, solid masses, sonography

DOI:10.2214/AJR.07.3390

Received November 6, 2007; accepted after revision March 10, 2008.

[1]All authors: Department of Radiology, Loyola University Medical Center, 2160 S First Ave., Maywood, IL 60153. Address correspondence to A. Vade (avade1@lumc.edu).

AJR 2008; 191:659–663

0361–803X/08/1913–659

sonographic criteria [6]. Individual malignant characteristics of a breast mass were marked hypoechogenicity, angular or spiculated margins, posterior acoustical shadowing, microcalcifications, ductal extension, and microlobulation. The presence of any malignant feature excluded a nodule from benign classification. A nodule was classified as benign if one of the following three combinations was present: intense and uniform hyperechogenicity, ellipsoid shape with a thin echogenic capsule, or three or fewer gentle macrolobulations associated with a thin echogenic capsule [6]. According to these criteria, 15 of 21 solid masses were classified as benign appearing. The BI-RADS classification of breast lesions on sonography was not used because BI-RADS has historically been used only for adults and is not mandated by the Mammography Quality Standards Act.

The medical records of all 20 patients with 21 breast masses were reviewed. Final diagnosis was achieved with histopathologic findings for 17 (81%) of the 21 breast masses. In the other four cases, the presumed diagnosis of benign breast mass was made after 3–4 months of clinical follow-up.

TABLE 1: Sonographic Features of Solid Masses (*n* = 21)

Feature	Value
Thin echogenic pseudocapsule	21 (100)
Size > 3 cm	7 (33)
Shape, all ellipsoid	
No macrolobulations	11 (52)
2–3 macrolobulations	5 (24)
> 3 macrolobulations	5 (24)
Echogenicity	
Mildly hypoechoic	19 (90)
Hyperechoic	1 (5)
Isoechoic	1 (5)
Markedly hypoechoic	0 (0)
Echotexture	
Homogeneous	15 (71)
Mildly heterogeneous	6 (29)
Through-transmission	
Increased through-transmission	17 (81)
Normal through-transmission	4 (19)
Posterior acoustical shadowing	0
Echogenic foci without shadowing	1 (5)
Vascularity	
Vascular	19 (90)
Avascular	2 (10)
Cystic changes with comet tail artifacts	1 (5)

Note—Values in parentheses are percentages.

Results

None of the 20 patients had a family history of breast cancer. One patient had a history of being treated for neuroblastoma. Sonograms showed 21 solid masses in 20 patients with palpable breast masses; one of the patients had presented with simultaneous bilateral breast masses. The Stavros sonographic criteria for benign features were met by all but six of the solid masses. The six masses were one mass with possible calcifications that was proved at biopsy to be a benign phyllodes tumor and five masses that had more than three gentle macrolobulations. At biopsy, two of these five masses were proved to be benign fibroadenoma and

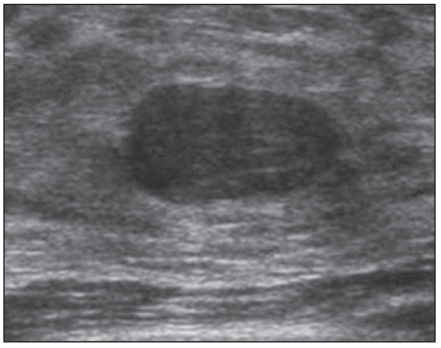

Fig. 1—14-year-old girl with palpable breast mass. Sonogram shows well-circumscribed 3.3-cm ellipsoid hypoechoic mass with increased through-transmission and pseudocapsule. Excisional biopsy revealed fibroadenoma.

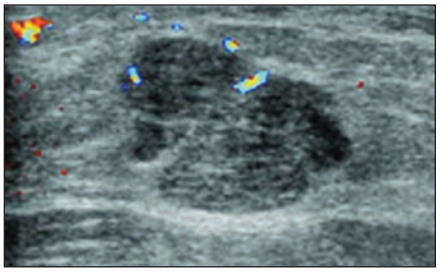

Fig. 2—13-year-old girl with palpable mass in right breast. Sonogram shows 3-cm well-circumscribed heterogeneously hypoechoic mass with more than three macrolobulations, minimal vascularity, and increased through-transmission. Excisional biopsy revealed benign phyllodes tumor.

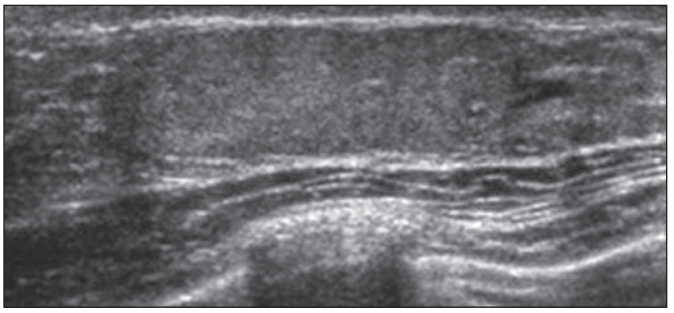

Fig. 3—17-year-old girl with palpable breast mass 1 year postpartum. Sonogram shows well-defined mildly hyperechoic 2.6-cm mass with through-transmission. Excisional biopsy revealed lactating adenoma.

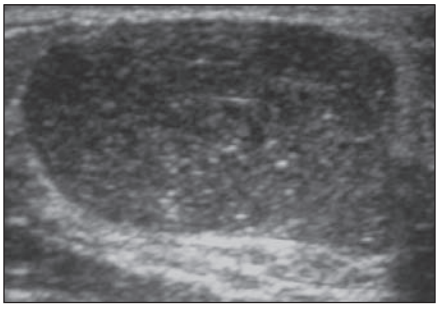

Fig. 4—14-year-old girl with palpable breast mass. Sonogram shows well-defined hypoechoic heterogeneous 7-cm mass with tiny echogenic foci and increased through-transmission. Excisional biopsy revealed benign phyllodes tumor.

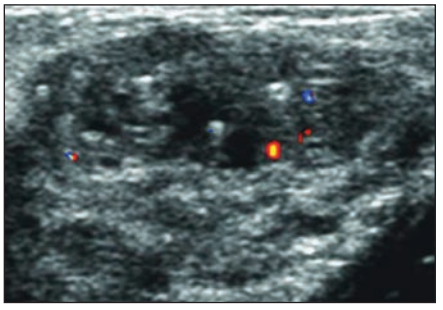

Fig. 5—16-year-old girl with palpable breast mass. Sonogram shows minimally vascular 2.5-cm well-defined ellipsoid hypoechoic mass containing tiny cystic components associated with comet tail artifacts. Excisional biopsy revealed sclerosing lobular hyperplasia.

three to be benign phyllodes tumors. Table 1 shows the sonographic data collected on the 21 solid breast masses. All solid masses had a thin echogenic pseudocapsule. All solid masses were ellipsoid. Eleven masses had no lobulations (Fig. 1), five had two or three gentle macrolobulations, and five had more than three lobulations (Fig. 2). Mild hypoechogenicity was present in 19 masses (Fig. 1), uniform mild hyperechogenicity in one mass (Fig. 3), and isoechogenicity in one mass. Fifteen masses were homogeneous and six were minimally heterogeneous in echotexture. One of the minimally heterogeneous masses exhibited scattered echogenic foci consistent with calcifications (Fig. 4), and another mass had cystic changes with comet tail artifacts (Fig. 5). At Doppler interrogation, 19 masses were found to have internal or peripheral vascularity, and two were avascular.

Seventeen (81%) of the 21 solid masses were subjected to tissue biopsy. Table 2 illustrates the sonographic features of these 17 solid masses with the tissue diagnoses. Excisional biopsy was performed on 16 of the 17 masses. Of the 16 masses, final diagnoses based on excisional biopsy findings were as follows: nine fibroadenomas, five benign phyllodes tumors, one case of lobular sclerosing hyperplasia, and one case of adenomatous lactational hyperplasia. Two of the benign phyllodes tumors had a previous fine-needle aspiration (FNA) biopsy diagnosis of fibroadenoma. Because the lesions continued to grow for 1 year, excisional biopsy was performed, revealing the final diagnosis of benign phyllodes tumor in one case and focal lactational hyperplasia in another. The seventeenth patient underwent FNA biopsy, which revealed fibrocystic changes of normal breast.

Four solid masses in three patients were not subjected to tissue biopsy. All three of these patients and the patient with an FNA biopsy diagnosis of fibrocystic changes of normal breast underwent clinical follow-up for 3–6 months until the breast masses were no longer palpable. Sonographic documentation of resolution of these masses was not possible because the patients became lost to follow-up.

TABLE 2: Sonographic Features of Solid Masses and Tissue Diagnoses (*n* = 17)

Stavros Criterion	Sonographic Finding	Biopsy Type	Tissue Diagnosis
Benign	1.3 cm, hypoechoic, homogeneous, ellipsoid, avascular, through-transmission	Excisional	Fibroadenoma
Benign	1.2 cm, hypoechoic homogeneous, ellipsoid, minimally vascularity, through-transmission	Excisional	Fibroadenoma
Benign	1.1 cm, hypoechoic, homogeneous, ellipsoid, minimal vascularity, through-transmission	FNA	Fibrocystic changes
Not benign	3.6 cm, hypoechoic, minimal heterogeneous, > 3 macrolobulations, minimal vascularity, through-transmission	FNA; excisional 1 y later	Fibroadenoma; fibroadenoma with focal lactational hyperplasia
Not benign	4.5 cm, hypoechoic, homogeneous, > 3 macrolobulations, minimal vascularity, through-transmission	Excisional	Fibroadenoma
Benign	5 cm, hypoechoic, homogeneous, ≤ 3 macrolobulations, minimal vascularity, through-transmission	Excisional	Fibroadenoma
Benign	3.3 cm, hypoechoic , homogeneous, ≤ 3 macrolobulations, minimal vascularity, through-transmission	Excisional	Fibroadenoma
Benign	5.2 cm, enlarging hypoechoic, homogeneous, ≤ 3 macrolobulations, minimal vascularity, through-transmission	FNA; core 1 y later; excisional 1 y later	Fibroadenoma; fibroadenoma; benign phyllodes
Benign	2.5 cm, hypoechoic, heterogeneous, few cysts, bright echogenic foci with comet tail artifact, minimal vascularity, through-transmission	Excisional	Sclerosing lobular hyperplasia
Not benign	4.7 cm, hypoechoic, minimally heterogeneous, > 3 macrolobulations, minimal vascularity, through-transmission	Excisional	Benign phyllodes
Not benign	7 cm, hypoechoic, minimally heterogeneous with tiny nonshadowing echogenic foci, ellipsoid, minimal vascularity, through-transmission	Excisional	Benign phyllodes
Benign	3.4 cm, hypoechoic, homogeneous, ≤ 3 macrolobulations, minimal vascularity, through-transmission	Excisional	Fibroadenoma
Benign	2.6 cm, homogeneous, hyperechoic, ellipsoid, mildly hypervascular, through-transmission	Excisional	Benign localized adenomatous lactational hyperplasia
Benign	1.5 cm, hypoechoic, homogeneous, ellipsoid, avascular, through-transmission	Excisional	Fibroadenoma
Not benign	2.5 cm, hypoechoic, heterogeneous, > 3 macrolobulations, hypervascular, through-transmission	Excisional	Benign phyllodes
Not benign	3 cm, hypoechoic, minimally heterogeneous, > 3 macrolobulations, minimal vascularity, through-transmission,	Excisional	Benign phyllodes
Benign	1.7 cm, hypoechoic, homogeneous, ellipsoid, minimal vascularity, through-transmission	Excisional	Fibroadenoma

Note—FNA = fine-needle aspiration.

Discussion

Pathologic conditions of the breast are rare in children and adolescents [7]. Reportedly, 34% of the children with palpable breast masses have pathologic lesions [5]. Most pediatric breast masses are benign. Regardless of histologic type, 10–40% of clinically detected breast masses in adolescents resolve completely [2]. The most common benign neoplastic breast lesions in children and adolescents are fibroadenoma and benign phyllodes tumors. Other benign solid neoplastic breast lesions include fibroma, hemangioma, papilloma, lymphangioma, and lipoma. Apart from fibroadenoma and benign phyllodes tumors, no benign neoplastic lesion has malignant potential. According to the National Cancer Institute [8], the age-specific incidence of breast cancer among patients younger than 19 years is less than 25 cases per 100,000 per year.

The American College of Radiology document [9] on appropriateness criteria for palpable breast masses in women younger than 30 years states that the most common use of breast sonography is characterization of breast masses. The document also states that with use of the Stavros sonographic criteria for benign and malignant solid breast masses, a high negative predictive value of 99.5% is possible. A detailed physical examination along with breast sonography has been considered sufficient for the correct diagnosis of breast masses in children [10]. The dogma that all discrete breast lumps should be excised has therefore been challenged [2]. We believe that the high prevalence of excisional biopsy of solid breast masses in our study was due to parental anxiety and surgeon concern, as also was found by Bock et al. [11] in a study involving 62 girls with breast symptoms.

Fibroadenomas are benign neoplasms that constitute 50–76% of breast masses in children and adolescents [2, 5, 7, 12–16]. Fibroadenomas have high cellularity and a biphasic pattern consisting of epithelial and stromal components. The peak age at occurrence of fibroadenoma is 18 years [17]. The cause of fibroadenoma is uncertain, but hormonal influences probably play an important role because a significant proportion of fibroadenomas change in size with changes in hormonal environment [1]. The course of fibroadenomas varies; 16–37% of the tumors resolve within 1–3 years, 30–40% of those that do not resolve shrink within 5 years, and the rest stop growing when they reach a diameter of 1–3 cm [1, 18, 19].

The sensitivity of sonography in the diagnosis of fibroadenoma has been reported to be 98% [19]. Sonographically, fibroadenomas may be oval, round, or macrolobulated and have been described as well-circumscribed hypoechoic or anechoic masses that may have areas of necrosis or fluid-filled clefts [3]. Five solid breast masses with typical sonographic features of fibroadenoma in our study were followed clinically until resolution. All of these masses were benign according to the Stavros sonographic criteria, being ellipsoid and having a thin echogenic capsule. Only one of these masses was subjected to FNA biopsy, which showed fibrocystic changes of normal breast. These masses were encountered in adolescents 16–19 years old, and the size range was 1.1–2.6 cm. No sonographic follow-up was performed on these masses to confirm clinical resolution.

Fibroadenomas exhibiting cysts, sclerosing adenosis, epithelial calcifications, or papillary apocrine changes at histologic examination are classified as complex [20]. Less than 5% of fibroadenomas grow large; the terms giant fibroadenoma and juvenile fibroadenoma are reserved for lesions larger than 10 cm in diameter [3]. Patients with fibroadenomas that have a complex histologic pattern are at increased risk of breast cancer [20, 21]. Sclerosing lobular hyperplasia is a benign tumor that resembles fibroadenoma clinically and is found up to the age of 35 years. These tumors have not been found to have malignant potential [15]. Fibroadenoma is three times as common as sclerosing lobular hyperplasia [15].

Phyllodes tumors resemble giant fibroadenomas in clinical and sonographic appearance but differ in surgical management and prognosis [22]. The stroma of phyllodes tumors has greater cellular content than does that of fibroadenomas. Phyllodes tumor is an extremely rare breast tumor, constituting 0.3–1% of fibroepithelial neoplasms of the breast; most of these tumors occur among women 35–55 years old [22]. Five percent of phyllodes tumors may have evidence of malignancy [4]. The mean size of phyllodes tumors is larger than that of fibroadenomas [22]. Phyllodes tumor probably develops de novo from breast tissue but may originate from a preexisting fibroadenoma, as may have been the case in one of our patients [4]. Phyllodes tumors often are lobulated in contour, have smooth margins, and are heterogeneous in echotexture, typically without calcification.

Posterior acoustic enhancement and internal cystic areas are more common in phyllodes tumors than in fibroadenomas. Results of FNA biopsy have been shown to differentiate giant fibroadenoma and phyllodes tumor [23]. However, in some cases, FNA biopsy findings may not differentiate phyllodes tumor from fibroadenoma, and excisional biopsy may be needed in cases of masses that have equivocal findings of fibroadenoma on sonography [24]. Four of five tumors in our study not benign according to the Stavros sonographic criteria were subjected to excisional biopsy within 1 month of sonography and were diagnosed as benign phyllodes tumors. One 5.2-cm mass benign according to the Stavros criteria and diagnosed as fibroadenoma with previous tissue diagnosis continued to grow for 1 year and therefore was subjected to excisional biopsy, which revealed benign phyllodes tumor.

Lactating adenomas are benign stromal tumors that typically occur during the third trimester of pregnancy through the period of lactation, as encountered in two of our patients. Lactating adenoma usually regresses spontaneously after cessation of breast-feeding. Differentiation of lactating adenoma from lactational changes in a preexisting fibroadenoma is possible because changes in a fibroadenoma tend to be focal while the underlying characteristic architecture of the tumor is preserved. The sonographic features of lactating adenoma have been described as nonspecific and can mimic those of a malignant tumor [25]. Core biopsy often is needed to confirm the diagnosis.

Adenocarcinoma of the breast is extremely rare in children and accounts for less than 1% of breast masses [7]. It presents as a palpable breast mass mostly in girls in the first decade of life [7]. Malignant breast masses in children and adolescents are more likely to be metastatic than primary in origin [3]. Metastatic breast lesions typically are secondary to lymphoma, leukemia, rhabdomyosarcoma, and neuroblastoma and have a nonspecific sonographic appearance [4, 7].

Some authors [14, 26] report that children with breast masses can be treated conservatively for two menstrual cycles, until adulthood, or until the mass shows rapid growth. Bower et al. [27] in 1976 and West et al. [14] in 1995 in studies with 134 and 74 children, respectively, undergoing operative procedures for breast abnormalities proposed that

breast biopsy is rarely indicated for a distinct mass lesion in the prepubertal breast but that breast mass lesions in adolescent girls necessitate excisional biopsy. Pacinda and Ramzy [2] in 1998 reported findings of FNA biopsy of 302 patients 21 years old or younger. No cases of malignancy or phyllodes tumors were encountered in the study. Those investigators concluded that FNA biopsy can play an important role in the conservative management of breast masses in children and adolescents. Because fibroadenoma can regress spontaneously and is not associated with increased risk of malignancy, Yilmaz et al. [24] and Ciatto et al. [28] recommend conservative management with no special surveillance of children and adolescents with breast masses that resemble fibroadenoma sonographically, if there is no risk of cancer.

The National Cancer Institute [29] states that most tumors that involve the breast during childhood are benign (noncancerous) fibroadenoma that can be watched for change without biopsy. When they undergo sudden, rapid growth, such tumors can exhibit malignant change and are called phyllodes tumors, which necessitate biopsy or surgical removal. Gordon et al. [30], in a study of solid breast masses diagnosed as fibroadenoma at FNA biopsy, concluded that these tumors can be safely observed with sonography if the volume growth rate is less than 16% per month in persons younger than 50 years. In that study, all excised masses with slower growth proved benign at histologic examination.

We found that sonographic findings were not predictive of the histologic diagnosis of a solid benign breast mass. The Stavros sonographic criteria, however, were helpful for predicting benignity of 11 (65%) of 17 breast masses on which histopathologic diagnosis was performed. Moreover, 35% of the solid breast masses in our study with findings suggestive of malignancy that were subjected to tissue biopsy also were proved benign. On the basis of our findings and the low incidence (0.025%) of malignant breast masses in children and adolescents reported by the National Cancer Institute, we conclude that excisional biopsy may not always be necessary for adolescents who present with solid breast masses that appear benign according to the Stavros sonographic criteria. Future studies of conservative management with sequential breast sonographic examinations for follow-up of solid breast masses that have benign sonographic features are warranted to further understanding of the course of these tumors in children and adolescents. Excisional biopsy may then be reserved for solid breast masses that exhibit progressive growth or are encountered in children or adolescents with either a known primary malignant tumor or a family history of cancer.

References

1. Amshell CE, Sibley E. Multiple unilateral fibroadenomas. *Breast J* 2001; 7:189–191
2. Pacinda S, Ramzy I. Fine-needle aspiration of breast masses: a review of its role in diagnosis and management in adolescent patients. *J Adolesc Health* 1998; 23:3–6
3. Weinstein SP, Conant EF, Orel SG, Zuckerman JA, Bellah R. Spectrum of US findings in pediatric and adolescent patients with palpable breast masses. *RadioGraphics* 2000; 20:1613–1621
4. Garcia CJ, Espinoza A, Dinamarca V, et al. Breast US in children and adolescents. *RadioGraphics* 2000; 20:1605–1612
5. Kronemer KA, Rhee K, Siegel MK, Sievert L, Hildebolt CF. Gray scale sonography of breast masses in adolescent girls. *J Ultrasound Med* 2001; 20:491–496
6. Stavros AT, Thickman D, Rapp CL, Dennis MA, Parker SH, Sisney GA. Solid breast nodules: use of sonography to distinguish between benign and malignant lesions. *Radiology* 1995; 196:123–134
7. Boothroyd A, Carty H. Breast masses in childhood and adolescence: a presentation of 17 cases and a review of the literature. *Pediatr Radiol* 1994; 24:81–84
8. Ries LA, Eisner MP, Kosary CL, et al., eds. SEER cancer statistics review, 1975–2002. Bethesda, MD. National Cancer Institute, 2005; http://seer.cancer.gov/csr/1975_2002. Accessed May 31, 2008
9. Parikh JR, Evans WP, Bassett L, et al. *American College of Radiology appropriateness criteria: palpable breast masses*. American College of Radiology Website. www.acr.org. Published 1996. Updated 2006. Accessed May 31, 2008
10. Ciftci AO, Tanyel FC, Büyükpamukçu N, Hiçsönmez A. Female breast masses during childhood: a 25-year review. *Eur J Pediatr Surg* 1998; 8:67–70
11. Bock K, Duda VF, Hadji P, et al. Pathologic breast conditions in childhood and adolescence: evaluation by sonographic diagnosis. *J Ultrasound Med* 2005; 24:1347–1354
12. Dehner LP, Hill DA, Deschryver K. Pathology of the breast in children, adolescents, and young adults. *Semin Diagn Pathol* 1999; 16: 235–247
13. Coffin CM, Dehner LP. The breast. In: Stocker JT, Dehner LP, eds. *Pediatric pathology*. Philadelphia, PA: JB Lippincott, 1992:927–939
14. West KW, Rescoria FJ, Scherer LR III, Grosfeld JL. Diagnosis and treatment of breast masses in the pediatric population. *J Pediatr Surg* 1995; 30:182–187
15. Jain M, Arora VK, Singh N, Bhatia A. Fine needle aspiration cytology of sclerosing lobular hyperplasia of the breast: a case report. *Acta Cytol* 2001; 45:765–767
16. Onuigho W. Breast fibroadenoma in teenage females. *Turk J Pediatr* 2003; 45:326–328
17. Simmons PS. Diagnostic considerations in breast disorders of children and adolescents. *Obstet Gynecol Clin North Am* 1992; 19:91–102
18. Carty NJ, Carter C, Rubin C, Ravichandran D, Royale GT, Taylor I. Management of fibroadenoma of the breast. *Ann R Coll Surg Engl* 1195; 77:127–130
19. Stehr KG, Lebeau A, Stehr M, Grantzow R. Fibroadenoma of the breast in an 11 year-old girl. *Eur J Pediatr Surg* 2004; 14:56–59
20. Dupont WD, Page DL, Parl FF, et al. Long-term risk of breast cancer in women with fibroadenoma. *N Engl J Med* 1994; 331:10–15
21. El-Wakeel H, Umpleby HC. Systematic review of fibroadenoma as a risk factor for breast cancer. *Breast* 2003; 12:302–307
22. Chao TC, Lo YF, Chen SC, Chen MF. Sonographic features of phyllodes tumors of the breast. *Ultrasound Obstet Gynecol* 2002; 20:64–71
23. Badhe BA, Iyengar KR, Alva N. A study of fibroepithelial tumours of the breast. *Indian J Cancer* 2002; 29:91–96
24. Yilmaz E, Sal S, Lebe B. Differentiation of phyllodes tumors versus fibroadenomas. *Acta Radiol* 2002; 43:34–39
25. Baker TP, Lenert JF, Parker J, et al. Lactating adenoma: a diagnosis of exclusion. *Breast J* 2001; 7:354–357
26. Siegal A, Kaufman Z, Siegal G. Breast masses in adolescent females. *J Surg Oncol* 1992; 51:169–173
27. Bower R, Bell MJ, Ternberg JL. Management of breast lesions in children and adolescents. *J Pediatr Surg* 1976; 11:337–346
28. Ciatto S, Bonardi R, Zappa M, Giorgi D. Risk of breast cancer subsequent to histological or clinical diagnosis of fibroadenoma: retrospective longitudinal study of 3938 cases. *Ann Oncol* 1997; 8:297–300
29. National Cancer Institute Website. Unusual cancers of childhood (PDQ®): treatment. http://www.cancer.gov/cancertopics/pdq/treatment/unusual-cancers-childhood/Patient/page3. Accessed May 31, 2008
30. Gordon PB, Gagnon FA, Lanzkowsky L. Solid breast masses diagnosed as fibroadenoma at fine-needle aspiration biopsy: acceptable rates of growth at long-term follow-up. *Radiology* 2003; 229:233–238