Preventive Care and Evaluation of the Adolescent with a Breast Mass

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Abstract

Adolescents have little knowledge of preventive breast care or breast screening, yet exposures in youth influence the risk of future breast disease.Nipple piercing increases the risk of trauma and breast infection. Alcohol consumption, smoking, nutrition, obesity, reproductive factors, previous cancer and chest radiotherapy, family history of breast cancer or genetic mutation increase the risk of breast cancer. Breast cancer is rare in adolescents and currently genetic testing is not recommended in those under 18 years, as medical surveillance is not usually recommended until around 25 years. Screening measures include clinical breast exam every 1 to 3 years, and breast self-awareness in healthy women from 20 years; and at least annual breast self examination, with annual clinical breast examination, mammography and magnetic resonance imaging in high-risk patients from 25 years. Breast ultrasound is used in diagnostic evaluation of breast masses in adolescents as mammography is less sensitive in young women.

Keywords
- adolescent
- breast cancer
- breast screening
- BRCA1/2
- body piercing

There is very little published information to guide physicians regarding preventive breast care in adolescents. Furthermore, adolescents may engage in lifestyle practices such as body piercing, which adversely affect breast health, with little knowledge of its potential impact.[1,2] It is now known that exposures during adolescence can be more important than adult exposures in the development of benign breast disease (BBD) and breast cancer (BC),and that preventive care of the breast programs should also focus on youth.[3]

In a review of adolescent studies since 1960,[4] fibroadenomas constituted the vast majority (30–50%) of medically diagnosed masses prior to surgery, followed by fibrocystic change (1.4–13%), benign phyllodestumor (0–17%), mastitis/abscess (0–7%), proliferative disease (0–7%), with malignancy found in 3.3 to 5.4%. Malignant breast masses are usually metastases or stromal malignancies rather than BC.[5] The age-adjusted incidence rate of BC in women < 25 years between 1935 and 2005 was reported as 3.2 per million per year in Olmsted County Minnesota.[6] Despite this, lifetime risk for BC is 12%.[7] BC prevention is a health priority; yet young women have little knowledge of appropriate breast care.[8]

This review will discuss risk factors for BBD and BC in young women including genetic factors; the recommended methods of breast screening and imaging for evaluation of a breast mass in young women, and health concerns associated with nipple piercing.

Risk Factors in Adolescence that Influence Risk of BBD and BC

Between menarche and first childbirth, breast tissue is susceptible to environmental exposures because there is rapid epithelial proliferation and lack of terminal duct differentiation, which eventually occurs at the end of a first full-term pregnancy.[3] Although BC cannot be prevented, sensitive and nonjudgmental communication regarding nutrition, smoking, alcohol use, and weight maintenance may assist young women in decreasing their risk for BC and BBD.[7]

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Proliferative BBD is a marker of subsequent BC risk in older women.[9] Risk in adolescents is not established, but caution is warranted. Other risk factors are not modifiable, but age-appropriate discussion may clear misconceptions and provide reassurance.

Reproductive risk factors for BC include early menarche, late menopause, nulliparity, later age of first full-term pregnancy, and shorter duration of breast feeding.[10] Oral contraceptive (OCP) use prior to 20 years is associated with a modest increase in BC risk, which progressively declines to baseline 10 years after last use.[11] There is an increased risk for premenopausal BC with OCP use before a first full-term pregnancy (odds ratio, 1.44).[12] However until information regarding the newer generation OCPs come to light, guidelines for the use of OCPs in healthy young adolescents are unchanged and require the usual risk–benefit assessment.[4]

Other lifestyle factors influencing breast disease include smoking, alcohol, nutrition, and obesity. The Nurses Health Study II (NHSII) demonstrated that the relative risk (RR) for estrogen receptor positive BC was 1.51 in those who smoked $\geq$ 25 cigarettes per day prior to 20 years.[13] Carcinogens from smoking cause direct epithelial damage and also convert estrogen to genotoxic metabolites.[14] This also increases the risk of breast abscess (sixfold compared with nonsmokers) due to fibrosis and comedomastitis.[15] Alcohol may increase estrogen levels, and consumption between 23 and 30 years of age is associated with BC risk.[16] Consumption greater than 15 g/d between ages 18 and 22 is associated with proliferative BBD (RR,1.33).[1] Those with a family history of BC doubled their risk of BBD if they had seven drinks per week.[17] A protective effect of adult vitamin D and calcium intake against premenopausal BC has been seen.[18] The NHS II cohort reported that adolescents with the high nondairy vitamin D intake (median 209 IU/d) had a 21% lower risk of proliferative BBD compared with those with the lowest intake, while adolescent calcium intake or dairy intake did not influence risk.[19] Physical activity, and weight maintenance reduce risk of BC, which may be related to hormonal factors.[20,21] Low fat intake during adolescence also decreases the risk of BC.[22] A 10-year cohort study of 9- to 15-year-olds demonstrated an increased risk of BBD with higher body mass index, waist circumference, and adult height.[17] However, results are not consistent, with other studies suggesting that higher relative weight compared with peers at 10 and 15 years, is associated decreased BC risk, possibly related to cancer estrogen receptor status.[10,23]

Female survivors of childhood cancer are at risk of secondary breast malignancy in adolescence.[5] Rhabdomyosarcoma, non-Hodgkins lymphoma, and leukemia are the most common metastases, mostly found within 2 years of diagnosis of the primary. Worrisome constitutional symptoms and local signs may be present.[5] High-dose chest radiotherapy increases the risk of future BC. The Childhood Cancer Survivor Study (of 5-year survivors of childhood cancer from 26 institutions in the United States and Canada) found that the standardized incidence ratio of developing breast cancer after chest radiotherapy was 24.7 compared with no radiotherapy (4.7).[24] In Hodgkins lymphoma survivors, the cumulative incidence of breast cancer by 40 years was 12.9%. There is a linear relationship between the radiation dose, with 40 Gy increasing risk of BC 11-fold.[24]

Women with a family history of BC (particularly a first-degree relative), ovarian cancer, male family members with BC, and multiple family members with BC are at increased risk for BC. Inherited mutations contribute to 5 to 10% of total BC[25,26] and include germline heterozygous mutations in BRCA1 and 2, mutations in PTEN (associated with Cowden syndrome), p53 associated with Li-Fraumeni syndrome, and STK11 associated with Peutz-Jeghers syndrome.[27,28]

Prevalence of BRCA1/2 mutations in the U.S. population is around 1 in 300 to 1 in 800,[29] but is higher in founder populations (such as U.S. Ashkenazi Jewish families).[27,30] In women with BC, it is 2.4% (BRCA1) and 2.3% (BRCA2).[31] Mutations are more common in younger BC, seen in12.8% of women younger than 41 years with BC.[32] BRCA1/2 contribute to 25% of familial breast cancer.[33] Cumulative risk for breast and ovarian cancer by 70 years is variable due to incomplete penetrance, and may be up to 87% and 40to 60%, respectively, for BRCA1; and 56% and 27% for BRCA2.[34,35] Risk is modified by reproductive and lifestyle factors, but the relationships are less clear compared to non-BRCA cancers.[36] Previous reports suggested an increased risk of BC in BRCA1 carriers (but not BRCA2 carriers) associated with OCP use.[37] However, a recent meta-analysis found no association with OCP formulations used since 1975. A significantly decreased risk of ovarian cancer was seen (RR, 0.5).[36] Use of the OCP in young women with a positive family history should be individualized after careful discussion.[27]

Genetic Evaluation

Professional organizations recommend genetic evaluation when there is a high risk of a genetic predisposition.[27,38,40] None recommend genetic testing prior to 18 years; the American College of Obstetricians and Gynecologists suggests deferral until 21 years.[27,38,40,41] There is a lack of specific preventive measures that could be instituted in adolescents as enhanced breast surveillance or intervention is not recommended until around 25 years, while ovarian screening does not begin until around 30 to 35 years or 5 to 10 years before diagnosis of first ovarian cancer in the family.[27,42] Preliminary reports have suggested a higher prevalence of childhood disease in families of BRCA2 carriers, such as retinoblastoma, leukemia sarcoma, astrocytoma, and Fanconi anemia.[43,44] However, further research is required. Genetic testing may induce psychological harm in adolescents, and potentially even violate their future autonomy.[45,46] A significant proportion of parents who have undertaken BRCA1/2 testing desire to know the genetic status of their child, and 24% support routine testing of minors on the grounds that it could foster positive health behaviors.[47] Opposition to testing appears to be higher in parents who have a genetic mutation, and lower in fathers, less educated, and non-white parents.[47] One report demonstrated that 33% of offspring from 53 BRCA1/2 families were also interested in genetic testing

during adolescence to assess their risk for breast cancer in adulthood.[48]

Rather than issues around testing, the majority of BRCA1/2 offspring experience psychosocial morbidities due to interactions with family members.[45,49,50] This includes exposure to more adverse life events (such as parental disease or loss);[49] and distress or concern for parents or themselves in 24% of those who learn about parental test results.[45] The majority of parents share their test result, usually within 1 month of receiving the result.[45] Disclosure is more common with older or female offspring, with negative results (so as to reassure offspring), or with less-educated parents. Mean offspring age at disclosure was 17 years, with the majority of 14 year olds knowing results.[45] Increased levels of psychological distress may be associated with more frequent thoughts of becoming sick and greater cancer worries.[50]

It is important that adolescent health providers address such issues in these families, as it provides a window of opportunity for appropriate counseling and support. In minors, genetic counseling expertise may be appropriate for further risk assessment, discussion, and reassurance.[4] For those aged 18 to 25 years, there are no recommendations for changes in medical surveillance; however, the patient has greater ability to give informed consent and genetic testing may be acceptable.[26] For those aged 25 years and beyond, medical surveillance may be instituted and testing is acceptable. Such testing may relieve or worsen psychological harm and requires the expertise of a genetic counselor for thorough discussion beforehand.[26,27,38–40]

Breast Screening

Breast screening consists of three components: (1) breast imaging, (2) clinical breast examination, and (3) breast self-examination or breast self-awareness.[51] Not all of these are suitable screening methods for healthy young women, but some may be appropriate for those at high risk (►**Table 1**).

Breast self-examination involves a woman examining her breasts in a systematic way at regular intervals, usually monthly.[51] Efficacy has not been established in large randomized controlled trials.[52,53] It is associated with twice as many biopsies performed for benign disease compared with no intervention[54] although may be of benefit in high-risk groups. Therefore, breast self-examination is not recommended in young women unless they are at higher risk for future disease, or unless they have a desire to continue the practice.[7,27,39,42,51] In BRCA1/2 families, training and education in breast self-evaluation with a view to monthly examinations from around 25 years has been recommended.[39] Breast self-awareness involves a woman understanding the normal appearance and feel of her breasts without a specific examination technique or interval so that she can promptly report any changes to a doctor. It is recommended for all women (from 20 years).[7,42]

Clinical breast examination is recommended annually for women aged 40 years and over, as it has a sensitivity of 58.8%, and specificity 93.4% in experienced hands, and modestly improves BC detection.[55] There is no evidence of benefit in 20

Table 1 Breast cancer screening recommendations in young women[7,27,39,42,51]

Population	BSA	BSE	CBE	Mammography	MRI
Healthy young women	Recommended from age 20[a–c]	Optional[a–c]	Every 1–3 y from age 20[a–c]	—	—
BRCA family or lifetime risk of BC > 20%	BSA including training for BSE from age 18[b]	Training from age 18[b] Monthly BSE from age 25 or earlier depending on earliest age of BC in family[a–c]	Every 6–12 mo from age 25[b]	Annually from age 25 or individualize based on earliest age of BC in family[a,b] Annually from age 30[c]	Annually from age 25 or individualize based on earliest age of BC onset in family[a,b] Annually from age 30[c]
Past thoracic radiation between 10–30 years of age	Recommended even prior to age 25[b]	Monthly from age 25 or 8–10 y after treatment, whichever is later[a,c]	Every 6–12 mo from age 25 or 8–10 y after treatment, whichever is later[a–c] If age < 25, annual CBE starting 8–10 y after treatment[b]	Annually from age 25 years or 8–10 y after treatment, whichever is later[a,b] Annually from age 30[c]	Annually from age 25 or 8–10 y after treatment, whichever is later[a] Consider as above but evidence lacking[b] Yearly from age 30[c]

Abbreviations: BSA, breast self awareness; BSE, breast self examination; CBE, clinical breast examination; MRI, magnetic resonance imaging; BC, breast cancer; y, years.
[a]Recommended by the American College of Obstetricians and Gynecologists.
[b]Recommended by the National Comprehensive Cancer Network.
[c]Recommended by the American Cancer Society.

to 49 year olds, but it is still recommended every 1 to 3 years or more frequently in high-risk young women.[7,27,39,42,51]

Breast imaging may include mammography, magnetic resonance imaging (MRI), or ultrasound imaging. Breast imaging is not recommended for breast screening in healthy young women, but may be utilized for high-risk groups. Younger women have increased breast parenchymal density, which decreases the sensitivity and specificity of mammography.[56] However, digital mammography has better sensitivity compared with film mammography,[57] and may be utilized in conjunction with MRI usually after 25 to 30 years of age.[7,27,39,42,51] MRI is recommended as a screening tool if there is at least a 20% lifetime risk of BC, including gene mutation carriers, first-degree relatives of those with a genetic syndrome who have not had testing themselves, those with a 20% lifetime risk of BC based on risk assessment tools such as the Gail method,[58] and a history of chest radiotherapy between 10 to 30 years of age.[7,27,39,42,51] MRI has been shown to be more sensitive (91%) than mammography (50%), ultrasonography (52%), and mammography and ultrasonography (63%) in a multicenter surveillance study of BRCA1/2 carriers in Italy and had a higher negative predictive value.[59] However, traditionally MRI is limited by high false-positive rates and associated intervention.[60] Ultrasound may play a role in screening of high-risk young women who cannot undergo MRI, but is not recommended for low-risk women.[51]

Radiographic Evaluation of Breast Masses in Adolescents

A breast mass can be distressing for an adolescent and requires a sensitive reassuring approach. After careful history and examination, breast ultrasound is the diagnostic modality of choice. It can correctly identify the type of mass 85% of the time but has poorer sensitivity for diagnosis of BC (58%).[61] Ultrasound is less sensitive for tumors smaller than 2 cm in diameter, and may not distinguish a phloxes tumor from a fibroadenoma.[61] It may be used with percutaneous biopsy in those with metastatic disease. Diagnostic sensitivity and specificity of MRI has been demonstrated in older women[62] however, results are unknown for adolescents.

Nipple Piercing

Prevalence of body piercing was 21% in a representative sample of U.S. women aged 18 to 50 years,[63] and 51% in a study of U.S. university students.[64] Although it may sometimes be a marker for high-risk behavior and psychopathology, it is now widespread and undertaken for aesthetic purposes, or individual expression.

Complications have been reported in 13 to 28%, with 1% requiring hospital admission.[64] A range of infective and dermatological complications have been reported.[65] Nipple piercing may also be associated with trauma and tearing of the nipple, galactorrhoea, and breast feeding difficulty including ejection of milk from the piercing tract.[65–67] Nipple-piercing tracts may take 6 weeks to 6 months to heal, with infection rates up to 20%, which may become chronic and associated with subareolar abscess, or even infective endocarditis.[15,68,69] Young men and women should be educated regarding attending centers where piercings are performed by qualified practitioners under sterile conditions, and the need for aftercare. Those at risk of endocarditis should be encouraged to avoid piercings and at least consider antibiotic coverage.[65] Nipple piercing should be avoided in those with blood-borne infections, diabetes, breast implants, pregnancy, or breast dermatoses.

Conclusion

Young women can be reassured that breast carcinoma is exceedingly rare prior to 25 years of age. Although there is no indication for routine breast screening in healthy women $\leq$ 20 years (apart from specific request), they should be educated regarding risk reduction. From age 20, women should be aware of the normal appearance and feel of their breasts, and may undergo clinical breast examination every 1 to 3 years. High-risk women should be offered at least annual medical surveillance from around age 25, although those with a past history of childhood malignancy are at higher risk for breast secondaries in adolescence, and should have earlier clinical surveillance. Genetic testing is not recommended in adolescence due to potential psychological harm, and lack of surveillance measures that may be instituted at a young age.

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