BRCA Genes and Breast Cancer

Among women, the lifetime risk of developing breast cancer is 1 in 8, and this disease is the second leading cause of cancer deaths (after lung cancer). The presence of a **mutation** (inherited abnormality) in breast cancer susceptibility gene 1 or 2 (*BRCA1/2*) significantly increases the risk of breast and ovarian cancers.

GENETICS

BRCA mutations are **autosomal dominant**, meaning that they affect 50% of a gene carrier's offspring. These mutations are present only in 5% of women who are diagnosed as having breast cancer. However, their presence may increase the lifetime risk of breast cancer to between 40% and 85% and of ovarian cancer to between 20% and 50%. It also increases the risk of prostate and breast cancer in men who carry these genes.

DIAGNOSIS

The presence of a *BRCA* mutation is determined by genetic testing of a small blood sample. A woman should consider testing if in her family (such as mother, daughter, sister, grandmother, or aunt) there are any of the following:

- 3 relatives with breast cancer
- 2 relatives with breast cancer if at least 1 was diagnosed at age 50 years or younger
- Cancer diagnosed in both breasts
- Ovarian cancer, especially if there is more than 1 relative or there is also breast cancer in the family
- Breast cancer in a male relative

Women who fit these criteria should consult with their doctor.

If a woman has a breast cancer removed that is **triple-negative** (a tumor with no estrogen, progesterone, or growth factor receptors) or she has Ashkenazi Jewish ancestors, she should consider genetic counseling and testing.

RISKS

The risk of having a *BRCA1/2* mutation in the general population is about 1 in 400. However, in the Ashkenazi Jewish population, it is 10 times higher (about 1 in 40). The individual risk of having a *BRCA1/2* mutation can be assessed using one of many calculators accessible through your doctor.

CANCER SCREENING AND PREVENTION

Women with *BRCA* mutations should have early and regular breast examinations that may include mammograms and breast magnetic resonance imaging (MRI), as well as oncologic and genetic counseling. *BRCA* carriers may also consider undergoing **prophylactic** (preventive) **mastectomy** (breast removal) or **ovariectomy** (ovary removal). *BRCA* carriers who are considering childbirth may opt for egg-harvesting procedures with genetic testing to exclude *BRCA* mutations affecting their children.

CANCER TREATMENT

Lumpectomy (resection of tumor from the breast) followed by chemotherapy and radiation is the usual treatment for *BRCA1/2* carriers with breast cancer. But because of increased risk of second tumor development in the same or the other breast, a woman may consider prophylactic bilateral mastectomy, particularly if she is young and a carrier of *BRCA1*. **Chemoprophylaxis** (tamoxifen) and/or ovariectomy may decrease the risk of second breast cancer development.

PROGNOSIS

With screening mammograms and breast MRIs, timely treatment, and/or prophylactic surgery, the life expectancy in *BRCA* carriers approaches the life span of noncarriers.

FOR MORE INFORMATION

National Cancer Institute
www.cancer.gov/cancertopics/factsheet/Risk/BRCA

INFORM YOURSELF

To find this and previous JAMA Patient Pages, go to the Patient Page link on *JAMA*'s Web site at www.jama.com. Many are available in English and Spanish.

Sources: National Cancer Institute at the National Institutes of Health

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