Quest Diagnostics®

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Breast Cancer

Three types of breast cancer

Breast cancer, like other cancers, is caused by genetic mutations. These mutations can be passed down in families. When this happens, the cancer is called genetic or *hereditary* cancer. When the mutations are not passed down, the cancer is called *sporadic* cancer. Sporadic mutations can occur in the egg, sperm, or fertilized egg. They can also occur in cells within the breast. The third type of breast cancer, *familial* cancer, may result from both inherited and sporadic mutations as well as other things.

Hereditary breast cancer

Hereditary breast cancer accounts for ~5% to 10% of breast cancer in women.[1] The cancer usually occurs at an early age. The patient has a strong family history of breast or other type of cancer. The mutation is often inherited directly from a parent.

Over 20 genes have been linked to hereditary breast cancer. The most common ones are *BRCA1* and *BRCA2*. Mutations in these 2 genes together account for 3% to 5% of all breast cancers.[2] They are the cause of hereditary breast and ovarian cancer (HBOC) syndrome. Mutations in other breast cancer genes are often linked to other syndromes or conditions. Each confers a relatively high risk of breast cancer:

- Li Fraumeni syndrome (*TP53* gene)
- Cowden syndrome (*PTEN* gene)
- Hereditary diffuse gastric cancer (*CDH1* gene)
- Peutz-Jeghers syndrome (*STK11* gene)
- *PALB2*-associated breast cancer (*PALB2* gene)

Sporadic breast cancer

Sporadic breast cancer accounts for the vast majority of breast cancer cases. Mutations occur by chance in genes most closely related to cell growth and/or DNA repair. Sporadic breast cancer tends to occur later in life. Although another family member may have the cancer too, there is no strong family history.

Breast cancer risk factors

Mutations (both hereditary and sporadic) don't always result in breast cancer. Things that increase the risk of breast cancer include:

- Inherited gene mutations (risk varies with degree of penetrance)
- Increasing age
- Ashkenazi Jewish ethnicity
- Overweight, obesity
- Physical inactivity
- Alcohol consumption
- Long-term, heavy smoking
- Hormone replacement therapy
- 1st menstrual period at a young age
- Never having given birth to a child
- Older age at first live birth
- Older age at menopause
- Increased number of abnormal cells in the breast
- Abnormal cells in the milk glands of the breast
- Dense breast tissue as seen on mammography
- Radiation therapy in the chest before age 30 years

Familial breast cancer

In familial breast cancer, breast cancer happens more often in family members than in other people. But there are no clear signs of a mutation being passed down from the parent to the child. It may be caused by a combination of:

- Inherited mutations with a lower risk of breast cancer
- Sporadic mutations that occur by chance
- Shared lifestyle and habits

Type of breast cancer—why it matters

Patient management is not the same for the 3 types of breast cancer. There can be differences in prevention, screening, and treatment. For example, a person who is likely to have hereditary breast cancer may opt for genetic testing. If a mutation is found, the person may choose to have more frequent and thorough screenings. Or the person may opt for preventive surgery or chemoprevention. A person who has hereditary breast cancer may decide to have more aggressive treatments. Such a person may be monitored more often too.

How the laboratory can help

Quest Diagnostics offers genetic testing to detect mutations that may cause hereditary breast cancer. Testing is currently available for the *BRCA1* and *BRCA2* genes. Testing will soon be available for the *TP53, PTEN, CDH1, STK11,* and *PALB2* genes. To go with the testing, Quest Diagnostics offers:

- Genetic counseling to help doctors with test selection and interpretation
- A service that helps patients find a genetic counselor
- A service that helps patients find out if their insurance company will pay for the genetic test
- Financial assistance for genetic testing
- Patient quiz: initial screen for *BRCA1/BRCA2* testing eligibility
- Patient support guide that helps patients learn about *BRCA1/BRCA2* testing.

Quest Diagnostics also offers:

- Tests for tumor classification: pathology review for histopathologic type and grade; ER, PR, and HER2 status
- Tests to screen for metastasis and/or toxicity: CBC, liver function tests, alkaline phosphatase
- Tests to assist with treatment selection: HER2 status, OncoVantage™ molecular characterization, *CYP2D6* genotype, VEGF ELISA or genotype
- Tests for monitoring: CEA, CA15-3, CA27.29, tamoxifen and metabolite levels

Additional information

More information about genetic testing can be found at Quest Diagnostics online Test Center. Use BRCAvantage™ as a search term.

More information about these 3 types of breast cancer can be found in the National Comprehensive Cancer Network® (NCCN) guidelines. These guidelines are available at: http://www.nccn.org/professionals/physician_gls/f_guidelines.asp.

References

1. American Cancer Society. Cancer facts and figures 2014. http://www.cancer.org/acs/groups/content/@research/documents/webcontent/acspc-042151.pdf. Accessed September 5, 2014.
2. ACOG Practice Bulletin No. 103: Hereditary breast and ovarian cancer syndrome. Obstet Gynecol. 2009;113:957-966.