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Genetics of Hereditary Breast and Ovarian Cancer

The majority of cancer cases are not attributable to hereditary causes. However, cancer can be hereditary in some families There are many factors that can increase the probability that the cancers in a family may be hereditary. Some of these factors are: early onset of cancer, more than one primary (new) cancer in an individual, the same cancer in two or more close relatives on the same side of the family, unusual presentation of cancer (breast cancer in a male), and related cancers (such as breast, ovarian, and pancreatic cancer) found in the same family. Women of Ashkenazi Jewish ancestry are also at greater risk for hereditary breast and ovarian cancer.

Several gene changes (mutations) have been discovered which predispose individuals to breast and ovarian cancer. In review, the genetic instructions for our bodies are stored in our cells in tiny structures called chromosomes. A normal individual has 23 pairs of chromosomes: one chromosome from each pair is normally inherited from the mother, and the other from the father.

One of the genes involved in hereditary breast and ovarian cancer is located on chromosome #17. This gene is called BRCA1 (breast cancer-1) and mutations in this gene are responsible for some cases of hereditary breast and/or ovarian cancer. A second gene, BRCA2 (breast cancer-2), has been found on chromosome #13. Mutations in this gene are responsible for some cases of hereditary breast cancer, and a smaller percentage of hereditary breast and ovarian cancer.

Both of these genes are passed down in families in a pattern called autosomal dominant. This means that a parent who carries the gene has a 50% chance of passing the gene on to each of their children. It also means that if a person carries such a mutation, their siblings have a 50% chance to carry the mutation.

Genetic testing for mutations in BRCA1 and BRCA2 has become clinically available within the past eleven years. For this reason we do not have a great deal of long-term prospective data on individuals who carry mutations in these genes. The available data does suggest that women who carry mutations in the BRCA genes have between a 55-85% risk to develop breast cancer, and as great as a 15-60% risk to develop ovarian cancer (this includes cancer of the fallopian tubes) by the time they are 70 years of age. These figures are significantly higher than the 12-13% lifetime risk for breast cancer and the 1-2% lifetime risk for ovarian cancer in the general population. Carriers also have a greater chance of developing second primary cancers. Males who carry BRCA1 mutations have a slightly increased risk for prostate cancer. Individuals who carry BRCA2 mutations are at increased risk to develop male breast cancer and prostate cancer, and have a slightly increased risk to develop pancreatic cancer and perhaps melanoma.

Individuals who learn they have a BRCA1 or BRCA2 mutation are offered special surveillance and risk reduction options.