Review of Cancer Genetics

Genes are pieces of information in the cells that make up the body. Cells are the basic units of life. Normally, cells grow, divide and make more cells in a controlled way as the body needs them to stay healthy. Cancer happens when a cell grows out of control in an abnormal way.

All cancer is caused by a buildup of mutations (changes) in specific genes. Normally, these genes help the cell grow and divide in a controlled manner. The mutation in the gene damages this process and, as a result, the cell can grow out of control and become cancer.

In most people who have cancer, the gene mutations that lead to their cancer cannot be passed on to their children. However, some families have a gene mutation that can get passed on from one generation to another. The differences between sporadic (non-hereditary) and hereditary forms of cancer are reviewed below. Additionally, some families have more cancer than would be expected by chance, but the cancer does not seem to be hereditary. This “familial” form of cancer is also discussed below.

Sporadic Cancer
Most cancer – 75% to 80% – is sporadic. In sporadic cancer, the gene mutations that cause the cancer are acquired (occur only in the tumor cells) and are not inherited. Risk for acquired gene mutations increases with age and is often influenced by environmental, lifestyle or medical factors. Cancer can sometimes happen by chance. Everyone has some risk of developing cancer in his or her lifetime. Because cancer is common, it is possible for a family to have more than one member who has cancer by chance.

It is becoming more common for doctors to look for gene mutations in cancer cells, which may be important for treatment or prognosis. However, in sporadic cancers, the gene mutations are acquired and, therefore, the relatives of an individual who has a sporadic cancer will not have the same cancer-causing gene mutations.

Familial Cancer
Certain common cancers, such as breast, prostate and colon cancers, may occur in more than one member of the same family, but are not thought to be hereditary. Multiple family members on one side of the family may be diagnosed with the same cancer, but usually the cancer occurs at later ages and does not follow the same patterns that are seen in hereditary cases.

Even though familial cancers cluster in a family, the cancer does not seem to be caused by a change in one gene. Instead, familial cancers are thought to be the result of multiple influences. A combination of several genes and other factors, such as diet and exercise, all contribute a small amount to an increased risk of developing cancer. Such families may have a moderately increased risk to develop cancer.

It is often not possible to pinpoint the exact causes of cancer in such families and genetic testing is not typically recommended. However, family members may need earlier or more frequent cancer screening.

Hereditary Cancer
Only 5% to 10% of all cancers are hereditary. Hereditary cancers develop due to a gene mutation that is present from birth. Usually, the mutation was passed from a mother or father to the child. Because of this, there is usually a recognizable pattern of cancer on one side of the family.

There are several clues which suggest that there is hereditary cancer in a family. These can include:

- Age of diagnosis is usually younger than in sporadic forms of cancer (often younger than age 50).
- Multiple family members have the same or related types of cancer.
- Cancer is more likely to develop in more than one site in the body.
- Rare cancers may occur, for example, male breast cancer.

Genetic testing is a blood or saliva test that can help detect gene mutations that cause hereditary forms of cancer. Genetic testing is best started in a family member who has already had cancer. Diagnosis with a hereditary cancer syndrome can provide information about further cancer risks for the individual tested and it may provide information about cancer risks for family members. In most cases, specialized screening or prevention strategies can be considered to help address increased cancer risks for the individual tested and for his or her family members.

If you are concerned about the possibility of a hereditary cancer syndrome in your family, you are encouraged to discuss your personal and/or family history with your health care provider. Your physician may refer you to the William G. Rohrer Cancer Genetics Program of MD Anderson Cancer Center at Cooper for a genetic evaluation and discussion of your genetic testing options. If genetic testing is warranted and you choose to proceed, a blood or saliva sample will be taken during your visit to start the process. Please note that health insurance companies may cover most, if not all, of the cost of genetic testing on a case-by-case basis.

For More Information on Cancer Genetics
The National Cancer Institute has valuable cancer related health information on more than 200 cancer types, clinical trials, cancer statistics, prevention, screening, risk factors, genetics and support resources. Information is available in Spanish. Visit www.cancer.gov.

The American Cancer Society (ACS) is a voluntary national health organization that supports research, provides information about cancer and offers many programs and services to patients and their families. Information is available in Spanish. Visit www.cancer.org.

Genetic Alliance, Inc., supports individuals with genetic conditions and their families, educates the public and advocates for consumer-informed public policies. Its site provides information on genetic policy, research and a helpline for people with genetic questions. Visit www.geneticalliance.org.