

## Tumor Markers: Questions and Answers

### Key Points

- Tumor markers are substances that can be found in abnormal amounts in the blood, urine, or tissues of some patients with cancer (see Question 1).
- Different tumor markers are found in different types of cancer (see Question 1).
- Tumor markers may be used to help diagnose cancer, predict a patient's response to particular therapies, check a patient's response to treatment, or determine if cancer has returned (see Questions 3 and 4).
- In general, tumor markers cannot be used alone to diagnose cancer; they must be combined with other tests (see Question 3).
- Researchers continue to study tumor markers and to develop more accurate methods to detect, diagnose, and monitor cancer (see Question 7).

### 1. What are tumor markers?

Tumor markers are substances produced by tumor cells or by other cells of the body in response to cancer or certain benign (noncancerous) conditions. These substances can be found in the blood, in the urine, in the tumor tissue, or in other tissues. Different tumor markers are found in different types of cancer, and levels of the same tumor marker can be altered in more than one type of cancer. In addition, tumor marker levels are not altered in all people with cancer, especially if the cancer is early stage. Some tumor marker levels can also be altered in patients with noncancerous conditions.

To date, researchers have identified more than a dozen substances that seem to be expressed abnormally when some types of cancer are present. Some of these substances are also found in other conditions and diseases. Scientists have not found markers for every type of cancer.

### 2. What are risk markers?

Some people have a greater chance of developing certain types of cancer because of a change, known as a mutation or alteration, in specific genes. The presence of such a change is sometimes called a risk marker. Tests for risk markers can help the doctor to estimate a person's chance of developing a certain cancer. Risk markers can indicate that cancer is more likely to occur, whereas tumor markers can indicate the presence of cancer (1).

### 3. How are tumor markers used in cancer care?

Tumor markers are used in the detection, diagnosis, and management of some types of cancer. Although an abnormal tumor marker level may suggest cancer, this alone is usually not enough to diagnose cancer. Therefore, measurements of tumor markers are usually combined with other tests, such as a biopsy, to diagnose cancer.

Tumor marker levels may be measured before treatment to help doctors plan appropriate therapy. In some types of cancer, tumor marker levels reflect the stage (extent) of the disease. (More information about staging is available in the National Cancer Institute (NCI) fact sheet *Staging: Questions and Answers*, which can be found at <http://www.cancer.gov/cancertopics/factsheet/Detection/staging> on the Internet.)



Tumor marker levels also may be used to check how a patient is responding to treatment. A decrease or return to a normal level may indicate that the cancer is responding to therapy, whereas an increase may indicate that the cancer is not responding. After treatment has ended, tumor marker levels may be used to check for recurrence (cancer that has returned).

#### **4. How and when are tumor markers measured?**

The doctor takes a blood, urine, or tissue sample and sends it to the laboratory, where various methods are used to measure the level of the tumor marker.

If the tumor marker is being used to determine whether a treatment is working or if there is recurrence, the tumor marker levels are often measured over a period of time to see if the levels are increasing or decreasing. Usually these “serial measurements” are more meaningful than a single measurement. Tumor marker levels may be checked at the time of diagnosis; before, during, and after therapy; and then periodically to monitor for recurrence.

#### **5. Does the NCI have guidelines for the use of tumor markers?**

No, the NCI does not have such guidelines. However, some organizations do have these guidelines for some types of cancer.

The American Society of Clinical Oncology (ASCO), a nonprofit organization that represents more than 25,000 cancer professionals worldwide, has published clinical practice guidelines on a variety of topics, including tumor markers for breast and colorectal cancer. These guidelines, called Patient Guides, are available on the ASCO Web site at <http://www.cancer.net/patient/ASCO+Resources/Patient+Guides> on the Internet.

The National Comprehensive Cancer Network® (NCCN), which is also a nonprofit organization, is an alliance of cancer centers. The NCCN provides Treatment Summaries for People with Cancer™, which include tumor marker information for several types of cancer. Most of the guidelines are available in English and Spanish versions. The summaries are on the NCCN's Web site at <http://www.nccn.com/Treatment-Summaries/CancerTypes.aspx?id=48> on the Internet.

The National Academy of Clinical Biochemistry (NACB) is a professional organization dedicated to advancing the science and practice of clinical laboratory medicine through research, education, and professional development. The Academy publishes *Practice Guidelines and Recommendations for Use of Tumor Markers in the Clinic*, which focuses on the appropriate use of tumor markers for specific cancers. More information can be found at [http://www.aacc.org/resourcecenters/resource\\_topics/tumor\\_markers/Pages/default.aspx](http://www.aacc.org/resourcecenters/resource_topics/tumor_markers/Pages/default.aspx) on the Internet.

#### **6. Can tumor markers be used as a screening test for cancer?**

Screening tests are a way of detecting cancer early, before there are any symptoms. For a screening test to be helpful, it should have high sensitivity and specificity. Sensitivity refers to the test's ability to identify people who have the disease. Specificity refers to the test's ability to identify people who do not have the disease. Most tumor markers are not sensitive or specific enough to be used for cancer screening.

Even commonly used tests may not be completely sensitive or specific. For example, prostate-specific antigen (PSA) levels are often used to screen men for prostate cancer, but this is controversial. It is not yet known if early detection using PSA screening actually saves lives. Elevated PSA levels can be caused by prostate cancer or benign conditions, and most men with elevated PSA levels turn out not to have prostate cancer. Moreover, it is not clear if the benefits of PSA screening outweigh the risks of follow-up diagnostic tests and cancer treatments. (More information about PSA screening is available in the NCI fact sheet *Prostate-Specific Antigen (PSA) Test*, which can be found at <http://www.cancer.gov/cancertopics/factsheet/Detection/PSA> on the Internet.)

Another tumor marker, CA 125, is sometimes used to screen women who have an increased risk for ovarian cancer. Scientists are studying whether measurement of CA 125, along with other tests and exams, is useful to find ovarian cancer before symptoms develop. So far, CA 125 measurement is not sensitive or specific enough to be used to screen all women for ovarian cancer. Mostly, CA 125 is used to monitor response to treatment and check for recurrence in women with ovarian cancer.

## 7. What research is being done in this field?

Scientists continue to study tumor markers and their possible role in the early detection and diagnosis of cancer. The NCI is currently conducting the Prostate, Lung, Colorectal, and Ovarian Cancer screening trial, or PLCO trial, to determine if certain screening tests reduce the number of deaths from these cancers. Along with other screening tools, PLCO researchers are studying the use of PSA to screen for prostate cancer and CA 125 to screen for ovarian cancer. Final results from this study are expected in several years.

Cancer researchers are turning to proteomics (the study of protein shape, function, and patterns of expression) in hopes of developing better cancer screening and treatment options. Proteomics technology is being used to search for proteins that may serve as markers of disease in its early stages or to predict the effectiveness of treatment or the chance of the disease returning after treatment has ended. More information about proteomics can be found in *Proteomics and Cancer*, which is available at <http://www.cancer.gov/cancertopics/factsheet/detection/proteomics> on the Internet.

Scientists are also evaluating patterns of gene expression (the step required to translate what is in the genes to proteins) for their ability to predict a patient's prognosis (likely outcome or course of disease) or response to therapy. NCI's Early Detection Research Network is developing a number of genomic- and proteomic-based biomarkers, some of which are being validated. More information about this program can be found at <http://edrn.nci.nih.gov/> on the Internet.

Information about clinical trials is available from the NCI's Cancer Information Service (see below) or on the clinical trials page of the NCI's Web site at <http://www.cancer.gov/clinicaltrials> on the Internet. In addition, PDQ®, the NCI's comprehensive cancer information database, contains cancer information summaries that can be found at <http://www.cancer.gov/cancerinfo/pdq/> on the Internet.

### Selected Reference

1. Bigbee W, Herberman RB. Tumor markers and immunodiagnosis. In: Bast RC Jr., Kufe DW, Pollock RE, et al., editors. *Cancer Medicine*. 6<sup>th</sup> ed. Hamilton, Ontario, Canada: BC Decker Inc., 2003.

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### Related NCI materials and Web pages:

- National Cancer Institute Fact Sheet 3.62, *BRCA1 and BRCA2: Cancer Risk and Genetic Testing* (<http://www.cancer.gov/cancertopics/factsheet/Risk/BRCA>)
- National Cancer Institute Fact Sheet 5.27, *Interpreting Laboratory Test Results* (<http://www.cancer.gov/cancertopics/factsheet/Detection/laboratory-tests>)
- National Cancer Institute Fact Sheet 5.29, *Prostate-Specific Antigen (PSA) Test* (<http://www.cancer.gov/cancertopics/factsheet/Detection/PSA>)
- National Cancer Institute Fact Sheet 5.32, *Staging: Questions and Answers* (<http://www.cancer.gov/cancertopics/factsheet/Detection/staging>)
- National Cancer Institute Fact Sheet 8.2, *Understanding Prognosis and Cancer Statistics: Questions and Answers* (<http://www.cancer.gov/cancertopics/factsheet/support/prognosis-stats>)
- *What You Need To Know About™ Cancer* (<http://www.cancer.gov/cancertopics/wyntk/overview>)

### How can we help?

We offer comprehensive research-based information for patients and their families, health professionals, cancer researchers, advocates, and the public.

- **Call** NCI's Cancer Information Service at 1-800-4-CANCER (1-800-422-6237)
- **Visit** us at <http://www.cancer.gov> or <http://www.cancer.gov/espanol>
- **Chat** using LiveHelp, NCI's instant messaging service, at <http://www.cancer.gov/livehelp>

- **E-mail** us at [cancergovstaff@mail.nih.gov](mailto:cancergovstaff@mail.nih.gov)
- **Order** publications at <http://www.cancer.gov/publications> or by calling 1-800-4-CANCER
- **Get help** with quitting smoking at 1-877-44U-QUIT (1-877-448-7848)

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