An introduction to tumor markers

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For individuals with a family history of cancer, tumor markers can be an important prediagnostic tool to screen for many different types of cancer. Nurses need to be aware of the importance of screening criteria and how tumor markers aid in the early detection of the disease.

In this article, I'll discuss what you need to know about tumor markers and what you as a nurse can do to encourage screening.

What are tumor markers?

Tumor markers are substances that when present may indicate the presence of cancer. They can be the by-product of cancer cells or the body's response to cancer. There are many different types of tumor markers, such as carcinoembryonic antigen, CA-125, prostate-specific antigen (PSA), CA 19-9, and alpha-fetoprotein. Some tumor markers are seen in one type of cancer, whereas others are found in a variety of cancers. Not every type of cancer may have a high level of a tumor marker, and sometimes noncancerous disease can cause a tumor marker to be higher than normal. To date, researchers haven't found tumor markers for every type of cancer. See *Common tumor-specific and tumor-associated agents* for more information on different types of tumor markers.

Most tumor markers are made up of proteins. The cell membranes are altered in cancer cells, which affect the movement of fluid in and out of the cell. The cell membranes of malignant cells contain proteins called tumor-specific antigens. These proteins tell the difference between the malignant (cancerous growth) cells and the benign (noncancerous) cells of the same tissue type. These proteins can be found in blood, urine, tumor tissues, or other bodily tissues.

Tumor-specific antigens or tumor markers can be used as a diagnostic tool in the detection of cancer or for monitoring the effectiveness of cancer treatments. Additionally, tumor markers can help diagnose cancer when there's widespread disease and the origin of the cancer is unknown. However, some tumor markers are diagnostic, whereas others are still in the developmental stages of diagnostic predictability. For example, prostate tumor markers are diagnostic and treatment modalities are based on levels; breast and ovarian cancer markers—the BRCA1 and BRCA2 genes—are still being researched. The literature has demonstrated, however, that women who have shown positive BRCA1 and BRCA2 genes are at an increased risk for developing breast or ovarian cancer. Measurements of tumor-specific antigens or tumor markers are usually combined with other diagnostic tools, such as a biopsy or ultrasound scan, to make a definitive diagnosis of cancer.

The following case studies highlight significant clinical screening procedures that are useful in diagnosing prostate, ovarian, and breast cancer.

Case study: Prostate cancer

Jose, a 66-year-old Hispanic man, has come to your clinic for a routine annual physical exam. He feels fine, although at times he doesn't sleep through the night, waking up frequently with a sense that he has to urinate. Jose has a history of mild hypertension that's controlled daily with hydrochlorothiazide, 12.5 mg by mouth. His mother died of colon cancer at age 65, and his father had prostate cancer but didn't die of the disease. Jose drinks one or two beers on the weekend and has no other significant past medical or social history, except for a

right inguinal hernia repair 4 years ago.

Upon physical exam, you note that Jose is afebrile, with a BP of 120/80, a heart rate of 88 beats/minute, and a respiratory rate of 12 breaths/minute. His abdomen is soft, nontender, and not distended, with a healing right inguinal scar. Jose's testes are bilaterally descended with no palpable masses noted. Upon rectal exam, you note an enlarged nodular prostate: The left side is firm and hardened, and the right side has soft nodules.

The healthcare provider orders a PSA test to check Jose for prostate cancer. This screening test can save Jose's life! Besides indicating prostate cancer, high levels of PSA can also be used to test for common conditions, such as benign prostatic hyperplasia (a common sign in aging men as the prostate gland becomes enlarged) and prostatitis (an inflammation of the prostate gland).

The American Cancer Society recommends prostate cancer screening for all men over age 50. A patient with a PSA screening level of greater than 4 ng/mL should be referred to a urologist for medical discussion and further treatment.

Case study: Ovarian cancer

Barbara is a single, 58-year-old African American woman with four children, two boys and two girls. She maintains an active, smoke-free lifestyle and has always been very healthy, maintaining a normal weight. Barbara's younger sister died of breast cancer at age 36; her mother had one living sister who was diagnosed with breast cancer at age 72. Barbara's mother died of ovarian cancer last year.

Recently, Barbara has been having a hard time closing the waistline of her pants. She has noticed her waistline getting larger, yet she remains at her current weight. She feels slightly bloated, but has no other symptoms. At times she's physically tired, which she attributes to the combination of babysitting her grandchildren and not sleeping well at night. Barbara was reluctant to visit her gynecologist because she thought the thickening of her waistline was due to advancing

Common tumor-specific and tumor-associated agents

Not intended to be an exhaustive list, the following are examples of tumor markers you may see in your practice.

Name of clinical marker	Type of cancer in which tumor marker may be found	Conditions other than cancer associated with abnormal values
Genetic markers (suppressor genes)		
P-53 gene mutation: Most common genetic mutation used for cancer prognosis	Breast, head, neck, colon, and small-cell lung cancers	Increased with colon polyps
BRCA1 and BRCA2: Used to monitor development of breast and ovarian cancer	Hereditary predisposition to developing breast and ovarian cancer	Carriers of BRCA1 have an 85% risk of developing breast cancer and a 45% risk of ovarian cancer by age 85
Hormones		
Calcitonin (CT) malignant C-cell thyroid tumor: Produces increased CT levels, a hormone produced by the perifollicular C cells of the thyroid gland	Metastatic breast cancer	Increased in renal failure, alcohol cirrhosis, anemia, and pregnancy
Proteins		
PSA: More sensitive than prostatic acid phosphatase (PAP) for monitoring and staging prostate cancer; correlates with adenocarcinoma disease and age (PSA screening recommended for men over age 50 only.)	Prostate cancer	Increased in benign prostatic hypertrophy, prostate surgery, and prostatitis
Enzymes		
PAP: Major pretreatment tumor marker; also used to predict recurrence	Prostate cancer	Increased in noncancerous prostate conditions

age. However, when she finally does decide to see the gynecologist, he suggests a blood test and ultrasound scan.

Barbara calls the office, and you receive all the information. She looks to you for support. You explain the blood test is to screen for a tumor-specific antigen called CA-125, which is specific to ovarian cancer. Barbara's scan is completed 2 days later, and she returns to your office by the end of that week. Unfortunately, the results of the blood test reveal high levels of CA-125. An appointment is arranged for Barbara the following Tuesday morning with a gynecologist specializing in oncology; she dies within 6 months of her diagnosis.

A woman who presents with vague signs and symptoms may, in fact, have cancer throughout her abdomen and pelvis. As the nurse, it's essential that you encourage your patients to undergo routine checkups, even if their signs and symptoms are vague and seem unimportant. A simple blood test may uncover underlying results that could save their lives if treated early.

Case study: Breast cancer

Rachel is a 48-year-old married Jewish woman of Eastern European descent. The mother of two boys and four girls, all her children were normal deliveries with no complications while in her 20s. Rachel didn't breast-feed any of her children. She has no known family history of breast cancer. Most of the women in her extended family died in the Holocaust, so the family's medical history is limited. Rachel has never gone for a mammogram; she tells you she found a hard, marble-sized lump in her left breast when she was in the shower.

A mammogram and bilateral ultrasound are scheduled for the end of the week. Rachel asks you why the rush, and you explain that appropriate timing is an impor-

tant factor in diagnosing and treating the possibility of breast cancer. Upon viewing both the mammogram and ultrasound results, there's a positive mass in Rachel's left breast. You're present when she hears the news. Another appointment is scheduled for a needle biopsy, and you explain how a needle will be inserted to aspirate some of the contents of the mass to test for pathology and etiology. After the biopsy, Rachel is told she has stage I breast cancer with no lymph node involvement.

You help Rachel explore the available treatment options and provide emotional support while she makes these difficult decisions. You also present her and her husband with the option of screening their daughters for the BRCA1 gene at a future date.

As a nurse, you can make a huge difference when caring for a patient who's considering being tested or who has been tested already for the BRCA1 and BRCA2 genes. Breast and ovarian cancer testing raises many challenges and responsibilities. You must be familiar with the legal and ethical considerations surrounding tumor marker testing for the breast and ovarian cancer genes. You'll also need to be well informed about the options when a patient tests positive for a gynecologic tumor marker in order to educate her. And it's important that after a patient's cancer has been successfully treated, you teach the significance of follow-up blood tests to confirm the presence or absence of tumor markers.

The word of the day is *early*

A patient's chances of survival increase when cancer is detected and treated early. Educating yourself and your patients about the latest screening tests available and treatment guidelines is crucial because tumor marker screening may be the first step in early detection. ■

Learn more about it

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