



Patient Guide to Tumor Markers

Key Takeaways:

- Tumor markers are substances found in the blood. Tumor marker levels may be higher when there is cancer in the body.
- They are not very “specific,” meaning non-cancer health issues can also cause these levels to be higher.
- They must be used along with radiology tests and exams by your healthcare provider.

What is a tumor marker?

A tumor marker is a substance that is made by the body because a cancer is present, or it can be made by the cancer itself. Some of these markers are specific to one cancer. Some are seen in several types of cancer. The markers can be found in the blood, urine, or tissues.

What are tumor markers used for?

Tumor markers are most often used to track how a patient's cancer responds to treatment. If the level is going down, the treatment is working. If it goes up, the cancer may be growing. There are health issues that can cause markers to be elevated that are not cancer. Because of this, you must think about the tumor marker levels along with the results of radiology scans (CT scan, MRI, Ultrasound), the patient's symptoms, and the healthcare provider's exam.

In some cancers, markers are used to watch for recurrence (return of the cancer after treatment). This is not useful in all cancer types. In breast cancer, research has found that watching tumor markers after treatment does not help people live longer. For that reason, they are not recommended.

Tumor markers can also be used along with other tests (scans, biopsies, and so on) to help find cancer in a patient who has symptoms that are suspicious for cancer. Some markers can help healthcare providers predict how the patient will do and to pick a treatment plan.

Can a tumor marker be used to screen for cancer?

Ideally, markers could be used as a screening test (looking for a cancer in people who do not have symptoms) for the general public. The goal of a screening test is to find cancer early, when it is the most treatable and before it has had a chance to grow and spread. So far, the only tumor marker to gain some approval as a screening tool is the Prostate Specific Antigen (PSA) for prostate cancer, though this has concerns as well.

The main worry with tumor markers is that they are not specific enough – they have too many false-positives. This means that the level is high when cancer is not present. This leads to costly tests that are not needed and causes the patient to be worried. The other concern is that the marker level is not high in early enough stages of the cancer, so the cancer cannot be found any earlier than when symptoms start to appear. Keep in mind that some substances used as tumor markers are normally made in the body, and a "normal" level is not always zero.

Does every cancer type have a tumor marker?

There is not a known tumor marker for all types of cancer. Also, tumor markers are not raised in all cases of the cancers they are used for, so they are not helpful for all patients. For example, carcinoembryonic antigen (CEA) is a tumor marker used in colon cancer, yet only 70-80% of colon cancers make CEA. This means 20-30% of people with colon cancer will not have a raised CEA level. Only 25% of early stage colon cancers have a raised CEA. Because of this, CEA cannot always help find colon

cancer in its early stages, when cure rates are best.

The bottom line is, tumor markers can be very helpful in watching a person's response to treatment and, in some cases, watching for the cancer to return. However, they need to be used along with your healthcare provider's exam, any symptoms you are having, and radiology studies (CT scan, MRI, PET, and so on).

Guide to Tumor Markers Used in Cancer

This is a table of the most often used tumor markers, the cancers they can be found with, non-cancerous health issues that can cause them to be high, and the range of normal results.

In cases where the half-life is listed, this should be kept in mind when checking levels. For example, the PSA half-life is 2-3 days, so if the level were checked the day after surgical removal of the prostate, it would still be raised. If the level were checked a week later, the result should be zero, or very close to zero, if no prostate cells remain.

Tumor Marker	Cancers Associated With Elevated Results	Non-Cancerous Reasons for Elevated Levels	"Normal" Results
<i>Blood test (blood serum marker), except where noted.</i>	<i>(**) indicates the most common association, if one exists</i>		<i>Different labs may have different high/low values</i>
AFP Alpha-fetoprotein	Germ cell cancers of ovaries & testes** (Non-seminomatous, particularly embryonal and yolk sac, testicular cancers). Some primary liver cancers (hepatocellular)	Pregnancy (clears after birth), liver disease (hepatitis, cirrhosis, toxic liver injury), inflammatory bowel disease	Low levels present in both men & non-pregnant women (0-15 IU/ml); generally results >400 are caused by cancer (Half-life 4-6 days)
Bence-Jones Proteins (urine test) or Monoclonal Immunoglobulins (blood test)	Multiple Myeloma** Waldenstrom's macroglobulinemia, chronic lymphocytic leukemia	Amyloidosis	Generally, a value of 0.03-0.05 mg/ml is significant for early disease
B2M Beta-2-Microglobulin	Multiple myeloma**, chronic lymphocytic leukemia (CLL), and some lymphomas (including Waldenstrom's macroglobulinemia)	Kidney disease, hepatitis	< 2.5 mg/L
BTA Bladder Tumor Antigen (urine test)	Bladder cancer**, cancer of kidney or ureters	Invasive procedure or infection of bladder or urinary tract	None normally detected

CA 15-3 Cancer Antigen 15-3 or Carbohydrate Antigen 15-3	Breast** (often not elevated in early stages of breast cancer), lung, ovarian, endometrial, bladder, gastrointestinal	Liver disease (cirrhosis, hepatitis), lupus, sarcoid, tuberculosis, non-cancerous breast lesions	< 31 U/ml (30% of patients have an elevated CA 15-3 for 30-90 days after treatment, so wait 2-3 months after starting new treatment to check)
CA 19-9 Cancer Antigen 19-9 or Carbohydrate Antigen 19-9	Pancreas** and colorectal, liver, stomach and biliary tree cancers	Pancreatitis, ulcerative colitis, inflammatory bowel disease, inflammation or blockage of the bile duct, thyroid disease, rheumatic arthritis	< 37 U/ml is normal > 120 U/ml is generally caused by tumor
CA 125 Cancer Antigen 125 or Carbohydrate Antigen 125	Ovarian cancer** breast, colorectal, uterine, cervical, pancreas, liver, lung	Pregnancy, menstruation, endometriosis, ovarian cysts, fibroids, pelvic inflammatory disease, pancreatitis, cirrhosis, hepatitis, peritonitis, pleural effusion, following surgery or paracentesis	0-35 U/ml
CA 27.29 Cancer Antigen 27.29 or Carbohydrate Antigen 27.29	Breast** (best used to detect recurrence or metastasis). Colon, gastric, liver, lung, pancreatic, ovarian, prostate cancers	Ovarian cysts, liver and kidney disorders, non-cancerous (benign) breast problems	< 40 U/ml Generally, levels > 100 U/ml signify cancer (30% of patients have elevated CA 27.29 for 30-90 days after treatment, so wait 2-3 months after starting new treatment to check)
Calcitonin	Medullary thyroid cancer**	Chronic renal insufficiency, Chronic use of Proton-pump inhibitors (medications given to reduce stomach acid)	<8.5 pg/mL for men < 5.0 pg/mL for women
CEA Carcinoembryonic Antigen	Colorectal cancers ** Breast, lung, gastric, pancreatic, bladder, kidney, thyroid, head & neck, cervical, ovarian, liver, lymphoma, melanoma	Cigarette smoking, pancreatitis, hepatitis, inflammatory bowel disease, peptic ulcer disease, hypothyroidism, cirrhosis, COPD, biliary obstruction	<2.5 ng/ml in non-smokers <5 ng/ml in smokers Generally, > 100 signifies metastatic cancer
Chromogranin A	Neuroendocrine Tumors**, carcinoid tumors, neuroblastoma, and small cell lung cancer	Proton-pump inhibitors (medications given to reduce stomach acid)	Normal varies on how tested, but typically < 39 ng/l is normal
Cytokeratin Fragment 21-1 (Blood Test)	Lung, urologic, gastrointestinal, and gynecologic cancers	Lung disease	0.05-2.90 ng/ml
HCG Human Chorionic Gonadotrophin Or Beta-HCG, B-HCG	Germ cell, testicular cancers**, gestational trophoblastic neoplasia	Pregnancy, marijuana use, hypogonadism (testicular failure), cirrhosis, inflammatory bowel disease, duodenal ulcers	In men: < 2.5 U/ml In non-pregnant women: < 5.0 U/ml

5-HIAA 5-Hydroxy-Indol Acetic Acid (24 hour urine collection)	Carcinoid tumors	Celiac & tropical sprue, Whipple's disease, dietary: walnuts, pecans, bananas, avocados, eggplants, pineapples, plums & tomatoes; medications: acetaminophen, aspirin and guaifenesin	Normal 6-10 mg over 24 hours
LDH Lactic Dehydrogenase	Lymphoma, melanoma, acute leukemia, seminoma (germ cell tumors)	Hepatitis, MI (heart attack), stroke, anemia (pernicious & thalassemia), muscular dystrophy, certain medications (narcotics, aspirin, anesthetics, alcohol), muscle injury	Normal values are 100-333 u/l
NSE Neuron-specific Enolase	Small cell lung cancer**, neuroblastoma	Proton pump inhibitor treatment, hemolytic anemia, hepatic failure, end stage renal failure, brain injury, seizure, stroke	Normal < 9 ug/L
NMP 22 (urine test)	Bladder cancer**	BPH (benign prostatic hypertrophy), prostatitis	Normal < 10 U/ml
PAP Prostatic Acid Phosphatase	Metastatic prostate cancer** Myeloma, lung cancer, osteogenic sarcoma	Prostatitis, Gaucher's disease, osteoporosis, cirrhosis, hyperparathyroidism, prostatic hypertrophy	Normal : 0.5 to 1.9 u/l
PSA Prostate Specific Antigen	Prostate**	BPH (benign prostatic hypertrophy), nodular prostatic hyperplasia, prostatitis, prostate trauma/ inflammation, ejaculation	Normal < 4 ng/ml (half life 2-3 days)
Tg Thyroglobulin	Thyroid Cancer	Anti-thyroglobulin antibodies	< 33 ng/mL; if entire thyroid removed < 2 ng/mL
Urine Catecholamines: VMA Vanillylmandelic Acid (24 hour collection of urine; it is a catecholamine metabolite)	Neuroblastoma** Pheochromocytoma, ganglioneuroma, rhabdomyosarcoma, PNET	Dietary intake (bananas, vanilla, tea, coffee, ice cream, chocolate), medications (tetracyclines, methyldopa, MAOIs)	8 – 35 mmols over 24 hours
HVA Homovanillic Acid (24 hour collection of urine; it is a catecholamine metabolite)	Neuroblastoma**	Same as VMA, in addition: psychosis, major depression, dopamine (a medication)	Up to 40 mmols over 24 hours

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