

Patient Guide to Tumor Markers

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A tumor marker is a substance that is produced by the body in response to cancer, or is produced by the cancer itself. Some of these markers are specific to one cancer, while others are seen in several types of cancer. These markers are generally used to evaluate the patient's response to treatment or to monitor for recurrence (return of the cancer after treatment). There are non-cancerous conditions that can cause markers to be elevated, so these must also be considered when interpreting the test results. Tumor markers can be used in conjunction with other tests (scans, biopsies, etc.) to help diagnose a patient who has symptoms suspicious for cancer. Some markers can help physicians to determine prognosis and treatment.

Ideally, markers could be used as a screening tool for the general public. The goal of a screening test is to diagnose 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 acceptance as a screening tool is the Prostate Specific Antigen (PSA) for prostate cancer, though this has its share of [controversy](#). Other markers are either not specific enough (too many false positives - a positive result, when no cancer is actually present - leading to expensive, anxiety producing and unnecessary follow-up testing), or they are not elevated early enough in the life of the cancer, and therefore the cancer cannot be detected any earlier than when symptoms begin to appear. Keep in mind that some substances used as markers are produced naturally in the body, and a "normal" level is not always zero.

Tumor markers are not elevated in all cases of the cancers they are used for, and they are not helpful in all patients. For instance, carcinoembryonic antigen (CEA) is used to detect colon cancer recurrence, yet it is only produced in 70-80% of colon cancer cases. In addition, only 25% of cases that are limited to the colon (early stages) have elevated CEA, so it cannot always detect colon cancer in its early stages, when cure rates are best. The bottom line is, tumor markers can be very helpful in following response to treatment and recurrence, but they cannot replace physical examination, evaluation of symptoms, and radiologic studies (CT scan, MRI, PET, etc.).

The following is a table of the most commonly used tumor markers, the cancers they can be present with, non-cancerous conditions that can elevate them, and the range of normal results. In cases where the half-life is listed, this should be considered 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 elevated. If the level were checked a week later, the result should be zero, or very close to zero, if no prostate tissue remains.

Guide to Tumor Markers

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	0-35 U/ml

		effusion, following surgery or paracentesis	
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
<i>Urine Catecholamines:</i> 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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