Tumor Markers

Tumor markers (*tumor markers* , TM) are **laboratory-proven** signs from which tumor growth depends (oncogenes , anti -oncogenes) or by which cancer manifests itself (tumor antigens , products of tumor cells or reactive products of non-tumor cells). [1][2]

- in the narrower (clinical) sense of the word, substances **detectable** in blood , urine or tissue, which have a higher value in cancer
- **used** to refine the diagnosis , monitor the course of therapy and detect disease relapse early
- they can also be elevated due to non-neoplastic causes
- they are not used as a comprehensive screening examination, only PSA is used to screen patients at risk for prostate cancer
- they can be **produced** directly by tumor cells or by non-tumor cells in response to the presence of a tumor
- if performed in a suitable selection and at reasonable time intervals, TM examination can be a good assistant to the attending physician - determining the response to treatment, disease progression and patient prognosis
- tumor markers can be divided according to the place of production, specificity, chemical structure and biological character

Tumor-specific tumor markers

- is related to the presence of certain tumor tissue
- since there is considerable overlap in TM production in different tumor tissues, specificity is low
- suitable for monitoring cancer remission and early diagnosis of disease relapse :
  - e.g. CEA (Ca GITu), CA 19–9 (pancreatic cancer), CA 125 (ovarian cancer) etc.

Tissue-specific tumor markers

- rather, it is related to a certain tissue in which a pathological event may take place (e.g. tumor growth)
- often increased from non-cancerous causes (e.g. PSA in men - prostate; hCG and AFP - embryonic or liver tissue)

Humorous

Abbreviation	Name	Production physiologically	Standard	Raised at	A false positive	Note
CEA	carcinoembryonic antigen	epithelial cells during fetal development	<3 µg/L	colorectal cancer , breast cancer , lung cancer , ovarian cancer, liver metastases,	cirrhosis , GIT inflammations	
AFP	α-fetoprotein	yolk sac and fetal liver	<10 µg/L	cirrhosis , active hepatitis , nonseminomas, germinal tumors (teratoma), hepatocellular carcinoma , hepatoblastoma	pregnancy	
CA 15-3	Carcinoma antigen 15-3			breast cancer , GIT tumors, glandular epithelial tumors	hepatopathy, cholangitis , lung disease, renal disorders, pregnancy	↑ Breast cancer – sensitivity 75%, specificity 90%, some GIT tumors
MCA	antigen of mucinous carcinomas			breast cancer		rise earlier than CA 15-3, use for confirmation when CA 15-3 is elevated
CA 19-9	carbohydrate antigen			pancreatic cancer , stomach cancer , colorectal cancer , breast cancer	obstructive jaundice	
CA 72-4	carbohydrate antigen			stomach cancer , esophagus cancer , lung cancer , ovarian cancer		
					benign affections of the ovaries and endometrium,	follow-up of ovarian cancer treatment,

CA 125	carbohydrate antigen			ovarian cancer	hepatopathy, pancreatitis, pregnancy, menstruation	screening in women with ovarian cancer in the family history
SCC	squamous cell carcinoma antigen			squamous cell carcinomas		
TPA/S	tissue polypeptide antigen	cell proliferation		various cancers (bladder cancer , ca head and neck cancer)		a mixture of about 20 cytokeratins, increases in proportion to the growing tumor
CYFRA 21-1	fragments of cytokeratin 19			non-small cell lung cancer		
PSA	prostate specific antigen	into the fluid of the seminal vesicles for liquefaction of the ejaculate by prostate cells	<2.5 µg/l < 50 years <5 µg/l 50–60 years 8.5< µg/l > 60 years	prostate cancer	ejaculation, per rectal examination before sampling, BHP	values above 10 µg/l – 50% risk ca, about 20% ca prostate has a PSA in the norm
LD	lactate dehydrogenase	liver, myocardium, skeletal muscles, erythrocytes	4.10 µcat/l	testicular tumors, leukemia , RCC, Hodgkin's lymphoma		
ALP	alkaline phosphatase			sarcoma, prostate cancer	obstruction of the bile ducts	
ACP	acid phosphatase			skeletal metastases, prostate cancer		
GGT	γ-glutamyltransferase			metastatic liver involvement	alcoholics, bile duct obstruction	
NSE	neuron specific enolase			neuroblastoma , retinoblastoma , malignant melanoma , SCLC	hemolysis	in CNS tumors it is better to determine in the cerebrospinal fluid
TK	thymidine kinase			leukemia , lymphomas , non-small cell lung cancer		pathway of replacement DNA synthesis
hCG	human chorionic gonadotropin	placenta		trophoblast tumors, choriocarcinoma (100% sensitivity), testicular and ovarian germinal tumors	pregnancy	screening of people at risk, examination of the β-subunit
PRL	prolactin	during pregnancy and after childbirth		prolactinoma, MEN I	slightly during physical exertion, mental stress	
CT	calcitonin			medullary carcinoma of the thyroid gland		
Thyroglobulin	thyroglobulin			follicular carcinoma of the thyroid gland		
Ferritin	ferritin			multiple myeloma , AML , Hodgkin's lymphoma		
β2 microglobulin	β2 microglobulin			CLL , multiple myeloma, lymphomas		
Paraprotein	paraprotein			multiple myeloma		Bence-Jones protein
VMA	vanillin mandelic acid	catecholamine degradation product		functional adrenal tumors		determination in urine, or determination of metanephrines (plasma, urine)
HIAA	5-hydroxyindoleacetic acid	degradation product of serotonin		functional carcinoids		determination in urine

Cell markers

Abbreviation	Name	Production physiologically	Standard	Raised at	A false positive	Note
HER2/neu				breast cancer		target for monoclonal antibodies (Herceptin), increased expression = worse prognosis

Genetic markers

Abbreviation	Name	Production physiologically	Standard	Raised at	A false positive	Note
p53	*guardian of the genome*	cell cycle regulation		Li-Fraumeni syndrome , sarcomas, breast cancer		
BRCA1/2	breast cancer			breast and ovarian cancer		

Links

References

1. ↑ Tumor Markers - National Cancer Institute. [online].
2. ↑ KALOUSOVA, Marta. Tumor Markers - Tumor markers. [online].
3. ↑ SCHNEIDERKA PETR. *Chapters in Clinical Biochemistry* . 2., add. and rework Prague: Karolinum, 2004, 365 p.
4. ↑ PETRUŽELKA LUBOŠ and KONOPÁSEK BOHUSLAV. *Clinical Oncology* . 1st ed. Prague: Karolinum, 2003, 274 p.
5. ↑ PRUSH RICHARD. *Indicative range of biochemical and hematological examination values according to age groups* . 1st ed. Prague: Institute of Clinical Biochemistry and Pathobiochemistry of the 2nd Faculty of Medicine, Charles University, 1999, 41 p.
6. ↑ VALÍK, D, T ZIMA and O TOPOLČAN, et al. Recommendations of the Czech Society of Clinical Biochemistry (ČSKB ČLS JEP), the Czech Oncological Society (ČOS ČLS JEP) and the Czech Society of Nuclear Medicine (ČSNM ČLS JEP) for the use of tumor markers in clinical practice. [online].

Tumor markers	
Humorous	oncofetal antigens: CEA • AFP • CA 15–3 enzymes: PSA • NSE • thymidine kinase • LD hormones: hCG • PRL • PTH • ADH plasma proteins: ferritin • β2M • paraprotein other: HIAA • VMK
Cellular	ER • PR • HER2/neu
Genetic	ATM • BRCA • p53 • Rb1
Portal: Pathobiochemistry	