



# TUMOR MARKERS

# DEFINITION

A substance produced or Induced by tumor cells that's used to detect the presence of a tumor or to differentiate between tumor and normal cells based on measurements in blood, body fluids or on cell surface

## Classified into :

### 1. Tumor specific antigens

expressed by tumor cells, not present in normal host cells.

### 1. Tumor associated antigens

Self antigens produced by tumor cells, present in a subset of normal host cells.

# USES

**Tumor markers are used for :**

- **Screening** : to identify patients with early stages
- **Determining diagnosis**
- **prognosis** : to assess the aggressiveness
- **Assessing response to therapy**
- **Detecting early or recurrent metastasis.**
- **Determination of risk : in genetically predisposed individuals.**

# CHARACTERS OF AN IDEAL TUMOR MARKER

- Should be highly **specific** (negative in all negative cases).  
(Diagnosis and screening)
- Should be highly **sensitive** ( positive in all positive cases).  
(Diagnosis and screening)
- Should provide a **lead time over clinical diagnosis**.  
(Screening)

- **The levels of the markers should correlate with the tumor burden. (Prognosis)**
- **It's accurately reflecting any tumor progression or regression. (Monitoring)**
- **Procedure of estimation should be reliable**
- **The test used for detection should be relatively cheap.**

# Different types of tumor markers :

1. **Oncofetal**
2. **Carbohydrates**
3. **Hormones**
4. **Enzymes**
5. **Proteins**
6. **Steroid receptors**
7. **Genes**

# EXAMPLES OF TUMOR MARKERS

**Table 1** Summary of the most common tumor markers associated with abdominal and pelvic tumors

Most common tumor markers	Tumor
CEA (carcinoembryonic antigen)	Colorectal cancer
PSA (prostate-specific antigen)	Prostate cancer
AFP (alpha-fetoprotein)	Hepatocellular carcinoma, germ cell tumor
CA 19-9	Pancreatic cancer
CA 125	Ovarian cancer
B-HCG (beta subunit of human chorionic gonadotropin)	Germ cell tumor
LDH (lactate dehydrogenase)	Germ cell tumor
CgA (chromogranin A)	Neuroendocrine tumors

# Oncofetal

## 1. CEA

- It is a glycoprotein that's normally derived from endodermal epithelium in fetus.
- Good for assessing the prognosis of colorectal cancer, post surgery surveillance and monitor response to chemotherapy.
- has low sensitivity and specificity so it cannot be used as a screening test.

# CEA

Normal values :

Non smoker : < 3 ng/ml

Smoker : < 5 ng/ml

**Elevated in :**

**Malignant conditions** → as in colorectal, pancreatic and gastric cancer, in some breast carcinoma and non-small-cell-lung-cancer.

**Benign conditions** → hepatitis, alcoholic cirrhosis, ulcerative colitis, heavy smokers, pancreatitis.

## 2. AFP

- It's a glycoprotein that is normally produced by the fetal yolk sac, liver, and gastrointestinal tract.
- Useful in screening with ultrasound , prognosis, monitoring and recurrence of HCC or ruling out a cancer diagnosis

# AFP

Normal value : 10 ng/ml

**Elevated in :**

**Malignant conditions** → HCC, testicular cancer and ovarian cancer

**Benign conditions** → acute and chronic hepatitis, liver cirrhosis and pregnancy.

# Enzymes

## PSA

a glycoprotein produced only in the epithelial cells of the acini and ducts of the prostate.

Worldwide, prostate cancer is the fourth most frequent malignancy in males.

used in screening and monitoring of prostate cancer, it's recommended that both PSA and DRE should be offered every year, starting at 50 years of age for screening.

# PSA

Normal value : 4ng/ml > (the higher a man's PSA level, the more likely it is that he has prostate cancer. )

**Elevated in :**

**Malignant conditions** → Prostate cancer

**Benign conditions** → BPH, prostatitis

# Hormones

## B-HCG

- HCG is produced by syncytiotrophoblasts in the placenta during normal gestation and forms the basis for pregnancy tests for urine or serum samples.
- The placental hormone HCG comes closest to being an ideal tumor marker.
- helpful in initial diagnosis, determining prognosis, monitoring the treatment and detect recurrence.

# B-HCG

Normal Value :

Non pregnant < 5 mIU/ml

In males : < 2 mIU/ml

- **Elevated in :**

**Malignant conditions** → Germ cell tumors of the testis, Trophoblastic tumors, Lymphoproliferative disorders, Melanoma, Some carcinomas of (GIT/lung/breast/ovary)

**Benign conditions** → treatment of hypogonadism, heterophil antibodies, marijuana use, tumor lysis after chemotherapy

# Carbohydrates

## 1. CA-19-9

- also known as Sialyl Lewis-a, is a cell surface glycoprotein complex.
- For pancreatic cancer the reported sensitivity and specificity for the diagnosis of pancreatic cancer are 79% and 85%.
- Useful in monitoring response to treatment and pancreatic cancer recurrence

## CA-19-9

- Normal value: < 37 U/mL
- Elevated in :

**Malignant conditions** → Pancreatic cancer, cholangiocarcinoma , colorectal and lung cancer

**Benign conditions** → Pancreatitis, cirrhosis, gallstones, cystic fibrosis.

## 2. CA-125

- antigenic tumor marker that is commonly expressed by the epithelial ovarian neoplasms and other tissues such as cells lining the endometrium, fallopian tubes, pleura, peritoneum, and pericardium.
- can detect ovarian cancer, monitor response to treatment, recurrence and follow up women who have a family history of ovarian cancer
- The specificity is particularly low in premenopausal women; thus, it is most useful in postmenopausal women.

# CA-125

Normal value: < 37 U/mL

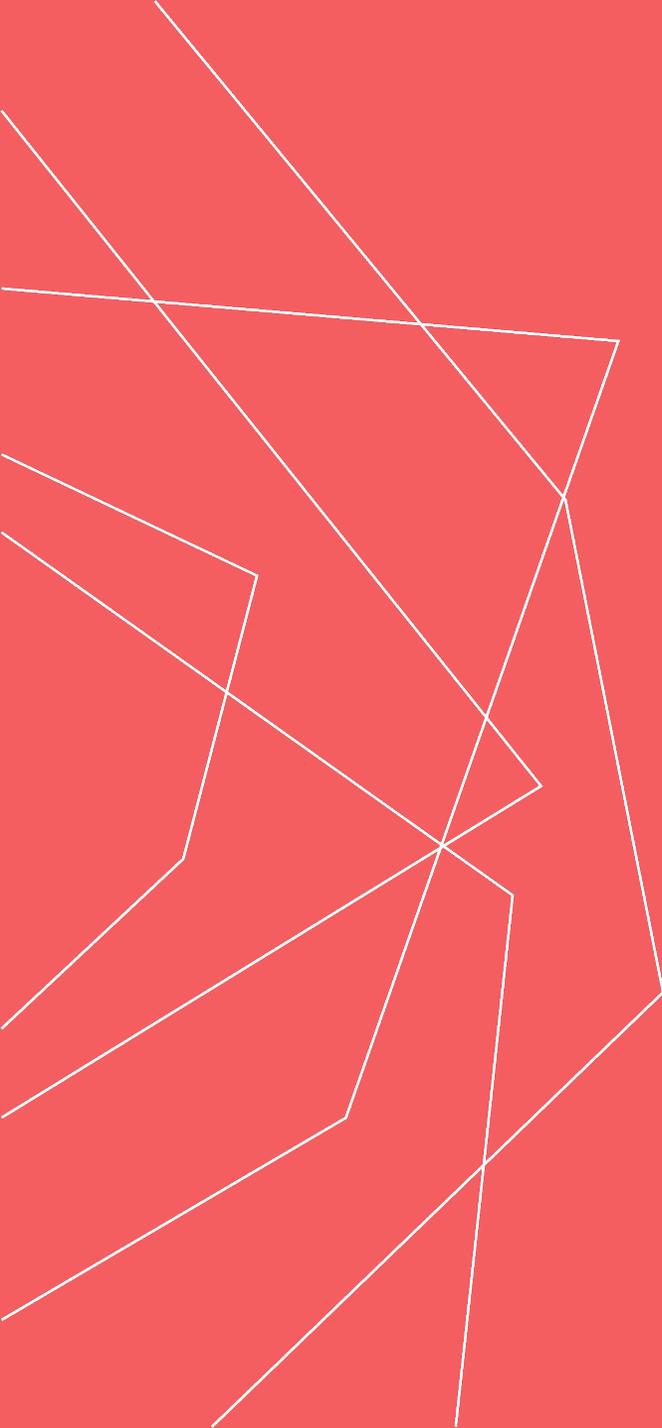
Elevated in:

**Malignant conditions** → Ovarian cancer

**Benign conditions** → Endometriosis, PID,  
Pregnancy, Liver disease

# SCREENING WITH MARKERS

- Several liquid biopsy-based assays that test for multiple tumor markers to detect cancer early :
  - PapSEEK : ovarian and endometrial cancer-related alterations in DNA obtained from fluids collected during a routine Pap test
  - CancerSEEK is a blood test that detects DNA mutations and protein biomarkers linked to multiple types of cancer
  - UroSEEK is a urine-based test that detects the most common alterations in 11 genes linked to bladder and upper tract urothelial cancers.

The image features a solid red background. On the left side, there is a complex, abstract pattern of thin white lines that intersect to form various irregular polygons and shapes. The lines are thin and white, creating a geometric, almost architectural feel. The overall composition is minimalist and modern.

**THANK YOU**