Tumor Marker Tests

Tumor markers are substances that can often be detected in higher than normal amounts in the blood, urine, or body tissues of some patients with certain types of cancer. These substances can be proteins, enzymes, biochemicals, or antigens. Tumor markers may either be produced by the cancer itself or by the body in response to the cancer. In general, tumor marker levels are lower in early stage disease (but still higher than normal) and higher with advanced disease. Furthermore, their levels decrease in response to treatment and increase when the cancer progresses.

Tumor markers are often used to:
- **Monitor response to treatment**—some tests show whether the cancer is responding to treatment
- **Monitor for progression**—in general, an increase in some tumor markers indicates disease progression
- **Detect recurrence**—regular monitoring of some tumor markers during a remission may help detect recurrence
- **Detect metastasis**—metastasis is the spread of cancer from its site of origin to another distant location in the body
- **Screen at-risk individuals**—Prostate specific antigen is an example of a tumor marker that is specific enough for one condition—prostate cancer—to function as a screening test for asymptomatic, at-risk men, which generally refers to men over 50 years of age with at least a 10-year life expectancy.
- **Identify specific cancer subtype**—some cancers are divided into subtypes that are more or less aggressive; some tumor marker tests make it possible to distinguish between cancer types
- **Predict prognosis**—test results may indicate the chance of a negative or positive outcome, based on outcomes of other patients with similar results

Tumor markers are not specific enough to be used alone for diagnosing cancer. There are several reasons for this:
- Tumor marker levels can be elevated in people with benign (non-cancerous) disease.
- Tumor markers are not elevated in every person with cancer, particularly those with early stage disease.
- Most tumor markers are not totally specific for a single condition, meaning that many different cancers or diseases can result in a higher than normal level of a particular marker.

For these reasons, tumor markers are not used in isolation; instead, results from tumor marker tests are evaluated in the context of a patient's history, symptoms, and other test results.

Despite these limitations, researchers continue to study the markers in table 1, as well as potential new markers to determine whether they may have a role in screening, early detection, and directing treatment.

**Enzymes as Tumor Markers**
The most commonly used tumor markers with enzymatic activity are:
- Prostate-specific antigen (PSA)
- Prostatic acid phosphatase (PAP)
- Alkaline phosphatase
- Neuron-specific enolase
While PAP was used for many decades as a screening tool and has utility in staging prostate cancer, elevated PAP is also associated with cancers of the bone and bone marrow, and also in benign conditions of not only the prostate, but the bones and parathyroid.

Among these most common enzymatic tumor markers, only PSA is specific or sensitive enough to identify specific organ involvement related to cancer.

On the following slides, the biochemistry and clinical applications of PSA will be discussed in greater detail.