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Diagnostic and Prognostic Biomarkers for Genitourinary and Gastrointestinal Cancer

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A B S T R A C T

Tumor markers are components generated by a tumor or by the host in reaction to the presence of a cancer cell. To detect the existence of cancer, they can be identified in cells, tissues, or bodily fluids and assessed qualitatively or quantitatively using techniques such as chemical, immunological, molecular, and mass spectrometry. The most widely utilized tumor markers in clinical practice are presented for breast, gastrointestinal, genitourinary, hepatocellular, lung, ovarian, and thyroid malignancies. This mini review evaluates different cancer biomarkers, mainly in Genitourinary and Gastrointestinal Cancers.

Identifying cancer biomarkers has recently been a prominent focus of cancer research. The widespread use of prostate-specific antigens in prostate cancer screening has prompted researchers to look for other acceptable indicators. Biomarkers can be used to diagnose, track disease development, predict recurrence, and assess therapy success

Keywords: Biomarkers, Cancer, Diagnostic, Prognosis

1. Main text

Introduction: Tumor markers are components generated by a tumor or by the host in reaction to the presence of a cancer cell. To detect the existence of cancer, they can be identified in cells, tissues, or bodily fluids and assessed qualitatively or quantitatively using techniques such as chemical, immunological, molecular, and mass spectrometry. The most widely utilized tumor markers in clinical practice are presented for breast, gastrointestinal, genitourinary, hepatocellular, lung, ovarian, and thyroid malignancies (1)

Biomarkers, particularly tumor markers, are an exciting tool for oncology clinical practice. However, when new disease indicators, such as physiological, biochemical, and genetic alterations, are discovered, they may become more than just effective diagnostic tools. These biomarkers may potentially be used in drug research and development and for predicting treatment response and prognosis.

Classification: The National Institutes of Health (NIH) organized a definitions working group to produce a collection of preferred terminology and descriptions and a conceptual model that could be extensively applicable to the expanding usage of biomarkers. The working group defined a biomarker as an objectively tested trait and analyzed it to indicate normal biological activities, pathogenic processes, or a response to a therapeutic intervention (2). The NIH Working Group on Definitions has identified numerous critical uses for biomarkers, such as their use in the diagnosis, disease staging, as indicators of disease risk, and as tools for predicting and monitoring clinical responses to therapy (3)

In addition to the characteristics listed in the introduction, Tumor markers should ideally be both sensitive and specific for cancer detection, minimize false-positive and false-negative test findings, and use the minimally invasive methodology to increase acceptance and compliance with animal owners (4). Tumor markers should also reflect the overall tumor burden, detect tumor recurrence after therapy, and be unaffected by cancer treatment or adverse

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events related to cancer treatment. To discriminate between health and illness, tumor markers should be reproducible across laboratories and have a well-defined reference range. Testing for tumor markers is only advised in human medicine when it has been proved to result in a better patient outcome, more excellent quality of life, or lower total cost of treatment (5)
Rapid technical breakthroughs in immunology, biochemistry, cell and molecular biology will continue to provide new avenues for evaluating prospective tumor indicators. However, few tumor markers have been carefully studied, including those routinely employed in veterinary medicine. Critical examination is required to establish whether a potential tumor marker has clinical usefulness. There are numerous criteria for determining the utility of a diagnostic test in evidence-based medicine (6)

Clinical Case: One interesting scenario is FNH. Hepatocyte hyperplasia with a central stellate scar is seen in FNH. AFP is generally within normal limits. Only half of the patients showed slightly elevated gamma-glutamyl transpeptidase levels; in our case, all of the laboratory mentioned above findings were within normal limits. Most sources propose AFP and glutamine synthetase immunostaining for patients with probable hepatoblastoma (7)
The probability ratio is one tool that can aid doctors in interpreting and using test data, and it may apply to veterinary tumor markers (8). Before tumor marker testing, the doctor must know the patient's likelihood of having cancer based on signalment, history, physical findings, and other criteria. Given knowledge of the likelihood of a high test value occurring in a cancer patient versus the likelihood of a high test value occurring in a cancer suspect who was later ruled out, the post-test probability for the patient having cancer given a high, low, or intermediate test result can be calculated. The Evidence-Based Medicine Working Group offers a comprehensive critical review of diagnostic tests, findings, interpretation, and application to clinical patients for the interested reader (9).

Veterinary tumor markers have historically included different substances detected in serum, flow cytometry, proliferation and apoptosis indicators, immunohistochemistry, cytochemistry, and cytogenetics. Cancer molecular markers will become more essential in human and veterinary oncology as new technologies emerge. Similarly, the emergence of "-omics," such as genomics, proteomics, and metabolomics, may be essential in the future detection and therapy of cancer. Each of these difficulties will be addressed one at a time (10)

Practical Examples: Tumor markers can be used for one of five different things:
Screening a cancer-free or high-risk population for the presence of cancer.
Cancer or a specific type of cancer diagnosis
Evaluating a patient's prognosis.
Predicting a patient's possible reaction to treatment.
Monitoring the recovery of a patient who has had surgery, radiation, or chemotherapy (11).

Comparison of Biomarkers: Tumor markers were first created to screen for cancer in persons who did not have symptoms, however, only a few markers are helpful. Prostate-specific antigen is the most often utilized tumor marker today (PSA) in clinical settings. Furthermore, only a few newly available markers have therapeutically meaningful predictive values for cancer at an early stage, and only when individuals at high risk are screened. Tumor markers are not the gold standard for cancer diagnosis. In most circumstances, a biopsy is the only way to determine whether or not a person has cancer. The tumor marker alpha-fetoprotein (AFP) is an example of a tumor marker that may be utilized to help in cancer diagnosis, particularly hepatocellular carcinoma (HCC). However, AFP levels can be elevated in several liver illnesses, and when they exceed a particular threshold, it is typically symptomatic of hepatocellular carcinoma.
It is vital to identify the etiology of stomach cancer to improve patient outcomes and prognoses. MLH1, MSH2, MSH6, and PMS2 are among the markers associated with microsatellite instability (MSI) that can aid in the prediction of gastric cancer prognosis. It is also necessary to identify related features across nations and cancers. Some researchers employed immunohistochemistry to examine the expression of MLH1, MSH2, MSH6, and PMS2 proteins in gastric cancer patients (12).

Some cancers develop and spread quicker than others, and some tumors react better to different medicines. The amount of a tumor marker can sometimes be used to predict the behavior and fate of certain malignancies. For example, in testicular cancer, very high levels of a tumor marker such as human chorionic gonadotropin (hCG) or AFP may suggest an aggressive disease with a bad prognosis. Patients with this high levels may require intensive treatment even at the start of cancer treatment. Specific indicators detected in cancer cells can be utilized to predict whether or not therapy will be effective.
Another biomarker is mast cell. Mast cells play an essential role in immune and allergic responses. Mast cells produce VEGF, angiopoietin, heparin, tumor necrosis factor (TNF), fibroblast growth factor (FGF), interleukin 4 (IL-4) and other substances that are associated with tumor formation (15-18). Key angiogenesis molecules are produced by mast cells (13).

For example, in breast and stomach cancers, if the cells have too much of a protein called human epidermal growth factor receptor 2 (HER2), medications like trastuzumab can be beneficial if administered with chemotherapy. However, with normal HER2 expression, these medicines may not provide the anticipated therapeutic advantages. Tumor markers are also utilized to detect the return of some malignancies following effective treatment. When there is no evident indication of cancer in the body, some tumor markers may be beneficial for ongoing examination of a patient after treatment completion. Tumor markers that are often tested in clinical laboratories include:

Gene Biomarkers: Single gene/protein or multi-gene "signature"-based assays have been established to evaluate particular molecular pathway deregulations that guide treatment decision-making as predictive biomarkers. Genome-based prognostic biomarkers are also available for various cancer types for prospective integration into clinical prognostic staging systems or practice recommendations. However, there is still a huge gap between initial biomarker discovery studies and their clinical translation due to the hurdles in the process of cancer biomarker development(14).

Conclusion: Identifying cancer biomarkers has recently been a prominent focus of cancer research. The widespread use of prostate-specific antigen in prostate cancer screening has prompted researchers to look for other acceptable indicators. Biomarkers can be used to diagnose, track disease development, predict recurrence, and assess therapy success. Biomarkers may be developed using modern genomic and proteomic technologies such DNA and tissue microarrays in conjunction with powerful bioinformatic tools. In the future, a serum or urine test for every stage of cancer may replace or enhance present invasive procedures.

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