A Comparative Assessment of Specific TumorMarker Levels in Blood: A Diagnostic Approach for Cancer Detection

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***Abstract*- Cancer, a formidable adversary that has plagued humanity for centuries, remains one of the most complex and challenging diseases to comprehend and combat. Cancer is a complex disease that can develop and progress through different stages. These stages help medical professionals understand the extent of the disease.The Most commonly used staging system is the TNM system, which elaborates for Tumor, Nodes, and Metastasis.This project investigates the significance of assessed tumor markers in blood samples as a diagnostic tool for early cancer detection. The study explores the potential of these markers to identify malignancies at their nascent stages, contributing to improved prognoses and tailored treatment strategies. By analyzing a diverse cohort of patients, this research sheds light on the sensitivity and specificity of these markers, providing valuable insights into their role in modern oncology practices. In Conclusion, this study highligts the crucial role of tumor markers in blood samples for cancer diagnosis and management. The findings contribute to the growing body of knowledge on tumor marker assessment and provide valuable insights for clinical** practice. Ultimately, this research underscores the importance of multidisciplinary approach to cancer care, incorporating tumor marker assessment to improve patient outcomes and quality of life.

***Keywords*: Tumor Markers, PSA, CA 19.9, CA 125, Blood Assessment, Cancer.**

List of abbreviations
PSA – Prostate Specific Antigen; CA 19.9 – Cancer Antigen 19.9; CA 125 – Cancer Antigen 125.

INTRODUCTION

Tumor markers, also known as biomarkers or cancer markers, are substances that can be found in the blood, urine, tissues, or other body fluids and are produced by cancer cells or normal cells in response to cancerous growth in the body. These markers serve as indicators of the presence of cancer, its progression, or the body's response to cancer.Tumor markers can be various types of molecules, including:**Proteins**: Many tumor markers are proteins that are either directly produced by cancer cells or released into the bloodstream due to cancer-related changes in the body. **Enzymes**: Certain enzymes may be elevated in the blood due to their production by cancer cells or changes in normal cell metabolism caused by the presence of cancer.**Hormones**: In some cases, cancer cells may produce hormones or hormone-like substances that can be detected in the blood or urine. **Antigens**: Tumor cells may express specific antigens on their surface that can be targeted and detected by the immune system or through laboratory tests. **Genes and Genetic Markers**: Alterations in specific genes or genetic mutations associated with cancer can serve as tumor markers and areoften identified through genetic testing.

1.1 Classification of Tumor Markers : Tumor markers can be detected in tissue (for example, in solid tumors, lymph nodes, bone marrow or circulating tumor cells in the blood) or in body fluids like pleural fluid or ascitic or serum (serological tumor markers).Tissue tumor markers are of prime importance to a diagnostic pathologist, while the serological tumor markers are more often used by a clinician and will be discussed in more detail in this review.Many classification schemes exist based on differences inorigin, structure, biological function or their relationship to the event in tumor growth or formation.

TABLE : 1

Category	Subcategory	Examples
Oncofetal antigens		AFP, CEA
Hormones		Catecholamines
		Calcitonin, β-hCG
Glycoproteins		CA 125, CA 15-3, CA
		19-9, CA 72-4, PSA

Category	Subcategory	Examples
Metabolites		VMA, HIAA
Tumor-associated antigens	Viral antigens	Polyoma, SV 40
	MHC-related antigens	H-2 k antigen
	Enzymes	PAP, NSE, PLAP
	Oncogene products	c-myc, c-erbB2
	Cytogenetic products	Philadelphia chromosome
Tumor-associated markers	Proteins	Immunoglobulins, β-2M
	Enzymes	Lactate dehydrogenase, alkaline phosphatase, pteridines, pterines
	Acute-phase proteins	C-reactive protein, ferritin
	Inflammatory makers	ESR, viscosity
Ultrastructural components	Intermediate filament components	Desmin, vimentin

Tumor markers play a critical role in cancer diagnosis and management, aiding healthcare professionals in various aspects of cancer care. These markers are substances, such as proteins, hormones, or genetic material, that are produced by tumor cells or the body in response to the presence of cancer. They can be measured in blood, urine, or tissue samples and provide valuable information that guides clinical decision-making throughout the cancer journey.

MATERIALS AND METHODS

2.1 Types of Tumor Markers Used for Assessing on Blood Samples

Tumor markers used in blood samples can provide valuable information about the presence and progression of cancer. There are various types of tumor markers, and their selection depends on the specific type of cancer being evaluated. Some of the commonlyused tumor markers in blood and samples include:

Prostate-Specific Antigen (PSA): PSA is primarily used as a tumor marker for prostate cancer. Elevated PSA levels in blood mayindicate the presence of prostate cancer or other prostate conditions, such as prostatitis or benign prostatic hyperplasia (BPH).

Cancer Antigen-125: CA-125 is commonly used as a tumor marker for ovarian cancer. Elevated CA-125 levels in blood can be indicative of ovarian cancer or other gynecological conditions.

Cancer Antigen-19.9 : The CA 19-9 marker is associated with cancers in the colon, stomach, and bile duct.The Increased levels ofCA 19-9 may indicate the advanced cancer in the pancreas

These are the tumor markers used for assessment in blood samples. It's important to note that the selection of tumor markers depends on the type of cancer being evaluated, and not all cancers have specific tumor markers that are consistently used in clinical practice. Additionally, tumor markers should always be interpreted in conjunction with other clinical findings and diagnostic tests to ensure accurate cancer diagnosis and management.

2.2 Selection Of Study Participants and Sample Collection

During my research study on tumor markers, I collected blood samples from different individuals as part of the study's cohort. These blood samples were carefully collected following standard protocols to investigate the levels of prostate-specific antigen (PSA), CA- 125 and CA-19.9. The objective was to assess the presence and concentration of PSA, CA-125 and CA-19.9 in the blood. The diagnostic center conducted a thorough analysis of the samples, measuring the levels of specific tumor markers in the blood. The primary objective of this assessment was to determine the levels of tumor markers present in the blood of these individuals.Upon receiving the results, we meticulously reviewed and analyzed the data. The findings shed light on the presence and concentration of tumor markers, allowing us to draw important conclusions regarding the individuals' cancer risk and overall health.The results obtained from the diagnostic center for the tumor marker assessment were presented in a clear and organized tabular format. The tabular layout provided a comprehensive overview of the data, making it easy to interpret and analyze the findings. Each row in the table represented an individual sample, while the columns displayed the specific tumor markers and their corresponding levels in theblood.

PSA TEST Prostate-specific antigen or PSA, is a protein produced by normal and as well as malignant cells of the prostate gland. PSA test shows the level of PSA levels in the blood. For this test, a blood sample is sent to a laboratory for the analysis. The results are usually reported in nanograms of PSA per milliliter (ng/mL) of the blood.The blood level of PSA is often elevated in the people effected with prostate cancer, and the PSA test was originally approved by the FDA in the year 1986 to monitor the progression of the prostate cancer in men who had already been diagnosed with the disease. In year 1994, FDA approved the PSA test to be used in conjunction with a digital rectal exam (DRE) to aid the detection of prostate cancer in men 50 years and older age. Until about 2008, many doctors and professional organizations had encouraged yearly PSA screening for prostate cancer beginning at age of 50.PSA testing (along with a DRE) is also often used by the health care providers for the individuals who report prostate symptoms to help determine the nature of problem. In addition to prostate cancer, there are several benign (not cancerous) conditions which can cause a person's PSA level to rise, particularly prostatitis (inflammation of the prostate) and benign prostatic hyperplasia (BPH) (enlargement of the prostate). There is no proper evidence that either condition leads to prostate cancer, but someone can have one or both of these conditions and develop a prostate cancer as well.

CA 125 TEST A CA 125 test measures the amount of protein CA 125 (cancer antigen 125) in blood. This test may be used to monitor certain cancers during as well as after treatment. In certain situations, the test may be used to look for early signs of ovarian cancer in the people with a very high risk of disease.In diagnostic centers, most common method used for measuring the CA 125 levels in blood samples is the Immunoassay, specifically the Enzyme-Linked Immunosorbent Assay (ELISA). ELISA is a widely used and highly sensitive technique used for quantifying the concentration of CA 125 in blood.

CA 19.9 TEST A CA 19-9 test measures the amount of protein called CA 19-9 (cancer antigen 19-9) in a sample of blood. There are blood tests commercially available that may be able to detect the pancreatic cancer. A test showing Increased CA 19-9 levels cannot detect the presence of pancreatic cancer by itself, but it can be used on a panel with other biomarkers which can confirm the presence of disease. After diagnosis, the CA 19-9 Radioimmunoassay (RIA) blood test can also be used for patients to progress the disease's development.Levels of CA 19-9 may be measured as part of a panel of biomarkers to know about the disease in early stages with a blood test. Patients may also get the test done after confirmation of pancreatic cancer diagnosis. If the CA 19-9 level was raised beforetreatment, patients may be tested during and also after treatment to judge success.

RESULT

Table : 2

TUMOR MARKERS	PARTICIPANT NAME	LEVELS
PSA	M. AJAY 23 M	0.58 ng/mL
CA 125	S. FIRDOUS 23 F	6.03 U/mL
CA 19.9	S.NAWAZ 19 M	7.81 U/mL

PSA	VENU GOPAL 43 M	95 ng/mL
CA 125	RUBIYA 60 F	873 U/mL
CA 19.9	AMRITA 52 M	96,544.3 U/mL

PSA

- Most men who is not effected with prostate cancer have PSA levels under **4 ng/mL of blood.** When prostate cancer develops, the PSA level in an individual often goes above 4ng/mL. Still, The PSA levels below 4 is not a guarantee that a man doesn't have cancer. About 15% ofmen with a PSA below 4 will have prostate cancer if a biopsy is done.

- Men with PSA level between 4 and10 (Often called the "Borderline range") have about a 1 in 4 chance of having a prostate cancer.

- If the PSA is more than 10,the chance of having prostate cancer is over 50%.

CA 125

- CA-125 levels in the body are measured by units per millimeter (U/mL).A CA-125 normal range falls **between 0 and 35 U/Ml.**

- .The CA 125 **Levels over 35 U/mL** may indicate the presence of **cancer.**Not all patients with a high CA125 result have cancer.For women with no ovarian cancer history, a high result usually leads to additional testing. In patients earlier who haveeffected with ovarian cancer,high CA-125 levels may indicate a cancer recurrence.

CA 19.9

- Results are given in units per millimeter (U/mL).Normal results are less than 39 U/mL.

- It's important to know that higher levels of CA 19-9 may not mean you have cancer.There are other Conditions other than cancer that can increase CA 19.9 Levels, these conditions that include Pancreatic Infection, cystic fibrosis, Other liver disease,gallstones.

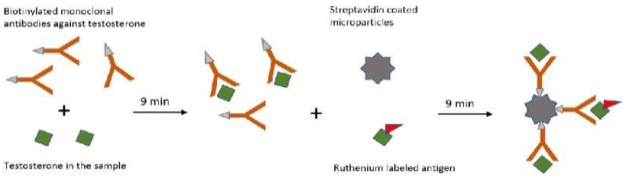
- If your CA 19-9 is less than 37U/mL, you may not have cancer.

- If your CA 19-9 levels are above 37 U/mL,you may have a cancer of the colon, pancreas, gall bladder or lung.

LABORATORY METHODS USED FOR ANALYZING THE BLOOD SAMPLES

In the Diagnostic Centre, a specific assay method was employed to examine the levels of **prostate- specific Antigen** (PSA) **CA-125** (Cancer Antigen - 125) and **CA 19.9** (Cancer Antigen 19.9) in a blood sample the method utilized for this analysis was the **Electro Chemiluminescence Immunoassay (ECLIA).** ECLIA is a widely used and highly sensitive immunoassay technique that allows for the precise quantification of Tumor Markers in the blood.It is a highly sensitive and specific technique that combines aspects of both electrochemical and luminescence-based detection methods.In the diagnostic centre, a specific assay method was employed to examine the levels of **prostate-specific antigen (PSA)** ***CA 125*** **(*cancer antigen 125*) and CA 19.9 (Cancer antigen 19.9)** in a blood sample. The method utilized for this analysis was the **Electro Chemiluminescence Immunoassay (ECLIA).** ECLIA is a widely used and highly sensitive immunoassay technique that allows for the precise quantification of Tumor Markers in the blood.It is a highly sensitive and specific technique that combines aspects of both electrochemical and luminescence-based detection methods.

The mechanism of Electrochemiluminescence Immunoassay (ECLIA) in assessing PSA (Prostate-Specific Antigen) tumor markers involves a highly specific and sensitive approach. In this method, a solid surface, such as a microplate well, is coated with antibodies that selectively bind to PSA molecules. Patient blood samples are then introduced to the coated surface, allowing any PSA present in the sample to bind to the immobilized antibodies. After a thorough washing step to remove unbound components, a detection antibody labeled with a chemiluminescent marker is introduced. When an electric potential is applied, the labeled antibody-bound PSA molecules emit light, producing a measurable signal. The intensity of the emitted light is directly proportional to the concentration of PSA in the sample. This quantitative signal is then compared to a calibration curve generated using known PSA concentrations to determine the exact PSA concentration in the patient sample. The ECLIA mechanism's precision and sensitivity make it a valuable tool for assessing PSA tumor markers, enabling early detection and accurate monitoring of prostate cancer.



DISCUSSION

In this project, we investigated the estimation of tumor markers PSA, CA125, CA 19.9 in blood samples and their clinical significance in cancer diagnosis and management. The analysis of the data revealed intriguing findings. In the group of patients with suspected or diagnosed cancer, elevated levels of PSA , CA125 , CA 19.9 were observed, aligning with previous research and confirming the potential of these markers as indicators of cancer presence. However, it was crucial to consider other factors that might influence the marker levels, such as age, gender, and comorbidities, to avoid misleading interpretations.

We observed variations in PSA , CA125 , CA19.9 levels among different patient groups. For instance, PSA levels were significantlyhigher in individuals with prostate cancer compared to those with Normal condition or
healthy controls. Similarly, CA125 levels were notably elevated in patients with ovarian cancer, distinguishing them from individualswith other gynecological conditions Whereas CA 19.9 levels were significantly higher in
individuals effected with pancreatic cancer compared to those with healthy controls.The discussion of our results emphasized the clinical relevance of PSA , CA125 and CA 19.9 testing. These tumor markers exhibited value not only in cancer diagnosis but also in monitoring treatment response and detecting cancer recurrence. We acknowledged that the appropriate use of these markers requires amultidisciplinary approach, integrating clinical findings, imaging, and other diagnostic tests.

CONCLUSION

In conclusion, our project on the estimation of tumor markers PSA, CA125 and CA19.9 in blood samples which gave **results 0.58 ng/ ml (PSA) , 6.03 U/ml (CA 125) , 7.08 U/ml (CA 19.9)** respectively has provided valuable insights into the clinical significance and potential applications of these biomarkers in cancer diagnosis and management. Through a systematic investigation, we have established the importance of PSA in prostate cancer detection and monitoring, CA125 in ovarian cancer and CA19.9 in Pancreatic Cancer assessment. These tumor markers have demonstrated their value as early diagnostic indicators, aiding in the timely detection of cancer, which is crucial for improving treatment outcomes.

The data obtained from our study have reaffirmed the utility of PSA,CA 125,CA 19.9 in monitoring treatment response and detecting cancer recurrence. The ability to assess treatment efficacy and tailor therapeutic approaches based on tumor marker levels has the potential to significantly impact patient care and quality of life. Additionally, the use of PSA CA125,CA 19.90 as prognostic indicators has allowed for more accurate patient counseling and risk stratification, guiding treatment decisions.

Furthermore, the project has highlighted the necessity of combining PSA, CA125, CA 19.9 testing with other clinical and diagnostic tools for comprehensive patient assessment. The interpretation of tumor marker levels should be done with caution, considering the patient's medical history, symptoms, and imaging findings to avoid potential false positives or negatives.The conclusive evidence from our project highlights the crucial role that tumor markers play in advancing early cancer detection strategies.

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