

Impact of Chemotherapy on Protein Levels in Cancer Patients Undergoing Treatment

Thakre Pratima

Jawaharlal Nehru Cancer Hospital & Research Centre, India

ABSTRACT

Cancer staging is a critical component of cancer management and directly influences the patient's treatment approach. Numerous protein tumor indicators assist in the diagnosis and prognosis of cancer patients. The objective of this study is to assess the total protein levels in serum samples from chosen cancer patients and to identify any correlations with various stages of the disease. Materials and Methods: Total proteins were quantified using the IR-VS spectroscopy approach and compared among various patients. Outcome: The spectrophotometric examination of the obtained serum samples indicated that chemotherapy-induced total protein loss correlates with the dysregulation of serum proteins and electrolytes. Total protein serves as a crucial indicator for assessing tumor stage in cancer patients; hence, it functions as a prognostic marker as well. It is a straightforward, non-invasive, and economical analytical approach.

Keywords: Chemotherapy, Spectrophotometry, Tumour.

INTRODUCTION

The Significance of Protein values in Cancer Proteins with modified expression levels in cancer participate in signaling pathways related to protein synthesis and degradation, DNA repair, apoptosis, and other cellular processes, the modifications of which contribute to tumor

Received: 2024-11-12 Revised: 2025-02-11 Accepted: 2025-04-01 Published: 2025-06-30

growth and progression. This results in enhanced cellular proliferation and regeneration, as well as advancements in hemostasis and pathogen resistance. Oncogenes in human malignancies frequently trigger significant and rapid cellular proliferation, correlated with an elevation in total protein synthesis. Protein synthesis can be regulated at multiple levels, including the generation of new ribosomes.

A significant category of tumor protein is the translationally controlled tumor protein (TCTP), which has been thoroughly investigated. This protein exists in three forms: P21, Q23, and P23, and is implicated in various biological functions and disease mechanisms, including cancer, across all eukaryotic organisms, particularly in response to cellular stresses such as oxidative stress, heat shock, genotoxic stress, and ion metabolism imbalances. TCTP functions as an anti-apoptotic protein and is implicated in DNA damage repair, cellular autophagy, and cell division. Tumor Infiltrating Lymphocytes are immune cells generated in reaction to tumors; they are protein-based and have proven to be valuable diagnostic and prognostic indicators of tumors. There is unequivocal evidence that the immune system is crucial to tumor defense. Assessing tumor-infiltrating lymphocytes (TILs) elucidates and quantifies the unique immune response. In breast cancer, elevated levels of tumor-infiltrating lymphocytes (TILs) correlate with a more favorable clinical outcome. The study effectively demonstrated the utility of these signaling proteins as biomarkers for tumor classification and outcome prediction in gastric cancer patients.

A different cohort of scientists investigated exosomal proteins as prospective biomarkers for tumorigenesis and progression. Exosomal proteins have been identified as regulators of tumor development and their microenvironment, offering insights into exosome generation and tumor-related activities such as angiogenesis and metastasis. Consequently, they serve as highly valuable biomarkers for cancer diagnosis, prognosis, and treatment. Examined the electrophoretic profile of blood proteins in several cancer patients [2]. The study sought to assess the variation in protein profiles across various tumors to determine whether a distinct protein pattern correlates with certain cancer types and can serve as a diagnostic biomarker. The research employed colorimetric methods to assess total protein and albumin in cancer patients, while densitometry facilitated the quantitative investigation of each protein fraction. Both univariate analysis and multivariate logistic regression analysis demonstrated a significant association between serum protein profiles and cancer prevalence, indicating their

Received: 2024-11-12 Revised: 2025-02-11 Accepted: 2025-04-01 Published: 2025-06-30

potential as biomarkers [3]. The optimal markers for differentiating between malignant and healthy states were alpha (1)-globulin, total protein, erythrocyte sedimentation rate, and the albumin-to-globulin ratio. Investigated the disparities in total protein content between the saliva and serum of female breast cancer patients and healthy females, revealing a statistically significant difference in total protein levels in both saliva and serum between the breast cancer patients and the healthy cohort [4]. Consequently, they endorsed the significance of protein biomarkers in the diagnosis and prognosis of cancer patients, necessitating additional research efforts.

RESEARCH LABORATIONS

Blood samples from volunteers with multiple myeloma were collected in red-capped tubes, with a volume of 2 ml each. Samples are acquired from the Department of Pathology at JNCH & RC, Bhopal, with consent from the Institutional Ethical Committee. Approval from the Institutional Ethical Committee will be obtained prior to commencing the research. INFORMED CONSENT: Each participant enrolled in the study will sign an informed consent form. The protein in the sample interacts with copper (II) ions in an alkaline environment, resulting in the formation of a colored complex that can be quantified by spectrophotometry. Example: Serum.

Table 1 Dispense into labeled test tubes.

REAGENTS	BLANK	STANDARD	SAMPLE
Distilled water	20 μ l	-----	-----
Protein Standard (S)	-----	20 μ l	-----
Sample	-----	-----	20 μ l
Reagent (A)	1.0ml	1.0ml	1.0ml

Thoroughly combine and allow the tubes to rest for 10 minutes at ambient temperature. Measure the absorbance (A) of the standard and the sample at 545 nm relative to the blank. The color remains consistent for a minimum of two hours.

The protein content in the sample is determined using the following generic formula.

Received: 2024-11-12 Revised: 2025-02-11 Accepted: 2025-04-01 Published: 2025-06-30

$$\frac{A \text{ sample} \times C \text{ standard}}{A \text{ standard}} = C \text{ Sample}$$

A standard

Normal serum range for adults

AMBULATORY	64-83g/L
RECUMBENT	60-78g/L

RESULTS AND DISCUSSIONS

Blood samples from cancer patients in our study group were collected to assess the total protein level and its correlation with serum protein electrophoresis results. The female group had a slight decrease in total protein levels [5]. Our findings indicate that patients with severe multiple myeloma had significant alterations in serum proteins and electrolytes, along with a heightened occurrence of aberrant serum protein patterns. The majority of individuals included in our study are classified as having stage III cancer. The alterations in total protein exhibited a favorable connection with the variations in blood protein and electrolyte levels. A comparable tendency was observed in both groups: 20 males and 17 females. Our findings indicate that chemotherapy-induced total protein loss correlates with dysregulation of serum proteins and electrolytes [6]. Cancer treatment encompasses chemotherapy, radiation therapy, biological therapy, surgery, or a combination of two or more of these modalities. All of these therapy modalities are designed to eliminate the cancer cells present in the patient's body. Chemotherapy aims to eliminate all rapidly proliferating cells, encompassing both malignant and healthy cells. Chemotherapy consequently impacts the body's normal organs and tissues, leading to a reduction in protein levels. The blood total protein levels in the elderly may progressively decline with age. Nonetheless, blood total protein levels are not appropriate as a consistent reference standard for the elderly across varying ages and genders.

CONCLUSIONS

The total protein serum test quantifies the overall concentration of albumin and globulin in the bloodstream. Values below the normal threshold are typically linked to nutritional

Received: 2024-11-12 Revised: 2025-02-11 Accepted: 2025-04-01 Published: 2025-06-30

deficiencies, hepatic and renal diseases, and malignancies. Increased total protein levels may indicate chronic inflammation or malignancies, including multiple myeloma. An elevated total protein level may signify dehydration or a specific disease, such as multiple myeloma, which leads to aberrant protein accumulation. An aberrant total protein test result necessitates additional testing to determine which proteins are elevated or diminished. This information will facilitate an appropriate diagnosis. Proteins with modified expression levels in cancer participate in signaling pathways for protein synthesis and degradation, DNA repair, apoptosis, and other cellular activities, the modifications of which contribute to tumor growth and progression. This leads to enhanced cellular proliferation and restoration, as well as advancements in hemostasis and pathogen resistance. Oncogenes in human malignancies frequently stimulate significant and rapid cellular proliferation, correlated with an elevation in total protein synthesis. Our findings indicate that chemotherapy-induced total protein loss correlates with the dysregulation of serum proteins and electrolytes. It is important to point out that persons receiving chemotherapy may necessitate elevated protein consumption to facilitate tissue healing and combat infection.

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Received: 2024-11-12 Revised: 2025-02-11 Accepted: 2025-04-01 Published: 2025-06-30

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