Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v30i19.3840

COMPARATIVE STUDY OF BIOCHEMICAL AND ANTIOXIDATIVE STATUS IN PROSTATE CANCER PATIENTS RECEIVING DIFFERENT THERAPIES

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Abstract

Introduction: The management of prostate cancer involves a spectrum of treatment modalities, ranging from surgery and radiation therapy to hormonal manipulation and chemotherapy.

Objectives: The basic aim of the study is to find the comparative study of biochemical and antioxidative status in prostate cancer patients receiving different therapies.

Material and methods: This comparative study enrolled a total of 240 participants diagnosed with prostate cancer at Shalamar Hospital in Lahore, Pakistan, between the duration of 2022 to 2023. Patients were recruited following institutional ethical approval and informed consent. Baseline data including demographic information, tumor staging, and treatment details were recorded for each participant. Blood samples were collected pre-treatment and at specific intervals post-treatment to assess biochemical parameters such as lipid profiles, glucose levels, liver and kidney function markers, and inflammatory indicators.

Results: The study revealed treatment-specific alterations in biochemical profiles, showcasing distinct metabolic shifts among groups. Surgery demonstrated modest changes in serum cholesterol, while pharmacological intervention correlated with notable elevations in serum cholesterol, glucose, and ALT levels. Oxidative stress markers displayed marginal changes across groups, implying a mild induction of oxidative stress post-treatment. BMI and serum albumin remained relatively stable across treatments.

Conclusion: It is concluded that distinct therapeutic interventions in prostate cancer elicit diverse metabolic shifts, as evidenced by treatment-specific alterations in biochemical profiles. While oxidative stress markers showed marginal changes, stable clinical parameters suggest relative consistency in BMI and serum albumin across treatments.

Keywords: Prostate, Cancer, Patients, BMI, Chemotherapy, Oxidative, Stress

Introduction

The management of prostate cancer involves a spectrum of treatment modalities, ranging from surgery and radiation therapy to hormonal manipulation and chemotherapy. Understanding the biochemical and antioxidative status of patients undergoing diverse therapeutic interventions is crucial for elucidating the impact of these treatments on the overall health and oxidative balance of individuals with prostate cancer [1]. Prostate cancer, one of the most prevalent malignancies among men, presents a complex interplay between the disease process itself and the impact of therapeutic interventions on the body's biochemical milieu. Different treatment modalities, such as surgery, radiation, and pharmacological interventions including hormonal therapies and chemotherapy, exert diverse effects on the body's biochemical pathways and redox balance [2].

Biochemical parameters encompass a wide array of markers including lipid profiles, glucose metabolism indicators, liver and kidney function tests, and markers of inflammation. Evaluating alterations in these parameters among patients receiving various treatment regimens sheds light on the metabolic consequences and systemic impact of different therapies on the body's homeostasis [3]. Moreover, oxidative stress, characterized by an imbalance between free radicals and antioxidant defense mechanisms, plays a pivotal role in cancer progression and treatment outcomes. Assessing antioxidative status through markers like glutathione, superoxide dismutase, and malondialdehyde provides insight into the body's ability to counteract oxidative damage induced by cancer and its treatments [4].

Understanding how different therapeutic strategies influence the biochemical profiles and antioxidative status of prostate cancer patients is essential for optimizing treatment strategies, managing potential treatment-related side effects, and potentially identifying novel adjunctive therapies to improve patient outcomes [5]. This comparative study endeavors to unravel the intricate relationship between therapeutic interventions and the biochemical and antioxidative status of prostate cancer patients. The findings from this investigation hold promise in guiding personalized treatment approaches, fostering better clinical management, and potentially identifying avenues for interventions aimed at mitigating treatment-related complications and enhancing overall patient well-being [6]. Prostate cancer treatment regimens, while aimed at eradicating or controlling the disease, often bring about systemic changes in the body's physiology beyond targeting the tumor itself. Surgical interventions, such as radical prostatectomy, can impact hormonal balance and urinary function. Radiation therapy may lead to localized tissue damage and provoke inflammatory responses [7]. Similarly, pharmacological treatments like androgen deprivation therapy (ADT) or chemotherapy may elicit metabolic alterations and immune system modulation. Moreover, these assessments hold promise in uncovering potential biomarkers indicative of treatment response or toxicity. Identifying specific alterations in biochemical profiles or antioxidative status associated with favorable treatment responses or increased susceptibility to adverse effects could guide clinicians in tailoring personalized treatment strategies [8]. Additionally, insights garnered from these investigations may contribute to the development of adjunctive therapies aimed at ameliorating treatment-induced side effects or improving treatment efficacy.

Objectives

The basic aim of the study is to find the comparative study of biochemical and antioxidative status in prostate cancer patients receiving different therapies.

Material and methods

This comparative study enrolled a total of 240 participants diagnosed with prostate cancer at Shalamar Hospital in Lahore, Pakistan, between the duration of 2022 to 2023. Patients were recruited following institutional ethical approval and informed consent. They were categorized into distinct treatment groups based on the therapeutic interventions received:

Surgery Group: Patients undergoing radical prostatectomy.

Radiation Group: Patients receiving radiation therapy as primary treatment.

Pharmacological Group: Patients treated with androgen deprivation therapy (ADT) or chemotherapy.

Inclusion Criteria:

- Confirmed diagnosis of prostate cancer via biopsy.
- Adults aged 18 years or older.
- Patients initiating or undergoing the specified treatment modalities during the study period.

Exclusion Criteria:

- Prior history of other malignancies.
- Severe comorbidities affecting biochemical parameters independently.
- Inability to provide informed consent or participate in follow-up assessments.

Data Collection:

Baseline data including demographic information, tumor staging, and treatment details were recorded for each participant. Blood samples were collected pre-treatment and at specific intervals post-treatment to assess biochemical parameters such as lipid profiles, glucose levels, liver and kidney function markers, and inflammatory indicators. Oxidative stress markers including glutathione, superoxide dismutase, and malondialdehyde were assessed using standardized assays to evaluate antioxidative status. Clinical evaluations, including BMI measurements, were conducted pre- and post-treatment.

Statistical Analysis:

Descriptive statistics summarized demographic and clinical characteristics. Comparative analyses between treatment groups were performed using ANOVA or appropriate non-parametric tests for continuous variables, while categorical variables were assessed using chi-square tests. Longitudinal changes were analyzed using repeated measures ANOVA or mixed-effects models.

Results

There were total 240 patients, and mean age was 65.4± 7.2 years. The comparative analysis among distinct therapeutic groups in prostate cancer patients revealed nuanced variations in biochemical profiles and oxidative stress markers. Post-treatment, the surgery group demonstrated modest elevations in serum cholesterol and liver enzyme ALT levels, while the radiation group displayed a tendency towards increased glucose and ALT levels. Conversely, the pharmacological group exhibited a notable rise in serum cholesterol, glucose, and ALT levels. Oxidative stress markers, such as glutathione and superoxide dismutase, generally showed marginal alterations post-treatment across all groups, while malondialdehyde levels increased slightly, suggestive of oxidative stress induction. Clinical assessments demonstrated minimal changes in BMI and serum albumin, indicating relative stability in these parameters across treatments.

Table 01: Demographic characteristics of patients

Characteristics	Surgery Group (n=80)	Radiation Group (n=90)	Pharmacological Group (n=70)
Age (years), Mean ± SD	65.4 ± 7.2	64.8 ± 6.5	66.2 ± 8.0
Tumor Stage (I/II/III)	25/40/15	30/45/15	20/35/15

Table 02: Changes in biochemical parameters in all groups

Parameters	Surgery Group (Mean ± SD)	Radiation Group (Mean ± SD)	Pharmacological Group (Mean ± SD)
Serum Cholesterol (mg/dL), Baseline	190.5 ± 15.6	195.2 ± 18.3	192.8 ± 14.9
Serum Cholesterol (mg/dL), Post-Treatment	195.7 ± 18.9	200.5 ± 20.1	203.4 ± 19.5
Serum Glucose (mg/dL), Baseline	120.3 ± 9.8	125.0 ± 10.5	122.6 ± 11.2
Serum Glucose (mg/dL), Post-Treatment	124.5 ± 10.5	128.6 ± 11.8	130.2 ± 12.5
Serum ALT (U/L), Baseline	35.2 ± 4.3	37.8 ± 5.1	36.5 ± 4.8

Serum ALT (U/L), Post-Treatment	38.6 ± 5.2	40.5 ± 6.0	42.1 ± 5.5

Alterations in oxidative stress markers were observed across treatment groups (Table 3).

Table 03: Oxidative stress markers in all patients

Markers	Surgery Group (Mean ± SD)	Radiation Group (Mean ± SD)	Pharmacological Group (Mean ± SD)
Glutathione (µmol/L), Baseline	35.8 ± 3.5	36.2 ± 3.8	35.5 ± 3.2
Glutathione (µmol/L), Post-Treatment	37.2 ± 4.0	36.8 ± 4.2	34.9 ± 3.5
Superoxide Dismutase (U/mg), Baseline	12.5 ± 1.2	12.8 ± 1.4	12.3 ± 1.1
Superoxide Dismutase (U/mg), Post-Treatment	12.6 ± 1.3	12.9 ± 1.5	12.1 ± 1.0
Malondialdehyde (nmol/mL), Baseline	5.2 ± 0.6	5.4 ± 0.7	5.1 ± 0.5
Malondialdehyde (nmol/mL), Post-Treatment	5.8 ± 0.8	6.2 ± 0.9	6.0 ± 0.7

Changes in BMI and clinical parameters were observed pre- and post-treatment (Table 4).

Table 04: BMI and Clinical assessments

Parameters	Surgery Group (Mean ± SD)	Radiation Group (Mean ± SD)	Pharmacological Group (Mean ± SD)
BMI (kg/m²), Baseline	28.1 ± 2.9	27.8 ± 3.1	28.5 ± 2.7
BMI (kg/m²), Post-Treatment	27.9 ± 2.8	28.1 ± 3.0	28.7 ± 2.9
Serum Albumin (g/dL), Baseline	4.0 ± 0.3	4.1 ± 0.4	4.0 ± 0.3
Serum Albumin (g/dL), Post-Treatment	3.9 ± 0.3	4.0 ± 0.4	3.8 ± 0.3
Total Protein (g/dL), Baseline	7.2 ± 0.5	7.1 ± 0.6	7.3 ± 0.4
Total Protein (g/dL), Post-Treatment	7.1 ± 0.6	7.0 ± 0.7	7.2 ± 0.5

Discussion

The findings from this comparative study exploring biochemical parameters, oxidative stress markers, and clinical assessments in prostate cancer patients undergoing different therapeutic interventions shed light on the multifaceted impact of varied treatments on patient physiology [8]. The observed alterations in serum cholesterol, glucose, and liver enzyme ALT levels post-treatment across the surgery, radiation, and pharmacological groups suggest divergent metabolic responses. The surgery group exhibited subtle elevations in serum cholesterol, while the radiation group displayed tendencies towards increased glucose levels [9]. Notably, the pharmacological group presented notable rises in serum cholesterol, glucose, and ALT levels. These variations may signify distinct metabolic shifts induced by different treatments, potentially linked to treatment-specific side effects or alterations in metabolic homeostasis. Marginal changes in antioxidative markers, such as glutathione and superoxide dismutase, alongside slight elevations in malondialdehyde levels post-treatment, suggest a mild induction of oxidative stress across all treatment groups [10-13]. However, the relatively stable antioxidative markers hint at a potential compensatory mechanism to counteract oxidative stress, indicating the body's resilience in response to prostate cancer therapies. Minimal changes in BMI and serum albumin pre- and post-treatment imply overall stability in these parameters across diverse treatments. This stability in BMI and serum albumin levels suggests a relatively unaffected nutritional status and consistency in body composition despite undergoing different therapeutic interventions [13-15].

These findings underscore the complexity of physiological responses to distinct prostate cancer treatments. The observed variations in biochemical profiles and oxidative stress markers among treatment groups underscore the necessity for tailored monitoring and management strategies specific to each therapeutic approach. Understanding these treatment-induced alterations in biochemical and oxidative parameters may aid in predicting and managing treatment-related side effects, optimizing therapeutic outcomes, and potentially identifying biomarkers indicative of treatment response or toxicity.

Conclusion

It is concluded that distinct therapeutic interventions in prostate cancer elicit diverse metabolic shifts, as evidenced by treatment-specific alterations in biochemical profiles. While oxidative stress

markers showed marginal changes, stable clinical parameters suggest relative consistency in BMI and serum albumin across treatments.

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