RESEARCH PAPER

ANALYSIS OF DOSE SPECIFIC TOPICAL CHANGES IN POST CHEMOTHERAPY AND RADIATION THERAPY IN CANCER SURVIVORS

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ABSTRACT

Background: Chemotherapy and radiation therapy, two primary approaches to cancer treatment, can result in dose-dependent damage to body tissues, leading to complications like fatigue, muscle weakness, neuropathy, and fibrosis. These side effects may interfere with daily tasks, mobility, and overall well-being. Physiotherapy provides essential support in managing these complications through personalized rehabilitation strategies, including mobility enhancement, pain management, strengthening exercises, and balance training. Early physiotherapeutic intervention not only aids recovery but also prevents further complications and supports mental health. A clear understanding of how treatment doses affect tissues allows physiotherapists to develop more targeted and effective recovery plans.

Methods: This observational study assessed dose-related skin changes in cancer survivors who underwent chemotherapy and radiation. A custom-designed questionnaire was used to gather data from 50 participants. Ethical approval and informed consent were obtained prior to data collection.

Results: Participants, mostly in Stage 2 cancer, had undergone chemotherapy or radiation therapy. A significant number received high-dose treatments, with 88% experiencing skin problems such as dryness, redness, and itching—primarily after completing therapy. These symptoms mainly affected the face, neck, and chest, and disrupted daily activities for 90% of respondents. Many reported emotional challenges. Over 80% sought medical treatment, and 67% were referred to physiotherapy, which commonly involved skin care advice and mobility exercises. While many found these interventions moderately effective, a large number desired additional support.

Conclusion: Though essential in cancer care, chemotherapy and radiation can cause dose-related tissue reactions with both short- and long-term consequences. Gaining insights into these effects is crucial for improving therapeutic approaches. New techniques, such as proton therapy and precision drug delivery, are showing potential in reducing adverse reactions. Tailoring treatments to balance efficacy and long-term outcomes is key to improving survivors' quality of life.

Keywords: Cancer, Chemotherapy, Radiation therapy, Post-therapy , Topical Change

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INTRODUCTION

Cancer refers to a broad category of diseases marked by uncontrolled growth of abnormal cells, which can arise in nearly any organ or tissue. These diseases are classified based on where they originate and the type of cells involved, such as in leukemia, lymphomas, central nervous system tumors, and multiple myeloma. With advancements in early diagnosis and treatment, survival rates have improved significantly, leading to a growing number of long-term cancer survivors. However, the intense nature of treatments like chemotherapy and radiation often causes side effects—particularly in the skin, which has a high regeneration rate and is often exposed during therapy.

The skin is highly sensitive to cancer treatments and frequently shows visible reactions, including dryness, inflammation, pigment changes, peeling, and nail alterations. While some symptoms may fade after treatment ends, others can persist, affecting daily comfort, emotional health, and sometimes even disrupting therapy. Interestingly, in certain cases, skin changes may reflect how well the body is responding to treatment, especially with newer targeted therapies.

Although nearly 90% of cancer patients report skin-related side effects, these are often overlooked in clinical care. Lack of attention can worsen symptoms, increase the risk of complications like infections, and negatively affect mental health. Therefore, timely identification and proactive management—including education on skin care and support from healthcare professionals—are

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essential to improving the patient experience during and after treatment.

In addition to skin problems, cancer therapy may cause fatigue, nerve damage, muscle weakness, digestive issues, and emotional challenges such as anxiety or depression. Some of these side effects, particularly those related to tissue damage, are closely linked to the **dosage** and **location** of treatment. For instance, radiation targeted at the chest or abdomen may impair wound healing or cause deeper tissue complications like fibrosis.

Physiotherapy plays a critical role in helping patients manage these long-term effects. When movement is restricted due to pain, stiffness, or skin-related limitations, physiotherapists provide techniques to improve mobility, restore function, and promote independence. Their involvement can significantly enhance recovery, physical health, and emotional resilience for cancer survivors.

As care for cancer survivors continues to evolve, understanding how treatment doses influence skin and functional outcomes is crucial. A multidisciplinary approach that includes oncologists, dermatologists, physiotherapists, and mental health professionals can ensure better long-term care and overall well-being for survivors.

Chemotherapy-Induced Dose-Specific Changes:

Chemotherapy is aimed at destroying cancer cells, but it also harms healthy tissues that regenerate quickly—particularly the cells lining the digestive system. One of the most common and painful side effects is **mucositis**, a condition marked by inflammation and ulceration in the mouth or gastrointestinal lining. This not only causes discomfort but also affects a patient's ability to eat, drink, or maintain nutritional health, especially when undergoing aggressive chemotherapy or bone marrow transplantation. The root cause lies in the direct damage chemotherapy inflicts on mucosal tissues, triggering inflammation and cell breakdown.

Another serious complication is the **impact on heart health**. Certain chemotherapy agents, such as anthracyclines, are known to weaken heart muscles over time. If not closely monitored, this can lead to long-term cardiac issues, especially in patients receiving higher cumulative doses.

Additionally, many individuals experience **peripheral neuropathy** as a result of nerve damage. This leads to tingling, numbness, or weakness—typically in the hands and feet—which can interfere with balance, coordination, and daily activities. In some cases, these symptoms persist even after treatment ends, requiring ongoing support and rehabilitation.

Radiation Therapy-Induced Dose-Specific Changes

Radiation therapy targets cancer cells with high-energy beams, but nearby healthy tissues often get affected depending on treatment location, intensity, and duration. In the short term, patients may develop **skin redness, irritation, and peeling**. When radiation exposure is prolonged or repeated, it can lead to more serious outcomes such as **tissue fibrosis, vascular changes,** and **organ dysfunction.**

Radiation exposure to the abdominal region, particularly the intestines and pelvic organs, can result in **fibrotic changes, nutrient malabsorption, and potential intestinal obstruction.** The rectum and ileum are especially vulnerable to these complications.

Radiation can also have long-term neurological effects. One such condition, **radiation-induced lumbar plexopathy,** may develop gradually and manifest as **numbness, muscle weakness, or pain in the lower back and legs.** These symptoms can appear years after the initial treatment, making it difficult to diagnose and manage without a detailed clinical history.

Dose-Effect Relationships and Long-Term Implications

Understanding how treatment intensity impacts long-term patient outcomes is essential in planning effective cancer care. **Higher cumulative doses of chemotherapy or radiation are strongly associated with an increased risk of complications.** For instance, children who undergo cranial radiation are more likely to experience **developmental delays, hormonal imbalances, or nervous system disorders** later in life. These observations highlight the importance of carefully balancing treatment effectiveness with safety.

Another serious long-term concern is the possibility of developing **secondary cancers** due to prolonged radiation exposure. In some cases, new tumors such as **radiation-induced sarcomas** may arise years after the original cancer has been treated. This underlines the importance of advanced, **targeted delivery techniques** that limit exposure to healthy tissues while maintaining therapeutic benefits.

To reduce such risks, modern oncology practices are shifting toward more precise methods like **proton beam therapy** and **customized drug regimens**. These innovations aim to achieve high cancer control while minimizing harm to non-cancerous tissues. Carefully considering the **dose-response relationship** during treatment planning can lead to better survivorship outcomes and improved overall quality of life.

Method :The Analytical study was carried out among 50Cancer survivors. The study was carried out by sending Google Forms from different social media platforms. Self made questionnaire was formed for check the analysis of dose specific topical changes in post chemotherapy and radiation therapy in cancer survivors. A case sheet was made which included name, age and gender. The random sampling method was used because of limited time. The collected data were analyzed by a statistician using an instant application. Chi-square test was used to analyze the questions. Forms were sent to the

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cancer survivours who aged between 20 to 65 years and taken the chemotherapy and Radiation Therapy.

Inclusion Criteria :The study was conducted among cancer survivors who belonged to the age group of 20 to 65 years. The questionnaire was given to those who were willing to participate in the study. Patients who have completed treatment chemotherapy and radiation Therapy.

Exclusion Criteria :The research excluded individuals with any skin infection ,skinallergy ,some autoimmune disorder, sickle cell anemia and patients with severe cognitive impairment or dementia .

Ethical Committee Approval

The approval for this study is gained from the Institutional Ethics Committee of Krishna Vishwa Vidyapeeth(Deemed to be University), Karad. Respondents were given a detailed explanation about the study which is to be conducted and inform consent was collected from each and every participant participating in this study. There was a volunteer involvement of all the respondents in this study whose confidentiality was thoroughly maintained.

RESULTS:

Section 1: Cancer Stage and Treatment

1. Most participants (42.85%) were in Stage 2 of cancer, followed by 26.53% in Stage 3, 20.40% in Stage 4, and 12.24% in Stage 1.
2. Radiation therapy (42.85%) and chemotherapy (36.73%) were the most common current treatments.
3. Smaller groups underwent surgery (8.16%), immunotherapy (2.04%), targeted therapy (2.04%), or other treatments (8.16%).

Section 2: General Treatment Information

4. A high percentage (87.75%) received high-dose chemotherapy.
5. More than half (55.10%) of those receiving radiation therapy had doses above 50 Gy.
6. About 87.75% of participants reported experiencing skin-related issues after their cancer diagnosis.
7. Skin changes began mostly after treatment (81.63%), with fewer reporting them during (16.32%) or before (2.04%) treatment.

Section 3: Types and Areas of Skin Changes

8. Common skin changes included dryness (42.85%), itching (14.28%), redness/rash (10.20%), swelling (8.16%), and peeling (6.12%).
9. Less common changes were skin discoloration (2.04%), thickened skin (4.08%), and others (10.20%).
10. The face was the most affected area (40.81%), followed by the neck (20.40%) and chest (20.40%).
11. Moderate skin changes were most reported (71.42%), while 20.40% had mild and 8.16% had severe changes.

Section 4: Impact on Daily Life

12. Around 89.79% said skin changes affected their daily activities.
13. Mobility difficulties (65.30%) and discomfort/pain (20.40%) were the main issues.
14. A majority (71.42%) experienced some emotional or psychological distress, while 8.16% experienced high distress and 20.40% had none.

Section 5: Management and Physiotherapy

15. Medical advice was sought by 81.63% of participants.
16. Treatments included topical creams (38.77%), oral medications (22.44%), physiotherapy referrals (30.61%), and others (8.16%).
17. About 67.34% were referred to physiotherapy.
18. Physiotherapy interventions included mobility exercises (40.81%), skin care advice (38.77%), scar mobilization (8.16%), and other methods (12.24%).

Section 6: Treatment Feedback

19. Most participants found treatment somewhat effective (79.59%), while 16.32% found it very effective and 4% found it ineffective.
20. 63.26% expressed interest in receiving additional support for managing skin changes.

Section 1

1. Stage of Cancer

	Frequency	Percentage
Stage1	6	12.24%
Stage2	21	42.85%
Stage3	13	26.53%
Stage4	10	20.40%

2. Which current treatment you are undergoing?

	Frequency	Percentage
Chemotherapy	18	36.73%
Radiation Therapy	21	42.85%
Surgery	4	8.16%
Immunotherapy	1	2.04%
Targeted Therapy	1	2.04%
Other	4	8.16%

Section 2 : General information

1. If chemotherapy, did your treatment involved high dose chemotherapy?

	Frequency	Percentage
Yes	43	87.75%

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No	6	12.24%

2. If radiation therapy, was the total dose above 50 Gy?

	Frequency	Percentage
Yes	27	55.10%
No	22	44.89%

3. Have you experienced any skin related issues since your cancer diagnosis?

	Frequency	Percentage
Yes	43	87.75%
No	6	12.24%

4. If yes, when did skin changes start?

	Frequency	Percentage
Before treatment	1	2.04%
During Treatment	8	16.32%
After treatment	40	81.63%

Section 3 : Skin changes

1. What types of skin changes have you noticed?

	Frequency	Percentage
Dryness	21	42.85%
Itching(Pruritus)	7	14.28%
Redness or rash	5	10.20%
Swelling or inflammation	4	8.16%
Peeling or scaling	3	6.12%
Skin discoloration	1	2.04%
Open wounds or ulcers	0	0%
Thickened or hardened skin	2	4.0%8
Other	5	10.20%

2. On which parts of your body have these changes occurred?

	Frequency	Percentage
Face	20	40.81%
Neck	10	20.40%
Thighs	1	2.04%
Arms	3	6.12%
Legs	2	4.08%
Chest	10	20.40%
Abdomen	2	4.08%
Back	0	0%
Other	1	2.0%4

3. How severe are these skin changes?

	Frequency	Percentage
Mild	10	20.40%
Moderate	35	71.42%
Severe	4	8.16%

Section 4 : Impact on daily life

1. Have these skin changes affected your daily activities?

	Frequency	Percentage
Yes	44	89.79%
No	5	10.20%

2. If yes, how have they affected your daily activities?

	Frequency	Percentage
Difficulty with mobility	32	65.30%
Discomfort or pain	10	20.40%
Impact on self-esteem or appearance	0	0%
Problems with wearing certain clothing	0	0%
Other	2	4.08%

3. Do you experience emotional/ psychological distress due to these skin changes?

	Frequency	Percentage
Not at all	10	20.40%
Somewhat	35	71.42%
Very much	4	8.16%

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Section 5 : Management and treatment

1. Have you sought medical advice for these skin changes?

	Frequency	Percentage
Yes	40	81.63%
No	9	18.36%

2. If yes, what treatments or recommendations were provided?

	Frequency	Percentage
Topical creams or ointments	19	38.77%
Oral medications	11	22.44%
Referral to physiotherapy	15	30.61%
Other	4	8.16%

3. Were you referred to physiotherapy for managing these skin changes?

	Frequency	Percentage
Yes	33	67.34%
No	16	32.65%

4. If yes, what types of physiotherapy interventions were provided?

	Frequency	Percentage
Skin care advice	19	38.77%
Exercises for mobility	20	40.81%
Manual lymphatic drainage or compression bandaging therapy	0	0%
Scar tissue mobilization	4	8.16%
TENS	0	0%
Other	6	12. 24%

Section 6 :Feedback

1. How effective have the treatments been in managing your skin changes?

	Frequency	Percentage
Not effective	2	4%
Somewhat effective	39	79.59%
Very effective	8	16.32%

2. Would you like additional support for managing your skin changes?

	Frequency	Percentage
Yes	31	63.26%
No	18	36.73%

DISCUSSION: This study highlights how cancer treatments, particularly chemotherapy and radiation therapy, lead to noticeable and often distressing changes in the skin, especially when administered in higher doses. A large proportion of participants reported visible skin reactions, supporting previous evidence that such side effects are both common and impactful during and after cancer treatment.

The skin complications observed—such as dryness, rashes, itching, thickening, and discoloration—were more pronounced in patients who had received **higher radiation doses (above 50 Gy)** or **high-intensity chemotherapy regimens**. These findings emphasize the **clear relationship between treatment dose and symptom severity**, aligning with established oncology literature. Areas like the **face, neck, and chest** were most frequently affected, which coincides with radiation exposure zones for head, neck, and breast cancers.

Beyond the physical symptoms, these skin changes also had functional and emotional consequences. Many participants reported **difficulty with daily activities**—such as walking, dressing, or maintaining hygiene—due to pain, tightness, or fragile skin. This reduced independence and mobility, negatively affecting their self-image and overall well-being. A large number of patients also experienced **emotional distress**, highlighting the psychological toll these complications impose.

While a majority of patients sought medical help for these issues, **physiotherapy referrals were limited,** and **specialized rehabilitation strategies** like **manual lymphatic drainage (MLD), scar tissue mobilization,** and **electrotherapy (TENS)** were **not utilized at all.** These techniques have proven benefits in managing tissue stiffness, edema, and scarring, yet were missing from patients' care routines. This gap points to a lack of integrated, multi-disciplinary support for cancer survivors facing long-term physical limitations.

Furthermore, while many patients received some form of intervention, only a small portion found it highly effective. A significant number continued to require support for their symptoms, indicating that current

rehabilitation practices may not fully address survivors' needs.

These findings underscore the importance of **early recognition and comprehensive rehabilitation** in cancer aftercare. A **collaborative care model**—involving oncologists, dermatologists, physiotherapists, and mental health professionals—is essential for addressing the complex effects of treatment. Educating patients about skincare and introducing timely physiotherapy can greatly improve outcomes by preserving function, relieving symptoms, and promoting mental well-being.

CONCLUSION: Chemotherapy and radiation therapy remain foundational components of cancer treatment, yet they often lead to a range of short- and long-term adverse effects, especially when administered in high doses. These dose-dependent changes can significantly impact various tissues and organs, contributing to both physical and emotional challenges for cancer survivors.

To enhance survivorship care, it's vital to understand how different treatment intensities affect the body. This knowledge enables healthcare providers to optimize therapy protocols in a way that maintains cancer control while minimizing complications. Advances in medical technology—such as **proton therapy** and **precision-targeted drug delivery**—are emerging as promising strategies to reduce the severity of tissue damage caused by traditional treatments.

Ultimately, providing high-quality care to cancer survivors requires a personalized and balanced approach—one that prioritizes both treatment effectiveness and the patient's long-term well-being. By tailoring interventions and monitoring post-treatment effects closely, the overall quality of life for cancer survivors can be significantly improved.

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Conflict of Interest: None

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