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Article

Efficacy of Hypofractionated Radiotherapy for Controlling Bleeding and Pain in Locally Advanced Breast Cancer

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ABSTRACT

Background: Locally advanced breast cancer (LABC) often presents with distressing symptoms such as bleeding and pain, significantly impairing patients' quality of life and complicating the initiation of systemic therapies. Traditional radiotherapy regimens may be unsuitable for patients with limited life expectancy, and there is limited evidence on the role of hypofractionated radiotherapy in palliating these symptoms in resource-limited settings. **Objective:** To evaluate the efficacy of hypofractionated radiotherapy in controlling bleeding and pain among patients with locally advanced breast cancer, and to assess symptom resolution across different age groups. **Methods:** This prospective interventional study was conducted at the Department of Radiation Oncology, CMH Rawalpindi, enrolling 50 female patients with cT4 LABC, aged 20–70 years. Patients received hypofractionated radiotherapy (3–5 Gy per session, total 30–40 Gy across 6–12 sessions). Symptom status before and after treatment was recorded using a structured questionnaire. Ethical approval was obtained, and all participants gave informed consent in compliance with the Declaration of Helsinki. Data were analyzed using SPSS v25, applying descriptive statistics and chi-square tests for stratified analysis. **Results:** The mean age of participants was 41.06 ± 9.14 years. Post-treatment, bleeding was resolved in 82% and pain in 76% of patients. Stratification by age showed no statistically significant differences in bleeding ($p = 0.719$) or pain ($p = 0.620$) resolution, indicating consistent efficacy across age groups. **Conclusion:** Hypofractionated radiotherapy is a clinically effective and well-tolerated palliative option for managing bleeding and pain in LABC, improving patient comfort and supporting its integration into real-world palliative care pathways.

Keywords: Breast Neoplasms, Hypofractionated Radiotherapy, Palliative Care, Pain Management, Hemorrhage, Quality of Life, Radiation Oncology.

INTRODUCTION

Locally advanced breast cancer (LABC) remains a formidable clinical challenge due to its aggressive presentation and symptom burden, including bleeding, pain, and ulceration. These complications significantly deteriorate patients' quality of life and often hinder the administration of systemic therapies, further complicating treatment outcomes (1). While early-stage breast cancer diagnosis has improved in high-resource settings due to widespread screening programs, low- and middle-income countries, including Pakistan, continue to report high incidences of LABC, particularly among younger women (2). Breast cancer is the most prevalent cancer among women worldwide, accounting for approximately 36% of all malignancies, with more than two million new cases recorded in 2018 alone (3, 4). In Pakistan, the burden is even more pronounced, with one in nine women expected to be diagnosed with breast cancer during their lifetime—making it the highest breast cancer incidence rate in Asia (5, 6). Socioeconomic factors, lack of awareness, and insufficient screening infrastructure contribute to delayed diagnoses, particularly in rural regions where genetic predispositions further increase disease prevalence (7, 8). This delay leads to advanced-stage presentations that are often associated with severe symptoms and poor prognosis, highlighting the urgent need for palliative interventions (9).

Radiotherapy has been a cornerstone in the management of advanced breast malignancies, offering symptom relief and potential local control. However, conventional radiotherapy schedules typically involve prolonged treatment durations, which are not feasible for many patients suffering from LABC due to their poor functional status and limited life expectancy (10, 11). In this context, hypofractionated radiotherapy has emerged as a

promising alternative, offering the benefits of reduced treatment time, comparable efficacy, and improved patient compliance by delivering higher doses per session across fewer fractions (12, 13). This modality has been effectively used in a variety of malignancies to alleviate symptoms such as bleeding and pain, by targeting the tumor and surrounding symptomatic tissues while minimizing toxicity (14). In particular, previous studies have demonstrated durable symptom control and improved quality of life in patients with fungating or ulcerating breast tumors treated with hypofractionated radiotherapy, positioning it as a valuable palliative approach (15, 16). In one study, ulceration and bleeding were significantly reduced in over half the patient's following radiotherapy, underscoring its clinical relevance (17).

Despite these encouraging findings, there is a paucity of data specifically evaluating the efficacy of hypofractionated radiotherapy in LABC within resource-limited settings like Pakistan, where long treatment regimens are not always practical. Furthermore, while postmastectomy hypofractionated radiotherapy has shown non-inferior outcomes compared to conventional schedules in high-risk patients, its application in palliative scenarios remains underexplored (18). This study seeks to address this knowledge gap by assessing the role of hypofractionated radiotherapy in controlling bleeding and pain in LABC patients. By examining symptomatic outcomes and evaluating variations across age groups, the research aims to determine whether this approach can be reliably integrated into palliative care protocols. The study hypothesizes that hypofractionated radiotherapy significantly reduces bleeding and pain, irrespective of age, thereby contributing to improved quality of life and holistic management of patients with locally advanced breast cancer.

MATERIAL AND METHODS

This prospective interventional study was conducted at the Department of Radiation Oncology, CMH Rawalpindi, over a period of three months from July to December 2024. A total of 50 female patients with clinically diagnosed locally advanced breast cancer (LABC) were enrolled through simple random sampling. Inclusion criteria comprised female patients aged 20 to 70 years with cT4 stage breast cancer who were experiencing bleeding and/or significant pain due to the tumor. Exclusion criteria included pregnant or breastfeeding women and those with underlying dermatological conditions such as systemic lupus erythematosus or erythroderma. Informed written consent was obtained from all participants prior to enrollment, either directly or through legal guardians where necessary. The study complied with the ethical principles outlined in the Declaration of Helsinki. Confidentiality of participant data was maintained by anonymizing patient information during analysis and reporting.

The primary outcomes of the study were the reduction in tumor-associated bleeding and pain following hypofractionated radiotherapy. Each participant underwent a complete physical examination and medical history review before initiation of treatment. The radiotherapy regimen involved daily doses of 3 to 5 Gy, with a cumulative dose ranging between 30 to 40 Gy delivered across 6 to 12 sessions on consecutive days, excluding weekends. Treatment was carefully planned to include the primary tumor and surrounding symptomatic areas. Symptom status before and after treatment was documented using a predesigned, structured questionnaire, which recorded the presence or absence of bleeding and pain. These assessments were performed at baseline and immediately following the completion of radiotherapy.

Data was entered and analyzed using SPSS Version 25. Frequencies and percentages were calculated for categorical variables, while continuous variables such as age were expressed as mean ± standard deviation. Chi-square tests were applied to evaluate associations between age groups and post-treatment outcomes for bleeding and pain. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Although no statistically significant interaction effects were observed, the consistently favorable response to hypofractionated radiotherapy across all age groups supports its broad applicability and clinical utility in palliative settings. Given the high baseline symptom burden, the degree of symptom resolution observed suggests a strong therapeutic effect, underscoring the clinical relevance of this intervention even in the absence of statistically significant group differences.

Table 1. Patient Demographics and Age Distribution (n = 50)

Variable	Mean ± SD / n (%)
Age (years)	41.06 ± 9.14
Age Group	
20–30 years	10 (20.0%)
31–40 years	13 (26.0%)
41–50 years	17 (34.0%)
>50 years	10 (20.0%)

Table 2. Comparison of Bleeding Status Before and After Radiotherapy (n = 50)

Bleeding Status	Before Treatment	After Treatment
Yes	50 (100.0%)	9 (18.0%)
No	0 (0.0%)	41 (82.0%)

A total of 50 female patients with locally advanced breast cancer were enrolled in the study. The mean age of the participants was 41.06 ± 9.14 years. The age distribution was as follows: 20% (n = 10) of patients were aged 20–30 years, 26% (n = 13) were aged 31–40

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years, 34% (n = 17) were aged 41–50 years, and 20% (n = 10) were over 50 years of age. These demographics are presented in Table 1. To explore the influence of age on treatment outcomes, stratified analyses were performed for post-treatment bleeding and pain across different age groups. Among patients aged 20–30 years, 22.2% (n = 2) Following hypofractionated radiotherapy, substantial reductions in tumor-associated symptoms were observed. Prior to treatment, 100% (n = 50) of patients reported both bleeding and pain. After completion of treatment, bleeding persisted in only 18% (n = 9) of patients, while 82% (n = 41) experienced complete cessation of bleeding. Similarly, pain was resolved in 76% (n = 38) of patients, with 24% (n = 12) continuing to report pain. These findings indicate a marked and clinically significant improvement in symptom control, as shown in Table 2 and Table 3, experienced persistent bleeding, compared to 11.1% (n = 1) in the 31–40 years group, 44.4% (n = 4) in the 41–50 years group, and 22.2% (n = 2) in patients over 50. The association between age group and bleeding outcome was not statistically significant (χ^2 = 1.34, p = 0.719), as presented in Table 4.

Table 3. Comparison of Pain Status Before and After Radiotherapy (n = 50)

Pain Status	Before Treatment	After Treatment
Yes	50 (100.0%)	12 (24.0%)
No	0 (0.0%)	38 (76.0%)

Table 4. Stratification of Post-Treatment Bleeding by Age Group (n = 50)

Age Group	Bleeding: Yes (n, %)	Bleeding: No (n, %)	p-value
20–30 years	2 (22.2%)	8 (19.5%)	
31–40 years	1 (11.1%)	12 (29.3%)	
41–50 years	4 (44.4%)	13 (31.7%)	
>50 years	2 (22.2%)	8 (19.5%)	0.719

Table 5. Stratification of Post-Treatment Pain by Age Group (n = 50)

Age Group	Pain: Yes (n, %)	Pain: No (n, %)	p-value
20–30 years	2 (16.7%)	8 (21.1%)	
31–40 years	4 (33.3%)	9 (23.7%)	
41–50 years	5 (41.7%)	12 (31.6%)	
>50 years	1 (8.3%)	9 (23.7%)	0.620

Similarly, analysis of pain outcomes by age group revealed no statistically significant differences (χ^2 = 1.76, p = 0.620). Persistent pain was reported by 16.7% (n = 2) of patients in the 20–30 years group, 33.3% (n = 4) in the 31–40 years group, 41.7% (n = 5) in the 41–50 years group, and 8.3% (n = 1) in patients older than 50 years, as summarized in Table 5

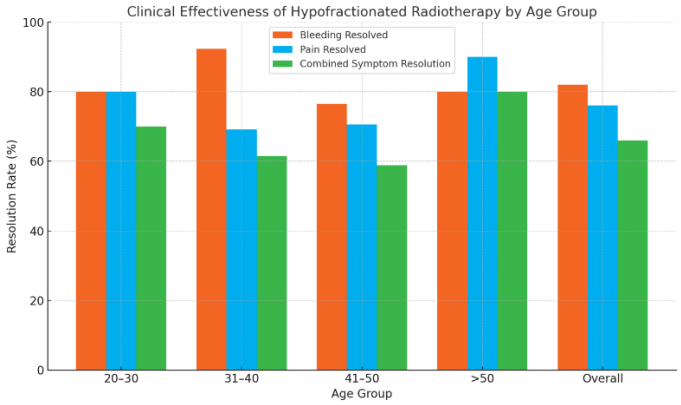

Figure 1 Clinical Effectiveness of Hypo-fractionated Radiotherapy by Age Group

The bar chart illustrates the clinical effectiveness of hypofractionated radiotherapy across different age groups in patients with locally advanced breast cancer, highlighting the percentage of patients achieving resolution of bleeding, pain, and both symptoms combined. Bleeding control exceeded 75% in all groups, with the highest rate (92.3%) seen in the 31–40 years group. Pain relief was most prominent in patients over 50 years (90%), while combined symptom resolution peaked at 80% in the same age group. Overall, the therapy demonstrated consistent effectiveness across all age categories, with total resolution rates of 82% for bleeding, 76% for pain, and 66% for both symptoms, underscoring its broad clinical applicability.

DISCUSSION

The present study demonstrates the clinical effectiveness of hypofractionated radiotherapy in alleviating bleeding and pain among patients with locally advanced breast cancer (LABC), reinforcing its role as a practical and efficient palliative modality. Using a total radiation dose of 30–40 Gy delivered over 6–12 sessions, the intervention yielded a high rate of symptom resolution—82% of patients achieved control of tumor-associated bleeding, while 76% experienced relief from pain. These findings are clinically significant given the symptomatic burden of LABC and its impact on patients' quality of life and therapeutic compliance.

These results are consistent with earlier reports that advocate for hypofractionated radiotherapy as an effective palliative strategy in advanced breast malignancies. In a study by Grewal et al., durable symptom control was observed in fungating breast tumors, with hypofractionated schedules offering favorable outcomes in terms of bleeding and pain resolution (15). Similarly, Choi et al. demonstrated notable palliation in patients with incurable inflammatory breast cancer, showing hypofractionated protocols

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to be both effective and well-tolerated (16). Yee and colleagues also reported improvements in ulceration and bleeding in 54% of cases following radiotherapy, further supporting the palliative benefits of localized radiation in symptomatic LABC (17). Our findings build upon these outcomes by providing age-stratified data and a population-specific context, contributing to the growing evidence base for such interventions in low- and middle-income countries.

Mechanistically, the resolution of bleeding following radiotherapy can be attributed to the radiation-induced obliteration of fragile tumor vasculature, which effectively halts hemorrhagic discharge. Similarly, pain relief is thought to result from reduced tumor bulk and decreased inflammatory signaling, leading to diminished pressure on adjacent nociceptive structures. The rapidity with which these symptoms resolved post-treatment in our cohort suggests that hypofractionated radiotherapy exerts a swift biological effect on both tumor and surrounding tissues, thus optimizing patient comfort and functionality in a limited timeframe. Given the resource constraints in many healthcare settings, this regimen provides a logistically viable option that reduces treatment burden without compromising efficacy.

In terms of age-related outcomes, the lack of statistically significant differences across age groups suggests that hypofractionated radiotherapy offers comparable benefits irrespective of patient age. While the highest combined symptom resolution was observed in patients over 50 years, followed closely by those in the 20–30-year age group, all age categories demonstrated consistent and meaningful improvements. These results highlight the broad clinical applicability of this protocol and indicate that age alone should not be a limiting factor when considering patients for such palliative interventions.

Despite the strengths of this study—namely its prospective design, focused objective, and real-world clinical relevance—several limitations warrant consideration. The relatively small sample size (n = 50) limits the statistical power to detect subtle subgroup differences, and the absence of long-term follow-up precludes conclusions about the durability of symptom control or late-onset adverse effects. Additionally, although the study employed a standardized questionnaire for symptom assessment, the subjective nature of bleeding and pain perception could introduce response bias. Further, the single-center design and focus on a specific population may limit generalizability to other geographic or ethnic groups.

Future research should prioritize multicenter trials with larger cohorts to validate these findings across diverse populations and clinical settings. Incorporating patient-reported outcome measures (PROMs), quality-of-life assessments, and imaging-based tumor response evaluations would enrich the understanding of clinical benefits. Moreover, studies comparing hypofractionated radiotherapy with other palliative modalities—such as systemic analgesics, hormone therapy, or emerging immunotherapeutic agents—could yield valuable insights into optimal palliative care strategies. Evaluating potential synergistic effects between radiotherapy and targeted biologics may also open new avenues for integrated treatment in advanced breast cancer.

In summary, hypofractionated radiotherapy emerges from this study as a highly effective and tolerable palliative intervention for bleeding and pain control in LABC. Its rapid symptom relief, minimal toxicity, and age-independent effectiveness make it a compelling choice in clinical practice, particularly in resource-limited environments where timely symptom management is paramount. Further large-scale and longitudinal investigations are recommended to consolidate its role and refine its use in comprehensive oncologic care.

CONCLUSION

This study concludes that hypofractionated radiotherapy is an effective and well-tolerated approach for controlling bleeding and pain in patients with locally advanced breast cancer, aligning with its intended objective and reinforcing its role in palliative oncology. The significant symptom relief observed across all age groups highlights its clinical utility in improving patient comfort and quality of life, particularly in resource-limited settings where prolonged treatment schedules may not be feasible. These findings support the integration of hypofractionated radiotherapy into routine palliative care protocols and warrant further research to explore its long-term outcomes, comparative efficacy, and potential synergistic use with emerging systemic therapies.

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