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Research Article

Comparative Study of Two Thoracic External Beam Radiotherapy Regimen 30Gy in 10 Fractions Versus 20Gy in 5 Fractions for Palliation of Symptoms in Non-Small Cell Lung Cancer

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Abstract

Metastatic non-small cell lung cancer (NSCLC) frequently manifests with symptoms from the primary tumor within the chest, such as shortness of breath, chest pain, coughing, and hemoptysis. Thoracic palliative radiotherapy is a viable option for alleviating symptoms in these patients, who typically have a poor prognosis and are not candidates for curative treatment. Given their limited survival, a shorter treatment period that achieves adequate palliation is often preferred. Hypofractionated thoracic radiotherapy may meet this criterion. This quasi-experimental study, conducted at the Department of Radiotherapy, Rajshahi Medical College Hospital from January to December 2020, aimed to compare the response and acute toxicity of two thoracic external beam radiotherapy (EBRT) regimens—30 Gy in 10 fractions versus 20 Gy in 5 fractions—in the palliation of symptoms in NSCLC patients. Seventy-two diagnosed NSCLC patients with chest tumor-related symptoms (cough, dyspnea, hemoptysis, chest pain) unsuitable for radical treatment were enrolled and allocated into two groups by a non-randomized technique. Arm-A received 30 Gy in 10 fractions, while Arm-B received 20 Gy in 5 fractions. Patients were assessed before radiotherapy, at the end of treatment, and at 4 and 8 weeks post-treatment. The study found that both Arm-A and Arm-B showed highly significant improvement in all symptoms compared to pre-treatment status ($p < 0.001$), with no significant difference between the two arms ($p > 0.05$). In Arm-A, 22.22% of patients achieved complete symptomatic response and 44.44% showed improvement, while in Arm-B, 19.44% of patients achieved complete symptomatic response and 50% showed improvement. No statistically significant difference was observed between the two arms regarding clinical symptomatic response ($p > 0.05$) or treatment-related toxicities ($p > 0.05$), all of which were manageable. In conclusion, both treatment regimens were equally effective in symptom palliation and had comparable toxicity profiles, supporting the use of either regimen depending on patient needs and resource availability.

Keywords

NSCLC, Palliative Radiotherapy, Palliation of Symptom

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1. Introduction

Lung cancer continues to be a major contributor to cancer-related illness and death across the globe, with non-small cell lung cancer (NSCLC) making up roughly 85% of all cases. In 2018 alone, lung cancer accounted for 2.1 million new diagnoses and 1.8 million deaths worldwide, highlighting its significant effect on public health [1]. In Bangladesh, lung cancer represented 8.3% of all cancer incidences in 2020 (The Global Cancer Observatory, 2020). NSCLC is typically diagnosed at an advanced stage, with the majority of patients presenting in either stage III (locally advanced) or stage IV (metastatic) of the disease [2]. At these stages, the disease is generally considered incurable with currently available therapies [3].

For patients with metastatic NSCLC, curative treatments such as surgery or high-dose radiotherapy are often not feasible due to the extensive tumor burden, presence of metastases, or the patient's overall fitness and comorbidities [4]. As a result, the main treatment focus shifts to palliation, which aims to enhance the quality of life (QOL) for individuals with life-threatening illnesses [3]. Palliative care for NSCLC can be categorized into supportive care—encompassing interventions like antibiotics, corticosteroids, pain relievers, antiemetics, transfusions, and psychosocial support—and tumor-directed therapy, which seeks to improve patient wellbeing by directly targeting the cancer to reduce tumor size and relieve symptoms [5].

Among the tumor-directed palliative treatments, palliative radiotherapy is a cornerstone for managing symptoms such as hemoptysis, cough, and dyspnea in patients with locally advanced NSCLC. It is an effective, relatively inexpensive method that can improve QOL and may also prolong survival [6]. Thoracic external beam radiotherapy (EBRT) is particularly significant for symptom reduction and QOL improvement in these patients [5]. However, the optimal dose-fractionation schedule for palliative radiotherapy remains a subject of debate. The choice of schedule is crucial as it must balance the effectiveness of symptom palliation with patient convenience and the minimization of treatment-related toxicities [4].

Despite international consensus guidelines, there is considerable variation in dosing and fractionation practices, leading to heterogeneous clinical practices among clinicians [7]. Higher doses per fraction, such as 30 Gy in 10 fractions, have shown improved symptom control and survival but are associated with higher toxicities, including radiation esophagitis, pneumonitis, and cardiac toxicities [8]. On the other hand, lower fractions, such as 20 Gy in 5 fractions, have demonstrated more patient compliance and fewer side effects, while still providing reasonable symptomatic control [9]. This variability underscores the need for further research to identify the most effective and tolerable regimen for palliative care in NSCLC patients.

Optimal palliation of patients with incurable NSCLC requires careful decision-making regarding the dose and fractionation of radiotherapy. The selected regimen should aim to provide effective symptom relief with minimal toxicity and inconvenience for the patient. A standard regimen should also consider the patient's overall health status, treatment duration, and economic factors. This study aims to compare the effectiveness and acute toxicity profiles of two commonly used thoracic EBRT regimens—30 Gy in 10 fractions versus 20 Gy in 5 fractions—in patients with NSCLC.

A quasi-experimental study was carried out in the Department of Radiotherapy at Rajshahi Medical College Hospital between January 2020 and December 2020. A total of 72 patients diagnosed with NSCLC, presenting with primary chest-related symptoms (such as cough, dyspnea, hemoptysis, and chest pain) and deemed unsuitable for radical treatment via surgery or high-dose radiotherapy, were included in the study. The patients were divided into two groups using a non-randomized method Group A (Arm A) received thoracic EBRT at 30 Gy in 10 fractions, while Group B (Arm B) received thoracic EBRT at 20 Gy in 5 fractions. Evaluations were performed before the start of radiotherapy, at the conclusion of treatment, and at 4 and 8 weeks post-treatment.

This indicates that either regimen can be used based on patient preference, convenience, and other individual factors. Given the high burden of lung cancer in Bangladesh and the need for cost-effective treatment options, the results of this study could help inform clinical practice and improve patient outcomes. In summary, this study adds to the ongoing debate regarding the most suitable dose-fractionation schedule for palliative thoracic EBRT in patients with NSCLC. The findings indicate that both 30 Gy in 10 fractions and 20 Gy in 5 fractions are equally effective and well-tolerated, offering flexibility in treatment planning based on patient-specific needs and the availability of healthcare resources. Further research, including larger-scale studies, is required to validate these results and improve guidelines for the palliative management of NSCLC, ultimately striving to enhance the quality of life for affected patients.

2. Manuscript Formatting

2.1. Figures

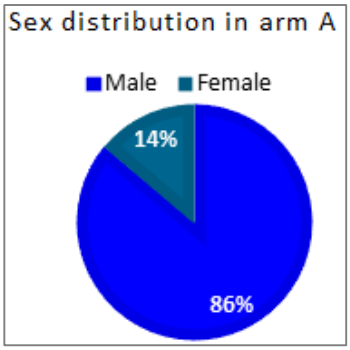

Figure 1. *Sex distribution of the study patients in Arm A (n=36).*

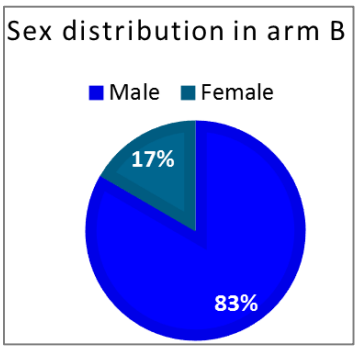

Figure 2. Sex distribution of the study patients in Arm B (n=36).

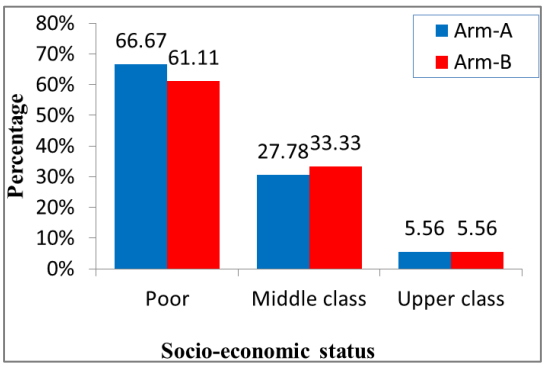

Figure 3. Socio-economic status of the study patients (N=72).

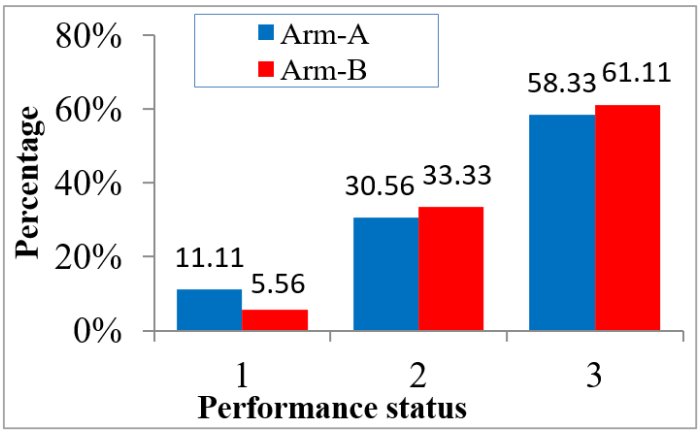

Figure 4. ECOG performance status of the study patients (N=72).

2.2. Tables

Table 1. Age distribution of patients in two arms.

Age (years)	Total		Arm-A		Arm-B		p-value
	N=72	%	n=36	%	n=36	%	
Age group							
≤ 40	3	4.17	2	5.56	1	2.78	
41-50	11	15.28	5	13.89	6	16.67	
51-60	38	52.78	19	52.78	19	52.78	a0.935
61-70	20	27.78	10	27.78	10	27.78	b0.788
Mean±SD	56.39±7.82		56.14±8.13		56.64±7.56		
Range (min-max)	38-70		38-70		40-70		

[a]p value reached from Chi-square Test; [b]p value reached from unpaired t-test

Table 2. *Distribution of study patients according to educational status.*

Education	Total		Arm-A		Arm-B		p-value
	N=72	%	N=36	%	N=36	%	
No formal education	50	69.44	25	69.44	25	69.44	
Below Primary	11	15.28	5	13.89	6	16.67	
Above primary to SSC	6	8.33	3	8.33	3	8.33	0.980
HSC	3	4.17	2	5.56	1	2.78	
Graduate	2	2.78	1	2.78	1	2.78	

p value reached from Chi-square Test

Table 3. *Distribution of study patients according to occupation.*

Occupation	Total		Arm-A		Arm-B		p-value
	N=72	%	N=36	%	N=36	%	
Farmer	41	56.94	19	52.77	22	61.11	
Housewife	11	15.27	6	16.67	5	13.88	
Service holder	7	9.72	4	11.11	3	8.33	0.967
Business	4	5.56	2	5.56	2	5.56	
Others	9	12.50	5	13.88	4	11.11	

p value reached from Chi-square Test

Table 4. *Risk factors of patients in two arms.*

Risk factors	Total		Arm-A		Arm-B		p-value
	N=72	%	N=36	%	N=36	%	
H/o smoking	55	76.38	29	80.55	26	72.22	a0.405
Occupational exposure	46	63.89	22	61.11	24	66.67	a0.623
COPD	10	13.89	4	11.11	6	16.67	a0.496
Pulmonary TB	14	19.44	8	22.22	6	16.67	a0551
Family history of cancer	6	8.33	4	11.11	2	5.56	b0.674

[a]p value reached from Chi-square Test; [b]p value reached from unpaired t-test.

Table 5. *Distribution of study patients according to histological type.*

Histological type	Total		Arm-A		Arm-B		p-value
	N=72	%	N=36	%	N=36	%	
Squamous cell carcinoma	46	63.89	22	61.11	24	66.67	
Adenocarcinoma	24	33.33	13	36.11	11	30.56	0.881
Large cell Carcinoma	2	2.78	1	2.78	1	2.78	

p value reached from Chi-square Test.

Table 6. *Distribution of the study patients according to presenting symptoms.*

Symptoms	Total		Arm-A		Arm-B		p-value
	N=72	%	N=36	%	N=36	%	
Cough							
Mild	11	15.27	6	16.67	5	13.89	
Moderate	37	51.38	18	50.00	19	52.78	0.861
Severe	5	6.94	3	8.33	2	5.56	
Dyspnea							
Mild	15	20.83	9	25.00	6	16.67	
Moderate	30	41.66	14	38.89	16	44.44	0.700
Severe	2	2.77	1	2.78	1	2.78	
Chest pain							
Mild	8	11.11	4	11.11	4	11.11	
Moderate	35	48.61	18	50.00	17	47.22	0.997
Severe	2	2.77	1	2.78	1	2.78	
Hemoptysis							
Mild	13	18.05	7	19.44	6	16.67	
Moderate	14	19.44	7	19.44	7	19.44	0.979
Severe	2	2.77	1	2.78	1	2.78	

p value reached from Chi-square Test

Table 7. *Cough status after radiotherapy in two arms.*

Time points	Arm-A (n=36) No. (%)				p1
	None	Mild	Moderate	Severe	
Before RT	9 (25)	6 (16.6)	18 (50)	3 (8.33)	0.946
At the End of RT	11 (30.5)	17 (47.2)	8 (22.2)	0 (0)	0.948
4 weeks after RT	19 (52.7)	11 (30.5)	6 (16.6)	0 (0)	0.778

Time points	Arm-A (n=36) No. (%)				p1
	None	Mild	Moderate	Severe	
8 weeks after RT	21 (58.3)	8 (22.2)	7 (19.4)	0 (0)	0.892
p2	<0.001				
Before RT	10 (27.7)	5 (13.8)	19 (52.7)	2 (5.56)	0.946
At the End of RT	10 (27.7)	17 (47.2)	9 (25.0)	0 (0)	0.948
4 weeks after RT	17 (47.2)	12 (33.3)	7 (19.4)	0 (0)	0.778
8 weeks after RT	20 (55.5)	8 (22.2)	8 (22.2)	0 (0)	0.892
p2	<0.001				

RT= Radiotherapy
P1 value reached from Chi-square Test by comparing two arms
P2 value reached from Chi-square Test by comparing before RT and 8 weeks after RT.

Table 8. *Dyspnea status after radiotherapy in two arms.*

Time points	None	Mild	Moderate	Severe	p1
Arm-A (n=36) No. (%)					
Before RT	12 (33.3)	9 (25.0)	14 (38.8)	1 (2.78)	0.856
At the End of RT	16 (44.4)	10 (27.7)	10 (27.7)	0 (0)	0.465
4 weeks after RT	18 (50)	8 (22.2)	10 (27.7)	0 (0)	0.485
8 weeks after RT	22 (61.1)	8 (22.2)	6 (16.6)	0 (0)	0.960
p2	<0.001				
Arm-B (n=36) No. (%)					
Before RT	13 (36.1)	6 (16.6)	16 (44.4)	1 (2.78)	0.856
At the End of RT	13 (36.1)	15 (41.6)	8 (22.2)	0 (0)	0.465
4 weeks after RT	17 (47.2)	12 (33.3)	7 (19.4)	0 (0)	0.485
8 weeks after RT	21 (52.7)	9 (25.0)	6 (16.6)	0 (0)	0.960
p2	<0.001				

RT= Radiotherapy
P1 value reached from Chi-square Test by comparing two arms
P2 value reached from Chi-square Test by comparing before RT and 8 weeks after RT.

Table 9. *Status of chest pain after radiotherapy in two arms.*

Time points	Arm-A (n=36) No. (%)				p1
	None	Mild	Moderate	Severe	
Before RT	13 (36.1)	4 (11.1)	18 (50)	1 (2.78)	0.996
At the End of RT	24 (66.6)	6 (16.6)	6 (16.6)	0 (0)	0.617

Time points	Arm-A (n=36) No. (%)				p1
	None	Mild	Moderate	Severe	
4 weeks after RT	29 (80.5)	4 (11.1)	3 (8.33)	0 (0)	0.283
8 weeks after RT	30 (83.3)	4 (11.1)	2 (5.56)	0 (0)	0.842
p2	<0.001s				
Before RT	14 (38.8)	4 (11.1)	17 (47.2)	1 (2.78)	0.996
At the End of RT	21 (58.3)	8 (22.2)	7 (19.4)	0 (0)	0.617
4 weeks after RT	23 (63.8)	8 (22.2)	5 (13.8)	0 (0)	0.283
8 weeks after RT	30 (83.3)	3 (8.33)	3 (8.33)	0 (0)	0.842
p2	<0.001s				

RT= Radiotherapy
P1 value reached from Chi-square Test by comparing two arms
P2 value reached from Chi-square Test by comparing before RT and 8 weeks after RT.

Table 10. *Hemoptysis status after radiotherapy in two arms.*

Time points	Arm-A (n=36) No. (%)				p1
	None	Mild	Moderate	Severe	
Before RT	21 (58.3)	7 (19.4)	7 (19.4)	1 (2.78)	0.992
At the End of RT	26 (72.2)	7 (19.4)	3 (8.33)	0 (0)	0.865
4 weeks after RT	30 (83.3)	4 (11.1)	2 (5.56)	0 (0)	0.827
8 weeks after RT	32 (88.8)	2 (5.56)	2 (5.56)	0 (0)	0.694
p2	<0.001				
Before RT	22 (61.1)	6 (16.6)	7 (19.4)	1 (2.78)	0.992
At the End of RT	24 (66.6)	8 (22.2)	4 (11.1)	0 (0)	0.865
4 weeks after RT	28 (77.7)	5 (13.8)	3 (8.33)	0 (0)	0.827
8 weeks after RT	30 (83.3)	4 (11.1)	2 (5.56)	0 (0)	0.694
p2	<0.001				

RT= Radiotherapy
P1 value reached from Chi-square Test by comparing two arms
P2 value reached from Chi-square Test by comparing before RT and 8 weeks after RT

Table 11. *Symptomatic improvement after radiotherapy in two arms.*

Symptoms		Arm-A No. (%)	Arm-B No. (%)	Total No. (%)	p value
Cough	Before treatment	27	26	53	0.442
	Improved	23/27 (85.19)	20/26 (76.92)	43/53 (81.13)	
Dyspnea	Before treatment	24	23	47	0.940
	Improved	19/24 (79.17)	18/23 (78.26)	37/47 (78.72)	

Symptoms		Arm-A No. (%)	Arm-B No. (%)	Total No. (%)	p value
Chest pain	Before treatment	23	22	45	0.665
	Improved	19/23 (82.61)	20/22 (90.91)	39/45 (86.67)	
Haemoptysis	Before treatment	15	14	29	0.960
	Improved	14/15 (93.33)	13/14 (92.86)	27/29 (93.10)	

p value reached from Chi-square Test to compare symptomatic improvement between two arms

Table 12. *Clinical symptomatic response after radiotherapy in two arms.*

	Total		Arm-A		Arm-B		p-value
	N=72	%	N=36	%	N=36	%	
Complete symptomatic response	15	20.83	8	22.22	7	19.44	
Improvement	34	47.22	16	44.44	18	50.00	0.961
No change	14	19.44	7	19.44	7	19.44	
Worsening of symptoms	9	12.50	5	13.89	4	11.11	

p value reached from Chi-square Test

Table 13. *Treatment related toxicities in two arms.*

Toxicities	Total		Arm-A		Arm-B		p-value
	N=72	%	N=36	%	N=36	%	
Acute esophagitis							
G0	43	59.72	18	50.00	25	69.44	
G1	23	31.94	14	38.89	9	25.00	0.235
G2	6	8.33	4	11.11	2	5.56	
Nausea							
G0	44	61.11	21	58.33	23	63.89	
G1	20	27.78	11	30.56	9	25.00	0.865
G2	8	11.11	4	11.11	4	11.11	
Vomiting							
G0	64	88.89	31	86.11	33	91.67	0.453
G1	8	11.11	5	13.89	3	8.33	
Radiation dermatitis							
G0	67	93.05	33	91.67	34	94.44	0.643
G1	5	6.94	3	8.33	2	5.55	

p value was determined by Chi-squared Test

3. Materials and Methods

Study Design This quasi-experimental study was conducted from January 2020 to December 2020 at the Department of Radiotherapy, Rajshahi Medical College Hospital, Rajshahi. Data was collected between February 2020 and December 2020. Patients with histopathological or cytological confirmation of non-small cell lung cancer, who fulfilled the eligibility criteria and visited the department during the study duration, were included. A purposive sampling method was utilized, and data were collected using a semi-structured form.

Sample Size 72 patients with above mentioned criteria were selected as sample; 36 in each arm.

Eligibility Criteria Patients included in this study had histopathologically or cytologically confirmed NSCLC suitable for radicle treatment because of documented metastatic disease (stage IV) and intrathoracic symptoms (cough, dyspnea, hemoptysis, chest pain), and an ECOG performance status of 1 to 3. Exclusion criteria were a history of prior radiotherapy to the chest, pleural effusion, age outside 18-70 years, pregnancy or lactation, severe comorbidities (cardiac disease, uncontrolled diabetes, hypertension, renal diseases), and hemoglobin levels below 10 g/dl. Treatment discontinuation criteria included patient refusal or the occurrence of unacceptable toxicity or disease progression necessitating major treatment modifications.

Study procedure Case collection, Pretreatment Evaluation, and Investigations, and Treatment Planning Written informed consent was obtained from patients who met the inclusion and exclusion criteria before their participation in the study. Comprehensive history taking, clinical examination, and required investigations were documented using a semi-structured data collection sheet. Pretreatment included a complete history evaluation, physical examination, performance status assessment, and histopathology or cytology reports. Investigations comprised CBC, RBS, serum creatinine, chest X-ray (P/A and lateral views), chest CT scan, whole abdomen ultrasound, ECG, echocardiogram (if ECG abnormalities or CVD history), whole-body bone scan (if body ache present), abdominal CT (if indicated by ultrasound), and brain CT (if headache present). Eligible patients were then randomized into two arms Arm A was received 30 Gy in 10 fractions (3 Gy per fraction over a period of 2 weeks), while Arm B received 20 Gy in 5 fractions (4 Gy per fraction over 1 week).

Radiotherapy technique All patients were treated in a supine position with arms by the side. Thoracic radiotherapy for both groups involved two parallel opposed anterior-posterior fields encompassing the primary tumor with a 2 cm margin, including hilar and mediastinal lymph nodes if indicated. Field markings were done using the usual marking system, and dose calculation was at the mid-plane of the opposing fields using the SSD technique. Radiotherapy was delivered using a telecobalt-60 machine (Best Theratronics, Canada). Arm-A received a total dose of 30 Gy in 10 fractions (3 Gy per fraction) over 2 weeks, while Arm-B received 20 Gy in 5 fractions (4 Gy per fraction) over 1 week.

Patient assessment Assessment during treatment Patients were assessed weekly during treatment.

Symptom Grading and Relief Symptom intensity was evaluated using a 4-point scale (none, mild, moderate, severe) following the National Cancer Institute's "Common Terminology Criteria for Adverse Events (CTCAE), version 5.0, 2017." Symptoms were assessed and recorded prior to radiotherapy, at the end of radiotherapy, and at 4 and 8 weeks post-radiotherapy. Physicians also conducted a categorical evaluation of the overall treatment effect, classifying it as complete symptomatic response, improvement, no change, or worsening of symptoms [10].

Toxicities reporting Acute toxicity was evaluated using the National Cancer Institute's "Common Terminology Criteria for Adverse Events (CTCAE), version 5.0, 2017."

Assessment after treatment Patients were assessed at the end of RT, and followed up 4 weeks after RT and 8 weeks after RT. The response was assessed by taking history, clinical examination, chest X-ray, CT scan of chest (if needed).

Data collection Findings of observation was recorded in semi-structured data collection from.

Data Analysis Data from both Arm-A and Arm-B were tabulated, checked, edited, coded manually, and entered into a computer. Data analysis was performed using IBM SPSS version 24.0, utilizing unpaired t-tests for continuous variables and χ^2 tests for categorical variables. Results were displayed through tables, figures, and diagrams, and a p-value of less than 0.05 was considered statistically significant.

Ethical consideration Rajshahi Medical College ethical committee was approved the study protocol, and permission was obtained from the relevant department. Patients were thoroughly informed about the study's purpose, procedures, potential risks and benefits, and their right to decline participation. Written informed consent was obtained, and patient information was kept confidential.

4. Results

This quasi-experimental study was carried out in the Department of Radiotherapy at Rajshahi Medical College Hospital over a year, including 72 NSCLC patients who met the inclusion criteria. Participants were evenly divided into two groups Arm A, consisting of 36 patients treated with 30 Gy in 10 fractions over 2 weeks, and Arm B, comprising 36 patients treated with 20 Gy in 5 fractions over 1 week. The treatment durations were 10 days for Arm A and 5 days for Arm B, with respective costs of 2200 Taka and 1200 Taka. The mean age of participants was 56.39 ± 7.82 years, ranging from 38 to 70 years, with no significant age difference observed between the two groups ($p > 0.05$). Table 1 outlines the age distribution, revealing that most patients (80.56%) were over 50 years old.

The demographic characteristics of the 72 patients enrolled

in the study, equally divided into two treatment arms (Arm-A and Arm-B), were analyzed for age, education, and occupation distributions. Table 1 details age categories, with the majority (52.78%) aged between 51 and 60 years, and a mean age of 56.39 ± 7.82 years. The age range spanned from 38 to 70 years, with no significant differences observed between the arms (p=0.935, Chi-square; p=0.788, t-test). Table 2 summarizes educational background, indicating that 69.44% of patients had no formal education, with only a minor representation across other levels, from below primary to graduate. This distribution did not significantly vary between arms (p=0.980). Table 3 describes the occupational distribution, where 56.94% of the cohort were farmers, followed by housewives, service holders, business individuals, and others. The occupation distribution across arms similarly showed no statistical significance (p=0.967).

In this study, patients were assessed across various demographic and clinical factors, including risk factors, histological types, and presenting symptoms. Table 4 summarizes the key risk factors observed among patients, with a history of smoking being the most common (76.38%), showing a slightly higher prevalence in Arm-A (80.55%) compared to Arm-B (72.22%), though the difference was not statistically significant (p=0.405). Other notable risk factors included occupational exposure, observed in 63.89% of the total sample (61.11% in Arm-A and 66.67% in Arm-B, p=0.623), while COPD, pulmonary TB, and family history of cancer were present at lower rates (13.89%, 19.44%, and 8.33%, respectively) with non-significant p-values (0.496, 0.551, and 0.674). Table 5 outlines the histological distribution, where squamous cell carcinoma was the most prevalent type, accounting for 63.89% of cases, slightly more in Arm-B (66.67%) than in Arm-A (61.11%), though this variation lacked statistical significance (p=0.881). Adenocarcinoma was the next most common type (33.33%), followed by a minimal presence of large cell carcinoma (2.78%). Table 6 presents the distribution of symptoms at presentation, with moderate cough being the most frequently reported symptom across both arms (51.38%), followed by moderate dyspnea (41.66%), moderate chest pain (48.61%), and mild to moderate hemoptysis, which was seen in a subset of patients. Each symptom category—cough (p=0.861), dyspnea (p=0.700), chest pain (p=0.997), and hemoptysis (p=0.979)—showed no statistically significant differences between Arm-A and Arm-B, indicating a comparable symptom profile across both treatment arms.

The symptomatic response across 72 patients undergoing two thoracic external beam radiotherapy regimens was evaluated for four primary symptoms: cough, dyspnea, chest pain, and hemoptysis, at multiple intervals following treatment. Table 7 shows cough severity, where both arms experienced substantial improvement. Initially, moderate cough was the most reported (50% in Arm-A and 52.7% in Arm-B), but by the 8-week mark, a majority of patients in both arms reported no cough (58.3% in Arm-A and 55.5% in Arm-B; $p < 0.001$), reflecting a significant reduction in symptom burden. Similarly, Table 8 provides data on dyspnea, demonstrating consistent improvements; patients reporting no dyspnea increased from 33.3% and 36.1% in Arm-A and Arm-B at baseline to over 61.1% and 52.7%, respectively, at 8 weeks ($p < 0.001$), indicating effective relief across both treatment arms.

Chest pain, as outlined in Table 9, also showed a marked decline, with those reporting no pain rising from 36.1% at baseline in Arm-A and 38.8% in Arm-B to 83.3% in both arms at 8 weeks post-treatment ($p < 0.001$). For hemoptysis, Table 10 reveals similar improvement, where those with no symptoms increased from 58.3% in Arm-A and 61.1% in Arm-B before treatment to 88.8% and 83.3%, respectively, at 8 weeks ($p < 0.001$). As reflected in Table 12, the overall clinical response showed that 20.83% of patients achieved a complete symptomatic response, while 47.22% reported improvement. Only 12.5% of patients experienced worsening symptoms, underscoring the efficacy of the radiotherapy regimens in relieving symptoms with minimal disparity between the treatment arms.

5. Discussion

This study demonstrates that both 20 Gy in 5 fractions and 30 Gy in 10 fractions of palliative thoracic radiotherapy (RT) are effective in alleviating symptoms in patients with advanced non-small cell lung cancer (NSCLC). These results are consistent with previous studies that have shown the effectiveness of palliative thoracic RT in reducing major symptoms such as cough, dyspnea, chest pain, and hemoptysis in advanced-stage lung cancer patients [11-13]. The results are especially pertinent for healthcare systems in resource-limited settings like Bangladesh, where reducing treatment costs and durations can significantly improve access to care, particularly for patients from rural areas or lower socio-economic backgrounds.

Symptomatic improvement after RT was substantial in both treatment arms. Hemoptysis, chest pain, cough, and dyspnea all showed notable amelioration post-treatment. Hemoptysis improved in the majority of patients (93.10%), followed by chest pain (86.67%), cough (81.13%), and dyspnea (78.72%). These results are consistent with prior studies that have demonstrated the positive impact of RT in palliation, with hemoptysis and chest pain being the most effectively managed symptoms [14, 15]. Although there were no statistically significant differences in the rates of symptomatic improvement between the 20 Gy in 5 fractions and 30 Gy in 10 fractions, the overall benefits from RT are noteworthy, given that both regimens resulted in substantial symptomatic relief.

The finding that dyspnea was the least effectively palliated symptom aligns with existing literature on the challenges of managing dyspnea in advanced lung cancer [13, 15]. This may be due to irreversible lung damage, including pulmonary consolidation or collapse, caused by advanced-stage cancer, which cannot be reversed by RT. Even with significant symptomatic relief, the pathophysiological complexity of

dyspnea in lung cancer patients presents a unique challenge. Radiotherapy alone may not be sufficient to address this symptom fully, which calls for further exploration into combined therapies or complementary treatments that may enhance dyspnea palliation.

From a healthcare delivery perspective, the 20 Gy in 5 fractions RT regimen presents an attractive option, especially in settings with limited healthcare infrastructure. The reduced treatment duration and lower cost make this regimen particularly suitable for patients in developing countries like Bangladesh, where healthcare access is often constrained by economic factors and geographic barriers [13, 16]. Patients from rural areas, comprising a large portion of the study cohort (63.89%), often face logistical challenges when seeking treatment, such as the need for prolonged stays at treatment facilities. The shorter treatment time associated with the 20 Gy in 5 fractions helps mitigate these challenges, reducing the financial burden on patients and their families. Moreover, for many patients, the cost of 20 Gy in 5 fractions (1200 Taka) represents a significant saving compared to the 30 Gy in 10 fractions regimen (2200 Taka). This financial relief could be a decisive factor for patients and healthcare providers in resource-poor settings.

In terms of toxicity, this study found no statistically significant differences between the two treatment arms, though acute esophagitis, nausea, and vomiting were slightly more prevalent in Arm-A. The observed rate of esophagitis (41.67%) aligns with previous findings that higher radiation doses are associated with increased treatment-related toxicities [9, 17]. However, these toxicities were generally mild (grade 1) and manageable. The prevalence of nausea and vomiting in this study was also comparable to rates reported in other studies [9]. Radiation dermatitis, although less frequent, was observed in a small percentage of patients, again reflecting the findings of other research on treatment-related toxicities [18, 19]. Importantly, the absence of significant differences in toxicity between the two arms supports the use of the low-dose regimen as a less burdensome and equally tolerable option for palliative treatment in advanced NSCLC.

A strength of this study is the use of comparable fractionation schedules in both groups, enabling a direct comparison of the efficacy and toxicity between 20 Gy in 5 fractions and 30 Gy in 10 fractions for palliative radiotherapy. Previous research has explored various fractionation regimens, with several studies demonstrating that 20 Gy in 5 fractions can provide equivalent symptomatic relief to higher-dose schedules while minimizing toxicity and treatment burden [13, 16]. These studies have highlighted the need to balance symptom relief with treatment-related side effects, especially in palliative care, where the main objective is to enhance the patient's quality of life rather than achieve a cure. The results of this study align with this evidence, further supporting the use of low-dose radiotherapy as an effective option for symptom palliation in advanced NSCLC.

Another significant observation from this study is the similar symptomatic response seen in both treatment groups, irrespective of the radiation dose. This result is in agreement with previous research, which indicates that both higher and lower doses of palliative thoracic radiotherapy can provide comparable symptom relief in patients with locally advanced lung cancer. [11]. Moreover, studies such as that by [19] and have shown comparable rates of symptomatic improvement across different fractionation regimens, lending further support to the argument for the efficacy of lower-dose schedules in palliative care. [10].

While the study's results are promising, it is important to acknowledge certain limitations. The follow-up period in this study was relatively brief, concentrating mainly on immediate and short-term outcomes rather than on long-term survival or quality of life. Future studies should consider extending the follow-up duration to evaluate the sustainability of symptom relief and the potential effects of different fractionation schedules on overall survival. Additionally, while this study included patients from rural and lower socio-economic backgrounds, further research could explore the specific challenges faced by these populations in accessing and adhering to RT, particularly in the context of limited healthcare infrastructure and financial constraints.

In conclusion, the findings of this study suggest that 20 Gy in 5 fractions palliative thoracic RT is as effective as the 30 Gy in 10 fractions dose regimen in providing symptomatic relief in patients with advanced NSCLC. Given the lower treatment cost, shorter treatment duration, and similar toxicity profiles, the 20 Gy in 5 fractions dose regimen represents an attractive option for patients in resource-limited settings, particularly in developing countries like Bangladesh. Additional research, including long-term follow-up studies, is required to assess the effects of various radiotherapy regimens on survival and quality of life in this patient population. Nevertheless, this study contributes valuable evidence to the ongoing discussion about optimizing palliative care for NSCLC, demonstrating that low-dose RT can offer substantial benefits to patients without compromising efficacy or safety.

6. Conclusions

The efficacy of the two palliative thoracic external beam radiotherapy (EBRT) regimens, Arm A (30 Gy in 10 fractions) and Arm B (20 Gy in 5 fractions), showed no significant difference in this study. Despite a slightly higher incidence of treatment-related toxicities in Arm-A, the differences were negligible. Given its lower cost and shorter treatment duration, the 20 Gy in 5 fractions schedule is more suitable for the context of Bangladesh. However, due to the non-randomized allocation of patients, there is a potential for non-uniform distribution between groups. Future research should focus on randomized trials to confirm these findings and investigate progression-free survival outcomes.

Abbreviations

AJCC	American Joint Committee on Cancer
ASCO	American Society of Clinical Oncology
BSMMU	Bangabandhu Sheikh Mujib Medical University
COPD	Chronic Obstructive Pulmonary Disease
CT	Computed Tomography
CTCAE	Common Terminology Criteria for Adverse Events
DC	Differential Count
EBRT	External Beam Radiotherapy
ECG	Electro Cardio Gram
ECHO	Echocardiography
ECOG	Eastern Cooperative Oncology Group
ESR	Erythrocyte sedimentation Rate
FNAC	Fine Needle Aspiration Cytology
Hb	Hemoglobin
Gy	Gray
IARC	International Agency for Cancer Research
IRB	Institutional Review Board
LN	Lymph Node
MRI	Magnetic Resonance Imaging
NICRH	National Institute of Cancer Research and Hospital
NSCLC	Non-Small Cell Lung Cancer
OS	Overall Survival
PS	Performance Status
P/A	Postero-Anterior
QoL	Quality of Life
SGOT	Serum Glutamic Oxaloacetic Transaminase
SVCO	Superior Venacaval Obstruction
TNM	Tumor-Node-Metastasis
USG	Ultrasonography
WBC	White Blood Cell
WHO	World Health Organization

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Author Contributions

Md Abdul Karim: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Visualization, Writing original draft

Ashim Kumar Ghosh: Project adminstration, Resources, Supervision, Validation

Rawshan Ara Khatun: Supervision, Resources, Validation

Julekha Khatun: Validation, Writing - reviewing & editing

Nishan Chakrabarty: Project administration, Validation, Writing – review & editing

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Conflicts of Interest

The authors declare no conflicts of interest.

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Biography

Md. Abdul Karim is a dedicated oncologist currently working at Rajshahi Medical College Hospital, Bangladesh. He has been deeply involved in the field of Oncology, contributing both through his clinical practice and ongoing research. Dr. Md. Abdul Karim completed his MBBS from Rajshahi Medical College Hospital in 2007, making the beginning of his medical career. With a passion for cancer treatment and research, he pursued higher studies in Oncology, completing his MD in Oncology from Bangabandhu Sheikh Mujib Medical University (BSMMU) in Dhaka, Bangladesh. Currently Dr. Md. Abdul Karim is actively involved in both clinical work and research within the field of Oncology. His efforts focus on enhancements in Oncology research, with the goal of improving patient outcomes and advancing medical knowledge in Bangladesh.

Research Fields

Md. Abdul Karim: Radiobiology, Radiotherapy and Combination Therapies.

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Rawshan Ara Khatun: Clinical Oncology, and Radiation Physics.

Julekha Khatun: Radiotherapy and Cancer Metabolism.

Nishan Chakrabarty: Cellular Mechanotransduction, Ionization and Cancer Oncogene therapy.