e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(1); 933-940

Original Research Article

Palliative Radiation Therapy Defining Principles: A Real-World Study

Puja Bhagat[1], Dinesh Kumar Sinha[2], Seema Devi[3], Rajesh Kumar Singh[4]

[1]Senior Resident, Department of Radiation Oncology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India

[2]Professor, Department of Radiation Oncology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India

[3]Professor, Department of Radiation Oncology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India

[4]Professor, Department of Radiation Oncology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India

Received: 01-11-2025 / Revised: 16-12-2025 / Accepted: 16-01-2026

Corresponding Author: Dr. Puja Bhagat

Conflict of interest: Nil

Abstract

Objective & Aim: Palliative radiation therapy's primary objective is to lessen patients' discomfort. However, when a patient's overall condition rapidly deteriorates, they may not benefit from this treatment at all. This prospective, monocentric study evaluated how well palliative radiation was administered.

Methods: All consecutive patients getting palliative radiation at our hospital between March 1, 2025, and August 31, 2025 were included. The successful administration of palliative radiation in accordance with the original prescription (total dose, overall treatment period, and fractionation) was the main outcome. The number of treatment breaks, the clinical benefit, the number of deaths, and the length of time it took to be admitted to the palliative care unit were the secondary objectives.

Results: A total of fifty-nine patients and sixty-four treatments were examined. The brain (21.9%) and bone (70.3%) were the therapy locations. Pain control alone (43.8%), decompression alone (21.9%), pain control with decompression (32.8%), and hemostatic aim (1.6%) were the therapy objectives. In 57 cases (89%), palliative therapy was successful. Six cases (9.4%), three for medical reasons and three for logistical reasons, required a temporary halt to the radiation treatment. Worsening performance status was the primary cause of the permanent disruption (seven cases). In 44 cases (68.8%), palliation of symptoms (full or partial responses) was achieved. In the month following the conclusion of treatment, seven patients (11.9%) passed away. There were no instances of admission delays or cancellations in the palliative care unit.

Conclusion: In 51 cases (79.9%), palliative radiation was finished as intended, and in 44 cases (68.8%), there was a therapeutic benefit. When it comes to palliative care, radiation therapy should not be disregarded.

Keywords: Palliative Care; Radiotherapy; Neoplasm Metastasis.

DOI: 10.25258/ijcpr.18.1.155

Introduction

Pain from bone metastases or neurologic symptoms from brain or spinal metastases can be effectively treated with external beam radiation. The best dosage fractionation schedules for bone metastases, brain metastases, or spinal cord compression have been the subject of numerous published randomized trials [1–7,31].

Palliative radiotherapy at the end of life has been the subject of several research [8–12]: is radiation therapy possible for these patients? Would radiotherapy actually help patients? How can patients who will pass away before their treatment is finished be identified a priori? In France, radiation therapy is often discontinued upon admission to palliative care units due to the discontinuation of particular oncologic care. In a similar vein, if radiation therapy is recommended, it may cause the postponement or cancelation of The best dosage fractionation schedules for bone metastases, brain metastases, or spinal cord compression have been the subject of numerous published randomized trials [1–7,31]. Palliative radiotherapy at the end of life has been the subject of several research [8–12]: is radiation therapy possible for these patients?

Furthermore, it was noted that some patients appeared to receive no benefit from palliative radiotherapy due to the quick deterioration of their overall health, which prompted them to stop their treatment. The primary objective of palliative care,

which is described by the World Health Organization (WHO) as "an approach that improves the quality of life of patients and their families facing the problems associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial, and spiritual," could not be fulfilled for these patients [13]. Palliative care unit workers at Georges-Pompidou European Hospital questioned the validity of palliative radiation for patients receiving the best supportive care after observing the high fatality rate. The primary objective of palliative care, which is described by the World Health Organization (WHO) as "an approach that improves the quality of life of patients and their families facing the problems associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial, and spiritual," could not be fulfilled for these patients [13]. Furthermore, it was noted that some patients appeared to receive no benefit from palliative radiotherapy due to the quick deterioration of their overall health, which prompted them to stop their treatment. The primary objective of palliative care, which is described by the World Health Organization (WHO) as "an approach that improves the quality of life of patients and their families facing the problems associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial, and spiritual," could not be fulfilled for these patients [13]. Furthermore, it was noted that some patients appeared to receive no benefit from palliative radiotherapy due to the quick deterioration of their overall health, which prompted them to stop their treatment.

Materials and Methods

Included were all consecutive patients who sought palliative treatment from the hospital's radiotherapy department between March 1, 2025, and August 31, 2025. Excluded were patients who had already been admitted to the palliative care unit. The Helsinki Declaration and the guidelines of good clinical practice were followed in the conduct of this investigation.

Every patient received conformal three-dimensional (3D) radiation (Clinac® Varian Medical System).

The oncologist made the decision about the dose and fractionation based on the patient's performance, the treatment site, and prior radiation exposure.

If the patient's overall condition worsened during treatment, the dosage and fractionation could be changed. In order to evaluate the effectiveness of radiation, patients were observed both during their treatment and after a month. The Eastern Cooperative Oncology Group performance status (ECOG-PS), neurological symptoms, pain assessment and analgesic consumption, and the patient's medical oncologic treatment (systemic therapy, best supportive care) were all recorded at the time of study enrollment, on the final day of radiotherapy, and one month later. Throughout the trial, the date of admission and the request for admission to the palliative care unit were recorded. The National Cancer Institute Common Terminology Criteria for Adverse Events (NCI-CTC AE) version 4.0 was used to evaluate toxicity.

The effective administration of palliative radiation therapy (total treatment duration and fractionation) in compliance with the original prescription was the main outcome. The number of short-term or long-term treatment pauses, the clinical benefit of radiation therapy in relation to symptoms, the number of deaths within a month following the conclusion of treatment, and the delays or cancellations of admission to a palliative care unit because the patient was receiving radiation therapy were the secondary endpoints.

The International Consensus on Palliative Radiotherapy Endpoints group [14] used the following criteria to assess the response to therapy for bone radiation: complete response (pain score of zero at the treated site with no concurrent increase in analgesic intake), partial response (pain reduction of two or more at the treated site on a scale of 0 to 10 without analgesic increase or analgesic reduction of 25% or more from baseline without an increase in pain), pain progression (pain score of two or more above the baseline at the treated site with stable analgesic intake or one point above baseline), or indeterminate response.

A symptom checklist of five items—headache, nausea/vomiting, motor and/or sensory weakness, dysphasia, and visual changes—was used to assess the response to therapy for brain radiation. Every symptom was classified as either present or absent. A complete reaction was defined as no symptoms, a partial response as fewer symptoms, a progression as more symptoms, or no changes at all. The following predictive criteria of radiation implementation were examined: ECOG-PS (0-1 vs. >1), place of residence (home vs. hospital and residential care home), age (<70 vs. ≥70 years), number of fractions (1-4 vs. >4), number of metastatic anatomic sites (1 vs. >1), treatment goal (pain control only vs. decompression only vs. pain control and decompression), and number of oncologic therapy lines (0-1)Every symptom was classified as either present or absent. A complete

reaction was defined as no symptoms, a partial response as fewer symptoms, a progression as more symptoms, or no changes at all.

The following predictive criteria of radiation implementation were examined:

The STATA program (version 11.0) was used to perform statistical analyses. The demographic data was summarized using descriptive statistics. $\chi 2$ tests were used to evaluate the putative predictive variable's connection.

Results

59 patients (40 men) were involved in the study between March 1, 2025, and August31, 2025, and 65 treatments were examined (four patients received therapy twice, and two patient received treatment three times).

Table 1 lists the patient's characteristics, cancer history, tumor features, and therapy. Twenty-three of the forty patients with an ECOG-PS 1 had recently been diagnosed with lung metastatic cancer. Only two patients (rectal cancer with severe bleeding, one patient; lung cancer with surrounding painful bone lysis, one patient) did not come with metastatic disease but were treated with palliative intent because too bulky locoregional illness.

Table 1: Baseline patient characteristics in a prospective monocentric trial evaluating the efficacy of palliative radiation therapy (n = 59)

Characteristics	Participants (n=65)
Age (Years)	63.4±18.6
Men	40 (63%)
Performance status, n (%)	
0	0
1	40 (63%)
≥2	25 (37%)
Place of living, n (%)	
Home	37 (57%)
Hospital	24 (37%)
Residential care centre	3 (5%)
Missing data	1(1%)
Primary tumour, n (%)	
Lung	41(63%)
Genitourinary	7 (11%)
Gastrointestinal	5 (8%)
Other	12 (18%)
Metastatic at diagnosis, n (%)	
Yes	35 (54%)
No	30 (46%)
Number of metastatic sites at inclusion, n (%)	
0	2 (3%)
1-2	52 (80%)
>2	11 (17%)
Number of oncologic therapy lines, n (%)	
0	12 (18%)
1-2	38 (59%)
>2	15 (23%)
Systemic oncologic therapy ongoing, n (%)	
Yes	50 (77%)
No	14 (23%)
Prior radiotherapy, n (%)	
Yes	21 (32%)
No	43 (68%)
Reirradiation (same location) n (%)	
Yes	0
No	65 (100%)

Twenty-one patients (32.8%) had previously had radiation therapy, and fifty-two patients (81.3%) had at least one line of specific oncologic treatment (chemotherapy and/or targeted therapy). Individual stable 1 lists the patient's characteristics, cancer history, tumor features, and therapy. Twenty-three

of the forty patients with an ECOG-PS 1 had recently been diagnosed with lung metastatic cancer. Only two patients (rectal cancer with severe bleeding, one patient; lung cancer with surrounding painful bone lysis, one patient) did not come with metastatic disease but were treated with palliative intent because to bulky locoregional illness. Twenty-one patients (32.8%) had previously had radiation therapy, and fifty-two patients (81.3%) had at least one line of specific oncologic treatment (chemotherapy and/or targeted therapy).

Table 2 reports the treatments. Palliative radiation was administered at other sites in 70.3% of cases of bone metastases, 21.9% of cases of brain metastases, and 7.8% of cases of lung, rectum, pelvic adenopathy, and ovary. Ten patients had substantial target volumes (i.e., more than three vertebrae) for bone metastases, while 17 instances had epidural involvement. The clinicians chose multifractionation methods more voluntarily for these patients. Fifty-one treatments, or 47 patients (79.7%), were administered in accordance with the original prescription. Due to the general condition being worse, seven treatments (10.9%) were finally ended before the end (two before the first fraction). Six cases (9.4%), three for medical reasons (transfusion on the day of radiotherapy, one patient; traumatic fall, one patient; immobilization failure due to intractable pain in relation to omission of painkillers, one patient), and three for logistical reasons (appointment scheduling error, one patient; unplanned maintenance, one patient; breakdown, one patient) required a pause in radiotherapy treatment.

In the month following the conclusion of treatment, seven patients (11.9%) passed away due to the advancement of their malignancy. Prior to therapy, five of them (71%) had an altered ECOG-PS and were admitted to the hospital. During therapy or in the month following treatment, four patients were admitted to the palliative care unit. Radiation therapy was discontinued before the completion of treatment for the three patients whose admission to a palliative care facility was advised. There were no cancellations or delays for admission, including those related to ongoing radiation therapy.

Table 2: Monocentric prospective research evaluating the efficient provision of palliative radiotherapy: Description of treatment

Characteristics	Participants (n=65)
Location, n (%)	
Bone	45 (69%)
spine	20 (31%)
sacrum/pelvis	17 (27%)
other	8 (13%)
Brain	15 (23%)
Other	5 (8%)
Treatment goals, n (%)	
Pain control only	29 (45%)
Decompression only	14 (22%)
Pain control and decompression	21 (32%)
Haemostatic	1 (1%)
Radiotherapy prescribed dose, fractionation, n (%)	
8 Gy, 1 fraction, 1 day	6 (10%)
10 Gy, 2 fractions, 3 days	1 (1%)
16 Gy, 4 fractions, 17 days [a]	1 (1%)
20 Gy, 4 fractions, 4 days	4 (6%)
23 Gy, 4 fractions, 17 days [b]	25 (38%)
20 Gy, 5 fractions, 5 days	10 (15%)
26 Gy, 6 fractions, 31 days [c]	12 (18%)
28 Gy, 6 fractions, 31 days [d]	1 (1%)
30 Gy, 10 fractions, 12 days	5 (7%)

[a]4Gyat days 1, 3, 15, 17
[b]6.5Gyat days1, 3 and 5Gyat days 15, 17
[c]4Gyat days 1, 3, 15, 17 and 5Gyat days 29, 31 [d]5Gyat days 1, 3, 15, 17 and 4Gyat days 29, 31

For 23 (35.9%) and 21 (32.8%) treatments, respectively, complete and partial responses to radiation were attained.

Eight instances (12.5%) had an ambiguous response, while twelve cases (18.8%) had deteriorating symptoms. In 71.4% of patients for pain control (n = 20/28), 78.6% for decompression

alone (n = 11/14), and 61.9% for pain control + decompression (n = 13/21), a complete or partial response was achieved.

During therapy and follow-up, there were no reports of toxicity grade 3 or higher. Five patients (7.8%) had acute grade 1-2 toxicity (two patients had oesophagitis pain, two had a brief increase in bone pain at the radiation site, and one had a headache during brain radiation). At the conclusion of radiation therapy, all of these toxicity incidents were vanished.

Table 3 presented the results of the univariate analysis. ECOG-PS and site of residence were linked to the efficient administration of palliative radiation in compliance with the original prescription. The delivery of the suggested palliative radiotherapy was unaffected by age, tumor expansion (number of metastases anatomic sites), number of oncologic therapy lines, radiotherapy features (dose and fractionation), or treatment aim.

Table 3: A prospective monocentric research using univariate analysis (χ2 tests) to evaluate how well palliative radiation is delivered

Characteristics	Participants (n)	% effective achievement of radiotherapy	P value
ECOG performance status			
1	40	93.4	0.021
>1	24	57.8	
Place of living			
Home	39	90.8	0.009
hospital or residential care home	26	66.5	
Number of metastatic anatomic sites			
1	25	82.9	0.64
>1	40	78.2	
Number of oncologic therapy lines			
1	37	78.4	0.72
>1	28	83.8	
Number of fractions			
1-4	37	87.4	0.17
>4	28	71.3	
Aim of treatment			
pain control	28	86.3	0.21
Decompression	15	63.9	
Both	22	86.2	

Discussion

This prospective study set out to evaluate the palliative radiotherapy's viability and outcomes in a group of 59 patients. The successful administration of palliative radiation therapy in compliance with the original prescription was the main outcome. The percentage of patients who did not receive palliative radiation was modest; only six patients (10.2%) required treatment to be permanently stopped due to a worsening of their overall condition. Lung cancer and bone were the most frequent primary tumors and treatment sites for these six patients. The delivery of palliative radiation was not the subject of any prior prospective trials that we are aware of, and this primary endpoint is our study's greatest strength. Similarly, there aren't many published retrospective studies that address this problem, and the termination ofThe successful administration of palliative radiation therapy in compliance with the original prescription was the main outcome. The percentage of patients who did not receive palliative radiation was modest; only six patients (10.2%) required treatment to be permanently stopped due to a worsening of their overall condition. Lung cancer and bone were the most frequent primary tumors and treatment sites for these six patients. The delivery of palliative radiation was not the subject of any prior prospective trials that we are aware of, and this primary endpoint is our study's greatest strength. This prospective study set out to evaluate the palliative radiotherapy's viability and outcomes in a group of 59 patients.

They concluded that patients with lung cancer had a significant chance of passing away soon after starting palliative radiation [15]. A series of 216 patients who were referred for palliative radiation was reported by Gripp et al. The authors discovered a significant percentage (42%) of treatment discontinuation in a subgroup of patients (33 patients, 15.3%) who passed away within 30 days of treatment [16]. Patients who were unfit to live at home or had an altered ECOG-PS (≥2) prior to radiotherapy appeared to be at risk of stopping treatment too soon. Nonetheless, there was likely a

correlation between ECOG-PS and the residence, home, or hospital. ECOG PS of 3–4 was one of the recursive partitioning analysis criteria used in the Angelo et al. study to forecast short A series of 216 patients who were referred for palliative radiation was reported by Gripp et al. The authors discovered a significant percentage (42%) of treatment discontinuation in a subgroup of patients (33 patients, 15.3%) who passed away within 30 days of treatment [16]. Patients who were unfit to live at home or had an altered ECOG-PS (≥2) prior to radiotherapy appeared to be at risk of stopping treatment too soon.

Age, the number of anatomic sites of metastases, the number of lines of oncologic therapy, and the dose and fractionation of radiotherapy did not appear to have any bearing on the use of palliative radiotherapy. Twenty-four patients (37.5%) were 70 years of age or older, and two patients were 85 years of age or older. Age had no effect on the administration of palliative radiation, according to our findings. According to Wong and colleagues, palliative radiation was utilized much less after the age of 70, with over 44% of patients 85 years of age or older abstaining [18]. In a retrospective research, Nieder and colleagues found no significant differences in survival outcomes or rates of radiation completion between a group of 445 younger patients (31–79 years of age) and the 94 oldest patients (> 80 years) [17].

According to the flow chart of earlier research [1,19,20], there was no discernible variation in the efficient administration of radiation based on the fractionation schedule. There have been numerous studies evaluating the effectiveness of single versus multi-fractionation, but none have explicitly assessed how well radiation is delivered.

Within a month following the conclusion of radiation therapy, seven patients (10.9%) passed away, all as a result of their cancer progressing. Radiation dose and fractionation, age, and the number of prior lines of cancer treatment did not affect the incidence of death. Our mortality risk during a 30-day period was somewhat comparable to earlier reports. 9% of patients died within 30 days, according to Angelo and colleagues' analysis of all consecutive palliative radiation treatments in a single facility [15]. As was previously mentioned, the most significant danger for Nieder and colleagues was a changed ECOG-PS. There have been numerous studies evaluating the effectiveness of single versus multi-fractionation, but none have explicitly assessed how well radiation is delivered. Within a month following the conclusion of radiation therapy, seven patients (10.9%) passed away, all as a result of their cancer progressing. Radiation dose and fractionation, age, and the number of prior lines of cancer treatment did not affect the incidence of death. After radiation therapy, response often happened three weeks later. Thirty days following the conclusion, the assessment was completed. For bone metastases, we employed predefined endpoints [14,21,22]. Eight of the twenty patients (71.4%) had full pain alleviation. According to the review by Chow et al. [23], overall pain response for simple bone metastases varied from 47% to 100% in the literature. The total pain response varied from 47% to 92% for the nine trials that used the same deadline assessment; the mean value for multiple fraction radiotherapy was 74.4%, while the overall response rate for an 8 Gy single-dose was 72% [23–26].

The evaluation criteria for brain palliative radiation therapy are not universally agreed upon [27–29]. We selected the five primary elements on the symptom checklist that is typically used in our department: headache, nausea/vomiting, dysphasia, motor and/or sensory weakness, and visual abnormalities. Eight of the eleven patients with brain metastases (78.6%) had complete clinical recovery. Few studies detailed patient-rated symptoms and palliation, despite several papers showing the effectiveness of whole-brain radiation (overall survival, tumor remission, performance status).

There were no palliative care unit admission delays or cancellations due to ongoing radiation therapy. Conversely, radiotherapy was discontinued for the three patients whose admittance to a palliative care unit was advised for the best possible global management before to the end of the treatment.

Depending on the anatomic site, target volume size, and ECOG-PS, various fractionation strategies were employed in our series. Regarding efficacy and acute toxicity, we found no differences across these various fractionation strategies. Our study's use of several fractionation patterns is a constraint that makes it challenging to compare with earlier or future research on evidence-based medicine fractionation schemes. Nonetheless, Park et al. noted this variation in their review; single fraction utilization varied from 0% to 59%, and the most popular regimen was 30 Gy in 10 fractions (36–90%) [30].

Conclusion

In summary, 79.9% of patients received palliative radiation as scheduled, while 69.5% of patients experienced a therapeutic benefit. No grade 3 toxicity or higher was noted during follow-up, and the treatment was well tolerated. Ongoing radiation therapy did not cause any delays or cancellations for admission to the palliative care unit. This one monocentric prospective study provided insightful input regarding the efficacy of palliative radiotherapy and our therapeutic practice. When it

comes to palliative care at the end of life, radiation therapy should not be disregarded.

References

1. Hartsell WF, Scott CB, Bruner DW, Scarantino CW, Ivker RA, Roach M, et al. Randomized trial of short- versus long-course radiotherapy for palliation of painful bone metastases. JNCI J Natl Cancer Inst. 2005;97:798–804.
2. Chow E, Harris K, Fan G, Tsao M, Sze WM. Palliative radiotherapy trials for bone metastases: a systematic review. J Clin Oncol 2007;25:1423–36.
3. Lutz S, Berk L, Chang E, Chow E, Hahn C, Hoskin P, et al. Palliative radiotherapy for bone metastases: an ASTRO evidence-based guideline. Int J Radiat Oncol Biol Phys 2011;79:965–76.
4. Lutz ST, Jones J, Chow E. Role of radiation therapy in palliative care of the patient with cancer. J Clin Oncol 2014;32:2913–9.
5. Janjan N, Lutz ST, Bedwinek JM, Hartsell WF, Ng A, Pieters RS, et al. Therapeutic guidelines for the treatment of bone metastasis: a report from the American College of Radiology Appropriateness Criteria Expert Panel on Radiation Oncology. J Palliat Med 2009;12:417–26.
6. Tsao MN, Rades D, Wirth A, Lo SS, Danielson BL, Gaspar LE, et al. Radiotherapeutic and surgical management for newly diagnosed brain metastasis(es): An American Society for Radiation Oncology evidence-based guideline. PractRadiat Oncol 2012;2:210–25.
7. Maranzano E, Trippa F, Casale M, Costantini S, Lupattelli M, Bellavita R, et al. 8Gy single-dose radiotherapy is effective in metastatic spinal cord compression: results of a phase III randomized multicentre Italian trial. Radiother Oncol 2009;93:174–9.
8. Nieder C, Angelo K, Dalhaug A, Pawinski A, Haukland E, Norum J. Palliative radiotherapy during the last month of life: Predictability for referring physicians and radiation oncologists. Oncol Lett 2015;10:3043–9.
9. Nieder C, Andratschke N, Angelo K, Haukland E, Grosu AL. Development of a Score predicting survival after palliative reirradiation. J Oncol 2014;2014:1–7.
10. Guadagnolo BA, Liao K-P, Elting L, Giordano S, Buchholz TA, Shih Y-CT. Use of radiation therapy in the last 30 days of life among a large population-based cohort of elderly patients in the United States. J Clin Oncol 2013;31:80–7.
11. Berger B, Ankele H, Bamberg M, Zips D. Patients who die during palliative radiotherapy. Status survey. Strahlenther Onkol 2014;190:217–20.
12. Dennis K, Wong K, Zhang L, Culleton S, Nguyen J, Holden L, et al. Palliative radiotherapy for bone metastases in the last 3 months of life: worthwhile or futile? Clin Oncol R Coll Radiol 2011;23:709–15.
13. Anon. WHO definition of palliative care. Geneva: World Health Organization; n.d. Available at:http://www.who.int/cancer/palliative/definition/en/.
14. Chow E, Hoskin P, Mitera G, Zeng L, Lutz S, Roos D, et al. Update of the international consensus on palliative radiotherapy endpoints for future clinical trials in bone metastases. Int J Radiat Oncol Biol Phys 2012;82:1730–7.
15. Angelo K, Norum J, Dalhaug A, Pawinski A, Aandahl G, Haukland E, et al. Development and validation of a model predicting short survival (death within 30 days) after palliative radiotherapy. Anticancer Res 2014;34:877–85.
16. Gripp S, Mjartan S, Boelke E, Willers R. Palliative radiotherapy tailored to life expectancy in end-stage cancer patients: Reality or myth? Cancer 2010;116:3251–6.
17. Nieder C, Angelo K, Haukland E, Pawinski A. Survival after palliative radiotherapy in geriatric cancer patients. Anticancer Res 2014;34:6641–5.
18. Wong J, Xu B, Yeung HN, Roeland EJ, Martinez ME, Le Q-T, et al. Age Disparity in Palliative Radiation Therapy Among Patients With Advanced Cancer. Int J Radiat Oncol 2014;90:224–30.
19. Nielsen OS, Bentzen SM, Sandberg E, Gadeberg CC, Timothy AR. Randomized trial of single dose versus fractionated palliative radiotherapy of bone metastases. Radiother Oncol 1998;47:233–40.
20. Chow E, van der Linden YM, Roos D, Hartsell WF, Hoskin P, Wu JSY, et al. Single versus multiple fractions of repeat radiation for painful bone metastases: a randomised, controlled, non-inferiority trial. Lancet Oncol 2014;15:164–71.
21. Chow E, Wu JSY, Hoskin P, Coia LR, Bentzen SM, Blitzer PH. International consensus on palliative radiotherapy endpoints for future clinical trials in bone metastases. Radiother Oncol 2002;64:275–80.
22. Lutz S, Hoskin P, Chow E. Update on palliative radiotherapy endpoints for bone metastasis trials. Clin Oncol 2009;21:659–61.
23. Chow R, Hoskin P, Chan S, Mesci A, Hollenberg D, Lam H, et al. Efficacy of multiple fraction conventional radiation therapy for painful uncomplicated bone metastases: A systematic review. Radiother Oncol 2017;122:323–31.

24. Madsen EL. Painful bone metastasis: efficacy of radiotherapy assessed by the patients: a randomized trial comparing 4 Gy X 6 versus 10 Gy X 2. Int J Radiat Oncol Biol Phys 1983;9:1775–9.
25. Majumder D, Chatterjee D, Bandyopadhyay A, Mallick S, Sarkar S, Majumdar A. Single fraction versus multiple fraction radiotherapy for palliation of painful vertebral bone metastases: A prospective study. Indian J Palliat Care 2012;18:202.
26. Chow R, Hoskin P, Hollenberg D, Lam M, Dennis K, Lutz S, et al. Efficacy of single fraction conventional radiation therapy for painful uncomplicated bone metastases: a systematic review and meta-analysis. Ann Palliat Med 2017;6:125–42.
27. Bezjak A, Adam J, Barton R, Panzarella T, Laperriere N, Wong CS, et al. Symptom response after palliative radiotherapy for patients with brain metastases. Eur J Cancer 1990. 2002;38:487–96.
28. Wong J, Hird A, Zhang L, Tsao M, Sinclair E, Barnes E, et al. Symptoms and quality of life in cancer patients with brain metastases following palliative radiotherapy. Int J Radiat Oncol 2009;75:1125–31.
29. Langley RE, Stephens RJ, Nankivell M, Pugh C, Moore B, Navani N, et al. Interim data from the Medical Research Council QUARTZ Trial: does whole brain radiotherapy affect the survival and quality of life of patients with brain metastases from non-small cell lung cancer? Clin Oncol R Coll Radiol 2013;25:e23-30.
30. Park KR, Lee CG, Tseng YD, Liao JJ, Reddy S, Bruera E, et al. Palliative radiation therapy in the last 30 days of life: A systematic review. Radiother Oncol 2017;125:193– 9.