

Bone Metastasis – A Retrospective Analysis of Fractionation Schedules, and Re-Irradiation in a Tertiary Cancer Centre

Ashwini G¹, G Rajeev², Deleep Kumar G³

ABSTRACT

Introduction: Bone metastasis patients experience severe bone pain, inability to move, loss of independence and reduced quality of life. Path-physiology of bone pain is still unclear. Study was done at analysing the fractionation schedules, demographics, re-irradiation in bone metastasis patients treated with radiation in a tertiary cancer care hospital in India.

Material and methods: Retrospectively reviewed the data of patients who were symptomatic with bone metastasis treated by radiation at our institution from March 2016 to February 2017. The data was then analysed and interpreted.

Results: A total of 79 patients were analysed. Spinal metastasis was present in 55 (69%) patients. Dorsal spine with lumbar spine metastasis together was present in 20 patients (36.3%), dorsal spine alone in 20 patients (36.3%) and lumbar spine alone in 15 patients (27.2%). Both single fraction radiation (SFRT) and multiple fractions radiation (MFRT) were used in 8 (10.1%) patients and 23 (29.1%), 38 (48.1%), 10 (12.6%) patients received SFRT (8 Gy), MFRT (30 Gy in 10 fractions) and MFRT (20 Gy in 5 fractions) respectively. Re-irradiation was done in 6 patients (7.5%) with median age of 72 years. 5 (16.1%) patients in SFRT arm and 1 patient in MFRT received re-irradiation, respectively. Duration between two radiation therapies was ranging from 1 month to 12 months with mean of 6 months and median of 5 and half months duration.

Conclusion: Different schedules of external beam irradiation were used, of which SFRT is used in less than half of our patients. Re-irradiation rate was higher SFRT. Further studies are necessary to know which patients will benefit from single fraction radiation.

Keywords: Bone Metastasis, Palliative Radiotherapy, Single Fractions, Multiple Fractions, 8Gy, Reirradiation

INTRODUCTION

Axial and appendicular skeleton is one of the preferential sites for metastasis of solid tumors, and metastatic disease is the most common malignancy of the bone.¹ Radiotherapy is an useful option to palliate pain and prevention of the morbidity caused by bone metastases.² Different schedules of external beam radiation have been used for pain palliation, and single fraction radiation (SFRT) and multiple fractions radiation (MFRT) have had similar outcomes.³

In the present study, we assessed the fractionation schedules, demographics, re-irradiation in patients with bone metastasis treated with radiation in a tertiary cancer hospital.

MATERIAL AND METHODS

This is a retrospective study done in a tertiary cancer hospital in India. Data of all patients treated with palliative

radiation to bone metastasis were collected from March 2016 to February 2017 from hospital records. Patients who discontinued treatment were not included for the analysis.

RESULTS

A total of 85 patients completed the planned palliative radiation. Out of these patients 6 patients data was excluded due to different radiation schedule. Majority of patients were females 43 (54%). Median age of our patients was 56 years. Median age of males was 57 years and median age of females was 54 years. Primary site from which bone metastasis developed were lung 35%, breast 25%, head and neck cancers 15%, GIT 8%, prostate 5%, followed by cervix and MUO (Figure 1). Spinal metastasis were present in 55 (69%) patients. Dorsal spine with lumbar spine metastasis together were present in 20 patients (36.3%), Dorsal spine alone in 20 patients (36.3%) and lumbar spine alone in 15 patients (27.2%), respectively. Cervical spine metastasis was present in 6 patients and Solitary metastasis to cervical spine was not present (Figure 2). Single field of irradiation was used in 34 patients (43%) and multiple sites were treated in 43 patients (57%).

Both SFRT and MFRT were used in 8 (10.1%) patients. 23 (29.1%), 38 (48.1%), 10 (12.6%) patients received SFRT (8 Gy), MFRT (30 Gy in 10 fractions) and MFRT (20 Gy in 5

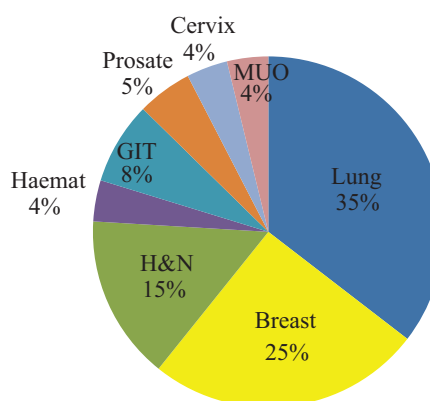


Figure-1: Percentage distribution of primary cancer in our bone metastasis patients

¹Registrar, ²Resident, ³Consultant, Department of Radiation Oncology, Basavatarakam Indo American Cancer Hospital and Research Institute, Hyderabad, India

Corresponding author: Ashwini G, 201, Sri Kuteer, Road No 8, Kakatheeya Hills, Madhapur, Hyderabad 500081, India

How to cite this article: Ashwini G, G Rajeev, Deleep Kumar G. Bone metastasis – a retrospective analysis of fractionation schedules, and re-irradiation in a tertiary cancer centre. International Journal of Contemporary Medical Research 2018;5(2):B1-B3.

	Primary	Age	Sex	RT schedule	Site of re-irradiation	Duration between Radiation
1	Breast	77	F	SFRT	PELVIS	1 month
2	RCC	56	M	SFRT	PELVIS	10 months
3	Prostate	76	M	SFRT	L spine	12 months
4	Lung	63	M	SFRT	D spine	5 months
5	Nasopharynx	80	M	SFRT	PELVIS	6 months
6	Multiple Myeloma	68	F	MFRT-30Gy	D Spine	2 month

Table-1: Characteristic features of patients who received Re-irradiation

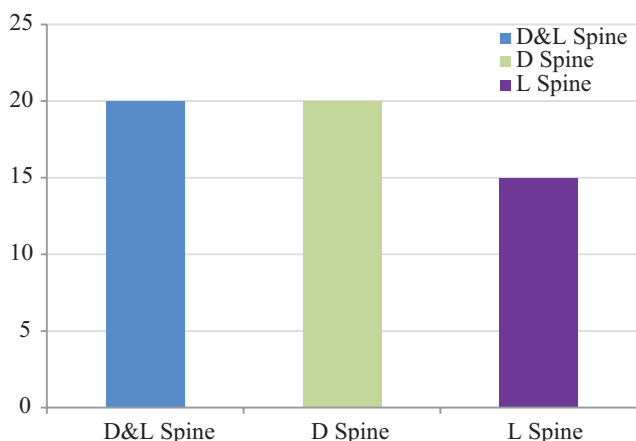


Figure-2: Distribution of Spinal metastasis

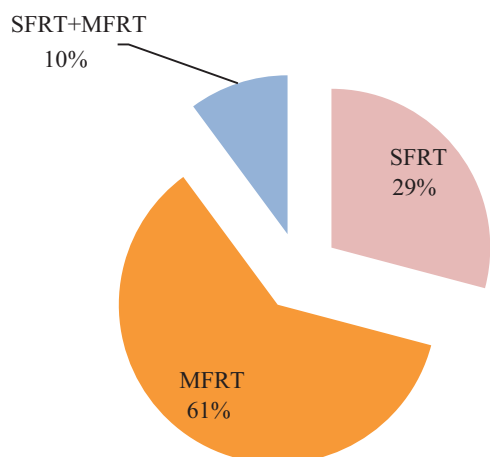


Figure-3: Distribution of patients SFRT, MFRT

fractions) respectively (Figure 3). Re-irradiation was done in 6 patients (7.5%). In SFRT arm 5 (21.7%) patients received re-irradiation and 1 patient in MFRT received re-irradiation. Patients who received re-irradiation were males (66%) with median age of 72 years and mean age of 70 years. Pelvis was most common re-irradiated site (50%) followed by dorsal spine and lumbar spine. Duration between radiations was ranging from 1 month to 12 months with mean of 6 months and median of 5 and half months duration. (Table1).

DISCUSSION

Pain may be due to tumor-directed osteoclast-mediated osteolysis, tumor cells themselves or structural damage, periosteal reaction or nerve entrapment. Pathological fractures may be a late complication of bone metastasis.⁴⁻⁶ Breast and prostate cancer are most common primary which cause skeletal metastasis. Median survival in these patients ranges from 6 months to 5 years depending on the primary

tumour.⁷

Spine is the most common site of metastasis⁸. In a study by Choi J et al metastases are most commonly located in the lumbar spine, followed by thoracic spine and cervical spine (52%, 36% and 12% respectively).⁹ Many treatment options are available for bone pains such as usage of analgesics, radiation, bisphosphonates, interventional technique like kyphoplasty, targeted therapy like Denosumab which acts on RANK L ligand. Spinal cord compression or spinal instability with bone metastasis may require surgical decompression. External beam radiotherapy is an efficient means to palliate pain in patients with bone metastasis.^{4,10} Caissie A et al concluded radiation decreases the pain, as early as 1 week with maximum response by 2 months. Radiotherapy also decreases insomnia and improves in quality of life (QOL).¹¹ Over the past years many radiation schedules are used for pain palliation like 30 (Gray) Gy in 10 fractions, 20/25 Gy in 5 fractions, 8 Gy in single fractions. Meta-analysis has shown there is no difference in pain relief and survival with different schedules. Higher rates of re-irradiation was seen when single fraction was used. Dutch study had re-irradiation rates of 24% and 6% for single fraction and multiple fraction radiation, respectively.¹²⁻¹⁴ Single fraction radiation schedule was less expensive of the treatments available for treating bone metastasis and is most preferably used in uncomplicated bone metastasis and poor predicted survival.^{15,16,17,18} Survey of practice pattern in bone metastasis among radiation oncologists by Fairchild A et al has shown limited use of single fraction radiation.¹⁹ Haddad P et al in a study showed that single fraction radiation was used only in one third of patients who were older with poor performance status.²⁰

In our study most common primary from which bone metastasis occurred was lung and breast. Spine was most common site of bone metastasis. Dorsal spine was most commonly involved followed by lumbar spine. Multiple fraction radiation is most commonly used in our study and only 39% of cases were treated with single fraction radiation. As in other studies, re-irradiation rates in our patients treated with single fraction was higher. Pain relief was not assessed in our patients as it's a retrospective study; we considered re-irradiation as a surrogate for inadequate pain relief. Majority of our patients had adequate pain relief 92.4%. Only 6 patients were re-irradiated and the time between radiations was variable from 1 month to 12 months. Sfrt in our study showed cost effectiveness due adequate pain relief with single day treatment without any hospital stay and patient can go back home be with his loved ones in a familiar

environment.

CONCLUSION

Multiple fractions radiation was most commonly used radiation schedule in our study. Single fraction radiation was used in less than half of patients in spite of many evidences showing equal benefits from multiple fractions or single fraction radiation. Re-irradiation rate was higher in older, male patients with pelvic bone metastasis treated with SFRT. Further studies are necessary to know which radiation schedules are preferred over single fraction radiation based on characteristics of patient, tumour, or outcomes.

REFERENCE

- Cuccurullo V, Cascini GL, Tamburrini O, Rotondo A, Mansi L. Bone metastases radiopharmaceuticals: an overview. *Curr Radiopharm.* 2013;6:41-7.
- 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.
- Rades D, Stalpers LJ, Veninga T, Schulte R, Hoskin PJ, Obralic N et al. Evaluation of five radiation schedules and prognostic factors for metastatic spinal cord compression. *J Clin Oncol.* 2005;23:3366-75.
- Smith HS. Painful osseous metastases. *Pain* 2011;14:E373-403.
- Goblirsch MJ, Zwolak PP, Clohisy DR. Biology of bone cancer pain. *Clin Cancer Res.* 2006;12:6231s-6235s.
- Coleman RE. Skeletal complications of malignancy. *Cancer.* 1997;80:1588-94.
- Filipa Macedo, Katia Ladeira, Filipa Pinho, Nadine Saraiva, Nuno Bonito, Luisa Pinto. Bone Metastases: An Overview. *Oncol Rev.* 2017; 11: 321.
- Asdourian PL, Weidenbaum M, DeWald RL, Hammerberg KW, Ramsey RG. The pattern of vertebral involvement in metastatic vertebral breast cancer. *Clin Orthop Relat Res.* 1990;250:164-70.
- Choi J, Raghavan M: Diagnostic imaging and image-guided therapy of skeletal metastases. *Cancer Control.* 2012;19:102-12.
- 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.
- Caissie A, Zeng L, Nguyen J, Zhang L, Jon F, Dennis K et al. Assessment of health-related quality of life with the European Organization for Research and Treatment of Cancer QLQ-C15-PAL after palliative radiotherapy of bone metastases. *Clin Oncol (R Coll Radiol).* 2012;24:125-33.
- Wu JS, Wong R, Johnston M, Bezjak A, Whelan T: Meta-analysis of dose-fractionation radiotherapy trials for the palliation of painful bone metastases. *Int J Radiat Oncol Biol Phys.* 2003;55:594-605.
- 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.
- Roos DE, Turner SL, O'Brien PC, Smith JG, Spry NA, Burmeister BH. Randomized trial of 8 Gy in 1 versus 20 Gy in 5 fractions of radiotherapy for neuropathic pain due to bone metastases (Trans-Tasman Radiation Oncology Group, TROG 96.05). *Radiother Oncol.* 2005;75:54-63.
- Konski A, James J, Hartsell W, Leibenhaut MH, Janjan N, Curran W et al. Economic analysis of radiation therapy oncology group 97-14: multiple versus single fraction radiation treatment of patients with bone metastases. *Am J Clin Oncol.* 2009;32:423-8
- 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.
- Rades D, Stalpers LJ, Veninga T, Schulte R, Hoskin PJ, Obralic N et al. Evaluation of five radiation schedules and prognostic factors for metastatic spinal cord compression. *J Clin Oncol.* 2005;23:3366-75.
- Meeuse JJ, van der Linden YM, van Tienhoven G, Gans RO, Leer JW, Reyners AK et al. Efficacy of radiotherapy for painful bone metastases during the last 12 weeks of life: results from the Dutch Bone Metastasis Study. *Cancer.* 2010;116:2716-25.
- Fairchild A, Barnes E, Ghosh S, Ben-Josef E, Roos D, Hartsell W et al. International patterns of practice in palliative radiotherapy for painful bone metastases: evidence-based practice? *Int J Radiat Oncol Biol Phys.* 2009;75:1501-10.
- Haddad P, Wong RK, Pond GR, Soban F, Williams D, McLean M, et al. Factors influencing the use of single vs multiple fractions of palliative radiotherapy for bone metastases: A 5-year review. *Clin Oncol (R Coll Radiol)* 2005;17:430-4.

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 27-01-2018; **Accepted:** 01-03-2018; **Published:** 09-03-2018