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EFFICACY OF 8 GY SINGLE FRACTION PALLIATIVE RADIATION THERAPY IN PAINFUL BONE METASTASES: AN INSTITUTIONAL STUDY

Radiotherapy

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ABSTRACT

Cancers that originate in the solid organs often spread to the bones, a condition known as bone metastases. The major consequences of BM include discomfort, fractures, compression of the spinal cord, and hypercalcemia. Radiotherapy is a well-known method for treating BM-related pain. For BM, many radiation regimes are utilised globally. This research looks at changes in pain and quality of life after a single palliative radiation portion for uncomfortable bone metastases. This research is prospective. 96 patients were treated with single fraction radiation at our facility between January 2022 and July 2022. They had radiographic evidence of bone metastases along with pathologically confirmed breast, prostate, lung, or kidney cancer. Our research lends credence to the use of 8 Gy of palliative radiation delivered in a single portion, since this dose considerably alleviated the suffering brought on by painful bone metastases in our setting while simultaneously enhancing patients' quality of life.

KEYWORDS

Bone Metastases, Single Fraction, 8 Gy, Palliative Radiation Therapy

INTRODUCTION:

When cancer has spread, the pain is usually worse in the bones. Radiation treatment is often used to treat painful, simple bone metastases. There have been several studies comparing single- and multiple-fraction regimens, and most of them have concluded that both are effective in relieving pain. Based on these findings, the Choosing Wisely Canada and United States campaigns, as well as the American Society for Therapeutic Radiology and Oncology, no longer advocate SFRT for uncomplicated bone metastases. Recent study by Conway et al. shows that SFRT, in both the complex and straightforward setting of bone metastases, improves patient-reported outcomes for pain, function, and symptom annoyance equivalent to MFRT (1).

The optimal dose of conventional external beam SFRT for maximum pain relief is unknown. In studies that directly compared 8 and 4 Gy, participants in the higher-dose arm reported considerably less painful side effects. Doses of 8 Gy or more were associated with significantly greater response rates in clinical trials than doses of 8 Gy or less across all investigations. Considering that 8 Gy is by far the most often administered dose, it was recommended in a previous study that this value be used as the benchmark against which all future studies are compared in terms of their ability to induce a satisfactory pain response (2).

Painful Bone Metastases

Bone metastases may occur in up to 50% of people with cancer. Cancers of the breast, prostate, or lungs are the most frequent primary sites for bone metastases to spread from. Primary malignancies of the urinary bladder, kidney, endometrial, thyroid, and melanoma can often cause bone metastases (3-5). Deterioration of bone structure and pain may result from metastatic tumours invading a localised area, which can disrupt the delicate balance between osteoblast and osteoclast activity in the microenvironment. Bone pain may be triggered by a number of different factors, including the direct invasion of a nerve root or an increase in the production of inflammatory mediators. Additionally, the patient may experience additional pain due to local muscle spasms. Bone metastases are often effectively treated with radiation therapy (6-8).

Painful Bone Metastases Treatment through Brachytherapy

By placing radioactive sources into the patient's body, brachytherapy damages the DNA of cancer cells and destroys their capacity to grow (9). In comparison to traditional external beam radiation treatment, it permits the utilisation of a greater total radiation dosage to treat a smaller region in a shorter amount of time. However, despite its efficacy, brachytherapy is seldom utilised to treat bone metastases. Recent literature has highlighted the value of this therapy in the management of painful spinal metastases, and a comprehensive review of this topic was recently published.

Painful Bone Metastases Treatment through Radioactive Isotopes

In order to successfully treat cancer, radiopharmaceuticals that target bone metastases are employed (10). Strontium-89 chloride, samarium-153 ethylenediamine tetramethylene phosphonic acid (EDTMP), rhenium-186 hydroxyethylidine diphosphonic acid (HEDP), and radium-233 dichloride are used to treat bone discomfort caused by osteoblastic or mixed bone metastases, most typically from the prostate and breast. These drugs tend to build up in osteosclerotic and osteoblastic bone metastases, but have little impact on osteolytic and osteoclastic ones (11). Radionuclide therapy should be reserved for metastatic bones that are very fragile, and local treatment, such as surgery or radiation therapy, should be attempted first.

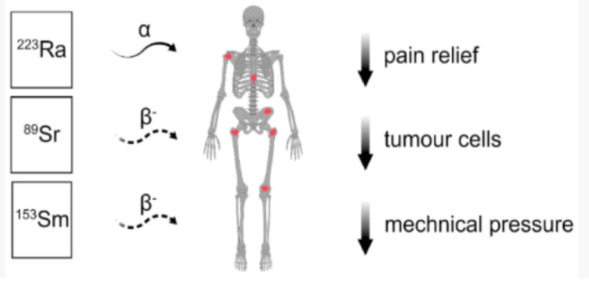

Figure 1: Depleted uranium and other radioactive isotopes multiple bone metastases treatment

Radiation Therapy for Distinct Solid Tumors Other Than Bone Tumors That Are Painful Primary, Regional, or Metastatic

The pain caused by soft tissue tumours may vary from hardly noticeable to debilitating. Pain is a common complaint among those who have been diagnosed with a primary or metastatic brain tumour. This is particularly true if the tumour is large or has produced swelling in the surrounding tissue. Patients in this group are arguing the advantages and hazards of surgery and radiation therapy based on factors such as individual preference, the existence of uncontrolled extracranial illness, estimated survival time, and other factors (12-15). To alleviate the symptoms of the oedema and tumour mass, whole brain radiation therapy is only one of several possible treatments. Apical tumour invasion of the brachial plexus may cause agonising pain for those with lung cancer. A meta-analysis of 14 randomised clinical trials found that palliative radiation significantly improved symptoms for patients with lung cancer, including pain. Different studies used a broad variety of radiation fractionation schedules, with some using as little as one fraction of 10 Gy and others using as many as 15 fractions of 45 Gy. Pain is another possible symptom for patients with locally advanced gastrointestinal cancer (16). When it comes to relieving symptoms, including pain, more than 70% of patients with an

adequate functioning level who receive IMRT for a stomach tumour report improvement. Prostate cancer patients in the latter stages of the disease may suffer from discomfort (17-19). Normal fractionation (45 Gy in 25 pieces) or hypofractionated radiation was effective in relieving pain for almost 70% of patients (30 Gy in 6 fractions). Within five years of diagnosis, 40% of people with pancreatic cancer will either progress to a more advanced stage or have their present stage deteriorate. Seventy-eight percent of patients with advanced pancreatic cancer reported relief from abdominal pain after undergoing SBRT, with the median dose being 28 Gy (25-33 Gy) in 5 fractions. Between 43 and 72 percent of patients feel considerable pain when nerves surrounding the pancreas are damaged.

Pain Assessment after Radiation Therapy

Radiation oncology patients are not uniformly assessed for pain levels prior to treatment. Various sources refer to doctor and patient testimonials on the effectiveness of various pain treatments. Furthermore, a Validated Brief Pain Inventory (BPI) was employed to assess the level of pain (20-22).

OBJECTIVE OF THE STUDY

To investigate changes in pain and quality of life after a single dose of palliative radiation for painful bone metastases.

MATERIAL AND METHODS

Research Design

This research carried out at the Acharya Tulsi Regional Cancer Treatment and Research Institute, Bikaner, in the department of radiation oncology. In our research, 73 patients who met the eligibility requirements were recruited. We carried out our research from January 2022 to July 2022. On a questionnaire describing the major illness location and the site of bone involvement, study-specific demographic data, including age and gender information, was gathered.

The average age was 58. (range 33–72 years). Breast cancer affected 39% of patients (n = 37), prostate cancer 35% (n = 33), lung cancer 23% (n = 24), and kidney cancer 3% (n = 2). The results of pretherapy and posttherapy assessments were evaluated using the Numerical Rating Scale (NRS). Its numerical equivalent of the Visual Analogue Scale classifies pain into three categories based on the intensity of the pain: Mild NRS (1-4), Moderate (5-6) and Severe (7-10)

Pain Assessment

BPI scores, which range from 0 to 10, were used to objectively quantify pain severity. The absence of pain is represented by a score of 0, whereas the highest possible value of 10 represents excruciating agony. The degree of pain was evaluated before treatment, after one or two days, and three months afterwards. Both at the conclusion of RT and at the three-month follow-up consultation, negative effects were reported.

Treatment And Follow-up

Radiation doses of up to 8 Gy were given in a single fraction. The extent of therapy was determined by the precise site of bone involvement. When the spine was at fault, the treatment area was assigned the space between the vertebrae above and below the one with the problem.

The treatment volume included the affected region plus a 3–5 cm buffer on all sides for long bones. The patient received follow-up care three months after treatment ended to assess their pain score and check for any residual side effects.

Response Assessment

Three-month complete responses (CR) and partial responses (PR) were used to evaluate the efficacy of the treatment. Three months following treatment, CR reported no pain using the BPI scale. In the third month after treatment began, PR indicated at least a two-point decrease in pain intensity as measured by the Brief Pain Inventory.

RESULTS

Patients

A total of 73 patients were included in the research, of whom 4% had an ECOG PS 0 score, 56% had an ECOG PS 1, and 40% had an ECOG PS 2. The gender split was 53% male and 47% female. The patients' median age was 58 years, with a mean age of 62.23 years and a standard deviation of 13.67 (Range 33–87).

Breast cancer affected 39% of patients, prostate cancer 35%, primary lung cancer 23%, and kidney cancer 3% (Table 1). The pelvic bone 25%, lumbar spine 34%, and thoracic spine 18% had the greatest bone metastases (Table 2).

Table 1: Primary cancer frequency

Primary Disease	Frequency	Percentage (%)
Breast cancer	28	39
Prostate cancer	26	35
Lung cancer	17	23
Renal cancer	2	3
Total	73	100

Table 2: Bone metastatic site

Bone site	Number of patients	Percentage (%)
Lumbar spine	25	34
Pelvic bone	18	25
Thoracic spine	13	18
Humerus	7	10
Femur	4	6
Sternum	1	1
Cervical spine	2	2
Tibia	2	2
Clavicle	1	1
Total	73	100

Response

Three months after concluding radiation therapy, 23% of patients reported no pain at the site of the sickness. Three-and-a-half percent of patients had some relief from pain as measured by a BPI score of 2 or above, indicating a partial response. Sixty-two percent or so was productively used (Table 3). The average pain rating before therapy was 8.15, but it dropped to 4.68 thereafter (p 0.001). (Table 4).

No one in our sample had a serious adverse event during the standard three-month follow-up. Mild to severe skin redness (grade II or lower) was seen in 8 individuals (11% of total patients), however it resolved within a week after topical treatment (four days or less).

Table 3: Frequency distribution of efficacy

Efficacy	Number of patients	Percentage (%)
No	28	38
Yes	45	62
Total	73	100

Efficacy = Complete response + partial response

Table 4: Mean pain score on BPI at the time of diagnosis and after radiotherapy.

Variables	Mean	SD
Mean BPI score after RT at three months	4.68	1.70
Mean BPI score from baseline	8.15	1.21

BPI: Bone Pain Inventory; RT: Radiotherapy.

DISCUSSION

While pain relief is the primary goal of palliative radiation treatment (RT) for bone metastases, normal appendicular function and structure are also sought for. Modern and effective systemic treatment has increased the life expectancy of cancer patients, allowing them to experience BM for extended periods of time. In certain cases, RT might provide a more localised, focused, and less intrusive therapy alternative.

Palliative radiation treatment, with external beam radiation therapy being a common and successful method, may relieve pain and suffering in as many as 80% of patients.

Palliative radiation therapy is recommended for the treatment of painful bone metastases by the National Comprehensive Cancer Network (NCCN) recommendations on cancer pain, the Ontario guidelines for palliative pain, and the third international consensus workshop on palliative radiotherapy and symptom management.

Low-dose, shorter-duration RT regimens were shown to be equally effective as high-dose, longer-duration RT regimens in reducing BM pain, as reported by the Radiation Therapy Oncology Group (RTOG) in study RTOG 7402. - The results of RTOG experiment 9701 comparing the effectiveness of short-term RT (8 Gy single fraction)

with long-course RT (30 Gy in 10 fractions) for treating painful BM were given by D. Tong et al., Hartsell et al. All of these randomised controlled studies found that when it came to relieving chronic pain, a single fraction of radiation therapy was just as beneficial as somewhat longer extended regimen RT treatments.

CONCLUSIONS

In cases with painful bone metastases, a single portion of palliative radiation at 8 Gy seems to be as effective as lengthier regimens in managing pain. Our 62% response rate is consistent with statistics from internationally published randomised studies. When the number of patients who can be accommodated by radiation therapy facilities is small, a single fraction regimen may be the most feasible and cost-effective option.

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