EXTERNAL BEAM IRRADIATION IN THE PALLIATION OF BONE METASTASES: A PRACTICE ANALYSIS AMONG SICILIAN DEPARTMENTS OF RADIATION ONCOLOGY

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Background: In the treatment of bone metastases, the choice of radiation fractionation, total radiation dose, delivery technique, and imaging studies before treatment varies among radiation oncologists. Surveys on this issue, using case scenarios, have been published by groups from Europe, North America, and Australia-New Zealand. Our objective was to analyze retrospectively the “real” practice in nine radiotherapy centers located in Sicily.

Method: A questionnaire including 17 items was distributed to 30 practicing radiation oncologists working in seven departments of four Sicilian cities (Messina, Catania, Ragusa and Palermo) during a meeting of the Sicilian Division of the Associazione Italiana Radioterapia Oncologica (AIRO). Participants were asked to answer the questions using a card for every patient treated with external beam irradiation from 1 January to 31 December, 2000.

Results: Six centers returned the questionnaires; 332 cards were valuable for a total of 5644 responses. All six responding departments used linear accelerators for treatment delivery. The most common dose fractionation was 30 Gy in 10 fractions and the most common technique used was opposed parallel local fields. Before the start of irradiation a bone scan was performed in 325 of the 332 (98%) patients treated and CT and/or MRI was performed in 320 (96%); surprisingly, standard roentgenograms were used in only 142 of 332 patients (43%).

Conclusion: The “real” radiation practice for bone metastases in the region of Sicily confirms the results of the previously reported international surveys: there is a clear preference for fractionated treatment and local field therapy. The results of randomized studies, which demonstrated both the efficacy and the feasibility of a single 6-8 Gy fraction in the palliation of bone metastases, have little or no impact on the pattern of practice.

Key words: bone metastases, radiotherapy.

Introduction

Bone metastases are common in advanced cancer and radiotherapy (RT) is an effective approach both to control pain and to prevent fractures\(^1\). Although RT is a widely used treatment, there is no standard approach to fractionation. Numerous randomized studies on this issue have demonstrated that a single dose of 6-8 Gy is as effective as more protracted fractionation (eg, 10 x 3 Gy or 5 x 4 Gy)\(^2,3\). Based on fixed case scenarios several surveys of the patterns of practice have confirmed the lack of uniformity among radiation oncologists in the prescription of fractionation and in total radiation dose\(^3\). Curiously, the radiation practitioner seems to be more influenced by the data of an old RTOG paper\(^4,5\) than by updated information from numerous recent papers\(^2,6-12\).

Is this an instinctive fear of single fractionation or the result of personal, unpublished experience?

To assess the actual practice among Sicilian radiation oncologists, we proposed the institution of a database containing information about patients with bone metastases treated in this Italian region during the year 2000. This paper presents the results related to 332 patients.

Patients and methods

For data collection we used a questionnaire with 17 items, some of which were related to patient and tumor characteristics and others to technical aspects of radiation delivery (see Appendix). During a meeting of the Sicilian Division of the Associazione Italiana Radioterapia Oncologica (AIRO), the questionnaire was distributed among 30 radiation oncologists in active practice in seven Sicilian radiation departments (two university hospitals, three regional hospitals and two private hospitals). Radiation oncologists had to compile a card for every patient with bone metastases without spinal cord compression, treated with external beam irradiation between 1 January and 31 December 2000.

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Dr S Pergolizzi and Dr A Pontoriero, two of the principal investigators, take the responsibility for the overall content of the article.

The principal investigators, database operators, investigators and collaborating centers are listed in the Appendix.

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Results

Six departments mailed the cards regarding their patients. The participating departments were the University of Messina (UM), the Centro Catanese di Oncologia and REM Catania (CCO-REM), the San Luigi Hospital of Catania (SLH), the University of Catania (UC), and the “M Paternò Arezzo” Hospital of Ragusa (HR).

Patient characteristics

A total of 336 cards were compiled; four were incomplete and were excluded from the analysis. Therefore, 332 cards with a total of 5644 responses make up the database used in the present study. During the one-year observation period in six Sicilian Departments of Radiation Therapy, 332 patients with bone metastases had been consecutively treated at 458 skeletal sites. One hundred and forty-eight and 123 patients were treated at the CCO-REM and UM, respectively; Figure 1 details the number of patients treated at each institution. Among the 332 patients there were 191 men and 141 women, with a median age of 66 years (range, 21-91 years) and a median Karnofsky performance status of 70 (range, 40-80). The most common primary tumor sites were breast (33%), lung (26%), and prostate (13%). Table 1 shows both patient and tumor characteristics. Most patients had two or three skeletal segments involved by metastatic disease; Figure 2 details the number of involved sites.

Preradiation imaging

In 325 patients a bone scan was performed before radiation treatment; for 320 patients CT and/or MRI information was available (Figure 3).

Anatomic distribution of metastases

Among the 458 treated skeletal sites there was a prevalence of spinal metastases (239 sites) followed by pelvic bones (63 sites) and lower limbs (91 sites). Figure 4 shows the anatomic distribution of the irradiated skeletal segments.

<table>
<thead>
<tr>
<th>Characteristics of the patients</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age</td>
<td>66 (21-91)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>191</td>
</tr>
<tr>
<td>Female</td>
<td>141</td>
</tr>
<tr>
<td>Karnofsky PS</td>
<td>70 (40-80)</td>
</tr>
</tbody>
</table>

Table 1 - Characteristics and primary cancer sites of 332 patients with bone metastases

<table>
<thead>
<tr>
<th>Primary cancer sites</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>111 (33)</td>
</tr>
<tr>
<td>Lung</td>
<td>86 (26)</td>
</tr>
<tr>
<td>Prostate</td>
<td>44 (13)</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>18 (5)</td>
</tr>
<tr>
<td>Kidney</td>
<td>16 (4.8)</td>
</tr>
<tr>
<td>Colon-rectum</td>
<td>16 (4.8)</td>
</tr>
<tr>
<td>Unknown</td>
<td>15 (4.8)</td>
</tr>
<tr>
<td>Others</td>
<td>35 (10)</td>
</tr>
</tbody>
</table>

Radiation techniques

All patients were treated using linear accelerators and local fields with a median field size of 80 cm² (range, 30-1200 cm²); the most commonly used technique was parallel opposed fields (224/458 treatments). Figure 5 shows the employed techniques.

The most frequently delivered dose was 30 Gy (range, 6-46 Gy), with a median daily dose of 3 Gy (range, 6-10 Gy) in a median time of 12 days (range, 1-29 days); the most frequent fractionation schedule was
3 Gy x 10 fractions, which was employed in 257 patients. The fractionation is detailed in Figure 6.

Discussion

External beam radiation therapy is the principal therapeutic approach to control pain and to prevent pathological fractures in patients with bone metastases. Bone metastases account for about 50% of the palliative treatments in radiation practice and it is calculated that around 30% of cancer patients will require irradiation for skeletal metastases in the course of their disease. In our observational-retrospective study we tried to photograph the actual radiation practice for bone metastases in Sicily.

Despite the great clinical impact of skeletal metastases, there is no universally accepted standard treatment. The published guidelines for radiation delivery for bone metastases are particularly confusing because of the great variation in beneficial results of reported clinical trials and because reports include a wide variety of tumor types as well as different scoring methods and reporting techniques. In 1998 experts of the American College of Radiology were unable to formulate standard criteria for the irradiation of bone metastases. It is a common approach to treat single asymptomatic bone metastases, especially in breast cancer patients, using a more protracted irradiation course.

This clinical practice is confirmed in our series: 11 patients (6 UM, 3 CCO-REM, 1 SLH) with apparently
single skeletal metastases from breast cancer received “conventional” fractionation of 2 Gy per day for total doses of 40-46 Gy.

In the symptomatic-palliative setting, many studies have addressed the feasibility and efficacy of single fractionation (8 Gy); nevertheless, this approach is less utilized in the radiotherapeutic practice. Besides, a recent meta-analysis of dose fractionation irradiation randomized trials for the treatment of painful bone metastases further demonstrated that there is no significant difference in overall pain relief between single- and multifraction palliative radiotherapy for bone metastases.

“Case-scenario” studies conducted in North America, Australia-New Zealand, and Europe used virtual patients and were referred exclusively to an ideal radiation treatment. In this instance the answers could be different from real clinical practice. Instead, in our survey we report on the true clinical practice over a period of as long as one year.

In spite of the difference in data collection, our results confirm those observed in the case-scenario studies: there is a clear preference for fractionated treatment with 30 Gy in 10 fractions and local field therapy. In our series the single shot radiation delivery technique was employed in only 12% of all treated patients.

In conclusion, randomized studies showing the efficacy of the single fraction in the treatment of bone metastases appear to have had no real clinical impact. In agreement with Chow et al., we believe that prospective randomized studies with well-defined endpoints are necessary to advance consistency in reporting.

References
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