

Efficacy of postoperative radiation treatment for bone metastases in the extremities

Leah Drost, Vithusha Ganesh, Bo Angela Wan, Srinivas Raman, Stephanie Chan, Monique Christakis, May Tsao, Elizabeth Barnes, Michael Ford, Joel Finkelstein, Albert Yee, Angela Turner, Henry Lam, Edward Chow



Odette Cancer Centre, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, ON, Canada



Introduction

- 10% of patients with bone metastases experience pathological fractures (1-3); surgery is often required to stabilize these to provide pain relief and restore function (4).
- Postoperative radiation treatment following surgery for these fractures is often given as it is believed to lessen pain, decrease displacement of surgical hardware, and reduce need for second surgery.
- However, there is a lack of clinical evidence in the actual effectiveness of postoperative radiation in the extremities (1).
- This study aimed to investigate the benefits of postoperative radiation treatment patients in this cohort.

Materials and Methods

A retrospective study was conducted in patients referred for postoperative radiation to the extremities between 2009 and 2017 at the Sunnybrook Odette Cancer Centre.

Demographic information, radiation treatment plans, and details regarding surgical procedures were extracted from the prospective database and medical records. Approval was obtained from the institution's Research Ethics Board. All data were analyzed using descriptive statistics.

The primary objective of this study was to evaluate the need for second surgery following postoperative radiation. Operative reports from medical records were analyzed. Information including the date, type, and site of procedure were extracted.

The secondary objectives in this study were to assess the need for re-irradiation and the radiological changes at the treatment site over time. Radiation treatment characteristics were analyzed in cases of re-irradiation, and all imaging of the surgical site performed post radiation was reviewed and analyzed to determine frequencies of tumour progression and prosthesis displacement at the treatment site.

Time to specified outcome (second surgery, re-irradiation, progression of bone metastases, displacement of prosthesis, or follow-up) was calculated from the date of first fraction of postoperative radiation.

Results

Demographics

Sixty-five patients received radiation to 74 sites at a median time of 24 days following orthopedic surgery. The median age was 74 years, median Karnofsky Performance Status (KPS) was 50 at time of radiation consultation, and the most common primary cancer sites were lung (29.2%), breast (27.2%), and prostate (15.4%).

Treatment information

The radiation fields covered the entire prosthesis in all but 2 treatment sites (97.3%); neither of these prostheses required a subsequent intervention or showed radiological progression. Most treatment sites (81.1%) received 20 Gray (Gy) in 5 fractions, and the majority of surgeries were performed at the hip or femur (79.7%). All patients received postoperative radiation within 3 months, with the exception of one patient.

Need for second surgery

Only 2 treatment sites (2.7%) required a second surgery to the same site, at 9 months and 10 months following postoperative radiation due to fracture and prosthesis displacement, respectively.

Need for re-irradiation

There were 7 treatment sites (9.5%) that required re-irradiation, administered a median time of 9.3 months. All 7 patients reported increased pain at the site, and 2 showed local progression in the bone.

Assessment of radiological changes

A total of 47 treatment sites had radiological imaging available post radiation. On average, 5 imaging tests were performed with a median radiological follow-up time of 4.5 months. 8 treatment sites had imaging revealing local progression of bone metastases (17.0%), and progression was noted after a median of 2.1 months. A single treatment site had radiological evidence of prosthesis displacement after 1 month.

Conclusions

This study provides clinical support for the role of postoperative radiation treatment of the extremities, following orthopedic stabilization for impending or pathological fracture due to bone metastases. Our study found low rates of second surgery, re-irradiation and local progression that may affect alignment of prosthesis. Accordingly, we believe that postoperative radiation has a positive effect on patients with advanced cancer and bone metastases.

References

1. Willeumier JJ, van der Linden YM, Dijkstra PDS. Lack of clinical evidence for postoperative radiotherapy after surgical fixation of impending or actual pathologic fractures in the long bones in patients with cancer; a systematic review. *Radiother Oncol* 2016;121(1):138-42.
2. Townsend PW, Smalley SR, Cozad SC, Rosenthal HG, Hassanein RES. Role of postoperative radiation therapy after stabilization of fractures caused by metastatic disease. *Int J Radiat Oncol Biol Phys* 1995;31(1):43-9.
3. van Geffen E, Wobbes T, Veth RPH, Gelderman WAH. Operative management of impending pathological fractures: a critical analysis of therapy. *J Surg Oncol* 1997;64:190-4.
4. Malviya A, Gerrand C. Evidence for orthopaedic surgery in the treatment of metastatic bone disease of the extremities: A review article. *Palliat Med* 2011;26(6):788-96.

Acknowledgement: We thank the generous support of Bratty Family Fund, Michael and Karyn Goldstein Cancer Research Fund, Joey and Mary Furfari Cancer Research Fund, Pulenzas Cancer Research Fund, Joseph and Silvana Melara Cancer Research Fund, and Ofelia Cancer Research Fund.