CORR Tumor Board

CORR® Tumor Board: Sacral Insufficiency Fractures are Common After High-dose Radiation for Sacral Chordomas Treated With or Without Surgery

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Now that we know that there is a higher than previously reported association between high-dose radiation for sacral chordomas and sacral insufficiency fractures, what can we do to prevent them?

A Note from the Editor-in-Chief: We are pleased to present our newest column, CORR® Tumor Board. This column provides multidisciplinary perspective on the themes raised in selected CORR® tumor papers. In this column, we will discuss the implications of the highlighted article from the varied disciplines of the Tumor Board members: Orthopaedic surgery, pathology, and radiology. This month's column discusses "Sacral Insufficiency Fractures are Common After High-dose Radiation for Sacral Chordomas Treated With or Without Surgery" by Osler and colleagues available at: DOI: [10.1007/s11999-015-4566-5](https://doi.org/10.1007/s11999-015-4566-5).

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members are on file with the publication and can be viewed on request.

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Preventing these fractures is important, since we know from our patients and other research [13] that the morbidity of sacral insufficiency fractures is tremendous. The fractures in combination with radiation osteitis are painful and limit patients' abilities to mobilize, care for themselves, work, and other daily living activities. They are difficult to treat and slow to heal [13]. Patients may be cured of their tumors, but have lasting effects from the treatment on their quality of life. These tumors are rare, but further prospective multiinstitutional collaborative efforts [6, 9] can demonstrate the exact morbidity in this specific population.

Given that these fractures are relevant clinically, what can we do to prevent them? Other work by some of the same investigators [10] has shown that high-dose radiation, in addition to en bloc resection, leads to the highest rates of local control in chordomas. Therefore, the argument could be made that radiation cannot be withheld to best improve local tumor control. Antiresorptive therapy, such as use of bisphosphonates, might offer some

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promise and deserves prospective evaluation in this population. Both clinical [3, 4] and laboratory research [1] suggest this avenue worthy of further inquiry.

What issues does this study raise in terms of musculoskeletal imaging?

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Perhaps the most important issue raised by this study is that radiologists may be underdiagnosing sacral insufficiency fractures on followup imaging studies in patients with sacral chordomas treated with radiotherapy. This study reveals a higher-than-expected risk of sacral insufficiency fracture following radiotherapy when compared to past studies with fracture rates of 6% to 8% [2, 11]. Nearly half of the patients in the study developed insufficiency fractures, and the proportion was even higher in patients with high sacrectomy.

Since the authors were specifically searching for insufficiency fractures, they likely discovered more patients with this complication than did earlier reports that relied on the initial radiology report [2, 11]. It is important for radiologists and surgeons to be aware of this complication in order to interpret the imaging scans correctly,

which can guide the correct treatment. It is also important to realize that insufficiency fractures following radiotherapy can be difficult to identify on imaging studies. Irradiated bone can distort the normal trabecula and the classic low-signal fracture line with surrounding marrow edema on MRI may not be present. In these situations, one would worry that cases of insufficiency fracture could be mistaken for tumor recurrence, or vice versa. One needs to be aware of this pitfall when searching for recurrence of tumor on followup imaging studies. Lastly, although this study was performed on only patients with chordomas, sacral insufficiency fractures can also occur with high frequency following radiotherapy for prostate, uterine, cervical, and other pelvic malignancies. It would be important to search for insufficiency fractures in these patients as well in order to guide management and to not mistake an insufficiency fracture for tumor recurrence or a new metastasis.

What more does the surgeon need to know about musculoskeletal pathology in order to get the most out of this study?

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The study comes from a regional referral center for chordoma. The

availability of proton beam irradiation at the authors' institution has been a particular draw for patients, and it has afforded specialists in multiple disciplines the opportunity to accrue substantial experience with a quite rare tumor.

The rarity of a chordoma can make it hard to recognize histologically. At some hospitals, a pathologist may go years and years in between cases of chordoma. The entity is even more difficult to identify because it may not always show classic physaliferous cells in a myxoid matrix. Recent work, much of which stems from the authors' institution, has expanded the histologic spectrum of chordoma [5, 12]. The discovery that chordoma cells express the T-box transcription factor brachyury, which can be detected via tissue immunohistochemistry, has permitted the recognition of a group of poorly differentiated "chordomas" that may otherwise have been undiagnosed [7, 8, 12]. Therefore, the authors' series may include a higher percentage of poorly differentiated (that is, likely biologically aggressive) chordomas than did previous studies, perhaps accounting to an extent for the high rate of sacral insufficiency fractures in the present study. Additionally, clinico-radiographic and pathology expertise is required to distinguish chordoma from notochordal remnants (such as ecchordosis physaliphora);

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exclusion of these benign histologic mimics of chordoma from a clinical study could also contribute to poorer oncologic outcomes relative to studies in which this diagnostic pitfall is less readily recognized.

Cancer care is an interdisciplinary endeavor. Accumulated experience with a rare cancer type can lead to synergistic progress among the various medical disciplines. In other words, advances in diagnosis can influence clinical research findings and vice versa.

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