Letter to the Editor

The use of preoperative imaging in the treatment of sacral chordomas

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We greatly appreciate the thoughtful response by Munger and colleagues (1) to our original article on the predictive value of magnetic resonance imaging (MRI) findings on outcomes after *en bloc* resection of sacral chordomas (2). While we caution against over-interpretation given our sample size, we humbly believe that the preoperative imaging factors elucidated in our study may have prognostic implications that are important for both patients and surgeons.

First, identifying prognostic imaging factors can enable a more informed discussion with patients and their families prior to making the potentially life-altering decision to undergo *en bloc* resection of a sacral chordoma. Patient education is one of the primary roles of the surgeon, and it is particularly important when the diagnosis is rare and the treatment is complex. Chordoma patients have unprecedented access to online information and networking (3). Nonetheless, the surgeon must be able synthesize the latest findings and present them in a comprehensible manner. *En bloc* resection for sacral chordoma often results in permanent alterations of bowel, bladder, and/or sexual function. Being able to have the most informed discussion about long-term disease trajectory, and balance this with the morbidity of surgery, can significantly help patients and families during the early phases of their journey. In addition, novel imaging information helps the surgeon as he or she plans a complex, often staged operation involving up to four different surgical teams: neurosurgery, vascular, colorectal, and plastics (4). We found that patients whose chordomas had extension into the subcutaneous fat had an inferior prognosis. This pattern of anatomic spread may represent a more aggressive tumor type capable of invading beyond the thick lumbosacral fascia. Moreover, it may lead to an increased likelihood of tumor violation by the surgeon. Few things derail an *en bloc* resection quite like trespass of the tumor capsule in the opening minutes of an operation. We strongly emphasize meticulous review—if possible with a specialized musculoskeletal radiologist—of all sequences and slices of preoperative imaging, multiple times during the surgical planning process. Given the high stakes of the surgery, one must not fail to recognize tumor extension into the subcutaneous fat.

We wholeheartedly agree with Munger and colleagues (1) that the small sample size in our study hindered our statistical analysis, and we must avoid definitive conclusions. It is entirely possible that in a larger cohort, several of the univariate factors that predicted local recurrence may have remained significant after multivariate testing with more statistical power, and conversely, the finding of fat extension may not have remained significant. Even in dedicated cancer centers, the number of patients undergoing *en bloc* resection of sacral chordomas is relatively small. The importance of multicenter efforts when studying sacral chordomas cannot be overemphasized. Reports of

166 mobile spine chordomas (5) and 167 sacral chordomas (6) are only feasible with international, collaborative efforts such as the AOSpine Knowledge Forum Tumor database.

Amidst the challenges and complexities of sacral chordoma surgery, several controversies persist, the greatest of which may be the true benefit of an *en bloc* resection versus newer forms of radiation. We eagerly await the results of the ongoing clinical trial testing surgery versus definitive radiation therapy in primary localized sacral chordomas (SACRO), conducted by the Italian Sarcoma Group (7), that aims to accrue 100 patients by 2022. A second controversy deals with the role of radiation treatment as a surgical adjuvant. Should radiation be used in conjunction with surgery, and if so, what type, what dose, and when? Highlighting this controversy, Dea *et al.* (8) administered a survey to 39 experienced spinal tumor surgeons and the main area of disagreement was the role of postoperative radiation, where 41% gave radiation only if positive margins, and 38% gave postoperative radiation regardless of margin status. Anecdotally, we reserve adjuvant radiation therapy for intralesional margins or tumor recurrence, as the morbidity of this high dose radiation is not insignificant. With respect to which type of radiation is best, a second ongoing trial from France (7) aims to test the efficacy of high dose proton radiation therapy for residual tumor in chordomas throughout the spinal column, planning to accrue 64 patients by 2022. Lastly, we have yet to fully study the impact of percutaneous ablative techniques such as radiofrequency ablation (9), cryoablation (10), and laser interstitial thermal therapy (LITT) (2) on residual or recurrent chordoma.

We again thank the authors for a thoughtful response and their efforts to advance the care of patients with this rare, challenging surgical problem.

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None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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