Neoadjuvant Radiation Influences the Pseudocapsule in Soft Tissue Sarcoma: A Histopathologic and Radiographic Evaluation

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INTRODUCTION:
Soft tissue sarcomas (STS) are malignant tumors of mesenchymal origin often treated with neoadjuvant radiation and en bloc resection with emphasis on achieving wide negative margins. Surgical margins for STS are described in relation to a pseudocapsule that immediately circumscribes the tumor. The purpose of this study was to describe pathologic composition and radiologic appearance of the pseudocapsule in STS and assess effect of neoadjuvant radiation on pseudocapsule thickness and composition.

METHODS:
This was a retrospective review of high-grade STS patients over a consecutive 10-year period. Resected specimens were reviewed by a board-certified pathologist with subspecialty training in surgical pathology and musculoskeletal sarcoma. MRI studies were reviewed by two board-certified, fellowship-trained musculoskeletal radiologists.

RESULTS:
In patients treated with neoadjuvant radiation, the pseudocapsule was well-demarcated with fewer viable tumor cells in the pseudocapsule and surrounding tissues when compared to untreated samples. The pseudocapsules of the irradiated cohort were thicker using pathology mean pseudocapsule thickness measurements (0.76 mm, standard deviation (SD) = 0.37 mm) versus non-irradiated pseudocapsules (0.37 mm, SD = 0.16 mm) (p < 0.001). The irradiated cohort was also thicker when measured using MRI point of maximal thickness (2.36 mm, SD = 1.22 mm) versus the non-irradiated cohort (1.42 mm, SD = 0.65 mm) (p = 0.04). Pathology mean pseudocapsule thickness was positively correlated with tumor necrosis percentage (p = 0.044), and negatively correlated with mitotic rate (p = 0.043). When investigating effect modification of neoadjuvant chemotherapy, pseudocapsules exposed to radiation only were thickest, followed by radiation and chemotherapy, while no neoadjuvant treatment was the thinnest (radiation only = 0.95 mm, SD = 0.32 mm; chemotherapy and radiation = 0.57 mm, SD = 0.31 mm; no neoadjuvant therapy = 0.37 mm, SD = 0.16 mm).

DISCUSSION AND CONCLUSION:
The pathologic and radiologic features of the pseudocapsule are influenced by neoadjuvant radiation, and pseudocapsule thickness may correlate with tumor response to radiation. Future studies are required to identify the clinical significance of the pseudocapsule, including its potential use as a preoperative tumor response assessment tool or a predictive measure of disease-related outcomes.