Which boost is the best boost? a comparison of BCT boost techniques

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Purpose/Objective: Breast Conservation Therapy (BCT) is the ‘gold standard’ in early-stage breast cancer treatment. Many BCT patients also require a boost to the tumor bed in addition to 3 to 5 weeks of external beam radiation treatment (EBRT). There are several different technologies that can be used to boost the tumor bed. This study reviews these various technologies, compares the volumes irradiated, the dose distributions to the tumor bed, and the overall homogeneity of the treatment, as well as the dose which is delivered to critical structures. The advantages and disadvantages of each boost approach are discussed.

Materials and Methods: To simplify comparison in this study, we selected patients to evaluate who had a maximum tumor dimension of 2 cm at the time of the surgery. We selected patients with left-breasted tumors to maximize the impact of each technique on treating critical structures. For patients treated totally with EBRT, we selected patients who started EBRT no later than 6 weeks post-surgery. Both 3 and 5 week EBRT treatment schedules were studied. The TPS system and home-made software evaluated the dose distributions of the combined EBRT boost and EBRT whole breast treatment. For patients treated with IORT, the dose map was added to the EBRT distribution with a suitable registration. Estimated RBE corrections were made for the 50 kV devices. The α/β model was used to convert IORT doses to normal fractionated EBRT doses.

Results: Three (3) patients treated with each technique were studied and the results were averaged to obtain the final data for each technique. Dose to critical structures were compared for all techniques knowing that the driving factor for dose to critical structures is the EBRT dose, not the boost dose. In theory, IORT with electrons had the most uniform dose over the smallest boost volume of all boost techniques but several parameters can influence the boost volume (50 kV applicator diameter, presence of a chest wall shield, etc...)

Conclusions: There are significant variations in the volumes and dose homogeneity of the irradiated boost volumes depending on which boost technique is used, but this does not appear to significantly impact the overall physical dose distributions when the EBRT dose is added to the boost. BED variations are somehow greater. There are, however, significant differences in advantages in one technique over another, and these can result in both cosmetic and oncologic differences.

Poster Discussion: Innovation in physics and technique of IORT