

PRE-CLINICAL TREATMENT DOSIMETRIC ASSESSMENT of ACCELERATED PARTIAL BREAST IRRADIATION (APBI) WITH THE SENORX BALLOON BRACHYTHERAPY CATHETER

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Purpose

A common and well accepted treatment paradigm for APBI brachytherapy is the central, single lumen balloon (SLB) catheter such as the MammoSite (Hologic Inc.). Balloon asymmetry or/and proximity to skin or chest wall can lead to increased dose to these structures. The multi-lumen balloon (MLB) catheter (Contura, SenoRx Inc.) with four offset lumens represents an evolved paradigm that preserves the balloon approach, but addresses the issues of unwanted dose to chest wall and skin. The purpose of this study is to assess the dosimetric impact of the MLB design over current central lumen only balloon catheters.

Materials/Methods

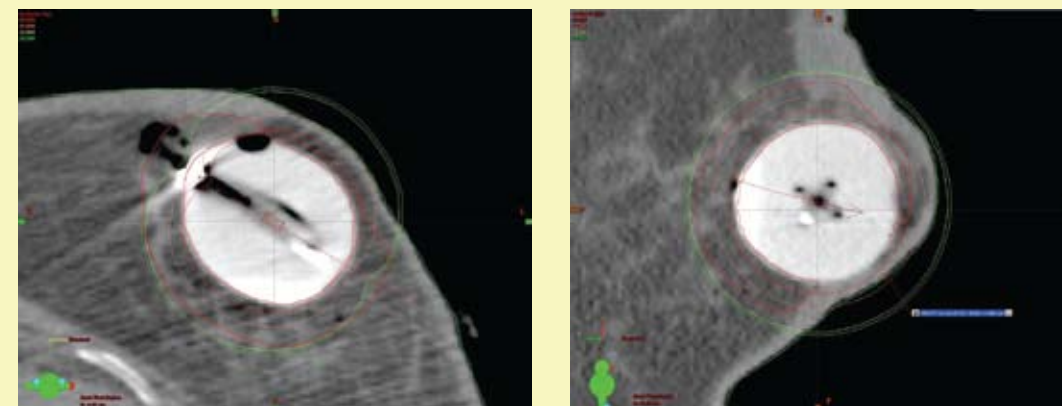
Ten CT datasets from patients treated with the MammoSite were used in this study. All were considered to have had acceptable balloon placement according to NSABP B39/RTOG 0413 protocol guidelines. The targeted breast tissue immediately surrounds the balloon to a measured 10 mm distance from the balloon surface. PTV_EVAL was defined as PTV excluding the chest wall and constrained to 5 mm from the skin. PTV_EVAL is the structure used for DVH constraints, dosimetric analysis, and comparison of SLB and MLB plans. Other clinical structures included the healthy breast, skin, chest wall, and pectoralis muscle. To simulate clinical MLB results, the SLB plans were modified to account for the geometry of the SenoRx catheter offset lumens and dosimetry reoptimized. SLB and MLB plans were compared for four implant scenarios: balloons placed < 5mm, between 5-10mm, beyond 10mm from the skin or chest wall, and balloons with about 3mm of radial asymmetry placed adjacent to the chest wall.

Results

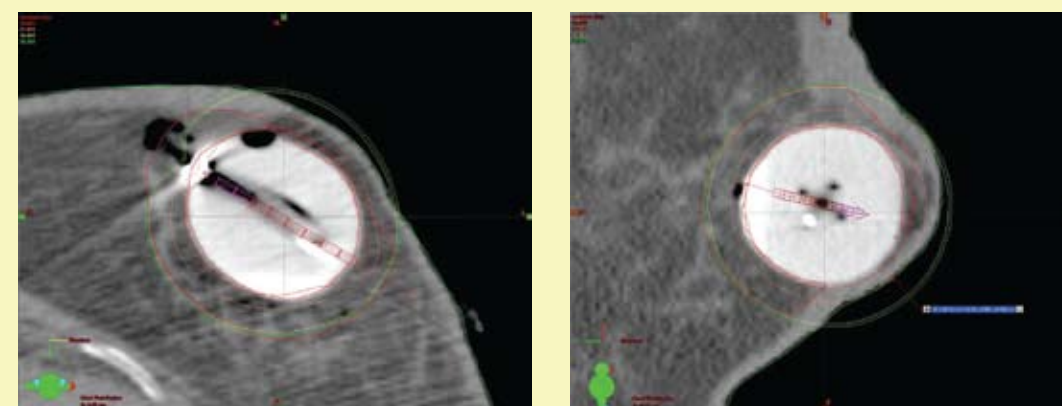
For symmetric balloons placed > 10 mm from skin and chest wall, SLB and MLB dosimetric results were similar. In the 5-10mm skin distance range, when the balloon was adjacent to the chest wall or ribs, the MLB maintained good PTV_EVAL coverage (V95>90%), diminished V100 and V150 to breast tissue by about 30% and 20%, respectively, and reduced chest wall dose by about 40%. Similarly, for balloons placed at 5mm skin distance, the maximum dose to skin was reduced to less than 115%, typically 30% less than the corresponding SLB. Furthermore, dose distributions better conformed to the target shape with dose to breast tissue outside PTV_EVAL reduced: V150 was reduced to zero, V100 was reduced by 22% to 56%. PTV_EVAL coverage was consistently increased in all cases by 5-15% with MLB.

Conclusions

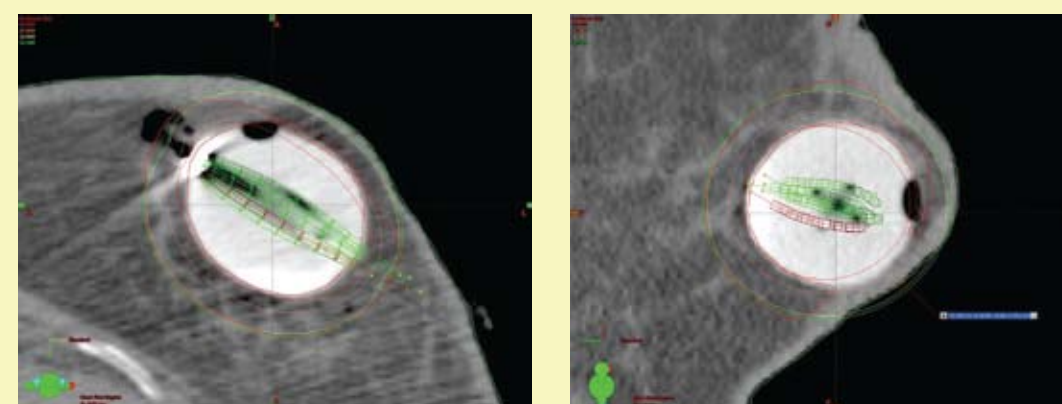
Through evaluation of ten clinical cases, geometric scenarios have been identified where loading of only a central lumen presents dosimetric limitations. The multi-lumen balloon catheter (Contura, SenoRx Inc.) design can lead to significant improvements in dose coverage of the partial breast target with simultaneous dose reductions to adjacent skin and chest wall structures and improved conformity.



V95> 95% V150=25.5cc V200=9.3cc Max Dose to Skin=167.2% Treat. Time=430.9s



V95> 95% V150=20.1cc V200=4.2cc Max Dose to Skin=149.0% Treat. Time=380.4s



V95> 95% V150=18.2cc V200=4.6cc Max Dose to Skin=109.0% Treat. Time=257.1s



Contura, a Multi-Lumen Balloon catheter