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abstract

In-Vivo EPID Gamma Constancy During DIBH Tangential Breast Radiotherapy: Cohort Performance, and Day-to-Day Stability

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In-Vivo EPID Gamma Constancy During DIBH Tangential Breast Radiotherapy: Cohort Performance, and Day-to-Day Stability

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Introduction: Deep inspiration breath hold (DIBH) is widely used to reduce cardiac and pulmonary dose in left-sided breast radiotherapy. However, daily reproducibility can vary with breath-hold amplitude, patient coaching, and immobilization consistency. In-vivo EPID gamma analysis offers a practical lens on treatment constancy across fractions. Aim was to quantify in-vivo delivery constancy using EPID-based gamma metrics under a 3%/4 mm criterion, compare medial vs lateral tangential fields, and identify patterns of day-to-day variability across a clinical cohort.

Methodology: Integrated EPID images were collected for multiple fractions per patient and analyzed with a 3%/4 mm gamma criterion. For each fraction/field we recorded pass rate (%), mean gamma, and the area with γ>2%. We defined failure as any of: pass <95%, mean γ>1.0, or γ>2% >2%. Metrics were aggregated per patient and per field (med/lat). A stability index was computed as any of: pass <95%, mean γ>1.0, or γ>2% >2%. Metrics were aggregated per patient and per field (med/lat). A stability index was computed as 100×SD(Mean γ)/ Mean(Mean γ), indicating fraction-to-fraction variability.

Results: Across 231 integrated images, median pass rate was 98% (mean 94.5%±9.0). Mean gamma was 0.31±0.18 (median 0.26). The cohort mean area with γ>2% was 0.64%±3.39. The overall fraction failure rate (any criterion) was 26.8%, typically clustering within specific patients and/or in later fractions. Field-level comparison showed differences between medial and lateral tangents in several patients (lateral fields more often degraded late in the course). Patients with higher stability index exhibited greater day-to-day drift, likely linked to DIBH amplitude reproducibility, arm positioning consistency, and coaching fatigue.

Conclusion: In-vivo EPID gamma at 3%/4 mm demonstrates generally high agreement during DIBH breast RT, while revealing clinically relevant clusters of

instability. Routine monitoring of simple gamma descriptors (pass rate, mean γ, γ>2%, stability index) can flag patients/fields that benefit from reinforced coaching or minor gating adjustments.

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