Personalized Dosimetry in Radioembolization: A Paradigm Shift in Interventional Oncology

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Purpose

- Radioembolization with yttrium-90 (Y-90) microspheres is a cornerstone therapy for hepatocellular carcinoma (HCC).
- Historically, treatment planning was standardized, ignoring patient- and tumor-specific variability.
- Recent advances in personalized dosimetry aim to optimize therapeutic efficacy while minimizing toxicity.
- This abstract highlights the clinical value of tailored dose planning and its implications for outcome improvement in interventional oncology.

Materials and Methods

- The primary methodology employed in this educational exhibit involves a comprehensive evidence- and case-based PubMed literature review of published outcomes to date.

Results

- Several prospective studies have demonstrated that tailoring the Y-90 dose based on tumor volume, location, and absorbed radiation can significantly improve outcomes.
- The DOSISPHERE-01 trial compared standard dosimetry (uniform dose of 120 ± 20 Gy) versus personalized dosimetry targeting ≥205 Gy to the tumor.
- Imaging techniques like pre-treatment 99mTc-MAA SPECT/CT and post-treatment Y-90 bremsstrahlung or PET/CT were integrated to assess dose distribution and treatment efficacy.[2,3,5]
- In DOSISPHERE-01, the personalized dosimetry arm showed a significantly higher median overall survival (26.6 vs 10.7 months; HR, 0.42; P = .0096) and better tumor response rates.[2]
- Similarly, a secondary analysis of the SARAH trial demonstrated that an absorbed tumor dose ≥100 Gy was associated with longer median survival (14.1 vs 6.1 months; HR, 0.38; P < .001).
- When imaging correlation and tumor targeting were optimized, survival extended to 24.9 months.[3,5]
- The SIRveNIB trial also supported selective internal radiation therapy (SIRT) as a viable alternative to systemic therapies like sorafenib in Asian populations.4
- These studies collectively emphasize that personalized dosimetry can turn a marginal treatment into a transformative therapy.

Conclusion

- Personalized dosimetry represents a significant evolution in radioembolization, underscoring interventional oncology's shift toward precision medicine.
- Integrating patient-specific imaging, predictive modeling, and dosimetric calibration enables maximization of tumor dose while sparing healthy tissue.[2,3,5,6]
- To gain wider clinical adoption, interventional oncology must continue to produce prospective, multicenter evidence demonstrating meaningful improvements in survival and quality of life.[2,3,4]
- With innovation in imaging, AI integration, and tumor biology analysis, personalized dosimetry is poised to become standard practice in locoregional cancer therapy.[7-9]

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