

# Stereotactic Body Radiation Therapy for Primary Liver and Pancreatic Tumors Under Total Intravenous Anesthesia

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## Purpose

Respiratory-induced motion of upper abdominal tumors presents a major challenge for accurate dose delivery in Stereotactic Body Radiotherapy (SBRT). This work introduces our approach, using Total Intravenous Anesthesia (TIVA) with Assist-Control Mechanical Ventilation (ACMV) combined with Optical Surface Guidance to achieve controlled Breath-Hold conditions. This technique significantly reduces tumor and organ motion, enabling more precise targeting. As a result, planning margins can be minimized, allowing safe single-dose escalation for liver and pancreatic tumors.

## Materials and Methods

Between October 2022 and June 2025, 303 patients with primary or metastatic liver and pancreatic tumors were treated with single-fraction SBRT under TIVA-controlled Breath-Hold conditions on Varian EDGE® linear accelerator. Image guidance was performed using Hypersight Cone-Beam CT, while Optical Surface Guidance provided motion monitoring and gating. All patients were treated with mean tumor BED<sub>10</sub> = 120 - 157 Gy in a single fraction.

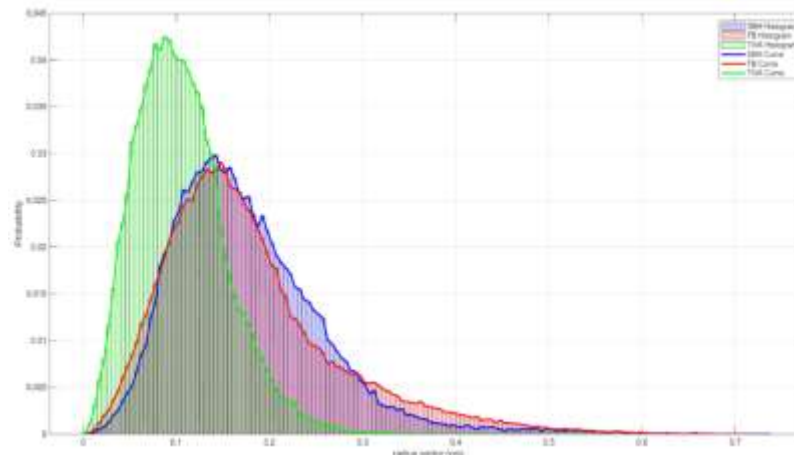


Figure 1. Radial target movements for pancreatic tumor in TIVA, deep inspiratory breath hold (DBH) and free breathing (FB)

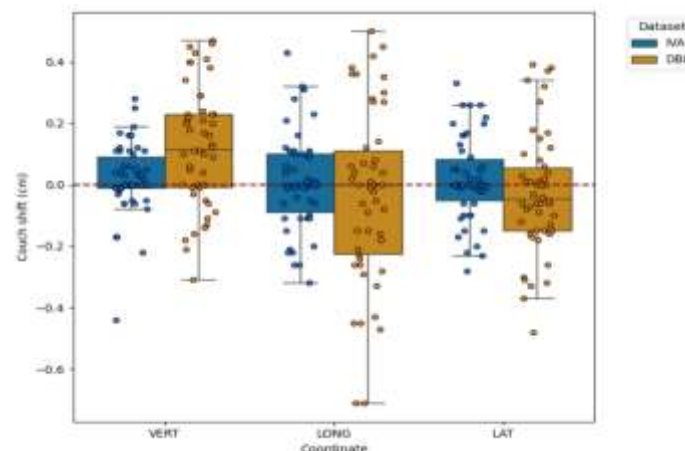


Figure 2. Intrafractional couch shifts in TIVA compared with DBH for liver SBRT

## Results

No acute Common Terminology Criteria for Adverse Events (CTCAE) toxicities grade  $\geq 3$  were observed. TIVA controlled Breath Hold showed the lowest median radial target movement both for pancreas (Fig. 1.) and liver (Fig. 2.) SBRT and resulted in statistically significant reduction in interfractional movement in all 3 translational axis compared with DBH approach ( $p = 0.02, 0.04$  and  $0.02$  for vertical, longitudinal and lateral axis, respectively). Early clinical outcomes show promising local tumor control and high reproducibility, with some liver patients proceeding to successful transplantation.

## Conclusion

SBRT delivered under TIVA-controlled Breath-Hold is a safe and effective method for treating liver and pancreatic tumors with precise motion management. This approach enables significant reduction in geometric uncertainties and supports delivery of ablative radiation doses in a single-fraction, while sparing surrounding tissues, and represents a promising advancement in high-precision radiotherapy for upper abdominal malignancies.