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Theme: Physics

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Abstract Title: Proton Therapy for Thoracoabdominal Tumors: Strategies for Mitigating Respiratory Motion Effects —Tongji Experience

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Background / Aims:

Proton therapy is particularly suitable for treating thoracoabdominal malignancies with the distinct physical advantages of the Bragg peak. However, its precision is compromised by respiration motion-induced uncertainties in proton range. This study summarizes the clinical experience and stratified management strategies for thoracoabdominal proton therapy at the Tongji Proton Center, with a specific focus on evaluating the feasibility of optical surface-guided voluntary breath-hold techniques in proton treatment delivery.

Subjects and Methods:

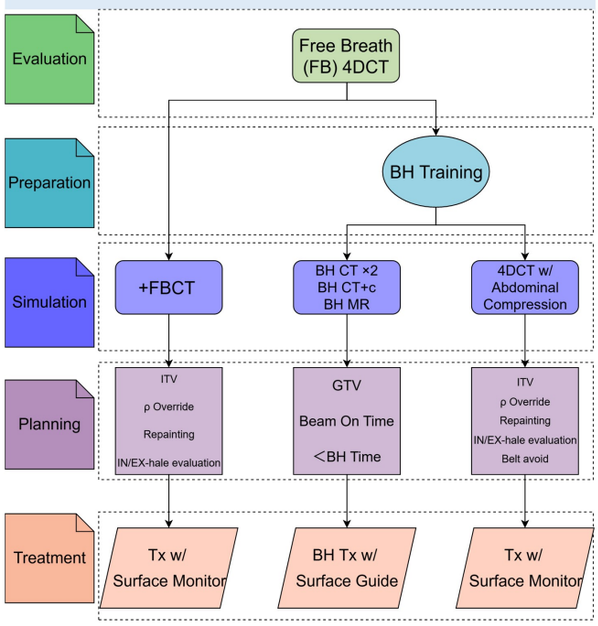

Fig.1 Workflow of respiratory management

This analysis included 25 patients treated with voluntary breath-hold proton-therapy (18 with hypofractionation), all processed via the stratified workflow in Figure 1. Positional reproducibility of tumors and OARs was assessed by comparing QACT with planning CT, while dosimetric reproducibility was evaluated by comparing QACT-recalculated doses and nominal plan doses.

Result:

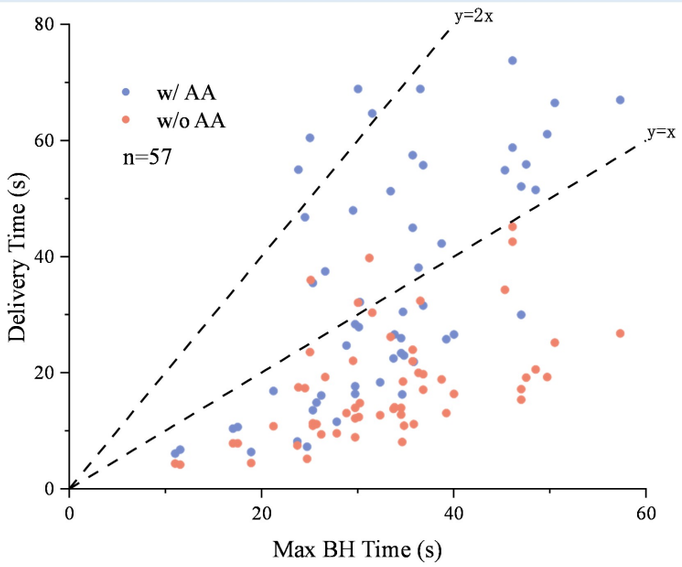

Fig.2 Correlation Between Beam Delivery Time and Breath-hold Duration

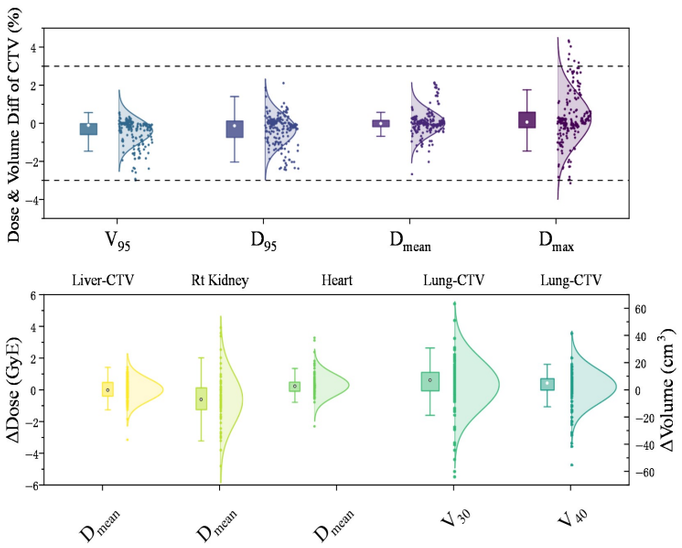

Fig.3 Box plots of dose change of QACT plan parameters with respect to the nominal plan

As shown in Fig.2, 54 out of 57 fields were delivered within a single breath-hold, which may potentially mitigate the dose heterogeneity (e.g., cold and hot spots) arising from intra-fraction target displacement during multiple breath-holds. Furthermore, the results in Fig.3 demonstrate notable interfraction reproducibility of the optical surface-guided breath-hold technique in proton therapy.