

Feasibility of a new frontier to advance Emergency Palliation through an Online Helical Scan-Plan-Treat Workflow

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PURPOSE

- Single fraction palliative radiotherapy is resource intensive, often requiring several hours to prepare and multiple table transfers per patient.
- Helical tomotherapy systems can acquire large field-of-view ClearRT kVCT images suitable for treatment planning.
- This study investigates the feasibility of advancing emergency palliation through a streamlined rapid Helical scan-plan-treat workflow.

MATERIAL & METHODS

- An anthropomorphic phantom was used to simulate palliative lung, abdomen and rib treatments on an Accuray Radixact system.
- After registering the phantom in the treatment delivery console, the phantom was positioned on the couch and aligned at the approximate level of the target using the green lasers at the machine's virtual isocenter.
- ClearRT images were acquired and sent to MIM for deep learning-based auto-segmentation. Images and structures were then sent to the Precision TPS where VoloUltra Helical- and Tomo-3DCRT plans were generated to deliver 800 cGy in one fraction.
- Plans were then reviewed, approved, and promoted in Record and Verify (Mosaik) for each treatment site.
- Secondary dose check was performed using MIM-SureCalc. Total time including imaging, contouring, planning, plan promotion and approval, software-based QA checks, and delivery of 800 cGy was recorded and 3D gamma analysis using 2%/3mm criteria was performed. Corresponding plans using CT-simulation images were also generated for comparison.

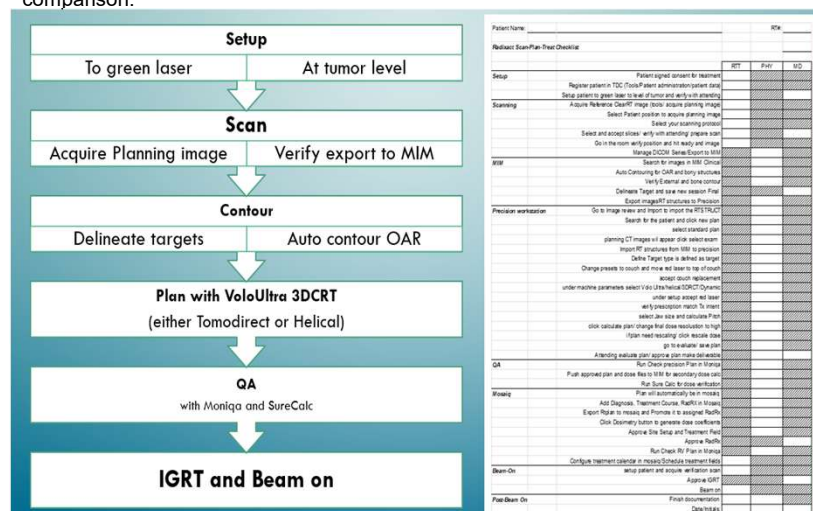


Figure 1. clinical workflow and Multi-role checklist for efficient online helical scan-plan-treat workflows

CONCLUSIONS

- Emergency palliation using an online helical scan-plan-treat workflow is feasible.
- The workflow can support rapid, patient-centered care facilitating broader clinical adoption of online treatment paradigms while minimizing clinical resources, time, and number of table transfers for patients in pain

RESULTS

- The scan-plan-treat workflow can be completed within 22.0±1.8min using Helical_3DCRT and 20.0±0.8min using TomoDirect_3DCRT.

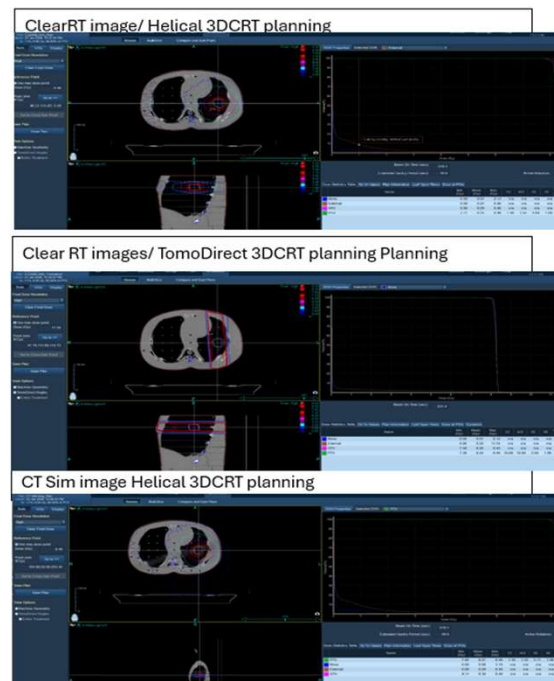


Figure 2. Emergent palliative treatment plans on anthropomorphic phantom generated using VoloUltra Helical 3DCRT (top) and Tomodirect 3DCRT (middle) both with large field-of-view ClearRT kVCT images. For comparison, VoloUltra Helical 3DCRT plan generated with CT simulation images (bottom).

- VoloUltra Helical plans demonstrated improved conformality compared to TomoDirect plans and reduced average Dmax (842.7±8.3 vs 1061.3±107.5 cGy).
- Dose calculated from VoloUltra_Helical_3DCRT plans using ClearRT_KVCT images was comparable to those calculated using CT simulation planning images (3D_gamma: 99.93±0.08% vs 99.91±0.08% and Dmax: 842.7±8.3 vs 844.2±11.8 cGy).

Table 1. Dosimetric and 3D- gamma analysis comparisons between Helical 3DCRT and TomoDirect 3DCRT plans

Site	VoloUltra Helical 3DCRT				TomoDirect 3DCRT	
	Clear RT Images		CTSim Images		Dmax	Gamma passing
Lung	845.98	99.85	848.05	99.92	1154.3	99.14
Ribs	848.84	100	853.66	99.99	943.61	99.96
Abdomen	833.29	99.96	831.09	99.84	1085.9	99.76

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