A Study of Online Adaptive Planning Workflow for Pancreatic Cancer Using Adapt LTE

2026 JOINT AAPM | COMP MEETING
JULY 19–22 | VANCOUVER, BC

Oanh D. H. Luu, PhD[1]; Rhonda Geoffrey, BSc[1]; Asma Amjad, PhD[1]; Haidy G. Nasief, PhD[1]; Eric S. Paulson, PhD[1]; Jennifer Rassuchine, PhD[2]; Karl Bzdusek, BEng[2]; Guang-Pei Chen, PhD[1]
[1]Department of Radiation Oncology, Medical College of Wisconsin, Milwaukee, WI
[2]Accuray Incorporated Company. Madison, WI

Froedtert & Medical College of Wisconsin

ABSTRACT

Purpose: This study aimed to evaluate Adapt LTE, a retrospective evaluation tool by Accuray to compare past helical treatment plans against original therapy goals.

Methods: Five pancreatic cancer patients treated on Radixact machines, all with large anatomy changes, were retrospectively studied. Using Adapt LTE, contours from planning images were deformed and propagated to the merged daily CT images (5 fractions each). The deformed pancreas and duodenum contours were compared against expert-defined ground truth manual delineations and evaluated using mean distance to agreement (MDA) and Dice similarity coefficients. Dose from the daily delivery with IGRT only, the adaptive plan with re-optimization, and the original reference plan were evaluated by comparison to planning goals (PG). The time needed at each step in Adapt LTE, including contour propagation, daily dose calculation, adaptive optimization and final dose calculation were recorded.

Results: Adapt LTE-generated deformed pancreas and duodenum contours satisfied acceptance criteria, achieving average MDA values of 1.76 mm and 1.98 mm and Dice scores of 0.80 and 0.79, respectively. Dosimetric analysis showed that none of the daily plans treated with IGRT alone met PTV acceptance criteria, with significant deviations from the PG. The duodenal D0.03cc exceeded the PG by 1.23%. In contrast, adaptive planning improved target coverage (>95% of PTV) and kept duodenal D0.03cc within tolerance. The Adapt LTE workflow required an average processing time of ~15 minutes, of which approximately 65% was attributable to adaptive optimization. The total treatment time, including patient setup, IGRT, adaptation and delivery, is expected to be completed within 30 minutes.

Conclusions: Adapt LTE provided fast and accurate contour propagation, improved target coverage, and OAR sparing with adaptive optimization. The adaptive workflow is efficient and clinically feasible. Adapt LTE can help clinicians analyze outcomes, refine decision-making and train more effectively in adaptive techniques.

CONTACT

❑ Oanh (Emma) Luu, PhD: dluu@mcw.edu
❑ Guang-Pei Chen, PhD: gpchen@mcw.edu
Department of Radiation Oncology, Medical College of Wisconsin, Milwaukee, WI

INTRODUCTION

Background: Inter-fraction anatomical changes in pancreatic radiotherapy may reduce target coverage and increase OAR (Organ at risk) dose with IGRT-only treatment.

Purpose: To evaluate **Adapt LTE**, a retrospective tool developed by Accuray, for its ability to assess whether adaptive re-optimization can restore planning goals (PGs) while maintaining clinical efficiency.

METHODS AND MATERIALS

- ✓ 5 pancreatic cancer patients treated on Radixact were included in this study.
- ✓ These patients showed large anatomical changes during treatment.
- ✓ 5 fractions were selected form each patient, resulting in a total of 25 fractions.

This study utilized **Adapt LTE** - online adaptive radiotherapy for daily image registration, contour propagation, daily dose recalculation, and adaptive replanning. Figure 1 illustrated Adapt LTE workflow.

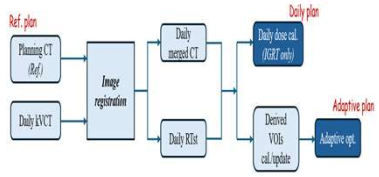

Figure 1. Adapt LTE workflow

This study was conducted with 3 primary objectives:

1. We compared deformed contours generated via deformable image registration on the daily merged CT images against manually delineated ground truth (GT) to evaluate the contour accuracy.
2. We analyzed and compared dose distributions across 3 plan types : IGRT-only, adaptive, and reference plans with planning goals (PGs), to quantify the dosimetric benefit of adaptive radiotherapy.
3. The processing time of each Adapt LTE workflow step were measured to assess the clinical feasibility of this approach in a real treatment setting.

RESULTS AND DISCUSSION

➢ **Contour comparison:**

Deformed contours agreed well with ground truth (GT), with Dice 0.80 ± 0.08 (pancreas) and 0.79 ± 0.10 (duodenum), and MDA of 1.76 ± 0.75 mm and 1.98 ± 1.07 mm, respectively.

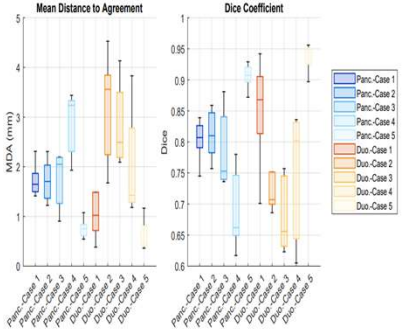

Chart 1. Contour comparison between deformed contours (pancreas & duodenum) with ground truth (GT)

➢ **Dosimetric evaluation:**

- ✓ Daily plans showed PTV under coverage (3-80%), while adaptive plans achieved >95% coverage with ~1% deviation from planning goals (PGs).
- ✓ Duodenum max dose met constraints in reference and adaptive plans; only Patient 2 daily dose slightly exceeded (1.27%)
- ✓ Improved target coverage may contribute to better local control while maintaining acceptable duodenal dose constraints.

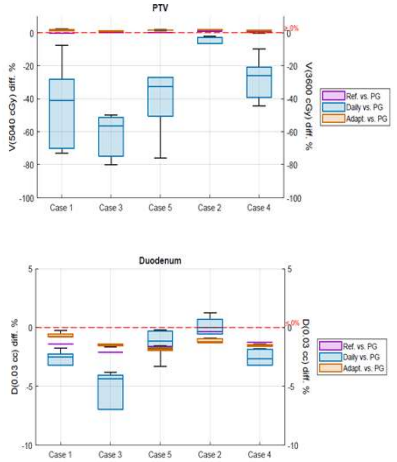

Chart 2. Dosimetric comparison of daily, adaptive and reference plans against Planning goals (PGs)

RESULTS AND DISCUSSION

➢ **Timing analysis:**

Across 25 fractions, Adapt LTE averaged >15 min, dominated by adaptive planning (> 65%), followed by registration (24%); other steps were minor (3-8%) with up to 23 min in complex cases

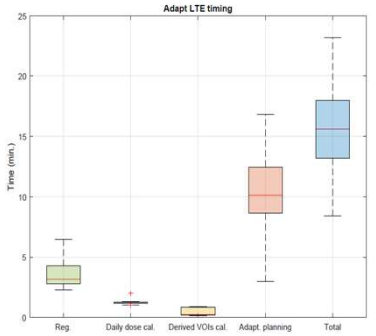

Chart 3. Timing analysis of each Adapt LTE workflow step

CONCLUSIONS

- ✓ **Adapt LTE** enables fast and accurate contour propagation via automated DIR, improving target coverage and OAR sparing.
- ✓ The adaptive workflow (~15-25 min/fraction) is clinically feasible for helical delivery on the Radixact system, supporting its use as a decision-support and training tool.
- ✓ Despite the small patient cohort, the results support the feasibility of Adapt LTE and warrant validation in a larger population.

FUTURE WORK

Develop a **SVM (Support vector machine)** model to predict daily fractions requiring adaptive planning, reducing unnecessary adaption and improving clinical workflow efficiency.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the **Accuray team** for their valuable support and collaboration in this study.

REFERENCES

1. American Cancer Society. Cancer Facts & Figures 2026.
2. AAPM TG-132, Med Phys, 2017.
3. Zou KH et al., Academic RADIOLOGY, 2004
4. Accuray, Adapt LTE Technical Documentation.