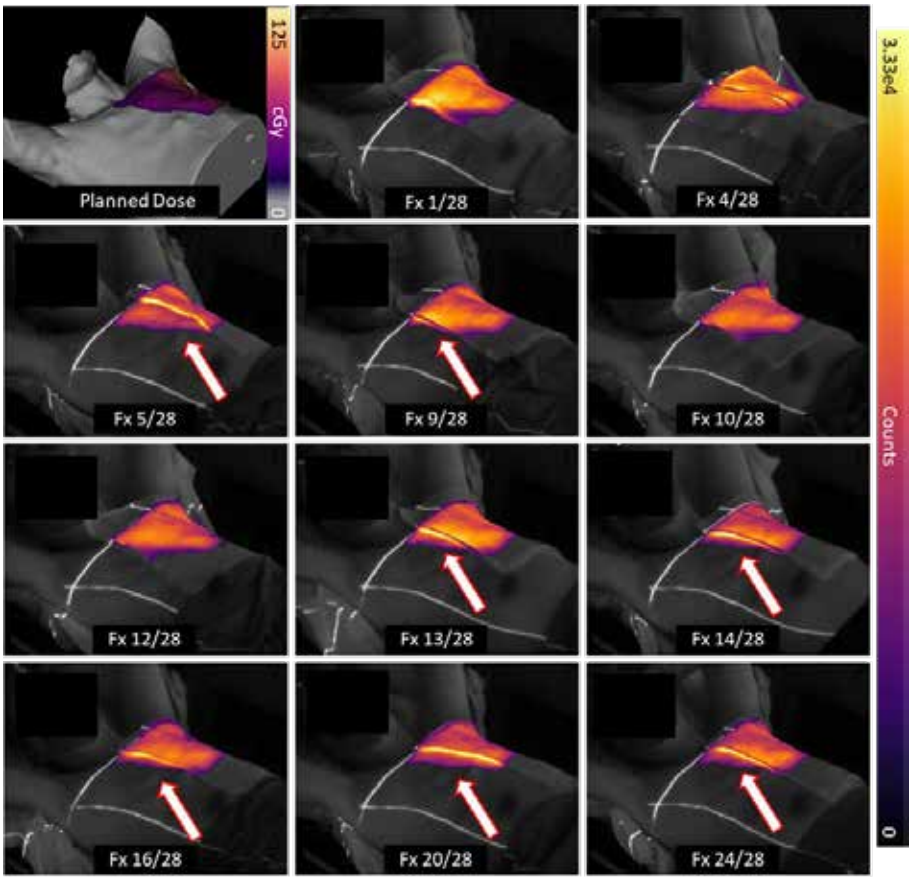
Unintended Radiation Dose Due to Bolus Misplacement

PATIENT: A patient was treated to her left chest wall for 28 fractions of 180 cGy each. Plan consisted of two fields: RAO and LPO.

SUMMARY: Cherenkov imaging is able to show the dose distribution on the patient, which in this case highlights the improper bolus coverage on the medial chest wall.

DISCUSSION: During post-treatment review it was found there was significant inconsistency in the placement of bolus, and on many fractions the exit side of the LPO field was not covered by bolus. This highlights the challenge of consistently placing the Bolus properly to ensure the field is fully covered. Image for fraction 4 shows two pieces of bolus to provide coverage, while fraction 20 shows uncovered chest wall, leading to potential underdose relative to the plan. This was the case for 7 imaged fractions.

KEY LEARNINGS: Cherenkov imaging can reveal improper bolus placement during treatment or post-treatment review.



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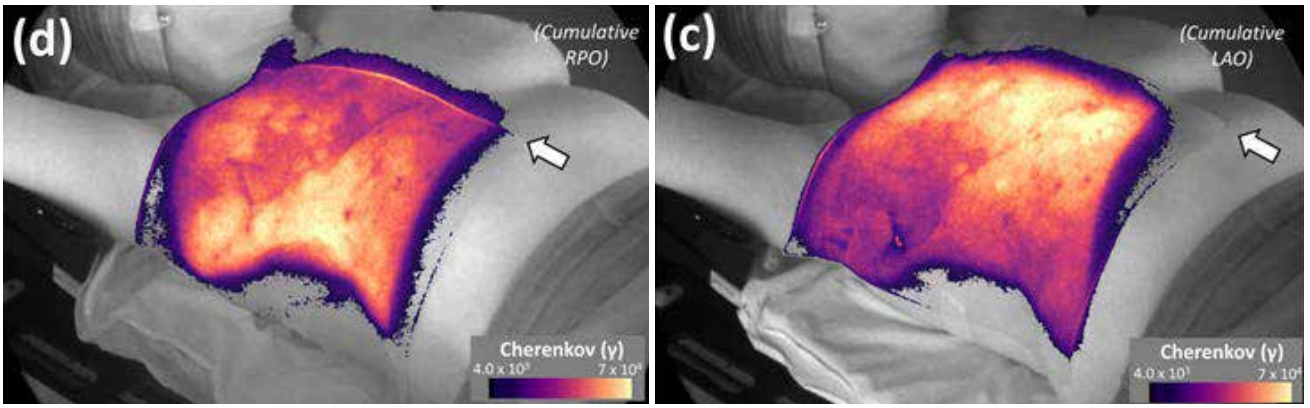

DISCUSSION: Using bolus in radiation therapy can present some challenges such as how to properly position the bolus to ensure the field is fully covered. While this may be easy for beams where the field light can clearly be seen on the patient, it can be more difficult when the field light cannot be visualized on the patient or if exit dose is a concern.

For this patient 12 of 28 fractions were imaged. Cherenkov imaging shows that in at least one fraction the LAO field was fully covered by the bolus (image c) whereas the RPO field did not have bolus covering the medial extent of the RPO field (image d). The Cherenkov images above are cumulative for the field and were reviewed after the treatment was completed.

SUMMARY: When Cherenkov imaging is used and observed during treatment delivery, therapists can see when the bolus is not positioned correctly, pause the treatment and take steps to correct the bolus placement.

KEY LEARNINGS: Cherenkov imaging can help improve treatment quality when using bolus. Currently there isn't any real time verification tool that can detect bolus misplacement.

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