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e eld of radiation oncology has entertained either side-by-side computing technology, overlay of diagnostic and planning image sets, or fusion of positron emission tomography (PET) and computed tomography (CT) data for the purpose of creating a single image data set for stereotactic radiosurgery planning [1]. 2-[^{18}F]- uoro-2-deoxy-D-glucose (^{18}F-FDG) has starred among the radiotracer cast of characters because of its recognition and sequestration by the intracellular enzyme hexokinase. Once ensnared, ^{18}F-FDG breakdown creates positrons detected by diagnostic scanners that will display di erent positron intensities according to brightness and color. resholded ^{18}F-FDG intensity has guided radiation planning cancer target contouring (1), and perhaps, has strengthened a conceptual relationship between cancer target motion and quiet breathing during on-beam radiation treatment [2]. Here, we obtained approval from Summa Akron City Hospital (Akron, Ohio) to review a user-de ned ^{18}F-FDG PET setting threshold of 40% of the standard uptake value maximum in a series of irradiated stage III lung cancer patients (Table 1).

Five patients underwent stereotactic lung radiosurgery to a dose of 50 Gy in ve every other day fractions. ree multiphase CT image data sets were acquired on each patient for radiosurgery planning: a free-breathing scan, a moderate inspiration breath-hold scan, and a moderate expiration breath-hold scan. During the CT scan (voltage 120 kVp, 350 mAs; 64-slice Toshiba Aquilon LB, Toshiba Medical Systems), patients rested comfortably in head- rst supine treatment position with their arms supported over their head. ^{18}F-FDG PET datasets were acquired on a mobile scanner (Siemens Biograph 6.0, Siemens Healthcare) a er an intravenous administration of 13 to 17 mCi of ^{18}F-FDG. Scans in a patient head- rst supine position were done by institutional protocol, acquiring ^{18}F-FDG signal between the orbitomeatal line to the upper thighs. Co-registration of multiphase CT and PET datasets were done by a certi ed medical dosimetrist and veri ed by a certi ed medical physicist in the Pinnacle 9.0 planning system (Philips Medical Systems, Cleveland, Ohio). Physician contours included separate volumes for free-breathing (FB-CTV), end-inspiration (INS-CTV), and end-expiration (EXP-CTV), each delineated on pre-set chest CT window settings. Post-imaging fusion of CTV contours depicted the extremes of lung tumor target motion in the respiratory cycle, creating a single

O-ring gantry mounted with a 6 MV, 500 cGy/minute linear accelerator capable of rotating 360° around a patient during treatment, putatively lowering total radiation dose exposure to pass-through normal tissues [4]. Treatment beams on the Vero are shaped by a multi-leaf collimator comprised of 60 single-focused 5 mm leaves made of tungsten alloy capable of full over-center-travel. Vero has a minimum single treatment eld size of 10×10 millimeters and a maximum treatment eld size of 150×150 millimeters. What has the radiation oncology eld abuzz is that the linear accelerator and multi-leaf collimator are contained within a Gimbal mount, allowing tracking of and treatment of mobile tumors. Further development of the Gimbal mount will expand the treatment eld size to 230×230 millimeters. Accurate tracking of tumors during quiet respiration by Vero ultimately may allow for lung treatment elds to narrowly approximate PTV contours, adapt nearly in real-time with respiratory motion, and permit radiation dose intensi cation. Formal motion management studies and clinical trials involving the Exac Trac Vero system are eagerly awaited.

References

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