Conformal Field Margins in Multifield, Axial, Coplanar Treatment Planning

Conformal dose delivery for multi-field axial coplanar treatments using multileaf collimation (MLC) typically involves setting an additional 7 to 8 mm margin around the planning target volume (PTV) in order that a specific isodose surface encloses the entire PTV. However, the cranial and caudal ends of the PTV lie within overlapping penumbras from all beams, and additionally may lie within narrow leaf separation regions. Opening additional leaf pairs at the field ends to compensate results in a "stovepipe" appearance of the MLC portal and increased irradiation of adjacent structures. Film measurements on single field and composite treatments were performed to assess the dose delivered in these narrow areas of overlapping penumbras, and to confirm three-dimensional treatment plan calculations. Results from film dosimetry and calculation show that when an additional leaf pair was opened the 97%-50% isodose separation increased from an average of 1.5 cm to 2.0 cm due to the increasingly restricted geometry in the upper stovepipe region. Only half of the increase in the 50% isodose area was therefore realized for higher isodose coverage in this process. The 95%-50% isodose separations showed approximately the same percentage change but with absolute values 3-5 mm less. Protocols that require a strict dose coverage may thus inadvertently sacrifice true conformality when critical structure doses are considered, unless more careful tailoring of the end leaf pairs is used to avoid very narrow field ends.