Purpose:

Accurate modeling of the dose distribution in a lung tumor is challenging for traditional dose calculation algorithms. We compare the dose distributions of four commercial dose calculation methods: Raysearch (Raysearch Laboratories) and Pinnacle (Philips Healthcare) collapsed cone, and Eclipse AAA and Eclipse Acuros,(Varian Medical Systems) with measurements using radiochromic film in a lung tumor phantom.

Methods:

A simple lung tumor phantom was constructed using a thermoplastic cylinder 29 mm diameter and 40mm in length (density 1.3 gm/cc) imbedded in cork phantom 25 x 25 x 20 cm of density 0.32 gm/cc. Nine film layers normal to the axis of the cylinder where placed between layers of cork, above, below and through the cylindrical inhomogeneity. The phantom was irradiated with a single asymmetric 10x10 cm 6 MV field with the central axis collinear with the cylinder axis. Thirteen film exposures at 5 cm depth taken with doses 0 -10 Gy were used to calibrate the film. The phantom was CT scanned and the DICOM study loaded into each of the treatment planning systems to calculate the dose distribution in the phantom.

Results:

Away from cork-poly interfaces, agreement between the four algorithms was within 3% of the film measurements. For Acuros, the dose at the edge of the cylinder was found to be up to 2% lower than that at the center of the cylinder possibly because of the loss of lateral electron equilibrium.

Conclusions:

All four algorithms achieved remarkable agreement with the radiochromic film measurement. The Acuros algorithm appeared to more accurately model the peripheral dose deficit in the tumor, although a more detailed study is required for confirmation.