The dose property of grid therapy

Abstract

The possibility of a therapeutic advantage in the use of a megavoltage grid to deliver large single dose fractions has been previously demonstrated. Assessment of dose response characteristics is essential to the understanding and use of grid therapy in the clinic. A Wellhofer scanning system, an EDR2 film dose measurement device, and Monte Carlo calculations were used in evaluating the dosimetric properties of a megavoltage grid. A range of grid hole diameters was simulated by the Monte Carlo technique, and a 0.8 cm diameter grid was singled out to carry out a comprehensive comparison between the measurements and Monte Carlo calculations. The maximum and minimum doses, and dose profiles at the depth of maximum dose d_{max} as well as the percentage depth dose were obtained. With the dose normalized at 100 cGy at d_{max} in a 10x10 cm^2 open field, the maximum dose for the grid was found to range from 11.9 to 94.5 cGy when the diameter of grid was varied from 0.2 to 1.0 cm, while the minimum dose between holes increased only from 6.8 to 16.1 cGy. A fairly good agreement between the Monte Carlo simulated and measured data was demonstrated for the 0.8 cm diameter grid. With our calculated results, the cell survival rates for grid therapy were further derived using a linear-quadratic survival model, and a therapeutic advantage for the grid was confirmed for large single fractions.