

Myelopathy, as a consequence of radiation damage to the spinal cord, should be avoided at any price. To quantify the risk of myelopathy for any dose distribution a model of dose-volume relationship is necessary. The models often employed to describe the probability of myelopathy are variations of the probabilistic model (Schultheiss). However, some recent animal data are not well described by these models. In particular, these models cannot explain the results on rats (van der Kogel), where dose-response of two separated 4mm segments of the cord was similar to the response of one 4mm segment, and very different from the response of one 8mm segment. These and other experimental data on dogs (Powers) suggest that the cord dose-response curves for different irradiated lengths might be parallel while the probabilistic model predicts flattening out of the curves with increasing irradiated length. This fact has important clinical implications because parallel curves mean larger tolerance doses at the clinically meaningful low probabilities of complication. To overcome these predicaments a new model is proposed in which a spatial correlation requirement on the damaged subunits is imposed. The cord is modeled to be composed of a few parallel fibers (nerves), and each fiber loses its functionality when the extent of local lesions exceeds some threshold size. The cord is damaged when the number of damaged fibers exceeds some threshold level. Analytic formulae describing the model will be compared with Monte Carlo simulations. Good agreement of the model with the experimental data will be demonstrated.