AbstractID: 2741 Title: Measurement of radiation induced lung damage in the rat by CT image analysis

Purpose: To design a method to quantify morphological changes in irradiated lung tissue, assessed by CT.
Method and Materials: CT images were made at different time points after administration of varying doses to different regions of the rat lung. The experiment included irradiation of 100%, 50% (6 different regions) and 25% (2 regions) of the total lung volume. The applied doses were: 9,10,11 and 12 Gy for the 100% lung volume, 16,18,20 and 22 Gy for the 50% volumes and 27,30,33 and 36 Gy for the 25% volumes. A computerized contouring method was developed to automatically delineate the lungs in the CT images. For each irradiated region the average CT-value (ACV) of its pixels and its standard deviation (SD) were determined. The changes in ACV and its SD with respect to the same region in controls were combined in a vector M. The length and orientation of M was used to characterize the changes in the CT image pattern, i.e. the morphology of the lung tissue. The total lung volume of all animals and M were measured at 8, 26 and 38 weeks for all irradiated regions, averaged over all dose values. After normalization, M was also measured as a function of dose.
Results: About 13.000 contours in lung volume studies of 374 rats were automatically drawn. With respect to the controls, a decrease in total lung volume in time was observed. Significant changes in radiation responses M were found in all irradiated regions. The largest radiation response was found for lateral lung volumes.
Conclusion: The auto-contouring method is very robust and can easily be applied to process large amounts of CT-slices of irradiated rat lung. The method showed significant changes in average lung CT pixel values and their variation for sub volumes of irradiated lung tissue.