Effects of High Dose Radiation on Dog Thigh Muscle: MR Imaging and ^{31}P MR Spectroscopy

Won-Hee Jee, M.D., Bo-Young Choe, Ph.D., Kyung-Sub Shinn, M.D.
Department of Radiology, Catholic University Medical College

Purpose: To investigate the alterations of signal intensity, relaxation times (T1 and T2) and phosphorus metabolites of dog thigh muscle on MR imaging and ^{31}P MR spectroscopy after x-ray irradiation.

Materials and Methods: MR imaging and ^{31}P MR spectroscopy were underwent before, and 1 day, 1, 2, 4 and 6 weeks after 5,000 and 10,000 cGy irradiation, and 8 weeks after 5,000 cGy irradiation, in ten dogs. For measurement of T1, TR was changed 300, 500, 1000, 1500, 2000 msec, fixing TE, 12 msec. Also, for measurement of T2, TE was changed 20, 40, 60, 80 msec, fixing TR, 2000 msec.

Results: There were no significant morphologic changes until eight weeks after 5,000 cGy irradiation. However, signal intensity began to change four weeks, and extensive signal changes were observed six weeks after 10,000 cGy irradiation. Although there was no correlation between T1 and time lapse in 5,000 cGy irradiation, we found low correlation in 10,000 cGy irradiation. A significant correlation between T2 and time lapse in case of 10,000 cGy irradiation was observed, while there was low correlation in case of 5,000 cGy irradiation. T2 value increased dramatically in terms of time lapse. There were no significant MR spectral changes until six weeks after 5,000 cGy irradiation. But, Pi signal intensity began to increase slowly six weeks after irradiation. Eight weeks after 5,000 cGy irradiation, PME and PDE signal also began to increase. Spectral changes began two weeks, and significant changes were observed four and six weeks after 10,000 cGy irradiation. Six weeks after 10,000 cGy irradiation Pi signal intensity became to be greater than PCr signal intensity. However, signal intensities of PCr, α, β and γ slowly decreased in terms of time lapse.

Conclusion: The present study demonstrated that morphologic and metabolic changes were dependent upon the x-ray dose and time lapse, and suggested that MR imaging and ^{31}P MR spectroscopy could aid in diagnosing muscle disease by simultaneous analysis of the biochemical and morphological changes in skeletal muscle after x-ray irradiation.