

## Identification And Evaluation of the Factors Affecting The Efficiency of Magnetic Resonance-Guided Focused Ultrasound Ablation of Uterine Fibroids

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### Abstract

The aim of the study was to identify and evaluate of the factors affecting the efficiency of magnetic resonance-guided focused ultrasound ablation (FUS) of uterine fibroids. Retrospective analysis of 67 FUS ablations (67 women, 94 fibroids) was performed. We evaluated the characteristics of fibroids (the number of fibroids in uterus, the location in the myometrium and in relation to parts of the uterus, MR-type, standardized signal intensity (SSI) and signal heterogeneity in T2-WI, the maximum diameter, the distance to the skin and to the sacrum during FUS, volume, nonperfused volume (NPV) after treatment), sonication energy and patients age. Standardization of the fibroid signal intensity was performed by using the signal intensity from iliac muscle. Correlation between NPV and quantitative characteristics was calculated. The estimation of influence of the qualitative factors (MR-type, location and number of fibroids) on the NPV values was performed. We evaluated the relation between MR-type of fibroids and SSI. Post treatment NPV ratio was  $57,1 \pm 22,5$  % (n = 94). SSI showed significant correlation with NPV ratio ( $R = -0,28$ ,  $p < 0,01$ ). Significant correlation between NPV ratio and others quantitative characteristics was not detected ( $p > 0,05$ ). NPV for MR-type 1 fibroids (n = 67) was  $63,4 \pm 19,7$  %, for type 2 (n = 20) –  $46,8 \pm 19,5$  % and for type 3 (n = 7) –  $26,4 \pm 21$  %. Differences between groups was significant ( $p < 0,05$ ). NPV for intramural and type 2 submucosal fibroids ( $64,8 \pm 20,2$  and  $61,3 \pm 20,1$  %) was significantly higher than for type 1 and 2 subserosal fibroids ( $45,1 \pm 20,7$  and  $49,4 \pm 20,1$  %) ( $p < 0,05$ ). Significant difference between NPV ratio for type 1 submucosal fibroids ( $49,8 \pm 37,4$  %) and for fibroids in other locations was not identified ( $p > 0,05$ ). Differences of the NPV ratio depending on the number and location of fibroids (in relation to the parts of the uterus) were not observed ( $p > 0,05$ ). MR-types of fibroids were characterized by different SSI ( $p < 0,05$ ).  $SSI \leq 1,4$  was characteristic only for 1 MR-type fibroids and these SSI values were observed in 56 (83,6 %) of them. Fibroid signal intensity in T2-WI and location in the myometrium significantly affect the NPV ratio and therefore the effectiveness of FUS ablation. Lower fibroid SSI values correspond to the higher NPV values after FUS. MR-type 1 fibroids are characterized by the highest values of NPV after FUS ablation. The effectiveness of MR-guided FUS of intramural and type 1 submucosal fibroids is higher than subserosal fibroids.  $SSI \leq 1,4$  can be used as an additional objective criterion for MR-type 1 fibroids (sensitivity 83,6 %, specificity 100 %).

**Key words:** Uterine Fibroid, Magnetic Resonance Imaging, Standardized Signal Intensity, Focused Ultrasound Ablation, Nonperfused Volume.

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