

Significance of Perfusion Parameters and Muscle Performance in the Rotator Cuff Muscles of Young Badminton Athletes: Assessment by Dynamic Contrast-Enhanced MR Imaging

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PURPOSE

Recent progress in dynamic contrast-enhanced MR Imaging (DCE-MRI) and pharmacokinetic modeling has made the assessment of tissue microcirculation possible. The purpose of this study is to evaluate correlation of perfusion parameters of DCE-MRI and muscle performance in rotator cuff muscles of the young badminton athletes.

METHODS

In this cross-sectional research, 22 young badminton athletes (11 male and 11 female athletes; 19 to 25 years old) were enrolled. DCE-MRI of the dominant shoulder was performed with a 3T MR scanner. DCE-MRI of the shoulder was performed with a 3D-T1w- turbo fast low-angle shot (FLASH) sequence acquired during contrast agent bolus injection and an oblique sagittal plane. Post-processing of all DCE-MRI data performed using a two-compartment pharmacokinetic model modified by Tofts was selected to quantify the perfusion parameters (K^{trans} , v_e , and v_p). Two regions of interest were chosen manually in the anterior and posterior bellies of supraspinatus muscle. Evaluation for the rotator cuff muscle performance (maximal isometric strength and endurance) using an isokinetic dynamometer were carried out in all subjects.

RESULTS

The maximal isometric strength of rotator cuff muscles was significantly higher in male than in female athletes (32.3 vs. 20.7 Nm, $P < .01$). No significant correlation between muscle endurance and perfusion parameters. The K^{trans} and v_p of the posterior belly were significantly higher than those of anterior belly (K^{trans} : 77.6 vs. 56.1 min^{-1} , $P = 0.01$; v_p : 12.9 vs. 7.5, $P < 0.01$) of supraspinatus muscle (Figure 1). Muscle strength was positively and strongly correlated with K^{trans} ($R^2 = 0.87$, $P < 0.01$) of the anterior belly of supraspinatus muscle only in the female athletes (Figure 2).

CONCLUSION

Perfusion parameters of MRI in the rotator cuff muscles may correlate with muscle strength of the young badminton athletes. Significant difference was observed in perfusion parameters between the anterior and the posterior bellies of supraspinatus muscle.

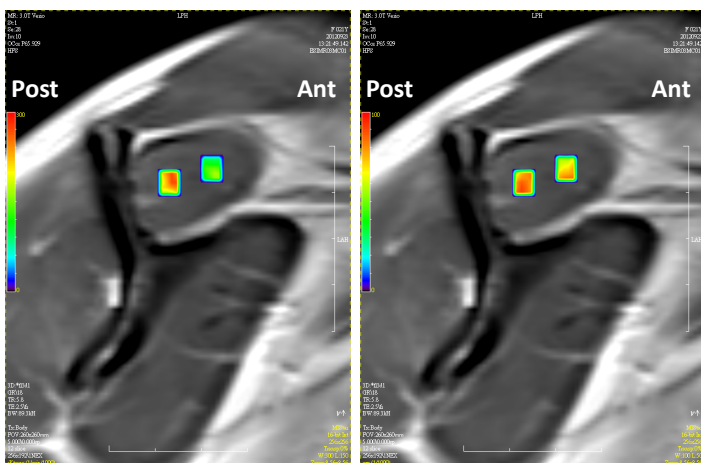


Figure 1. The color map of the K^{trans} (left) and the v_p (right) of the supraspinatus muscle. The highest value was colored red and the lowest value blue. Values of both parameters were higher in posterior

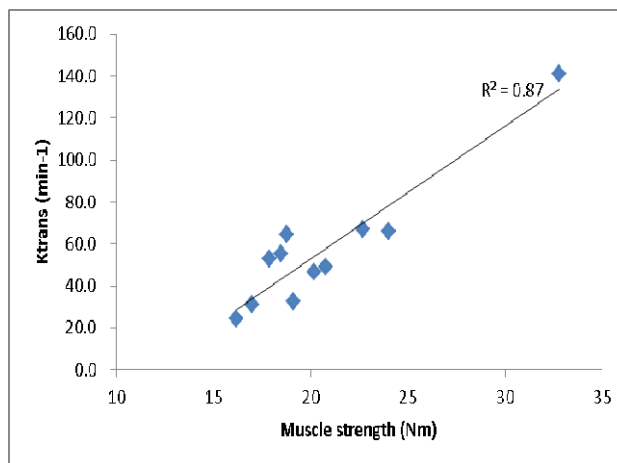


Figure 2. Scatterplot with fitted regression lines showing the relationship between muscle strength and K^{trans} ($R^2 = 0.87$, $P < 0.01$) of the anterior belly of supraspinatus muscle in the female athletes.