

EVALUATION OF CORRELATION BETWEEN LUMBAR DISK DEGENERATION LEVEL AND FAT CONTENT OF MULTIFIDUS BY PROTON MAGNETIC RESONANCE SPECTROSCOPY

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Introduction

The major function of inter-vertebral disc is served as the cushion of spine. Its degeneration will cause inflammation of nearby joints and induce low back pain¹. And the usage of multifidus muscle is to remain the spine at center and keep the stability of inter-body. When dysfunction or atrophy occurred in this muscle, the consequential spinal instability will also generate the low back pain. We therefore intended to investigate the correlation between lumbar disc degeneration and fat content of multifidus muscle by non-invasive and no-radiation proton magnetic resonance spectroscopy (¹H MRS) method, which can be used to investigate metabolite content in living animals and patients.

Material and Methods

Philips 3.0 T MR Imager (Philip, Achieva Xseries) was employed to acquire the first lumbar (L1) to the second sacral (S2) routine MRIs, the median sagittal turbo spin echo (TSE) T₂ relaxation time maps (T₂ map) of lumbar spine and the chemical shift images (CSI) of multifidus muscle next to the fourth and fifth inter-vertebral disc. Two groups of subjects, aged 20 to 50 were recruited: an experimental group composed of 30 patients that expressed complaints regarding lower back pain, and a control group composed of 30 volunteers that did not experience lower back pain. T₂ map studies (TR 2500 ms, TE 7.1 ms) were utilized to measure average of T₂ value of each disc for degeneration grading. CSI studies with CSI_se_135 pulse sequence (TR 1500 ms, TE 135ms) were used to analyze muscle variations in the lumbar multifidus. Both of the water and fat signals were unsuppressed in order to calculate the fat/water ratio.

Results

After baseline and phase correction of CSI data, two radiologists were invited to evaluate the degeneration of multifidus muscle according to Kadar four levels grading method². The fat/water ratios of multifidus were then calculated. It showed that the more severe the multifidus degraded the higher the fat it contained (Figure 1). By the way, the T₂ Map results were used to obtain the T₂ value of each lumbar disc nucleus. Then, Pfirrmann classification method³ was referred to correlate disc degeneration grade to different T₂ ranges⁴. It appeared a positive linear correlation between severity of disc degradation and T₂ values. After statistical analysis by SPSS 17 software, our results indicated disc's T₂ values were highly correlated with age, BMI and multifidus fat content of patients (Table 1).

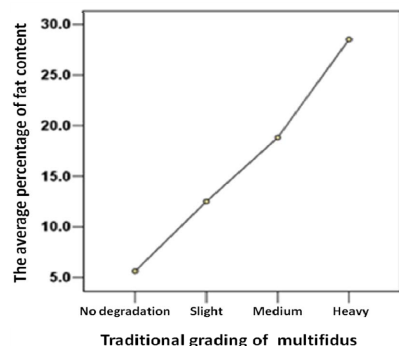


Figure 1: A near liner dependence exists between degradation of multifidus muscle and fat content percentage in the muscle.

Discussion

According to common sense, it is expectable that disc degeneration is closely correlated with age and BMI. However, the higher the lumbar multifidus fat/water ratio the more severe the disc degeneration is a new finding. This new finding may help to detect the disc degeneration in the early stage from fat content of surrounding multifidus in future denial diagamss, and will provide sufficient time to use advanced alternative therapies to increase the inter-vertebral disc hydration, which is more safe and effective than interventional therapies.

Table 1: Correlation of nucleus T₂ values vs BMI, age and fat content of multifidus.

Related variables		N =	correlation coefficient	p-value	Net-related	p-value
Nucleus T ₂ Number	BMI	60	-0.381	0.003**	-0.205	0.126
	Age	60	-0.596	0.000***	-0.282	0.034*
	Fat (%)	60	-0.613	0.000***	-0.423	0.001**

Note: An asterisk (*) represents p <0.05; (**) on behalf of p <0.01; (***) behalf p <0.001 was significant.

Keywords: multifidus muscle, proton magnetic resonance spectroscopy (¹H MRS), inter-vertebral disk degeneration

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