Role of MRI T2 mapping in assessment of articular Knee Cartilage in Osteoarthritis

Thesis

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Muhammad Alsayyad

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ABBREVIATIONS

ACL	Anterior cruciate ligament
BLOKS	Boston-Leeds osteoarthritis knee score
BMI	Body Mass Index
ECM	Extracellular Matrix
FOV	Field of view
FSE	Fast Spin Echo
GRE	Gradient Echo
GWAS	Genome-wide association studies
IKDC	International Knee Documentation Committee
KOSS	knee osteoarthritis scoring system
MR	Magnetic resonance
MRI	Magnetic resonance imaging
ms	mellisecond
NCSS	Number Crunching Statistical System
OA	Osteoarthritis
PDFS	Proton density with fat saturation
PFPS	patellofemoral pain syndrome
PDWI	proton density-weighted image
SAR	specific absorption rate
SD	Standard Deviation

SE	Spin Echo
SNR	Signal-to-noise ratio
SPAIR	Spectral Attenuated Inversion Recovery
SPIR	Spectral Presaturation with Inversion Recovery
STIR	Short-TI Inversion Recovery
STZ	Superficial Transitional Zone
3D	Three Dimensional
TE	Time to echo
TR	Repetition time
2D	Two Dimensional
WHO	World Health Organization
WORMS	Whole-organ MR imaging Score

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INTRODUCTION

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Osteoarthritis is a slowly progressive degenerative joint disease characterized by gradual loss of articular cartilage ***(Karande and Kini, 2018)***. It ranks with cancer and heart disease as a major cause of disability in the elderly. About 30% of the persons above 65 years of age are affected all over the world ***(Kumar, 2015).***

Articular cartilage pathology may be the result of degeneration or due to acute injury. The articular cartilage is composed of cartilage cell and extracellular matrix including water, type II collagen, and proteoglycan. Currently, MRI is a powerful noninvasive tool for the evaluation of degenerative changes in the articular cartilage of knee and articular cartilage pathology because of its high sensitivity, specificity, high contrast, and multiplanar capability ***(Farook et al., 2016)***.

With advances in joint preservation surgery that are intended to alter the course of osteoarthritis by early intervention, there is a rising demand in developing accurate and reliable quantitative MRI techniques that are sensitive to early structural degeneration in articular cartilage ***(Hesper et al., 2014).***

There are two broad categories of MR imaging techniques according to their usefulness for morphologic or compositional evaluation of articular cartilage. Standard spin-echo (SE), Gradient-recalled echo (GRE), Fast SE, and three-dimensional SE and GRE

sequences are available to assess the structure of knee cartilage. To assess the knee cartilage matrix, including the collagen network and proteoglycan content, compositional assessment techniques, such as **T2 mapping,** may be used in clinical and research settings to promote earlier and more precise depiction of articular cartilage changes ***(Crema et al.,2011).***

T2 mapping as a biochemically sensitive MRI technique can add robust biomarkers for disease onset and progression, and therefore, could be meaningful assessment tool for the diagnosis and follow-up of cartilage abnormalities ***(Hesper et al., 2014).***

T2 mapping of hyaline cartilage is an imaging technique for the qualitative and quantitative detection of the cartilage providing convincing color mapping and quantitative detection of the cartilage mainly regarding architecture and changes in water content, proteoglycan and collagen matrix ultra-structure associated with early cartilage degeneration ***(Farook et al., 2016).***

T2 mapping would combine the benefits of biochemical cartilage evaluation with remarkable features including short imaging time and the ability of high-resolution cartilage evaluation without the need for contrast media administration or special hardware ***(Hesper et al., 2014).***

AIM OF WORK

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The aim of this study is to elucidate the role of MRI complementary T2 mapping in assessment of articular knee cartilage for improving sensitivity of early detection of Osteoarthritis. Also, compare the articular cartilage T2 relaxation values in normal subjects and patients with osteoarthritis.

REVIEW OF LITERATURE