European Journal of Radiology 149 (2022) 110191

Contents lists available at ScienceDirect

European Journal of Radiology

journal homepage: www.elsevier.com/locate/ejrad

Research article

High-resolution magnetic resonance imaging of the triangular fibrocartilage complex using compressed sensing sensitivity encoding (SENSE)

Hiroki Fujiwara [a], Hidetake Yabuuchi [a,*], Tatsuhiro Wada [b], Kouji Kobayashi [b], Toko Hoshuyama [a], Takeshi Kamitani [c], Kousei Ishigami [c]

[a] Department of Health Sciences, Graduate School of Medical Sciences, Kyushu University, 3-1-1 Maidashi, Higashi-ku, Fukuoka 812-8582, Japan
[b] Division of Radiology, Department of Medical Technology, Kyushu University Hospital, Japan
[c] Department of Clinical Radiology, Graduate School of Medical Sciences, Kyushu University, Japan

ARTICLE INFO

Keywords:
High-resolution
Magnetic resonance imaging (MRI)
Compressed sensing
Sensitivity encoding (SENSE)
Triangular fibro cartilage complex (TFCC)

ABSTRACT

Purpose: To evaluate the optimal sequence for high-resolution magnetic resonance imaging (MRI) of the triangular fibrocartilage complex (TFCC) using compressed sensing-sensitivity encoding (CS-SENSE).
Methods: Three-dimensional fast field echo T2-weighted images were obtained from 13 healthy volunteers using the original, high spatial resolution sequence with CS-SENSE [HR (CS-SENSE)] and without CS-SENSE (HR) and super-high spatial resolution sequence with CS-SENSE [S-HR (CS-SENSE)] and without CS-SENSE (S-HR). For qualitative analysis, the number of patients affected by motion artifacts in each sequence was counted, and the visualization of the TFCC anatomic structures and overall image quality were categorized. For the quantitative analysis, relative signal intensity (SI) and relative contrast of the lunate bone marrow, lunate cartilage, and disk proper in the wrist joint were all calculated.
Results: The HR (CS-SENSE) sequence showed better visualization scores than the original sequence in the triangular ligament at the ulnar styloid tip, dorsal radioulnar ligament, and ulnotriquetral ligament. Similarly, the S-HR (CS-SENSE) sequence showed better visualization scores than the original sequence in the triangular ligament at the ulnar styloid tip and dorsal radioulnar ligament. Overall image quality scores were not significantly different, and motion artifacts in the HR and S-HR sequences were observed in 3 of the 13 patients. In contrast, the original sequence showed higher values than those in the HR (CS-SENSE) and S-HR (CS-SENSE) sequences in relative SI of the bone marrow and relative contrast of the cartilage-bone marrow and cartilage-disk proper.
Conclusions: Out of the three sequences, the HR (CS-SENSE) sequence provided the highest visualization score and diagnostically sufficient image quality score, although relative SI and relative contrast were low. The HR (CS-SENSE) sequence may be clinically useful for imaging TFCCs.

1. Introduction

In the data collection of magnetic resonance imaging (MRI), the k-space data must be sampled to acquire images. However, due to the time-consuming nature of k-space data sampling, parallel imaging techniques and compressed sensing have been recently developed to reduce k-space data and shorten the imaging time of MRI examinations in clinical applications.

While sensitivity encoding (SENSE) of parallel imaging techniques can reduce imaging time with k-space Cartesian sampling by using a phased array coil with multiple elements [1,2], compressed sensing is a novel MRI technique used to reduce imaging time from random sampling of k-space data [3,4]. Studies have further shown that combining compressed sensing with SENSE, known as CS-SENSE, can achieve even higher speeds than compressed sensing alone [5]. In CS-SENSE, the imaging time mainly depends on the selected acceleration factor. The higher the acceleration factor, the larger the ratio of data reduction in k-space and shorter the imaging time. In addition, the image quality

* Corresponding author.
E-mail address: h-yabu@med.kyushu-u.ac.jp (H. Yabuuchi).