

Preliminary Clinical Assessment of Extended Field-of-View Imaging with Table Translation and Frequency Sweeping

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Synopsis

The purpose of this study is to assess the feasibility and clinical utility of extended field-of-view imaging with table translation and frequency sweeping or frequency-adapted sliding table acquisition (FASTA). Five patients suspected of having systemic or multifocal lesions were tested with FASTA imaging. FASTA can provide coronal and sagittal head-to-toe image in about 8 min. In terms of detecting bone lesions, comparable information to conventional MRI or bone scintigram was obtained Brain and hepatic metastases beyond the size of 1cm and 2cm, respectively, were detected; however, smaller lesions were not detectable. Lung lesions were also not detectable except for one Pancoast tumor.

Introduction

Extended field-of-view imaging with table translation and frequency sweeping or frequency-adapted sliding table acquisition (FASTA) is a recently developed technique enabling a seamless and extremely large field-of-view image [1]. The method utilizes continuous table translation along z-axis, body coil transmit and receive, rectilinear 2D or 3D k-space traversing with z-direction frequency encoding, and object-space image synthesis. Unlike conventional "step and shoot" method, the data acquisition is conducted concurrently with the table translation; thereby eliminates waiting periods devoted to table stepping operations. Image artifacts caused by local magnetic field inhomogeneity is also minimal, because all segments of data acquisitions are performed around the magnet center. The purpose of this study is to assess the feasibility and clinical utility of FASTA in screening multifocal lesions of the body.

Materials and Methods

Five consecutive patients who were suspected of having systemic or multifocal lesions of the body underwent MRI with FASTA imaging. Patients included a 74 year old female of multiple myeloma, a 67 year old male with prostatic cancer, a 60 year old male of lung cancer (Pancoast tumor), a 65 year old male with lung cancer and a 44 year old male with multiple compression fractures after traffic accident. Written informed consent was taken before each examination. The imager used was Signa MR/i Echospeed, software version of 9.0. Imaging parameters utilized were 2 dimensional fast gradient echo acquisitions in the steady state (2DFGRASS) with TR/TE/FA of 14.3/6.9/70, sub image matrix of 160x160 and the NEX of 1. Seven sagittal sections of 10 mm thickness were acquired in 2 min 56 seconds. A FOV of 40x185 cm, overlap of 60%, sub image of 11, table speed of 0.999cm/s were used. For coronal imaging s, FOV of 48x185 cm, overlap of 60%, sub image of 9, table speed of 0.559 cm/s provided 15 slices of 12 mm thick gapless sections acquired in 5 min 9 second. For tumor-bearing individuals, 0.1 mmol/kg of gadolinium chelate was intravenously administered before the examination. Computed tomography was performed in all cases, and bone scintigram was performed in three cases for reference.

Results

Large field of view 2-dimensional whole body images were successfully acquired in all cases. In the current parameters for pulse sequence, an image contrast similar to fat saturated T1 weighted to proton density image was obtained. As for the vertebral lesions, comparable information to conventional MRI or bone scintigram was obtained in terms of the detection and the localization of the vertebral metastases in all four cases (fig. 1). Other bone lesions involving ribs or pelvic bone metastases were also detectable as high signal (fig. 2). Multiple compression fractures were also readily seen as high signal lesions without contrast media. Although the sensitivity of bone metastasis was comparable to that with bone scintigram, detailed assessment of the spinal canal or spinal cord was impossible. Hepatic metastases beyond the size of 2 cm in diameter were also depicted; however, smaller hepatic tumors less than 2 cm in diameter were overlooked except in cases with cavernous hemangioma. Likewise, all brain metastases beyond the size of 1 cm in diameter were detected; however, smaller lesions were not detectable. Lung lesions were also not detectable except for one Pancoast tumor involving the thoracic wall (fig. 3).

Discussion

Although in the limited number of cases, FASTA has shown its usefulness in detecting multifocal lesions of the body in this particular clinical setting. The method seems to be especially useful for detecting bone lesions, which is probably due to the lack of respiratory movement with the musculoskeletal system. Detection of smaller lesions or lesions in the organs with physiological movements will be more challenging; however, further development of the method (i.e. an application to cancel respiratory motion, more variety of pulse sequence selections, combined use of tissue specific contrast media and fusion imaging with PET) may enhance the usefulness of this unique technique.

Conclusion

FASTA can provide a head-to-toe image. Although in the limited number of patients, the technique has shown its potential as a sensitive screener of multifocal systemic lesions particularly in terms of skeletal metastasis in the current clinical setting.

Reference

[1] Zhu Y and Dumoulin CL. Magn Reson Med 2003; 49:1106

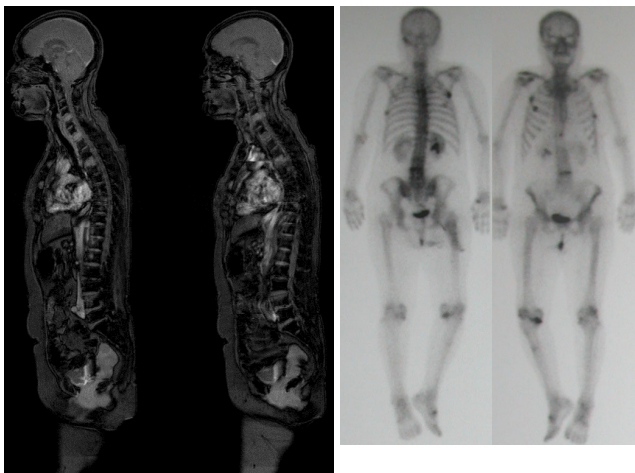


Fig.1. FASTA image and bone scintigram
Comparable information to bone scintigram was obtained in terms of the detection and the localization of the vertebral metastases

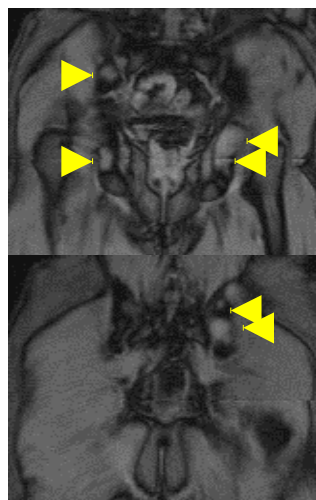


Fig.2. FASTA images
Pelvic bone metastases were also detectable as high signal

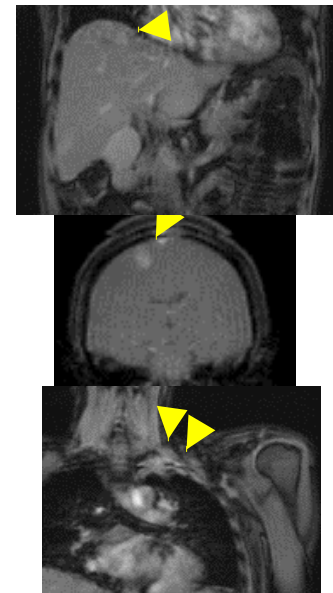


Fig.3. FASTA images
Relatively large hepatic or brain lesions were detectable. Lung lesions were not detectable except for one case of Pancoast tumor