عنوان مقاله:

Fabrication of New 3D Phantom for the measurement of Geometric Distortion in Magnetic Resonance Imaging System

محل انتشار:

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خلاصه مقاله:

Introduction: Geometric distortion, an important parameter in neurology and oncology. The current study aimed to design and construct a new three-dimensional (3D) phantom using a 3D printer in order to measure geometric distortion and its 3D reproducibility. Material and Methods: In this study, a new phantom containing 13,824 reference features (control points) was designed with AutoCAD software, fabricated with a 3D printer, and filled with vegetable oil. This phantom was tested on the Siemens 3 Tesla Prisma MRI model using a 64-channel head coil. Six-slice computed tomography (CT) scan images were used as a reference. Moreover, the reference features of MRI images were matched with those of CT scan images using a 3D reference model. The reproducibility of the phantom was investigated on three different days (three different imaging sessions per day). Results: The obtained 3D results indicated that the non-uniformity of field and nonlinearity of the gradients and imaging reproducibility could lead to geometric distortion. The mean Euclidean distance error for MRI volume was less than 1 mm. The maximum Euclidean error was 1.5 mm. Distortion in the whole volume was pronounced more specifically at the edges of the magnetic field. Conclusion: The results showed that the amount of distortion in the middle of the field was less than at its sides. This phantom can be used to check the distortion filters on the device. Furthermore, this phantom can be used to study geometric distortion in scenarios that require a small study volume, such as prostate studies.

کلمات کلیدی:

MRI, Distortion, Phantom