Sensitivity encoding (SENSE): advantages and disadvantages

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Introduction

Coil sensitivity encoding (SENSE) is a new technique for considerably enhancing the performance of magnetic resonance imaging (MRI) and enables reduction of scan time in any standard Fourier imaging mode by means of arrays of multiple receiver coils. We have used the technique practically, especially in body imaging for more than 9 months.

The purpose of this exhibition is to demonstrate and summarize the image quality of SENSE technique for body imaging focusing on advantages, disadvantage, and specific artifacts of the technique.

Methods

All studies were performed at a Philips Gyroscan ACS-NT15 equipped with Syncra4 SENSE software package using Synergy body coil, which has four individual coil elements and preamplifiers.

Advantages

(1) Suppressed motion artifact; Reduction of scan time can minimize deterioration of image due to respiratory motion or bowel peristalsis and cause improved image quality.

(2) Correction of heterogeneous sensitivity of coils; Synergy coil or phased array coil is composed of multiple surface coils and can cause difference of intensity in a image with heterogeneous sensitivity of each coil. SENSE technique uses the known coil sensitivity with reference scan to make the final image totally uniform.

(3) Decreased T2 filtering effect; Shortening of phase encoding time is correspond to the shortening of echo spacing and improves image quality minimizing burring due T2 filtering effect.

(4) Decrease of chemical shift artifact; When using EPI, chemical shift artifact along phase encoding direction is.

Disadvantages

(1) SNR of reconstructed image is reduced with increase of SENSE reduction factor. If SENSE reduction factor is 2, SNR is reduced by approximately 30%.

(2) Geometry factor affects image quality. Geometry factor describes the ability with the used coil configuration to separate pixels superimposed by aliasing. The coil arrangement and phase encoding direction are major determinant of SNR.

(3) Displacement artifact is a curved linear intensity on the unfolded image and result from poor sensitivity assessment (Fig. 1).

(4) Black hole artifact describes a focal low intensity area on unfolded image probably resulting from movement of large bowel gas between reference scan and regular clinical protocol speeded up by SENSE (Fig. 2).

Conclusion

SENSE is a powerful and promising technique for fast MRI of any kind of body imaging. Advantages of image quality using are based upon not only reduction of total scan time but also longer sampling time and reconstruction using reference scan. Disadvantages usually resulted from suboptimal reference scan and coil alignment. Radiologists should be familiar with the characteristic features of SENSE technique to obtain better image quality and interpret them precisely.

Figures omitted at submission.