Field of View Reduction with RF Shield Mesh Sheet

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Introduction

Although recent many works have accomplished acceleration of imaging speed and increase of spatial resolution, still many clinicians and scientists are eager for more advance. FOV reduction which directly shortens scan time or decreases voxel size is therefore still a basic technique to be developed. In this study, we introduced a mesh sheet which shields RF pulses and examined its usefulness for FOV reduction, that is, safety and shielding effectiveness, on a 1.5T scanner.

Materials and Methods

The RF shield mesh (Mac Corporation, Ltd., Osaka, Japan) is a net of nylon fiber covered with 99% silver (Fig.1a). In the frequency range of 50 to 500 MHz, it reduces electromagnetic wave to about 23dB (7.1 %) with single layer and about 36dB (1.6%) with double layer. In order to reduce FOV for body imaging, an arm cover (Fig.1b) was made by the double layer mesh and tried to suppress signal from the arms which are usually hamper in body imaging.

A whole-body 1.5T scanner (Sonata, Siemens, Erlangen, Germany) was used with a body-array and spine-array coils. Heating, stimulation, artifact and intensity reduction with the cover were checked with various sequences, gradient echo, turbo spin echo and balanced SSFP (bSSFP).

Results

Totally more than ten volunteers were scanned with the cover, and there was no heating problem. However, two of them felt tiny stimulation around their necks only when bSSFP sequence was run. Considering that no stimulation was felt on their arms which were at almost the gantry center, large and rapid changes of the magnetic field produced by the gradient coil can be a major cause.

Figure 1 shows bSSFP images obtained with (right column) and without (left column) the cover which was worn only on the right arm. To see artifacts and shielding effectiveness, the contrast is enhanced on the bottom row images. No artifact is observed and signal intensity at the right arm region is decreased to the noise level.

Discussion

Considering that, with bSSFP sequence, clear signal can be observed even with flip-angle of a few degree in the off-resonance region [1], the RF shield mesh could suppress MR signal completely. The stimulation felt at neck can be avoid by wrapping the mesh with insulated cloth. Because diffraction of electromagnetic wave at opening parts of the cover decreases effectiveness of the signal suppression, they are needed to be as small as possible. The mesh is also useful for isolating electric devices and cables because it is soft and easy to cut and sew.

Conclusions

The cover made by the RF shield mesh effectively suppresses signals from arms, and its usefulness for FOV reduction can be demonstrated.

Acknowledgments

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References

1.Miller K. et al, MRM, 50, 675-683, 2003;

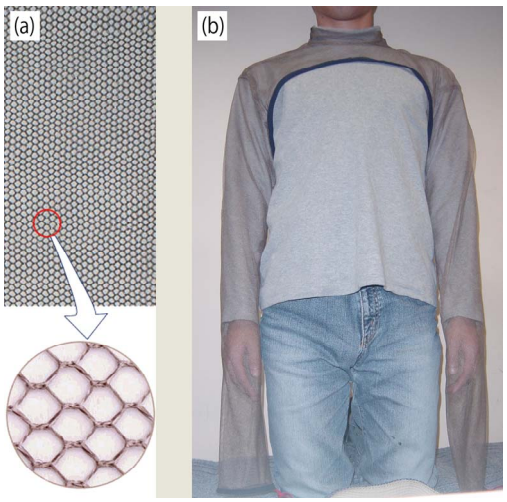

Fig.1
RF shield mesh and the arm cover made by the mesh

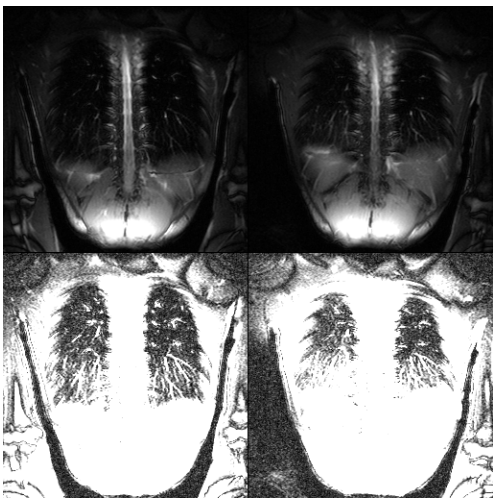

Fig.2
Balanced SSFP images measured with (right) and without (left) the shield cover on the right arm. Contrast was enhanced for checking artifact and efficiecy of signal reduction (bottom row).