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Original Article

Magnetic Resonance Imaging Susceptibility-weighted Imaging is More Reliable to Detect Hemorrhage and Calcification than Magnetic Resonance Imaging T2*-weighted Gradient Echo in Brain Imaging

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Abstract

Introduction: Magnetic resonance imaging (MRI) of the brain is the best modality to visualize brain parenchyma and brain pathology. Apart from routine sequence, T2*gradient echo (GRE) sequence was being used to detect calcification and bleed. We have studied that the sensitivity and reliability of MR susceptibility-weighted imaging (SWI) sequence are far better than T2*GRE sequence for detecting cerebral microbleed (CMB) and calcification.

Materials and Methods: The study was a retrospective study conducted with 50 patients with symptoms and signs of brain pathology. The patients underwent MRI and computerized tomography (CT). The MRI was performed in 1.5 Tesla scanner, and CT was performed in 128 multislice CT scanner using recommended sequences. The obtained images were being subjected to radiological analysis and interpretation.

Results: Out of 50 cases, SWI exclusively identified CMB in 16 cases in which even CT failed to identify the lesion. SWI sequence in MRI is a better sequence to detect bleed and calcification in brain parenchyma.

Conclusion: Both the modality was being carried out in all patients including normal patients with prescribed sequences. On comparison with T2*GRE sequence, SWI is excellent in spatial resolution for evaluating CMB and calcification.

Key words: Cerebral calcifications, Cerebral hemorrhage, Cerebral microbleed, Magnetic resonance imaging, Magnetic resonance imaging brain, Susceptibility-weighted imaging, T2*-weighted gradient echo imaging

INTRODUCTION

Computerized tomography (CT) of the brain is being considered as gold standard for evaluation of bleed and calcification of brain, though magnetic resonance imaging (MRI) is considered as best modality to view brain anatomy, physiology, and pathology.[1] In MRI T2*gradient echo (GRE) sequence, it is being used to detect calcification and bleed, but still it cannot able to detect the calcification and bleed to a certain extent.[1,2] After the introduction of susceptibility-weighted image (SWI) sequence, we were able to determine calcification and even cerebral microbleed (CMB) in brain, equivalent to that of CT brain images.[3]

Since CT brain cause radiation hazardous and contraindicated to pregnancy patient, we can use MR SWI sequence for detecting calcification and cerebral microbleed.[4,5]

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MATERIALS AND METHODS

The study was conducted at the Chettinad Hospital and Research Institute. The patients were examined by two different radiologists. It is a retrospective study; both the genders were included in this study. The study is done after proper consent for both MRI as well as CT. The MRI is done in GE 1.5 Tesla scanner, and CT is done in PHILIPS 128 multislice CT scanner.

Control Group

Brain images of the 50 patients, age ranging from 18 to 60, were examined. Based on the visibility of pathological structures, we were using three-point confidence scale: (1) Invisible, (2) partial visible, and (3) clearly visible.

Experimental Group

The acquired image of the 50 patient is taken for random sampling and calculated with routing workload in the department, in which 29 are male and 21 are female, and the age ranges from 18 to 60 (mean age = 36.5).

Exclusion Criteria

MRI is contraindicated for the following patients:

1. Patients with cardiac pacemaker
2. Patients with metallic implants
3. Claustrophobic patients.

Score System

The grading system is being categorized under 6 grading units, namely:

Score 0: Normal patient

Score 1: Visualized in CT images and not visualized in MR images

Score 2: Visualized in CT images, MR (SWI sequence) image and not visualized in MR (T2*GRE sequence)

Score 3: Visualized in both CT and MR SWI and GRE sequences

Score 4: Visualized in MR (SWI) sequence and not visualized in CT images

Score 5: Visualized in T2*GRE sequence and not visualized in CT images and MR SWI.

Image Acquisition and Image Interpretation

- The MRI study was conducted in 1.5 Tesla GE Signa HDxT MRI scan (Table 1)
- The CT scan of brain study was scanned in 128 Slice PHILIPS ingenuity core CT scan
- 8 channel phased array head coil was being used for MRI
- Two radiologists examined the images independently for qualitative analysis on independent AW GE workstation with MPR (multiplanar reconstruction).

RESULTS

We have included 50 patients for this research after getting proper consent.

The results are given below:

- 24 patients were normal categorized Score 0
- 0 patient in Score 1
- 8 patients in categorized in Score 2
- 2 patients were categorized under Score 3
- 16 patients were categorized under Score 4
- 0 patient in Score 5.

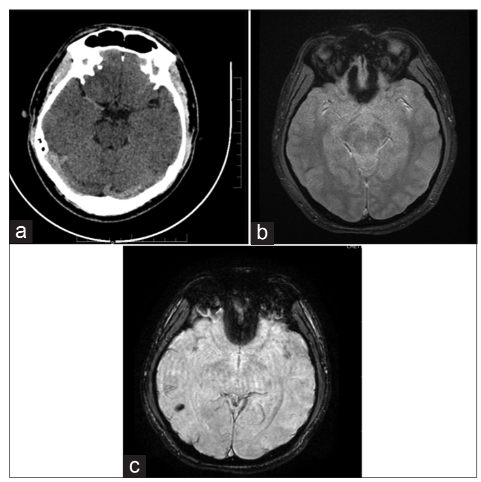
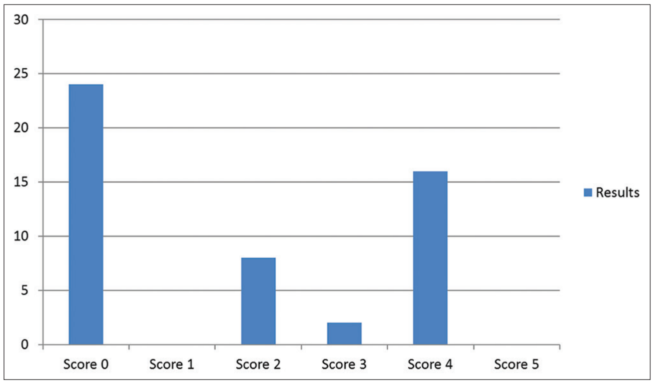


Figure 1: (a) Plain computerized tomography axial brain image shows no abnormalities, (b) Magnetic resonance imaging (MRI) gradient echo axial image shows no significant abnormalities and, (c) MRI susceptibility-weighted imaging shows blooming in the right parietal lobe

Table 1: Parameters and sequences used for the study

Parameters	MR-T2 FLAIR	MR-T2 W FSE	MR-T1 W SE	MR-T1 W SE	MR-T2 FLAIR	MR-T2 W GRE	MR SWI	CT
Mode of acquisition	2D	2D	2D	2D	2D	2D	3D	2D
Plane	Axial	Axial	Axial	Sagittal	Coronal	Axial	Axial	Axial
FOV (mm)	250	250	250	250	250	250	250	250
TR	8002	4800	1100	1100	8002	1500	62	
TE	85	101	26	26	85	150	41	
Matrix	256*160	320*192	320*192	320*192	256*160	512*224	352*224	512*512
Slice thickness (mm)	3	3	3	3	3	3	2	3
Interslice gap (mm)	0.5	0.5	0.5	0.5	0.5	0.5	-	0.5

SWI: Susceptibility-weighted image, CT: Computerized tomography, FSE: Fast spin echo, Flair: Fluid-attenuated inversion recovery, GRE: Gradient echo, MR: Magnetic resonance, 2D: Two-dimensional, 3D: Three-dimensional



Graph 1: Results

Graphical representation of the results is shown in Graph 1.

DISCUSSION

In our study, we found that CMB and calcification are better seen in SWI sequence rather than T2*GRE sequence. CMB is caused by structural abnormalities of small vessels in the brain, resulting small chronic hemorrhage, which occurs in normal aging, cerebral vascular disease, and dementia, which may damage the adjacent brain cell causing some impairment.[6,7] The byproduct of CMB is hemosiderin which is superparamagnetic substance, as hemosiderin is high susceptibility to magnetic field, it causes inhomogeneity when placed in the high signal which is called as susceptibility effect, whereas the GRE sequence is generated by (a) use of gradient coil to generate transverse magnetization and (b) make the flip angle lesser than 90 degrees.[8,9] Hence, SWI is far better than T2*GRE sequence in early diagnosis in CMB. The patients also underwent CT brain for correlation.

SWI also helps in differentiation of hemorrhage and calcification in brain tumors.[10]

Three dimension images of SWI can also be viewed in multiplanar reconstruction as it has good spatial resolution than T2*GRE sequence.[11]

The images of (Figure 1) SWI, T2*GRE, and the CT images of the brain belongs to the same patient which reveals that SWI sequence in MRI is better sequence to detect bleed in brain parenchyma.

CONCLUSION

In our study, both the SWI and GRE sequences were being carried out in all patients including normal patients with prescribed sequences, which we infer that SWI sequence in MRI imaging of brain is better spatial resolution for diagnosing CMB and calcification than T2*GRE sequence, we can also avoid CT brain, since radiation is hazardous to health.

REFERENCES

1. Fazekas F, Kleinert R, Roob G, Kleinert G, Kapeller P, Schmidt R, *et al*. Histopathologic analysis of foci of signal loss on gradient-echo T2*-weighted MR images in patients with spontaneous intracerebral hemorrhage: Evidence of microangiopathy-related microbleeds AJNR Am J Neuroradiol 1999;20:637-42.
2. Nighoghossian N, Hermier M, Adeleine P, Blanc-Lasserre K, Derex L, Honnorat J, *et al.* Old microbleeds are a potential risk factor for cerebral bleeding after ischemic stroke: A gradient-echo T2*-weighted brain MRI study. Stroke 2002;33:735-42.
3. Haacke EM, Xu Y, Cheng YC, Reichenbach JR. Susceptibility weighted imaging (SWI). Magn Reson Med 2004;52:612-8.
4. Wycliffe ND, Choe J, Holshouser B, Oyoyo UE, Haacke EM, Kido DK. Reliability in detection of hemorrhage in acute stroke by a new three-dimensional gradient recalled echo susceptibility - weighted imaging technique compared to computed tomography: A retrospective study J Magn Reson Imaging 2004;20:372-7.
5. Cho KH, Kim JS, Kwon SU, Cho AH, Kang DW. Significance of susceptibility vessel sign on T2*-weighted gradient echo imaging for identification of stroke subtypes. Stroke 2005;36:2379-83.
6. Thomas B, Somasundaram S, Thamburaj K, Kesavadas C, Gupta AK, Bodhey NK, *et al.* Clinical applications of susceptibility weighted MR imaging of the brain - A pictorial review. Neuroradiology 2008;50:105-16.
7. Tong KA, Ashwal S, Obenaus A, Nickerson JP, Kido D, Haacke EM. Susceptibility-weighted MR imaging: A review of clinical applications in children. AJNR Am J Neuroradiol 2008;29:9-17.
8. Haacke EM, Mittal S, Wu Z, Neelavalli J, Cheng YC. Susceptibility-weighted imaging: Technical aspects and clinical applications, part 1. AJNR Am J Neuroradiol 2009;30:19-30.
9. Santhosh K, Kesavadas C, Thomas B, Gupta AK, Thamburaj K, Kapilamoorthy TR. Susceptibility weighted imaging: A new tool in magnetic resonance imaging of stroke. Clin Radiol 2009;64:74-83.
10. Ayaz M, Boikov AS, Haacke EM, Kido DK, Kirsch WM. Imaging cerebral microbleeds using susceptibility weighted imaging: One step toward detecting vascular dementia. J Magn Reson Imaging 2010;31:142-8.
11. Goos JD, van der Flier WM, Knol DL, Pouwels PJ, Scheltens P, Barkhof F, *et al.* Clinical relevance of improved microbleed detection by susceptibility-weighted magnetic resonance imaging. Stroke 2011;42:1894-900.

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