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Is "Middle Cerebral Artery Hypointensity Sign" on Susceptibility Weighted Imaging Associated With Greater Infarct Volume?

KEYWORDS

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AIM:

- To study the association between"MIDDLE CEREBRAL ARTERY(MCA) HYPOINTENSITY SIGN" on SUSCEPTIBILITY WEIGHTED IMAGING(SWI) and infarct volume in acute MCA territory stroke.

OBJECTIVE

- To demonstrate the association of MCA hypointensity sign on SWI with greater volume of infracted brain tissue in MCA territory acute stroke as compared to patients with MCA territory acute stroke with no demonstrable MCA hypointensity sign.

MATERIALS AND METHODS

- STUDY DESIGN : Prospective and retrospective study
- STUDY SETTING : 1.5 T MRI system – Magnetom Siemens Avanto
- SAMPLE SIZE :20

METHODOLOGY:

The MRI images of a group of 20 patients who presented with acute stroke were studied. Diffusion weighted sequences, apparent diifusion coefficient maps and susceptibility weighted images (mIP, Mag, phase and SWI) were obtained. The volume of brain tissue showing diffusion restriction was calculated and compared among two groups. Group A contained cases with positive MCA hypointensity sign and group B contained MCA territory acute infarcts with negative MCA hypointensity sign.

- **INCLUSION CRITERIA :**

Patients presenting with stroke within 12 hours of onset.

- **EXCLUSION CRITERIA :**

Patients with :

- Intracranial aneurysm clips.
- Intra-orbital metal fragments.
- Any electrically, magnetically or mechanically activated implants (including cardiac pacemakers, biostimulators, neurostimulators, cochlear implants, and hearing aids).

SWI parameters

- Repetition time - TR/TE - 49/40 ms
- Flip angle – 15°
- Rectangular field of view (FOV) – 230mm
- Slice thickness -2.2 mm.
- Slices per slab – 56 & minIP reconstructions.

RESULTS

1. Of the 20 patients studied, MCA hypointensity sign was demonstrable in 9 patients (group A) and 11 patients showed no hypointenaity sign (group B).
2. The volume of brain tissue involved in patients with no demonstrable MCA hypointensity sign ranged from 2 to 54 cc on diffusion weighted images.
3. The volume of brain tissue involved in patients with demonstrable MCA hypointensity sign ranged from 46 to 116 cc on diffusion weighted images.
4. MCA territory infarcts with hypointensity sign showed significant correlation with larger volume of infarcts (p~.0237).

DISCUSSION:

SWI is a high spatial resolution, gradient MRI sequence. Diamagnetic, paramagnetic and ferromagnetic substances produce inhomogenieties in the magnetic field which results in signal loss. Deoxyhemoglobin is a para magnetic substance due to presence of unpaired electrons.[1] This results in signal loss along the MCA resulting in the MCA hypointensity sign.

Detection of intra-arterial clot is of diagnostic and prognostic significance. Derex L et al have demonstrated a poor prognostic outcome of patients with demonstrable artery occlusion on MRA.2

Dayanand lingegowda et al compared the accuracy of susceptibility sign with contrast enhanced MRA (gold standard) and found that the susceptibility sign had a sensitivity 82% and a specificity of 100%.3

In another study conducted by Christian W et al 88 consecutive patients with acute ischemic stroke due to middle cerebral artery (MCA) occlusions under- going endovascular recanalization were screened. Thrombus visibility and location on SWI were compared to those on TOF-MRA, GE-MRA and DSA. The association between thrombus length on SWI and reperfusion success was studied. Eighty-four of the 88 patients included (95.5 %) showed an MCA thrombus on SWI. Strong correlations between thrombus location on SWI and that on TOF-MRA ($P<0.001$), GE-MRA ($P<0.001$) and DSA (, $P<0.001$) were observed. They also concluded that SWI was superior compared to the other techniques in assessing the distal end of the thrombus.4

In our study, the volume of infarcted brain tissue in acute MCA territory stroke as demonstrated by diffusion weighted images was higher in group A patients than in group B patients. This can be explained by the fact that the sensitivity of susceptibility sign in demonstrating major vessel

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thrombus (M1/M2 segments of MCA) is higher than that in the peripheral branches (M3 segment of MCA).5

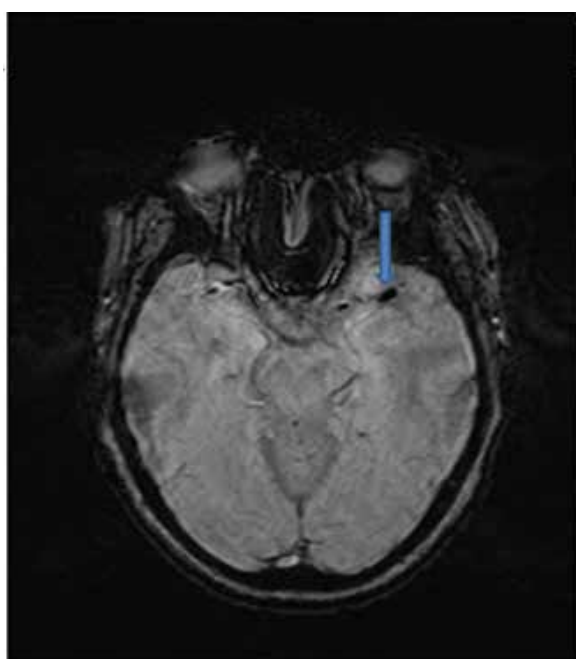
Bigger infarct volumes are associated with poor outcomes even in the setting of timely institution of thrombolytic therapy. Yoo et al demonstrated that patients with initial infarcts >70cc, all had poor outcomes despite a 50% recanalization rate. Patients with initial infarct volumes <70cc who recanalized early had the best clinical outcomes.6

The overlap in infarcted volume seen in some of the cases in group B with group A can be explained by the presence of white clots in the M1/M2 segments of MCA. All acute thrombi do not produce blooming. White clots are ones in which are predominantly composed of white blood cells. The changes in the paramagnetic effect of the thrombus as compared to rest of the flowing blood depend on content of the clot. Clots in which white blood cells predominate show more subtle changes in paramagnetic effect as compared to red blood cell predominant clots.7

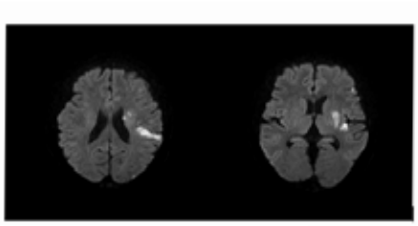
CONCLUSION:

Presence of hypointensity sign on susceptibility weighted images in acute MCA territory infarcts is associated with a greater volume of infarct as compared to acute MCA territory infarcts showing no hypointensity sign.

IMAGES:



Susceptibility weighted image showing hypointensity sign in distal M1 segment of left middle cerebral artery.



Diffusion weighted images of the same patient showing acute left MCA infarct.

REFERENCES:

1. Moseley ME, Kucharczyk J, Mintorovitch J, Cohen Y, Kurhanewicz J,Derugin N, Asgari H et al. Diffusion-weighted MR imaging of acute stroke: correlation with T2-weighted and magnetic susceptibility enhanced MR imaging. AJNR Am J Neuroradiol. 1990;11:423–429.
2. Derex L, Nighoghossian N, Hermier M, Adeleine P, Froment JC, Trouillas P. Early detection of cerebral arterial occlusion on magnetic resonance angiography: predictive value of the baseline NIHSS score and impact on neurological outcome. Cerebrovasc Dis [Internet]. 2002 Jan [cited 2015 Sep 9];13(4):225–9.
3. Thomas B, Hingwala D, Sylaja P, Lingegowda D, Vaghela V, Kesavadas C. 'Susceptibility sign' on susceptibility-weighted imaging in acute ischemic stroke. Neurol India. 2012;60(2):160.
4. Weisstanner C, Gratz PP, Schroth G, Verma RK, Köchl A, Jung S, et al. Thrombus imaging in acute stroke: Correlation of thrombus length on susceptibility-weighted imaging with endovascular reperfusion success. Eur Radiol. 2014;24(8):1735–41.
5. Radbruch A, Mucke J, Schweser F, Deistung A, Ringleb PA, Ziener CH, et al. Comparison of susceptibility weighted imaging and TOF-angiography for the detection of Thrombi in acute stroke. PLoS One [Internet]. 2013 Jan [cited 2015 Sep 9];8(5):e63459.
6. Yoo AJ, Verduzco LA, Schaefer PW, Hirsch JA, Rabinov JD, González RG. MRI-based selection for intra-arterial stroke therapy: value of pretreatment diffusion-weighted imaging lesion volume in selecting patients with acute stroke who will benefit from early recanalization. Stroke [Internet]. 2009 Jun;40(6):2046–54.
7. Kim HS, Lee DH, Choi CG, Kim SJ, Suh DC. Progression of middle cerebral artery susceptibility sign on T2*-weighted images: its effect on recanalization and clinical outcome after thrombolysis. AJR Am J Roentgenol [Internet]. 2006 Dec [cited 2015 Aug 20];187(6):W650–7.