Sir,

We present a case of 28-year-old man admitted with an episode of fall due to weakness in all four limbs, with differential weakness of right upper limb that was associated with cognitive dysfunction. He had experienced multiple episodes of such attacks in the past 10 years. The relatives also noticed that after such an attack the patient remained confused for few hours. He did not give history of palpitations, hand tremors, or heat intolerance. His computed tomography scan of head and electroencephalogram suggested no abnormality. MRI of the brain was not done. A short review of systems was otherwise noncontributory. Neurological examination revealed the overall power in limbs was about 4/5, but in the right upper limb it was found to be 1/5. There was generalized hyporeflexia with a flexor plantars. His score on mini mental state examination (MMSE) was 21/30. The remainder of the physical examinations was noncontributory. Serum electrolyte: Potassium 1.7 mEq/L (normal range: 3.5-5.3 mEq/L). He was investigated for renal loss of potassium which was normal. His thyroid stimulating hormone (TSH) level was reduced to 0.05 ng/dL (normal range: 0.45-4.5 ng/dL) indicating a hyperthyroid state. He was given potassium supplementation after which his symptoms recovered completely along with improvement of cognitive functions without any residual weakness. His nerve conduction velocity (NCV) done during a nonparalyzed state was normal.

Periodic hypokalemic paralysis is often unrecognized when first encountered because of its relative rarity. Atypical presentations of severe hypokalemia may be in the form of total paralysis including respiratory, bulbar, and cranial musculature. Some patients complain of muscular weakness, especially of the lower extremities, while marked and generalized weakness of skeletal muscles is common with more severe potassium depletion, but they may present as weakness of specific group of muscles. Sudden deaths from respiratory failure and arrhythmia like ventricular tachycardia and fibrillation have been reported. Our case was typical in presence of marked generalized weakness with differential weakness of right upper limb, reason of which cannot be explained. The sensations and level of consciousness are generally unaffected. Our patient had history of cognitive disturbance during the attack with hyporeflexia in all four limbs. Cognitive disturbances with hypokalemia have not been reported in literature. Both of the problems improved completely after potassium replacement which is a prerequisite for diagnosis of this disease.

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DOI: 10.4103/0028-3886.55581

Imaging of spontaneous neuromagnetic activity in a patient with internal carotid artery stenosis

Sir,

Magnetoencephalography (MEG) is beginning to
be applied clinically because this technique allows direct capture of cerebral neural activity and resolves the problem associated with low spatial resolution of electroencephalography (EEG). The present study measured spontaneous cerebral magnetic fields using a whole-head-type MEG system, and used frequency analysis to attempt imaging of cerebral ischemic areas.

A 76-year-old man suffered an ischemic attack resulting in left hemiparesis, and brain magnetic resonance imaging (MRI) confirmed a small infarct in the watershed area of the right parieto-occipital region [Figure 1a]. Cerebral angiography confirmed approximately 80% stenosis at the origin of the right internal carotid artery [Figure 1b]. Positron emission tomography by the $^{15}$O gas inhalation (steady-state) method ($^{15}$O gas PET) confirmed a decrease in cerebral blood flow (CBF) in the region of the right middle cerebral artery (right 36.2 ml/100 g/min; left 40.7 ml/100 g/min) [Figure 2a] and increased oxygen extraction fraction (OEF) (right 45.2%; left 37.7%) [Figure 2b]. The patient was thus diagnosed to have reduced CBF and metabolism reserve (misery perfusion) in the right middle cerebral artery region. Using a 160-channel whole-head-type gradiometer (MEG vision PQ1160C; Yokogawa, Kanazawa, Japan), MEG was performed to measure spontaneous cerebral neuromagnetic activities. Slow-wave component analysis was performed using an adaptive beamformer, which provided a kind of spatial filtration. At a sampling frequency of 500 Hz, a DC-200 Hz bandpass filter and a 50-Hz notch filter were used; 150-s data were analyzed in terms of $\delta$ waves (0.3-4 Hz) and $\theta$ waves (4-8 Hz). Asymmetrical slow-wave distributions in the cerebral cortex within 3 cm of the brain surface were superimposed onto preoperative cerebral MRI scans. MEG showed that the distribution of $\delta$ waves was broad from the right frontal area to the parietal area in the ipsilateral cerebral hemisphere corresponding to ischemic areas as confirmed by PET [Figure 3a], while the distribution of $\theta$ waves was relatively localized from the posterior temporal area to the parietal area in the ipsilateral cerebral hemisphere [Figure 3b].

Studies on slow-wave distributions as assessed by MEG have been previously conducted. These studies surmised that $\delta$ wave distributions are seen around the cerebral infarction, while $\theta$ waves are in a relatively localized area irrespective of the extent of ischemia. However, in the past, slow-wave analysis was performed by comparing raw data or estimating equivalent current dipoles (ECDs), and such techniques are not suited to estimating ischemic areas beyond a certain volume in the brain, and imaging has not been necessarily clear. We addressed this problem by using the adaptive beamformer method, which allows reconstruction of cerebral activity sources with high spatial resolution without limits to numbers.

The results of the present study suggest that cerebral

Figure 1: (a) Diffusion-weighted MRI at onset of transient ischemic attack. Small infarct lesion is seen in watershed area of right parieto-occipital region; (b) Cerebral angiography. Approximately 80% stenosis is seen at origin of right internal carotid artery (arrow)
magnetic field frequency analysis using MEG has the potential to identify the area of cerebral ischemia and may represent a useful technique for visualizing the ischemic penumbra.[5] Future investigations of differences between δ and θ wave distributions will be necessary in greater numbers of patients.

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DOI: 10.4103/0028-3886.55584

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Accepted on 09-01-2009