Etiopathophysiological assessment of cases with chronic daily headache: A functional magnetic resonance imaging included investigation.

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Abstract

BACKGROUND: Chronic daily headache (CDH) has gained little attention in functional neuro-imaging. When no structural abnormality is found in CDH, defining functional correlates between activated brain regions during headache bouts may provide unique insights towards understanding the pathophysiology of this type of headache.

METHODS: We recruited four CDH cases for comprehensive assessments, including history taking, physical examinations and neuropsychological evaluations (The Addenbrooke's Cognitive Evaluation, Beck's Anxiety and Depression Inventories, Pittsburg Sleep Quality Index and Epworth Sleepiness Scale). Visual analogue scale (VAS) was used to self-rate the intensity of headache. Patients then underwent electroencephalography (EEG), transcranial Doppler (TCD) and functional magnetic resonance imaging (fMRI) evaluations during maximal (VAS = 8-10/10) and off-headache (VAS = 0-3/10) conditions. Data were used to compare in both conditions. We also used BOLD (blood oxygen level dependent) - group level activation map fMRI to possibly locate headache-related activated brain regions.

RESULTS: General and neurological examinations as well as conventional MRIs were unremarkable. Neuropsychological assessments showed moderate anxiety and depression in one patient and minimal in others. Unlike three patients, maximal and off-headache TCD evaluation in one revealed increased middle cerebral artery blood flow velocity, at the maximal pain area. Although with no seizure history, the same patient's EEG showed paroxysmal epileptic discharges during maximal headache intensity, respectively. Group level activation map fMRI showed activated classical pain matrix regions upon headache.
bouts (periaqueductal grey, substantia nigra and raphe nucleus), and markedly bilateral occipital lobes activation.

**CONCLUSION:** The EEG changes were of note. Furthermore, the increased BOLD signals in areas outside the classical pain matrix (i.e. occipital lobes) during maximal headaches may suggest that activation of these areas can be linked to the increased neural activity or visual cortex hyperexcitability in response to visual stimuli. These findings can introduce new perspective towards more in-depth functional imaging studies in headaches of poorly understood pathophysiology.

**KEYWORDS:** Chronic Daily Headache; Electroencephalography; Functional MRI; Neuropsychology; Pathophysiology; TCD