

## The Author Response

## The Supernumerary Phantom Limb and Phantom Limb Pain in Stroke: Localization and Management Concerns

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The supernumerary phantom limb is the problem of perception of body scheme (1), and phantom limb pain is one type of central pain, defined as central neuropathic pain caused by lesions or dysfunction in the central nervous system (brain, brainstem, and spinal cord) (2). Central pain is a neurological disorder that is rather common although difficult to treat, causing unremitting suffering and disability (3). Diagnosis of central pain that may occur following stroke is complicated by cognitive and speech limitations as well as by depression, anxiety and sleep disturbances. Localized brain lesions causing central pain and their management have not been established clearly.

Kiefer et al. (4) reported that the phantom limb pain is difficult to treat compared to conventional pain, and repetitive transcranial magnetic stimulation (rTMS) have shown to respond to drug resistant neurogenic pain (3, 5). The mechanism of cortical stimulation for the relief of pain is based on the excitability modification of neuronal activity intimately involved in the neural circuits responsible for perception and pain processing. Lefaucheur et al. (5) studied whether neurogenic pain relief by rTMS depended on the origin or the site of pain. The most favorable conditions were trigeminal nerve lesion, facial pain, and absence of severe sensory loss within the painful zone. The worst conditions were brainstem stroke, limb pain, and severe sensory loss. Basbaum et al. (6) described various descending modulatory pathways in the brainstem acting on pain transmission. Patients with brainstem stroke could have damage on these structures, leading to the inefficacy of corticothalamic descending control triggered by rTMS. The patients in our case report had the supernumerary phantom limb and phantom limb pain after brainstem stroke (7). We chose multimodal sensory neurocognitive rehabilitation and anticonvulsants (pregabalin) instead of rTMS (1).

The purported age difference between poststroke patients, who developed central poststroke pain and those who did not, is a subject of some debate in the literature. Anderson et al. (8) found no disparity in age between the patients that went on to develop central poststroke pain (n = 87) versus those that did not (n = 120). Bowsher (9) found a significant difference in age

of stroke onset between 130 central pain patients (median age 57 yr) and the whole stroke population (median age 75 yr). No studies on the relationship of demographic characteristics and phantom limb pain have been published. Both patients in our case report are middle-aged, highly educated, and have median socioeconomic status. In addition, the patients did not have psychotic symptoms (hallucination, delusion), therefore psychiatric consultation about supernumerary phantom limb was thought to be unnecessary. Subsequent larger and randomized studies are needed to examine the relationship between demographic characteristics (age, sex, education level), personality characteristics and central pain including phantom limb pain.

We really appreciate the comments by Dr. Das, and further evaluation is needed for the brain localization of body scheme and the management of central pain.

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