

Alteration of regional cerebral blood flow in patients with chronic pain —Evaluation before and after epidural spinal cord stimulation—

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Background: Chronic pain is defined as intractable pain caused by abnormal pain transmission or impairment of the pain control system per se. Alteration of regional cerebral blood flow (rCBF) is known to occur under the presence of pain stimulation. Epidural spinal cord stimulation (SCS) is occasionally effective in relieving the symptom. **Objective:** The aim of the current study is to investigate the alteration of rCBF in baseline condition and to find the association between the rCBF change and the efficacy of SCS in chronic pain. **Methods:** A total of 18 patients underwent Tc-99m-HMPAO SPECT before and after SCS. Analysis with three-dimensional stereo-tactic surface projections (3D-SSP) with stereo-tactic extraction estimation (SEE) software was adopted to evaluate the rCBF. We assessed the extent score of the abnormal region in each segment (rate of the coordinates with a Z-value that exceeds three kinds of threshold value 2.0, 2.5 and 3.0 in all coordinates within a segment). According to the therapeutic response defined by visual analogue scale, we categorized patients into two groups, the good responder (GR) group (n = 12) and poor responder (PR) group (n = 6). In the analysis, we compared the extent score in the following two conditions. (1) Comparison between the PR group and normal control group under both baseline condition and after SCS. (2) Comparison between the GR group and normal control group under both baseline condition and after SCS. **Results:** (1) In the PR group, increased rCBF was observed in left thalamus, bilateral precuneus and bilateral cerebellum under the baseline condition. After SCS, the range of these increased rCBF areas localized but remained. Decrease of rCBF was noted in bilateral subcallosal gyrus, superior temporal gyrus (STG) and bilateral anterior cingulate gyrus (ACG). They localized after SCS, but remained. (2) In the GR group, increased rCBF areas were noted in bilateral precuneus and bilateral cerebellum under the baseline condition. After SCS, they localized in bilateral precuneus but those of bilateral cerebellum remained. Decreased rCBF area was noted in bilateral subcallosal gyrus, STG and bilateral ACG under the baseline. After SCS, they localized in bilateral subcallosal gyrus and bilateral STG. In contrast, they enlarged in bilateral ACG. **Conclusion:** Chronic pain patients demonstrated abnormal rCBF distribution on both baseline and post SCS conditions. Increased rCBF of thalamus and precuneus under both conditions in the PR group and decreased rCBF of ACG under post SCS conditions in the GR group were characteristic patterns. Tc-99m-HMPAO SPECT with 3D-SSP and SEE analysis is likely objective and effective in monitoring and evaluating therapeutic outcome by SCS in chronic pain. In addition, it provides information that is useful in the selection of SCS candidates.

Key words: ^{99m}Tc -HMPAO SPECT, chronic pain, 3D-SSP, spinal cord stimulation (SCS), SEE analysis