Association between preoperative anxiety in lumbar spinal stenosis patients and abnormal cerebral glucose metabolism: Voxel-based statistical analysis of F-18 FDG brain PET

INTRODUCTION: It is generally accepted that impending surgery is a stressful situation and people awaiting operation experience anxiety. Preoperative anxiety is characterized by subjective feelings of tension, apprehension, nervousness, and worry. Research has shown that preoperative anxiety is related fears related to surgical failures, anesthesia, fear of loss of control, and fear of death.

Preoperative psychological and emotional factors have been shown to be related with pain and functional outcomes in orthopaedic patients. Also, Rosenberger et al suggested that preoperative consideration of attitudinal and mood factors will assist the surgeon in estimating both the speed and extent of postoperative recovery. Interaction between psychological factors and body functions in human has been discussed by various investigators. Apart from hypothalamic-pituitary-autonomic nervous system, the cerebral cortex and limbic system could not be ignored. Although not in orthopaedic patients, psychological factors have been related to the prognosis of cancer patients and functional neuroimaging seems to be an not only for psychiatric evaluation of major factors such as depression and anxiety but also for further psychological factors in cancer patients.

Preoperative and postoperative anxiety tend to be correlated. Patients with high postoperative anxiety have longer hospitalization periods and report more postoperative pain. One recent prospective study of 102 patients who underwent lumbar spine surgery found that lower presurgical anxiety, depression, and hostility predicted better outcome.

Although a possible association between preoperative anxiety and abnormal cerebral glucose metabolism may exist, we are not aware of any report describing the preoperative anxiety and cerebral metabolism in patients with lumbar spinal stenosis (LSS) in detail. The primary purpose of the current study was to determine the association between the preoperative anxiety and cerebral glucose metabolism in patients with LSS.

METHODS: We studied thirty four patients who had been admitted to our department for the surgical treatment of LSS. The diagnosis of lumbar spinal stenosis was based on clinical presentation and radiological findings (plain radiograph, computed tomography and magnetic resonance imaging). All patients were diagnosed as having lumbar spinal stenosis. All patients aged between 43 and 78 years presenting to the LSS were asked to undergo a Hamilton anxiety rating scale (HARS). Zung self-rating anxiety scale (ZAS) and an analysis of their cerebral glucose metabolism. Thirty four age- and gender-matched adults were used as the control group.

All subjects were also examined clinically to rule out any hidden metabolic disease or psychiatric disease that could affect the cerebral glucose metabolism before entering the study. In addition, brain MR imaging studies were performed in all subjects before entering the study in order to rule out any organic brain lesion. Subjects with a history of neuromuscular disease, endocrine disease, connective tissue abnormalities, organic brain disease, psychiatric disease or previous spinal surgery were excluded from the study. All subjects provided informed consent before the examination and measurements. The study was approved by the Clinical Research Ethics Committee of the university and the hospital.

RESULTS: Twenty patients (22 women and 12 men) with a mean age of 59.1 ± 9.0 years. The control group consisted of thirty four subjects (20 women and 14 men) with a mean age of 59.1 ± 9.0 years. The mean HARS score in the LSS group was 24.6 ± 8.2 and the mean ZAS score was 45.1 ± 9.2. The control group consisted of thirty four subjects (20 women and 14 men) with a mean age of 59.1 ± 9.0 years. The mean HARS score in the control group was 6.2 ± 3.2 and the mean ZAS score was 26.5 ± 4.4. The mean HARS score and ZAS score were significantly lower in the control group than in the LSS group (P < 0.0001 and P < 0.0001, respectively).

Regional cerebral metabolism abnormalities by SPM analysis, several voxel clusters of significantly decreased cerebral metabolism were observed in the LSS patients with preoperative anxiety. The largest clusters were areas of left insula and left prefrontal cortex (Brodmann area 9 & 11). The second largest cluster area was left prefrontal cortex (Brodmann area 10). The other clusters were right insula (Brodmann area 13), right superior temporal gyrus (Brodmann area 22), and right middle frontal gyrus (Brodmann area 8).

Several clusters of significantly increased cerebral glucose metabolism compared to normal controls in LSS patients with preoperative anxiety. These areas were right cerebellar tonsil, left inferior semi-lunar lobule, right cerebellar tonsil, both ponses and right internal globus pallidus.

CONCLUSION: LSS patients with preoperative anxiety showed decreased cerebral glucose metabolism in several brain areas including left insula, left prefrontal cortex, right insula, right superior temporal gyrus, and right middle frontal gyrus. Also increased was noted in right cerebellar tonsil, left inferior semi-lunar lobule, right cerebellar tonsil, both pones and right internal globus pallidus. The findings of the present study provide...