VIII.10. Reviewed Article: Alexithymia and Awareness of Internal State in Human: A Study with H₂¹⁵O PET

Kano M., Hamaguchi T., Itoh M., Yanai K., and Fukudo S.

¹Graduate School of Medicine, Tohoku University
²Cyclotron Radioisotope Center, Tohoku University

Alexithymia: Clinical Significance

Alexithymia is a personality construct derived from clinical observations of patients with psychosomatic illness¹, and is characterized by the followings: reduced ability to identify and describe one’s feelings, difficulty in distinguishing feelings from the bodily sensations of emotional arousal, impaired symbolization, and a tendency to focus on external events rather than inner experiences². High rates of alexithymia have been reported in patients with essential hypertension, myocardial infarction, inflammatory bowel disease (IBD), functional gastrointestinal disorders (FGIDs), chronic pain, somatization, panic disorder, eating disorders, and post-traumatic stress disorders³. These findings suggest that alexithymia has aversive effects not only on mental health but also on physical health.

Empirical studies indicate that alexithymia exacerbates physical illness. However, direct evidence to explain the mechanism of this exacerbation has not been provided. One hypothesis is that alexithymics amplify unpleasant internal signals. We review trends of studies on alexithymia including our study⁴ which we investigated how alexithymia influences sensitivity to visceral stimulation in human.

Visceral Stimulation and PET

In 45 non-clinical healthy subjects (34 males and 11 females), brain processing of visceral sensation induced by colonic distension was examined using H₂¹⁵O positron emission tomography (PET)⁵. Subjective feeling evaluated on an ordinate scale and neuroendocrine response to stimuli were also measured. The degree of alexithymia was determined using the 20-item of Toronto alexithymia scale (TAS-20), and the correlation
between reaction to stimuli and the scores of TAS-20 and its three subscale [difficulty to identify feelings (DIF), difficulty to describe feelings (DDF) and external oriented thinking (EOT)] was evaluated. Statistical parametric mapping software (SPM2, Wellcome department of Cognitive Neurology, London, UK) was used create statistical maps of significant rCBF changes.

**Recognition of Internal State and Activated Brain Region**

At stimulation with the pressure of 40 mmHg, TAS-20 score significantly correlated with abdominal distention \( (r = 0.3, p < 0.05) \) and anxiety \( (r = 0.3, p < 0.05) \), while the score of DIF (difficulty to identify feelings) correlated with abdominal distention \( (r = 0.27, p < 0.05) \), abdominal pain \( (r = 0.34, p < 0.05) \), urgency for defecation \( (r = 0.31, p < 0.05) \), perceived stress \( (r = 0.3, p < 0.05) \), sleepiness \( (r = -0.3, p < 0.05) \) and anxiety \( (r = 0.28, p < 0.005) \)\(^{18}\). The scores of DDF (difficulty to describe feelings) and EOT (externally oriented thinking) did not correlate with any subjective perception.

TAS-20 score positively correlated with blood level of adrenaline \( (r = 0.29, p < 0.05) \), while the score of DIF positively correlated with blood levels of ACTH \( (r = 0.33, p < 0.05) \) and adrenaline \( (r = 0.39, p < 0.01) \). In contrast, the score of EOT negatively correlated with blood levels of ACTH \( (r = -0.31, p < 0.05) \) and adrenaline \( (r = -0.27, p < 0.05) \).

Areas of the brain where rCBF was higher in the alexithymics than in the non-alexithymics were: the right insula, middle frontal gyrus, midbrain, pregenual anterior cingulate gyrus, superior temporal gyrus, and postcentral gyrus (uncorrected \( p < 0.001 \), Figure). TAS-20 scores positively correlated with both activity in the right insula and orbital gyrus and adrenaline levels in the blood in response to stimulation (uncorrected \( p < 0.001 \)). The score of DIF positively correlated with rCBF in the orbital gyrus, insula, frontal gyrus and cerebellum (uncorrected \( p < 0.001 \)).

**Link of Alexithymia and Brain Function in Stress-related Disorders**

The present study demonstrates that alexithymia is associated with hypersensitivity to visceral stimulation induced by colonic distension. Activation of brain areas associated with alexithymia, such as the pregenual anterior cingulate cortex, right insula and midbrain, supports afferent representation of bodily states, and efferent autonomic and endocrine responses that accompany it\(^{18}\). Alexithymics may be more aroused by interoception of unpleasant feeling than non-alexithymics thereby displaying more autonomic responses. The results of this study support the somatosensory amplification hypothesis on alexithymia.
and could be used to confirm the results of clinical reports showing that alexithymia is associated with pain sensitivity in several chronic pain samples\(^9,10\). Although previous neuroimaging studies indicate that alexithymics were impaired in cognitive processing of emotion\(^11-13\), the present study demonstrates that individuals with high alexithymia were more emotionally distressed and displayed excessive arousal to visceral sensation. Subjects with alexithymia might be less aware of affective stimuli at the cognitive level but highly aroused by affective stimuli at the physiological level. Previous studies showed that alexithymia was associated with gastrointestinal symptoms with no relation to endoscopic findings in 1141 patients\(^14\) and high rate of alexithymia observed in FGID patients\(^15\), the alexithymia construct itself is not something that can be ignored to study FGIDs. Our results are regarded as primary mechanisms of symptom development in FGIDs\(^16,17\). We believe that understanding the influence of alexithymia and cognitive emotional processing on brain-gut function would be useful to elucidate the pathophysiology of FGIDs.

**Conclusion**

The study from our institution\(^18\) demonstrates that alexithymia is associated with hypersensitivity to visceral colonic stimulation. Our results show a positive correlation between TAS-20, and 1- activation of specific brain areas, 2- changes in blood neuroendocrine levels, and 3- subjective perception. These results support the somatosensory amplification hypothesis on alexithymia and could be one of the key mechanisms to explain the link between alexithymia and physical illness, especially FGIDs.

**References**

Figure 1. A statistical parametric map (SPM) showing the pregenual anterior cingulate cortex, midbrain, and right insula where rCBF was higher in the alexithymic subjects than in the non-alexithymics during colonic distension with a bag pressure of 40 mmHg (p<0.001, uncorrected).