

Self-recognition of one's own fall recruits the genuine bodily crisis-related brain activity

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【論文の内容の要旨】

[Introduction]

The human body is arranged vertically some segments, such that the head, trunk, legs, and feet. Some of the most important brain systems are dedicated to the maintenance of balance and to providing an online representation of where the body is located, via the integration of many different exteroceptive/interoceptive inputs. Although the neural mechanism for automatically detecting one's own body instability is an important consideration, there have thus far been few functional neuroimaging studies because of the restrictions placed on participants' movements.

[Methods]

Thirteen young healthy male participants took part in the experiment. We used functional magnetic resonance imaging to investigate the neural substrate underlying whole body instability, based on the self-recognition paradigm that uses video stimuli consisting of one's own and others' whole bodies depicted in stable and unstable states. After the fMRI scans, the participants were asked to rate their emotional states, and we conducted multiple regression analyses with the eigenvariate values in the spherical region of interest and the subjective ratings.

[Results]

Analyses revealed significant activity in the regions which would be activated during

genuine unstable bodily states: The right parieto-insular vestibular cortex (PIVC), inferior frontal junction / ventral premotor cortex (IFJ/PMv), posterior insula and parabrachial nucleus (PBN), and rostral-lateral prefrontal cortex (RLPFC). In addition, right IFJ/PMv activity was negatively correlated with emotional subjective ratings "calmness" scores.

[Conclusions]

The self-specific neural processing of body instability consists mainly of three component processes: 1) a vestibular/interoceptive process, which is related to detection of vestibular anomalies and to sympathetic activity as a form of alarm response (the right PBN and posterior insula), 2) an automatic motor-response preparation process (right IFJ/PMv), in which the necessary motor responses are automatically prepared/simulated in the brain to protect one's own body, and 3) a meta-cognitive process (right RLPFC) for self-recognition from the 3rd person perspective view. In addition, this right dominance may be based on lateralization of homeostatic brain structures and functions, which has been evolutionarily driven by a preexisting behavioral and autonomic asymmetry that is present in all vertebrates.