

## Brain and behaviour in post-acute stroke: Reduction in seeking and posterior cingulate neuronal variability

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### ABSTRACT

**Introduction:** Stroke is a complex event on both behavioral and neuronal grounds. Recent investigations evidence the central role of subcortical damage on the post-stroke brain and behavior reorganization. We have conducted an exploratory study combining anatomical lesion analysis, functional analysis of resting state fMRI, and behavioral assessment with focus on exploration as represented by SEEKING.

**Method:** 24 stroke inpatients were studied immediately after their clinical stabilization post-stroke; neuronal variability in fMRI along with behavioral outcomes were assessed. These outcomes were compared with a control group of 22 healthy subjects.

**Results:** First, we observed predominant subcortical lesions in our sample with all stroke patients showing subcortical lesions and only some exhibiting additional cortical lesions. Second, we observed significantly reduced neuronal variability in the posterior cingulate cortex (PCC) that did not show any structural damage. Third, our stroke subjects showed reduced SEEKING which was related to reduced PCC neuronal variability in an abnormal way (compared to healthy subjects). This last outcome was assessed by considering the subset of 11 stroke subjects for which fMRI and behavioral outcomes were jointly measured.

**Conclusions:** Taken together, our findings suggest that damage in subcortical regions may play a central role in abnormalities in both cortical activity (PCC) and associated behavior of post-stroke reorganization. Accounting for these aspects may have significant implications to optimize multi-disciplinary rehabilitation processes, particularly during the early steps of recovery, reducing the impact of stroke on the patient and caregiver quality of life.

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Post-acute stroke; SEEKING; PCC; neuronal Variability; resting State functional neuroimaging





## SEEKING and depression in stroke patients: An exploratory study

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### ABSTRACT

The concept of SEEKING describes a predisposition to search enthusiastically for rewards in the environment. While SEEKING and its underlying functional anatomy have been extensively investigated in animals, such processes in humans, especially brain-damaged individuals, remain understudied. We therefore conducted an exploratory behavioral study in stroke patients to investigate the effects of brain lesions that anatomically could be interpreted to impact the SEEKING system and predicted relationships to depression. Patients with lesions in anterior, medial, and/or subcortical lesions showed significantly lower SEEKING scores and higher depression scores than nonlesioned subjects in the control group. Based on our data and related work on animals, we propose central involvement of the anterior subcortical–cortical midline system as core of the limbic system in SEEKING in humans.

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## Do brain lesions in stroke affect basic emotions and attachment?

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### ABSTRACT

The aim of the current study was to investigate basic emotions and attachment in a sample of 86 stroke patients. We included a control group of 115 orthopedic patients (matched for age and cognitive status) without brain lesions to control for unspecific general illness effects of a traumatic recent event on basic emotions and attachment. In order to measure basic emotions and attachment style we applied the Affective Neuroscience Personality Scale (ANPS) and the Attachment Style Questionnaire (ASQ). The stroke patients showed significantly different scores in the SEEKING, SADNESS, and ANGER subscales of the ANPS as well as in the Relationship as Secondary Attachment dimension of the ASQ when compared to the control group. These differences show a pattern influenced by lesion location mainly as concerns basic emotions. Anterior, medial, left, and subcortical patients provide scores significantly lower in ANPS-SEEKING than the control group; ANPS-SADNESS scores in anterior, right, medial, and subcortical patients were significantly higher than those of the control group. ANPS-ANGER scores in posterior, right, and lateral patients were significantly higher than those in the control group; finally, the ANPS-FEAR showed slightly lower scores in posterior patients than in the control group. Minor effects on brain lesions were also individuated in the attachment style. Anterior lesion patients showed a significantly higher average score in the ASQ-Need for Approval subscale than the control group. ASQ-Confidence subscale scores differed significantly in stroke patients with lesions in medial brain regions when compared to control subjects. Scores at ANPS and ASQ subscales appear significantly more correlated in stroke patients than in the control group. Such finding of abnormalities, especially concerning basic emotions in stroke brain-lesioned patients, indicates that the effect of brain lesions may enhance the interrelation between basic emotions and attachment with respect to the control group.

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