The role of supplementary motor area in action monitoring: evidences from intracerebral ERP recordings in Humans

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Abstract

Performance evaluation and errors processing are fundamental for adaptive and flexible goal-directed behaviour. Electrophysiological approaches have shown a scalp-recorded event-related potential (ERP), called "error negativity" (Ne) and initially considered to reflect an "error detection" mechanism, while functional neuroimaging, together with some source localization studies, have pointed out the rostral cingulate zone (RCZ) as a possible generator of this activity. Nevertheless the evidence of a similar, even though smaller, ERP on correct trials has challenged the interpretation of Ne's nature and hence all current models of cognitive control processes. A condition necessary to establish if these two negativities reflect a common functional mechanism is the presence of a common cerebral source. In the present study we first questioned the anatomical source of the Ne, as to date only indirect data are available in humans. Secondly, we tried to assess the unicity of the generator for the negativities on correct and errors, to support the hypothesis of a unique modulated physiological process. Direct recordings from human cerebral cortex in epileptic patients show that supplementary motor areas (SMAs) are implicated in action monitoring. Moreover SMAs are involved in the generation of both error and correct trials evoked responses. These results suggest that these two scalp ERPs do not reflect two distinct brain activities but rather a single process whose amplitude is modulated by performance.

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