

Distraction from Pain: An fMRI Study on the Role of Age-Related Changes in Executive Functions

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Abstract : Even though age has been associated with increased and prolonged episodes of pain, little is known about potential age-related changes in the 'top-down' modulation of pain, such as cognitive distraction from pain. The analgesic effects of distraction result from competition for attentional resources in the prefrontal cortex (PFC), a region that is also involved in executive functions. Given that the PFC shows pronounced age-related atrophy, distraction may be less effective in reducing pain in older compared to younger adults. The aim of this study was to investigate the influence of aging on task-related analgesia and the underpinning neural mechanisms, with a focus on the role of executive functions in distraction from pain. In a first session, 64 participants (32 young adults: 26.69 ± 4.14 years; 32 older adults: 68.28 ± 7.00 years) completed a battery of neuropsychological tests. In a second session, participants underwent a pain distraction paradigm, while fMRI images were acquired. In this paradigm, participants completed a low (0-back) and a high (2-back) load condition of a working memory task while receiving either warm or painful thermal stimuli to their lower arm. To control for age-related differences in sensitivity to pain and perceived task difficulty, stimulus intensity, and task speed were individually calibrated. Results indicate that both age groups showed significantly reduced activity in a network of regions involved in pain processing when completing the high load distraction task; however, young adults showed a larger neural distraction effect in different parts of the insula and the thalamus. Moreover, better executive functions, in particular inhibitory control abilities, were associated with a larger behavioral and neural distraction effect. These findings clearly demonstrate that top-down control of pain is affected in older age, and could explain the higher vulnerability for older adults to develop chronic pain. Moreover, our findings suggest that the assessment of executive functions may be a useful tool for predicting the efficacy of cognitive pain modulation strategies in older adults.

Keywords : executive functions, cognitive pain modulation, fMRI, PFC

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