

HIGHER CENTRES ENCODE CARDIORESPIRATORY RESPONSE TO EXERCISE WITHOUT MOVEMENT FEEDBACK

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Motor cortical areas concerned with volitional inspiration are activated during exercise, however, uncoupling the role of higher centre command from movement feedback and identifying the neuroanatomical correlates underlying ‘central command’ during exercise has not been established. We have used hypnosis to study imagination of exercise at rest in experimentally naive volunteers (n=17). Positron Emission Tomography scanning (n=8) identified areas of neuronal activation during imagination of (i) freewheeling downhill, (ii) cycling uphill and (iii) volitional hyperventilation whilst at rest. Imagination of exercise resulted in 12% of the heart rate (HR) increase and 30% of the ventilation (V_I all in f) increase seen in actual bicycle exercise under hypnosis. Imagination of exercise (CO_2 held constant) activated higher motor cortical planning, timing and control centres (parietal association areas, dorsal lateral prefrontal cortex, supplementary motor area (SMA) and pre-motor area, bilateral cerebellum, thalamus and left insular cortex). In contrast, volitional hyperventilation activated the SMA, motor cortex and cerebellum. This suggests that a significant component (f) of the respiratory response to ‘exercise’, in the absence of both movement feedback and an increase in CO_2 production, can be generated by what appears to be a behavioural response, given the neuroanatomical areas activated.