6 月 6 日(土) 10 : 15〜11 : 15　第 7 会場(ホール D5) 【英語　Respiratory Disease】

O-0358

Movement-related functional connectivity correlates with the performance of brain-machine interfaces to decode real and imagined movements

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key words brain-machine interfaces・functional connectivity・magnetoencephalography

【Purpose】
Brain signals recorded from the primary motor cortex（M1）are known to serve a significant role in coding the information brain-machine interfaces（BMIs）need to perform real and imagined movements, and also to form several functional networks with motor association areas. However, whether functional networks between M1 and other brain regions, such as these motor association areas, are related to the performance of BMIs is unclear. To examine the relationship between functional connectivity and performance of BMIs, we analyzed the correlation coefficient between performance of neural decoding and functional connectivity over the whole brain using magnetoencephalography.
【Methods】
Ten healthy participants were instructed to execute or imagine three simple right upper limb movements. To decode the movement type, we extracted 40 virtual channels in the left M1 via the beamforming approach, and used them as a decoding feature. In addition, seed-based functional connectivities of activities in the alpha band during real and imagined movements were calculated using imaginary coherence. Seed voxels were set as the same virtual channels in M1. After calculating the imaginary coherence in individuals, the correlation coefficient between decoding accuracy and strength of imaginary coherence was calculated over the whole brain.
【Results】
The significant correlations were distributed mainly to motor association areas for both real and imagined movements. These regions largely overlapped with brain regions that had significant connectivity to M1.
【Discussion】
Our results suggest that use of the strength of functional connectivity between M1 and motor association areas has the potential to improve the performance of BMIs to perform real and imagined movements.