UKE Paper of the Month Oktober 2017

Science, 2017, 358 (6359), p. 105-108

Interactions between brain and spinal cord mediate value effects in nocebo hyperalgesia

Alexandra Tinnermann, Stephan Geuter, Christian Sprenger, Jürgen Finsterbusch, Christian Büchel

ABSTRACT: Value information about a drug, such as the price tag, can strongly affect its therapeutic effect. We discovered that value information influences adverse treatment outcomes in humans even in the absence of an active substance. Labeling an inert treatment as expensive medication led to stronger nocebo hyperalgesia than labeling it as cheap medication. This effect was mediated by neural interactions between cortex, brainstem, and spinal cord. In particular, activity in the prefrontal cortex mediated the effect of value on nocebo hyperalgesia. Value furthermore modulated coupling between prefrontal areas, brainstem, and spinal cord, which might represent a flexible mechanism through which higher-cognitive representations, such as value, can modulate early pain processing.

STATEMENT: *Our study shows that psychological factors such as treatment value have a strong impact on nocebo-related side effects and can even modulate pain processing at the earliest level of central ascending pain pathways, i.e., the spinal cord. This is the first study to investigate expectation-induced pain modulation within the entire descending pain pathway, from prefrontal cortex to spinal cord. We used a novel fMRI approach that allowed us to simultaneously measure neural activity in the brain and spinal cord in order to identify mechanisms through which psychological factors such as negative expectations and value exert top-down modulations on the spinal cord.*

BACKGROUND: This project was part of the PhD thesis of Alexandra Tinnermann, MSc. The study was performed at the Department of Systems Neuroscience in the group of Prof. Dr. Christian Büchel and funded by the Sonderforschungsbereich “Multi-Site Communication in the Brain” (SFB936/A6) and the European Research Council (ERC-2010-AdG_20100407). Both authors have strong research interests in the field of pain modulation within the central nervous system.