

Clinical neurophysiologic research in Turku

Active in multidisciplinary scientific research, accurate clinical diagnostics, and non-invasive neuromodulation...

According to Scandinavian tradition, clinical neurophysiology is an independent medical specialty in Finland. Since 2009, the Department of Clinical Neurophysiology in Turku University Hospital has been part of the public utility Tyks-Sapa, offering tertiary level diagnostic services for the hospital district of South-Western Finland. The management of the department is based on an extensive and high-level quality control system. First among laboratories of clinical neurophysiology in Europe, the department has undergone yearly external audits and had official accreditation for its quality system since year 2003 by FINAS, Finnish Accreditation Services (test laboratory T212; SFS-EN ISO/IEC 17025:2005 standard). The laboratory serves all medical specialties offering a wide range of neurophysiologic diagnostic services, including whole-night polysomnography and vigilance studies, 24/5 video-EEG for presurgical epilepsy diagnostics, as well as long-term neurophysiologic monitoring during surgery and intensive care, and neuromodulatory treatment with transcranial magnetic stimulation (TMS).

For 15 years, our research group has been conducting both basic and clinical research on human experimental and clinical neuropathic pain utilising investigations of the whole neuraxis from periphery to the cerebral cortex. Correct diagnosis is the basis for classification of pain, which in turn is the prerequisite for successful studies on pathophysiological mechanisms, treatment effects, risk factors, genetics, and brain level mechanisms of neuropathic pain. Post-surgical nerve injury with or without pain as well as orofacial pain entities have been utilised as clinical

models of human neuropathic pain in the projects that have been and are currently conducted in collaboration with Tartu University Hospital in Estonia, and University of Helsinki, in addition to cooperation with many medical specialties in Turku University hospital. This research has resulted in an array of new neurophysiologic and psychophysical tests for sensitive and accurate diagnosis of neuropathy and neuropathic pain. These include special ENMG techniques, reflex recordings, and evoked potential recordings of large and small fibre systems, quantitative sensory testing, epithelial nerve fibre density from skin and mucosal biopsies, and navigated TMS. With current combination of diagnostic tests, nearly 100% accuracy in the diagnosis of neuropathy and neuropathic pain can be achieved both in the orofacial area and the extremities.

In addition to development and validation of neurophysiologic diagnostic markers for neuropathic pain, the multidisciplinary group has utilised neurotransmitter PET scans of the brain dopamine and opioid systems, genetic analyses, and structured psychiatric and clinical examinations in the evaluation of mechanisms and risks of neuropathic pain. With accurate diagnostics, we have been able to clarify the pathophysiology of burning mouth syndrome, a frequent but enigmatic neuropathic pain condition, and the important role of striatal dopamine D2 receptor mediated pathways in human neuropathic pain and its endogenous top-down modulation. Most recent studies deal with mechanisms and clinical effects of neuromodulatory treatment of pain, depression, and tinnitus with repetitive TMS. The ultimate goal is to tailor personalised



treatment and find new treatment options according to the mechanisms revealed by comprehensive individual neurophysiologic and genetic profiling of the pain patients.

Furthermore, our neurophysiologic research team has collaborated with Turku PET Centre anaesthesia research team to develop advanced quantitative EEG analyses and multimodal brain imaging methods for the study of consciousness. We have also cooperated with several companies including Nokia Mobile Phones, General Electrics and Nexstim Ltd. Our department is able to offer high-level, quality controlled, sophisticated, and detailed neurophysiologic testing methods for clinical diagnostics as well as pain and anaesthesia research in humans.

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