

Research Profile



Joachim K. Krauss

- 1985 M. D., Albert-Ludwigs-University, Freiburg
- 1985 – 1993 Postgraduate training in Neurology and Neurosurgery
- 1995 Habilitation (Neurosurgery), Albert-Ludwigs-University, Freiburg
- 1995 Assistant Professor, Dept of Neurosurgery, Baylor College of Medicine, Houston, USA
- 1997 Associate Professor, Dept of Neurosurgery, Inselspital, Bern, Switzerland
- 2001 Professor of Neurosurgery, Dept of Neurosurgery, Ruprecht-Karls University Heidelberg, Faculty of Medicine, Mannheim
- 2005 Chair of the Dept of Neurosurgery, Medical School Hannover

Current Research

The research of my group includes emphases in the fields of functional neurosurgery, neurooncology, normal pressure hydrocephalus, evaluation of outcome after spinal surgery, and multimodal monitoring. Most studies are clinically oriented. The main research foci in the realm of functional neurosurgery are outlined in the following.

Dystonic Movement Disorders

Dystonic movement disorders often are refractory to medical treatment and patients become very disabled. We have introduced deep brain stimulation (DBS) as a beneficial treatment option for dystonic movement disorders in the 1990s. Pilot studies have shown that bilateral pallidal DBS is a very effective treatment modality for refractory dystonia with few side effects. At present, we investigate the longterm effects of DBS in dystonia. We also participate in two clinical trials on DBS for cervical dystonia in cooperation with our colleagues from the department of neurology. In addition the efficiency of pallidal DBS in rare dystonic movement disorders is explored. After promising early results in Meige syndrome a European-wide clinical study is initiated. Our group participates also in the European Dystonia Research Group and in the Task Force on the Diagnosis and Treatment of Primary Dystonia.

Multifocal Deep Brain Stimulation

Several targets in the basal ganglia are being used for treatment of movement disorders and neuropathic pain, nowadays. These include the subthalamic nucleus, the pallidum and several thalamic nuclei. Especially in rare movement disorders it is unclear, which target is optimal in the individual patient. We have developed a technique and treatment algorithms for multifocal DBS. These treatment algorithms allow to explore the use of DBS also in orphan diseases such as hemichorea-hemiballism or Wilson's disease. Furthermore, these techniques allow physiological studies on the coherence of basal ganglia activity.

Microelectrode Recording

Extracellular single unit recording with high impedance electrodes has become an important tool to optimize the positioning of DBS electrodes. We use these technique also to explore the physiology and the pathophysiology of basal ganglia activity in different movement disorders. Furthermore we perform pharmacological studies during microelectrode recording.

Local Field Potentials

Basal ganglia dysfunction has been hypothesized as an imbalance between synchronized oscillatory activities within different frequency bands. Such oscillations are evident in the local field potentials of patients with Parkinson's disease and dystonia. Local field potentials can be recorded from the different contacts of the electrodes used for DBS while the electrodes are being externalized. In clinical studies in corporation with the neurophysiological group from Queens Square, London, different spatiotemporal activities in the human pallidum have been demonstrated.

Trigeminal Neuralgia

Trigeminal neuralgia has been recognized to be triggered by vascular compression in the region of the nerve entry zone of the trigeminal nerve. However, precise physiological explanations are still missing. To further elucidate pathophysiological mechanisms we investigated quantitative sensory testing to detect specific nerve fiber dysfunctions in trigeminal neuralgia and also psychological variables in corporation with the department of neurosurgery in Heidelberg and the Central Institute of Mental Health in Mannheim.

Molecularbiological Characterization of Spinal Ganglions in Neuropathic Pain

The mechanisms for the manifestation of neuropathic pain have not been clarified in detail. There is evidence that the spinal ganglia are involved in the processing and maintenance of neuropathic pain. In patients with neuropathic pain who underwent thoracic ganglionectomy molecular biologic methods are used to characterize pathophysiological mechanisms.

Spinal Cord Stimulation

Spinal cord stimulation has been used for decades in patients with refractory neuropathic pain. Nevertheless its basic mechanisms are still poorly understood. We have investigated somatosensory function and nociception in a series of SCS patients. In addition we try to evaluate whether neuroplastic changes occur in these patients upon chronic stimulation. Furthermore, we participated in a study on a new reloadable implantable pulse generator for chronic stimulation.

Central Stimulation for Refractory Pain

Central stimulation for refractory pain allows modulation of pain perception both at the thalamic level and at cortical levels. Comparing the effect of stimulation of the intralaminar nuclei with that of somatosensory nuclei by bifocal stimulation we investigate the differential effects on the paleospinothalamic and the neospinothalamic system. We also participate in a multicenter study on the effect of motorcortex stimulation for central neuropathic pain and trigeminal neuropathic pain.

Future Aims

We aim to enhance translational research by addressing corresponding topics both from clinical and experimental approaches. For that purpose, the laboratory of Experimental Neurosurgery presently is being reorganized with funds from the Volkswagen Stiftung.

Selected Publications

[1] KRAUSS JK, POHLE T, WEBER S, OZDOBA C, BURGUNDER JM: Bilateral deep brain stimulation of the globus pallidus internus for treatment of cervical dystonia. **The Lancet** 354:837-838, 1999.

[2] LOHER TJ, BURGUNDER JM, WEBER S, SOMMERHALDER R, KRAUSS JK: Effect of chronic pallidal deep brain stimulation on off-period dystonia and sensory symptoms in advanced Parkinson's disease. **Journal of Neurology, Neurosurgery and Psychiatry** 73:395-399, 2002.

[3] CAPELLE HH, WEIGEL R, KRAUSS JK: Bilateral stimulation of the globus pallidus for treatment of blepharospasm-oromandibular dystonia (Meige syndrome). **Neurology** 60:2017-2018, 2003.

[4] KRAUSS JK, YIANNI J, LOHER TJ, AZIZ TZ: Deep brain stimulation for dystonia. **Journal of Clinical Neurophysiology** 21:18-30, 2004.

[5] CHEN CC, KÜHN AA, HOFFMANN KT, KUPSCH A, SCHNEIDER GH, TROTTENBERG T, KRAUSS JK, WÖHRLE JC, BARDINET E, YELNIK J, BROWN P: Oscillatory pallidal local field potential activity correlates with involuntary EMG in dystonia. **Neurology** 66:418-420, 2006.

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