Department of Anesthesiology

Chair of Anesthesiology

Address
Krankenhausstraße 12
91054 Erlangen
Phone: +49 9131 8533677
Fax: +49 9131 8539191
www.anaesthesie.uk-erlangen.de

Director
Prof. Dr. med. Dr. h. c. Jürgen Schüttler

Contact
Prof. Dr. med. Christian Jeleazcov
Tel.: +49 9131 8533901
Fax: +49 9131 8539161
christian.jeleazcov@uk-erlangen.de

Research Focus
• Clinical and experimental pharmacology of anesthesia
• Experimental pain research: Pathomechanisms of cold hyperalgesia and cold allodynia, pain models for rare pain syndromes
• Clinical research in perioperative medicine
• Medical technology of diagnostic and therapeutic procedures
• Research projects furthering the medical education

Structure of the Department
Professorships: 3
Personnel: 433
• Doctors (of Medicine): 133
• Scientists: 5 (thereof funded externally: 2)
• Graduate students: 13

Clinical focus areas
• Clinical anesthesiology
• Operative intensive care medicine
• Pain management center
• Emergency medicine
• Palliative medicine

Special structural features
• 50 anesthesiology workplaces
• Anesthesia outpatient department
• Pain outpatient department, pain ward (4 hospital beds)
• Two intensive care units (36 critical care beds)
• Pain management unit (in cooperation with the Department of Neurology)
• Medical management of the emergency service (Erlangen, Landkreis Erlangen-Höchstadt, Forchheim)
• Medical care in air rescue services and in transport within UK Erlangen

Research
Research at the Department of Anesthesiology is focused on the clinical and experimental pharmacology of anesthesia as well as experimental and clinical pain research. In addition, innovative techniques for drug administration and patient monitoring are investigated, and projects dealing with the quality improvement of teaching and training are part of the Department’s research program.

Clinical and experimental pharmacology of anesthesia
This research is focused on the quantitative mathematical modeling of the pharmacokinetics and pharmacodynamics of anesthetic drugs with respect to model identification, computer simulation to improve study design and for educational purposes, and model based dosing strategies for therapeutic optimization.

In the reporting period, the pharmacokinetics and pharmacodynamics of the opioid hydromorphone were investigated during postoperative pain therapy in cardiac surgery patients. Focus of these investigations was the validation of a pharmacokinetic model of hydromorphone that has been developed in previous studies, and the development of a pharmacodynamic model for the analgesic effect of hydromorphone. Further, we investigated the propofol effect on arterial blood pressure in volunteers and developed a new pharmacodynamic model.

Experimental pain research: Pathomechanisms of cold hyperalgesia and cold allodynia, pain models for rare pain syndromes
In the field of experimental pain research, a Heisenberg Professorship has been funded by the DFG since May 2014. The research topic of this program is the pathomechanisms of cold hyperalgesia and cold allodynia, which are examined in the somatic and the trigeminal system. In detail, the mechanisms of altered temperature processing in the brain were investigated for a special form of cold allodynia, which can be locally induced in the skin by ciguatoxins known as fish poisons. A new device has been developed and validated for improved quantification of cold avoidance and temperature preference in mice. It is based on an automated analysis without experimenter bias. Another transnational subproject investigates hereditary differences in the development of cold allodynia by screening inbred mouse strains and comparing differences across strains with differences in the haplotype pattern.
A further research area focuses on the investigation of rare pain syndromes using human stem cells. In cooperation with the Division of Stem Cell Biology (Institute of Human Genetics, IZKF advanced project), skin biopsies are obtained from healthy individuals and pain patients, and are further cultured and programmed to stem cells. Similar to steps in early development, these so-called human induced pluripotent stem cells are differentiated into nociceptors to overcome the lack of human tissue which is otherwise not available for functional analysis. We recently characterized the expression and function of voltage-gated sodium channels (Navs) in this model system using molecular and electrophysiological methods in order to model rare hereditary pain syndromes caused by mutations in Navs and to influence their pharmacology in vitro.

Clinical research in perioperative pain
One major project in clinical pain research investigates the molecular background of increased analgesic consumption in patients with Crohn’s disease. Differences in gene expression rather than an increased level of sensoric perception may be a possible explanation of these observations, as revealed by quantitative sensory testing and genomic DNA analyses.

Further scientific projects in perioperative medicine focus on the analysis of huge data amounts recorded during anesthesia procedures. This work is performed in cooperation with the chair of medical informatics and deals with the identification and selection of mathematical derivatives that allow an accurate description of the time course of monitoring parameters like blood pressure, heart rate and oxygen saturation in more than 400,000 anesthesia protocols. In addition, machine learning methods will be applied in order to automatically identify risk profiles for clinical outcome parameters like mortality and cardiac morbidity.

Medical technology of diagnostic and therapeutic procedures
Within the scope of the National Leading Edge Cluster Medical Valley EMN, our research focused on the development of innovative monitoring techniques and new technologies for continuous and variable intravenous application of fluid drugs. A further research goal was the development and implementation of new methods for a more precise measurement of total and unbound concentration of anesthetics in blood plasma.
During the reporting period, we developed a new method for individual and effect related intravenous dosing of opioids and validated it using the opioid hydromorphone in two clinical
trials in patients after cardiac surgery. The comparison with gold standard pain therapy as well as the contribution of respiratory and cardiovascular variables to the identification of opioid adverse effects is still under investigation. On the basis of the gathered experiences, the next step will be the implementation of new dosing algorithms that consider selected physiological variables for dosing adjustment to minimize the adverse effects of opioids.

**Research projects furthering the medical education**

An emphasis of the scientific work during the reporting period is the development of curricula. Using a six step approach for curriculum development, several curricula for the management of emergencies and a sample curriculum for the specialization in anesthesiology have been implemented on behalf of the German association for anesthesiology and intensive care (DGAI). Furthermore, several human factors have been researched in virtual reality scenarios in acute medicine. In this context, the influence of hierarchies and checklists on strategies of decision making and actions in an operative setting have been analyzed. In cooperation with industrial partners, the usability and practicability of medical products are regularly tested in the simulation- and training center.

**Teaching**

The Department of Anesthesiology is committed in mandatory and elective courses in the field of medicine and dentistry. It has to be pointed out, that the Department takes responsibility for a number of interdisciplinary course formats including pain medicine, emergency care medicine and rehabilitation / physical medicine / naturopathic treatment as well as emergency medicine for dentists in cooperation with the department of oral-maxillofacial surgery. The elective course “rescue medicine” bridges into multiprofessional teaching. Furthermore the Department of Anesthesiology is one of the hosts for the oral examination for the European diploma of anesthesiology and intensive care medicine (EDA).

For the training in education new teaching concepts could be implemented, including virtual situative learning in the simulation and training center.

Master’s theses as well as MD and PhD theses are supervised.

**Selected Publications**


**International Cooperations**

Prof. E. Jørum, University Oslo: Norway
Prof. M. Lavie lle, Inria Saclay-Île-de-Fr ance, Ecole Politec-chnique, Palaiseau Cedex: France
Prof. J. Mogil, McGill University, Montreal: Canada
Prof. G. Peltz, Stanford Medical School, Stanford: USA
Prof. T. Saari, University of Turku, Turku: Finland