

Department of Pediatric Surgery

Director: Professor Oliver Muensterer University Medical Center Mainz Langenbeckstr. 1 D-55131 Mainz phone: +49 (0) 6131 17-7111 oliver.muensterer@unimedizin-mainz.de www.unimedizin-mainz.de/kinderchirurgie

OVERVIEW

We are the only academic pediatric surgery center in Rhineland-Palatinate and committed to research in a wide spectrum of pediatric surgical disease. In the last year, we built up a dedicated pediatric surgical laboratory. Our research team comprises a PhD in biology and a dedicated research fellow, along with a number of graduate students.

Clinically, we are part of several research consortiums on congenital malformations.

We also perform research on telemedicine, care of refugee children, infertility after childhood operations, and short bowel syndrome.

Our lab focuses on Multiphoton Microscopy of Hirschsprung disease and pediatric solid tumors, as well as esophageal lengthening for congenital esophageal atresia.

HIGHLIGHTS

MULTIPHOTON MICROSCOPY (MPM)

Multiphoton Microscopy has been proposed as a real-time microscopic imaging modality that may be a useful adjunct for the surgeon in the operating room. We previously proved the ability to accurately determine the distribution of ganglion cells in mice with Hirschsprung's disease, and are currently working on translation of the method to human application. In pediatric surgical oncology three-dimensional real time imaging of tissue may provide immediate feedback to the surgeon on resection margins. Recently, we published our first results on characterizing pediatric solid tumors using MPM. The next step is to document sensitivity, specificity, and interobserver congruence compared to conventional histology.

SINGLE-INCISION PEDIATRIC ENDOSURGERY (SIPES)

SIPES is accomplished through only a single small incision in the navel, minimizing the visible scar and potentially reducing incisional pain associated with the multiple points of entry used during traditional laparoscopic surgery. Within our department, a variety of novel laparoscopic procedures were first described early childhood, and are now routinely and safely performed with this method. The aim of new research projects is to establish this method for minimal invasive tumor surgery in comparison to standard laparoscopy, and to expand indications in combination with other innovative techniques.

TELEMEDICINE

Telemedicine is the use of telecommunication and information technologies in order to provide clinical health care at a distance. Telemedicine can be broken into three main categories: store-and-forward, remote monitoring and (real-time) interactive services. Real-time interactive service using the Adobe Connect Software is evaluated for routine outpatient care with great success. Future goals are the evaluation of telemedical consultation as second opinion for rare diseases in childhood like esophageal atresia.

ESOPHAGEAL GROWTH INDUCTION

Management of congenital long-gap esophageal atresia is one of the greatest challenges in pediatric surgery. While several esophageal lengthening procedures have been described and are currently used in our department clinically, the mechanisms behind esophageal growth induction through traction are yet poorly understood. We are evaluating the physical, histologic and molecular effects of esophageal traction in the porcine and human model.

CONGENITAL CHEST WALL MALFORMATION

Recently minimal invasive surgical technics have been introduced in correction of congenital chest wall deformities. Therefore new concepts and materials have to be developed and tested before put into practice. In cooperation with the Institute of Functional and Clinical Anatomy (UMC-Mainz) biomechanical testing is carried out to improve and evaluate new materials and surgical approaches.

Loucas M, Loucas R, Muensterer O. Surgical Health Needs of Minor Refugees in Germany: A Cross-Sectional Study. EUROPEAN JOURNAL OF PEDIATRIC SURGERY. 2017; 28: 060-066. Muensterer O. Tracheoesophageal Fistula (EA/TEF): Association of Different EA/ TEF Subtypes with Specific Co-occurring Congenital Anomalies and Implications for Diagnostic Workup. EUROPEAN JOURNAL OF PEDIATRIC SURGERY. 2017; 01: 1-124 (doi:10.1055/1-0036-1597946): 0036.

Muensterer O. Fundoplication in Infants and Children. In Till H, Thompson M, Foker JE et al.: Esophageal and Gastric Disorders in Infancy and Childhood. Beitrag in: Esophageal and Gastric Disorders in Infancy and Childhood. Springer Springer-Verlag Berlin Heidelberg, 2017, 1069-1084. Muensterer O, Holler A, Schwind M et al. Thoracoscopic Tracheoesophageal N-fistula Repair using a 5.8-mm Miniature Stapler for Fistula Division. EUROPEAN JOURNAL OF PEDIATRIC SURGERY REPORTS. 2017; 05: e55-e56. Muensterer OJ, Waldron S, Boo YJ et al. Multiphoton microscopy: A novel diagnostic method for solid tumors in a prospective pediatric oncologic cohort, an experimental study. INTERNATIONAL JOURNAL OF SURGERY. 2017; 48: 128-133.

FUTURE DIRECTIONS

Our future goal is to establish the interaoperative use of MPM to map the aganglionic segment in children with Hirschsprung disease in realtime, and to determine resection margins of pediatric solid tumors during surgery. Also, we would like to expand our telemedicine initiative to include other centers and indications, studying both potential economic and ecologic effects, as well as the benefits on patient care and interdisciplinary collaboration.

Concerning esophageal lengthening, we recently completed a study evaluating the effect of traction on the esophagus in a porcine model, particluarly focusing on how traction induces growth and the relationship between anastomotic tension and later stenosis.

In terms of clinical research, we are currently reviewing the largest patient series of thoracoscopic sympathectomy for the treatment of hyperhydrosis and its impact on patient quality of life. A further project is testing the availability of a youtube video as a supplemental source of information for the parents in the consent process when children are scheduled for inguinal hernia repair. Two projects investigate how childhood operations impact on later fertility. And finally, we are evaluating the effect of sleep deprivation, interruptions, and alcohol intoxication on the workflow and performance of robotic surgery in a simulator model.



FIG. 1: The pediatric surgical team.

FIG. 2: Multiphoton microscopy imaging of Wilms tumor.

<u>FIG. 3:</u> Thoracoscopic esophageal elongation procedure showing the lower esophageal pouch in traction towards the thoracic inlet, where it later will be anastomosed to the upper esophagus.

FIG. 4: Telemedical follow up with one of our international patients after pectus excavatum surgery.

FIG. 5: Biomechanical analysis for minimal-invasive Pectus carinatum repair.

Multiphoton Microscopy

Congenital chest wall malformation PROJECT MANAGER: S Rohleder, Prof. O Muensterer, Dr. M Ackermann FUNDING: MedXpert GmbH PROJECT DURATION: 2017 - 2019

Induction of esophageal growth by traction PROJECT MANAGER: Prof. O Muensterer, Dr. C Oetzmann von Sochaczewski, A Lindner FUNDING: Else-Kröner-Fresenius Foundation

PROJECT DURATION:

2017 - 2022

as an alternative to intraoperative frozen section biopsies for pediatric surgical oncologic diseases and comparsion to conventional histopathology in childhood <u>PROJECT MANAGER:</u> Dr. J Gödeke, Prof. O Muensterer, F Simon et al. <u>FUNDING:</u> Else-Kröner-Fresenius Foundation <u>FUNDING:</u> IPEG Research Fund

> PROJECT DURATION: 2014 - 2019

Telemedicine in the diagnosis and treatment of pediatric surgical patients PROJECT MANAGER: Dr. J Gödeke, S Rohleder, Prof. O Muensterer FUNDING: University Medical Center Mainz SUM: € 5,000 PROJECT DURATION: 2014 - 2019 The MIMIC dv-trainer a robotic simulator to improve the surgical performance of residents and experienced surgeons PROJECT MANAGER: Prof. O Muensterer, Dr. J Gödeke FUNDING: Sterntaler e.V. SUM: € 2,500 PROJECT DURATION: 2016 - 2020