Investigating Possible Predictive Value of Hyaluronic Acid in Middle Ear Infections

Start: April/May 2026

Background:

This thesis is part of the TOOLS project that combines basic research of middle ear infections on an optical as well as a clinical level.

Middle ear infections, also called otitis media (OM), are one of the most common reasons for antibiotics therapy and surgical procedures in children. Left untreated they can hinder speech development and lead to systemic inflammation (sepsis). Chronic or recurrent OM correlates with a dysfunction of the eustachian tube and an accumulation of pathologic effusate.

OM can be caused by bacteria, viruses, or a combination of both. With the diagnostic tools currently available, it is not possible to make a clear distinction through an intact eardrum. Furthermore, the overuse of antibiotics contributes to the growing risk of antimicrobial resistance.

These limitations highlight the need for more advanced diagnostic approaches. Biophotonic methods may offer a more reliable means of differentiating between types of OM than existing techniques, potentially enabling more precise, targeted treatment. In addition, identifying biomarkers within the effusate could provide predictive value regarding disease progression, including the likelihood that a child will require repeat surgical intervention for drainage tube placement or closer monitoring of the healing process.

Objective:

The aim of this research project is to find out which pathogens (bacteria as well as viruses) are prevalent at the Jena University Hospital at the time of testing. At the moment OM is treated by “watchful waiting” (no treatment, but regular check-ins), if the condition worsens treatment with Amoxicillin takes place.

Recent studies show a possible predictive value of hyaluronic acid (HA) content in the middle ear effusate (MEE). HA content could be used to predict whether the disease needs to be treated with antibiotics or not.

- Creation of a standard of operations (SOP) for sample collection at operations
- Contact microbiology for identification of bacteria
- Isolate bacteria and test whether they are good/bad biofilm bacteria
- Synergism testing of different antibiotics in combination with Amoxicillin
- Collaboration with partners of the TOOLS project and preparation of samples
- Biophotonic imaging like HSI (hyperspectral imaging) and OCT (optical coherence tomography) in-house or as a part of the collaboration
- Determination of HA content in MEE of patients with acute or chronic OM

Methods:

This project encompasses a variety of methodologies, mainly microbiological techniques at biosafety level 2 (involving risk group 2 organisms).

- Collaboration and communication with the OR team (doctors, nurses, researchers)
    - Sample handling and storage
- Microbiological work:
    - Aseptic technique
    - Bacterial isolation
    - Biofilm experiments in well-plate and on semi-solid agar
- Antibiotic synergism testing and analysis of results
- ELISA assay for HA concentration measurement
- Histological techniques

Application:

A basic knowledge of microbiological work is required, the applicant should have completed a bachelor's degree in a natural science field. Importantly, a willingness to work with pathogenic bacteria and clinical isolates should be present.

Furthermore, the applicant must provide a valid antibody titer for hepatitis B and vaccination for measles, a pneumococcal vaccination can be acquired at the start of lab work.

Contact Person:

Please send your complete application documents (letter of motivation, certificates, curriculum vitae including practical laboratory experience) by email to Luisa Duong

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