

# New Vaccination Strategy for the Prevention of Infections in Chronic Pulmonary Diseases

Clinical Cooperation Group 'Inflammatory Lung Diseases'

**C**hronic obstructive pulmonary disease (COPD) leads to a progressive reduction in pulmonary function. This can result in severe breathing difficulty due to narrowing of the airways and destruction of lung tissue. Smoking is the major risk factor, but in the developing countries the inhalation of smoke from the open fireplaces in poorly ventilated rooms is an additional factor. According to the World Health Organization (WHO), COPD is the fifth most common cause of death world-wide, and it will be the fourth most common

cause by 2030. Approx. five million people are estimated to be currently affected by the disease in Germany.

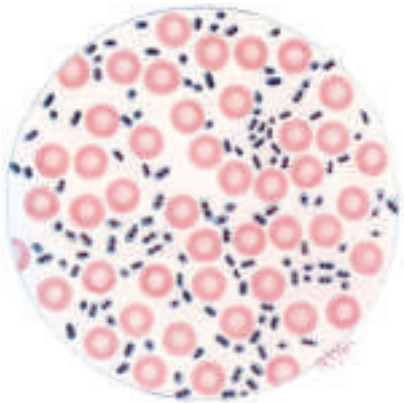
Patients with COPD have an increased susceptibility to lung infections. These infections result in the further deterioration of the lung structure and function. For this reason, vaccinations against influenza and pneumococci are recommended in order to protect COPD patients from these infections. With the common vaccination methods against pneumococci,

however, only a partial protection can be achieved.

The Clinical Cooperation Group 'Inflammatory Lung Diseases' is working on an innovative procedure for introducing vaccines directly into the lung by means of inhalation. This involves the generation of an aerosol from the liquid vaccine and the use of the AKITA device, which ensures controlled breathing during inhalation (AKITA® = "Apparatur zur kontrollierten Inhalation therapeutischer Aerosole" (device for the controlled inhalation of therapeutic aerosols), see picture). This approach leads to optimum deposition of the vaccine in the lung. The KKG has conducted previously two randomised studies with this method: a first one with healthy volunteers (Menzel et al) and a second one with COPD patients (see Meyer et al).



**Inhalation of a vaccine: in the new vaccination strategy the vaccine is atomised and inhaled. The AKITA device (in the front) ensures that the inhalation proceeds slowly and that the vaccine is ideally deposited in the lung.**



*Streptococcus pneumoniae*



**Pneumococci in the blood**

The red circles are the red blood cells, and the dark blue dots are the pneumococci, which are typically found in pairs. This historical picture was taken from Muir's Bacteriological Atlas, van Rooyen, published by Livingstone, Edinburgh, 1937.

These studies showed good tolerance of the inhalative vaccination: The most frequent side-effects were fatigue and a slight rise in body temperature. These are, however, desired reactions, which are due to a strong immune reaction.

This strong immune reaction was then also manifested in a good antibody response to the sugar structures of the pneumococci. When the immunoglobulin G antibody response in the blood of the COPD patients was measured, the reaction following inhalative immunisation was comparable to the reaction seen after the commonly employed intramuscular injection.

This project was carried out by the Clinical Cooperation Group in cooperation with the Asklepios Fachklinik für Pneumologie in Gauting near Muenchen and the spin-off company Inamed, also Gauting. The aim of the inhalative vaccination strategy is not only to generate a systemic immunoglobulin G response, but also to develop a potent specific local immunity in the lung.

Therefore, follow-up studies will investigate the development of local immunity, i.e. the formation of Immunoglobulin A. Immunoglobulin A is THE CRUCIAL DEFENCE MOLECULE found on the mucous membranes of the lung and in saliva. Therefore, in this new study samples of saliva are taken before and after the vaccination, which are then analysed for IgA directed against pneumococci. If this

additional development of local immunity is successful, the inhalation vaccination of COPD patients can be extended to include other microbial pathogens and help protect these patients more efficiently from life-threatening infections.

**Literature:**

- Menzel, M., Muellinger, B., Weber, N., Haeussinger, K., Ziegler-Heitbrock, L.: Inhalative Vaccination with Pneumococcal Polysaccharide in Healthy Volunteers, *Vaccine*, 23: 5113, 2005
- Meyer, P., Menzel, M., Muellinger, B., Weber, N., Haeussinger, K., Ziegler-Heitbrock, L.: Inhalative Vaccination with Pneumococcal Polysaccharide in Patients with Chronic Obstructive Pulmonary Disease, *Vaccine*, 24: 5832, 2006



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