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**AUTOMATIC REGISTRATION OF CT IMAGES TO PATIENT  
DURING THE INITIAL PHASE OF BRONCHOSCOPY – A  
CLINICAL PILOT STUDY**

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Bronchoscopy is the main investigative procedure in lung medicine, used for inspection, targeted lavage, cell and lung tissue sampling. However, the conventional bronchoscope diameter limits its depth of insertion, leading to a substantially reduced success rate in the diagnosis of peripherally located tumors, as low as 15% compared to 80% in proximal tumors, also dependent on tumor size and pulmonologist experience.

Recently, electromagnetic based navigated bronchoscopy (ENB) based on preoperative CT imaging has been introduced, particularly for the diagnosis of small, peripheral tumors. This has shown to increase the success rate to about 70-80 %. ENB development has the last years experienced a lot of important refinements, especially with improvements in navigation, tracking of flexible instruments and image acquisition and quality. Nevertheless, only a few commercial solutions are available. Due to the time limitation constraint in bronchoscopy it is important that the technological solutions do not prolong the current routine.

Our primary goal is to develop a multi-purpose navigation system for the range of minimal invasive procedures in endobronchial lung medicine. In this part of the main project we have developed an intraoperative registration method for automatically performing a CT to patient based registration during the initial phase of the bronchoscopy, i.e. the sedation of the airways. An electromagnetic tracking sensor was integrated into the tip of a conventional bronchoscope and position data is acquired continuously during the sedation phase of a bronchoscopic procedure. An iterative closest point (ICP) registration algorithm is then run matching these tracking data with the centerline of the airways, which is extracted from the CT images prior to the procedure. The registration algorithm is, in addition to the positions, utilizing the orientations of the bronchoscope by comparing it to the running direction of the centerline from the airways.

We present our initial results from a pilot patient study with this registration method. Our conclusion is that the combination of an integrated electromagnetic tracking sensor in the bronchoscope and an automatic registration method are valuable approaches in achieving a more seamless

solution for the pulmonologists with respect to performing navigated bronchoscopy.