Section: **Intraoperative Bildgebung**

ID: 111

Abstract-Title:
USER INTERFACE FOR ELECTROMAGNETIC NAVIGATED BRONCHOSCOPY

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Abstract-Text:
Purpose

Three-dimensional CT-guided navigation in bronchoscopy can guide bronchoscopic instruments to peripheral lesions. Several systems in the past were proposed and evaluated using an electromagnetic tracking system for navigation [1-3] to show the current position of the bronchoscopic instrument with in CT data in real time. An often addressed issue is the patient's motion during the intervention. We developed a fully functional prototype that is capable of compensation the patient's motion using a second sensor.

Method

A CT scan is acquired in prior to the intervention. A minimum of four natural landmarks for registration are selected in the CT scan. Solomon et al. [3] showed that the use of natural landmarks within the bronchus is more accurate than the use of external fiducials in terms of the target registration error (TRE). The electromagnetic tracking field generator (Ascension MicroBird) is placed such that it covers the entire area of interest on a metal free tripod (see figure 1 for the system setup). Using a calibrated sensor (tip calibration) the previous selected points in CT space are referenced in tracker space. A fully automatic algorithm finds the right correspondence of the registration points and computes the transformation matrix form CT to tracker space. Instantly the visualization interface is provided (see figure 2). In addition to the slice sagittal, coronal, and axial slice view, a three dimensional volume rendered presentation is visualized.

A second 6DOF tracking sensor is attached onto the skin of the patient before the registration process. This sensor is capable of rigid patient motion compensation in 6DOF during registration and visualization.

Results

An application, which visualizes the tip of the surgeon‘s instrument with the usage of an electromagnetic tracking system, was implemented for bronchoscopy. Both, slice view (axial, sagittal, and coronal) and three-dimensional view, are computed from the patient's CT-scan and are aligned in real-time to the position of the bronchoscope after registration.

For registration natural landmarks were used such a laryngeal, carina, and right and left carina. Earlier studies [1] showed difficulties with the patient's movement during surgery. This motion is compensated by the second sensor and quantitative tests showed a precise navigation and almost zero jitter due to motion artifacts. The system was tested on several phantoms. The sensor was always visualized within the bronchus.

Conclusion

Three-dimensional CT-guided bronchoscopy navigation with an electromagnetic tracking system is safe, accurate, and useful. A first prototype was developed to show the peas ability of the navigation system and the user interface to show the position of the flexible instrument robust, accurate, and in real time within the CT data including motion compensation. Further tests are scheduled to show its benefit on the biopsy of peripheral lung lesions with real patients soon.

References

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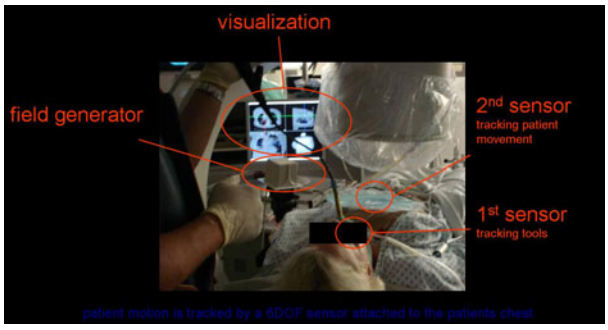
Bild 1/JPG



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