

Medical Image of the Week: Virtual Anatomical Dissociation During Electromagnetic Navigation Bronchoscopy

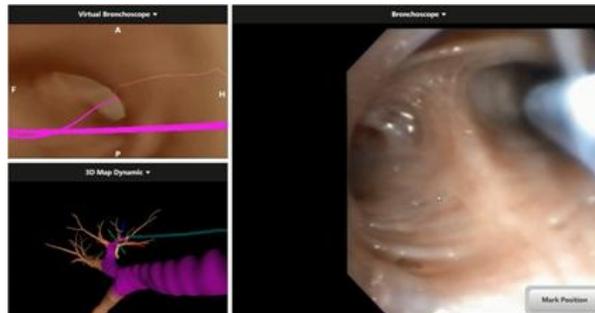


Figure 1. During the first navigation virtual bronchoscope image and 3D map (top left and bottom left) show the tip of the locatable guide in the posterior segment of the right upper lobe matching live video bronchoscope image.



Figure 2. Second navigation: the virtual bronchoscope image and 3D map (top left and bottom left) show the tip of the bronchoscope in the right main bronchus whereas the video bronchoscope shows the tip in the posterior segment of the right upper lobe.

A 59 year-old woman with a 40 pack-year smoking history was referred to our practice with a 2.5 cm spiculated right upper lobe lung nodule for a diagnostic bronchoscopy. We performed electromagnetic navigation bronchoscopy under general anesthesia in the operating room. After successfully navigating to the lesion and obtaining 3 needle biopsy samples and two cytology brush samples we lost target alignment. After attempting to rotate and reposition the catheter several times it was decided to re-navigate from the trachea. Two images comparing virtual navigation to real anatomy during the first and second navigation attempts are provided bellow (Figures 1 and 2).

Why are the virtual images different?

1. It is an artifact from respiratory movements
2. The locatable guide is outside the sensing volume
3. You should suspect a pneumothorax
4. Your registration procedure was suboptimal, you should repeat it.

Correct!

3. You should suspect a pneumothorax

Fluoroscopy confirmed the diagnosis of a moderate sized pneumothorax. The virtual-anatomical dissociation was created by the collapsed lung. Airways that were closer to the chest wall were now retracted towards the hilum, the takeoff of the posterior segment of the right upper lobe was now where the takeoff of the right upper lobe used to be.

Electromagnetic navigation bronchoscopy matches computed tomography (CT) images to the real anatomy of the patient during bronchoscopy providing real time GPS like guidance to allow accurate sampling of peripheral lung nodules or masses. At the beginning of the procedure the patient is placed on a location board with three sensors on the chest. The location board creates an electromagnetic field within which the patient sensors and the locatable guide can be located. Following this, the bronchoscope with a locatable guide inserted through its working channel is advanced into the airway. Using the main carinas and airways the real patient anatomy is matched to the CT anatomy. This process is called registration. Once registration is finished the locatable board and the sensors can account for patient respiratory motion (1).

The most common complication of the procedure is pneumothorax occurring in 3.5-7.5% of the cases in the published literature (1). The most common symptoms of pneumothorax are chest pain and dyspnea. In patients who are anesthetized and intubated, such as ours, changes in respiratory mechanics are the most common clinical clues for pneumothorax. The changes in respiratory mechanics include increased peak and plateau pressures, unanticipated decreases in tidal volume, asymmetric chest rise, decreased breath sounds and in advanced cases pulsus paradoxus and obstructive shock (2). This is to our knowledge the first report of virtual-anatomical dissociation during electromagnetic navigation bronchoscopy as a sign of pneumothorax.

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2. Yarmus L, Feller-Kopman D. Pneumothorax in the critically ill patient. *Chest*. 2012;141(4):1098-105. [\[CrossRef\]](#) [\[PubMed\]](#)