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Title: Prospective international trial of endobronchial implantation of electromagnetic fiducials for real-time tracking of lung tumors during radiotherapy (RT)

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Body: Introduction: Technologic advance in RT delivery has resulted in dramatic improvement in lung cancer tumor control, but respiratory motion of these tumors still complicate RT. We present our results implanting novel anchored electromagnetic transponders (Varian Medical, Palo Alto, CA) which provide real-time localization and tracking of tumor position during RT. Methods: 31 patients (pts) underwent bronchoscopic implantation of 3 transponders (93 total) in small airways in or near the tumor under fluoroscopy ± superDimension electromagnetic navigation or EBUS. Transponder positions were determined from serial CTs to assess positional stability. Localization and tracking of transponders and tumor was performed using the Calypso System during RT. Results: There were 14 males/17 females, ages 43-79 (med. 63), with 10/31 tumors in the LUL and 21 in the other lobes. Follow-up was 0-12 mos (med. 2 mos). No unique skills or tools were required for implantation, and satisfaction with the procedure was high. 29 pts had no significant problems associated with the transponder or procedure. One pt with an apical pleural-based tumor developed a pneumothorax, resolving overnight after chest tube placement. Migration of 1 transponder at appx 1 wk was attributed to implantation in a larger airway; pt was asymptomatic. Positional stability of 74/75 transponders was confirmed in the 25 pts completing RT to date. Localization and tracking was achieved in all pts in whom this was attempted. Conclusions: Implantation of electromagnetic anchored transponders is feasible and safe. This technology should enable highly accurate delivery of radiotherapy.