Clinical factors that affect fiducial tracking in Stereotactic Ablative Radiotherapy (SABR) against lung tumors

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INTRODUCTION

- Lung cancer is the second most common cancer in North Carolina after breast cancer and causes the most deaths of all cancers in North Carolina.
- Stereotactic Ablative Radiotherapy (SABR) is noninvasive and delivers a concentrated radiation dose to the target lesion.
- SABR uses multiple fiducials placed around the tumor to follow its movement during breathing cycles throughout treatment.
- Tracking at least 3 fiducials is required for 6-D information and tumor rotations.
- Tracking errors can prevent additional fiducials from being tracked.
  - Rigid body - fiducials not moving together as a group
  - Spacing - fiducials too close or far apart
  - Collinearity - 3 fiducials within 15-degrees of a straight line
- Local control and overall survival
  - Higher rates of uncertainty errors (p=0.015)
  - Correlate with the number of fiducials tracked during SABR (p=0.034)
- More fiducials may have been tracked in patients with COPD due to reduced elastic recoil.
- Although longer follow up analysis with more patients may result in stronger correlations between patient and tumor factors and outcomes.

RESULTS

- Demographics, n=77
  - Age, median (range) 69 (37-98)
  - Sex, n (%)
    - Male 33 (44.2%)
    - Female 40 (44.8%)
  - Race, n (%)
    - Caucasian 47 (64.4%)
    - African American 26 (35.6%)
- Treatment characteristics, n=77
  - Less than 3 fiducials tracked (n=25)
  - More than 3 fiducials tracked (n=52)
  - Age at treatment (median, range) 69 (55-90) 68 (37-89) 0.238
  - Sex, n (%)
    - Male 23 (41.8%) 11 (50%)
    - Female 32 (58.2%) 11 (50%)
  - Race, n (%)
    - Caucasian 23 (41.8%) 16 (72.7%)
    - African American 21 (38.2%) 6 (27.3%)

Table 1. Demographic data for study population with p-values from logit regression comparing these characteristics between less than 3 fiducials versus 3 or more fiducials tracked.

- Clinical factors
  - Number of Fiducials tracked
  - Overall survival, Local control

MATERIALS & METHODS

- Population: Patients who received SABR for lung tumors and had fiducial tracking data from 2016 to 2019 at Vidant.
- Retrospective review of patient demographics, prior lung history, prior lung surgeries, pulmonary function, technical treatment data, local control and overall survival.
- Technical treatment data included number of fiducials tracked and respective tracking errors if less than 3 were tracked.
- PFT data was determined pre-bronchodiabators.
- Local control was determined from chest CT/PEt impressions with t=0 at treatment end date.
- Overall survival was determined from obituary searches, EPIC records and most recent corresendences with t=0 at treatment end date.
- Clinical correlations, overall survival and local control were determined using Chi-square and Kaplan-Meier analysis from MedCalc v19.0.6.

DISCUSSION

- Increased uncertainty errors in the lower lobe could be due to increased movement that part of the lung.
- More fiducials may have been tracked in patients with COPD due to reduced elastic lung tissue.
- Greater motion in lower lobes can contribute to certain errors that prevent more fiducials from being tracked.
- With a medium follow-up of 2.5 years, having more or less than 3 fiducials tracked resulted in similar overall survival and local control, although longer follow-up is required.
- Additional follow-up analysis with more patients may result in stronger correlations between patient and tumor factors and outcomes.

REFERENCES


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