The role of Synchrony® Respiratory Tracking System in the management of primary and secondary lung tumors

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Contents

- How much do lung targets move?
- What do we need to hit the target?
- Our experience with online tracking
How much do lung targets move?

- Location within the lung

- Other variables
  - gender? (type of breathing)
  - tumor type?
  - tumor volume?
How can we analyze the movement of targets?

- If we don’t properly identify the movement, we can’t define the target precisely and we miss a part of it.
- Risk of marginal recurrence.
How can we analyze the movement of targets?

- Pretreatment analysis
  - CT inspiration + expiration
  - 4DCT
  - cineMRI

+ Additional –spirometry

- Insufficient **predictive** power for movement during treatment
How can we analyze the movement of targets?

- Interfractional analysis
  - daily IGRT
    - simple but insufficient

- Intrafractional analysis
  - online tracking
    - the best option is ONLINE—target is PTV
    - Great source of data!
Online tracking

- Tumor control without compromise (no ITV)
- Analysis of movement
- Variability among fractions in one patient and among patients

- Better understanding to motion patterns
  - to find a predictive model for individualized target delineation
  - describe factors affecting the range and variability of motion
Log file analysis from online respiratory tumor tracking in 145 patients (world's largest group)
The closer to diaphragm, the more motion

\[ R = -0.66 \]
\[ p < 0.001 \]
The more motion, the more variability during treatment

$R^2 = 0.775$

$P < 0.001$
Motion in the SI direction: gender, tumor type

**Men**

- Mean motion amplitude SI (mm)
- Tumor position SI direction

**Women**

- Mean motion amplitude SI (mm)
- Tumor position SI direction

**Men/Women**

- Mean motion amplitude SI (mm)
- Tumor position SI direction
Gradual motion of target center in the AP direction within 30min
- The more movement, the more variability
- Gender is a strong factor
- Metastases and primaries move differently

What do we need to hit the target?

- Again…If we don’t properly identify the movement, we can’t define the target precisely and we miss a part of it…

- Current target definition methods are insufficient for moving targets (including 4DCT or cineMRI)

- Need to define patients at risk for big variation in target movement
  - Patient, gender, tumor type specific motion

…..let’s track online!
What we heard about online tracking

- Extremely time-consuming setup
- Inconvenient for patients
- Doesn’t make a difference anyway…
- Very slow treatment with plenty of interruptions
What we think about online tracking – based on experience

- Minimizing the margins MUST be the goal in high precision radiotherapy

- Online tracking is the right way

- It is exciting to see the motion ONLINE
What we think about online tracking – based on experience

- 83% of 1000 lung cases treated with online tracking
- Enables minimal safety margins even in complex PTV shapes and difficult tumor locations
- Big progress in technology – 8.5 → 10.5
  - More patients are eligible for SBRT
So, do we need online tracking?

Online tracking is the right choice if you agree that:

◦ minimizing the margins is the right way is SBRT
◦ SBRT should be offered to all indicated patients and should not be contraindicated due to technical issues
◦ the treatment should be as comfortable and noninvasive as possible because of severe co-morbidities in these patients
◦ every attempt must be made to minimize toxicity