Esperienza di stereotassia polmonare al Campus Bio-Medico: tecnica e risultati

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Background

BED$_{10} > 100$ Gy

Background

Peripherally vs centrally located Tumors

Peripheral Lesions: 60 Gy in 3 fx
\[ \text{BED}_{10} : 180 \text{ Gy} \]

Centrally Located: 60 Gy in 8 fx
\[ \text{BED}_{10} : 105 \text{ Gy} \]

Open question

Simulation

Treatment Planning

Pre-treatment verification

Treatment

Post-treatment control
Open question

Simulation

Treatment Planning

Pre-treatment verification

Treatment

Post-treatment control
Open question

How to immobilize patient
Open question

Breathing:

Free vs. Abdominal compression vs. Breath-hold vs. Coaching (audio/video)
Open question

CT scanning (i.e. ITV definition):

Standard vs. Slow vs. 4D-scan (AIP vs MIP)
Open question

Treatment planning

Dose heterogeneity to PTV: Homogeneity vs. Dose Gradient
Open question

Treatment planning

Dose heterogeneity to PTV:
  Homogeneity vs. Dose Gradient

Field distribution:
  Static vs. Arc vs. Volumetric
  # of beams
Open question

Pre-treatment verification

Type of identification:
2D (MV vs. KeV) vs. Cone-Beam CT
Open question

Pre-treatment verification

Tumor location:
- Invasive (seeds) vs. Non-invasive

Patient rotation:
- No adjust vs. Manual vs. Robotic table
Open question

Treatment

Overall treatment time:

Consecutive vs. Every other day vs. 1.5-2 weeks
Open question

Post-treatment verification

Follow-up: Tumor vs. Fibrosis
One among several answers

In the next few minutes we want to share

Technical solutions

Results according these solutions
Facilities @ UCBM

Siemens CT scan
BrainLab ExacTrack
Brainscan
Varian cLinac 2100 C/D
Technical issues

Patient Simulation:

*Supine, Vac-Lock, Optical Marker, Free breathing*
Technical issues

ITV definition by 3 CT scans:

Free + deep inspiration + deep expiration
Technical issues

Treatment Plan:

20 Gy @ isocenter with 65% isodose covering whole PTV
Technical issues

Field distribution:

Multiple arcs technique
Technical issues

Dose distribution:

*According to site?*
Technical issues

Dose distribution:

*Analysis of pattern of radiological changes*
## Technical issues

**Dose distribution:**

*Evaluation of DVH, 21 Grade 1 lung reaction on 96 treated lesions (21.8%)*

<table>
<thead>
<tr>
<th>V-Lung</th>
<th>V12*</th>
<th>V15*</th>
<th>V18*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presente</td>
<td>&gt;18%</td>
<td>&gt;15%</td>
<td>&gt;10%</td>
</tr>
<tr>
<td>Assente</td>
<td>&lt;10%</td>
<td>&lt;7%</td>
<td>&lt;5%</td>
</tr>
</tbody>
</table>

*Biological Equivalent Dose for $\alpha/\beta=3$; 3 fx
BED2= 15, 20, 30 Gy
Technical issues

Dose distribution:

*Evaluation of dose distribution*
Technical issues

Dose distribution:

Evaluation of dose distribution
Technical issues

Dose distribution:

Evaluation of dose distribution
Technical issues

Pre-treatment verification:

*Exactrac with manual tilt adjustment*
Technical issues

Pre-treatment verification:

*Exac-Track plus verification*

Treatment:

*On 3 consecutive days*
Results

From January 2007 to December 2011
Patients treated: 78
Number of lesions: 96

2007-09: 48 lesions; 2010-11: 48 lesions

Median age: 72 yrs (range: 43-88)
Male:Female ratio: 47:31

Primary lung cancer: 40 patients
Lung metastases: 56 (lung: 27, colon: 15, others: 14)
Results

Primary lung cancer

Histology:

- Adenocarcinoma: 17 (42.5%)
- Squamous cell: 10 (25%)
- NSCLCs: 4 (10%)
- Undefined: 9 (22.5%)

Mean GTV volume: 9cc (5-32 cc)
Results

3 years Local control: 84%

Failures: 21 patients (52.5%)
- Local: 3 (7.5%)
- Nodal: 8 (20%)
- Distant: 10 (25%)
Local control progression: any increase on CT scan

PT#1

Pre-SABR

3 months later

PT#2
Local control progression: any increase on CT scan

PT#1

Pre-SABR

6 months later

PT#2
Stereo-ABLative Radiotherapy for lung cancer at UCBM: technique and results

Pre-SABR
SUV = 7.6

Post-SABR@3
SUV = 2.5

Post-SABR@6
SUV = 1.6
Follow-up

PET/CT scan:

17 patients with PET/CT scan

Time point: pre-SABR, 3 and 6 months after

PET/CT evaluation:

SUVmax

Tumor-to-Background Ratio

Metabolic Tumor Volume
18F-FDG PET/CT scan in Follow-up

PET/CT evaluation:

$SUV_{max}$

$SUV = 8.6$
18F-FDG PET/CT scan in Follow-up

PET/CT evaluation:

*Tumor-to-Background Ratio*

Tumor to Background Ratio = 4.1
18F-FDG PET/CT scan in Follow-up

PET/CT evaluation:

*Metabolic Tumor Volume*

MTV = 53 cc
Follow-up

**POST-1 PET-CT**

- **SUVmax**: p=0.031
- **TBR**
- **MTV**

**POST-2 PET-CT**

- **SUVmax post-2**: p=0.001
- **TBR post-2**: p=0.004
- **MTV post-2**: p=0.013
Conclusion

Several solutions are available for SABR in clinical practice.

BrainLab facilities with Exactrack is suitable and consistent for SABR treatment

Improving technique could reserve better clinical performance and indication
Stereo-ABlative Radiotherapy for lung cancer at UCBM: technique and results

Thank you

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