Proton Beam Therapy for Esophageal Carcinoma

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May 18-23, 2007  PTCOG46, Wanjie, Zibo
In China, the incidence of esophageal cancer is high (32/100,000 in men and 16/100,000 in women. In LinXian county, Henan Province, northern China, the incidence is 479/100,000.

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The incidence of esophageal cancer
Radiation therapy plays an important role in the management of esophageal carcinoma. Proton radiation therapy can reduce the irradiated volumes in adjacent organs, including spinal cord, lungs, and heart.
6 patients with esophageal cancer were treated between Dec. 2004 and April 2006 with proton.

- Male 6  female 0
- Median age 65yr (50~82)
- PS  ECOG 0~1
- Primary length(cm) : median 5(3~8)cm
Primary tumor site:

- Upper thoracic   1
- Middle thoracic  3
- Lower thoracic   1
- Abdominal        1
The radiation fields were 3cm to 4 cm beyond the primary tumor for the cephalic and caudal borders.

The lateral borders were 1.0 cm to 1.5 cm beyond the primary tumor.
- The daily fraction dose: 1.8 or 2.0 CGE
- The total dose: 54 to 66 CGE
- Fields: 2~3 coplanar
- Period: 5~7 weeks

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Upper Thoracic Esophageal Carcinoma

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Case # 33
Treatment date: June, 2005
Pathology: squamous.

Male, 60yr, upper third thoracic esophageal carcinoma with 4 cm length tumor
Proton Fields design

AP:PA=3:1

Right and left anterior oblique portals

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90% dose distribution
50% dose distribution
Prescribed dose: 66 CGE

Lung V20: 11%
Mean: 5.7 CGE

Dose = 2005.99 cGy
Volume = 579.05 cm³

Lung V20: 24%
Mean: 9.4 CGE

Dose = 2005.95 cGy
Volume = 271.03 cm³
Max: 10.8 CGE

Spinal cord: Max: 29 CGE
Isodose distribution

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The dose to the spinal cord is tolerable and dose to the lung is very low.
Middle Thoracic Esophageal Carcinoma

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Male, 70y, middle third thoracic esophageal carcinoma with 3 cm length tumor
Opposed portal

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DVH for Spinal cord

Plan Sum 1+2

Structure Coverage Volume Min Max Mean Modal Median STD
DVX1
DVX2
DVX3
Heart
Lung, Lungs
Surgical field
Simu couch

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<td>Heart</td>
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<tr>
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<td>76.2</td>
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Histogram

Dmax: 27 CGE
DT 66CGE/33F

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DVH for Lung

V20: 4%
Mean: 1.9 CGE
Lower Thoracic Esophageal Carcinoma

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67y, male, squamous, lower thoracic esophageal carcinoma with 8cm tumor length
Pathology proved to be squamous.
PET-CT revealed the regional mediastinal lymph node metastasis.
Portal arrangement

PA:LRO:RLO 1: 0.5: 0.5
Isodose lines
DVH for Spinal Cord

Dmax: 35 CGE
Mean: 2 CGE
DVH for Lung

V20: 11%
Mean: 10 CGE
DVH for Heart

Mean: 25 CGE

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Pre PBT  Post PBT, 66CGE/33F

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The patient is alive and has no evidence of tumor.
Abdominal Esophageal Carcinoma

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82-yr-old man suffered from an abdominal advanced carcinoma of the esophagus with serious obstructive symptom and can only drink milk.
Pathology proved to be adenocarcinoma.
Palliative radiation therapy for obstructive symptom

with severe multiple nodi lymphatici gastrici sinistri metastasis
The serious obstruction was relieved and the quality of life greatly improved.
Follow up

- The radiation related esophagitis was Grade 0-1 for 4 patients and Grade 2 for 2 patients.

- No radiation-induced esophageal ulcers were observed during the 12-24 month follow ups.

- No radiation-induced pneumonitis was observed.

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Follow up

All six patients survived 12 months or longer. The overall 1-year survival rate for all six patients was 100% (6/6).
Our experience

Upper thoracic  AP:PA  3:1

The dose to the skin and spinal cord is tolerable and dose to the lung is very low.

Middle thoracic  AP:PA  2:1

Lower dose to the lung and the spinal cord.

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Our experience

Lower thoracic  AP:LPO:RPO  1: 0.5: 0.5

Lower dose to the lung, heart and spinal cord.

Abdominal  AP:PA  1:1

We should change the beam according to the patients’ situations such as; lung function, heart function, and previous treatment.
The optimal radiation dose for esophageal carcinoma

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Proton radiation therapy for esophageal carcinoma appears to reduce dose to normal tissues such as spinal cord, lungs, and heart.

Dose escalation can be given to patients with tumors of the paralled organs such as lung and liver, but as for the serial organs such as esophagus and spinal cord......
The radiation dose escalation may improve treatment results, but complications of esophagus may also be increased.
Clinical research is required to define the optimal radiation dose for esophageal carcinoma.
Let's work on it together!

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