Clinical Report for Wanjie Proton Therapy Center

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Wanjie Proton Therapy Center

May 21-23, 2007  PTCOG46, Wanjie, Zibo
Wanjie Proton Therapy Center was founded in June 2001

The first patient was treated in Dec. 2004

339 patients have been treated successfully with proton or proton combined with photon up to Feb. 2007
Tumor Sites in Proton Treatment at WPTC

Total patients: 339

- Lung: 81 (23.89%)
- Liver: 52 (15.34%)
- Head and Neck: 27 (7.96%)
- Lung carcinoma metastasis: 12 (3.54%)
- Esophageal: 19 (5.60%)
- Gynecological: 8 (2.36%)
- Pancreas: 8 (2.36%)
- Meningioma: 29 (8.55%)
- Miscellaneous: 25 (7.37%)
- Acoustic neuroma: 8 (0.29%)
- Pituitary adenoma: 8 (2.36%)
- Glioma: 51 (15.04%)
- Chordoma: 18 (5.31%)
There are 12 therapists in two shifts for each room.

Treatment time was from 8:00am to 10:00pm.

5 days/w for patient treatment in the beginning.

6 days/w for the patient treatment currently.

Weekends are usually reserved for engineering.
3 to 5 days needed for new patient preparing, including
- simulation
- treatment plan design
- aperture and bolus verification
- field calibration

The mean treatment time was usually 15 to 20-min
More time is needed for new patient positioning and position verification.

30-min needed for each patient first treatment.

Fraction size is from 1.8 to 6.0 CGE.
Fractionation
Cyclotron Proteus 235 from IBA
Parameters of The Cyclotron

- Fixed Energy: 230MeV
- Maximum Beam Current: 300nA
- Minimum Beam Current: 1nA
- Magnet Diameter: 434cm
- Magnet Height: 210cm
- Magnet Gross Weight: 220Ton
Energy Selection System: ESS
Beam Transport Line

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Treatment Parameters in Double Scattering mode

- Range in Patient: 7.49—28g/cm²
- Range modulation: <1.0g/cm²
- Range adjustment: 0.1g/cm²
- Average dose rate: >2.0CGE/min
- Field diameter: <24.0cm
- SAD: 2.3m
Qualitative consistency of the range compensator shape with treatment plan isothickness line.
Reproducibility of Pristine Peak

90% range difference < 1mm

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Reproducibility of SOBP (R10/ M5), 90% dose difference <1mm
Patients Treated at WPTC
Brain Tumor and Chordoma

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Female, 28yr, after three surgeries, malignant meningioma, WHO: grade III repeat radiation therapy.

Tumor disappeared 6-mo post PBT (2.0x29F, DT 58CGE).
Before PBT

2.0x21F (42.0CGE)

Tumor disappeared 6-mo post PBT (2.0x29F, DT 58CGE)

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Case #2, 73yr, female, recurrent 2-yr post r-knife
Fields design

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54.0CGE was given in 27 F with PBT
Case #3, Male, 38yr, cervical Chordoma, surgery was given and recurrence 2-yr post radiotherapy.

DT 60 CGE/30F
The tumor decreased obviously and the symptoms improved greatly.
89 cases with brain tumors
2-year local control rate: 84.2%
18 cases of chordoma
2 years local control rate was 88.8%
Details will be shown in another paper
Recurrent Nasopharyngeal Carcinoma
Four patients with recurrent nasopharyngeal carcinoma were treated

\[ \text{PTV} = \text{GTV} + 5\sim10 \text{mm} \]
\[ \text{DT} = 64 \sim 72 \text{ CGE} \ \text{in} \ 32\sim36 \text{F} \]
DVH for CTV

Plan Comparison with Dose Volume Histogram

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<tr>
<td>IMRT/IMRT 6f CTV</td>
<td></td>
<td>6600.0</td>
<td>95.0</td>
<td>100.0 / 100.1</td>
<td>64.1</td>
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- proton
- IMXT
## Conformity Index

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<th>IMXT</th>
<th>PRT</th>
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<tr>
<td></td>
<td>0.73±0.09</td>
<td>0.70±0.06</td>
<td>t=1.683</td>
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IMXT is a litter better than PBT, but there was no statistical difference (t=1.683, p=0.143)
### Inhomogeneity coefficient

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<th>IMXT</th>
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<td>coefficient</td>
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<td>0.30±0.05</td>
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IMXT is a little better than PBT, but there was no statistical difference ( \( t=2.21, p=0.07 \) )
Comparison of Organs at Risk
DVH-Spinal Cord

Plan Comparison with Dose Volume Histogram

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<td>0.0</td>
<td>140.6</td>
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Photon

proton

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DVH-Brainstem

Plan Comparison with Dose Volume Histogram

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<td>0.0</td>
<td>170.6</td>
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Grid
Type:
- Cumulative
- Differential
- Natural

Dose range [cGy]:
0 to 2500

Apply Range

Print...
Export...
Close

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1 year post PBT
DT 66.0 CGE in 33F

Pre PBT
The median duration of follow-up was 18 months (range, 12-28)

The local control rate was 100% (4/4)

The survival rate at 1 year was 100% (4/4)

Long-term results need to be followed up
Side effects

- No serious side effects were found
- Grade 0~1 acute reaction
  - skin or mucosa reaction in 3 of the 4 patients
- Grade 2 reaction was found in 1 patient
Case #1, 58yr,M, pancreatic tumor  
CA19-9: 60ng/ml
2005-7 Pre- PBT 
SUV:14

2005-12 Post PBT 
SUV:11

2006-6 10-mo post PBT 
SUV:8

Head of pancreas

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July, 2005  SUV: 13

June, 2006  SUV: 2.1

Body of pancreas

2006-6 CT
Case#2, 70yr, M, Pancreatic tumor, DT 56.0 CGE/28F

Before PT SUV: 21 PET
Before PT PET-CT
1-mo post PT SUV: 6 PET

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PBT for Metastatic Retroperitoneal Tumor
50 yr Female, uterus cancer 3.5-yr post surgery retroperitoneal metastasis

GTV and PTV

GTV was 593 cc and PTV was 900 cc

TD 56.0CGE/23F
Fields design

Beam 1   AP
Beam 2   RL
Spinal cord, intestine, and kidney were well spared.
1 Pre proton
2 one day post proton
3 nine months later
PET-CT 18 months later
SUV: 2.8

The lady survived for 20 months and is alive now.
PBT for Intrathoracic Tumour
Lung cancer

48y, male, recurrent post surgery
Squamous cell
Define GTV with PET-CT
Lower dose to the heart and lung
66CGE/33F

Heart
Dmean: 16.8 CGE

Lung
V20 = 12.5%
Dmean: 6.7 CGE

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Case#1, 75yr male, squamous recurrence post resection
Without PET-CT, it is hard to define the CTV.
Response rate

- NSCLC: 100%
- HCC: 82%

Details for HCC and esophageal carcinomas will be shown in separate papers.
Let's try our very best to help our patients.

Thank you for your attention.