HADRON THERAPY IN GREECE

Kiki Theodorou

Associate Professor of Medical Physics
Medical School, University of Thessaly
Cancer Facts

A growing challenge...

- 3.4 millions of new cases in Europe per year
- About 50% will develop cancer at some point of their lives
- Main cause of death between the ages of 45 and 65 in Europe
- Second most common cause of death in Europe
Cancer Facts – Epidemiological Data in EU

Estimated incidence & mortality from all sites but non-melanoma skin in both sexes, 2012

Age Standardised Rate (European) per 100,000

- Incidence
- Mortality

Estimated incidence from all sites but non-melanoma skin in both sexes, 2012

Age Standardised Rate (European) per 100,000

- <400.3
- <407.3
- <379.1
- <346
- <307.2
Fight Against Cancer

- Early Diagnosis
- Local Control
- Less Side Effects

- Multi-modality imaging
- New Technology
- Advanced Radiobiology
Fight Against Cancer - Radiotherapy

Cure (40-50% of all cancer cases are cured)
Conservative (non-invasive, fewer side effects)
Cheap (5-10% of total cost of cancer on radiation)

(J.P. Gérard)

✓ About 60% are treated with RT
✓ No substitute for RT in the near future
✓ No of patients is increasing

Present Limitation of RT:
~30% of patients tumour recurs
Fight Against Cancer – Ion-Beam Therapy

- 3Fract/week, 18 fractions
- $\omega=0.65$, $p=0.095$, $\alpha/\beta=0.11$
- $T_{\text{double}}=60$ days

15MV Photons vs SOBP Protons

Relative Depth Dose [%]

Depth [cm]

Medulloblastoma
- conventional
- charged particles
- Target dose 32 Gy/GyE

Dose comparison:
- 22 Gy bone marrow < 1 GyE
- 18 Gy heart < 0.5 GyE
- 20 Gy intestinal < 0.5 GyE
Growing Interest on Ion-Beam Facilities
Growing Interest on Ion-Beam Facilities

New Planned Facilities
Hadron Facility in Greece

Why in Greece?

...best therapeutic outcome comes ONLY with coordinated & multidisciplinary care, with the specialists “around the patient...”

& NOT

“the patient referred from one specialist to another...”
Hadron Facility in Greece

Why in Greece?

“World declaration for Cancer” urges state authorities

✓ to decrease the burden & ease access of cancer patients to Comprehensive Cancer Care

✓ to include Cancer to their political Priorities for Health & Development
PURPOSE: the establishment of a Comprehensive Cancer Center of Thessaly (CCC-Thessaly) which will encompass all the advantages that innovative technology can offer today for cancer diagnosis and treatment, accommodating patients from all over Greece, the Balkans, and Eastern Mediterranean countries.

VISION:

- Diagnostic & Therapeutic Health Services
- Research/ Education
- Innovation
- Development Node
Hadron Facility in Greece

Why in Greece?

While in Greece we have **35% less incidence** of cancer from the European mean value, we have the **SAME mortality** rate!

- Lack of *early* and *accurate* diagnosis
- **Limited access** to the *best*, scientifically and technologically, treatment available
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Why in Greece?

The EU directive is 1 Linear Accelerator / 200.000 population → For Greece, this mean over of 50 machines

- 35 Linear Accelerator in the country currently in use
- Mean age over 15 old!
- No Hospital of the public sector can offer advanced Radiotherapy treatment
- Only 5 hospital of the private sector can offer those treatment and are all located in Athens.

As a result:

- While in Europe and in US, Radiotherapy is the treatment of choice for the 60% of cancer patients, in Greece this percentage is dropped to less than 30%.
- The Health System is paying more expensive treatments which, according the above data, are less effective!
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PROPOSAL: Comprehensive Cancer Center

DIAGNOSIS

PET/CT

MRI

CT
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PROPOSAL: Comprehensive Cancer Center

IMRT

IGRT

SRT/SBRT
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PROPOSAL: Comprehensive Cancer Center

- Cyclotron
- Proton Beam
- 1 Gantry
- 1 Eye line
- 1 Experimental beam
Clinical Indications

For the 15% of all cancer types, hadron therapy could improve the therapeutic outcome.

<table>
<thead>
<tr>
<th>Indication</th>
<th>Incidence (no./$10^5$ people)</th>
<th>% for IBT</th>
<th>Annual cases</th>
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<tbody>
<tr>
<td>NSCLC</td>
<td>54</td>
<td>20</td>
<td>1080</td>
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<tr>
<td>Gastric cancer</td>
<td>16</td>
<td>45</td>
<td>720</td>
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<tr>
<td>Prostate cancer</td>
<td>80*</td>
<td>25</td>
<td>575</td>
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<tr>
<td>Liver cancer</td>
<td>10</td>
<td>50</td>
<td>500</td>
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<tr>
<td>Head &amp; neck cancer</td>
<td>13</td>
<td>25</td>
<td>325</td>
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<tr>
<td>Non-Hodgkin lymphoma</td>
<td>14</td>
<td>20</td>
<td>280</td>
</tr>
<tr>
<td>Rectal cancer</td>
<td>11.4</td>
<td>20</td>
<td>228</td>
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<tr>
<td>Pancreatic cancer</td>
<td>9.8</td>
<td>20</td>
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<tr>
<td>Bladder cancer</td>
<td>10.1</td>
<td>15</td>
<td>152</td>
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<tr>
<td>Cervical cancer</td>
<td>6.7</td>
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<tr>
<td>Uveal melanoma</td>
<td>0.6</td>
<td>100</td>
<td>60</td>
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<tr>
<td>Brain tumors</td>
<td>2.3</td>
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<td>58</td>
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<tr>
<td>Bile duct cancer</td>
<td>2.7</td>
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<td>Soft tissue sarcoma</td>
<td>1</td>
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<tr>
<td>Hodgkin lymphoma</td>
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<td>20</td>
<td>40</td>
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<tr>
<td>Anaplastic thyroid cancer</td>
<td>0.7</td>
<td>45</td>
<td>32</td>
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<tr>
<td>Salivary gland cancer</td>
<td>0.5</td>
<td>45</td>
<td>23</td>
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<tr>
<td>Pediatric malignancies</td>
<td>$0.6 \ (3.6/10^5$ children)</td>
<td>15</td>
<td>9</td>
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<tr>
<td>Chordoma</td>
<td>$&lt; 0.1 \ (0.06)$</td>
<td>100</td>
<td>6</td>
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<tr>
<td>Chondrosarcoma</td>
<td>$&lt; 0.1 \ (0.03)$</td>
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</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>4515</strong></td>
<td></td>
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</tbody>
</table>

*Related to $10^5$ men.
HADRON THERAPY FACILITY UNIQUE IN LARGE AREA @ MOMENT
Hadron Facility in Greece - Feasibility

Existing Infrastructure

- 1.5 M people immediate health coverage
- 3ry care University Hospital
- Medical School
- Institute for Research & Technology
Hadron Facility in Greece - Feasibility

Existing Infrastructure

- University of Thessaly / Medical School → Scientific Personnel / Knowhow
- University Hospital → 500 beds, 1000 physicians, Radiotherapy Department (collaborations)
- I.R.E.TH. → Land, Research and Development Structure

Central Node

- Geographical Center of Greece
- Proximity to Balkan countries, Turkey and Middle East
- Accessibility → National Roads, Airport, Railway

Regional Health Coverage

- 11,000,000 in Greece → 40,000 new cancer patients / year
- 30,000,000 of habitants in the neighbouring countries

Scientific Collaborations

- CERN
- NTUA, DEMOKRITOS
Hadron Facility in Greece - Feasibility

INVESTMENT $\rightarrow \sim$ 60M Euros!

~150 new job positions.
70% for high level scientific personnel
Hadron Facility in Greece – R&D

Innovation to Cancer care with Immense socio-economic Value
Will boost research output Med School & research Institute
reduce Dramatic Unemployment of scientists
reduce Brain Drain

Medical School

I.RE.TE.TH

Univ Hospital – Larissa
Hadron Facility in Greece – R&D

• With Specialization & Focus to
  
  Basic, 
  
  Clinical & 
  
  Epidemiological & 
  
  Translational 
  
  RESEARCH
Hadron Facility in Greece - Advantages

- It will affect the quality of treatment delivered from all other hospitals in Greece, both at the public and at the private sector.
- There will be transfer of knowledge, innovation and technology from the most advanced institutes in Europe to Greece, i.e. CERN, PSI-Zurich, Heidelberg, Pavia.
- Participation of the Greek industrial sector to a high technology and innovative project
- New job places will be created especially for scientists that now immigrate to other countries. Parallel production of radioisotopes for PET
- Development of the medical tourism sector of the Greek economy
Need Multidisciplinary / Collaboration

CERN
- Physicists & Medical physicists

Epidemiologists

I.R.E.TH
- Engineers

Biologists

Funding agencies
- Policy makers

Medical School

NTUA
- Doctors

Industry

CCC
- Thessaly

Policy makers

Kiki Theodorou

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Thank you