RADIATION THERAPY

“A Brief Overview And New Trends”

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Global Cancer Burden for Ten Most Common Sites

<table>
<thead>
<tr>
<th>Cancer site</th>
<th>PERCENT</th>
<th>No. in thousands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td>52 (48)</td>
<td>901</td>
</tr>
<tr>
<td>Stomach</td>
<td>37 (63)</td>
<td>558</td>
</tr>
<tr>
<td>Prostate</td>
<td>77 (23)</td>
<td>543</td>
</tr>
<tr>
<td>Colon/Rectum</td>
<td>64 (36)</td>
<td>499</td>
</tr>
<tr>
<td>Liver</td>
<td>18 (82)</td>
<td>398</td>
</tr>
<tr>
<td>Mouth/Pharynx</td>
<td>32 (68)</td>
<td>316</td>
</tr>
<tr>
<td>esophagus</td>
<td>20 (80)</td>
<td>279</td>
</tr>
<tr>
<td>Bladder</td>
<td>63 (37)</td>
<td>260</td>
</tr>
<tr>
<td>Non-Hodgkin Lymphoma</td>
<td>48 (52)</td>
<td>167</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>40 (60)</td>
<td>144</td>
</tr>
</tbody>
</table>

Source: IARC website www-dep.iarc.fr 2006
Global Cancer Burden for Ten Most Common Sites

Cancer site (No. in thousands)

<table>
<thead>
<tr>
<th>Cancer site</th>
<th>Developed countries</th>
<th>Developing countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>Cervix uteri</td>
<td>19</td>
<td>81</td>
</tr>
<tr>
<td>Colon/Rectum</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td>Lung</td>
<td>52</td>
<td>48</td>
</tr>
<tr>
<td>Stomach</td>
<td>39</td>
<td>61</td>
</tr>
<tr>
<td>Ovary</td>
<td>47</td>
<td>53</td>
</tr>
<tr>
<td>Corpus uteri</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Liver</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Mouth/Pharynx</td>
<td>24</td>
<td>76</td>
</tr>
<tr>
<td>Esophagus</td>
<td>12</td>
<td>88</td>
</tr>
</tbody>
</table>

Source: IARC website www-dep.iarc.fr 2006
FIVE MOST COMMON CANCERS: INDIA
ESTIMATED NUMBER OF NEW CASES AND DEATHS (IN THOUSANDS):

**MALES**

- Oral cavity: 29 New cases, 7 Deaths
- Pharynx: 27 New cases, 7 Deaths
- Lung: 34 New cases, 9 Deaths
- Oesophagus: 31 New cases, 7 Deaths
- Larynx: 14 New cases, 7 Deaths

**FEMALES**

- Cervix uteri: 7 New cases, 7 Deaths
- Breast: 40 New cases, 9 Deaths
- Oral cavity: 29 New cases, 7 Deaths
- Ovary: 20 New cases, 7 Deaths
- Oesophagus: 20 New cases, 7 Deaths

**No. of cases (X1000)**

Five most common cancers account for almost half the total cases and deaths due to cancer in Indian men.

Five most common cancers account for almost two-thirds of the total cases) and deaths due to cancer in Indian women.

*Source: IARC website www-dep.iarc.fr 2006*
Radiation Therapy needed in > 75% of patients as part of

**Radical or Definitive radiotherapy**

**Adjuvant Radiotherapy**: Pre op / Post-op

**Concomitant Chemo-radiation**

**Consolidation radiotherapy**

**Palliative radiotherapy**

*Use of ionizing radiation for treatment of malignant & (benign) lesions*
Marie and Pierre Curie

HISTORY OF RADIATION THERAPY

Konrad Von Roentgen

Marie and Pierre Curie

Discovered Radium 1898

Curies & Becquerel discovered radioactivity in 1903

Nobel prize for discovery of radioactivity in 1903

Discovery of X-Rays: 1895
- Basis – ionizing particles interact with cellular molecules
- Relies on transfer of energy created by secondary charged particles (usually electrons)
- Break chemical bonds
- Teletherapy and Brachytherapy
EXTERNAL RT FOR SOFT TISSUE SARCOMA

RT PORTAL MARKED ON PATIENT

RT SIMULATION FILM
BRACHYTHERAPY

Radioactive source close / inside the body/cavities

Rapid radiation dose fall off

High doses to tumor with maximal normal tissue sparing

Highly Skill Oriented

Brachytherapy

Intracavitary
Cs-137 - LDR
Ir-192 - HDR

Interstitial
Ir-wires LDR
Ir-Pellet HDR

Surface Mould
Ir-wires LDR
Ir-Pellet HDR
MRI BASED PLANNING
RT FOR CARCINOMA OESOPHAGUS

EXT. RT SIMULATION FILM

INTRALUMINAL RT
INTERSTITIAL BRACHYTHERAPY FOR CARCINOMA OF TONGUE
3 D DOSE DISTRIBUTION OF TONGUE IMPLANT
MUPIT IMPLANT IN CA CERVIX
INTERSTITIAL
BRACHYTHERAPY
SURFACE MOULD THERAPY FOR BASAL CELL CARCINOMA
Basic Principle of Newer Radiotherapy Techniques

- **Conventional RT Beam**: Uniform Beam Intensity
  - squares / rectangles

- **Conformal RT Beam**: Uniform Beam Intensity

- **IMRT Beam**: Non-Uniform Beam Intensity
EXTERNAL BEAM RADIATION THERAPY RECOMMENDATIONS

- WHOLE PELVIS WITH AP/PA OR FOUR FIELD BOX TECHNIQUE
- DOSE DEPENDING ON THE STAGE
- BORDERS

ANTERIOR

LATERAL

CT SCAN BASED RADIOTHERAPY PLANNING
CONVENTIONAL

INTENSITY MODULATED RADIATION THERAPY (IMRT)

IMRT
Stereotactic Conformal Radiotherapy

Pituitary Adenomas
Craniopharyngiomas
Meningiomas
Optic Gliomas
EXTRA CRANIAL STEREOTACTIC RADIOTHERAPY

- Hepatic tumors
- Gall bladder cancers
- Pancreas tumors
- Lung cancers
TREATMENT DELIVERY

Linear Accelerator with Dynamic Multileaf Collimators (dMLC)

Treatment Verification by Portal Vision (EPID)
CT-PET Imaging

- Newly Diagnosed Cancers
- Staging Investigation
- Treatment Planning
- Response Evaluation
- Recurrence
  - Local
  - Regional (Pelvic / Para-aortic)
  - Distant Metastasis
Ca Cervix & Para Aortic Nodal Disease
PET-CT GUIDED RADIATION THERAPY

Eg: PNS TUMORS
Orthogonal kV imaging

- kV Xray tube
- kV flat panel imager
  - High QE 60%
- Integrated mounting
TOMOTHERAPY
Differential Expression of Biological Markers
N = 120 Cx Biopsy Samples: Jan 2006
Markers for angiogenesis, proliferation, hypoxia and radio-resistance
• High SF3 is associated with poor outcome (p=ns)
• High expression of 14-3-3
• Metallothionein II correlates with the poor survival significantly
• Needs to be tested on a larger patient base and longer follow-up
The concept of a „biological target volume“

FDG  FLT  Cu-ATSM  MMP

Metabolism  Proliferation  Hypoxia  Angiogenesis

(From Apisanthanrax, Rad. Res. 163, 2005)
Growth of RT infrastructure in India over the years

1962-1986 -- 76 Co-60 & Cs-137 units (> 20 years old): Definitely need replacement
1987-1991 -- 35 Co-60 units (> 15 years old): Should be considered for replacement
Pre 1991 LA -- 12 units (>15 years old): Could be considered for replacement

123/337 teletherapy units need replacement
Summary

- Radiation Oncology: Well-Established
- Organ and Function Preservation
- Rapid Technological Advances
- Translational Research and Wider Clinical Applications
- Newer techniques: Needs Further Evaluation
- Up-gradation and Many More Oncology Centers

“Multidisciplinary, Multimodality Evidence Based Approach”

Thank You
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