IAEA’s technical support and integration of medical uses of radiation into global initiatives

Enhancing Radiotherapy for Cancer Care in Singapore

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Singapore:

a) Multi-racial, multi-cultural and multi-religious
b) Resident population: 4.04 mil (3.52+0.52 mil)
c) Aging population – increasing healthcare needs


Cancer trends 1968-2019

Singapore Cancer Registry Report 2019

Cancer statistics 1968-2019

<table>
<thead>
<tr>
<th>Period</th>
<th>Total Cases</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968-1972</td>
<td>189 cases</td>
<td>106</td>
<td>83</td>
</tr>
<tr>
<td>(earliest 5-year period)</td>
<td>per 100,000 population</td>
<td>50</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>93 deaths</td>
<td>52</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30%</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55%</td>
<td>45%</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Period</th>
<th>Total Cases</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-2019</td>
<td>235 cases</td>
<td>138</td>
<td>97</td>
</tr>
<tr>
<td>(latest 5-year period)</td>
<td>per 100,000 population</td>
<td>47</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>78 deaths</td>
<td>44</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15%</td>
<td>15%</td>
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<tr>
<td></td>
<td></td>
<td>85%</td>
<td>85%</td>
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</tbody>
</table>

3 most common cancer diagnoses

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colon &amp; rectum</td>
<td>Breast</td>
</tr>
<tr>
<td>6,436 cases</td>
<td>11,805 cases</td>
</tr>
<tr>
<td>2,264 deaths</td>
<td>2,208 deaths</td>
</tr>
<tr>
<td>61% 5-year survival rate*</td>
<td>82% 5-year survival rate*</td>
</tr>
<tr>
<td>Prostate</td>
<td>Colon &amp; rectum</td>
</tr>
<tr>
<td>5,875 cases</td>
<td>5,253 cases</td>
</tr>
<tr>
<td>989 deaths</td>
<td>2,015 deaths</td>
</tr>
<tr>
<td>88% 5-year survival rate*</td>
<td>61% 5-year survival rate*</td>
</tr>
<tr>
<td>Lung</td>
<td>Lung</td>
</tr>
<tr>
<td>5,218 cases</td>
<td>3,074 cases</td>
</tr>
<tr>
<td>3,997 deaths</td>
<td>2,008 deaths</td>
</tr>
<tr>
<td>16% 5-year survival rate*</td>
<td>29% 5-year survival rate*</td>
</tr>
</tbody>
</table>

*5-year age-standardised relative survival rate.

Cancer Registry - National Registry Of Diseases Office [nrdo.gov.sg], (for period 2015-2019, Feb 2022)
Cancer in Singapore

a) Social and Economic Impact
b) Leading Cause of death
   - growing and aging population
   ~12000 cases (1968-1972)
   ~78000 cases (2015-2019)

Overall Aim:
Quality and affordable medical services for all

Radiotherapy in Singapore

National Specialist Centres (Public, ~80%)

Private (~20%)

7 Hospitals/Medical Centres

Medical Linear Accelerator (LINAC): 14
Brachytherapy: 2
CT Simulator: 6
Proton Therapy Gantry: 4

Medical Linear Accelerator (LINAC): 11
Brachytherapy: 2
CT Simulator: 7
Proton Therapy Gantry: 2
Radiotherapy in NCCS

- LINAC (8x)
- CT Simulator (2x)
- Brachytherapy (1x)
- Intra-op RT (1x)
- Treatment Planning Systems
- Seed implant
- Proton Beam Therapy (2022)
Recently completed:
1. Statistical method to predict RT treatment plan quality for treatment

Ongoing:
1. Adapting to tumor changes during treatment (Adaptive RT)
2. CT calibration study for radiation dose accuracy
3. Moving platform for quality assurance of moving targets

Medical Physics Research Focus:
1. Improving QA and radiation dose accuracy for treatment
2. Study of motion effects in radiotherapy
3. Tumor changes and adaptive treatment

Completed
New QA method for respiratory motion target localization

e.g. Adaptive RT (ref. only)

Front. Oncol., 30 June 2022
Sec. Radiation Oncology
https://doi.org/10.3389/fonc.2022.777793
IAEA Support:
1. Produces reference resources (e.g. technical reports, implementation guides, online training platform, handbooks)
2. Workshops and meetings (education and training, guide to certification/accreditation)
3. Audits for quality and safety

Benefits:
1. Increased knowledge and competency
2. Best practices (quality audit, certification)
3. Ready reference guides
4. Residency training within career framework
Clinical and Technical Trainings

Benefits:

1. Increased and deepen knowledge via expert lectures and consultation
2. Acquiring relevant skill-sets (clinical techniques, practicals)

NCCS and SGH attend and host IAEA regional/international training courses, fellowships and meetings
IAEA Support:

1. NCCS Designated a Secondary Standard Dosimetry Laboratory with help of WHO (1970s)
2. Actively participates in the IAEA/WHO SSDL Postal TLD Quality Audit program
3. Training courses and reference document for Quality Assurance Teams for Radiation Oncology (QUATRO)

Benefits

1. External radiation dosimetry audit to monitor accuracy of radiation dose to RT patients for NCCS and Singapore via inter-comparison
2. Improves and strengthens NCCS QA program and clinical processes via benchmarking best practices
3. Singapore QUATRO team for the region
Technical Expert Assistance

Radium Conditioning 2002 (Long term storage for legacy radioisotopes)

IAEA Support:
Identify and sent expert team

Benefits:
1. Safe long-term storage of long half-life radioisotopes
2. Accountability and ownership

Source Containment (welding)
Source Containment (leak test)
Source Storage
Radiation Survey

With the Expert Lead and Team
Proton Beam Therapy Training

IAEA Support:
1. Education workshops
2. Short visits (2 weeks)
3. Fellowships (3 to 4 months)

Benefits:
1. Increased knowledge
2. Technical skill-sets
3. Clinical experience
4. Future reference site for region

System Operation and Treatment Delivery
- Certification
- Treatment Planning
- Beam data and commissioning
- QA and Calibration
- Special measurement
1. Cancer care and Radiotherapy (RT) is a growing need in Singapore.
2. NCCS is the largest academic comprehensive cancer centre in Singapore.
3. RT professionals must be well trained to provide high quality and safe treatment for patients.
4. IAEA’s technical support has been continuous and invaluable in building capabilities for Singapore’s RT program. This support also extends to Nuclear Medicine and Diagnostic Radiology.
5. With IAEA’s strong support, Singapore’s Radiation Medicine will continue to be strengthened.
6. This has in turn enabled us to contribute to the region through regional trainings and expert input.

Thank you for your kind attention!