Multidisciplinary cancer treatment

The photon treatment area of new Kanagawa Cancer Center has the 4 modern liniac machines, and will have a total of 5 in the future, which will be one of the largest facility in Japan.

The Radiation Oncology Center in Kanagawa will have both liniac machines and carbon-ion radiotherapy machines, and will be able to offer a full-range of radiotherapy for patients with any type and stage of cancer.

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The Radiation Oncology Center in Kanagawa

High-precision radiotherapy device (LINAC)

Current indications for carbon-ion radiotherapy

◆ Cancer with broad metastases
◆ Leukemia and other cancers of the blood

Cancers unsuitable for treatment

Cancers suitable for treatment

Localized solid cancer

Brain tumor
Eye
Cancer that can manifest in the head and neck area (mouth, throat, nose, paranasal sinus)
Esophageal cancer
Lung cancer
Liver cancer
Pancreatic cancer
Uterine cancer/Prostate cancer
Rectal cancer
Bone/Soft-tissue cancer

*Based on the results of the National Institute of Radiological Sciences (NIRS)

A case treated by carbon-ion radiotherapy

(PET image)After (PET image)Before

*Image source: National Institute of Radiological Sciences (NIRS)

This patient had early lung cancer in the right lung. The shadow of lung cancer had disappeared after single irradiation of total dosage using carbon-ion beams.

Carbon-Ion Radiotherapy in Kanagawa

Kanagawa Cancer Center Promotion Division of Heavy Ion Facilities

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http://kcch.kanagawa-pho.jp/
i-ROCK will start its clinical operation in December 2015

i-ROCK* is the nickname for the carbon-ion radiotherapy facility in Kanagawa prefecture. The facility is under construction to start the clinical operation from December 2015 at the Kanagawa Cancer Center. i-ROCK will be the fifth carbon-ion radiotherapy facility in Japan.

*The origin and meaning of i-ROCK. The abbreviation comes from the Ion-beam Radiation Oncology Center in Kanagawa.

**Schedule until the start of treatment**

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Building</td>
<td>Design</td>
<td>Construction work</td>
<td>Design &amp; Manufacture</td>
<td>Start of treatment</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
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</tbody>
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**Convenient access by public transport**

Kanagawa Cancer Center was newly opened in November 2013. There is convenient to access from Kanagawa and Tokyo area by public transport.

i-ROCK building is connected to the main-hospital building in the tunnel, and close to photon treatment zone.

Kanagawa Cancer Center (KCC) is conveniently located in Yokohama, one of the largest metropolitan areas in Japan. It takes 50 minutes to get to KCC from the Tokyo International Airport by train. KCC closest station is Futamatsagawa station at Sotetsu-line, and it takes about ten minutes on foot.
Basic concept

Features of carbon-ion radiotherapy

(1) Precise irradiation of deep-seated cancer within the body
Carbon-ion beams can be adjusted to the shape and depth of the cancer. So carbon-ion radiotherapy strikes at cancer cells without damage to the surrounding normal tissues.

(2) High capability of killing cancer cells
Compared to photon beams and proton beams, carbon-ion radiotherapy is highly capable of killing cancer cells. Therefore, it is effective on tumors that resist against photon radiotherapy.

[Graph showing damage to cancer (Relative dose (100%)) vs. Depth from surface of body (cm)]

X-rays
Carbon-ion beams
Cancer lesion

Depth from surface of body (cm)

0 5 10 15 20

i-Rock provides treatment that is gentle on the body and emphasizes the quality of life

Treatment is gentle on the body
Carbon-ion radiotherapy is gentle on the patient's body, as it mostly avoids damage to normal cells.

Treatment emphasizes the quality of life
As carbon-ion radiotherapy can be given over a short period of time with minimum adverse effects, it can enhance the patient's quality of life. It is also suitable for diseases that are not easily treated by surgery and for elderly patients, etc. This treatment does not require hospitalization, so the patient can receive it as an outpatient while continuing to work.
What is carbon-ion radiotherapy?

Carbon-ion radiotherapy is one of the radiation therapy methods. For cancer treatment, surgery, chemotherapy and radiotherapy are generally used. As radiotherapy, photon beams are widely used. Among particle radiotherapy, proton beams and carbon-ion beams are available in the world.

### Main treatment methods for cancer

- **Surgery**
- **Radiotherapy**
- **Chemotherapy**
- **Particle beams**
- **Proton beams**
- **Carbon-ion beams**
- **X-rays**
- **Gamma rays**

### Comparison of cancer therapies

<table>
<thead>
<tr>
<th></th>
<th>Surgery</th>
<th>Radiotherapy</th>
<th>Chemotherapy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantages</strong></td>
<td>◆ Considered more likely to be curative at localized cancer</td>
<td>◆ Minimal burden on the body</td>
<td>◆ Can treat systemic cancer</td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>◆ May cause damage to the organ function and morphology</td>
<td>◆ Depending on the type of cancer, it can have the same result as surgery</td>
<td>◆ Difficult to cure solid cancer with only chemotherapy</td>
</tr>
<tr>
<td></td>
<td>◆ May not be suitable for some patients according to the cancer site and their age and complications</td>
<td>◆ May result in localized adverse effects</td>
<td>◆ Sometimes caused adverse effects throughout the whole body</td>
</tr>
</tbody>
</table>

### Accelerated up to 70% of light speed

Carbon-ions are accelerated up to 70% of light speed, and are irradiated into deep-seated tumors within the patient.

### What is carbon-ion?

Radiation composed of particles heavier than helium is called a “heavy-ion” beam. Currently, carbon-ion beams are used for heavy ion cancer therapy. The weight of carbon-ion is 12 times that of proton.
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