Utilization of Radiation in Medical Field

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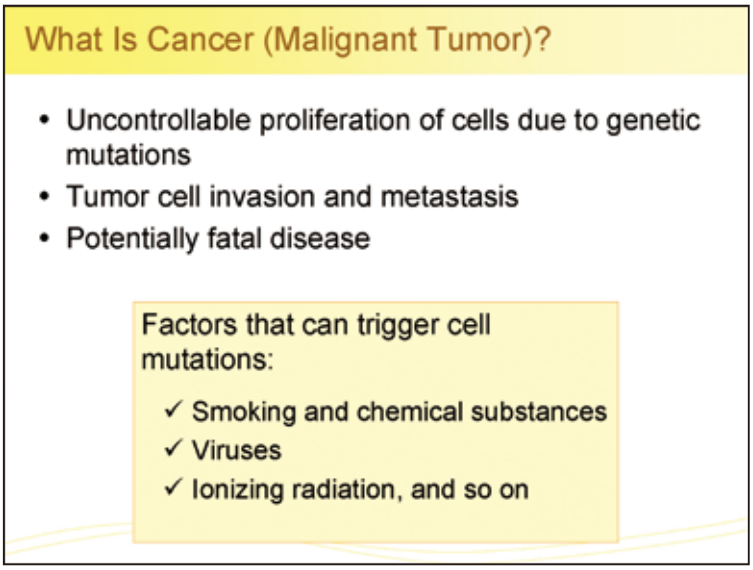
On January 28, 1896, Röntgen exhibited a photograph of the hand of Kölliker taken using the X-rays discovered the previous year, at a meeting of a society of physics held in Würzburg, Germany. This is the oldest existing evidence of the use of X-rays in medicine. The development of medicine in the Twentieth Century and onwards is closely linked to the development of radiogenics.

In contemporary medicine, radiation is used in a variety of aspects. Diagnostic imaging uses radiation in units of millisieverts to perform chest X-rays, digestive tract imaging, X-ray CT, mammography and so on. Nuclear medicine involves the introduction of isotopes into the body to perform scintigraphy for the bones and heart, FDG-PET examinations, treatment for thyroid cancer, and so on. Radiation is also used in units of sieverts for treating cancers, either as external irradiation or interstitial irradiation.

Cancer, in the form of malignant tumors, occurs due to the uncontrollable proliferation of cells, leading to metastasis from the original starting point to other areas, finally becoming fatal. In many developed countries malignant tumors are one of the three leading causes of death, along with heart disease and cerebrovascular disease. One of the causes leading to malignant tumors is radiation exposure, yet at the same time radiotherapy has an increasingly strong track record against malignant tumors. The progress of radiodiagnosis has led to the capturing of changes in tumors in areas deep inside the body normally difficult to see with the naked eye. Early cancer detection leads to a rapid start of treatment with the potential to cure it with less strain on the patient.



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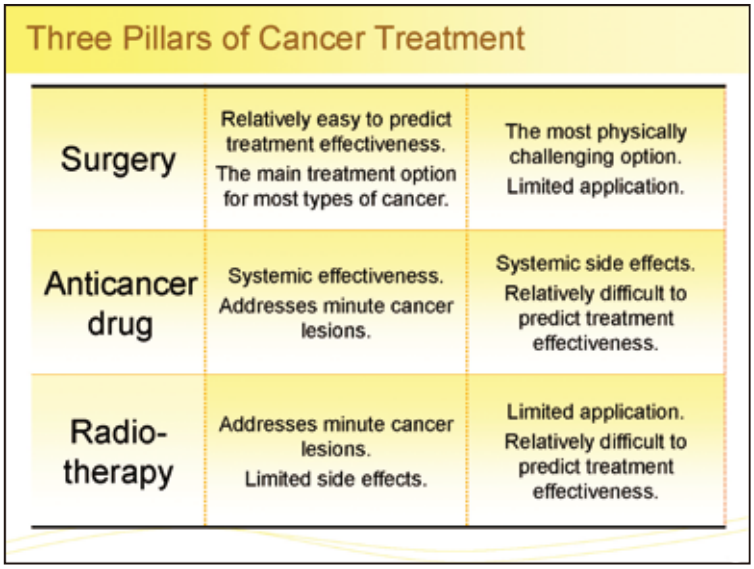
The three main types of cancer treatment are surgery, chemotherapy and radiotherapy. These three are used separately, or if it is difficult to gain a cure, they may be combined. Surgery is the most effective method for lesions visible to the naked eye, and has the advantage of making it relatively easy to predict post-treatment outcomes. Chemotherapy can treat invisible lesions throughout the body. Radiotherapy is used as a relatively noninvasive local treatment.



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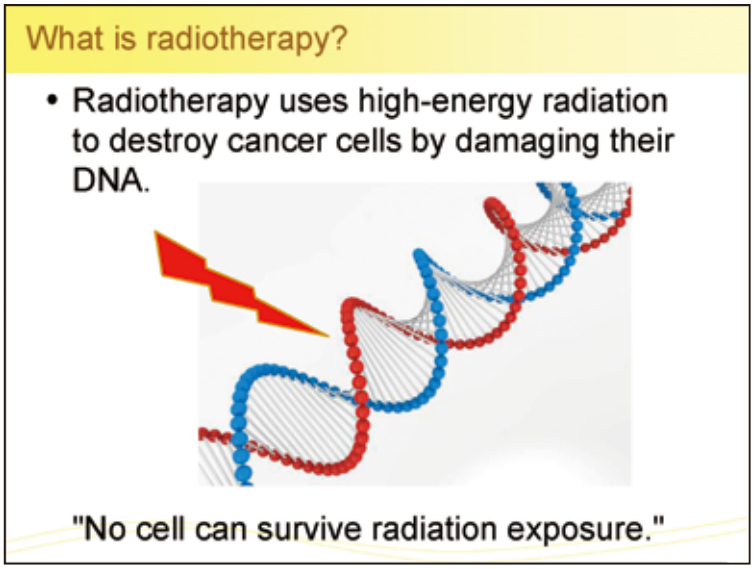
Radiotherapy irradiates tumor cells with high-energy radiation to destroy them by damaging their DNA. If a sufficient dose of radiation is given, no cell can survive. An important process in radiotherapy is the determination of the target volume and radiation dose, in other words the prescription. Putting the prescription into action is called radiotherapy planning, and is usually carried out based on diagnostic imaging of the patient.



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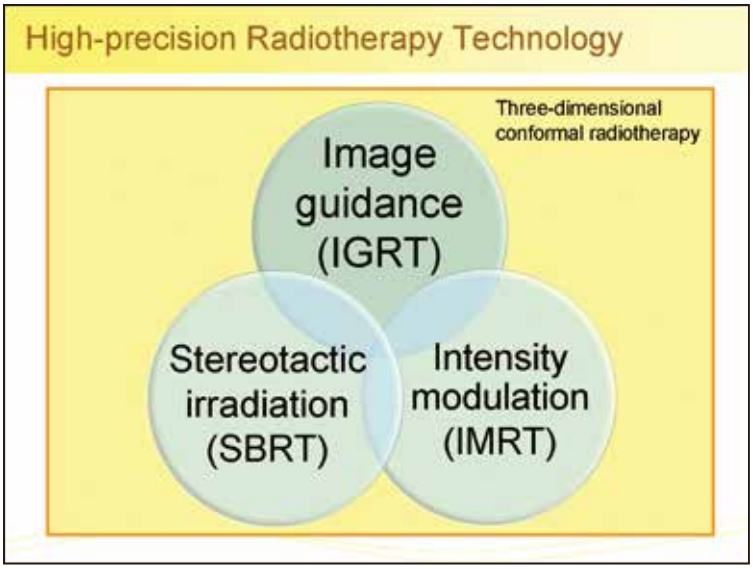
How to intensively deliver radiation to the cancer lesions is a key question, but advances in diagnostic imaging and radiotherapy equipment have made this possible. High-precision radiotherapy is the name of a recent type of radiotherapy realized using this method. In general it involves stereotactic body radiotherapy (SBRT), intensity-modulated radiotherapy (IMRT), and image-guided radiotherapy (IGRT). In some cases all three are used together.

Stereotactic body radiotherapy (SBRT), also called pinpoint irradiation, destroys cancer cells by administering a single high dose radiation on the lesion alone, directing several beams of radiation with millimeter-level accuracy. Intensity-modulated radiotherapy (IMRT), which is used for metastatic brain tumors, early stage liver cancer or early stage lung cancer where there are only a few relatively small cancers, divides the radiation into several beamlets, individually adjusting the intensity of each according to the shape of the tumor. Using this technology limits the amount of radiation reaching the surrounding normal tissues to protect them from damage while optimizing the delivery of the dose to the tumor, increasing the probability of a cure. Image-guided radiotherapy (IGRT) takes CT or X-ray images immediately prior to each treatment session to confirm the location of the tumor lesion, to correct the targeted location for delivery. Image guidance allows the radiation to be targeted accurately each time on lesions that move around. These methods make radiotherapy safer and more effective.



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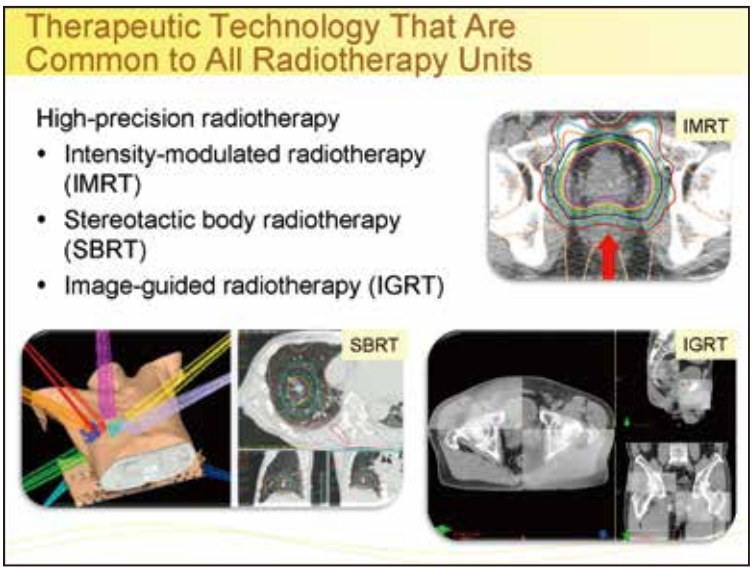
The Hiroshima High-Precision Radiotherapy Cancer Center (HIPRAC) was opened in Hiroshima in October 2015. HIPRAC provides high-precision radiotherapy as a collaborative cancer center that works in collaboration with a number of designated regional cancer centers and hospitals in Japan, including Hiroshima University Hospital, Hiroshima Prefectural Hospital, Hiroshima City Hiroshima Citizens Hospital, Hiroshima Red Cross Hospital & Atomic-Bomb Survivors Hospital. It has three radiotherapy units able to perform SBRT, IMRT, and IGRT.



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Through the incorporation of computer technology, the field of radiology continues to advance, playing a crucial role in today's medicine. It is important to continue to engage in the effective utilization of radiation in medicine.