INTRODUCTION TO REVIEW ARTICLES

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Current status and perspectives of brachytherapy

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Brachytherapy is one of the radiotherapy techniques that uses small sources of shielded radioisotopes. Brachytherapy has a long history, of more than 100 years. One of the advantages of brachytherapy is that it provides localized radiation around the tumor with minimal doses to the surrounding normal tissues. In the era of orthovoltage radiation, it was not easy to deliver enough doses of radiation to deep-seated tumors, and brachytherapy had an advantage of better dose distribution compared with external beam radiation. Now linear accelerators are mainly used for radiotherapy, and new techniques such as stereotactic radiotherapy, intensity modulated radiotherapy (IMRT), tumor tracking systems, and so on have been developed. These new techniques permit us to deliver a high radiation dose to the tumor with minimal side effects. So the status of brachytherapy is now changing.

Brachytherapy is classified into three groups according to the dose rate. Low dose rate (LDR) is brachytherapy with a dose rate of not more than 2 Gy per hour, and high dose rate (HDR) is that with a dose rate of not less than 12 Gy per hour. The third group is named medium dose rate (MDR).

In LDR brachytherapy, small sources are inserted into the tumor with manual loading or afterloading techniques. With these techniques radiation exposure to the medical staff is an important problem. In HDR brachytherapy, a remote-controlled afterloading system (RALS) is used to avoid radiation exposure to the medical staff.

Brachytherapy is also divided into three groups according to the type of target area, i.e., intracavitary, interstitial, and intraluminal brachytherapy. In intracavitary brachy-

therapy, radioisotopes are placed in a cavity, such as the uterine cavity or vagina. Cervical cancer can be treated with this technique. In interstitial brachytherapy, small radioisotope sources are directly inserted into the tumor. Tongue cancer and prostate cancer can be treated with this technique. Bile duct cancer and bronchial cancer can be treated with intraluminal brachytherapy.

In LDR brachytherapy, small sources of Cs-137 and Ir-192 are temporarily implanted, and those of Au-198, I-125, and Pd-103 are permanently implanted. There is another problem with LDR brachytherapy, as well as the problem of radiation exposure to medical staff. The supply of new sources of Cs-137, Sr-90, and other radioisotopes has now stopped. The working life of the small sources is only 10 years, and after 10 years, these sources must be checked for leakage at an authorized institute. In the near future, we will be able to use only Ir-192 for temporary implantation.

As already mentioned, brachytherapy has the advantage of providing localized radiation to the tumor with minimal radiation to the normal surrounding tissues. However, LDR brachytherapy has the disadvantages of radiation exposure to medical staff and the need for isolation of the patient in a highly shielded room. In HDR, patients are treated with RALS. Using RALS, there is no radiation exposure to the medical staff, and isolation of the patient is not needed. In Japan, HDR brachytherapy is mainly used for cervical cancer.

LDR brachytherapy can be employed for only limited numbers of patients in Japanese hospitals; firstly, because highly shielded rooms are needed, and secondly because the regulation of radioisotopes is very strict in Japan. It is very difficult to start LDR brachytherapy, except that in which I-125 seeds are used; because of their low energy, it is easy to protect staff from I-125 radiation. Treatment of prostate cancer with I-125 seeds is employed in more than 100 hospitals in Japan.

In this issue of the *International Journal of Clinical Oncology*, there are four review articles on brachytherapy: for head and neck cancer, for breast cancer, for cervical cancer, and for prostate cancer. These present the current status of and perspectives on brachytherapy.

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