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Research Progress of Radiotherapy for Nasopharyngeal Carcinoma

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Abstract: *Nasopharyngeal carcinoma (NPC) is a common head and neck malignant tumor. Radiotherapy can effectively improve the tumor control rate because of its sensitivity to radiation. With the continuous update of radiotherapy technology, on the basis of conventional fractionated radiotherapy, unconventional fractionated radiotherapy, 3D conformal radiotherapy (3DCRT), intensity modulated conformal radiotherapy (IMRT), volume arc intensity modulated radiotherapy (VMAT) and other methods have been developed. In this paper, the research progress of radiotherapy for nasopharyngeal carcinoma was briefly reviewed.*

Keywords: *Nasopharyngeal Carcinoma, Conventional Radiotherapy Three-Dimensional Conformal Radiotherapy, Intensity Modulated Radiotherapy, Volume Arc Intensity Modulated Radiotherapy*

Nasopharyngeal carcinoma (NPC) is a common head and neck malignant tumor with obvious geographical distribution, especially in East and Southeast Asia[1]. In China, the distribution of nasopharyngeal carcinoma also has obvious regional differences. Generally speaking, the incidence of nasopharyngeal carcinoma is higher in the south than in the north. The common pathological type of nasopharyngeal carcinoma is squamous cell carcinoma, which is highly sensitive to radiation. The DNA of nasopharyngeal carcinoma cells will be killed by radiation, so radiotherapy can control the proliferation and metastasis of NASopharyngeal carcinoma cells and prolong the survival period of patients [2, 3]. At present, the recognized and effective radical treatment for nasopharyngeal carcinoma is radiotherapy, or radiotherapy based combination therapy. Conventional fractionated radiotherapy is a traditional radiotherapy method for the treatment of nasopharyngeal carcinoma, but its accuracy is not high, and there are defects of insufficient target dose. In recent years, with the development of science and technology, the development of unconventional fractionated radiotherapy, THREE-DIMENSIONAL conformal radiotherapy (3DCRT), intensity modulated radiotherapy (IMRT), brachytherapy and other new radiotherapy methods and technologies, these new technologies improve the efficacy of nasopharyngeal cancer, the clinical control of nasopharyngeal cancer is very effective[4].

1. Two-Dimensional Radiotherapy

In the 1980s, nasopharyngeal cancer was treated by conventional radiotherapy, and combined face and neck irradiation field was used abroad. This irradiation field can avoid dose omission or overlap in the target area during face-neck field irradiation. Currently, the standard radiotherapy for nasopharyngeal cancer in China is conventional radiotherapy. During radiotherapy, oral brain stem and other areas were protected with low melting point lead block technology. Conventional radiotherapy uses CT machine and analogue locator machine to irradiate tumor by medical electron linear accelerator and other centers, which improves the accuracy of irradiation field. After the completion of the first stage of radiation therapy of approximately 45Gy, the exposure field needs to be narrowed to protect the spinal cord. With the development of radiation biology, the practice of nasopharyngeal carcinoma radiotherapy technology, gradually found that clinical routine radiotherapy of nasopharyngeal carcinoma (NPC) is not the best way, developed after the process accelerated greatly divided radiotherapy, incremental step by step acceleration than radiotherapy, continuous accelerated greatly divided radiotherapy, segmented acceleration and unconventional divided radiotherapy than radiotherapy methods. Unconventional fractionated radiotherapy improves the control rate of nasopharyngeal carcinoma.

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2. Three-Dimensional Radiotherapy

2.1 3D Conformal Radiotherapy (3DCRT)

Conventional and unconventional radiotherapy are two-dimensional radiotherapy (2DRT), with low accuracy and limitations in radiotherapy for head and neck tumors. With the development and progress of radiation physics, medical imaging and computer technology, 3D conformal radiotherapy (3DCRT) has been applied in clinical practice. 3D radiotherapy has more advantages than 2D radiotherapy in target delineation, dose distribution and normal tissue protection. It uses three-dimensional image to optimize and simulate the dose distribution. Combined with the new technology, multiple coplanar or non-coplanar irradiation fields are used to focus the radiation dose on the target area to improve the therapeutic dose of the target area, and at the same time, reduce the radiation damage to normal tissues. At present, 3DCRT is mainly used in the treatment of residual lesions after radiotherapy and remedial irradiation of recurrent lesions after radiotherapy for nasopharyngeal carcinoma[5].

2.2 Intensity Modulated Conformal Radiotherapy (IMRT)

Intensity modulation is adjusting the intensity, using different intensity of radiation, depending on the tumor. Conformal means to adapt to the shape, to adjust the radiation range according to the shape of the tumor. IMRT is a precision radiotherapy technology invented at the end of the last century. It uses a computer system to calculate the radiation dose required by different target areas and give different radiation doses according to the different tissues of target areas. IMRT improves the precision of radiotherapy, and it has greater advantages than 3DCRT in both increasing the therapeutic increment of tumor tissue and reducing the dose of normal tissue. Clinical studies have shown that when nasopharyngeal cancer patients receive IMRT treatment, the maximum radiation dose of spinal cord is decreased by 10Gy, and the total radiation dose of parotid gland is decreased by 18Gy, which improves the protection of spinal cord and parotid gland. [6, 7] In recent years, IMRT technology has been continuously developed in the treatment of NPC patients, and its effect has been widely recognized clinically, significantly improving the local control rate and recurrence free survival rate of NPC patients. However, IMRT has a general therapeutic effect on patients with advanced nasopharyngeal carcinoma [8, 9]. Therefore, further research is needed [10].

2.3 Volumetric Arc-shaped Intensity Modulated Radiotherapy (VMAT)

VMAT is a use of image guided radiotherapy technology, precise radiotherapy in the tumor and surrounding tissues CT scan at any time, by observing the real-time situation of tumor, select number of curved beam and the incident Angle, the more accurate the adjustment scope of ray, so as to realize the tumor more accurate treatment, in addition, can also according to the different light intensity of tumor thickness adjustment, Optimize the strength distribution. Compared with IMRT, THE target dose conformal degree of VMAT is higher, and the optimized dose distribution is more accurate. Studies show that VMAT has more accurate dose distribution and shorter radiotherapy time for newly treated nasopharyngeal carcinoma patients, which significantly improves the utilization rate of the equipment. However, compared with IMRT, VMAT did not significantly improve the clinical cure rate of nasopharyngeal cancer patients. Currently, the application of VMAT in the treatment of nasopharyngeal carcinoma remains to be further studied [11].

3. Comprehensive Treatment

In general, early nasopharyngeal cancer can be cured by radiotherapy. Metaphase nasopharyngeal carcinoma is mainly treated with radiotherapy, supplemented by chemotherapy according to the patient's condition. Advanced nasopharyngeal cancer, especially recurrence and metastasis, generally has a poor prognosis, and is often treated with radiotherapy, combined with other treatment methods. Such as: radiotherapy combined with chemotherapy, radiotherapy combined with targeted therapy, radiotherapy combined with immunotherapy and so on. [12,13] Nutritional support therapy can also be used to maintain patients' bodily functions.

4. Conclusion and Prospect

At present, there are many treatments for nasopharyngeal cancer, but most of them are mainly

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radiotherapy, supplemented by other treatments. Radiation therapy has obvious advantages, other treatments such as chemotherapy, targeted therapy, immunotherapy and other methods should be selected according to the patient's tumor stage, physical condition and other reasonable choices. In the past two years, radiotherapy combined with immunotherapy has been a research hotspot, and relevant research is ongoing. It is believed that with the development of science and technology and the completion of more clinical trials, radiotherapy for nasopharyngeal carcinoma will have greater progress.

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