Journal of Hainan Medical University

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Analysis of the efficacy and safety of conventional radiotherapy of chest wall and clavicular field and three−dimensional conformal radiotherapy in patients after modified radical mastectomy

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ARTICLE INFO

Article history:
Received 5 Nov 2016
Received in revised form 13 Nov 2016
Accepted 12 Nov 2016
Available online 24 Nov 2016

Keywords:
Breast cancer
Conventional therapy
Three-dimensional conformal radiotherapy
Tumor markers
T lymphocyte subsets

ABSTRACT

Objective: To explore the efficacy and safety of conventional radiotherapy of chest wall and clavicular field and three-dimensional conformal radiotherapy in patients after modified radical mastectomy. **Methods:** A total of 84 patients who were admitted in our hospital after modified radical mastectomy were included in the study and divided into the conventional radiotherapy group (n=42) and the three-dimensional conformal radiotherapy group (n=42) according to different radiotherapy methods. The patients in the conventional radiotherapy group were given conventional radiotherapy of chest wall and clavicular field, while the patients in the three-dimensional conformal radiotherapy group were given three-dimensional conformal radiotherapy. The serum tumor markers and peripheral blood T lymphocyte subsets 6-8 weeks after treatment in the two groups were detected. The clinical efficacy, and toxic and side effects in the two groups were evaluated. **Results:** The serum CA15-3, CA125, CEA, and CK19 levels after treatment in the two groups were significantly reduced when compared with before treatment, CD_3^+,CD_4^+, and CD_4^+/CD_8^+ were significantly elevated, while CD_8^+ was significantly reduced when compared with before treatment, but the comparison of the above indicators between the two groups was not statistically significant. The occurrence rate of radioactive skin damage and pneumonia after treatment in the conventional radiotherapy group was significantly higher than that in the three-dimensional conformal radiotherapy group. **Conclusions:** The two kinds of radiotherapy schemes have an equal efficacy, but the toxic and side effects of three-dimensional conformal radiotherapy are significantly lower than those by the conventional radiotherapy, with a certain advantage.

1. Introduction

Breast cancer is a malignant tumor highly occurred in females, while the modified radical mastectomy and breast conserving resection are the common schemes involved in the treatment of breast cancer. According to the statistics[1], 41.6% breast cancer patients are performed with modified radical mastectomy, among which 70%-80% patients require radiotherapy after operation. Radiotherapy is an important adjuvant therapy for patients with highly risk recurrence factors, and plays a vital role in enhancing the total survival rate, and reducing the local recurrence rate and distant metastasis rate[2,3]. The traditional tangent field conventional radiotherapy and three-dimensional conformal radiotherapy are the common radiotherapy methods in the clinic, but each has its own advantage and disadvantage[4]. The study is aimed to explore the efficacy and safety of conventional radiotherapy of chest wall and clavicular field and three-dimensional conformal radiotherapy in patients after modified radical mastectomy in order to search a more favorable therapeutic scheme.

2. Materials and methods

2.1. Clinical materials

A total of 84 patients who were admitted in our hospital from February, 2012 to May, 2014 after modified radical mastectomy

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Fund Project: The study was supported by the Scientific and Technological Support Project of Zhongixang City in Hubei Province with the number of 0910108144.

were included in the study. All the patients were confirmed with invasive cancer with no distant metastasis by the pathology, with tumor staging of $T_{3-4}N_{1-3}$. The patients were divided into the conventional radiotherapy group (n=42) and the three-dimensional conformal radiotherapy group (n=42) according to different radiotherapy methods. The patients in the conventional radiotherapy group were aged from 28 to 67 years old, 20 had left breast cancer, and 22 had right breast cancer. The patients in the three-dimensional conformal radiotherapy group were aged from 27 to 65 years old, 19 had left breast cancer, and 23 had right breast cancer. The comparison of age, disease characteristics, and general materials between the two groups was not statistically significant (P>0.05), but it was comparable. Those who had other malignant tumors, severe liver and renal dysfunction, organic lesions, and contraindications to the chemoradiotherapy were excluded from the study.

2.2. Methods

The patients in the conventional radiotherapy group were given conventional radiotherapy of chest wall and clavicular field. The breast dedicated bracket was adopted. The irradiation was given to the whole mammary region, internal mammary region, and supraclavicular lymph drainage region, with 6MV X linear accelerator, dosage of 2 Gy/time, 1 time/d, 5 times/week, continuously for 6-8 weeks. The patients in the three-dimensional conformal radiotherapy group were given three-dimensional conformal radiotherapy. The position was fixed. CT scanning was performed, with layer thickness of 3-5 mm, and interlayer space of 3 mm. The scanning data were sent to 3D-TPS workstation through the website. The corresponding vital organ profile was drawn according to CT scanning results in order to confirm the clinic target regions and irradiation methods. The irradiation field and appropriate dosage were confirmed by the computer. The irradiation dosage was 2 Gy/time, 1 time/d, 5 times/week, continuously for 6-8 weeks. The patients in the two groups were given paclitaxel and cisplatin chemotherapy, i.e. Paclitaxel (175 mg/m^2), ivdrip, on the first day, and cisplatin (25 mg/m^2), ivdrip, day 1 to 3. Three-week treatment was regarded as one course, for 2 courses. For patients with positive ER and PR receptors, the endocrine therapy was meanwhile given, i.e. Tamoxifen citrate tablets (produced by Shenyang Funing Pharmaceutical Co. Ltd., Approval No. H21024159, 10 mg/tablet), 20 mg/time, q.d. If grade III gastrointestinal or bone marrow suppression adverse reactions occurred during the chemoradiotherapy period, the next chemotherapy dosage was adjusted as 3/4 of the primary dosage, and the radiotherapy was suspended. If grade IV toxic effect occurred during the chemoradiotherapy period, the chemotherapy should be ceased, and radiotherapy should be suspended. Until the adverse reactions relieved, pure radiotherapy was performed.

2.3. Observation indicators

A volume of 4mL morning fasting venous blood before and after treatment in the two groups was collected, and centrifuged for the serum. ECL was used to detect CA15-3, CA125, CEA, and CK19. FCM was used to detect CD_3^+, CD_4^+, and CD_8^+. 48-month follow up visit was paid to the patients. 1-year and 2-year survival rate, local recurrence rate, distant metastasis rate, and disease free survival rate in the two groups were recorded and compared. According to WHO toxic reaction criteria[5], the toxic and side effects after treatment in the two groups were evaluated. According to the severity degree, the toxic and side effects were divided into grade 0, grade I, grade II, grade III, and grade IV. The higher the grade was, the more severe the toxic and side effects were.

2.4. Statistical analysis

SPSS 22.0 software was used for the statistical analysis. The measurement data were expressed as mean ± SD. The paired t test was used for the intra-group comparison, and the independent t test was used for the comparison between the two groups. The enumeration data were expressed as percentage, and *chi*-square test was used. P<0.05 was regarded as statistically significant.

3. Results

3.1. Comparison of the serum CA15-3, CA125, CEA, and CK19 levels before and after treatment between the two groups

The serum CA15-3, CA125, CEA, and CK19 levels after treatment in the two groups were significantly reduced when compared with before treatment (P<0.05), but the comparison between the two groups was not statistically significant (P>0.05) (Table 1).

Table 1.

Comparison of the serum CA15-3, CA125, CEA, and CK19 levels before and after treatment between the two groups.

Groups	n	Time	CA15-3	CA125	CEA	CK19
Conventional radiotherapy	42	Before treatment	75.01±41.71	65.28±22.06	25.67±20.36	23.16±17.64
		After treatment	23.03±8.29*	21.62±9.14*	6.59±1.21*	4.29±2.04*
Three-dimensional conformal radiotherapy	42	Before treatment	74.36±40.92	66.49±23.47	27.31±19.28	22.64±18.46
		After treatment	22.64±7.59*	22.39±8.94*	7.21±1.06*	5.16±2.17*

*P<0.05, when compared with before treatment.

Table 2.

Comparison of T lymphocyte subsets before and after treatment between the two groups.

Groups	*n*	Time	CD_3^+	CD_4^+	CD_8^+	CD_4^+/CD_8^+
Conventional radiotherapy	42	Before treatment	54.85±7.65	30.48±5.63	31.46±3.87	1.32±0.13
		After treatment	61.21±12.36*	40.89±7.56*	22.15±4.76*	1.89±0.42*
Three-dimensional conformal radiotherapy	42	Before treatment	55.36±7.23	31.23±5.72	30.87±5.23	1.33±0.14
		After treatment	64.86±11.64*	42.81±7.61*	23.21±5.46*	1.91±0.23*

*P<0.05, when compared with before treatment.

Table 3.

Comparison of the clinical efficacy after treatment between the two groups [*n* (%)].

Groups	*n*	1-year survival rate	2-year survival rate	Local recurrence	Distant metastasis	Disease free survival
Conventional radiotherapy	42	42(100.00)	39(92.86)	1(2.38)	12(28.57)	25(59.52)
Three-dimensional conformal radiotherapy	42	42(100.00)	40(95.24)	1(2.38)	9(21.43)	27(64.29)
χ^2		0.000	0.213	0.000	0.571	0.202
P		1.000	0.645	1.000	0.450	0.653

Table 4.

Comparison of the toxic and side effects between the two groups [*n* (%)].

Groups	*n*		Radioactive skin damage	Radioactive pneumonia	Bone marrow suppression	Hematologic toxic effect
Conventional radiotherapy	42	0	22(52.38)	40(95.2)	20(47.6)	24(57.14)
		I	18(42.86)*	2(4.76)*	14(33.33)	11(26.19)
		II	2(4.76)	0(0.0)	6(14.29)	4(9.52)
		III	0(0.0)	0(0.0)	2(4.76)	3(5.77)
		IV	0(0.0)	0(0.0)	0(0.0)	0(0.0)
Three-dimensional conformal radiotherapy	42	0	30(71.43)	42(100.00)	21(50.00)	24(57.14)
		I	8(19.05)	0(0.0)	13(30.95)	10(23.81)
		II	4(9.52)	0(0.0)	5(11.90)	6(14.29)
		III	0(0.0)	0(0.0)	3(5.77)	2(4.76)
		IV	0(0.0)	0(0.0)	0(0.0)	0(0.0)

*P<0.05, when compared with the three-dimensional conformal radiotherapy group.

3.2. Comparison of T lymphocyte subsets before and after treatment between the two groups

CD_3^+,CD_4^+, and CD_4^+/CD_8^+ were significantly elevated, while CD_8^+ was significantly reduced when compared with before treatment (P<0.05), but the comparison between the two groups was not statistically significant (P>0.05) (Table 2).

3.3. Comparison of the clinical efficacy after treatment between the two groups

The comparison of 1-year and 2-year survival rate, local recurrence rate, distant metastasis rate, and disease free survival rate after treatment between the two groups was not statistically significant (P>0.05) (Table 3).

3.4. Comparison of the toxic and side effects between the two groups

The average cardiac irradiation dosage in the three-dimensional conformal radiotherapy group was (10.25±1.4) Gy, while that in the conventional radiotherapy group was (62.15±3.29) Gy, and the comparison between the two groups was statistically significant (P<0.05). The distribution proportion of grade I radioactive skin damage and grade I radioactive pneumonia after treatment in the conventional radiotherapy group was significantly higher than that in the three-dimensional conformal radiotherapy group (P<0.05) (Table 4).

4. Discussion

The death rate of female breast cancer is only second to lung cancer, which can severely threaten female health. Radical mastectomy and modified radical mastectomy in combined with radiotherapy can enhance the local control rate and improve the living quality[6,7].The traditional tangent field radiotherapy is simple and easy, with wide target coverage and difficult omission, and can obtain a favorable control rate, but in the clinical treatment, it has some limitations, e.g. Due to the difference of breast outline, the dosage distribution fails to be homogeneous. Moreover, application of standard tangent field radiotherapy can make part of the lung being exposed to irradiation, and a part of the heart exposure to whole irradiation for patients with left breast cancer[8,9]. The three-dimensional conformal radiotherapy can clearly display the target region and peripheral organs by advantaging of CT simulation positioning technology, which can provide intuitive image information for the optimization of irradiation field and and three-dimensional dosage distribution, meanwhile protect the lung and heart, facilitate the parallel seamless connection of breast chest wall tangent field, supraclavicle field,

posterior axillary field, and internal mammary field, and optimize the irradiation dosage and irradiation scheme[10,11]. The results in the study showed that the comparison of 1-year and 2-year survival rate, local recurrence rate, distant metastasis rate, and disease free survival rate after treatment between the two groups was not statistically significant (P>0.05), and no severe cardiovascular disease occurred in the two groups after 48-month follow up, indicating that the two kinds of radiotherapy can achieve a satisfactory tumor local control.

CA15-3 is a specific marker of breast cancer, is highly expressed in breast cancer, is correlated with the tumor size, clinical staging, axillary lymph nodes, and estrogen receptors, and can be applied in the early diagnosis and prognosis evaluation of breast cancer[14,15]. CK19 is a kind of acid protein expressed in the epithelial cell skeleton, and a large amount of fragments are released into the blood after tumor formation due to the rapid degradation of activated protease cytokeratin. In the early stage of breast cancer, CK19 is elevated, and is closely correlated with the efficacy and tumor metastasis[16]. T lymphocyte subsets are the important components of tumor immunology, and are the first defense line of anti-tumor. Some researches demonstrate that due to the reduced immunity in patients with breast cancer, the patients are not sensitive to the chemotherapy or the effect is poor, and even the treatment has to be terminated due to intolerance to the adverse reactions[17]. The results in the study showed that the comparison of serum CA15-3, CA125, CEA, and CK19 levels after treatment between the two groups was not statistically significant (P>0.05), proving that the two kinds of radiotherapy have an equal therapeutic effect; but the distribution proportion of grade I radioactive skin damage and grade I radioactive pneumonia after treatment in the conventional radiotherapy group was significantly higher than that in the three-dimensional conformal radiotherapy group (P<0.05), showing that the three-dimensional conformal radiotherapy has a certain advantage in reducing the toxic and side effects.

In conclusion, the two kinds of radiotherapy schemes have an equal efficacy, but the toxic and side effects of three-dimensional conformal radiotherapy are significantly lower than those by the conventional radiotherapy, with a certain advantage.

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