ANALYSIS OF CRITERIA FOR EVALUATING THE DOSE TO THE HEART DUSRING RADIATION THERAPY TREATMENT PLANNING FOR BREAST TUMORS USING RESPIRATORY GATING

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Keywords: radiation therapy, treatment planning, dose-volume histogram, breast tumors.

This work is aimed at studying dosimetric risk indicators during radiotherapy treatments of patients with breast cancer. The main form of radiation complications of the heart is pericarditis. The paper analyzes the effect of various modifications of the traditional irradiation technique on the studied risk (the likelihood of pericarditis). To reduce the radiation load to the heart received during radiation therapy (RT) of the breast tumors, high-tech methods of treatment planning are being investigated. Information on heart movement during patient's breathing cycle and reproducibility of position during each treatment session is necessary to evaluate for using these methods.

Authors created dosimetric plans for radiation therapy of a breast tumor and calculated absorbed dose distributions using IMRT and VMAT methods allowed by the Eclipse v.13.7 (Varian Medical Systems).

10 patients with a left-sided breast tumor were selected. All patients underwent radiation therapy using IMRT and VMAT techniques with breath holding using the Respiratory Gating system before and during treatment. The prescribed average dose for tumors was 42.56 Gy, 2.66 Gy per fraction, 5 days a week. For each plan, the integral dose-volume histogram (DVH) for the heart (myocardium) was calculated. Various methods have been analyzed to reduce the likelihood of cardiac mortality risk (techniques such as IMRT and VMAT).

Table 1

Dose-volume histogram analysis of calculated IMRT and VMAT plans

	Volume		IMRT (%)	VMAT (%)
PTV	min		74,3	68,2
	max		109,5	107,7
	mean		100	100
Heart	RTOG 1005 [2]	V10 < 30 % (35 %)	32,2	20,5
		V20 < 5 % V25 < 5 %	1,7	1,5
	QUANTEC	V30 < 46 %	0,21	0,06
		V25 < 10 %	0,38	0,27
	min		4,6	1,5
	max		70,8	74
	mean		17,4	14,2

For all the 10 patients with a left-sided breast tumor treatment plans were calculated using IMRT and VMAT methods with photons of 6 MV energy. Based on the data analyzed, authors observed clear advantage of the VMAT methodology, which follows from the data listed table 4.

However, prediction of the radiation-induced heart damage requires further study. The study of radiation-induced heart damage is complicated by the use of mixed results in assessing the effects of irradiation. Since each probability of damage can have a different dose / volume relationship, this approach can be counterproductive. Therefore, it is recommended that a further study of heart lesions address the symptomatic, functional, and radiological lesions probabilities separately.

Different values of Vx (% of the volume of the heart that obtain absorbed dose ≥X Gy) may be associated with the risk of radiation complications (pericarditis). The observation of the fact that different dose levels are predictive leads us to the conclusion that there is no dose threshold below which there is no risk for heart injury. Within separate data sets, there are usually strong correlations between different dosimetric parameters and,

therefore, there are probably no “optimal” thresholds. In addition, the statistical relationships between dosimetric parameters depend on the methodology, and it is necessary to carefully evaluate the similarity of your treatment methodology before using any of these limits as clinical limitations for treatment planning. The authors consider providing further studies aimed at establishing significant dose levels in order to not exceed them when conducting treatment planning of left breast cancer radiotherapy and thus reduce the likelihood of radiation complications in this group of patients.

ANALYSIS OF SENSITIVITY TO ANTIBIOTICS OF PROBIOTIC STRAINS OF LACTIC ACID BACTERIA

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The work presents the results of a studying the sensitivity of probiotic strains of lactic acid bacteria isolated from monocomponent and multicomponent probiotic preparations to broad-spectrum antibiotics. According to the results of studies, these antibiotics have approximately the same inhibitory effect on the growth of probiotic strains of lactic acid bacteria both in the complex and on separately isolated pure cultures.

The results can be taken into account to make recommendations in selecting of probiotic drugs aimed at reducing the development of diseases of the gastrointestinal tract and restoration of the intestinal microflora, as well as the expediency of using them with antibiotic drugs.

Keywords: lactic acid bacteria (LAB), probiotics, growth retardation zone, antibiotics.

Lactic acid bacteria (LAB) play a key role in the technology of production of probiotic preparations: their task is to make better biomodification of plant and animal raw materials changing the physicochemical parameters of the starting components and forming organoleptic characteristics of the products; they increase nutritional and biological value; inhibit the development of extraneous harmful and pathogenic microflora [1-2].

During the study, we found out and identified pure cultures of strains of lactic acid bacteria from probiotic preparations (Lactiale, Normobact L, Bifidobacterin dry, Dialact, Maxilac baby) with further analysis of their sensi-tivity to broad-spectrum antibiotics. The isolation and identification of LAB was carried out by applying cultural research methods using differential diagnostic environments, as well as using microscopic and biochemical diagnos-tic methods.

Based on the analysis of the antibiotic resistance of strains of lactic acid bacteria which are included in monocomponent probiotic preparations, it was shown that the bacteria Lactobacillus rhamnosus GG (“Normobact L”) displaying the sensitive to doxycycline (30 μg, zone of inhibition (ZOI) – 22 ± 0,5 cm), chloramphenicol (30 μg. ZOI – 26 ± 0,9 cm). Bacteria Lactobacillus acidophilus ("Normobact L") in most cases displayed different degrees of sensitivity to all antibiotics used in the study. Bifidobacterium spp. ("Normobact L") showed sensitivity to chlo-ramphenicol (30 μg. ZOI - 29 ± 0,4 cm), doxycycline (30 μg. ZOI – 29 ± 0,8 cm) and tetracycline (30 μg. ZOI – 28 ± 0,5 cm).

Based on the analysis to study the antibiotic resistance of the LAB strains that are included in multicompo-nent probiotic preparations, it was shown that the bacteria mixture of the probiotic preparation “Maxilac Baby” were sensitive to doxycycline (30 μg. ZOI - 28±0,8 cm). Pure bacteria cultures of Lactobacillus sp., contained in “Maxilac baby”, are sensitive to doxycycline (30 μg. ZOI – 27±0,6 cm). Pure bacterial cultures of Bifidobacterium sp. ("Maxilac baby") display doxycycline (30 μg. ZOI – 25±0,7 cm), streptomycin (30 μg. ZOI – 22±0,9 cm).

A mixture of bacteria that is a part of the multicomponent drug "Lactiale" is sensitive to streptomycin (30 μg. ZOI – 22±0,5 cm), chloramphenicol (30 μg. ZOI - 20±0,7 cm). Pure bacteria cultures of Lactobacillus sp., isolat-ed from the multicomponent preparation “Lactiale”, are sensitive to carbenicelin (100 μg. ZOI – 24±0,6 cm). Pure cultures of Bifidobacterium sp. ("Lactiale") are sensitive to doxycycline (30 μg. ZOI – 25±0,7 cm) and streptomycin (30 μg. ZOI – 22±0,9 cm).

The results may indicate a different degree of resistance of the LAB included in the composition of probiotic drugs to broad-spectrum antibiotics. So the results can be taken into account while making recommendations in selecting of probiotic drugs aimed at reducing the development of diseases of the gastrointestinal tract and restora-tion of the intestinal microflora, as well as the expediency of using them with antibiotic drugs.