

POSTOPERATIVE THREE-DIMENSIONAL CONFORMAL RADIOTHERAPY IN THE PATIENT WITH A SIGNIFICANT CARDIOVASCULAR RISK: A CASE REPORT

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Radiotherapy of breast cancer represents an essential component in the overall multidisciplinary breast cancer treatment. Considering the satisfactory results of the application of the multimodal treatment as well as its role in the decrease in the mortality rate of breast cancer patients, the focus has shifted towards monitoring acute as well as chronic complications occurring as a consequence of oncological treatment, intending to preserve the patient's quality of life. Complications are numerous and vary from the local ones (dermatitis) to more serious forms including dysfunctions of the cardiovascular system. The application of 3D radiotherapy on the patient in this case report as the most used method in our centre points to its low acute toxic effect, while the observed negative effects in the high-risk patient were removed, which resulted in satisfactory therapeutic effects despite the limited technical equipment of the centre.

Acta Medica Medianae 2024;63(4):98–103.

Key words: breast cancer, cardiotoxicity, radiotherapy

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Introduction

Breast cancer represents a huge global challenge for public health considering the fact it is one of the most common neoplasms in humans, accounting for one-quarter of all cancers in women all over the world and 27% of cancers in developed countries. Breast cancer can also appear in men, but it is 100 times more frequent in women (1, 2). Persons who are at a greater risk of becoming ill are those with genetic predisposition, primarily relatives, then those being on hormonal therapy for a number of years, obese people having unhealthy lifestyles. There are several types of cancer, and in clinical practice ductal is the most frequent one, then lobular, while inflammatory cancer is the rarest (3, 4).

Upon receiving pathohistological verification, complete biochemical and diagnostic processing of the patient, the stage of illness and the treatment plan are defined. The Medical Consilium brings the initial plan of treatment of these patients, basing its decision not only on scientifically proven facts but also taking care of maximal individualistic approach to each patient, taking into consideration his/her general health and existing comorbidities. Methods of breast cancer treatment include operative treatment, radiotherapy, chemotherapy, hormonal therapy, target therapy and immunotherapy. Depending on the type and stage of cancer, these methods of treatment can be combined, and surgical removal of cancer is most frequently followed by radiotherapy or system therapy.

Radiotherapy of breast cancer represents an essential component in the overall treatment of early-stage and locally advanced breast cancer. It is based on the application of local and locoregional treatment of ionising radiation where local refers to the radiation treatment of the rest of the breast or the scar region after radical surgery. Also, the corresponding lymphatic drainage regions can be treated by radiotherapy. The role of radiotherapy is reflected in "the sterilisation" of the treated region to prevent ipsilateral recurrences, locoregional recurrences and potential dissemination of tumour cells (5).

Since the number of patients who survive breast cancer is on the increase, the focus has shifted towards monitoring and assessment of

toxicity, with the emphasis put not only on acute complications of usually reversible character but also on later consequences of radiotherapy. Complications are numerous and vary from the local ones (dermatitis) to more serious forms including dysfunctions of the cardiovascular system (6, 7).

Case report

At the beginning of 2022, patient D.Č. aged 54 discovered a lump the size of a walnut at the intersection of the lateral quadrants of the right breast. As part of diagnostic processing, mammography detected two stellate shadows, one next to the other, 15 mm and 14 mm in diameter, in the region of the right breast, at the intersection of the lateral quadrants, as well as one more stellate shadow 11 x 10 mm in the upper lateral quadrant, which retracted the surrounding parenchyma. No abnormality was detected in the axillae and contralateral left breast. The mammography result of the right breast was classified as Bi Rads 5, while the left breast was classified as Bi Rads 1. Taking into account Bi Rads classification, the Oncological Consilium suggested ultrasound "core" biopsy and it was pathohistologically determined that it was invasive breast cancer, with histological characteristics ER 8, PR 8, HER2 1+, Ki 67 20%.

By looking at the anamnesis and available medical documentation, it was observed that in 2017 the patient underwent surgical revascularisation of the myocard with one vein graft on RCA coronary artery, replacement of the mitral valve by the artificial mechanical valve and the plastic repair of the tricuspid valve with ring implantation. Since then she has been on the prescribed internistic therapy – application of oral anticoagulant therapy, regularly controlled hemodynamic status and regular echo sonography of the heart.

Considering a significant cardiovascular disease burden as well as the multicentricity of the malignant change verified by pathohistological biopsy, the Consilium decided that a specific oncological treatment should begin with surgery; therefore, the patient underwent surgery in May 2022 when radical mastectomy with the dissection of the axilla was performed.

Clinical, laboratory and diagnostic processing as well as heart and lungs X-ray, MSCT of the abdomen and the lesser pelvis were done prior to the surgery in order to exclude the dissemination of the malignant process. The patient was thoroughly examined by the cardiologist, when the echo sonography of the heart was done and anticoagulant therapy was prescribed during and after the surgery to keep the INR in the therapeutic range between 2.5 and 3.5.

A definite pathohistological result indicated that it was micropapillary grade 2 invasive breast cancer, dimensions were 15 mm and 9 mm, where in 6 out of 15 extirpated lymph nodes the presence of malignant cells was detected. The disease was determined to be at stage T1cN2Mx. Biological characteristics of the tumour indicated that it was a hormone-dependent breast tumour with highly positive estrogen and progesterone receptors ER 8, PR 7, Her 2 negative gene expression.

Taking this into account, in the continuation of treatment, the patient was prescribed hormonal therapy with aromatase inhibitors, 1 mg daily, with regular monitoring. The treatment was afterwards presented to the Consilium that indicated the continuation of the prescribed hormonal therapy with the application of locoregional radiotherapy.

During the first visit to the radiotherapy ambulance, the patient submitted control MSCT results of the thorax and abdomen, a cardiologist report with the consent to perform radiotherapy, after which she was clinically examined. The results corresponded to the performed procedures, no abnormality was detected regarding the scar tissue, and also no subjective symptoms were reported. She was processed on an MSCT simulator in order to perform postoperative radiotherapy of the right hemithorax and regional lymphatics. The recommendations of the national radiotherapeutic protocol for the treatment of malignant illnesses by the Ministry of the Republic of Serbia of 2022 were followed for the evaluation of the series of CT slices, which showed that a careful delineation of target volumes and organs from risk helped define the contours encompassing the scar region with the surrounding skin, where the upper and lower boundaries were at the level of tissue projection of the collateral breast. The contours of regional lymphatics included all three levels of the same side axilla and supra and infraclavicular regions (Figure 1).

Technical equipment of the radiotherapy centre in Niš referred to the application of 3D conformal radiotherapy, using the techniques of beforehand directed planning, when by combining two lateral fields with two added segment fields with a view to optimization, a satisfactory distribution of the dose was achieved. The patient was processed and was to receive TD 50 Gy in 25 fractions. By arranging the fields and using the experience of the medical physicist, it was attempted to maximally exclude the heart volume from the radiation volume, therefore, based on the Quantum constraints determined at V 10% < 10 Gy, the heart in our case received only 2.88 Gy by 10% of the volume.

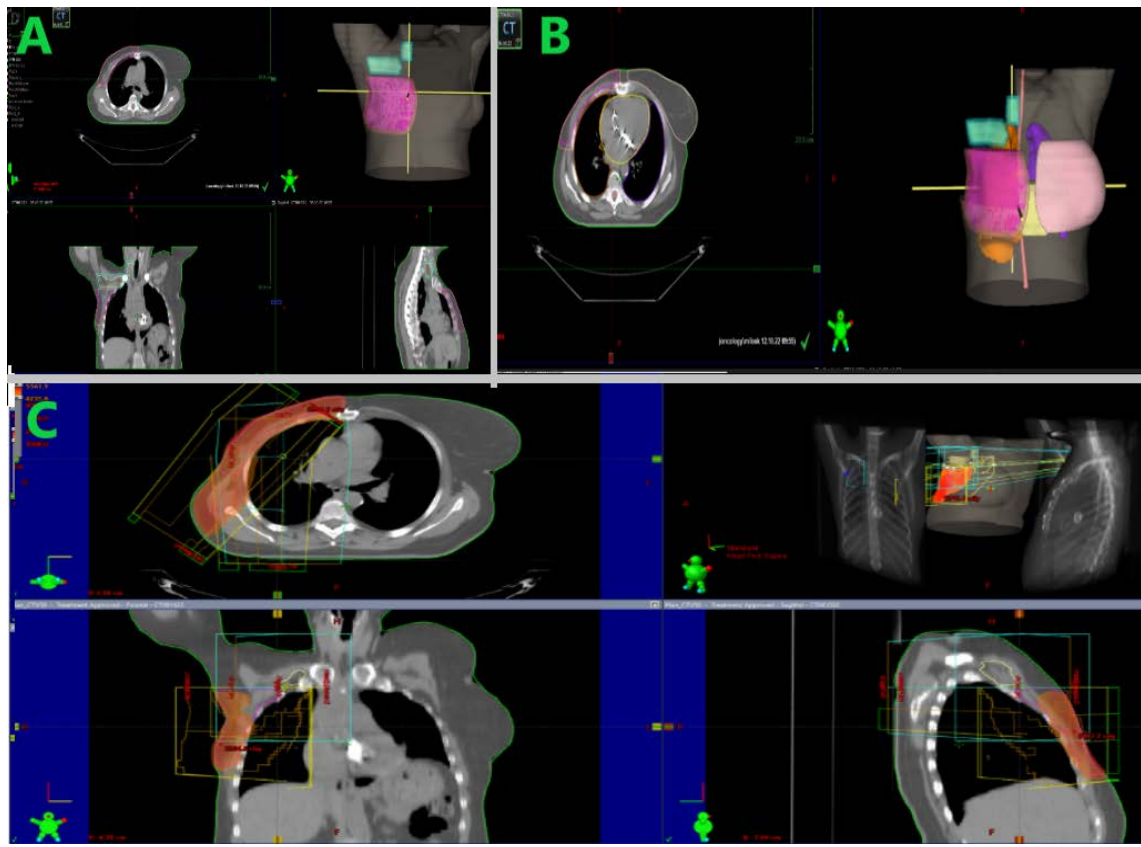


Figure 1. Delineation of the target volumes (A and B); Dose distribution to target volumes (C).

Discussion

Current options for the protection/avoidance of the heart to decrease cardiotoxicity of radiation include manoeuvres which transfer the heart from the field, such as coordination of the breathing cycles or positioning of the patient in the supine position. Technological advancement enabled therapies such as intensity modulated radiation therapy (IMRT) or proton beam therapy (PBT) and techniques treating lesser volume around the lumpectomy cavity, such as accelerated partial breast irradiation (APBI) or intraoperative radiation therapy (IORT) (7). Although these techniques have dosimetrically proven to be promising, there are limited possibilities of their application (8, 9). They are primarily related to the limited technical equipment of the centres, and on the other hand, there are insufficient data regarding later heart attacks due to difficulties related to long-term monitoring. The application of 3D conformal radiotherapy represents a standard in the radiotherapeutic treatment of patients, within which a precise delineation of target volumes is done on CT slices, not only because it is based on the recommendations but also because it is the only available treatment in our centre. Therefore, the purpose of this review was to assess how the

applied technique could lead to the decrease of heart dose in the patient with a significant cardiological burden. Future studies are necessary in order to confirm the efficiency of the advanced techniques which spare the heart dose and can use surrogates for heart attacks such as biomarkers or perfusion scanning.

The most common heart problems during radiotherapy are acute pericarditis, pericardial haemorrhage and arrhythmia. Acute damage of pericardial and intimal coronary endocytosis caused by radiation results in ischemia of myocytes and fibrosis. It seems that the risk of coronary diseases increases decades after radiation therapy (10). The majority of heart diseases was noticed in patients who underwent the radiation of the left thoracic wall after the left-side mastectomy, but present-day radiotherapy techniques expose the heart to less radiation than those 30 years ago, even in those patients with tumors on the left side (11). Earlier epidemiological cohort studies noticed a greater risk of death due to heart failure among the patients having cancer on the left breast as compared to those having cancer on the right breast, with the risk increasing as the time after treatment progresses (10, 11). However, the analysis of results of epidemiological surveillance

of the patients who had radiation of the left breast as compared to those who had radiation of the right breast did not show that the passage of time made a significant difference regarding the hospitalisation due to heart diseases or heart insufficiency (12), suggesting that the occurrence of complications is independent of the side on which the tumour change is present.

In our case, the patient with a high cardiovascular risk (burden) did not develop acute serious complications related to the cardiovascular or respiratory systems after the application of 3D conformal radiotherapy. The complications that developed in the patient included skin changes such as erythema (grade I) which was locally treated with corticosteroids. The incidence of skin toxicity caused by radiation is an important clinical problem which affects a majority of patients with breast cancer who were subjected to adjuvant therapy. This problem is related to the radiation technique, dose homogeneity, PTV receiving a dose bigger than 100% of the prescribed dose and prophylactic use of the local therapy (13) and is present in almost all patients exposed to radiotherapy, going up to 70–100% (14). The fluctuation of values of INR is common among oncological patients, and it was also noticed during

the radiotherapeutic treatment of the patient, thus it can be viewed as one more complication of this therapeutic protocol (15). On the other hand, this can be regarded as deterioration, i.e., change of the basic illness in the patient.

Conclusion

This case report indicates the applicability of 3D conformal radiotherapy in patients after breast cancer surgery with a high cardiovascular risk. Since the application of this technique is the most frequent at our centre, despite the implementation of new techniques, this case report confirms its safety and applicability in high-risk patients despite the implementation of new techniques. The applied radiation therapy in the patient in this case report points to its low toxic effect, while the noticed negative effects in high-risk patients were removed. The treatment was finished a few months ago and since then there have not been delayed complications, and in the future monitoring, they will be noted.

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Prikaz bolesnika

UDC: 618.19-006.6-085.849:616.12-06
doi: 10.5633/amm.2024.0411**POSTOPERATIVNA TRODIMENZIONALNA KONFORMALNA
RADIOTERAPIJA KOD BOLESNICE SA ZNAČAJNIM RIZIKOM OD
NASTANKA KARDIOVASKULARIH KOMPLIKACIJA: PRIKAZ SLUČAJA***Milica Radić^{1,2}, Aleksandar Popović¹, Katarina Krasić³, Andrija Jović⁴,
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Radioterapija raka dojke predstavlja esencijalnu komponentu u ukupnom lečenju i ranog stadijuma raka dojke i lokalno uznapredovalog raka dojke. S obzirom na zadovoljavajuće rezultate i udeo u smanjenju stope mortaliteta obolelih od raka dojke, primenom multimodalnog lečenja fokus je pomeren na praćenje akutnih, ali i hroničnih komplikacija koje nastaju kao posledica onkološkog lečenja. Cilj multimodalnog lečenja jeste da očuva kvalitet života bolesnika. Komplikacije su mnogobrojne i variraju od lokalnih (dermatitis) do ozbiljnijih, koje obuhvataju i disfunkcije kardiovaskularnog sistema. Primena trodimenzionalne (3D) zračne terapije kao najzastupljenije metode u našem centru kod bolesnice prikazane u ovom radu ukazala je na njen nizak akutni toksični efekat. Budući da su primećeni neželjeni efekti kod bolesnice kod koje postoji visok rizik od pojave kardiovaskularnih komplikacija bili otklonjeni, postignut je zadovoljavajući terapijski efekat uprkos limitiranoj tehničkoj opremljenosti centra.

*Acta Medica Medianae 2024; 63(4):98–103.***Ključne reči:** karcinom dojke, kardiotsičnost, radioterapija

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