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BREAST CANCER CONFORMAL (3-D) RADIOTHERAPY – A REPORT OF THE FIRST PATIENT AT THE UNIVERSITY HOSPITAL FOR TUMORS, ZAGREB, CROATIA

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Summary

This report describes 3-D conformal radiotherapy in a female breast cancer patient. A postmenopausal patient was admitted to the Department of Radiation Oncology, University Hospital for Tumors, Zagreb, Croatia for adjuvant radiotherapy treatment after right breast segmentectomy. Patohistology was ductal carcinoma *in situ* grade II (TisN0M0). With standard 2-D simulation, a relatively large lung volume in the irradiation field was defined (central lung distance - CLD > 2.5 cm). We decided to apply conformal radiotherapy, for its ability of homogeneous dose application and minimum radiation exposure of the surrounding normal tissues. A dose of 50 Gy was delivered to the whole breast in 2 Gy fractions, followed by a «boost» dose to the tumor bed of 12.5 Gy in 2.5 Gy fractions using electron beams (12 MeV). The patient tolerated treatment without any significant sequelae. At control examinations after 3 and 6 moths, the patient was well, with no signs of the disease, with normal clinical inspection results and without any skin changes.

KEY WORDS: *breast carcinoma, 3-D conformal radiotherapy*

KONFORMALNA (3-D) RADIOTERAPIJA RAKA DOJKE – PRIKAZ PRVE PACIJENTICE U KLINICI ZA TUMORE, ZAGREB

Sažetak

U radu je prikazano provođenje 3-D konformalne radioterapije u bolesnice s karcinomom dojke. Bolesnica je primljena u Službu radioterapijske onkologije Klinike za tumore radi provođenja adjuvantne radioterapije nakon segmentektomije desne dojke. Postavljena patohistološka dijagnoza je duktalni karcinom in situ gr. II (TisN0M0). Klasičnom 2-D simulacijom utvrđeno je da u polje zračenja ulazi relativno veliki volumen pluća (centralna plućna distanca, CLD > 2.5 cm). Odlučeno je provesti konformalnu radioterapiju, koja omogućuje apliciranje homogenije doze zračenja i bolju zaštitu okolnog zdravog tkiva. Aplicirana je tumorska doza 50 Gy na cijelu dojku u 25 frakcija po 2 Gy, nakon koje je slijedila «boost» doza na ležište tumora od 12.5 Gy u 5 frakcija po 2,5 Gy korištenjem elektronskog snopa e12 MeV-a linearnog akceleratora. Pacijentica je dobro i bez prekidanja podnijela radioterapiju. Na kontrolnom pregledu nakon 3 i 6 mjeseci, pacijentica je dobro, bez znakova bolesti, uredan je klinički nalaz, bez vidljivih promjena na koži dojke.

KLJUČNE RIJEČI: *karcinom dojke, 3-D konformalna radioterapija*

INTRODUCTION

3-D conformal radiation therapy is currently recommended as the treatment of choice for breast carcinoma patients. In 2005, the University Hospital for Tumors, Zagreb, was the first Croatian oncology center that started introducing 3-D conformal radiation therapy, initially only for prostate

cancer and then gradually for other tumors, too. Once the equipment required for breast cancer 3-D conformal radiotherapy was available, the University Hospital for Tumors introduced this method also for the treatment of breast cancer patients.

Studies to date showed that modern radiotherapy techniques can significantly improve long term results of breast carcinoma treatments, including overall patients' survival (1-5).

Normal tissues such as the lung and the heart should be spared as much as possible during the treatment of breast carcinoma patients to prevent possible late radiation toxic effects. Standard techniques which utilize two opposed tangential beams cannot, however, properly provide a uniform dose to a nonuniform structure of the breast, resulting in several overdosed and underdosed areas that can cause acute and chronic toxicities in some patients (4, 6-8).

Figure 1. CT scan using immobilization device MED-TEC MT-350

Figure 2. Placing radiopaque markers

3-D conformal radiotherapy enables proper visualization of organs at risk, and dose-volume histograms (DVH) show the relation between the radiation dose and the risk organ volume, allowing a maximum protection of normal tissues during radiation therapy. 3-D conformal radiotherapy enables a more homogenous dose distribution within the planned target volume (9-15).

PATIENT REPORT

This report describes 3-D conformal radiotherapy in a female breast cancer patient. A postmenopausal patient born in 1953. was admitted to the Department of Radiation Oncology for adjuvant radiotherapy treatment after right breast segmentectomy. Patohistology showed ductal carcinoma in situ grade II (TisN0M0). Following surgery, adjuvant hormonotherapy (Nolvadex tbl. 2x1) and radiotherapy were prescribed.

Standard 2-D simulation was performed, but the field defined included an unacceptably large volume of the lung (CLD > 2.5 cm). In an attempt to minimize the irradiated lung volume and obtain a more homogenous dose distribution, a 3-D conformal radiotherapy planning was performed.

MATERIALS AND METHODS

For breast cancer 3-D conformal radiotherapy the following equipment was used: CT scanner

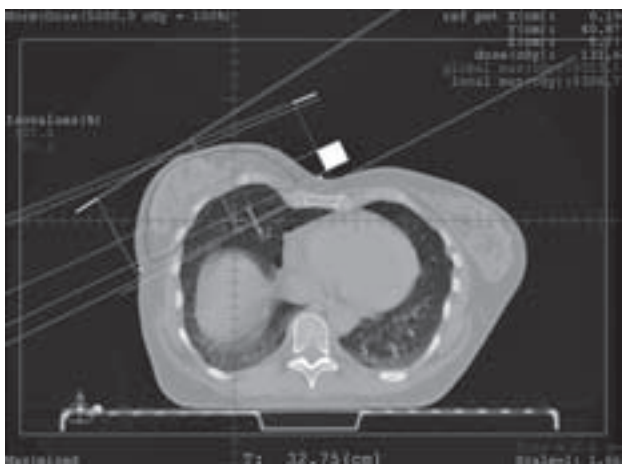


Figure 3. CT slice showing isodose curves

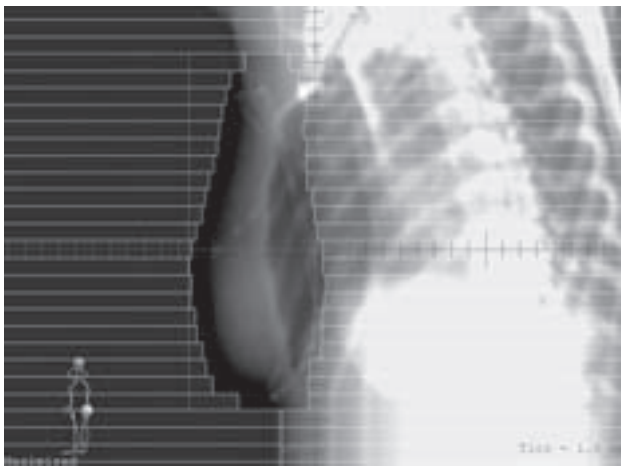


Figure 4. Digitaly reconstructed radiogram (DRR)

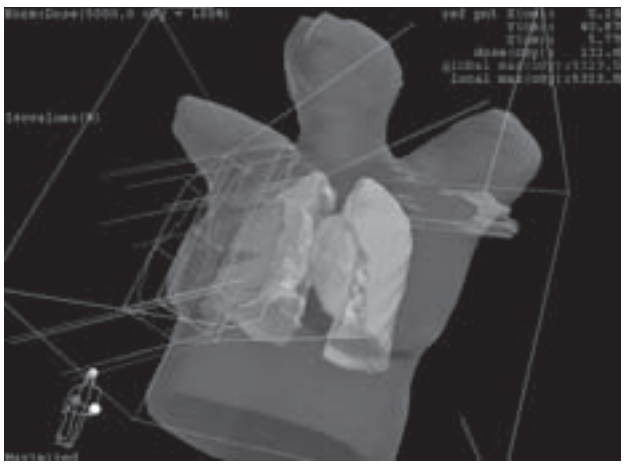
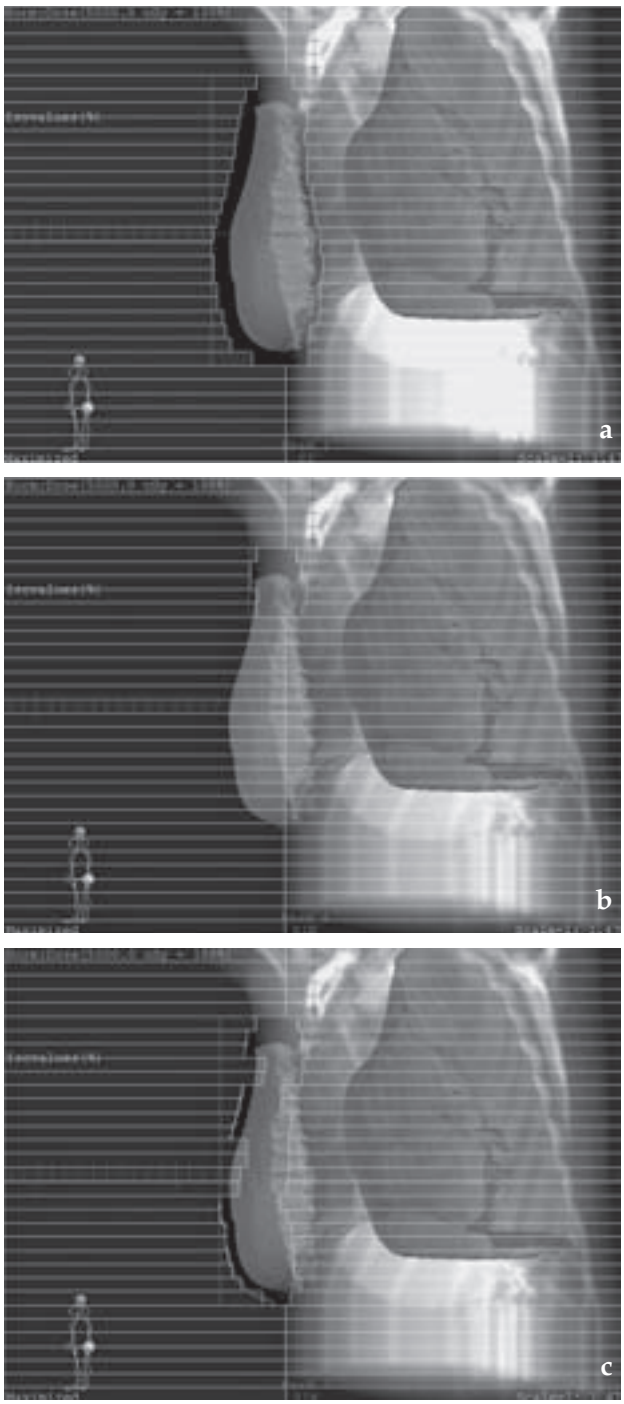


Figure 5. 3-D volume view

Siemens Somatom Sensation Open (bore opening – 82 cm), planning system CMS XiO 4.3.1. Treatment was delivered using Siemens Oncor linear accelerator with MLC – MultiLeaf Collimator equipped with a 41–leaf-pair.

An immobilization device MED-TEC MT-350 was used during CT scanning and irradiation for more precise positioning (Figure 1). The patient was on her back with arms extended above her head and radiopaque markers were placed to define clinical extent of the breast (Figure 2), while CTV was delineated to encompass the whole breast, with a rear margin set on the thoracic wall. The skin on each axial CT slice was delineated as the superficial boundary, while the deep edge of the chest wall and tangential borders of the medial and lateral beams formed the posterior boundary of the irradiated volume, excluding the lung. A 1



Figures 6 a-c. Beam-eye-views for treatment fields.

cm margin was added to CTV, to compensate for inter- and intra-fraction movements of the CTV. The position of isocenter was chosen in such way to minimise the irradiated volume of the lung. Opposing X6 MV tangential beams on the linear ac-

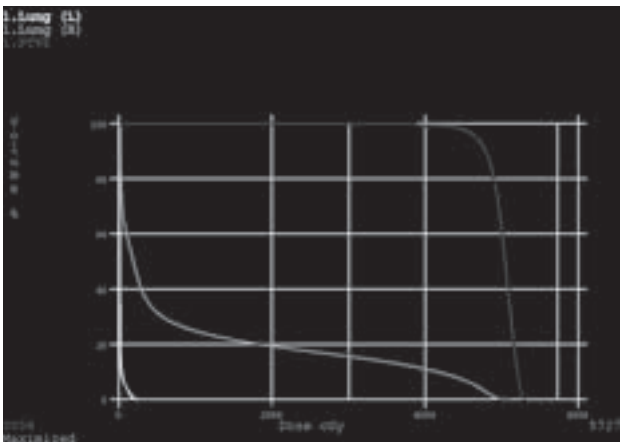


Figure 7. Dose-volume histogram

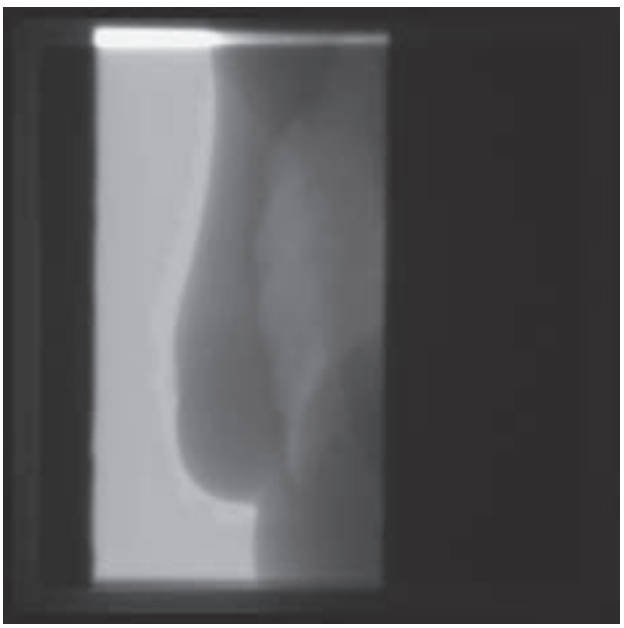


Figure 8. Portal image on linear accelerator

celerator were used. (Figures 4, 5). To compensate for dose irregularities within the PTV, several «patch» fields were used (Figure 6).

The dose-volume histogram (DVH) constraints used with this new system and for this patient were as follows:

- Delivery of the prescribed dose (PD) 50 Gy uniformly by ICRU constraints (max. permitted variation in PTV from 95-107%) (16)
- Lung irradiation
  - less than 10 Gy mean lung dose (MLD)
  - V20 (percentage of ipsilateral lung receiving 20Gy dose) less than 20% (Figure 7)

Compared to the standard 2-D simulation (analyzed subsequently by the same computer system), where MLD was 14 Gy, 3-D conformal radiotherapy produced significantly better dose homogenity and protection of normal tissue. A dose of 50 Gy was delivered to the whole breast in 2 Gy fractions, followed by a supplemental boost to the tumor bed of 12.5 Gy in 2.5 Gy fractions, using electron beams (12 MeV). The position accuracy during therapy was checked and documented at portal images on the linear accelerator (Figure 8).

RESULTS

The patient tolerated the treatment well and without any significant sequelae. Upon treatment completion, only moderate local skin erythema was observed. At control examinations after 3 and 6 months, the patient was well, with no signs of the disease, with normal clinical inspection results and without any changes of the skin.

CONCLUSION

This paper describes the first Croatian experience with breast carcinoma 3-D conformal radiotherapy. The technique is currently becoming a standard method of irradiation for breast carcinoma patients in the University Hospital for Tumors, Zagreb, Croatia.

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