Radiotherapy of Stage IEA Primary Breast Lymphoma: Case Report

Antonio Juretić, Mirko Živković, Mirko Šamija, Davorin Bagović, Anka Purišić, Tomislav Viculin, Matija Bistrović, Mladen Stanec, Stjepan Juzbašić, Miro Lesar, Rudolf Tomek

University Hospital for Tumors, Zagreb, Croatia

A 47-year-old woman was referred for treatment to our Hospital because of a palpable nodule in the upper medial quadrant of her right breast. After tumor excision, pathohistological examination showed a follicular center cell lymphoma grade 2, B-cell type (CD20+, bc16+, CD10+, bcl2+). The final diagnosis was stage IEA primary extranodal non-Hodgkin’s breast lymphoma. The involved breast was irradiated isocentrically with two opposite 6-megavolt (MeV) photon beams delivered from the linear accelerator (tangential fields) using asymmetric collimator opening. Radiation volume, inclinations of the medial and lateral field, and the part of the underlying chest wall and lung parenchyma were determined during the radiotherapy simulation process. The total irradiation dose was 44 Gy delivered in single daily doses of 2 Grays (Gy). After breast photon irradiation, a boost to the tumor bed was performed by a direct 12 MeV electron beam, with a total dose of 6 Gy delivered over three days. Since primary non-Hodgkin lymphoma of the breast is rather rare, there has been no uniform approach to its treatment. The advantage of applying the asymmetric collimator jaw opening in breast radiotherapy is the instant reduction of the dose at margin fields, resulting in both the protection of neighboring lung parenchyma and the good coverage of planned target volume.

Key words: breast neoplasms; lymph nodes; lymphoma, non-Hodgkin; radiotherapy; radiotherapy dosage

Patients with breast lymphoma with or without simultaneous ipsilateral axillary nodal involvement are usually diagnosed as having the IE or IE stage primary non-Hodgkin’s lymphoma, respectively. Primary breast lymphomas are rare, comprising less than 1% of all breast neoplasms and only up to 2% of all extranodal lymphomas (1,2). Due to their rarity, studies usually report only on a limited number of patients (usually 10 to 20), collected over the span of many years (3-11). There are also differences in both lymphoma classifications and treatment approaches. Most primary breast lymphomas are of B-cell origin, and diffuse large B-cell lymphomas seem to be the most common type (1,2,6,7). After local excision and histological classification, high-grade primary breast lymphomas should be treated with combination chemotherapy with or without radiation similarly to systemic lymphomas of a similar histological type. For low-grade lymphomas, however, radiotherapy alone is considered a sufficient treatment modality (1,2,11).

Reports on breast lymphoma treatment include few or no details about the target volume and applied irradiation technique and usually mention only the total radiation dose (3,8-11). However, since it concerns irradiation of the breast, the technique should be the same as for breast cancers, applied either after conservative breast surgery or as primary irradiation (3,12). Thus, when planned target volume includes only the breast, the technique consists of two tangential fields placed medially and laterally to the breast (“tangential breast fields”). The purpose of such field arrangement is to minimize the irradiation of the underlying normal tissue.

Since published reports usually do not include information on radiotherapy techniques used in the treatment of breast lymphoma, we provide a detailed account of tangential field arrangement for breast irradiation by an asymmetric collimator opening at the University Hospital for Tumors, Zagreb. This treatment was applied in a 47-year-old woman diagnosed with stage IEA primary extranodal non-Hodgkin’s breast lymphoma.

Case Report

A 47-year-old woman with a palpable nodule in the upper medial quadrant of her right breast was referred for treatment to the University Hospital for Tumors, Zagreb, Croatia. On admission, the lump measured 2 cm in diameter; it was well circumscribed, elastically firm, and fixed to the overlying skin, which was darker in color than the surrounding skin. Laboratory tests were normal. Mammography findings were rather nonspecific, i.e., no lesion suspicious for breast cancer (microcalcifications or spiculations) was visible. Cytological examination of the tumor

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specimen obtained by needle biopsy did not reveal any malignant epithelial cells either. Tumorectomy was performed in January 2002. Pathological examination revealed a tumor of 0.5 cm in diameter, which corresponded histologically with non-Hodgkin’s lymphoma. The final diagnosis was follicular center cell lymphoma grade 2 (centrocytes 75% and centroblasts 25%), B-cell type (CD20+, bc16+, CD10+, bcl2+). The patient underwent staging procedure, which included ultrasound examination of the neck, supraclavicular regions, both breasts, axillary regions, abdomen, and inguinal regions; computerized tomography of the thorax; cytological bone marrow examination; and gynecological examination. There was no evidence of disseminated disease and/or regional lymph node involvement. Accordingly, the patient was diagnosed with primary stage IAE non-Hodgkin’s lymphoma of the breast.

**Radiation Therapy**

On the basis of the histological classification and the disease stage, we decided to treat the patient with radiotherapy only ("involved-field" breast irradiation). The standard breast radiotherapy technique used at the University Hospital for Tumors is tangential breast irradiation, with asymmetric collimator openings adjusted so as to block half of the beam. Briefly, the breast is irradiated isocentrically by two opposite 6 megavolt (MV) photon beams delivered from the linear accelerator (tangential fields). By setting the asymmetric collimator jaws at the isocenter, the lower half of the irradiation beam is blocked. Consequently, by eliminating the beam divergence, irradiation of the adjacent neighboring lung parenchyma is also reduced.

A radiation simulator was used to plan accurately the patient’s radiation therapy treatments. The radiation volume and inclinations of the medial and lateral fields were determined, as well as the size of a part of underlying chest wall and lung parenchyma that was included in the target volume (not more than 2 cm) (Fig. 1).

The patient lay supine on the radiation simulator table, with her arm extended and elevated, placed on an unilateral arm pole. An inclined plane was placed under her back chest, shoulders, and head. The patient was in the same position during planning, simulation, and treatment. Medial and lateral margins of the treatment field were marked with paint on the skin of the patient’s breast (lead wire was used for demarcation of the treatment field during simulation) (Fig. 1). The superior border of the treatment field was at the level of the sternal notch, and the inferior border 15 mm below the inframammary fold. Furthermore, the laser beam coordinate system was used for the precise three-dimensional determination of the lateral and medial breast margins. After the coordinates of the medial and lateral margins were determined, the “treated” breast was positioned at the isocenter. The angles of mid-tangential fields were determined by simulating collimator rotation during diascopy. The inclination between the lateral and medial field was 180°. The central axis angles of the medial and lateral tangential beams were 54° and 234°.

![Figure 1](image.png)
After the breast had been placed at the isocenter, the irradiation field was determined and shaped by use of the asymmetric collimator. The collimator was opened symmetrically in the longitudinal, and asymmetrically in the transversal direction, so that half of the field including lung parenchyma was blocked. The field sizes of medial and lateral tangential beams were $x_1=8\text{ cm}$, $x_2=0\text{ cm}$, $y=17\text{ cm}$, and $x_1=0$, $x_2=8\text{ cm}$, $y=17\text{ cm}$, respectively. The lung parenchyma was exposed to maximum 2 cm in depth (Fig. 1). After checking, the borders of the treatment fields and laser beams were drawn on the patient’s skin (Fig. 1). When simulation was over, computerized planning of dose distribution within the target volume was done, which required taking into account the breast contour (Fig. 2). For that purpose, central contour (single slice) of the patient’s breast outline was used. This breast outline was obtained from the shape of a piece of thin, soft metal wire modeled after the patient’s breast and transferred later into the computer program. Substantial nonhomogeneity of the doses within the target volume, usually caused by the breast tissue curvature, was compensated by two 30° wedges (Fig. 2). Finally, after having all calculations done, reviewed, and accepted, irradiation was carried out with 6 MeV X-rays by use of the linear accelerator. Daily irradiation doses were 2 Gy; the total breast tumor dose was 44 Gy. When photon irradiation of the breast was completed, a boost irradiation to the tumor bed followed. This was performed by a direct electron beam (field $8 \times 5\text{ cm}$), using 12 MeV electrons and a total dose of 6 Gy over three consecutive days.

The presented tangential field arrangement allows the delivery of a therapeutic dose to the breast parenchyma while sparing a significant portion of the lung (12). The clinical benefit of radiotherapy for breast (cancer) must be balanced against the documented risk for early and late toxicity (12,16). Adverse effects of breast irradiation on many organs have been reported, such as ischemic heart disease, pneumonitis and pulmonary fibrosis, erythema, telangiectasia and ulceration of the skin, and bone necrosis in the ribs and sternum. The incidence rate and severity of these toxic effects have been associated with radiation dose and field arrangements (12,16, 17). The tangential set-up can spare substantial volumes of the lung and heart from high radiation doses. With the conventional two-field tangential technique, further minimization of lung (and heart) irradiation can be obtained, for example, by angling the opposite irradiation fields slightly beyond 180°. Another technique that uses modern linear accelerators equipped with asymmetric collimator jaws consists of setting the isocenter at the deep edge and half-beam blocking to avoid divergence. The advantage of this method, applied in the treatment of our patient, is the instant reduction of the dose at irradiation field margins, resulting in protection of the neighboring lung parenchyma and good coverage of planned target volume (12).

Moreover, in order to improve the breast target volume coverage, on the one hand, and to minimize the irradiation of neighboring normal healthy lung (and heart) tissue, on the other, radiotherapy centers with adequate radiotherapy planning systems, tech-
nology, and equipment should investigate, test, and apply more complex tangential fields for breast irradiation. For instance, one of the intensively tested planning methods today is virtual CT-based three-dimensional conformal radiotherapy treatment planning, with or without intensity modulation (12,16,18), which seems very promising. However, since such complex planning procedures are more time consuming, in most radiotherapy centers they have not yet become routinely available and/or applicable.

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References


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Correspondence to:
Antonio Juretić
University Hospital for Tumors
Ilica 197
10000 Zagreb, Croatia
antonio.juretic@zg.hinet.hr