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Original research article

Intraoperative radiation therapy as part of breast conserving therapy of early breast cancer—Results of one-year follow-up

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ABSTRACT

Aim: The aim of this study was to assess the therapeutic effect of intraoperative radiotherapy, describe the method, and examine the occurrence of side effects and quality of life.

Background: Breast conserving therapy has recently become a standard treatment modality in patients with early invasive cancer. Radiotherapy, along with surgery, is an integral part of such treatment. The important thing of radiotherapy is to deliver a high dose to the tumour bed. One of the methods is the intraoperative radiotherapy.

Materials and methods: The analysis comprised sixty Tis-T2N0-1A breast cancer patients treated with breast conserving surgery. Patients' mean age was 57 years (range: 32–73 years). Intraoperative radiation therapy was delivered in the operating theatre during surgery and involved a single dose of 10 Gy with an electron beam of 4, 6, 9 or 12 MeV. After that, all patients were treated with whole breast irradiation. During one year observation photos and side effects examination were made.

Results: Physical and imaging examinations performed during a one-year follow-up revealed no local or distant relapse and good tolerance of IORT. Acute mild responses to the radiotherapy occurred in 23.3% of patients. Based on the examination, a good and very good cosmetic effect was found in 78.3%, with 83.3% of patients evaluating their treatment effects in the same way.

Conclusions: Due to its exceptional physical and radiobiological properties, intraoperative radiation therapy can be a good alternative to other methods of boosting dose to the post-operative site in management of low stage breast cancer, enabling a precise therapy to the tumour bed.

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1. Background

Breast cancer is the most prevalent cancer among women in the world and the most frequent cause of cancer deaths. Breast conserving therapy has recently become a standard treatment modality in patients with early invasive breast cancer. Radiation therapy, along with surgery, is an integral part of such treatment. Radiotherapy delivered to the whole breast remains to be a standard procedure in adjuvant treatment in breast cancer patients after breast-conserving surgery. Many studies have confirmed its efficacy in reducing both the risk of local relapse and breast cancer mortality.[1] Radiotherapy is aimed not only to cover the whole breast with a prescribed dose, but also to increase irradiation dose to the site of tumour removal, known as boost. The benefits of delivering an additional dose to a tumour site have been confirmed by the EORTC study.[2] There are many methods of delivering a high dose to the post-operative site: brachytherapy, external beam radiotherapy (electron or photon) and intraoperative radiotherapy.[3] Intra Operative Radiation Therapy (IORT) enables a delivery of a single dose directly to the post-operative site in the course of a surgical procedure. The application of IORT allows to avoid a geographical error, enabling a delivery of a single dose to the target volume.

2. Aim

The aim of this study was to assess the therapeutic effect of intraoperative radiation therapy, describe the treatment method, and examine the occurrence of early and late reactions to radiation and quality of life, including the cosmetic effect, in women treated conservatively for low-stage breast cancer.

3. Materials and methods

The analysis comprised sixty Tis-T2N0-1A breast cancer patients treated with breast conserving surgery at the Greater Poland Cancer Centre in the period 2008–2009. Patients' mean age was 57 years (range: 32–73 years). The characteristics of the patients in terms of disease stage and histopathological evaluation are shown in Tables 1 and 2.

14 patients (23.3%) were managed with post-operative chemotherapy due to the presence of adverse predictors in post-operative specimens. Hormonal therapy was also given to 54 patients (93.3%) due to the presence of oestrogen and progesterone receptors in the tumours.

Intraoperative radiation therapy was delivered in the operating theatre during a breast conserving surgery. In the first phase, the surgeon excised a lesion with a margin of healthy tissues. The histopathologist evaluated the excised tumour by intraoperative examination and determined clear margins. In the next stage, some breast tissue was dissected from the facia of the pectoralis major muscle along a 4–5 cm section for an aluminium-lead plate (thickness 0.5–1.0 cm, diameter 5–10 cm) to be placed there as protection for the organs at risk (lung, heart, pectoral muscle) – see Figs. 1 and 2. Mobilised breast tissue of the post-operative site was brought together over the plate. Depending on the size of the tumour and healthy tissue margin, a diameter of an applicator was selected for irradiation to cover the excision site with a 2 cm margin. With the mammary gland separated from the subcutaneous tissue, the skin could be drawn away from the

Table 1 – Sample characteristics.

Tumour size-T feature	No. of patients	No. of patients with N+ (N1a)
Tis	3	0
T1b	21	2
T1c	33	6
T2	3	1

Table 2 – Tumour histopathology.

Tumour histopathology (tumour type)	No. of patients
Ductal carcinoma	49
Labular carcinoma	4
Mucinous carcinoma	4
Papillary carcinoma	2
Tubular carcinoma	2

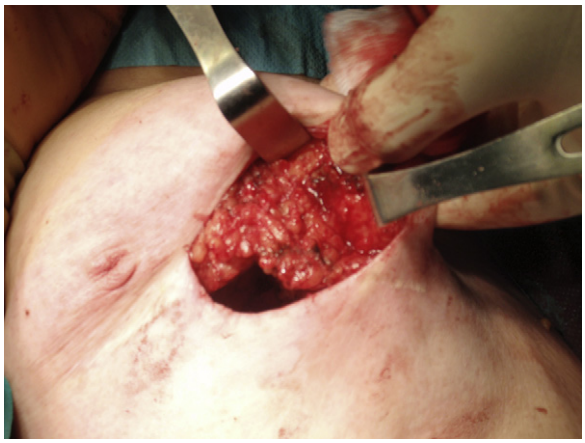

Fig. 1 – Preparation of the tumour bed.

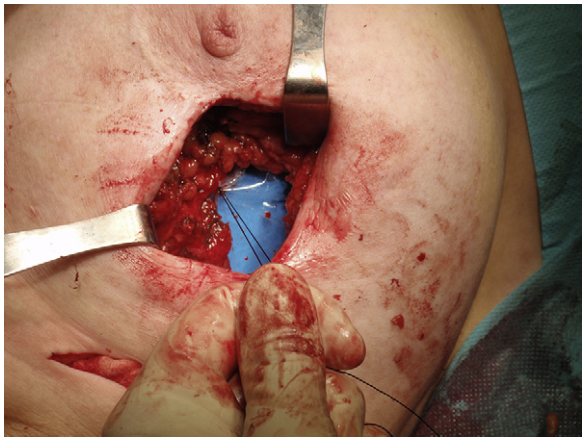

Fig. 2 – View of the aluminium-lead plate under the tissues of the tumour bed.