available at www.sciencedirect.com

ScienceDirect

journal homepage: http://www.rpor.eu/

Original article

The role of high-dose-rate brachytherapy boost in breast-conserving therapy: Long-term results of the Hungarian National Institute of Oncology

Csaba Polgár[a,*], *Levente Jánváry*[b], *Tibor Major*[a], *András Somogyi*[a], *Zoltán Takácsi-Nagy*[a], *Georgina Fröhlich*[a], *János Fodor*[a]

[a] *Department of Radiotherapy, National Institute of Oncology, Ráth György u. 7-9, H-1122 Budapest, Hungary*
[b] *Department of Radiation Oncology, University Hospital of Liege, Liege, Belgium*

ARTICLE INFO

Keywords:
Breast-conserving therapy
Radiotherapy
High-dose-rate brachytherapy
Boost

ABSTRACT

Aim: To report the long-term results of high-dose-rate (HDR) brachytherapy (BT) boost for breast cancer patients treated with conservative surgery and radiotherapy.
Materials and methods: Between 1995 and 2007, 100 early-stage breast cancer patients received an HDR BT boost after conservative surgery and whole breast irradiation. Ten patients (10%) received a single-fraction HDR boost of 8–10.35 Gy using rigid needles, while 90 (90%) were treated with a fractionated multi-catheter HDR BT boost. The latter consisted of 3×4 Gy ($n = 19$), 3×4.75 Gy ($n = 70$), and 2×6.4 Gy ($n = 1$). Breast cancer related events, cosmetic results and side effects were assessed.
Results: At a median follow-up time of 94 months (range: 8–152) only 7 (7%) ipsilateral breast failures were observed for a 5- and 8-year actuarial rate of 4.5 and 7.0%, respectively. The 8-year disease-free, cancer-specific, and overall survival was 76.1, 82.8, and 80.4%, respectively. Cosmetic outcome was rated excellent in 17%, good in 39%, fair in 33%, and poor in 11%. Data on late radiation side effects were available for 91 patients (91%). Grade 3 fibrosis and grade 3 telangiectasia occurred in 6 (6.6%) and 2 (2.2%) patients, respectively. In univariate analysis only positive margin status had a significant negative effect on local control.
Conclusions: HDR BT boost using multi-catheter implants produce excellent long-term local tumour control with acceptable cosmetic outcome and low rate of grade 3 late radiation side effects.

1. Background

Over the last decades, breast-conserving surgery (BCS) and postoperative radiotherapy (RT) became the standard of care for the treatment of early-stage breast carcinoma.[1,2] The standard technique of RT after BCS is to treat the whole breast by teletherapy via tangential fields up to a total dose of 45–50 Gy.[3] The main rationale to give an additional dose of 10–25 Gy to the tumour bed after whole breast irradiation (WBI) was based on the clinical observation that 67–100% of ipsilateral breast recurrences originated from the vicinity of the original index

* *Corresponding author*. Tel.: +36 1 224 8600; fax: +36 1 224 8680.
E-mail address: polgar@oncol.hu (C. Polgár).
1507-1367/$ – see front matter © 2009 Wielkopolskie Centrum Onkologii. Published by Elsevier Urban & Partner Sp. z.o.o. All rights reserved.
doi:10.1016/j.rpor.2010.01.002

lesion.[4] To date, three randomized trials have confirmed that a boost dose of 10–16 Gy after 50 Gy WBI significantly decreased the local recurrence (LR) rate.[4–8] Patient age less than 50 years, close, microscopically positive or unknown surgical margins, and the presence of an extensive intraductal component (EIC) are generally accepted as absolute indications for boost irradiation.[4] However, a controversy still exists regarding the optimal boost technique. Traditionally, low-dose-rate (LDR) brachytherapy (BT), electrons or photons have been used to deliver the boost dose to the tumour bed.[4,5,8–15] Later, high-dose-rate (HDR) BT has also been accepted as a safe alternative boost modality.[6,7,12,16–27]

2. Aim

A retrospective analysis was performed to report the long-term results of HDR BT boost for breast cancer patients treated with BCS and RT at the Hungarian National Institute of Oncology (HNIO).

3. Materials and methods

3.1. *Surgery, patient and tumour characteristics*

Between 1995 and 2007, 100 early-stage breast cancer patients received an HDR BT boost after conservative surgery and WBI. All patients underwent wide excision, defined as a resection of the primary tumour with at least 1 cm of macroscopic free margin. During surgery, the boundaries of the excision cavity were marked with titanium clips. At least level I–II axillary dissection was performed for 84 patients (84%) and 12 women (12%) underwent sentinel lymph node biopsy. For the remaining 4 cases (4%), operated on for pure ductal carcinoma in situ (DCIS), surgical axillary staging was omitted by the surgeon's preference. Patient and tumour characteristics are listed in Table 1.

Table 1 – Patient and tumour characteristics.

Characteristic	n (%)
Mean age (years)	56.7
Range	37–77
Age (years)	
<40	5 (5%)
40–50	22 (22%)
>50	73 (73%)
Premenopausal	30 (30%)
Histological type	
DCIS	6 (6%)
Ductal	67 (67%)
Lobular	16 (16%)
Ductal + lobular	2 (2%)
Mucinous	4 (4%)
Medullary	2 (2%)
Tubular	1 (1%)
Apocrin	1 (1%)
Metaplastic	1 (1%)
Surgical margins	
Positive	5 (5%)
Close (≤2 mm)	13 (13%)
Clear (>2 mm)	69 (69%)
UK	13 (13%)
Pathologic tumour size (mm)	
Mean	18.2
Range	1–35
pTis	6 (6%)
pT1	57 (57%)
pT2	37 (37%)
Pathologic nodal status	
pN0 (ALND)	59 (59%)
pN0 (SLNB)	11 (11%)
pN1mi (SLNB)	1 (1%)
pN1a (ALND)	16 (16%)
pN2a (ALND)	7 (7%)
pN3a (ALND)	2 (2%)
pNx (cN0)[a]	4 (4%)
HG	
1	20 (20%)
2	39 (39%)
3	27 (27%)
NA[b]	6 (6%)
UK	8 (8%)
LVI	
Positive	31 (31%)
Negative	60 (60%)
UK	9 (9%)
EIC	
Positive	21 (21%)
Negative	58 (58%)
NA[b]	6 (6%)
UK	15 (15%)
ER status	
Positive	59 (59%)
Negative	30 (30%)
UK	11 (11%)
PR status	
Positive	54 (54%)
Negative	34 (34%)
UK	12 (12%)

DCIS = ductal carcinoma in situ; UK = unknown; ALND = axillary lymph node dissection; SLNB = sentinel lymph node biopsy; HG = histological grade. LVI = lympho-vascular invasion; EIC = extensive intraductal carcinoma; ER = estrogen receptor; PR = progesterone receptor. Data presented as number of patients, with percentage in parentheses, unless otherwise noted.

[a] Surgical axillary staging was omitted in 4 out of 6 patients with DCIS.

[b] NA = not applicable (for DCIS).

3.2. *External beam irradiation*

All patients received WBI delivered with telecobalt ($n = 5$) or 6–9 MV photon ($n = 95$) beams using wedged tangential fields with 2 Gy daily fractions (5 fractions/week). The dose was prescribed to 95% of the dose at the isocentre, which was located on the central axis CT slice at the midpoint between the lung–chest wall interface and skin surface. The median total dose of WBI was 50 Gy (range: 30–50 Gy). Seventy-five out of 100 patients (75%) received the full intended total dose of 50 Gy. In 25 patients (25%) the total dose was limited to 30 Gy ($n = 1$), 38 Gy ($n = 1$), 44 Gy ($n = 4$), 46 Gy ($n = 10$), and 48 Gy ($n = 9$) based on the decision of the treating radiation oncologist. Twenty-five axillary lymph node-positive patients (25%) received 44–50 Gy (median: 50 Gy) regional nodal irradiation using an anterior supraclavicular–axillary 6–9 MV photon field.

3.3. *HDR brachytherapy boost*

Interstitial BT boost was performed 2–3 weeks after completing WBI. Patients were treated with HDR remote afterloading