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CASE REPORT / ПРИКАЗ БОЛЕСНИКА

Implementation of accelerated partial breast irradiation at the Oncology Institute of Vojvodina

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SUMMARY

Introduction Early breast cancer is usually treated with breast conserving surgery followed by radiation treatment. Whole breast irradiation is standard of care so far, but currently there is an increasement in accelerated partial breast irradiation for selected patients which showed many advantages. The aim of this paper is to present the implementation of the accelerated partial breast irradiation in Oncology Institute of Vojvodina.

Case outline A 54-year-old woman was referred to radiotherapy after breast conserving surgery. After she met all of the inclusion criteria, she underwent accelerated partial breast irradiation with 38.5 Gy in 10 fractions. Active breathing control device was used during the treatment and cone beam computed tomography was performed before each fraction for the purpose of target position control. She terminated therapy in good health condition with only adverse effect of mild radiation dermatitis of irradiated area. On the first follow up, she was without any symptom or sign of disease or complication.

Conclusion Accelerated partial breast irradiation is safe and effective. Radiation oncologist should be encouraged to implement this technique.

Keywords: breast cancer; radiation therapy; accelerated partial breast irradiation

INTRODUCTION

In EU countries incidence of breast cancer is 109.8/100,000 per year and mortality rate is 38.4/100,000. Serbia has incidence rate of 60.8/100,000, and each year there are 4000–4600 new cases diagnosed [1]. Early breast cancer is usually treated with breast conserving surgery (BCS) followed by radiotherapy. Whole breast irradiation (WBI) is commonly given in 5–6 weeks and 45–50 Gy is delivered. Boost dose (10–16 Gy) is given to the tumor bed in most patients, after many studies have confirmed its benefit [2]. Although it is well established that radiation therapy (RT) after BCS decreases local recurrence and improves overall survival, in practice we are faced with the fact that patients are discouraged from long treatment duration and there are many logistical issues: distance from RT facility, lack of beds in RT units, lack of transportation, social care issues, etc. [3]. For all mentioned, an interest to shorten treatment duration was born.

Accelerated partial breast irradiation (APBI) is a type of RT when radiation fractions are given more than once per day and it's based on the fact that the most of tumor recurrences are at or near the tumor bed. Patient selection should be strict: histology of invasive ductal carcinoma, size $\leq$ 2 cm (T1), over 50 years old, negative surgical margins $\geq$ 2 mm, no lymphovascular invasion, positive hormonal receptor status and BReast CAncer gene negative [4, 5, 6].

The main goal of this paper is to present external beam RT technique of APBI through the presentation of the first case of this kind performed at the Oncology Institute of Vojvodina.

CASE REPORT

A 54-year-old woman was referred to a radiologist for regular annual breast examination at the Oncology Institute of Vojvodina. In the low-medial quadrant of the left breast ultrasound examination revealed an impalpable BI RADS 4 lesion and CORE biopsy was performed. Histology showed invasive ductal carcinoma, no other specification type, grade 3 and, after the tumor board review, the patient underwent BCS. Definitive histology was invasive ductal carcinoma, grade 2, pT1bN0 without lymphovascular invasion, hormone receptor positive and HER 2 negative, Ki-67 was 30%. five clips were placed in tumor bed. The patient decided to decline adjuvant chemotherapy and continue with anastrozole and RT as the tumor board recommended. She fulfilled all of the criteria for APBI and after signing written consent she started with preparation for external beam RT. For the reason that tumor was left-sided, medially located to be more precise, it was decided to use Active Breathing Control device (ABC, Elekta Crawley, Crawley, UK) during the treatment (Figure 1).

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Figure 1. Active breathing control device (ABC, manufacturer Elekta Crawley, Crawley, UK)

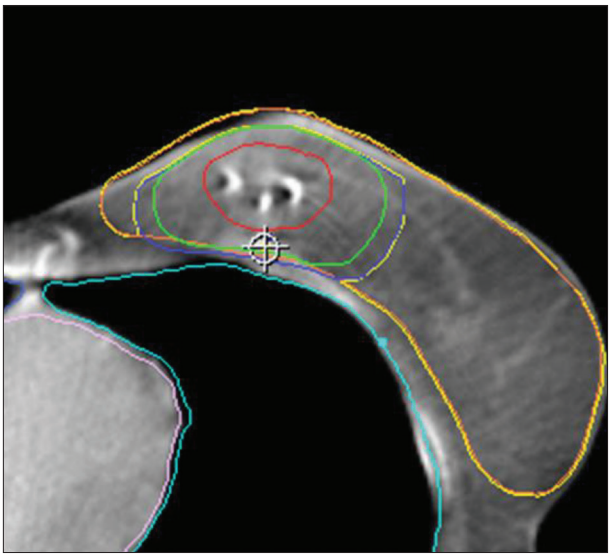


Figure 2. Target structures for accelerated partial breast irradiation: surgical cavity (red), clinical target volume (green), planning target volume (blue)

She was scanned in supination with breast immobilizing device (Wing-board, Civco Medical Instruments Co Inc., Orange City, IO, USA). Eighty percent of maximum inhale volume was used as the reference line for further radiotherapy daily treatment fractions. First step in delineation was to define surgical cavity which includes surgical clips and change in surrounding tissues. Clinical target volume (CTV) was created as expansion of 15 mm around the surgical cavity and planning target volume was created by adding a 5 mm margin to the CTV (Figure 2).

Skin, lungs, heart, and contralateral breast were contoured as organs at risk. Dose prescription was 38.5 Gy in five days (two daily fractions of 3.85 Gy) [3]. Treatment planning (volumetric arc therapy) was performed by treatment planning system Monaco v 5.11 (Elekta Crawley) by two medical physicist and dose-volume histograms was analyzed together with two radiation oncologists. All of the organs at risk received radiation doses within tolerance limits [4] (Figure 3).

Treatment was image-guided, cone beam computed tomography (CT) was performed before each fraction to ensure that target position was correct. Matching was done for bone structures and for soft tissue separately for every fraction. Up to 5 mm shift was allowed for target position and correction was automatically performed by the software XVI (Elekta Crawley), installed on the accelerator. During the treatment, radiation dermatitis grade I occurred at the third fraction in the irradiated area and afterwards the patient treated the affected skin with emulsions. Erythema persisted until the end of the treatment. Performance status of the patient was ECOG 1 (Eastern Cooperative Oncology Group) during entire treatment, and she did not experience any other complication. Two weeks after the end of therapy, irradiated breast skin was completely healed, the patient was feeling well without any

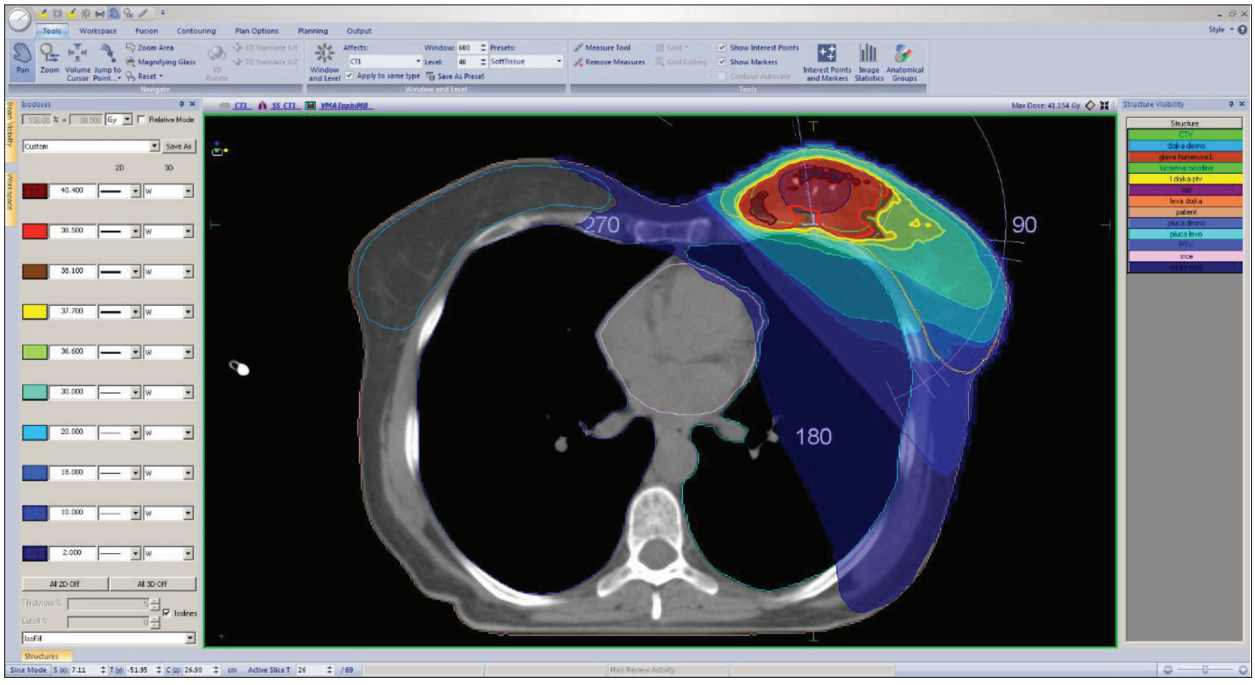


Figure 3. Dose distribution for breast and surrounding structures

health disturbances. At first follow-up, two months after radiotherapy termination, she was feeling well, without any signs of disease or complications.

DISCUSSION

During the past decades, breast cancer radiotherapy moved towards reducing treatment duration. First, START A and START B studies have showed that post-lumpectomy RT in duration of three weeks is safe and effective [7, 8]. Second, good cosmetic results were evident. These findings enabled other radiation treatment schemes. Interstitial brachytherapy was the first developed APBI technique [9]. After positive results of long term follow up studies, this technique was accepted in experienced centers as comparable to WBI in terms of efficacy and toxicity [9, 10]. Furthermore, there is a novel approach to delivery of APBI – image guided breast brachytherapy that maintains a high level of precision by using breast immobilization via breast compression and image guidance [11]. Irradiation of tumor bed immediately after surgical procedure was investigated in TARGIT A and ELIOT study [13, 14]. Due to the controversies of some aspects of these studies, intraoperative RT is not currently widely accepted.

Baglan was the first to initially describe external beam radiotherapy based APBI [14]. It can be performed as "simple" 3D RT, intensity modulated radiotherapy, volumetric arc therapy, with photons, electrons or as proton therapy. External beam APBI technique starts with identification of tumor localization before BCS inside the breast and translating this information into current imaging data set [15]. Total safety margin from tumor in all six directions should be at least 2 cm. For tumor delineation, first step is to define surgical cavity on CT scans, which includes surgical clips and change in surrounding tissues or tumor cavity according to ultrasound or magnetic resonance imaging, and second step is delineation [16, 17]. In the presented case, surgical cavity was defined using visible five clipses on CT scans.

The main advantage of external beam RT APBI is that it is non-invasive, the treatment does not depend on manual skills of the staff that performs therapy and quality assurance issues are simpler compared to brachytherapy. Dose homogeneity is better compared to brachytherapy and balloon catheter techniques. On the other hand, defining surgical cavity is a potential problem and substantial inter-observer variability of CTV delineation have been observed [18]. Surgical clips and tissue density should be main guides for delineation and to avoid inappropriate contouring. Indications for APBI changed over time, ASTRO and GEC-ESTRO recommendation were adopted in most countries, although different oncological associations come up with different selection criteria [5, 6]. Multicentric cancer makes the patient unsuitable for APBI and defining the risk for multicentric disease is essential to avoid patient selection bias. For elderly with early breast cancer APBI is a very attractive treatment option, considering the complexity of patient transport, associated comorbidities, etc. [18, 19].

Long-term outcomes of APBI were investigated by recent OCOG-RAPID and NSABP B-39/RTOG0413 trials [20, 21, 22]. Both trials demonstrated non-inferiority of APBI compared with WBI in terms of ipsilateral breast tumor recurrence rate [20, 21, 22]. These results were confirmed in Florence III trial as well [23]. In OCOG-RAPID trial acute toxicity was reduced in APBI group but late toxicity and breast cosmesis were worse. Results of other conducted trials showed that the cosmetic outcome is better in the APBI group as compared to the WBI group [25]. On the other hand, telangiectasia and mild breast fibrosis are significantly higher in the APBI group although the fibrosis related to APBI is low grade and limited to the tumor bed and does not significantly affect overall cosmetics. Actually, published randomized controlled trials have shown inconsistent outcomes [24]. Recent meta-analysis has shown that APBI compared to WBI has similar toxicity side effects and cosmetic effects [25]. Further studies are needed to confirm these findings.

Pandemic of COVID-19 virus also forced radiotherapy centers worldwide to implement shorter treatment schedules with the goal to minimize exposure for both patients and health care providers. In the light of that, APBI is a desirable option for selected patients, without inferiority in overall survival and local control of breast cancer patients [26].

In conclusion, it needs to be emphasized that APBI is a cost-effective technique. Treatment costs are reduced and the patient gets back to their normal activities sooner. Radiation oncologist should be encouraged to implement this technique, especially in low- and middle-income countries with limited resources.

Conflict of interest: None declared.

REFERENCES

1. Nacionalni vodič dobre kliničke prakse za dijagnostikovanje i lečenje raka dojke. Izdavač: Agencija za akreditaciju zdravstvenih ustanova Srbije 2013. Urednik Goran Milašinović
2. Gulstene S, Raziee H. Radiation Boost After Adjuvant Whole Breast Radiotherapy: Does Evidence Support Practice for Close Margin and Altered Fractionation? Front Oncol. 2020;10:772.
3. Stelczer G, Maror T, Meszaros N, Polgar C, Pesznyak C. External beam accelerated partial breast irradiation: dosimetric assessment of conformal and three different intensity modulated techniques. Radiol Oncol. 2019;53(1):123–30.
4. Bonfantini F, De Martin E, Giandini T, Fumagalli ML, Cavallo A, Pinzi V, et al. A Dosimetric Comparison between Three Different External Photon Beam Techniques for Accelerated Partial Breast Irradiation. Clinics in Oncology. 2018;3:1501.
5. NCCN Clinical Practice Guidelines in Oncology. Breast Cancer. Version 5.2021. June 28, 2021. Available from: https://www.nccn.org/patients
6. Correa C, Harris EE, Leonardi MC, Smith BD, Taghian AG, Thompson AM, et al. Accelerated Partial Breast Irradiation: Executive summary for the update of an ASTRO Evidence-Based Consensus Statement. Pract Radiat Oncol. 2017;7(2):73–9.

7. START Trialists' Group, Bentzen SM, Agrawal RK, Aird EG, Barrett JM, Barrett-Lee PJ, et al. The UK Standardisation of Breast Radiotherapy (START) Trial A of radiotherapy hypofractionation for treatment of early breast cancer: a randomised trial. Lancet Oncol. 2008;9(4):331–41.
8. Hopwood P, Haviland JS, Sumo G, Mills J, Bliss JM, Yarold JR, et al. Comparison of patient-reported breast, arm, and shoulder symptoms and body image after radiotherapy for early breast cancer: 5-year follow-up in the randomised Standardisation of Breast Radiotherapy (START) trials. Lancet Oncol. 2010;11(3):231–40.
9. Rodriguez-Ibarria NG, Pinar MB, Lara PC. Accelerated partial breast irradiation with interstitial multicatheter brachytherapy after breast-conserving surgery for low-risk early breast cancer. Breast. 2020;52:45–9.
10. Polgár C, Ott OJ, Hildebrandt G, Kauer-Dorner D, Knauerhase H, Major T. Late side-effects and cosmetic results of accelerated partial breast irradiation with interstitial brachytherapy versus whole-breast irradiation after breast-conserving surgery for low-risk invasive and in-situ carcinoma of the female breast: 5-year results of a randomised, controlled, phase 3 trial. Lancet Oncol. 2017;18(2):259–68.
11. Hepel JT, Leonard KL, Sha S, Graves TA, Wiggins DL, Mastras D, et al. Phase 2 Trial of Accelerated Partial Breast Irradiation (APBI) Using Noninvasive Image Guided Breast Brachytherapy (NIBB). Int J Radiat Oncol Biol Phys. 2020;108(5):1143–9.
12. Holmes DR, Baum M, Joseph D. The TARGIT trial: targeted intraoperative radiation therapy versus conventional postoperative whole-breast radiotherapy after breast-conserving surgery for the management of early-stage invasive breast cancer (a trial update). Am J Surg. 2007;194(4):507–10.
13. Veronesi U, Orecchia R, Maisonneuve P, Viale G, Rotmensz N, Sangalli C, et al. Intraoperative radiotherapy versus external radiotherapy for early breast cancer (ELIOT): a randomised controlled equivalence trial. Lancet Oncol. 2013;14(13):1269–77.
14. Yan L, Lin S, Xiaodong W, Yu S, Renming Z, Pixian S, et al. Long-Term Results of Partial Breast Irradiation After Breast-Conserving Surgery for Early Stage Breast Cancer: A Prospective Phase II Trial in China. Front Oncol. 2020;20:1803.
15. Strnad V, Major T, Polgar C, Lotter M, Guinot JL, Gutierrez Miguelez C, et al. ESTRO-ACROP guideline: Interstitial multi-catheter breast brachytherapy as Accelerated Partial Breast Irradiation alone or as boost – GEC-ESTRO Breast Cancer Working Group practical recommendations. Radiother Oncol. 2018;128(3):411–20.
16. Coles CE, Griffin CL, Kirby AM, Titley J, Agrawal RK, Alhasso A, et al. Partial-breast radiotherapy after breast conservation surgery for patients with early breast cancer (UK IMPORT LOW trial): 5-year results from a multicentre, randomised, controlled, phase 3, non-inferiority trial. Lancet. 2017;390(10099):1048–60.
17. Yu T, Li Y, Wang W, Li F, Wang J, Xu M, et al. Interobserver Variability of Target Volumes Delineated in the Supine and Prone Positions Based on Computed Tomography Images for External-Beam Partial Breast Irradiation After Breast-Conserving Surgery: A Comparative Study. Front Oncol. 2020;10:323.
18. Hannoun-Lévi JM, Lam Cham Kee D, Gal J, Schiappa R, Hannoun A, Fouche Y, et al. Accelerated partial breast irradiation in the elderly: 5-Year results of the single fraction elderly breast irradiation (SiFEBI) phase I/II trial. Brachytherapy. 2020;19(1):90–6.
19. Tagliaferri L, Lancellotta V, Colloca G, Marazzi F, Masiello V, Garganese G, et al. Could a Personalized Strategy Using Accelerated Partial Breast Irradiation be an Advantage for Elderly Patients? A Systematic Review of the Literature and Multidisciplinary Opinion. J Oncol. 2020;2020:3928976.
20. Whelan TJ, Julian JA, Berrang TS, Kim DH, Germain I, Nichol AM, et al. External beam accelerated partial breast irradiation versus whole breast irradiation after breast conserving surgery in women with ductal carcinoma in situ and node-negative breast cancer (RAPID): a randomised controlled trial. Lancet. 2019;394(10215):2165–72.
21. White JR, Winter K, Cecchini RS, Vicini FA, Arthur DW, Kuske RR, et al. Cosmetic outcome from post lumpectomy whole breast irradiation (WBI) versus partial breast irradiation (PBI) on the NRG Oncology/NSABP B39-RTOG 0413 Phase III clinical trial. IJROBP. 2019;105(1):S1–S3.
22. Goldberg M, Whelan TJ. Accelerated Partial Breast Irradiation (APBI): Where Are We Now? Curr Breast Cancer Rep. 2020;12(4):275–84.
23. Meattini I, Marrazzo L, Saieva C, Desideri I, Scotti V, Simontacchi G, et al. Accelerated Partial-Breast Irradiation Compared With Whole-Breast Irradiation for Early Breast Cancer: Long-Term Results of the Randomized Phase III APBI-IMRT-Florence Trial. J Clin Oncol. 2020:38(35):4175–83.
24. Haussmann J, Budach W, Strnad V, Corradini S, Krug D, Schmidt L, et al. Comparing Local and Systemic Control between Partial- and Whole-Breast Radiotherapy in Low-Risk Breast Cancer-A Meta-Analysis of Randomized Trials. Cancers. 2021;13(12):2967.
25. Liu G, Dong Z, Huang B, Liu Y, Tang Y, Li Q, et al. Efficacy and safety of accelerated partial breast irradiation: a meta-analysis of published randomized studies. Oncotarget. 2017;8(35):59581–91.
26. Al-Rashdan A, Roumeliotis M, Quirk S, Grendarova P, Phan T, Cao J, et al. Adapting Radiation Therapy Treatments for Patients with Breast Cancer During the COVID-19 Pandemic: Hypo-Fractionation and Accelerated Partial Breast Irradiation to Address World Health Organization Recommendations. Adv Radiat Oncol. 2020;5(4):575–6.

Имплементација акцелерисане парцијалне ирадијације дојке у Институту за онкологију Војводине

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САЖЕТАК

Увод Поштедна операција дојке уз радиотерапију је стандардни приступ у лечењу раног карцинома дојке. До сада је најчешће била примењивана ирадијација целе дојке, међутим, све више је у употреби акцелерисана парцијална ирадијација, која је показала бројне предности код селектованих пацијената.

Циљ овог рада је приказ имплементација акцелерисане парцијалне ирадијације дојке у Институту за онкологију Војводине.

Приказ болесника Код 54-годишње жене је индикована радиотерапија дојке након поштедне операције. С обзиром на то да је испунила све критеријуме, одлучено је да се спроведе акцелерисана парцијална ирадијација дојке са дозом 38,5 греја у 10 фракција. У току радиотерапије свакодневно је коришћена активна контрола дисања помоћу уређаја и компјутеризована томографија купастим пољем ради контроле позиције мете. Болесница је завршила терапију у добром општем стању, са јединим нежељеним ефектом у виду благог радијационог дерматитиса ирадиране регије. На првој контроли није имала ниједан симптом или знак болести, нити компликацију.

Закључак Акцелерисана парцијална ирадијација дојке је безбедна и ефикасна. Радијационим онколозима се препоручује имплементација ове технике.

Кључне речи: карцином дојке; радиотерапија; акцелерисана парцијална ирадијација дојке