

3-D conformal photon boost in the treatment of early stage breast cancer: acute and late toxicity profile

Gabor Toller

University of Kaposvar, Health Center, Department of Diagnostics and Oncoradiology

Summary

In the treatment of early stage breast cancer, breast conserving surgery (BCS) followed by whole breast irradiation (WBI) is the standard treatment. In this paper we demonstrate our 2 year follow up results of 3D conformal photon boost technique focusing on acute and late side effect profile of this treatment modality. Between January 2004 and July 2008, 128 early stage (Stage I-II) breast cancer patients were enrolled in this study. All patients received whole breast irradiation (WBI, 50.4 Gy in 28 fractions) after breast conserving surgery. Following WBI, 3-D conformal photon boost was delivered (10-16 Gy in 5-8 fractions) for all patients. Acute and late side effect profile (acute skin reaction, fibrosis, fat necrosis and cosmetic outcome) was recorded and studied. The mean follow up time was 24 months (median: 25, range: 12-71, SD: 3). For side effect analysis the RTOG/EORTC system was used. Cosmetic results were assessed using the Harvard criteria. During the treatment the majority of the patients (104/128- 81%) complained of acute dermatitis. Only 16 cases of them were classified as grade II radiodermatitis. There was no need to make treatment switch because of these side effects, skin reactions were controlled by conservative supportation. In 32 cases (25%) asymptomatic grade I breast fibrosis, in 12 cases (9.35%) asymptomatic breast fat necrosis were registered. In case of the 3 Grade II breast fibrosis patients complained about "mass feeling" in their breasts. For 14 patients (18.2%) asymptomatic lung fibrosis (no clinical presentation) was recorded on the control CT scans. 3D conformal photon boost gives the clinician the opportunity to reach good clinical outcome with a comparable side effect profile and good cosmetic results compared to other boost techniques.

Keywords: breast cancer, radiotherapy, 3-D conformal photon boost, side effect

3-D konformális foton boost kezelés a korai emlőrák komplex terápiájában: akut és késői mellékhatás profil

Összefoglalás

A korai emlőrákok modern komplex kezelésében az emlőmegtartó műtéteket (breast conserving surgery-BCS) követő teljes emlőbesugárzás (whole breast irradiation- WBI) napjainkban gold standard kezelés. Munkánkban az Intézetünkben rutinszerűen alkalmazott tumorágy kiegészítő boost kezelésével foglalkozunk. 2 éves követési periódust vizsgálunk kiemelten fókuszálva a kezelés melletti akut és késői mellékhatás profilra. 2004 január és 2008 július között 128 Intézetünkben kezelésben részesülő korai emlőrákos (Stage I-II) beteget vontunk be vizsgálatunkba. Minden beteg emlőmegtartó műtétben, majd teljes emlőbesugárzásban (3D tervezés alapján 50,4Gy összdózisú WBI) részesült. Ezt követően minden betegnél a tumorágy boost kezelését 3-D konformális foton technikával végeztük el (10-16 Gy, 5-8 frakcióban). Betegeinknél az akut és késői mellékhatásokat (bőrreakciók, fibrosis, zsírnecrosis, kozmetikai eredmény) regisztráltuk, és elemeztük. Az átlagos követési idő 24 hónap volt (median: 25, range: 12-71, SD: 3). A mellékhatások felmérésére, gradálására az RTOG/EORTC rendszert, a kozmetikai eredmények kiértékelésére a Harvard kritériumokat használtuk. A kezelés ideje alatt a betegek döntő többsége akut dermatitissel számolt be (104/128- 81%). Ezek közül csupán 16 esetet értékelünk Grade II-es elváltozásnak. A bőrelváltozások miatt kezelést felfüggeszteni nem kellett, konzervatív kezelés mellett a tünetek uralhatóak voltak. A hosszútávú követés során 32 esetben (25%) tünetmentes, grade I emlő fibrózist, 12 esetben (9.35%) tünetmentes zsírnekrózist regisztráltunk. 3 esetben Grade II emlőfibrózist tapasztaltunk, a betegek "tömeges emlőállományról" számoltak be. 14 esetben (18.2%) tünetmentes tüdőfibrózist írt le a kontroll CT. Az Intézetünkben rutinszerűen használt 3D konformális foton boost kezelés lehetővé teszi megfelelő klinikai eredmények elérését jó mellékhatásprofil mellett. Eredményeink abszolút összevethetőek az irodalomban leírt eltérő technikák mellékhatás profiljával.

Kulcsszavak: emlőrák, sugárterápia, 3-D konformális foton boost, mellékhatás

References

1. Bartelink H, Horiot JC, Poortmans P, et al. Recurrence rates after treatment of breast cancer with standard radiotherapy with or without additional radiation. *N Engl J Med* 2001;345:1378–1387.
2. Bates A, Swift C, Kwa W, Moravan V, Aquino-Parsons. A computed tomography-based protocol vs conventional clinical mark-up for breast electron boost. *Clin Oncol* 2007; 19: 349-355.
3. Bedwinek J. Breast conserving surgery and irradiation: the importance of demarcating the excision cavity with surgical clips. *Int J Radiat Oncol Biol Phys* 1993;26:675–9.
4. Denham JW, Sillar RW, Clarke D. Boost dosage to the excision site following conservative surgery for breast cancer: it's easy to miss!. *Clin Oncol* 1991;3:257–61.
5. Denham JW, Carter ML. Conservative treatment of breast cancer-where should the booster dose go [letter]? *Int J Radiat Oncol Biol Phys* 1988;14:399–400.
6. Early Breast Cancer Trialists' Collaborative Group. Effects of radiotherapy and surgery in early breast cancer: an overview of the randomized trials. *N Engl J Med* 1995;333:1444-1445 [erratum, *N Engl J Med* 1996;334:1003].
7. Fisher B, Anderson S, Bryant J, et al. Twenty-year follow-up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer. *N Engl J Med* 2002;347:1233–1241.
8. Goldberg H, Proznitz RG, Olson JA, et al. Definition of post-lumpectomy tumor bed for radiotherapy boost field planning: CT versus surgical clips. *Int. J. Radiat. Oncol. Phys.* 2005; 63:209-213.
9. Graham P, Fourquet A. Placing the Boost in Breast-conservation Radiotherapy: A Review of the Role, Indications and Techniques for Breast-boost Radiotherapy *Clin Oncol* 2005;18:210-219.
10. Harrington KJ, Harrison M, Bayle P, et al. Surgical clips in planning the electron boost in breast cancer: a qualitative and quantitative evaluation. *Int J Radiat Oncol Biol Phys.* 1996;34:579–84.
11. Hunter MA, McFall TA, Hehr KA. Breast conserving surgery for primary breast cancer: necessity for surgical clips to define the tumor bed for radiation planning. *Radiology* 1996;200:281–2.
12. International Commission on Radiation Units and Measurement (ICRU). ICRU Report No. 50. Prescribing, recording and reporting photon beam therapy. Washington, DC: ICRU;1993.
13. Kovacs A, Hadjiev J, Lakosi F et al. Comparison of photon with electron boost in treatment of early stage breast cancer. *Pathol. Oncol. Res.* 2008; 14: 193-197.
14. Kovner F, Agay R, Merimsky O, Stadler J, Klausner J, Inbar M. Clips and scar as the guidelines for breast radiation boost after lumpectomy. *Eur J Surg Oncol* 1999;25:483–6.
15. Machtay M, Lanciano R, Hoffman J, Hanks GE. Inaccuracies in using the lumpectomy scar for planning electron boosts in primary breast carcinoma. *Int J Radiat Oncol Biol Phys* 1994;30:43–8.
16. Polgar Cs, Fodor J, Major T, Orosz Zs, Nemeth Gy. The Role of Boost Irradiation in the Conservative Treatment of Stage I-II Breast Cancer. *Pathol Oncol Res.* Vol 7, Nr 4, 241-250, 2001.
17. Poortmans P, Bartelink H, Horiot J-C, Struikmans H, Van den Bogaert W, Fourquet A, Jager J, Hoogenraadh W, Rodrigusa P, Rodenhuis C.W, Collette L, Pierartj M, On behalf of the EORTC Radiotherapy and Breast Cancer Groups. The influence of the boost technique on local control in breast-conserving treatment in the EORTC 'boost versus no boost' randomized trial. *Radiother Oncol* 2004;72:25–33.
18. Regine WF, Ayyangar KM, Komarnicky LT, Bhandare N, Mansfield CM. Computer-CT planning of the electron boost in definitive breast irradiation. *Int J Radiat Oncol Biol Phys* 1991;20:121–5.
19. Kovacs A, Lakosi F, Liposits G, Toller G, Hadjiev J, Vandulek Cs, Walter N, Glavak Cs, Antal G, Horvath A*, Repa I, Bogner P. 3-D conformal photon boost in the treatment of early stage breast cancer: four year follow up results. *Pathol. Oncol. Res.* 2010 Apr 11. [Epub ahead of print]
20. Romestaing P, Lehingue Y, Carrie C, et al. Role of a 10 Gy boost in the conservative treatment of early breast cancer: results of a randomized clinical trial in Lyon, France. *J Clin Oncol* 1997;15:963–8.
21. Smitt MC, Birdwell RL, Goffinet DR. Breast electron boost planning: comparison of CT and US. *Radiology* 2001;219:203–6.
22. Van Limbergen E: What are the optimal boost methods in relation to boost target depth in the breast? *Proceedings of the Consensus Meeting on Breast Cancer: To boost or not to boost and how to do it. GEC-ESTRO, 2001, pp. 105-114.*
23. Veronesi U, Cascinelli N, Mariani L, et al. Twenty-year follow-up of a randomized study comparing breast-conserving surgery with radical mastectomy for early breast cancer. *N Engl J Med* 2002;347:1227–1232.
24. Vrieling C, Collette L, Fourquet A et al. The Influence of the Boost in Breast-Conserving Therapy on Cosmetic Outcome in the EORTC "Boost versus No Boost" Trial. *Int. J. Radiat. Oncol. Biol. Phys.* 1999; 45:677-685.
25. Vrieling C, Collette L, Fourquet A et al. The influence of patient, tumor, and treatment factors on the cosmetic results after breastconserving therapy in the EORTC "Boost versus No Boost" Trial. *Radiother. Oncol.* 2000; 55:219-232.
26. Weed DW, Yan D, Martinez AA, Vicini FA, Wilkinson TJ, Wong J. The validity of surgical clips as a radiographic surrogate for the lumpectomy cavity in image-guided accelerated partial breast irradiation. *Int. J. Radiat. Oncol. Biol. Phys.* 2004; 60: 484-492.
27. Lovey K, Fodor J, Major T et al. Fat necrosis after partial-breast irradiation with brachytherapy or electron irradiation versus standard whole-breast radiotherapy- 4 year results of a randomized trial. *Int. J. Radiat. Oncol. Biol. Phys.* 2007; 69 (3):724–731.
28. Cox JD, Stetz J, Pajak TF. Toxicity criteria of the Radiation Therapy Oncology Group (RTOG) and the European Organization for Research and Treatment of Cancer (EORTC). *Int J Radiat Oncol Biol Phys* 1995;31:1341–1346.
29. Harris J, Levine M, Svensson G, et al. Analysis of cosmetic results following primary radiation therapy for stage I and II carcinoma of the breast. *Int. J. Radiat. Oncol. Biol. Phys.* 1979;5:257-61.
30. Kovacs A, Hadjiev J, Lakosi F, Cselik Zs, Glavak Cs, Antal G, Bogner P, Repa I. Comparison of photon with electron boost in treatment of early breast cancer. *Radiotherapy & Oncology*, 2006;81:Supplement 1.
31. Horvath G, Tizedes Gy, Kalman E, Szalai G, Köver E, Faluhelyi Zs, Dank M, Lakosi F, Kovacs A, Hadjiev J. Single plane implant results in the boost irradiation of early breast cancer. *Radiotherapy & Oncology*, 2005;75:Supplement 1.