Volume : 5 | Issue : 9 | September 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

Original Research Paper

Role of Imrt in Early Breast Cancer

Medical Science

KEYWORDS : breast cancer, imrt, dosimetry

*** RITUSHA MISHRA** SENIOR RESIDENT,DEPARTMENT OF RADIOTHERAPY AND RADIATION MEDICINE,INSTITUTE OF MEDICAL SCIENCES, BANARAS HINDU UNIVERSITY,VARANASI,U.P. * CORRESSPONDING AUTHOR

HIMANSHU MISHRA SENIOR RESIDENT,DEPARTMENT OF RADIATION ONCOLOGY,DR RAM MANOHAR LOHIA INSTITUTE OF MEDICAL SCIENCES,LUCKNOW

ABSTRACT

The main objective of intensity modulated radiation therapy (IMRT) when used at any site is to allow maximal sparing of the adjacent normal structures while attempting for dose escalation when required. In breast cancer IMRT is being used for two main reasons; the first is to provide a better dose homogeneity and secondly to limit dose to adjacent normal structures. Patients with larger breasts are more likely to benefit from IMRT. It has also been utilised for left-sided breast cancers to decrease cardiac dose; deep seated tumor bed or re-irradiation. Multiple studies have addressed the role of IMRT in early breast cancer after breast conserving surgery. All studies report decreased incidence of acute toxicities which theoretically may translate into decreased skin fibrosis and telangiectasia. The follow-up of these studies is too short to assess the tumour control and the quality of life.

Role of IMRT in early breast cancer

Radiation therapy after breast conserving surgery is the standard of care for patients with early stage breast cancer. The most commonly implemented plan uses two opposing tangential fields targeting entire breast or chest wall while attempting to minimize dose to the underlying lung within the treatment portals. The goal of IMRT when used at any site is the maximal sparing of the adjacent normal structures and to allow for dose escalation if required. In breast cancer IMRT is being used for two main reasons; the first is to provide a better dose homogeneity and secondly to limit dose to adjacent normal structures, lung and heart. Patients with larger breasts are more likely to have dose inhomogeneities and most likely to benefit from IMRT. It can also be utilised for left-sided breast cancers to decrease cardiac dose; deep seated tumor bed or re-irradiation.

There are multiple studies reporting the acute radiation toxicity of IMRT . Vicini et al[1] reported a study of breast IMRT on 281 patients and demonstrated a reduction in acute skin reactions. The median breast volume receiving 110% of the prescribed dose was 0% . 56%patients experienced RTOG Grade 0 or I acute skin toxicity; 43% developed Grade II and only 1% experienced Grade III toxicity. The cosmetic results at 12 months was good/excellent in 99% patients. No skin telengiectasias, significant fibrosis, or persistent breast pain was noted. McDonald et al[2] reported cohort analysis on outcomes of IMRT (n = 121) and conventional RT (3D RT) (n = 124). The median dose to the whole breast was 50 Gy. IMRT resulted in reduced Grade 2 or 3 dermatitis compared with conventional RT (39% vs 52%, P = 0.047) at a median follow-up of 6.3 years. Harsolia et al[3] reported that the use of IMRT resulted in significantly less acute grade 2 or more toxicity for dermatitis (41% vs 85%, P < 0.001), breast edema (1% vs 28%, P < 0.001), and hyperpigmentation (5% vs 50%, P < 0.001), as compared to patients treated with conventional RT at a median follow-up of 4.7 years. Freedman et al[4] studied a matched-pair analysis of 131 patients who were treated using either breast IMRT or 2D wedge-based RT and found a significant reduction in the rate of acute skin toxicity using IMRT compared with the wedge-based treatment. Morganti et al[5] found that skin-related acute toxicites were reduced when standard wedged technique was compared to IMRT technique (P < 0.05), despite with a lower total dose in the IMRT group. Also IMRT technique allowed better PTV coverage and reduced overall treatment time . Barnett et al[6] reported the randomized trial demonstrating no significant difference in the incidence of any acute toxicity and development of any photographically assessed breast shrinkage between the IMRT or standard RT groups .

There have been four large randomized trials that addressed the role of IMRT. Pignol et al[7]reported the results of a multi-centeric phase III trial in which 358 patients were randomly assigned to receive either breast IMRT or a standard wedge compensation treatment post breast conservation surgery. The primary end points of the study were intensity of acute skin reaction or pain using the National Cancer Institute Common Toxicity Criteria (NCI CTC) version 2.0 and the occurrence of moist desquamation. Breast IMRT significantly improved the dose distribution compared with standard wedged fields. lMRT significantly reduced proportion of patients experiencing moist desquamation with an absolute reduction of 16.6% (p=.002). The use of breast IMRT (p =.003) and smaller breast size (p =.001) were two factors found on multivariate analysis significantly associated with a decreased risk of moist desquamation. The use of IMRT did not correlate with pain and quality of life.

Donovan et al [8] randomized 306 patients after BCS to two groups; standard 2D wedge-based RT or to IMRT. All were treated to a dose of 50 Gy in 25 fractions to whole breast followed by a 10-Gy boost to the lumpectomy cavity with electron beam. Forward-planned IMRT significantly reduced dose inhomogeneity compared to standard wedge-based plans (19% vs 92%). The conventional arm patients were 1.7 times more likely to have a change in breast appearance than the IMRT arm patients when evaluated using photographic assessment at 1, 2, and 5 years follow-up. However, there were no significant differences in outcome between two groups in any of other parameters, including hardness , discomfort ,breast pain, body image, or QOL. Barnett et al[6] randomized 815 patients of early stage breast cancer to either standard wedged-based tangential fields or IMRT. All patients were treated to a dose of 40 Gy in 15 fractions. The patients in the standard RT group were more likely to develop telangiectasia than those in the IMRT group at follow-up of 2 years. In patients who had good baseline surgical cosmesis, those randomized to IMRT were less likely to deteriorate to a moderate or poor overall cosmesis than those in the standard RT group. Mukesh et al[9] analysed tangential plans of 1,145 patients; 815 patients had inhomogeneous plans and were then randomly assigned to standard radiotherapy (RT) or

Volume : 5 | Issue : 9 | September 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

replanned with simple IMRT. Breast tissue toxicities were assessed at 5 years by photographically and clinically .It was observed that fewer patients in the simple IMRT group developed suboptimal overall cosmesis and skin telangiectasia. No difference was observed for breast shrinkage, breast edema, tumor bed induration, or pigmentation.

IMRT has also been explored as a measure to reduce cardiac doses in the treatment of left sided breast cancer. Active Breathing Control enables a decrease of cardiac and Left Anterior Descending (LAD) coronary artery dose. Mast et al[10] compared 3D-CRT to IMRT treatment plans based on free-breathing (FB)and breath-hold(BH) in 20 patients .IMRT resulted in a significant decrease of dose in the heart and LAD-region in both BH and FB. Zhao et al[11] compared Volumetric arc(VMAT) to various IMRT in 11 patients. They found that IMRT plan achieved good PTV coverage and sparing of organs at risk besides for the heart and coronary artery with fewer monitor units and shorter delivery time.

Based on these studies it can be seen that utilizing IMRT, better dose homogeneity can be achieved as compared to standard two-field wedged technique; but as of now forward planning remains the method of choice to modulate beam and a reasonably good dosimetric parameters can be achieved by this method. Well conducted randomized controlled trial with a longer follow-up is required to analyse the long term tumour control and quality of life.

References

1. Vicini FA, Sharpe M, Kestin L, Martinez A et al. Optimizing breast cancer treatment efficacy with intensity-modulated radiotherapy. Int J Radiat Oncol Biol Phys 2002; 54: 1336-1344 .
2. McDonald MW, Godette KD, Butker EK, et al. Long-term outcomes of IMRT for breast cancer: a single-institution cohort analysis. Int J Radiat Oncol Biol Phys 2008; 72: 1031-1040
3. Harsolia A, Kestin L, Grills I, et al. Intensity-modulated radiotherapy results in significant decrease in clinical toxicities compared with conventional wedge-based breast radiotherapy. Int J Radiat Oncol Biol Phys 2007; 68: 1375-1380.
4. Freedman GM, Anderson PR, Li J, Eisenberg DF,et al. Intensity modulated radiatiotherapy (IMRT) decreases acute skin toxicity for women receiving radiation for breast cancer. Am J Clin Oncol 2006; 29: 66-70 .
5. Morganti AG, Cilla S, Valentini V, et al. Phase I-II studies on accelerated IMRT in breast carcinoma:technical comparison and acute toxicity in 332 patients. Radiother Oncol 2009; 90: 86-92.
6. Barnett GC, Wilkinson JS, Moody AM, et al. Randomized controlled trial of forward-planned intensity modulated radiotherapy for early breast cancer: interim results at 2 years. Int J Radiat Oncol Biol Phys 2012; 82: 715-723
7. Pignol JP, Olivotto I, Rakovitch E, et al. A multicenter randomized trial of breast intensity-modulated radiation therapy to reduce acute radiation dermatitis. J Clin Oncol 2008; 26: 2085-2092
8. Donovan E, Bleakley N, Denholm E, et al. Randomised trial of standard 2D radiotherapy (RT) versus intensity modulated radiotherapy (IMRT) in patients prescribed breast radiotherapy. RadiotherOncol 2007; 82: 254-264
9. Mukesh MB, Barnett GC, Wilkinson JS, et al. Randomized controlled trial of intensity-modulated radiotherapy for early breast cancer: 5-year results confirm superior overall cosmesis. J Clin Oncol 2013; 31: 4488-4495
10. Mirjam E. Mast ,Loes van Kempen-Harteveld,Mark W. Heijenbrok, et al .Left-sided breast cancer radiotherapy with and without breath-hold: Does IMRT reduce the cardiac dose even further? August 2013Volume 108, Issue 2, Pages 248–253.
11. Hongfu Zhao, Mingyuan He, Guanghui Cheng, et al .A comparative dosimetric study of left sided breast cancer after breast-conserving surgery treated with VMAT and IMRT. Radiation Oncology (2015) 10:231-241.