

## Cosmetic outcome with interstitial implant as part of breast conservation therapy

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### Abstract

*Factors related to cosmetic outcome in breast cancer patients treated with an interstitial implant as part of breast-conservation therapy were studied between November 2006 and July 2007. Six patients with stage II carcinoma breast, who had undergone only lumpectomy were selected for breast conservation therapy. All patients received 6 cycles of chemotherapy by interstitial implant. The dose homogeneity index (DHI) was calculated for each implant along with excision volume and variables correlated for cosmesis. The DHI was 0.7 in 5 out of 6 cases. Only one case had DHI of 0.9. The cosmetic outcome score as per scale was excellent in 3 cases (50%) and good in remaining 3 cases (50%). None of the patients had fair or poor cosmesis as per scale. All patients had completed their treatment and were disease free at the time of analysis. The range of follow up varied from 12 months to 20 months with an average of 16 months, calculated from the date of appearance of lump. To achieve optimal cosmetic outcome, DHI requires be maximized. The volume of tissue removed, however, remains the most significant determinant.*

**Key Words :** *Interstitial breast implant, dose homogeneity index, cosmetic outcome*

### Introduction

Breast-conservation therapy is the preferred method of treatment for early stage carcinoma of this organ. Survival and local control rates are comparable to those with more radical surgery[1,4]. In this method interstitial implant is used as a boost to the resection bed after standard external beam irradiation of the entire breast as part of breast conservation therapy[5,11]. Interstitial implantation alone, without whole breast irradiation, is being studied by the Radiation Therapy Oncology Group (RTOG), in an ongoing prospective trial[1-2]. The most attractive feature of breast-conservation therapy is improved psychological well-being due to a less disfiguring surgery[13]. It is the responsibility of the whole oncology team, particularly the Radiation Oncologist to apply careful technique to maximize the cosmetic outcome in breast-conservation therapy. Interstitial implantation is the preferred method to deliver a boost to the tumor bed, although an electron beam can also be used for the same. Cosmetic outcome in cases with implants are superior to

those in cases treated with electron-beam boosts with the same prescribed nominal dose[14]. In patients with implants, the cosmetic outcome is dependent not only on the technical quality of the source position but also the volume of breast tissue removed.

### Materials and Methods

From November 2006 to July 2007, six patients with stage II carcinoma breast, treated with only lumpectomy were selected for breast conservation therapy for analysis. The volume of the tumor or excised volume was determined by multiplying together the size of the tumor in all three dimensions. All patients received a total of 6 cycles of chemotherapy with 3 cycles before radiotherapy and 3 cycles after radiotherapy. Five out of 6 patient, received CAP as their chemotherapy schedule, only one patient received Taxol and Doxorubicin. External beam radiotherapy (EBRT) was given using Cobalt 60 teletherapy unit. Each patient received a dose of 50 Gy/25fraction/5 weeks. After a gap of one week of EBRT, all patients received Interstitial Implant using Iridium 92 source guided to tumor bed through needles using HDR remote after loading brachytherapy unit. A standard template along with needles were used (Fig: 1). In all cases and needles were implanted in tumor bed (Fig: 2). The planning was done using Abacus brachytherapy treatment planning system. Dosimetry was done using Paris system in each cases. A dose of 10 Gy was delivered to the central plane. The Dose Homogeneity

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Index (DHI) was calculated for each patient, which is ratio of peripheral dose to the central dose. All patient were then followed up on monthly basis. On follow up, a four tier Cosmetic Scoring 21 was used to asses cosmetic outcome in each case (Fig: 3). It was as follows: "Excellent" indicated perfect symmetry, with no visible distortion or skin changes; "Good" indicated slight skin distortion, retraction or edema, any mild telangectasia, mild hyperpigmentation, or an absent nipple-areolar complex; "Fair" indicated moderate distortion of the nipple or breast symmetry, moderate hyperpigmentation, prominent skin retraction, edema, or telangectasia; and "Poor" indicated marked distortion, edema or fibrosis. or severe hyperpigmentation.

### Results

There were total 6 patients of stage II carcinoma breast who presented after lumpectomy. All cases were histopathologically classified as infiltrating duct carcinoma. Out of these 6 cases, 1 was T<sup>2</sup> N<sup>0</sup> M<sup>0</sup>, 3 were T<sup>2</sup> N<sup>1</sup> M<sup>0</sup> and 2 were T<sup>3</sup> N<sup>0</sup> M<sup>0</sup> as per TNM classification. Thus all cases were of stage II disease. The range of age was from 40 to 60 years with 1 out of 6 patient in pre-menopausal state. The range of tumor/excision volume was from 8cm<sub>3</sub> to 120cm<sub>3</sub> with average of 43.33 cm<sub>3</sub>. The total dose by interstitial implant in all cases were 10 Gy with mean implant dose 9.88 Gy. The range of follow up was from 7 months to 12 months with average of 9.16 months when calculated from date of registration. Similarly when follow up was calculated from date of appearance of lump, it was from 12 to 20 months with average of 16 months. The dose homogeneity index (DHI) was calculated for each case. It was 0.7 in 5 out of 6 cases. Only one case has DHI of 0.9. The cosmetic outcome score as per scale[4] was excellent in 3 cases (50%) and good in remaining 3 cases (50%). None of the patient had fair or poor cosmesis as per scale. All patients have completed their treatment and are disease free at the time of analysis.



**Fig: 1** Picture showing template, needles and connecting catheters



**Fig 2:** Picture showing template along with needle insertion in progress



**Fig 3:** Picture showing patient in follow-up with normal implant site



**Fig 4:** Mammography of patient on follow up showing increase in density of breast tissue at implanted site

### Discussion

The ultimate goal of breast-conservation therapy is to achieve local control and survival rates equal to those for mastectomy while providing improved cosmetic outcome and functional results. Today in the era of organ preservation, it is very important to conserve the breast in early cases, especially in younger patients. Patients after mastectomy, go into a state of depression due to a sense of incompleteness. Any treatment, which can not only preserve the breast but also maintain its shape in acceptable form, will be welcome among these patients; provided it does not compromise the treatment outcome. A slightly scarred breast, occasionally hyper pigmented or hypo pigmented is always preferable to a flat chest wall, especially among younger women.

In breast conservation, the most important step is excision

of tumor mass. The larger the volume of the excision mass, the lesser is the outcome of cosmesis. Various authors have reported cutoff values for tumor excision volume above which cosmetic outcome was poor. Mills et al[15] and Olivotto et al[7] have reported worsening cosmetic outcome with a total excision volume greater than 70cm<sup>3</sup>, de la Rochefordiere et al[16] noted a decline with greater than 86 cm<sup>3</sup>, and Taylor et al[17] noted a decline with volumes greater than 100 cm<sup>3</sup>. In our study, only one patient had excision volume of 120 cm<sup>3</sup>. Even in this patient the cosmetic index was good, most probably due to good DHI as well as fair amount of breast tissue. An important goal of radiation treatment planning is to deliver a uniform dose to the target volume while minimizing the dose to the surrounding tissues. This is inherently difficult in brachytherapy as this method of irradiation is by default nonhomogenous, however, careful planning can minimize it. Dose uniformity or the lack thereof may have important consequences with regard to tumor control and late tissue complications. It has been hypothesized that an increase in the central dose to a target volume may lead to increased tumor necrosis and local control rates. However, increased dosage may also contribute to an increased number of late complications, particularly in the case of breast implantation, where normal breast tissue is innately a part of the target volume. An area of inhomogeneity can result in what has been termed "double trouble." Both the total dose and the dose per unit time are increased. Increasing the dose per unit time and the total dose have been shown to have consequences with regard to late normal tissue effects (i.e. cosmetic outcome)[18]. Radiation therapeutic factors have been found by other investigators to be related to breast cosmetic outcome and late tissue effects. A high dose per fraction (particularly > 2.5 Gy/d), the use of a boost, a high total target dose, and a total dose to the entire breast of more than 50 Gy have been shown to negatively affect cosmetic outcome.[19,24] These variables were not significantly correlated with cosmetic outcome in our group, since it was a homogeneous population and all patients received 50 Gy to the entire breast and a boost of 10 Gy. Also, no patients was treated with a fraction greater than 2 Gy. The technique used in EBRT was same in all cases including portals and wedges.

It was previously thought that adequate tumor control as well as good cosmesis could only be achieved if the central dose was high and peripheral dose less, in cases of interstitial implants leading to low DHI. It has now been established that the more even the dose distribution,

higher is the DHI with ultimately better cosmesis. According to Bradley et al 25 DHI of less than 0.7 produces poor cosmesis, although there is no clear cut association as a number of factors are still involved, but if DHI is kept to 0.7 and above, good cosmesis can be achieved. In our case DHI was 0.7 in 5 cases, and 0.9 in 1 case, in which the amount of tissue present at the tumor bed was less, leading to decreased travel path for source and a more homogenous dose distribution with high DHL. Due to combined effect of good DHI and low excision volume, 50% patient had excellent cosmesis (3/6) and even in the other 50% good cosmesis could be achieved as per scale enumerated in material and methods before. Although the number of cases studied is low, it still sends the message of the important role played by interstitial implant in breast conservation therapy. This modality becomes significant, as it not only provides better cosmesis but all patients in present study are disease free at the time of reporting (most of them are in second year of their follow-up).

### Conclusion

It is evident from above study that optimal cosmetic outcome depends on many variables, not the least of which is the irradiation technique. The dose uniformity of any implant is contingent on the design of that implant. We have found that cosmetic outcome is negatively affected by increased inhomogeneity and inversely related to the dose homogeneity index. The dose homogeneity index can be easily calculated for pre-and post implantation assessment. The goal of brachytherapeutic treatment planning in the breast should be to maximize the dose homogeneity index and hence maximize the probability of excellent cosmesis. Careful attention to other treatment variables, including the amount of breast tissue removed, remains very important.

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