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Laser Ablation of Multifocal Breast Carcinoma: Assessing Viability for Patients not Accepting Surgery

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Abstract

Breast carcinoma is a major public health problem in India and world. It is the no 1 cause of cancer in women in India.

The overall 5 year survival rate in western countries is over 90%. In India it drops to 40% to 60%. The various factors responsible for this include unacceptability of many women for mutilation of their breasts. Breasts being a very important feminine cosmetic benchmark.

Laser ablation of breast tumors is now a USFDA and CE approved procedure. The aim of this observational study was to observe completion of tumour ablation by intralesional laser ablation. The Ablation was performed as a single procedure in 10 women over a 7 year period. All women who consented to the procedure were in stage 3 with multifocal and/or multilocational disease. As such they were not candidates for Breast conservation surgery.

Results: All patients showed a complete necrosis of the tumour on a follow up of 2 to 7 years. The findings were confirmed on serial PET scans after 6 months and 2 years.

Conclusion: Laser Ablation is a viable procedure for patients unwilling for mastectomy in stage 3 breast cancer. The skill sets required for the procedure are new and surgeons will have to be trained for the procedure.

Keywords: Breast cancer; Stage 3 breast cancer; Laser ablation; Breast conservation surgery

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Introduction

Breast cancer is the leading cause of cancer in women in India. The breast registry shows over 100,000 cases added to the cancer patients list of breast cancer every year [1]. The overall survival rate after standard treatment depends on the age of patient, tumour histopathology, staging of tumor, hormonal status. The overall 5 year survival rate in western countries is more than 90 % while in India the overall survival rate is 40% to 60% [2]. This is abysmally low compared to western countries. One of the factors suggested was late presentation of tumour due to unacceptability of breast mutilation. Most patients if given a choice opt for BCS. However if there is a multilocational disease this is not an option. This leads to a further delay in decision making in many patients [3].

Addition of Neo adjuvant treatment gives a response rate from 12% to 30% only. Many patients develop resistance to chemotherapy during the treatment. These patients ultimately succumb to the disease much faster [1-4]. Laser ablation can downgrade the tumour very predictably from 95% to 100% based on sonography and scan findings. Ablation techniques like radiofrequency ablation have been used since 1999 for breast cancers with good results [5]. Laser ablation of Breast tumors is now a USFDA and CE approved procedure [6-8]. Many studies have demonstrated the effectiveness of Ablation procedure in necrosing the tumor. Most studies have reported satisfactory results [9-12]. This was a study to study effectiveness of the laser procedure for tumors up to 4.0 cm in a multiple, multifocal and multilocational setting where the only option is a mastectomy [3]. All these patients were not willing for a surgery and informed consent was taken for the same.

How does Laser Work

Laser ablation is a relatively new procedure. It is being increasingly used in various malignancies for ablation of cancerous tissue. Most common laser used for surgical purposes is a diode laser where the delivery medium is a glass fiber. This is a contact laser and is of 980 nm wavelength. Laser

works by burning the tissue and causing endothelial damage to blood vessels. This happens because of protein denaturation due to heat. The endothelial damage causes thrombosis in small and medium sized blood vessels and consequent retrograde thrombosis increases the effect of the laser [13,14]. Since Laser does not differentiate between various malignant cells it is extremely useful in ablating any kind of malignant cell. This can be done with a high degree of precision. With use of proper skill sets one can ablate the cancerous tissue with minimal damage to normal surrounding tissue [9].

Patients and Methods

The patients were selected over a period of 7 years

Inclusion criteria were as follows

- Tumor localized to breast
- No skin involvement
- Not more than 2 lymph nodes in Axilla
- No involvement of contralateral breast
- Multifocal and Multilocational disease in ipsilateral breast

Exclusion criteria

- Involvement of skin
- No distant metastasis on PET scan
- Prior surgery or chemotherapy or radiotherapy

The patients were counseled prior to the laser procedure and all information of BCS and mastectomy was given to them. The demography of the patients was as follows N=10 (Tables 1-4).

The tumour was localized under sonography control (Figure 1). Multiple tumors were localized and marked on overlying skin. The localization was aided by a preoperative PET scan.

18 no needle was passed under direct sonography control. The laser fiber of 980 nm 600 Micrometer was inserted through the bevel of the needle into the tumor. The tumor was laserised by passing the needle to the outer extent of the tumor and laserisation was commenced in different planes relevant to the tumor. The end result was planned to be 1.5 cm outside the boundary of the tumor (Figure 2). The lymph nodes were similarly visualized under sonography. An 18 no needle was maneuvered to the hilum and the lymph node laserised (Figure3,4).

Table 1: The demography of the patients was as follows N=10.

Premopausal	2
Post menopausal	8

Table 2: N=10.

Unilocational	1
Multilocational	9

Table 3: Tumour size collective.

<1.5 cm	1
1.5 cm to 3 cm	6
3cm to 5 cm	3

Table 4: Hormonal status.

Triple negative	1
ERPR negative	1
ERPR positive	8

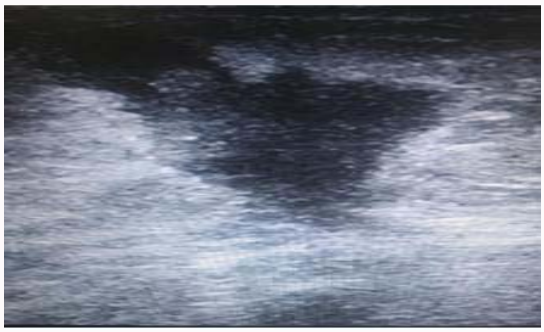

Figure 1: Pre-laser sonography picture of Ca breast hypoechoic area with speculated margins.

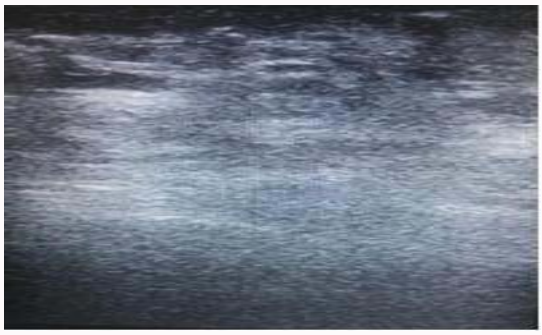

Figure 2: Hyperechoic lesion area after laserisation.

Post-laserisation the effectiveness of the laserisation was checked by hyperechogenecity of the laserised area. This area after laserisation was measured to be around 2 cm beyond the outer laserised area due to thermal damage and retrograde thrombosis (Figure 2). There was only 1 session of laserisation in all patients for the initial tumor. The patients were administered hormonal treatment for ERPR positive status and chemotherapy treatment for ERPR negative patients. No radiotherapy was given to any patient. Patients were followed up with ultrasonography of breasts for a period of 2 years on monthly basis. PET scan was administered at 3, 6 and 24 months. Recurrence was defined as incomplete laserisation of the tumour or a growth of tumor at the same site as previous tumour. New occurrence was defined as a new tumor in an area different from the original tumor (Figure 9,10).

Results

All patients had a total necrosis of tumor as seen on ultrasonography (Figure 1,2). The lymph nodes showed destruction of architecture after laserisation (Figure 3,4). PET scan showed a total resolution of tumor at 6 and 24 months (Figures 5-8). Two patients had abscess in the laserised area which was drained and healed uneventfully. These patients had a necrosis of overlying skin which healed on simple dressing. Two patients who were pre-menopausal had a new occurrence at a different site after 6 and 18 months (Figure 9,10). This was laserised again and was followed up. On follow up there was adequate necrosis of the new tumor. This is treated as a new lesion and being followed up for last 1 year and is stable.

Discussion

Surgery is the mainstay of treatment of breast cancer. It is of significance that the extent of surgery has been toned down from ultra radical mastectomies to lumpectomy. BCS is now the main treatment option in early breast cancer. Mastectomy has a very profound

Figure 3: Needle inside axillary lymph node.

Figure 4: Laserised lymph node with loss of architecture.

Figure 5: Pre laser carcinoma in left breast with lymph node.

Figure 6: Post laser 1 year complete resolution of tumor.

psychological effect on the patient. The depressive symptoms ranged from 20% to 50% in various studies [14]. Addition of lymphoedema to the arm adds to the misery. This leads to a significant decrease in QOL [15]. In addition some studies have found depression increases the spread of malignancy in post surgery depressive patients [16].

Figure 7: Pre Laser PET scan picture of multifocal carcinoma in right breast with lyymph node.

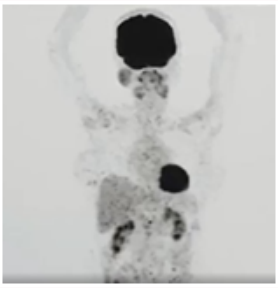

Figure 8: Post Laser after 2 years showing total resolution of the original lesion.

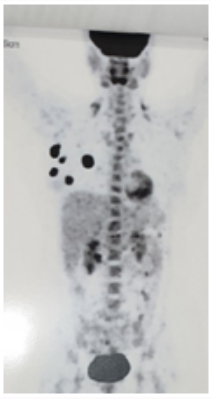

Figure 9: Multifocal and multilocational carcinoma of right breast with lymph nodes in a premenopausal woman.

These 2 side effects are postulated to be the main cause of patient reluctance and consequent late presentation of breast cancer in India. This indirectly leads to a low 5 year survival rate in Indian patients. Mastectomy has also been postulated to be the cause of tumor spread during surgery. Various studies have proposed the spread of tumour cells during surgical intervention. Surgery induces increased shedding of cancer cells into the circulation, suppresses anti-tumor immunity allowing circulating cells to survive, up regulates adhesion molecules in target organs, recruits immune cells

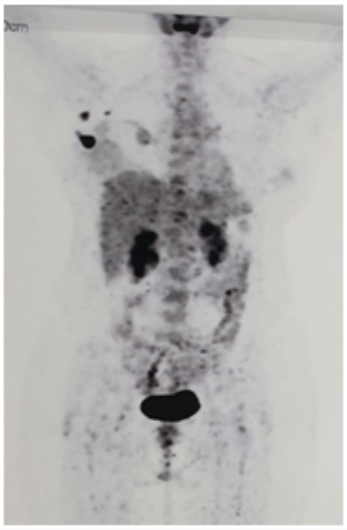

Figure 10: New occurrences with total resolution of original tumors after 8 months.

capable of entrapping tumor cells and induces changes in the target tissue and in the cancer cells themselves to enhance migration and invasion to establish at the target site. Surgical trauma induces local and systemic inflammatory responses that can also contribute to the accelerated growth of residual and micrometastatic disease [17]. In cases of advanced breast cancer this factor may be an important factor in low survival rates after mastectomy in stage 3 breast cancer. Laser ablation as discussed earlier can necrose the whole tumor without any mutilation of the breast [18]. Widespread application of this procedure should logically lead to a better survival rate among patients. In our experience there has been no spread of cancer due to laser ablation hormonal treatment is now the mainstay in ERPR positive cases. Administration of Tamoxifen and anastrozole has given a satisfactory result in all hormonal positive patients. There were 2 cases which were premenopausal and both these patients developed new occurrences at different sites. There were no recurrences in post menopausal patients. This is in keeping with studies which have shown a favourable outcome with BCS in postmenopausal patients. Studies have corroborated a greater heterogeneity in ERPR status of premenopausal women [19]. Our observation though limited corroborates a higher recurrence or new occurrence rate among premenopausal women [20-21]. The efficacy of laser procedure is maintained across all age groups for tumors which were laserised.

Conclusion

Though Surgery is the mainstay in treatment of stage 3 breast cancer, there is a significant number of patients which delay or avoid surgery due to psychological and cosmetic reasons. The laser procedure though not carried out on a routine and large scale is better than a delay in treatment or no treatment. The complete necroses of tumour make the procedure viable for the patients. Laser ablation can be offered to the as an alternative procedure as an alternative to mastectomy and BCS in early cancer. Care must be taken in premenopausal patients as the incidence of new occurrences is high. Routine monthly sonography and MRI scan should be carried out and taken care by repeated laserisation. NACT is not a very good predictable procedure and non response to chemotherapy can be fatal to patients. Laser ablation can be used in downgrading of tumour as an alternative since the procedure is predictable in decreasing the tumor load. More control studies should be carried out to compare laser ablation with BCS to assess recurrence and spread of cancer outside the breast post procedure.

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