**BREAST**

**MR imaging of the skin and nipple of the breast: differentiation between tumour recurrence and post-treatment change**

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**Abstract** Contrast-enhanced MR imaging of the breast has been found to be valuable in the assessment of local recurrence of previously treated breast cancer. We looked specifically at the appearances of the skin and nipple of the treated breast in order to describe the appearances of post-treatment change and recurrence in this region. Thirty-nine women treated for breast cancer had MR imaging of one or both breasts reviewed retrospectively with particular attention to the nipple and skin. The skin and chest wall were assessed for patients with mastectomies. All available histology of the skin and/or nipple, obtained following MR imaging, was reviewed. In patients who did not undergo surgery following MR imaging, clinical follow-up was obtained. Six of 39 cases had nodular enhancing areas seen on MR imaging, which correlated with histology demonstrating tumour recurrence within the skin and/or nipple. Of the remaining 33 patients, changes of linear or diffuse enhancement were seen in the skin and/or nipple of 15 patients. These changes were shown to be benign post-treatment changes at surgery/biopsy in 4 cases or by clinical follow-up in the remainder. In this article we demonstrate differing patterns of contrast enhancement within the skin and nipple in recurrent breast carcinoma vs post-treatment changes. This suggests that contrast-enhanced MR imaging of the breast may be a useful tool in differentiating tumour recurrence from post-treatment changes within the skin and nipple.

**Keywords** MR imaging of breast · Breast neoplasm · Skin disease · Recurrent disease · Nipple

**Introduction**

Loco-regional tumour recurrence may occur in the breast parenchyma, skin, nipple, or in lymph nodes. With the widespread practice of breast conserving surgery, early detection of local recurrence has gained importance in order to optimise local control and reduce morbidity and mortality [1, 2]. Recurrent disease must be distinguished from the background of treatment changes due to radiotherapy and/or surgery [3, 4, 5, 6, 7].

Skin recurrence is uncommon [8, 9, 10]. In a large North American study of 1030 women undergoing breast conservation surgery, 65 patients developed local tumour recurrence and of these only 7 patients had skin involvement and 7 dermal lymphatic invasion [10]. Skin recurrence without concurrent parenchymal recurrence is very rare but is associated with a poorer prognosis than other local recurrence. In 1624 patients treated with breast conservation therapy, 1.1% developed isolated skin recurrence (a total of 8% of all tumour recurrences) [9]. This subset of patients went on to develop distant metastases and uncontrolled local disease more frequently than the reference group. Local recurrence with skin involvement has been shown to be a predictor for distant metastases in patients with invasive local recurrence [10]. The skin and nipple are difficult
areas to assess using mammography or ultrasound. The MR imaging appearances of the normal nipple and the nipple involved by primary tumour have been described by our group [8]. The appearances of breast parenchymal recurrence on MR imaging of the breast have been described extensively [2, 6, 7]. A series describing the appearances of recurrent disease in the skin and/or nipple of the treated breast has not been reported previously.

In this study we retrospectively reviewed a series of patients with treated breast cancer who had undergone MR imaging of the breast because of a high clinical suspicion for recurrent disease. We attempted to identify the skin and nipple changes that occur secondary to treatment, and to distinguish these changes from recurrent tumour/metastases.

**Patients and methods**

An imaging database (from September 1994 to September 1997) was searched for patients with treated breast cancer who had received radiotherapy as part of their treatment and who had undergone MR imaging of the breast. All patients were referred from the radiotherapy or surgical outpatient clinics following clinical and X-ray mammography review, either because of high clinical suspicion of recurrence or because the changes seen on X-ray mammography were equivocal.

Thirty-nine women (age range 33–81 years, median age 50 years) with treated primary breast cancer were assessed. The histological type of the original tumour was available in 36 of 39 women; 29 had invasive ductal carcinoma, 2 had invasive lobular cancer, 4 had ductal carcinoma in situ only and 1 patient had a mucinous carcinoma. The original histology was not available in 3 patients who had undergone their initial therapy elsewhere.

Thirty-three women had been treated with wide local excision (WLE) and radiotherapy, 2 by radiotherapy and chemotherapy alone and 4 by mastectomy and radiotherapy including 1 patient with bilateral breast prostheses following bilateral breast cancer surgery.

The interval between surgery and MR imaging of the breast \( (n = 37) \) ranged from 1 to 11 years with a median of 4 years. The interval between completion of radiotherapy and MR imaging of the breast \( (n = 39) \) ranged from 4 months to 11 years, median 4 years.

**Contrast-enhanced MR imaging technique**

All patients were scanned in the transverse plane on a 1-T (Magnetom 42SP) or 1.5-T (Magnetom) MRI system (Siemens, Erlangen, Germany), using a dedicated receive-only double breast coil.

A T1-weighted, 3D fast low-angle shot (FLASH) sequence was used before and after injection of intravenous gadolinium DTPA (Magnevist, Schering, Berlin, Germany) at a dose of 0.1 mmol/kg. The scan parameters for the 1- and 1.5-T scans were: TR/TE/acquisition time/FA/FOV/matrix/NEX/effective slice thickness \((= 18 \text{ ms}/7 \text{ ms}/3.5 \text{ ms}/40^\circ/410/128 \times 256/3/ < 2 \text{ mm})\) and \((= 8.1 \text{ ms}/4 \text{ ms}/3.1 \text{ ms}/40^\circ/410/192 \times 256/3/ < 2 \text{ mm})\), respectively. Some patients scanned later in the series on the 1.5-T system also underwent “dynamic scanning” [5], but only the peak post-contrast images (judged by visually assessing the images) were used for the purposes of this study. Images obtained prior to and after contrast agent injection and subtracted images were reviewed. Images performed later in the series on the 1.5-T scanner were subtracted using software on the manufacturer’s console and this was routinely hard copied and reviewed. Both breasts were examined unless the patient had undergone mastectomy, in which case the scar and overlying skin were assessed.

**Fig. 1** Transverse T1-weighted MR images a pre- and b post Gd-DTPA in a 78-year-old woman who had undergone a mastectomy and radiotherapy 3 years previously enhancement show a 20-mm enhancing mass in the retromammary fat invading the skin. c Histology confirms recurrent tumour invading skin