CASE REPORT

Use of magnetic resonance imaging for detecting clinically and mammographically occult ductal carcinoma in situ

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We report on two cases where breast magnetic resonance imaging examination changed clinical management. Breast magnetic resonance imaging is now recognised as an indispensable adjunctive examination to mammography and ultrasound. In each of the two cases described, breast magnetic resonance imaging revealed unsuspected, extensive, and mammographically and ultrasonologically occult, ductal carcinoma in situ. In each of these cases, planned breast conserving surgery was changed to mastectomy. The success of breast conservation treatment depends on removal of all tumour with clear margins at the time of surgery. Magnetic resonance imaging is now considered the most sensitive method for evaluating the extent of breast cancer. Breast magnetic resonance imaging has a very high sensitivity for invasive carcinoma (near 100%), and recent studies show its specificity in high-risk patients is between 93 and 99%. Magnetic resonance imaging may well be proven an important adjunctive examination in patients who have dense breasts or extensive fibrocystic change.

Introduction

Although breast magnetic resonance imaging (MRI) has been available for over a decade, it has only recently become recognised as an indispensable adjunct to examination of the breast, after mammography and ultrasound. Several key factors contribute to this. Firstly, the breast MRI protocol is approaching standardisation. Secondly, high-resolution images are now routinely obtained using 1.5 Tesla and especially so using 3 Tesla scanners. Thirdly, MRI breast biopsy devices are now commercially available. Most breast MRI examinations are completed in 30 minutes. Since November 2005, we have been doing breast MRI examinations using a 3 Tesla MRI scanner. 3 Tesla imaging gives increased signal to noise compared with 1.5 Tesla scanners. In addition, 3 Tesla MRI scanners perform well in tandem with other imaging techniques, yielding very high-resolution images without increasing the scan time.

Case reports

Case 1

A 52-year-old woman first noticed some thickening in the upper outer quadrant of her left breast in 2003. A mammogram and an ultrasound performed at that time were normal. Increasing density was noted in May 2005 but an ultrasound showed no particular masses. In November 2006 she had a repeat mammogram that showed two areas of architectural distortion in the upper quadrant (Fig 1a). This finding could not be seen on the craniocaudal projection of the mammogram. The breast ultrasound was entirely normal (Fig 1b). A physical examination showed mild thickening at 2 o'clock on the left breast. A fine needle aspiration of the thickening, however, yielded cancer cells. A core needle biopsy confirmed invasive ductal carcinoma. Magnetic resonance imaging was performed to seek the exact location and extent of disease since the mammographic abnormalities were seen on one view only and the ultrasound was not informative. The MRI scan showed two spiculated masses in the upper outer quadrant corresponding to the areas of architectural distortion on the mammogram (Fig 1c). These masses measured 0.7 x 1.5 x 1.3 cm and 0.8 x 1.5 x 1 cm. A signal intensity-time graph looking at the uptake of contrast showed rapid uptake of contrast with washout in lesion 1 and rapid uptake of contrast with a plateau in lesion 2. These features are diagnostic for carcinoma.

Apart from these two lesions, the MRI scan showed a large segmental area with nodular and linear clumped enhancement throughout the lower quadrant of the left breast. These findings are compatible with extensive ductal carcinoma in situ (DCIS) with

Key words
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應用核磁共振造影偵測在臨床上和鉬靶X線檢測中隱匿的乳腺導管原位癌

本文報告關於乳房核磁共振造影檢查改變了臨床的治療措施的兩個病例。乳房核磁共振造影現已公認為是鉬靶X線和高頻超聲之外所必須進行的聯合檢查。兩案例中，乳房核磁共振造影確定了大片的乳腺導管原位癌，在鉬靶X線和高頻超聲檢查時卻發現不到。原本計劃的保乳手術治療改為乳房切除術，因為保乳手術能否成功在乎手術時能否把界線清晰的腫瘤完全切除。核磁共振造影目前已獲公認為是評估乳癌範圍最有效的方法，而乳房核磁共振造影對浸潤癌的檢查尤其高效（接近100%），最近的研究發現它對高危病者的針對度高達93至99%。對乳房腺體致密或有廣泛纖維囊性變的病者，核磁共振造影亦已證實為一種十分重要的聯合檢查項目。

and without an invasive component (Fig 1d). Because of the extensive and multicentric disease seen on MRI, the initially planned breast conserving surgery was switched to mastectomy. The patient underwent a left skin-sparing total mastectomy, with a sentinel node biopsy, axillary dissection and immediate breast reconstruction with transverse rectus abdominis myocutaneous (TRAM) flap reconstruction on 4 January 2007. Examination of the surgical specimens revealed an extensive intraduct carcinoma measuring 7 cm in diameter, with five foci of invasion, the largest measuring 1.8-cm grade II, multifocal lymphovascular invasion with two of the resected axillary nodes showing metastasis.

In summary, this patient had stage IIA carcinoma of left breast. She received adjuvant chemotherapy, radiotherapy, and hormonal therapy following surgery.

Case 2

A 37-year-old woman first noticed a lump in her left breast in January 2007. A mammogram showed an asymmetric density in the left breast at the 9 o'clock position with bilateral scattered benign and coarse microcalcifications in both breasts (Fig 2a). An ultrasound showed an irregular hypoechoic nodule measuring 0.8 x 0.6 x 0.8 cm at the 9 o'clock position of the left breast (Fig 2b). Inferolateral to this nodule was another small, well-circumscribed hypoechoic nodule measuring 0.3 x 0.2 x 0.4 cm. She also had a cyst in the right breast. The left 9 o'clock mass seen on ultrasound was highly suggestive of cancer, which was confirmed by a fine needle aspiration. The smaller inferolateral nodule was worrisome, suggesting a satellite tumour. A breast MRI was ordered to exclude multifocal disease and found that the index lesion at the 9 o'clock position in the left breast was highly compatible with carcinoma, and measured 1.1 cm. The inferolateral nodule was seen and had benign morphology but washout enhancement kinetics. Therefore, it was an indeterminate lesion. In addition there was extensive intraductal enhancement involving the area from 6 o'clock to 10 o'clock, and measuring 6 x 2.3 cm (Fig 2c).

These MRI findings led to a change in surgical management, from an initially planned lumpectomy to a mastectomy. A left, skin-sparing total mastectomy and sentinel node biopsy with a TRAM flap reconstruction was performed on 1 February 2007. Examination of the surgical specimens revealed a 0.8-cm grade III invasive ductal carcinoma at the left 9-o'clock position, associated with an 8 x 2.8 x 1.3 cm area of DCIS. No metastasis was found in the sentinel node biopsy.

In summary she had stage I carcinoma of the left breast. She was put on tamoxifen as adjuvant therapy.

Discussion

Successful breast conservation treatment depends on removal of all tumour with clear margins at the time of surgery. Any residual tumour will increase the chance of recurrence even after radiation therapy.[1] Surgeons are sometimes faced with re-operations

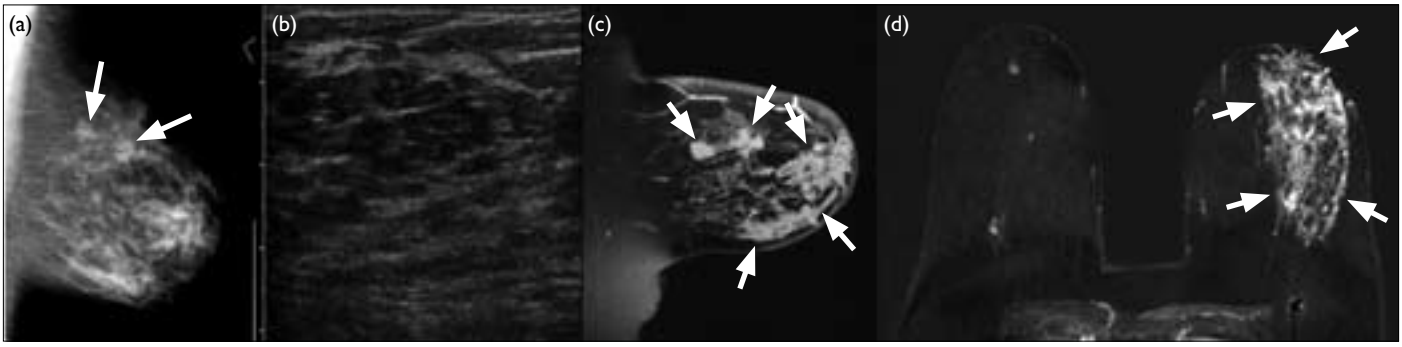

FIG 1. (a) Left medio-lateral oblique mammogram shows two areas of architectural distortion in the upper quadrant of the left breast. (b) The left breast ultrasound is normal. (c) Magnetic resonance imaging sagittal T1-weighted Fat-saturation post-contrast shows two spiculated masses in the upper quadrant and segmental enhancement in the lower quadrant. (d) Magnetic resonance imaging subtraction axial T1-weighted post-contrast scan shows segmental linear and nodular clumped enhancement in the lower outer quadrant of the left breast

on patients who appeared to be suitable for breast conserving surgery after clinical, mammographic, and ultrasound assessments. Often, these patients have intraduct carcinomas with no apparent mass formation and no microcalcifications visible on mammograms. Multifocal (more than 1 tumour in 1 quadrant) and multicentric tumours (tumours in more than 1 quadrant) occur in 6 to 34% of breast cancer cases.[2]

Magnetic resonance imaging is now considered the most sensitive method for evaluating the extent of breast cancer.[3] It is superior to mammography and ultrasound. Breast MRI has a very high sensitivity of greater than or equal to 90% for breast cancer and near 100% sensitivity for invasive breast carcinoma.[4,5] Recent studies of the use of breast MRI in high-risk groups, such as those with *BRCA1* and *BRCA2* genes, have reported a specificity of 93 to 99%.[6] This is achieved by using a dedicated breast coil and meticulous techniques. Lesions are analysed by their morphology as well as their enhancement characteristics.[7,8] The sensitivity of MRI for detecting DCIS is lower, probably due to various subtypes. Menell et al[9] reported a sensitivity of 88%. Mammography has been used traditionally to evaluate DCIS showing suspected areas of microcalcification but mammography frequently underestimates the tumour size and as many as 60% of breast carcinomas do not form microcalcifications. Magnetic resonance imaging can detect DCIS with or without microcalcifications. In the two cases presented, the areas of extensive DCIS had no microcalcifications and were mammographically and ultrasonologically occult. Our two case reports illustrate the use of breast MRI to fully evaluate the extent of breast cancer before definitive surgery, thus avoiding multiple re-operations due to unexpected positive tumour margins from clinically occult extensive DCIS.

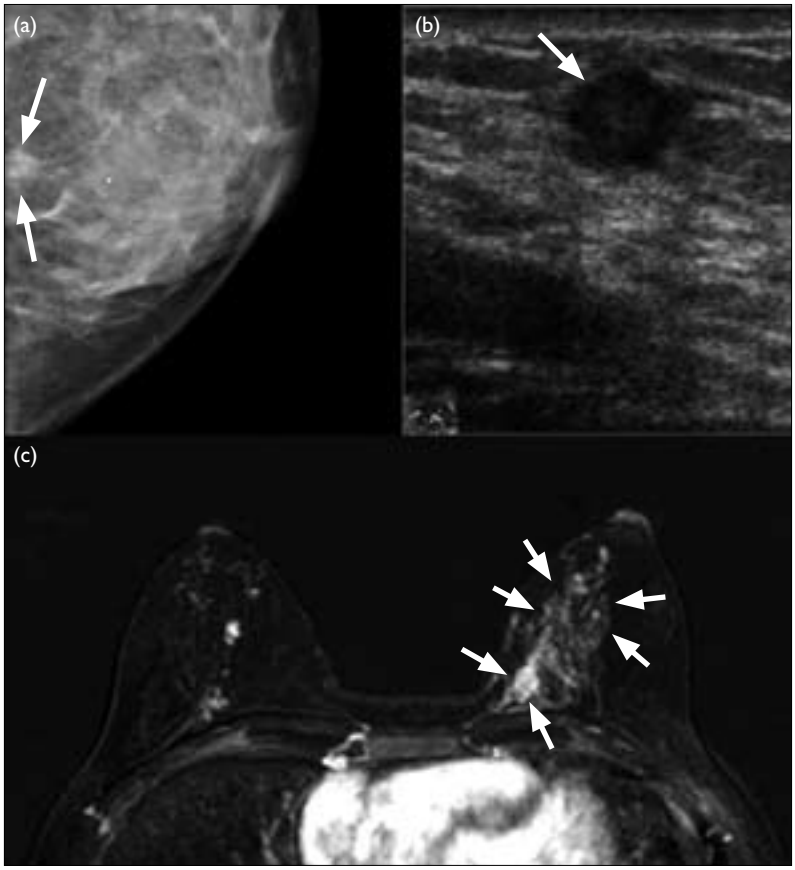

FIG 2. (a) Left medio-lateral oblique mammogram shows asymmetric density at 9 o'clock. (b) Ultrasound left breast shows irregular hypoechoic mass at 9 o'clock position. (c) Post-contrast axial T1-weighted Fat-saturation shows a rim-enhancing mass at 9 o'clock position and segmental linear enhancement in the medial lower quadrant of the left breast

Conclusion

The use of MRI as a routine investigation before all breast cancer surgery is yet to be evaluated. It may prove to be a useful adjunct in the preoperative assessment of young breast cancer patients whose more dense breasts may reduce mammographic accuracy. It may also be useful in patients with fibrocystic breast changes who have multiple, indeterminate shadows on ultrasound, as illustrated by case 2. When there are discordant findings on clinical, mammographic, and ultrasound images, MRI can provide more information enabling a more definitive breast cancer assessment, as illustrated by case 1. The cost of breast MRI may be a concern, but such a cost becomes insignificant when compared to multiple re-operations.

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