Benign Breast Lesions that Simulate Malignancy: Magnetic Resonance Imaging with Radiologic–Pathologic Correlation

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The typical appearance of benign breast conditions on magnetic resonance imaging (MRI) is well established and diagnosis is usually easy. However, cases of benign breast lesions that are extremely difficult to differentiate from malignant breast tumors are occasionally encountered in MRI of the breast because overlap between benign and malignant lesions characteristics is found. This article describes the MRI features of a variety of suspicious breast conditions that were confirmed to be benign in the histopathologic study. We evaluated both enhancement kinetics and lesion morphological information to differentiate malignant from benign lesions. We also correlated the MRI findings with clinical data, and mammographic, ultrasound, and pathologic findings. Lesions evaluated included benign proliferative breast disease, fibroadenoma, intraductal papilloma, granular cell tumor, pseudoangiomatous stromal hyperplasia, fat necrosis, mastitis, inflammatory granuloma, epidermal inclusion cyst, and benign intramammary lymph node.

Similarities between benign and malignant lesion characteristics are found in mammographic and ultrasound evaluations of the breast. Magnetic resonance imaging (MRI) of the breast is not an exception to this rule. The typical appearance of benign breast conditions on MRI is well established and allows the clinician to diagnose benign lesions with certainty. However, cases of benign breast lesions that are extremely difficult to differentiate from malignant breast tumors are occasionally encountered. Although MRI does appear to offer improved specificity than is possible with mammography, some benign lesions have architectural features and enhancement curves that are indistinguishable from cancers. Specificities of 65 to 92% for MRI of the breast have been reported.[1-3] These values were obtained from interpretation models that integrate a combination of morphological features and enhancement characteristics. In this article we describe the MRI features of a variety of benign breast conditions that may simulate malignancy at breast MRI. We have considered both the contrast uptake characteristics and the morphologic appearance of the lesion, correlating these findings with mammography, ultrasound, and clinical data. All lesions were confirmed to be benign in the histopathology study. The histological study was obtained because all lesions included had features that made them indistinguishable from cancer. Finally, depending on the type of benign breast condition, breast MRI findings can be used to determine in which lesions biopsy may or may not be necessary.

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Breast MRI: Examination and Image Evaluation

We performed MRI of the breast with the patient in the prone position using a dedicated bilateral breast coil and a long-line venous access to a cubital or hand vein. To avoid misregistration artifacts on subtracted images, patients were carefully instructed not to move during the time required for the full examination. MRI was performed during the second week of the menstrual cycle in premenopausal women[4,5] and 1 month

TABLE 1. Features that suggest the possibility of benign disease on breast MRI

Morphology
Margins: Well-defined (>50% of circumference visible)
Shape: Round or oval, lobulated
Contrast uptake
Enhancement pattern: Absent, centrifugal, homogeneous
Time intensity curve evaluation
Speed of contrast onset: Slow rise
Level of increase: <70-100%
Pattern of contrast washout: No delayed washout

TABLE 2. Features that suggest the possibility of malignant disease on breast MRI

Morphology
Margins: Ill-defined or spiculated
Shape: Irregular
Contrast uptake
Enhancement pattern: Peripheral with centripetal progression, ductal enhancement
Time intensity curve evaluation
Speed of contrast onset: Early steep rise
Level of increase: >70-100%
Pattern of contrast washout: Rapid washout

after the interruption of hormone replacement therapy in postmenopausal women.[6]

All examinations were obtained with a field strength of 1.5 T and pulse sequence protocol included axial T1-weighted spin-echo, T2-weighted fast spin-echo, short-time fast inversion recovery, and, optionally, sagittal T1-weighted fat-saturated spin-echo before dynamic imaging. The dynamic sequence is acquired before and after the intravenous bolus injection of a nonselective Gd-chelate (0.2 mmol/kg). The contrast agent was flushed with 15 mL saline solution. To standardize the contrast injection we used an automatic MR-compatible power injector.

We evaluated the MR images using a combination of the amount and speed of enhancement and morphological features of the lesion, taking into account the results of the other diagnostic methods.

Under these circumstances a list of probably benign (Table 1) and malignant (Table 2) features in breast MRI can be made.

Unfortunately these descriptions represent only one end of the spectrum of the appearance of breast cancer. Some lesions (Table 3) might not conform to this "typical" appearance and will be described in this article.

TABLE 3. Some benign breast lesions with MRI features that may simulate malignant tumors

Benign proliferative breast disease
Benign epithelial proliferations
Sclerosing adenosis
Radial scar/complex sclerosing lesion
Intraductal proliferative lesions
Atypical ductal hyperplasia
Intraductal papillary neoplasms
Papilloma
Fibroepithelial Tumors
Fibroadenoma
Mesenchymal tumors
Granular cell tumor
Pseudoangiomatous stromal hyperplasia
Inflammatory lesions
Mastitis
Fat necrosis
Inflammatory granuloma
Epidermal inclusion cyst
Other lesions
Intramammary lymph node

Benign Proliferative Breast Disease

Benign proliferative breast disease describes a variety of changes within the breast involving both glandular (lobules and ducts) and stromal tissues, in response to an imbalance of estrogen and progesterone stimulation over time. Essentially, with increased estrogenic stimulation epithelial cells proliferate in the ducts ("ductal hyperplasia and cyst formation") and lobules ("adenosis"). With decreased estrogen levels, the epithelium involutes, and the lobules and stromal fibrous tissue increase ("sclerosing adenosis" and "stromal fibrosis," respectively).

Mammography and Ultrasound Findings

Mamographically and clinically the appearance of benign proliferative breast disease is quite variable. It is most often bilateral and distributes diffusely through both breasts. However its appearance may greatly vary in one or both breasts. It may be focal and asymmetrically more pronounced. Diagnostic problems arise in cases where there is architectural distortion, asymmetric density, irregular-shaped or increased mammographic density, or indeterminate microcalcifications, and in those cases where there are questionable palpable findings in mammographically dense areas. Some of these questions can be solved with the use of ultrasound. Ultrasound is helpful when cysts can be identified in an area of an indeterminate mammographic or palpable findings, suggesting underlying benign disease.

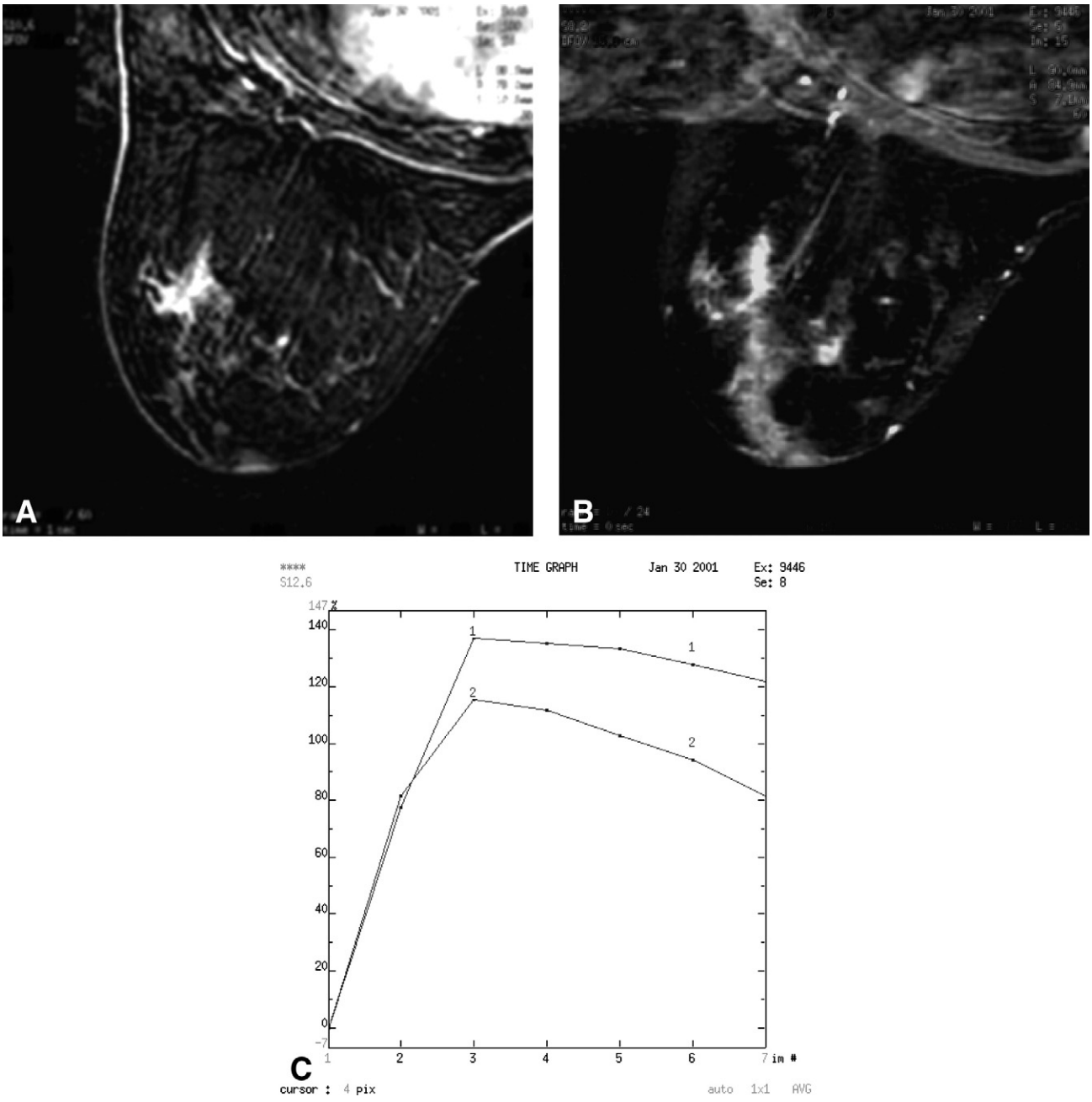

FIG 1. Fibrocystic changes and radial scar/complex sclerosing lesion. (A) Subtraction. An area of architectural distortion with strong enhancement is noted. (B) Short tau inversion recovery (STIR). The lesion is of high signal intensity compared with the adjacent glandular tissue. (C) Enhancement kinetics. Rapid increase in signal intensity during the initial phase followed by washout. (Excisional biopsy was negative for malignancy.)

MRI Findings

The use of contrast-enhanced MRI can be useful in the case of discrepancies not clarified by other methods or in patients with a mammographically dense breast when an increased risk of malignancy exists. Benign proliferative breast disease exhibits variable enhancement. Variations ranged from nonsignificant or delayed enhancement to strong and fast enhancement, which can be focal in some cases. Because both transient diffuse and focal enhancement may occur in the first and fourth weeks of the menstrual cycle predominantly in young women,[4,5] we perform contrast-enhanced MRI during the second week of the menstrual cycle. Diffuse and focal enhancement may

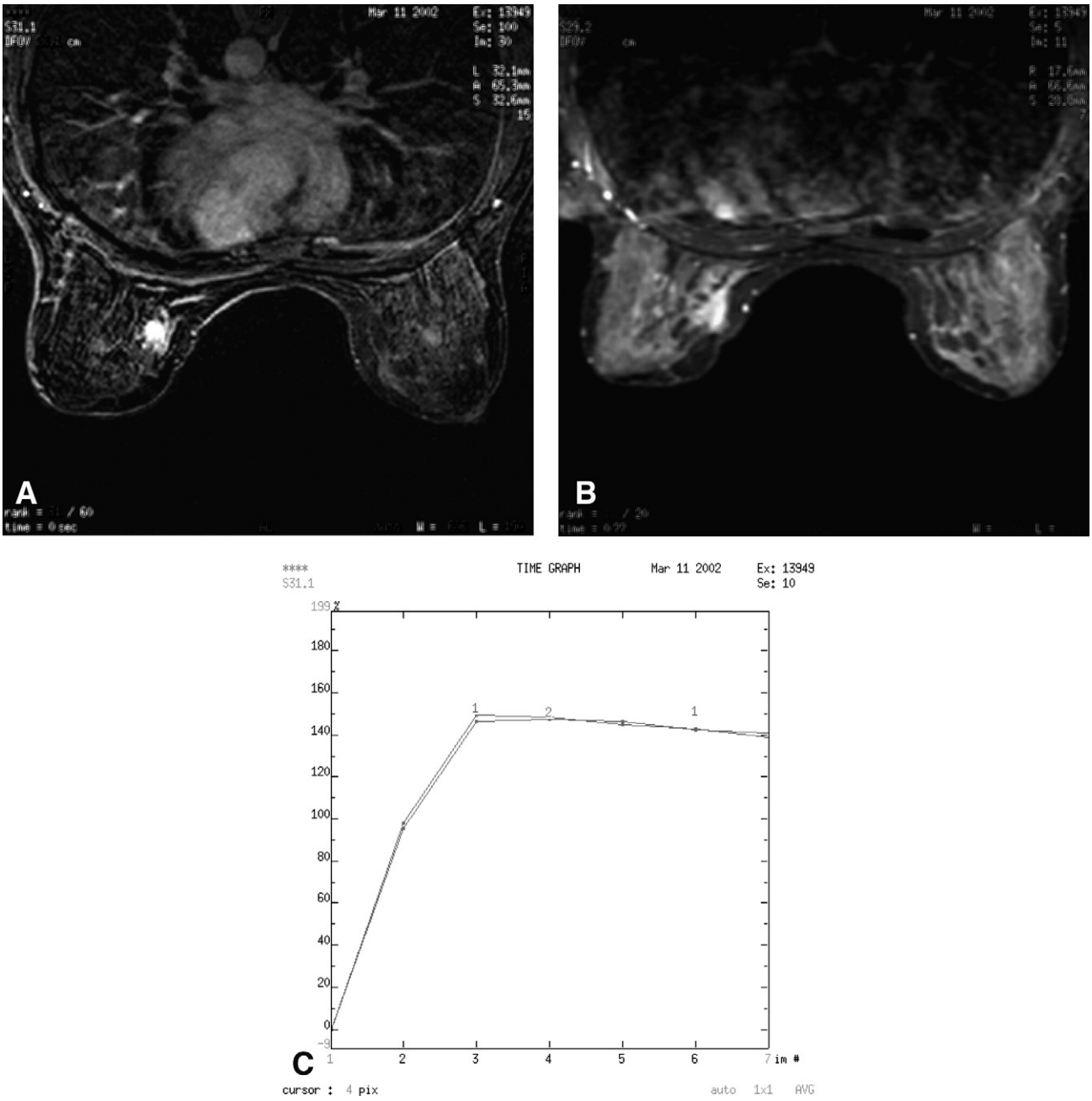

FIG 2. Fibrocystic changes and sclerosing adenosis. (A) Subtraction. Mass with irregular contours and strong enhancement is seen in the lower inner quadrant in the left breast. (B) STIR. The lesion is of high signal intensity compared with the adjacent glandular tissue. (C) Enhancement kinetics. Rapid increase in signal intensity during the initial phase followed by washout.

be encountered during postmenopausal hormone replacement therapy[6]; we perform contrast-enhanced MRI 1 month after interruption of the treatment whenever possible.

Many different changes can be found when fibrocystic breast tissue is studied. However, some of these changes, such as sclerosing adenosis (Fig 1), atypical ductal hyperplasia (Fig 2), and radial scars (Fig 3), can simulate malignancy, as they can demonstrate false-positive enhancement and architectural features of malignant lesions.[7,8]

Absence of enhancement has proved to be an important factor because it allows exclusion of malignancy with high probability. All information (clinical data, physical examination, mammography, and ultrasound findings) should be interpreted in conjunction with the

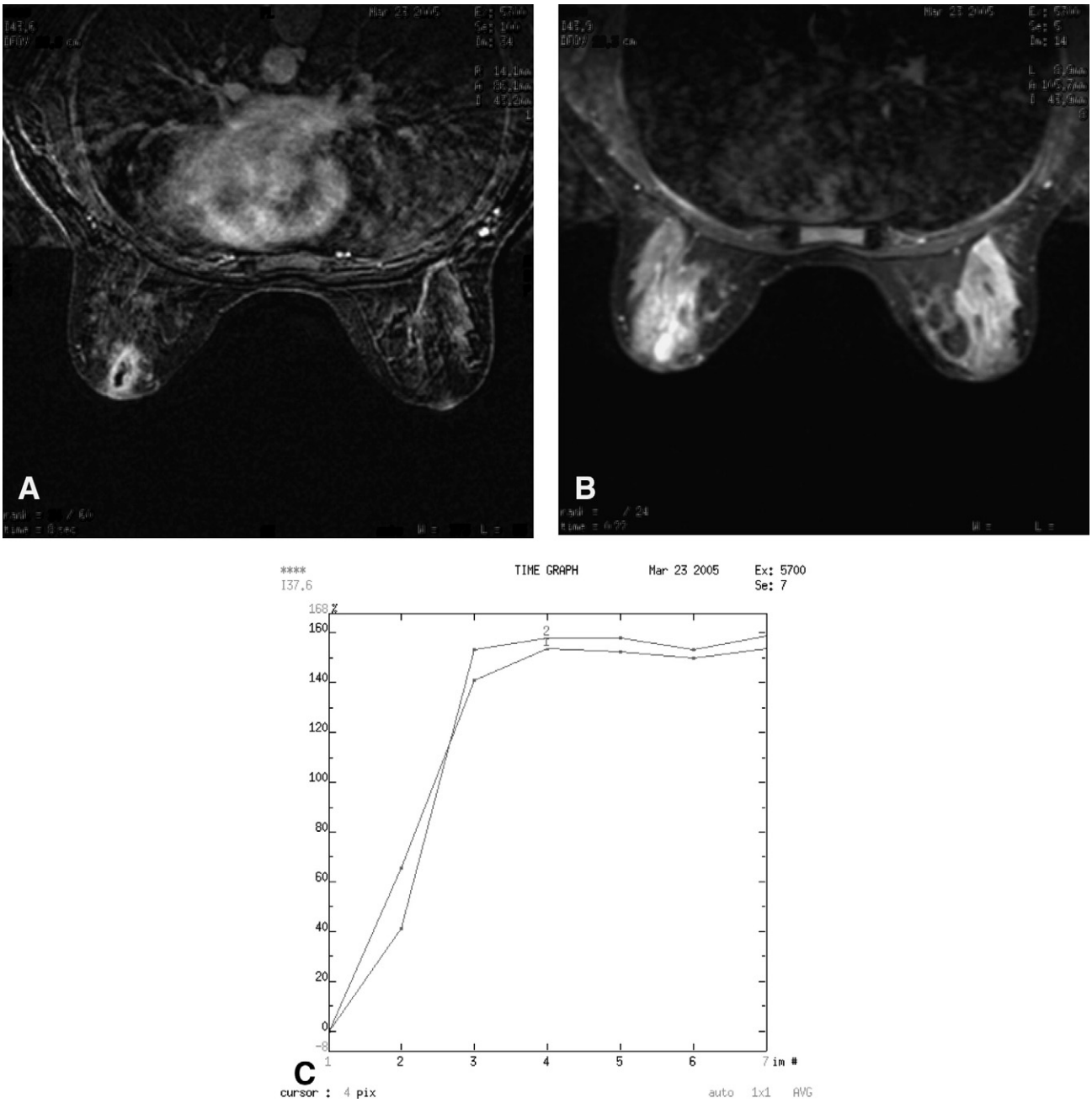

FIG 3. Fibrocystic changes and atypical ductal hyperplasia. (A) Subtraction. Mass with irregular contours and strong enhancement surrounding a small well-defined lesion with rim enhancement is seen in retroareolar region in the left breast. (B) STIR. The lesion is of high signal intensity compared with adjacent glandular tissue. (C) Enhancement kinetics. Rapid increase in signal intensity during the initial phase followed by a plateau. (Excisional biopsy was negative for malignancy.)

data provided by MRI. Nunes and colleagues reported absence of lesion enhancement or no lesion demonstration during a technically adequate breast MRI examination; the negative-predictive values for malignancy were 100 and 92%, respectively.[2,8,9]

We consider biopsy when focal, strong, and fast enhancement exists within a suspicious area in mammography, sonography, or physical examination. Biopsy may be avoided because invasive malignancy can be excluded with a high probability in cases of absence or nonsignificant enhancement. Imaging follow-up may be advised in patients with diffuse or delayed enhancement, and morphologic MRI features (cysts) that suggest the possibility of benign disease. Cysts are

clearly visualized on MRI, using T2-weighted sequences. On T2-weighted sequences they present high signal intensity and a well-defined smooth wall. Usually there is no enhancement after contrast, although Orel and coworkers[10] have described a faint enhancement of the wall after contrast medium injection.

Fibroepithelial Tumors: Fibroadenomas

Fibroadenomas are the most common benign tumors in the breast. They are composed of fibrous stroma with proliferation of ducts and acinar tissue. The epithelial component may vary in the degree of hyperplasia present and the stromal component varies in the proportion of myxomatous and collagenous elements and overall cellularity.

Mammography and Ultrasound Findings

On mammography fibroadenomas present as circumscribed (oval, lobulated, round) masses with low density or isodense to the surrounding breast parenchyma. Typically fibroadenomas are well-circumscribed, homogeneous, and hypoechoic lesions, often with a thin echogenic rim on ultrasound.[11] These lesions demonstrate posterior acoustic enhancement.

However fibroadenomas may mimic carcinoma, because they can present an atypical appearance: irregular shape and contour on mammography and irregular or microlobulated margins with posterior acoustic shadowing on ultrasound.

MRI Findings

The MRI appearance is variable depending on the cellularity of the fibroadenomas. On T1-weighted sequences fibroadenomas have low signals, either equal to or slightly less than the adjacent glandular tissue. On T2-weighted sequences signal intensity may be very low (sclerotic fibroadenomas) or very high (cellular myxomatous fibroadenomas) compared with the adjacent glandular tissue.[12]

The degree of contrast enhancement following the injection of gadolinium is also very variable (Fig 4). Mixomatous lesions enhance rapidly, similar to malignancy, and sclerotic fibroadenomas enhance minimally, if at all.[13] Nunes and coworkers[9] described the presence of nonenhancing internal septations in fibroadenomas. These septations are seen on either the T2-weighted images or the postcontrast images or both and are very specific for the diagnosis of fibroadenoma. This group found that the presence of nonenhancing internal septations was 86 to 93% specific for the diagnosis of fibroadenoma. The internal septations appeared to correspond to the collagenous bands seen on histological examination. However internal septations are identified in only 39 to 64% of fibroadenomas in MRI.[9,12]

We considered biopsy the method of choice when a fibroadenoma is suspected and it is not sufficiently proven by clinical data (growing) and conventional imaging. Biopsy is also required when an enhancing lesion, detected by MR alone, is suspicious due to indistinct margins, peripheral enhancement, fast enhancement and washout, or women at high risk.

Biopsy may be avoided in cases of well-circumscribed lesions that show low signal intensity on T2-weighted sequences and no enhancement (fibrous fibroadenoma). In addition, we indicate follow-up in well-circumscribed lesions with delayed enhancement and the presence of internal septations that favor the diagnosis of fibroadenoma.

Intraductal Papillary Neoplasms: Papillomas

Papillomas are benign ductal neoplasms with a papillary fibrovascular core covered with ductal epithelium and myoepithelial cells. They are usually solitary and occur within a dilated major duct in the subareolar position. Typically they present with bloody nipple discharge and occur in perimenopausal women.[14]

Mammography and Ultrasound Findings

On mammography, intraductal papillomas may be detected as small nodular densities sometimes with calcifications, although they are most often mammographically occult.[15] On ultrasound papillomas appear as a focal well-defined hypoechoic solid mass or as a dilated duct with or without a solid intraluminal mass.[16]

MRI Findings

Rovno and coworkers[17] described the appearance of papillomas on MRI. In their series the most common presentation of symptomatic papilloma was a dilated duct with a small, well-defined enhancing intraductal mass. In our experience papillomas present low signal intensity on T1-weighted sequences and intermediate or high signal intensity on T2-weighted sequences compared with the adjacent glandular tis-

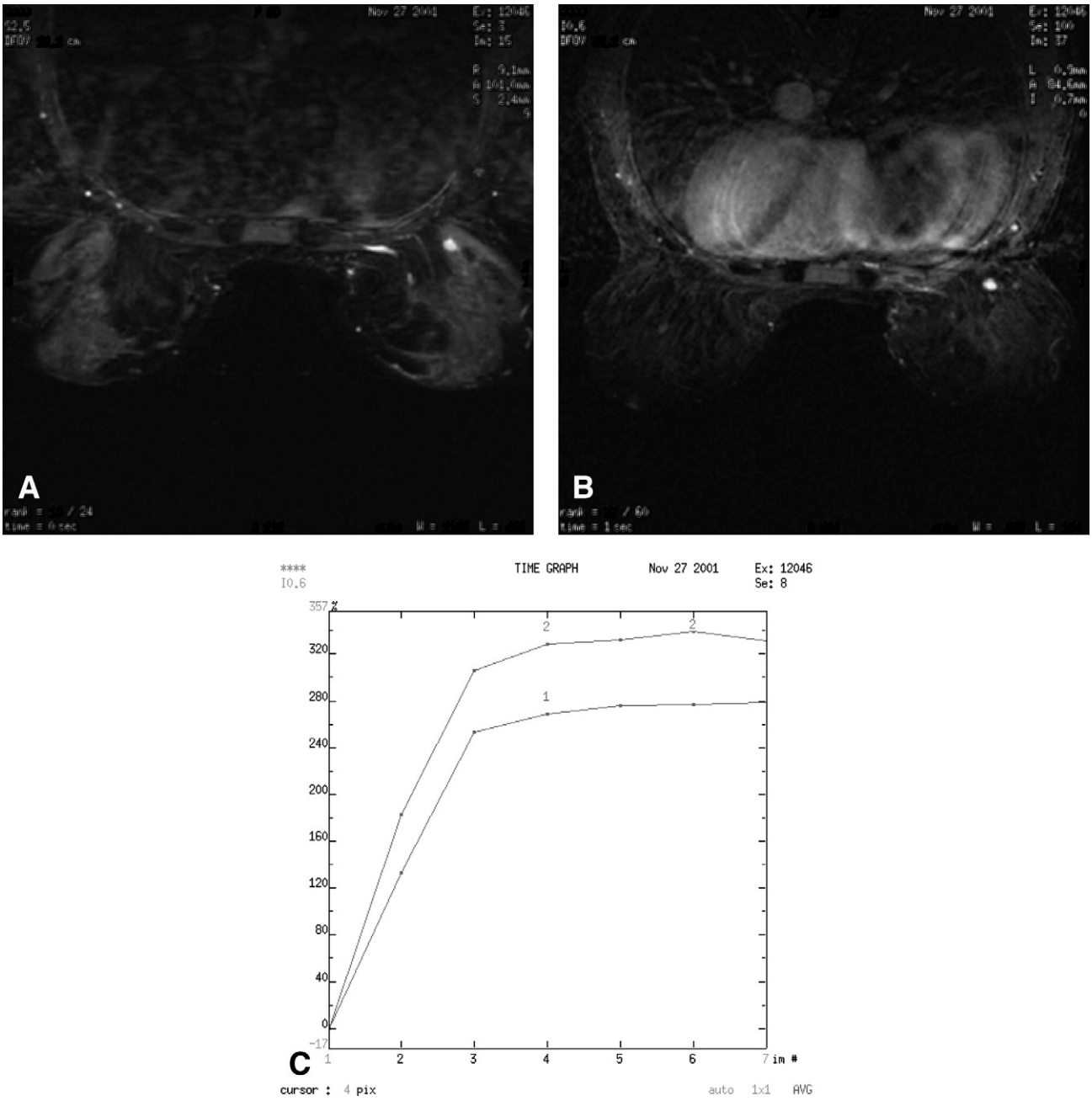

FIG 4. Fibroadenoma. MR imaging was performed for preoperative determination of tumor extent in a woman with left breast carcinoma (not shown). (A) Subtraction. Oval, well-defined, right (contralateral) upper outer quadrant nodule, with strong enhancement is demonstrated. (B) STIR MR image. The nodule of the right breast is of high signal intensity. (C) Enhancement kinetics: rapid contrast uptake followed by plateau in right breast nodule. Biopsy showed fibroadenoma.

sue. On contrast-enhanced MRI, papillomas show intense enhancement and no distinction can be made with malignant lesions.

We believe that biopsy is required for further differentiation if a well-defined retroareolar mass presents strong enhancement in a patient with nipple discharge, because no distinction can be made between a benign papilloma, a malignant papilloma, another malignancy, or a fibroadenoma. Biopsy may be avoided when a well-defined mass in the subareolar region shows low signal intensity on both T1- and T2-weighted sequences and no enhancement after gadolinium because a sclerosed papilloma can be diagnosed with high probability.

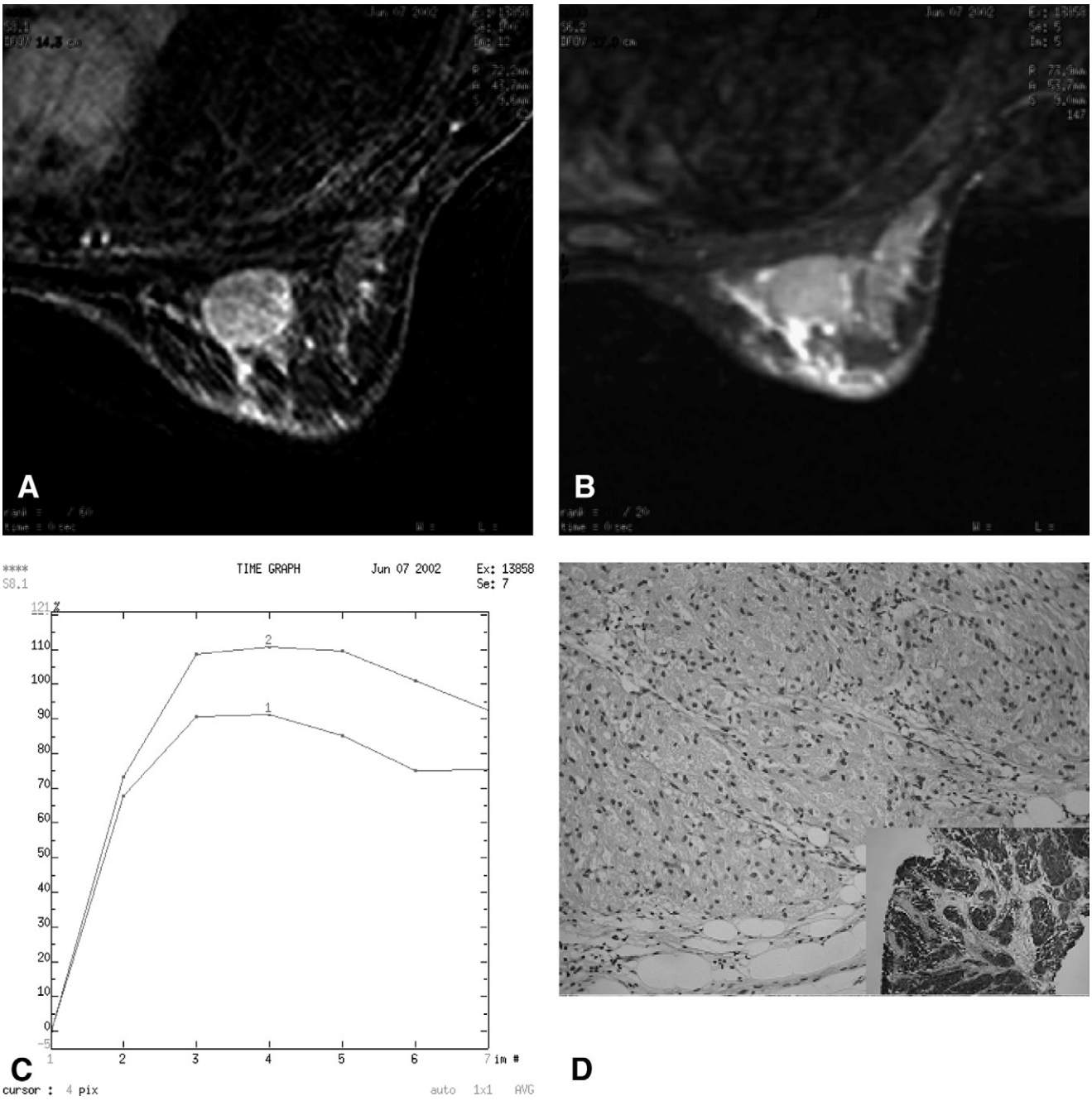

FIG 5. Granular cell tumor. (A) Subtraction. Focal ovoid mass with fine irregular borders and intense enhancement, especially at the borders. (B) STIR. The mass is of signal intensity slightly more than adjacent glandular tissue. (C) Enhancement kinetics. Rapid increase in signal intensity followed by washout. (D) Histology. Polygonal tumor cells with ample granular cytoplasm immunoreactive to S-100 protein (inset).

Mesenchymal Tumors

Granular Cell Tumor

A granular cell tumor is an uncommon benign tumor that occasionally presents as a breast mass. Although the histogenesis of granular cell tumors has been much debated, the general consensus is based on immunohistochemical analysis, which supports the theory of neural or neuroectodermal origin.[18] Breast granular cell tumor usually occurs in middle-aged, premenopausal women and it is more common in the superior medial quadrant.

Mammography and Ultrasound Findings

Radiologic findings in women with granular cell tumor of the breast can mimic invasive breast cancer. These tumors may present as dense masses with ill-defined borders on mammography, and as masses with irregular borders and irregular posterior shadowing on ultrasound.[19,20] Thus, no mammographic or ultrasonographic features are useful in distinguishing granular cell tumor of the breast from carcinoma.

MRI Findings

We studied one case of granular cell tumor of the breast with MRI. On T2-weighted sequences granular cell tumor shows signal intensity either equal to or slightly higher than adjacent glandular tissue. On T1-weighted sequences it shows low signal compared with adjacent glandular tissue. On contrast-enhanced MRI this tumor enhanced significantly and fast, especially at the margins (Fig 5). MRI features are not specific for this tumor and suggested the possibility of malignancy.

Pseudoangiomatous Stromal Hyperplasia

Pseudoangiomatous hyperplasia of mammary stroma is a benign proliferation of keloid-like fibrosis, containing slit-like pseudovascular spaces. Pseudoangiomatous stromal hyperplasia is frequently a microscopic incidental finding in breast biopsies.[21] However, it may also present as a mass, although this appearance of pseudoangiomatous stromal hyperplasia is very rare. Typically they present as palpable, unilateral, and painless masses that occur almost exclusively in premenopausal women. These masses often grow over time and can recur locally.[22]

Mammography and Ultrasound Findings

Mammography demonstrates a round or oval circumscribed or partially circumscribed mass.[23] The sonographic presentation is variable, although most of them are solid and hypoechoic in echotexture without posterior acoustic shadowing.[24]

MRI Findings

On T1-weighted sequences the mass presents intermediate signal with interspersed lower signals. On T2-weighted sequences the mass presents high and low signal intensity. After contrast administration the mass shows progressive and delayed enhancement (Fig 6). Based on these findings, the mass suggests the possibility of benign disease and follow-up may be advised. However, in the majority of cases, the mass presents a history of rapid growth, and biopsy of these lesions is necessary to exclude malignancy.

Fat Necrosis

Fat necrosis is a benign nonsuppurative process related to breast trauma. Fat necrosis is a lesion consisting of foamy histiocytes, lipid-laden macrophages, peripheral fibrosis, and necrotic center. There may also be inflammatory cells, hemorrhage, and calcification, depending on the age of the lesion. It presents most commonly in subareolar and superficial areas near the skin (more vulnerable to trauma).

Mammography and Ultrasound Findings

Fresh fat necrosis can produce changes that are similar in appearance to malignancy in mammography and ultrasound. It appears as a mass with spiculate margins that may contain indeterminate microcalcifications and skin retraction on mammography[25] and a mass that produces posterior acoustic shadowing on ultrasound.[26]

MRI Findings

On T1-weighted sequences, fat necrosis can show relatively high signal intensity with "globular aspect" within the lesion, comparable to that of surrounding fat. On contrast-enhanced MRI, the vascularized pseudocapsule in fresh fat necrosis enhances significantly and often fast, which can simulate malignancy (Fig 7).[27]

We suggest the use of biopsy when fat necrosis is suspected and it is not sufficiently proven by clinical data (growth of tumor) and conventional imaging. However, biopsy may be avoided because fat necrosis can be suggested when on the precontrast MRI scan (T1- and T2-weighted sequences) the lesion shows signal intensity similar to that of surrounding fat within it and postcontrast MRI shows a vascularized pseudocapsule without enhancement of its contents in a patient with a previous breast trauma or breast surgery. In such cases, we recommend follow-up.

Inflammatory Lesions

Mastitis

Mastitis is a focal or diffuse breast infection. A breast with mastitis is swollen, red, and tender with enlarged axillary lymph nodes. *Staphylococcus aureus* and streptococcal bacteria are the most common agents.

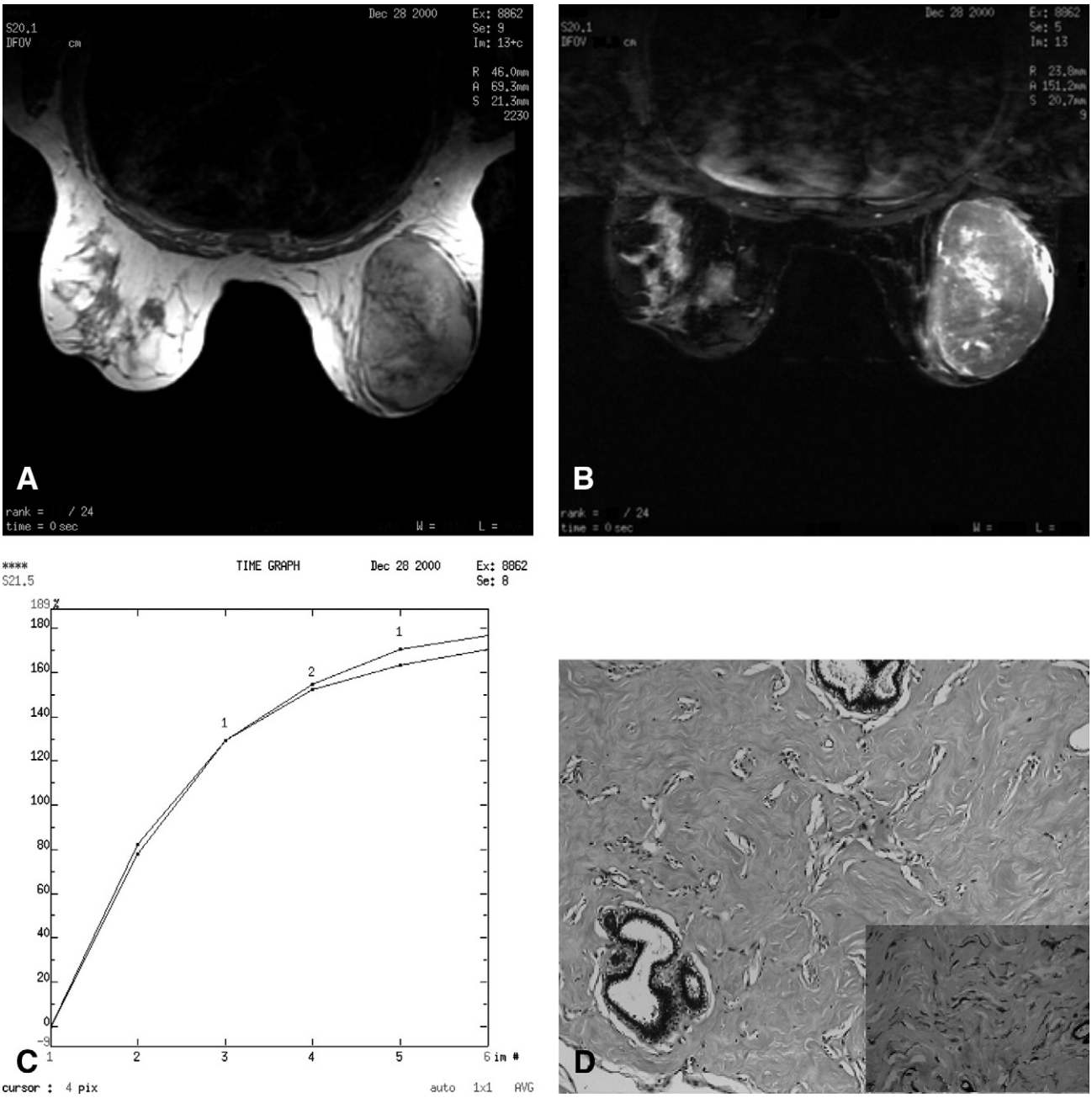

FIG 6. Pseudoangiomatous stromal hyperplasia. (A) Subtraction. Ovoid, well-circumscribed mass in the outer quadrants of the right breast with enhancement after contrast administration. (B) STIR shows intermediate signal intensity lesion with high signal intensity lines within the mass. (C) Enhancement kinetics shows a gradual signal intensity increase. (D) Histology. Collagenized stroma with pseudovascular slits which express CD34 (inset).

Mammography and Ultrasound Findings

On mammography there is diffuse skin thickening and the breast is denser than the contralateral breast. The appearance is similar to an inflammatory carcinoma. On ultrasound, breast shows skin thickening and hypoechoic fluid in the subcutaneous fat. Mammographic, sonographic, and clinical appearances are similar to an inflammatory carcinoma.[28]

MRI Findings

On MRI these patients present with thickening of the skin, generalized enlargement of the breast, and edema

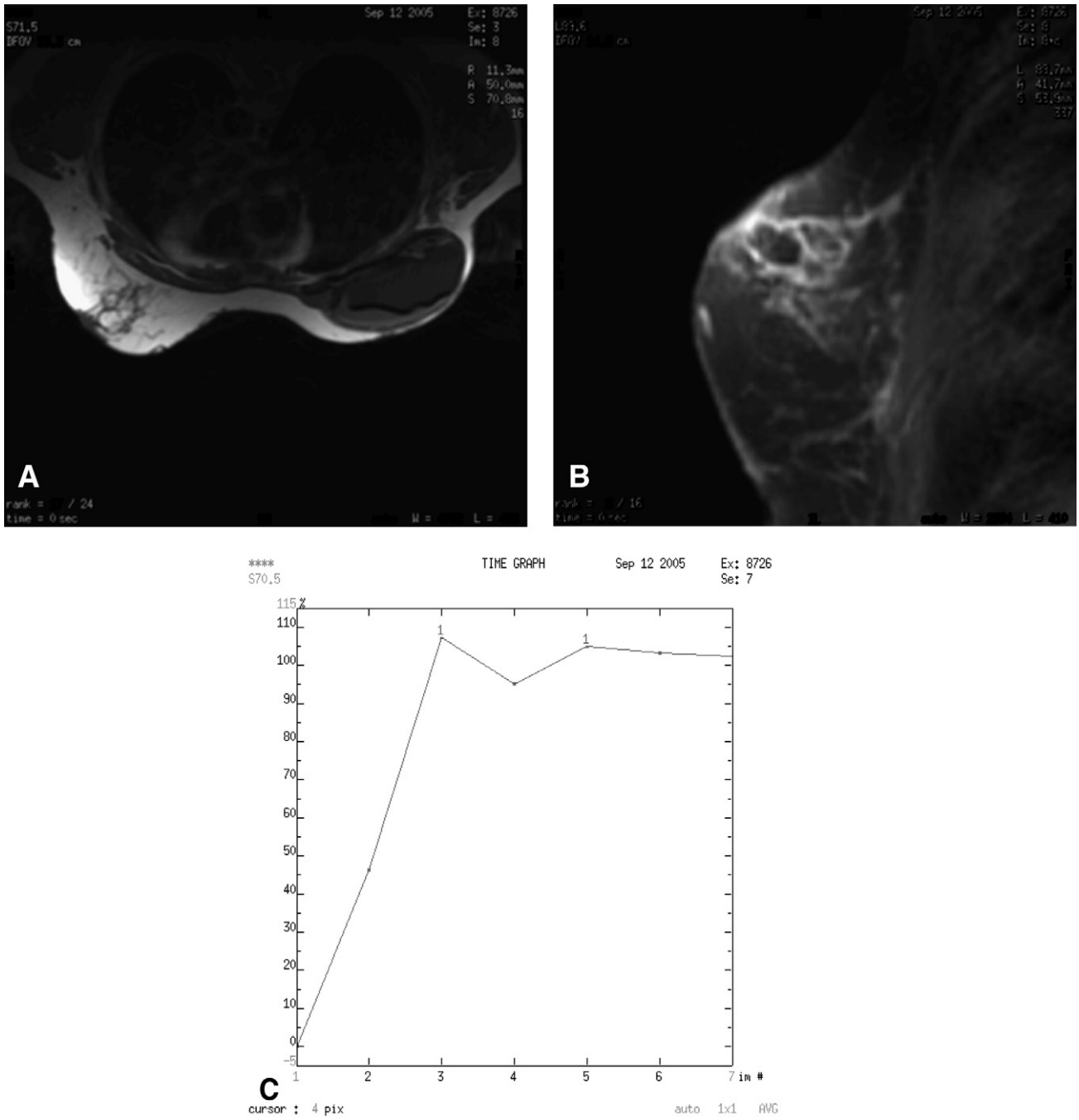

FIG 7. Fat necrosis. (A) T1-weighted SE image shows slightly irregular high signal intensity retroareolar mass (globular aspect) after reconstructive surgery (breast reduction). The signal intensity within the lesion is similar to that of adjacent fat. (B) Sagittal fat-suppressed T1 after contrast. Periareolar lobulated mass exhibits a partial rim enhancement. (C) Enhancement kinetics: rapid increase in signal intensity followed by a plateau.

with low signal on T1-weighted sequences and high signal on T2-weighted images. The degree of contrast enhancement following the injection of gadolinium is variable. Diffuse acute mastitis may show intense enhancement, which can be quite similar to that of malignant lesions (Fig 8). Adenopathy is frequently demonstrated.

MRI is nonspecific for the characterization of inflammatory processes of the breast and punch skin biopsy is often required for diagnosis. However MRI

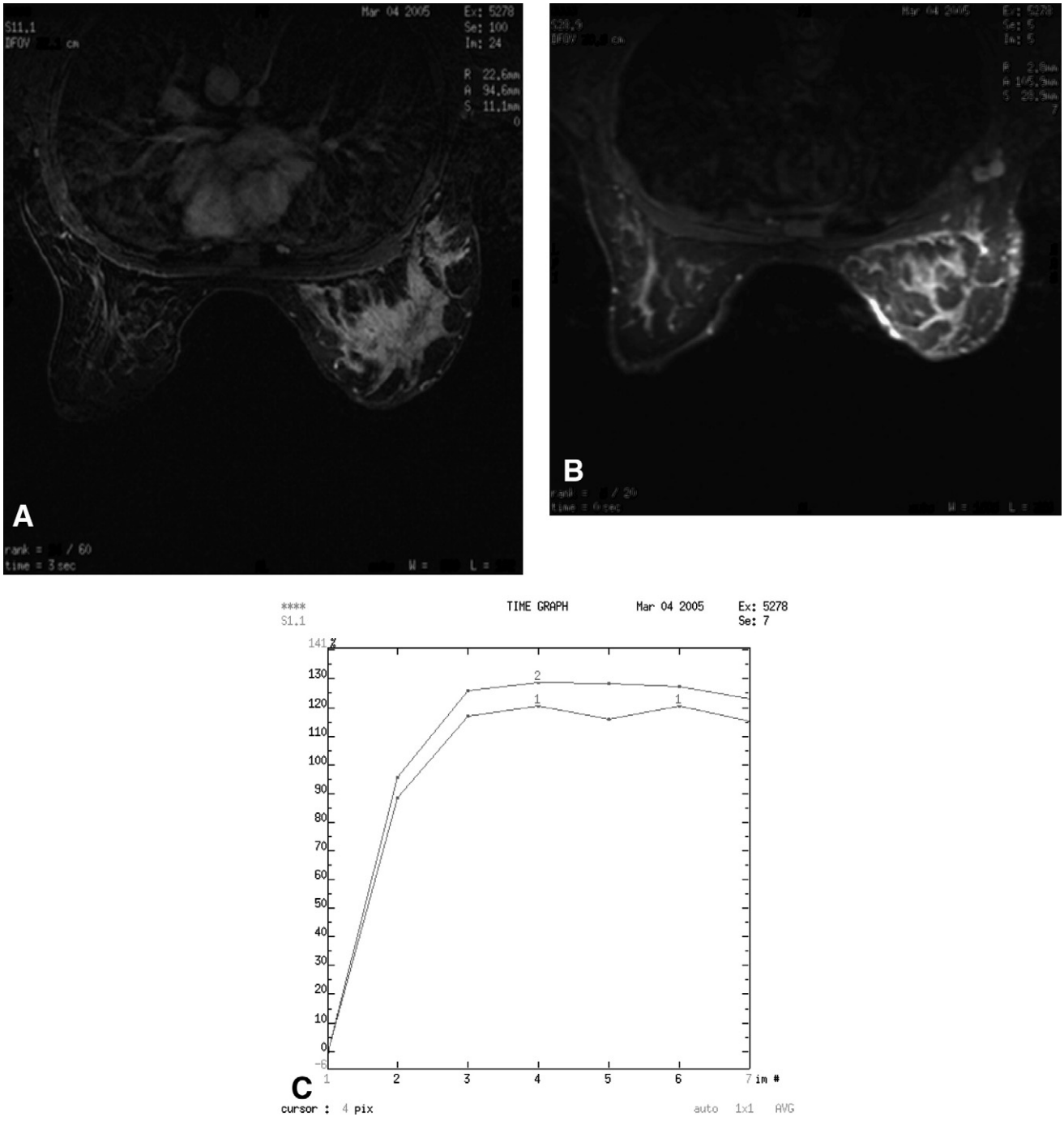

FIG 8. Mastitis. (A) Subtraction showing multiple adjacent poorly defined areas of intensely enhancing inflammatory tissue. (B) STIR. Diffuse growth of the breast with overall increase in breast signal intensity and axillary nodes. (C) Enhancement kinetics: rapid increase in signal intensity followed by plateau.

can be useful in follow-up after treatment with antibiotics for presumed mastitis in problematic cases.[29] If the histology is unclear, MRI will show a decrease in enhancement, which correlates with clinical improvement in patients with mastitis.

Inflammatory Granulomas

Granulomas are sometimes encountered around silicone implants (silicone granulomas) or within postsurgery scars (giant cell granulomatous reaction to

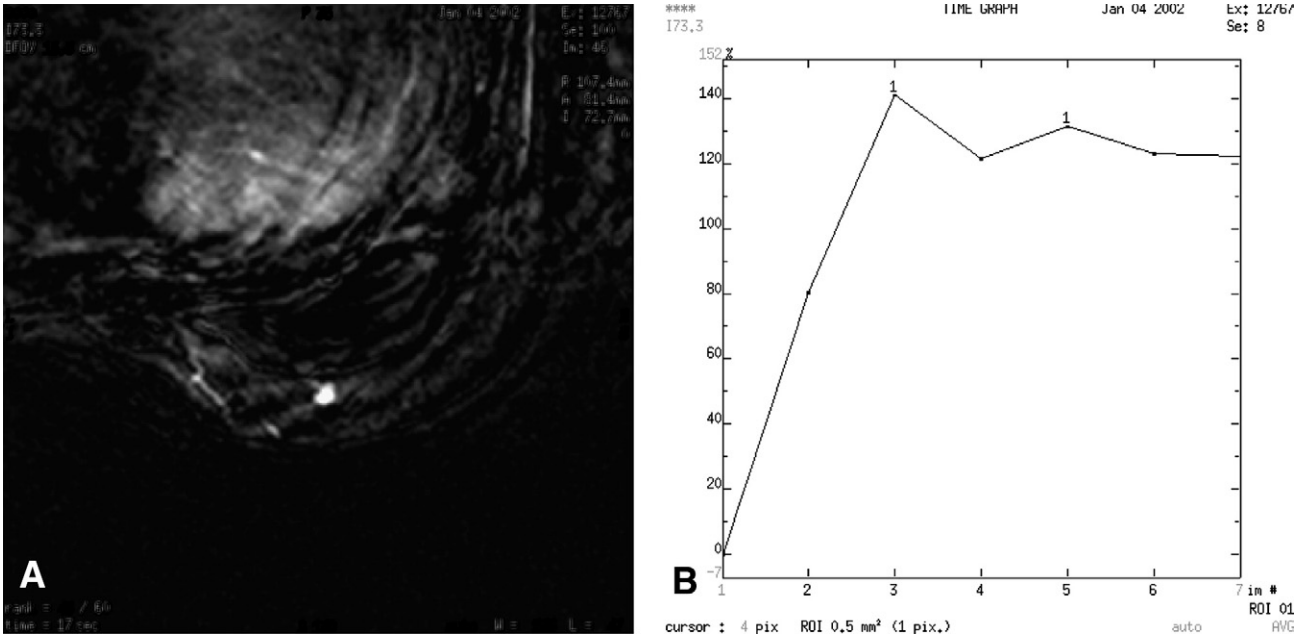

FIG 9. Inflammatory granuloma. MR imaging study performed 12 months after surgery, radiation therapy, and reconstruction because of breast carcinoma. (A) Subtraction. Lobulated, fairly well-circumscribed nodule around silicone implant with strong enhancement is noted. (B) Enhancement kinetics: rapid increase in signal intensity followed by washout.

foreign bodies). They can reveal reactive inflammation or fibrosis.

Mammography and Ultrasound Findings

Granulomas may present as ill-defined masses on mammography,[30] and as a hypoechoic shadowing lesion on ultrasonography.[31] In these cases granulomas cannot be distinguished from malignancies.

MRI Findings

The MRI appearance is variable depending on the histology of the granulomas. Fibrosed granulomas are more likely to be of low signal intensity on T2-weighted images and show minimal or no enhancement after contrast medium injection. Inflammatory granulomas, which contain more free water, display low signal intensity on T1-weighted images and high signal intensity on T2-weighted images. On contrast-enhanced MRI, inflammatory granulomas enhance significantly and exhibit a fast and strong nodular enhancement with washout, similar to malignancy (Fig 9). Enhancement can persist for up to 3 years without changes.[32]

Biopsy may be avoided because a fibrosed granuloma can be diagnosed with a high probability when a well-defined mass shows low signal intensity on both T1- and T2-weighted sequences and no enhancement after gadolinium. However, inflammatory granuloma with strong enhancement cannot be distinguished from malignancy if it is a well-defined small enhancing nodule; it is only detected by MRI beside an implant. Follow-up may be advised in patients with recent breast surgery.[32]

Epidermal Inclusion Cyst

Epidermal inclusion cyst is the most common epithelial cyst of the breast. It arises from skin and adnexa (cutaneous or subcutaneous). It can occur after posttraumatic downward implantation of epidermal fragments following reduction mammoplasty or biopsy. Formation of an intramammary epidermal cyst can be associated with circumscribed fibrocystic mastopathy.[33]

Mammography and Ultrasound Findings

These lesions may present as well-circumscribed masses, isodense to hyperdense on mammography. Ultrasound shows a superficial well-defined, round mass, usually hypoechoic with through transmission. Bergmann-Koester and coworkers[34] reported one case of epidermal cyst of the breast with mammography and sonography features mimicking a malignant lesion.

MRI Findings

On MRI, the lesion appears as a well-defined subcutaneous mass, isointense on T1-weighted im-

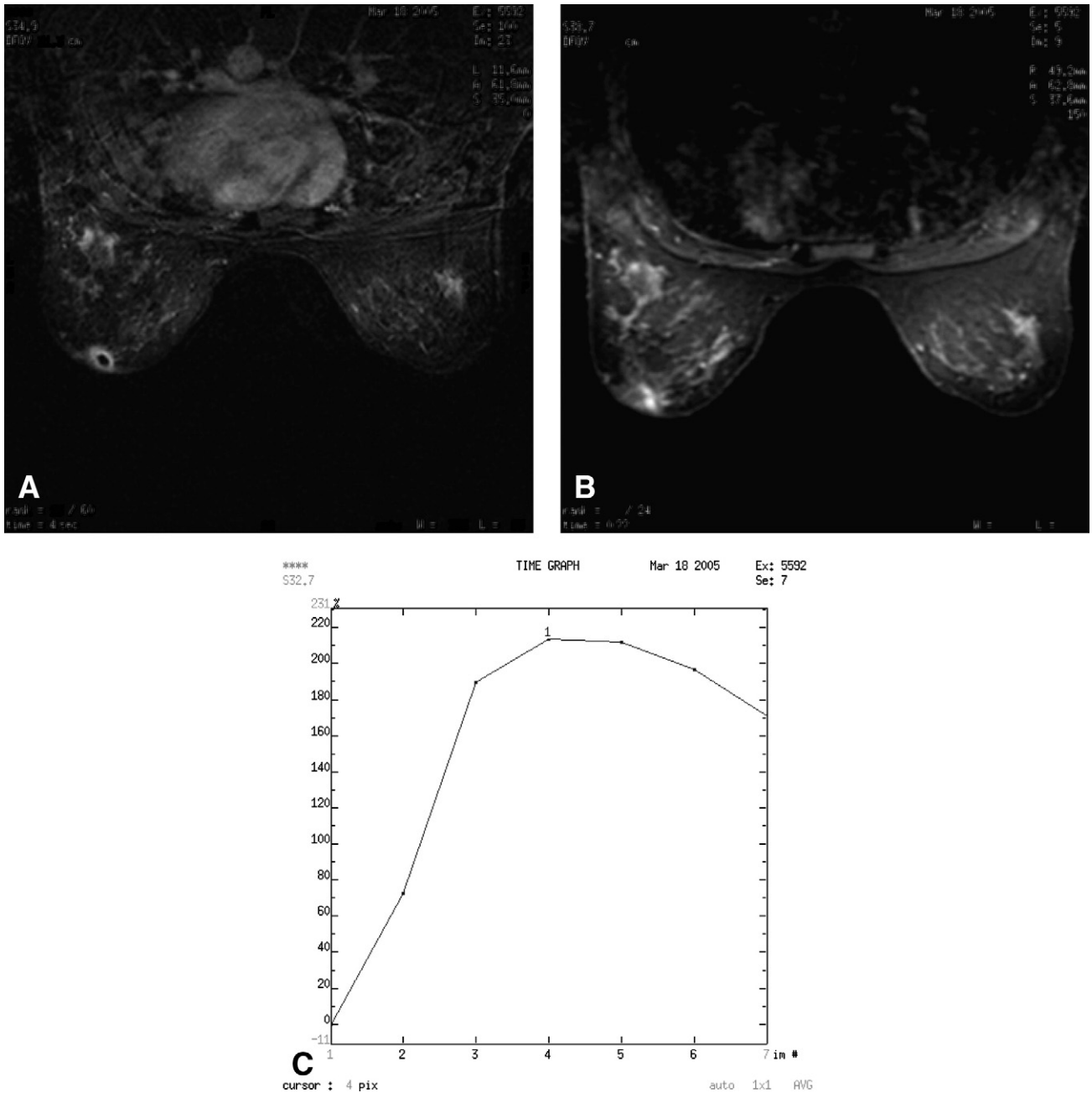

FIG 10. Epidermal inclusion cyst within an area of circumscribed fibrocystic mastopathy. (A) Subtraction. Retroareolar area of enhancing tissue surrounding a small nodule with rim enhancement. (B) STIR. Left asymmetric retroareolar area with irregular contours shows high signal intensity. (C) Enhancement kinetics: rapid increase in signal intensity followed by washout.

ages and hyperintense and heterogeneous on T2-weighted images. However in our case the epidermal cyst appeared as a retroareolar mass, surrounding a small nodule with peripheral enhancement. As MRI could not distinguish between a benign or malignant lesion, a biopsy was indicated (Fig 10). Pathological features of the retroareolar area showed an epidermal cyst within an area with histologic features of fibrocystic mastopathy.

Thus, biopsy is necessary when features that suggest the possibility of malignancy are demonstrated. Biopsy may be avoided if characteristic clinical (smooth, round, palpable, movable, and often visible mass) and characteristic imaging findings are present.

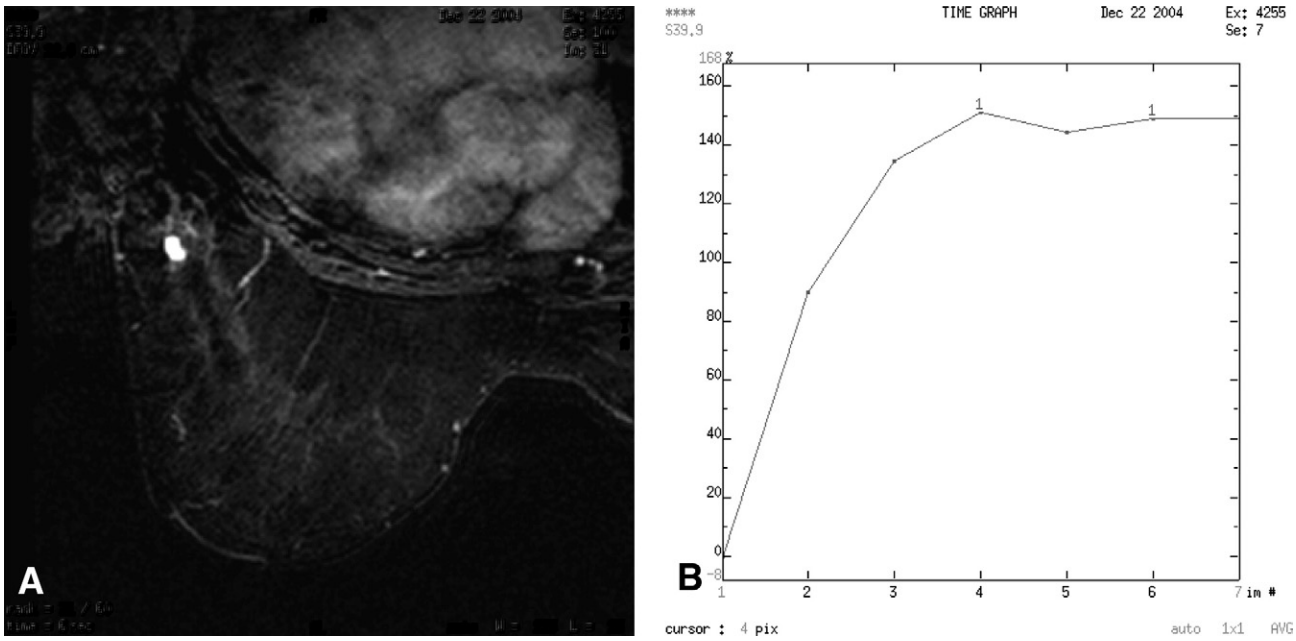

FIG 11. Intramammary lymph node. (A) Subtraction. Lobulated, well-defined, upper outer quadrant nodule, with strong enhancement, surrounded by breast tissue. (B) Enhancement kinetics: rapid contrast uptake followed by plateau.

Recognizing the typical extension of the mass into the dermis can help make the correct diagnosis and avoid unnecessary biopsy.[35]

Intramammary Lymph Node

Intraparenchymal lymph nodes are oval, smoothly marginated, fat-containing masses. They usually occur in the upper outer quadrant, although they may appear anywhere in the breast. Typically they are nonpalpable and do not need treatment unless the image or clinical findings are suspicious.

Mammography and Ultrasound Findings

Lymph nodes present low to moderate density and they are sharply defined, round to oval, and contain a radiolucent fatty hilus on mammography.[36] They appear as a hypoechoic oval, well-circumscribed mass with focal internal echogenicity mass, on ultrasound.[37]

MRI Findings

Lymph nodes are seen as smooth, well-defined, fat-containing masses that are frequently of intermediate signal intensity on T1- and T2-weighted images. After contrast injection, enhancement is seen in benign nodes. However enhancement may be intense with time–intensity curves that may be suspicious for malignancy.[38]

Biopsy may be avoided when MRI demonstrates a well-defined mass with a central focus of high signal intensity on unenhanced T1-weighted images (fatty hilum); there is no enhancement or a pattern of enhancement similar to that of benign lesions, and the patient has no history of malignancy (Fig 11).

Thus, biopsy can be required for further differentiation in patients with intramammary lymph nodes involved by lymphoid hyperplasia, because MRI does not demonstrate a fat-containing mass and contrast-enhanced MRI can show an enhancement pattern similar to that of malignant lesions. Also if in these patients the mass in mammography/ultrasound does not have the characteristic morphology (typical lucent center or notch), it should be investigated. We and others authors[39] believe that if a focal well-defined enhancing mass with any pattern of contrast washout is found incidentally, and is only identified on MRI in a patient who has no risk factors and who was not known to have breast cancer, the likelihood of it being malignant is low, biopsy could be avoided, and follow-up indicated.

Conclusion

Although the use of contrast-enhanced MRI of the breast has increased both the sensitivity and the specificity for the detection of breast cancer, the specificity of breast MRI is still limited because some benign lesions have features that are indistinguishable from cancers. The specificity of breast MRI can be improved by combining morphological features and enhancement characteristics, and correlating MRI features with clinical, mammographic, and ultrasonographic findings, although in our experience biopsy is necessary for further differentiation in many of these benign lesions.

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