European Journal of Radiology 95 (2017) 319–324

Contents lists available at ScienceDirect

European Journal of Radiology

journal homepage: www.elsevier.com/locate/ejrad

Research Paper

# Incidental liver lesions seen on Breast MRI: When is additional imaging warranted?

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ARTICLE INFO

*Keywords:*
Breast MRI
Incidental findings
Hepatic lesion
Breast metastasis

ABSTRACT

*Purpose:* Incidental hepatic lesions identified on breast MR can be a diagnostic dilemma due to concern for liver metastases or other significant hepatic lesions. The purpose of this study was to identify the incidence and nature of liver lesions seen on breast MR, and determine if additional imaging is necessary.

*Methods and materials:* Imaging reports of all breast MR examinations performed at our institution from January 1, 2010 to December 31, 2011 were reviewed to identify reports with hepatic abnormalities. Lesion characteristics, subsequent diagnosis, duration of follow up and additional imaging results (if performed) were all recorded.

*Results:* Of 1664 breast MRs, incidental hepatic lesions were seen in 207 studies (12.4%) in 169 patients. In 154 of 169 patients (91.1%) the lesions were characterized as T2 hyperintense and clearly as bright as adjacent fat on T2-weighted or localizer sequences. 0 of these 154 lesions were clinically significant at clinical or radiological follow-up. In the remaining 8.9% (15 of 169), lesions were characterized as not as bright as adjacent fat on T2 weighted or localizer imaging. In two cases, lesions were confirmed as incidental hepatic metastatic disease.

*Conclusion:* 91.1% of incidental hepatic lesions were circumscribed, T2 hyperintense lesions and characterised as clearly as bright as adjacent fat on T2 weighted imaging at additional review. None of which were clinically significant at clinical or radiological follow-up. We advocate that circumscribed T2 hyperintense lesions which are clearly as bright as adjacent fat on T2 weighted imaging are of unlikely clinical significance and follow-up imaging should not be recommended, reducing the rate of additional imaging from 37.3% to 5.3%.

## 1. Introduction

Incidental findings are commonly encountered in diagnostic imaging with a recent meta-analysis by Lumbreras et al. demonstrating a mean frequency of 23.6% across all imaging modalities [1]. Multiple previous studies have documented incidental extra-mammary findings on breast magnetic resonance imaging (MR) with rates of 10–34% for all findings and rates of between 6 and 28% for incidental liver lesions [2–9]. However, no previous studies have correlated lesion characteristics with final lesion diagnosis. The American College of Radiology (ACR) has published guidelines for the management of incidental liver masses identified on CT and ultrasound [10–13]; however, no such guidelines exist for liver lesions identified on MRI. The analysis of incidental liver lesions detected during breast MR examinations can be complicated by the fact that lesions may not be identified on all sequences, rendering lesion characterization incomplete. An additional issue is that breast MR studies are performed for both screening and diagnostic indications, with a significant proportion of women either having a new diagnosis of, or a past history of breast carcinoma. The purpose of this study was to evaluate the frequency and specific imaging characteristics of incidental liver lesions seen on breast MR, and propose safe and cost effective guidelines for when additional imaging would be warranted.

## 2. Materials and methods

This retrospective study was approved by our Institutional Review Board and the requirement for informed consent was waived.

The imaging reports of all breast MR examinations performed at our institution from January 1, 2010 to December 31, 2011 were reviewed to identify reports with “hepatic” or “liver” abnormalities. In patients with multiple examinations, only the earliest examination was included in the study cohort.

At our institution, breast MRI was performed at 1.5-T (GE

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http://dx.doi.org/10.1016/j.ejrad.2017.08.018
Received 19 February 2017; Received in revised form 8 August 2017; Accepted 16 August 2017

Healthcare, Milwaukee, USA) to produce high-spatial-resolution images in the axial and sagittal planes. Following a 3-plane localizer, a T2-weighted non-fat saturated axial sequence was obtained. Subsequently, unenhanced fat saturated axial T1-weighted images were obtained, followed by contrast-enhanced acquisition of fat saturated axial T1-weighted images with kinetic data acquired at four time points over a 5–6 min acquisition. Delayed sagittal T1-weighted fat saturated images were also obtained. Gadopentetate dime-glumine (Magnevist, Bayer Schering Pharma) was the contrast agent administered intravenously at a dose of 0.1 mmol/kg body weight with an MRI-compatible remote control power injector at a rate of 1.2 mL/s. Gadolinium contrast agents were administered as per our institutional policy and patients considered at risk of having altered renal function underwent 'point of care' testing to ensure the safe administration of gadolinium contrast agents. The contrast injection was followed by a 10 mL saline flush administered at the same flow rate. The imaging parameters were as follows: TR/TE, 9/4.4; flip angle, 10°; number of signals acquired, 1; acquisition matrix, 512 × 512; section thickness, 2 mm. Digital subtraction of the pre- and post-contrast imaging was performed and computer aided software (Dynacad, Invivo Corp., Gainesville, FL) was utilized for kinetic curve analysis. In cases where the MRI was performed for breast implant integrity, gadolinium contrast was not administered and dedicated silicone imaging was performed.

The breast MR reports were reviewed to determine if a definitive diagnosis was made regarding the incidental hepatic lesion and if further imaging was recommended. Patient age and cancer history and the indication for the examination were recorded. In patients undergoing surveillance breast MR examinations with a personal history of breast cancer, medical records were reviewed to determine the stage of disease at diagnosis as per the American Joint Committee on Cancer (AJCC) Cancer Staging Manual [14]. For patients with a new diagnosis of breast cancer undergoing diagnostic imaging, the radiologic stage of disease was based on the imaging preceding the breast MR or the new stage of disease based on the breast MR examination, whichever was higher.

The breast MR images were reviewed by a radiologist (MK) with fellowship training in abdominal MR. The reviewer did not have access to the report but was aware of the presence of a hepatic lesion. The reviewer was also unaware if subsequent follow-up imaging was performed or the final outcome. Sequences were reviewed in the following order: localizer, T2- weighted images, and then pre and post contrast fat saturated T1-weighted images along with the digital subtraction images. The size, shape and margins of the largest incidental hepatic lesion were recorded for each of the 169 cases. Lesion signal characteristics were assessed on the localizer and/or T2-weighted images. Lesions brighter than the adjacent hepatic parenchyma were further sub-categorized relative to the signal of adjacent adipose tissue (fat). Lesions which were clearly brighter than adjacent fat were categorized as hyperintense to adjacent fat, otherwise they were classified as isointense or hypointense, depending on relative signal intensity. Pre and post contrast T1 sequences were reviewed to assess if the identified lesions were visible and if any enhancement was present. The lesions identified at independent review were then correlated with those referenced in the radiological report. Medical and radiological records were reviewed for prior relevant imaging at our institution or affiliated institutions. If imaging was available, it was reviewed to assess if the lesion had previously been identified, if a prior diagnosis had been made and if the lesion was stable in size.

The radiological and medical records of each patient were then reviewed to determine if follow-up imaging was performed. In cases where additional imaging was performed, lesion stability and the radiological diagnosis made at further imaging was recorded. The duration of clinical follow-up and patient status at the time of follow-up was also documented.

Statistical analysis was performed with GraphPad Prism statistical software package (6th edition). Mean, standard deviation and range were provided where appropriate. 95% confidence intervals (CI) were performed to summarize statistical power.

**Table 1**
Indication for breast MR.

| Scan indication | Breast Cancer Risk Factor | n = 169 |
|---|---|---|
| Screening | High Risk | 54 (32%) |
| Surveillance | Personal history of breast cancer | 50 (30%) |
| Diagnostic evaluation | High risk | 7 (4%) |
| | Personal history of breast cancer | 9 (5%) |
| | No increased risk of breast cancer[a] | 21 (12%) |
| | New diagnosis of cancer | 23 (14%) |
| Neoadjuvent treatment follow-up | | 2 (1%) |
| Implant evaluation | No increased risk of cancer | 2 (1%) |
| | Personal history of breast cancer | 1 (0.6%) |

[a] These cases were performed for follow-up of a previously identified MRI abnormality. A cancer diagnosis was not made on this scan or during the follow-up period. 2 patients had a diagnosis of breast cancer made following biopsy recommended at the time of breast MR examination.

## 3. Results

### 3.1. Patient demographics

Of the 1664 breast MR imaging reports searched for "hepatic" or "liver" abnormalities, these findings were reported on 207 MR examinations (12.4%). 38 patients had more than one breast MR during the study period and in these cases, only the earliest breast MR was included in our cohort. Thus 169 individuals with breast MR studies showing incidental liver lesions comprised our study population. Mean patient age was 54.4 years (range, 29.9–80.8 years). All patients were female. 62% of studies (104 of 169) were performed as a high-risk screening or surveillance examinations, 50 of these 104 patients (48%) had a personal history of breast cancer (Table 1). 23 of 169 patients (14%) had a new diagnosis of cancer, 2 patients were undergoing neoadjuvant treatment for breast cancer and 10 patients having diagnostic imaging or implant evaluation also had a history of breast cancer. A further 2 patients had biopsies recommended at MRI which yielded a diagnosis of breast cancer at subsequent biopsy. Altogether, 87 of 169 patients (51.5%) had a current diagnosis or past history of breast cancer, or were diagnosed with breast cancer following breast MR. The previous or known stage of breast cancer at the time of the MR was also recorded, with 63% (55 of 87 patients) being categorized as stage 0 or 1 (Table 2).

A single lesion was identified in 56% of cases (95 of 169). The mean lesion size was 1.8 cm (SD 1.6 cm, range: 0.2–9.0 cm). In cases where more than 1 lesion was identified, the largest one was measured. Additional imaging was performed to further characterize 63 lesions out of a total cohort of 1664 cases, 3.8%.

**Table 2**
Stage of cancer in patients with a history or new diagnosis of breast cancer.

| Stage of Breast Cancer AJCC TNM staging [14] | n = 83 |
|---|---|
| 0 | 13 |
| 1 | 41 |
| 2 | 17 |
| 3 | 7 |
| 4 | 4 |
| Unknown | 1 |