Clinical Radiology 71 (2016) 92–95

Contents lists available at ScienceDirect

Clinical Radiology

journal homepage: www.clinicalradiologyonline.net

Factors influencing the stiffness of fibroadenomas at shear wave elastography

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ARTICLE INFORMATION

Article history:
Received 27 April 2015
Received in revised form
1 October 2015
Accepted 28 October 2015

AIM: To identify which features of fibroadenomas are associated with false-positive findings at shear wave elastography (SWE).

MATERIALS AND METHODS: A total of 151 patients with histologically confirmed fibroadenomata were identified from a prospective database, from a single breast unit. The following features were assessed by two observers who were unaware of the SWE findings: patient age, grey-scale ultrasound lesion diameter (<15 or ≥15 mm), distance from the lesion to skin, composition of surrounding tissue (fatty, mixed or dense), and source of referral (screening or symptomatic). Statistical analysis was carried out using the chi-square test.

RESULTS: A statistically significant positive association was found between grey-scale ultrasound lesion size and lesion stiffness. Twenty-nine of 70 (41%) lesions ≥15 mm were stiff, versus 10 of 81 (12%) <15 mm (p=0.001). Patient age, distance from the lesion to skin, make-up of surrounding tissue, and source were not significantly associated with stiffness.

CONCLUSION: Fibroadenomas giving false-positive SWE results tend to be larger in size than those that do not. More compression of adjacent normal tissue is assumed to be the cause of the present findings. As previous studies have shown that large cancers tend to be stiffer than smaller cancers, it may be appropriate to vary the quantitative cut-off value used for benign/malignant differentiation in SWE according to lesion size.

Introduction

Shear wave elastography (SWE) is a promising technique when performed during routine breast ultrasound examinations. It has been shown to improve benign malignant differentiation of solid breast masses.[1–3] Fibroadenomas are the commonest benign solid mass found within the breast. Although most fibroadenomas are soft, a proportion are stiff and give false-positive results at SWE.[1,2] The aim of the present study was to identify factors associated with stiffness within and around fibroadenomas. It was hypothesised that[1] larger fibroadenomas may be stiffer than smaller ones due to compression of adjacent normal tissue[2]; fibroadenomas in older woman may be stiffer than in younger women due to hyaline degeneration causing increase in stiffness[3]; fibroadenomas growing within dense parenchyma may cause increased perilesional stiffness compared with lesions growing in fatty tissue[4]; lesions close to the skin may be stiffer due to increase difficulty in not compressing the lesion during the scan. Identification of factors

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http://dx.doi.org/10.1016/j.crad.2015.10.029
0009-9260/

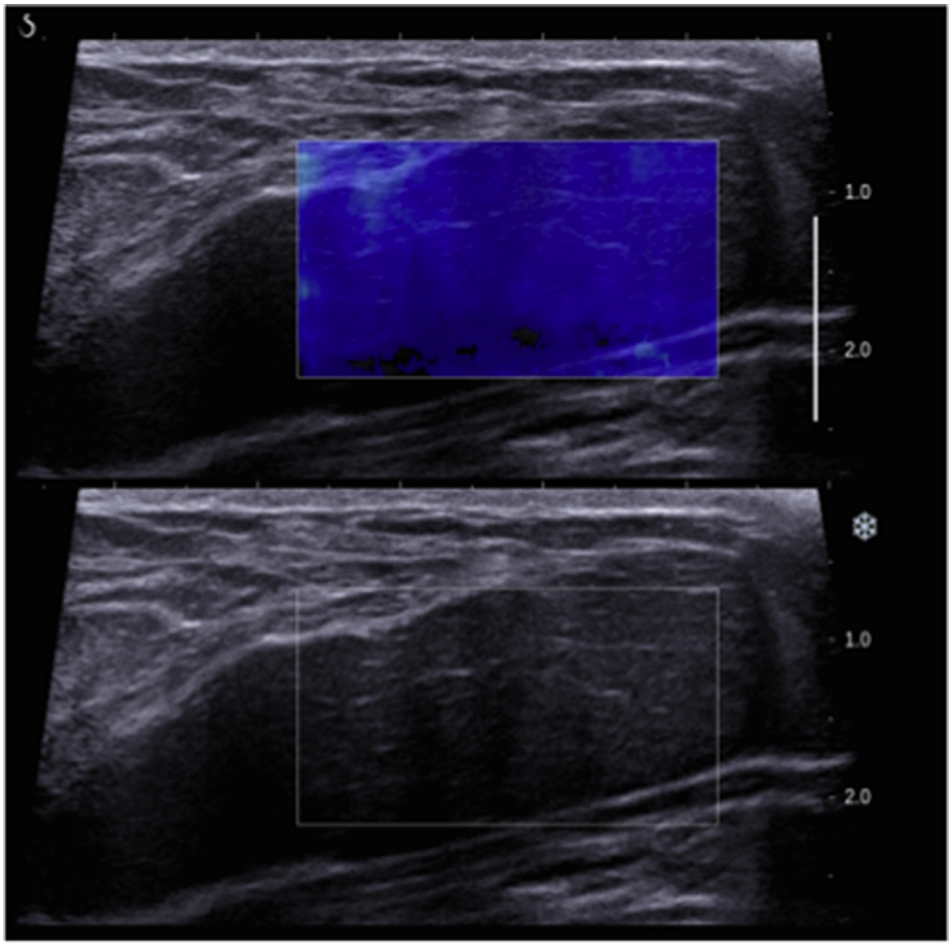

Figure 1 SWE image showing a soft fibroadenoma.

associated with stiff fibroadenomas may allow refinement of cut-off values used for benign/malignant differentiation during SWE.

Materials and methods

One hundred and fifty-one patients with histologically confirmed fibroadenomas were identified from a prospective database at a single breast unit. Imaging was performed between 19 April 2010 and 4 March 2013. SWE was performed using an Aixplorer ultrasound system (SuperSonic Imagine, Aix en Provence, France), which has been standard care in the authors' clinic since April 2010 for women presenting with symptomatic or screen-detected abnormalities. Clinically benign lesions in woman under 25 years with grey-scale ultrasound features of a fibroadenoma are not routinely biopsied. Therefore many fibroadenomas in younger woman attending at clinic are not included in this study. Fibroadenomas in woman under 25 were included in this study if they had grey-scale ultrasound features not typical of a fibroadenoma or the patient requested removal of the lesion, as both these scenarios would lead to histological confirmation of the nature of the lesion. The scans were performed by one of four practitioners with between 5 and 20 years of breast ultrasound experience and at least 3 months of previous experience of performing SWE on solid breast lesions.

In accordance with UK National Research Ethics Service guidance,[4] ethical approval for the study was waived as the study was carried out retrospectively on routinely acquired data available to the principal investigator by virtue of his clinical role. Combined grey-scale and elastography examination times were between 10 and 20 minutes. Acquisition of the elastography images takes 1–2 minutes. The mean stiffness measurements were recorded by a radiologist with 5 years of experience of SWE who was one of the four operators in the study, this was done before the core biopsy results were available. Previously published data have indicated that SWE findings have a high degree of reproducibility.[3,5] The other parameters, such as the distance from the skin and the composition of surrounding tissues, were generated by reviewing the images after the examination. The review was performed by a medical student and a consultant radiologist and differences opinion were resolved in consensus. Data extraction took 1–2 minutes per lesion.

Four elastography images taken in two orthogonal planes were obtained for each lesion by holding the transducer still with no pressure applied, and allowing the image