Oncology and Translational Medicine
DOI 10.1007/s10330-016-0196-6

April 2017, Vol. 3, No. 2, P49–P51

ORIGINAL ARTICLE

Ultrasonographic features of breast ductal carcinoma in situ*

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Abstract

Objective The aims of this study were to analyze ultrasound features of breast ductal carcinoma in situ (DCIS) and to evaluate the value of ultrasonography (US) in early diagnosis of DCIS.

Methods From July 2013 to March 2015, 180 patients with histologically proven DCIS were evaluated. US features recorded included the size, shape, margins, internal echogenicity, microcalcifications, posterior echogenicity, and blood supply. The data were analyzed and compared with mammographic and histologic findings.

Results Among 180 cases of DCIS, 168 patients had positive findings on US; the lesions were divided into 3 categories: (1) hypoechoic lesions with or without microcalcifications (n=94); (2) hypoechoic dilated ducts with or without microcalcifications (n=59); (3) microcalcifications alone without any other findings (n=15). Of the 180 lesions, microcalcifications were demonstrated by mammography in 128 (71%); among these 128 lesions, 90 were identified with microcalcifications on US. Only 80 cases (44%) manifested as masses or asymmetric densities on mammography. The diagnostic accuracy of US and mammography was 67% (120/180) and 69% (124/180), respectively, which can be improved to 80% (144/180) if US is combined with mammography.

Conclusion US can be used as an important tool in diagnosis of DCIS. The combination of US and mammography can improve the diagnostic accuracy of breast DCIS.

Key words: ultrasound; breast cancer; ductal carcinoma in situ; diagnosis

Received: 4 August 2016
Revised: 4 September 2016
Accepted: 25 October 2016

Introduction

Ductal carcinoma in situ (DCIS) of the breast is defined as proliferation of malignant epithelial cells within ducts without evidence of invasion or infiltration through the basement membrane into the surrounding stroma, and has a much better prognosis than invasive cancers [1]. DCIS itself does not result in death, and breast cancer-specific mortality among women with DCIS is extremely low, with 1.0% to 2.6% mortality from invasive breast cancer (IBC) 8 to 10 years after a diagnosis of DCIS [2]. Therefore, early detection of DCIS is essential for improving the prognosis of breast cancer. The development of ultrasonography (US) has made it possible to detect almost any early and small lesions in the breast.

In this study, we retrospectively evaluated the value of US examination for the diagnosis of DCIS. We also summarize and illustrate the US features of DCIS and compare it with mammographic and histologic findings.

Patients and methods

Patients

From July 2013 to March 2015, 180 cases of DCIS were diagnosed at our hospital; all patients underwent surgical treatment and had pure DCIS on pathological examination (no invasion or microinvasion). The median age was 53 years (range, 35–80 years); US and mammography were performed in all cases before excision.

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* Supported by a grant from the National Natural Sciences Foundation of China (No. 81571695).

US examination techniques and methods

GE LogiqE9 (GE Medical Systems, USA) and Siemens Acuson S3000 (Siemens, Germany) US systems were used with a high-frequency linear transducer (8–13 MHz). Whole breasts were routinely scanned, and transverse, longitudinal, and radial views of each lesion were obtained. Lesions were described in terms of size, shape, margin, internal echogenicity, ductal extension, posterior echogenicity, and microcalcifications, as well as blood supply. Images were retrospectively reviewed by three sonographers with 3, 5, and 8 years of clinical experience, respectively, and the US features were recorded with reference to the mammographic and clinic findings. US findings were divided into mass, ductal change, and pure microcalcifications. A mass was examined in two different planes. When the lesion did not exactly correspond to the definition of a mass, but rather to echo-filled distended ducts, we defined the lesion as a ductal change. When the lesion appeared as microcalcifications without any other local findings, we defined the lesion as pure microcalcifications. When mammography revealed microcalcifications not found by US, we repeated the US according to the location found by mammography.

Results

There were 12 false negatives on US among all 180 cases, and a total of 168 lesions were found on US. The US findings in these lesions were as follows: (1) hypoechoic masses with or without microcalcifications (n = 94). The shape was irregular and the margin was indistinct (Fig. 1). (2) Hypoechoic dilated ducts with or without microcalcifications (n = 59). The distended duct appeared as a flat hypoechoic nodule on US (Fig. 2). (3) Only microcalcifications without any other local findings (n = 15). Clustered or scattered microcalcifications were detected with the background of normal breast tissue, and there were no local masses or dilated ducts (Fig. 3).

Of 180 cases, 120 masses were diagnosed as malignant by US, with a diagnostic accuracy of 67% (120/180), including 84 masses, 26 cases of distended ducts, and 10 pure microcalcifications.

Of 180 lesions, microcalcifications were demonstrated by mammography in 128 (71%), and only 80 cases (44%) manifested as masses or asymmetric densities on mammography; the diagnostic accuracy of mammography was 69% (124/180). In those lesions (n = 128) with microcalcifications proven by mammography, 90 cases were identified with microcalcifications by US; the US detection rate of microcalcifications was 70%. The diagnostic accuracy was improved to 80% (144/180) when US was combined with mammography.

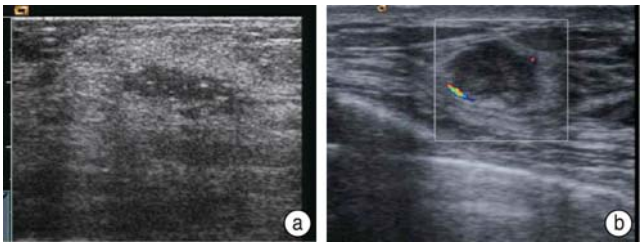

Fig. 1 DCIS of the breast on US. (a) An irregular hypoechoic mass with microcalcifications; (b) A hypoechoic mass without microcalcifications

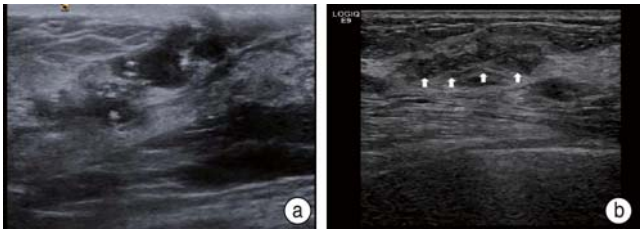

Fig. 2 DCIS of the breast. US showed a hypoechoic dilated duct (white arrows) with microcalcifications (a) and without microcalcifications (b)

Discussion

Mammography is regarded as the gold standard for the detection and characterization of microcalcifications, the most reliable mammographic feature of detected DCIS [3–4]. Owing to the wide use of mammography, the frequency of DCIS detection is increasing [5]. US generally has not been considered a diagnostic technique for DCIS because it is less sensitive than mammography for the identification of calcifications. However, the marked improvement of current high-frequency transducer technology has yield a high spatial resolution, allowing better and more frequent visualization of breast microcalcifications [6–7]. In our studies, the detection rate of microcalcifications with US was 70% (90/128); US can detect microcalcifications in most DCIS. When US can detect microcalcifications in lesions, US-guided procedures are preferred by patients over a mammography-guided procedure because patients are more comfortable, the breast is not compressed, and the procedure is quicker [8–9]. Furthermore, US has no ionizing radiation, and the needle can be observed in real time.

In our studies, apart from the finding of microcalcifications, DCIS appears most frequently as a solid, irregular mass with indistinct margins or as a hypoechoic mass with dilated breast ducts (153/180, 85%). Enlargement of ducts in DCIS can be attributed to tumor cells or necrosis within the duct lumen, periductal lymphocytic reaction, or periductal desmoplasia [10]. According to US features of the lesions' sharp margins, ductal extension, posterior echogenicity, and blood supply, we can easily differentiate benign from malignant

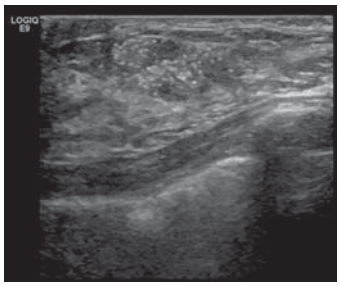

Fig. 3 DCIS of the breast. US showed pure microcalcifications without any other findings

lesions. Furthermore, calcifications that occur within masses are easily seen on US; this is partly because most malignant solid tumors provide a very hypoechoic background, which enhances the US demonstration of the bright punctate calcification [11]. Therefore, for detecting DCIS, the advantage of US examination is the high sensitivity to find the hypoechoic masses and nodules of the breast. However, mammographic detection of DCIS lesions without microcalcifications may be quite difficult, especially in dense breasts. In our study, only 44% cases manifested as masses or asymmetric densities on mammography.

It is thought to be more difficult to identify isolated microcalcifications within normal breast tissue by using US, as normal breasts comprise much hyperechoic and heterogeneous fibrous tissue. Only 15 cases were found with clustered or scattered microcalcifications under the background of normal breast tissues in our study. This is mainly due to a lack of contrast between normal parenchyma with hyperechoic heterogeneous fibrous structures and the microcalcifications [11]. Thus, the microcalcifications associated with DCIS are not easily visualized on US unless a mass is formed. In these patients, we performed US carefully at the location that was revealed by mammography in order to increase the US detection rate of microcalcifications.

DCIS is the early stage of breast cancer; therefore, early detection of DCIS is essential for improving the prognosis of breast cancer. In our study, the diagnostic accuracy of US and mammography was 67% and 69%, respectively, but when combining US and mammography, the diagnostic accuracy can be improved to 80%.

However, we only analyzed the ultrasound features of DCIS in this study, not including DCIS with microinvasion; therefore, the method for differentiating DCIS from DCIS with microinvasion has not been discussed.

In conclusion, our results show various US features of breast DCIS. US plays an important role in detecting DCIS with or without calcifications and in evaluating disease in women with dense breasts. US examination is an effective non-invasive method for identifying and localizing breast microcalcifications. US with a high-frequency transducer can be used along with mammography in detecting and evaluating DCIS of the breast.

Conflicts of interest

The authors indicated no potential conflicts of interest.

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DOI 10.1007/s10330-016-0196-6
Cite this article as: Wang LP, Deng YB, Cui XW. Ultrasonographic features of breast ductal carcinoma in situ. Oncol Transl Med, 2017, 3: 49–51.