Ultrasound in Med. & Biol., Vol. 41, No. 7, pp. 1835–1841, 2015

0301-5629/$ - see front matter

http://dx.doi.org/10.1016/j.ultrasmedbio.2015.03.024

● *Original Contribution*

SENSITIVITY, SPECIFICITY AND ACCURACY OF ULTRASOUND IN DIAGNOSIS OF BREAST CANCER METASTASIS TO THE AXILLARY LYMPH NODES IN CHINESE PATIENTS

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(*Received* 23 *May* 2014; *revised* 5 *March* 2015; *in final form* 27 *March* 2015)

Abstract—The use of ultrasound in the diagnosis of axillary lymph node metastases from breast cancer in a Chinese population was investigated. Data for 1,049 with breast cancer were retrospectively collected. All patients had undergone pre-operative axillary ultrasound and then axillary lymph node dissection. The sensitivity, specificity and accuracy of axillary ultrasound in this cohort were 69.4%, 81.8% and 77.0%, respectively. The overall false-negative rate of ultrasound images was 30.6% (123/402). False-negative ultrasound rates for pathologic N1, N2 and N3 patients were 46.2%, 21.8% and 9.3%, respectively. In patients with stage T1 disease and fewer than three metastatic lymph nodes, the false-negative ultrasound rate was 52.2% (47/90). Moreover, breast cancer patients with a false-negative axillary ultrasound were more likely to have a large tumor ($p < 0.001$) and high tumor grade ($p = 0.009$). However, there were no statistically significant differences between accuracy of axillary ultrasound and age of patients or experiences of ultrasound practitioners. In conclusion, the sensitivity, specificity and accuracy of ultrasound in the diagnosis of breast cancer metastasis to the axillary lymph nodes in Chinese patients were assessed. These data could help us to carefully use axillary ultrasound to diagnose and predict breast cancer axillary lymph node metastasis. (E-mail: pumchzyn@sohu.com or sunqiangpumc@sina.com) © **2015 World Federation for Ultrasound in Medicine & Biology.**

Key Words: **Breast cancer, Ultrasound diagnosis, Lymph node metastasis, Sensitivity, Specificity, Accuracy.**

INTRODUCTION

Breast cancer is one of the most significant health problems in the world and is the second leading cause of cancer-related death among women in the United States (American Cancer Society 2014). During the past three decades, both advancements in screening for early stages of breast cancer and improvement in treatment options have significantly reduced breast cancer mortality and improved quality of life, but many patients still develop metastatic disease and consequently die (Miao et al. 2014). A number of factors can affect the outcome of breast cancer, for example, clinicopathologic features (such as patient age, hormone receptor status, tumor stage, tumor size and presence of lymph node and distant metastases) (Goldhirsch et al. 2013). Among these, axillary lymph node status is one of the most important prognostic factors in breast cancer. Thus, pre-operative axillary ultrasound is crucial to staging and management of breast cancer in many institutions (Gentilini and Veronesi 2012; Vaidya et al. 1996). For example, accurate evaluation of axillary lymph node status could avoid an unnecessary sentinel lymph node biopsy (SLNB) or even the maximally invasive radical resection (Moorman et al. 2014). However, data on false-negative axillary ultrasound in Chinese women are sparse.

In addition, a recent large-scale randomized, controlled, multicentric clinical trial (SOUND [Sentinel Node versus Observation after Axillary Ultrasound] trial) of patients with negative axillary ultrasound compared the clinical outcome of SLNB with that of observation only (Gentilini and Veronesi 2012). In this trial,

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Conflicts of interest: The authors declare that there is no conflict of interest in this study.

Table 1. Clinicopathologic characteristics of breast cancer patients

Variable	Number (%) of cases
Age	
<65 y	945 (90.1)
≥65 y	104 (9.9)
Tumor size (cm)	
≤2	638 (60.8)
>2	411 (39.2)
Axillary lymph node metastasis	
N1	195 (18.6)
N2	110 (10.5)
N3	97 (9.2)
ER/PR expression	
Positive	707 (67.4)
Negative	342 (32.6)
HER-2 expression	
Low	613 (58.4)
High	436 (41.6)
Triple negative	
Yes	156 (14.9)
No	893 (85.1)
p53 expression	
Negative	696 (66.3)
Positive	353 (33.7)
Ki-67 expression	
Negative	399 (38.0)
Positive	650 (62.0)
Histologic grade	
I	213 (20.3)
II	467 (44.5)
III	369 (35.2)

ER/PR = estrogen receptor/progesterone receptor.

physicians used the inclusion criteria of negative axillary ultrasound and clinically negative axillary lymph nodes to rule out an evident or suspicious lymph node metastasis of breast cancer and, thus, perform conservative surgery instead of maximally invasive radical resection. However, a question was immediately raised as to whether ultrasound is useful in excluding axillary lymph node metastases from breast cancer. The reliability of the ongoing SOUND trial also needs to be considered with respect to the false-negative rate of axillary ultrasound.

Indeed, ultrasound imaging is widely used to evaluate the breast and axillae pre-operatively and can guide physicians in performance of core needle biopsy. Several previous studies (Motomura et al. 2001; Vaidya et al. 1996; Verbanck et al. 1997; Yang et al. 1996) on the accuracy of ultrasound in breast cancer staging reported that high-resolution ultrasound had broad ranges of sensitivity, specificity and overall accuracy of 50%–92%, 90%–100% and 76%–92%, respectively. Their finding indicates that ultrasound has moderate sensitivity, but high specificity in the detection of axillary metastases. However, other studies have reported on the impact of false-negative results in preoperative axillary ultrasound (Choi et al. 2012; Johnson et al. 2011; Neal et al. 2010; Park et al. 2013) on prognosis and choice of surgery. Thus, in this study, we assessed the diagnostic value of ultrasound imaging in the detection of breast cancer metastases to the axillary lymph nodes. Our aim was to investigate whether there is an identifiable subset of breast cancers associated with a higher risk of false-negative axillary ultrasound results.

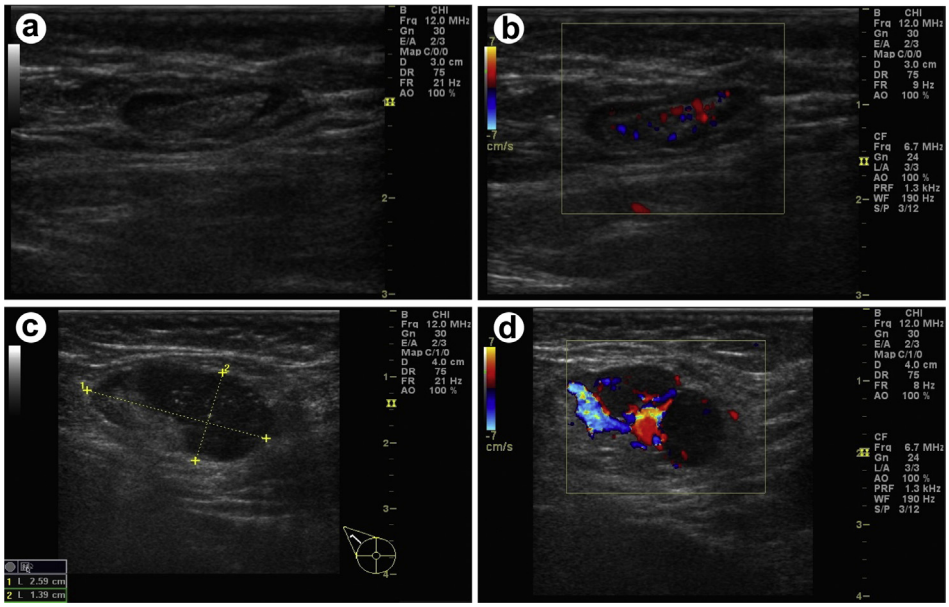

Fig. 1. Ultrasound images of normal and metastatic axillary lymph nodes. (a) Normal lymph node. (b) Blood flow in normal lymph node. (c) Metastatic lymph node (long-to-short axis ratio <2, compression of the fatty hilum, cortical thickening and asymmetry). (d) Blood flow in metastatic lymph node (rich blood flow signal).