

Tomosynthesis Confirms the Findings of Ultrasonography and Magnetic Resonance Imaging of the Breasts

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Abstract. Two-dimensional mammography has low sensitivity and often needs to be combined with other investigations. Tomosynthesis, a three-dimensional breast imaging technique, can be superior to mammography, in terms of size measurements and differentiation of breast lesions. We describe the case of a 41-year-old woman with a breast lesion imaged using mammography, ultrasonography, magnetic resonance imaging and tomosynthesis. Mammography showed heterogeneously dense parenchyma with a cluster of pleomorphic microcalcifications. Ultrasonography showed a poorly defined breast lesion and two enlarged left axillary lymph nodes. Magnetic resonance imaging revealed an irregular, persistently enhancing lesion and three abnormal left axillary lymph nodes. Biopsy confirmed the diagnosis of carcinoma. Tomosynthesis confirmed the breast lesion as well as the three abnormal lymph nodes. Thus, tomosynthesis plus mammography provided as much diagnostic information as the other tests combined and may be useful for the screening and diagnosis of breast cancer.

Keywords: Tomosynthesis, Breast imaging, Mammography, 3D mammography.

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Introduction

Digital two-dimensional mammography has been reported to have false-negative rates ranging from 8% to 66%^[1]. Therefore, this test usually needs additional views and magnifications or combined with other investigations, such as magnetic resonance imaging (MRI), ultrasonography and biopsy. Compared to digital mammography, tomosynthesis, a tool for three-dimensional breast imaging, has shown superior results in terms of size measurements and differentiation of breast lesions^[2]. However, the use of tomosynthesis in the clinical practice is still in its preliminary stages. A number of trials and research studies are being conducted worldwide to optimize tomosynthesis and pave the way to possibly replace the current gold standard for breast cancer screening^[3-5]. Currently, several institutions are investigating the usefulness of tomosynthesis for breast cancer screening or diagnosis with a large number of women recruited^[6]. Moreover, the combination of tomosynthesis with mammography for breast cancer screening has resulted in significantly higher cancer detection rates and enabled the detection of more invasive cancers^[7].

In this report, we describe the case of a patient with a breast lesion that required conventional two-dimensional mammography, ultrasonography, MRI and biopsy for diagnosis. In this patient, tomosynthesis was also requested to verify its usefulness. It has provided as much information as mammography, ultrasonography and MRI put together.

Case Report

Our patient was a 41-year-old woman with no personal or family history of breast cancer. She had identified a mass in her left breast on self-examination. Two-view mammography was performed using a Senographe Essential system by GE Healthcare, (General Electric Healthcare, Little Chalfont, Buckinghamshire UK) and it showed heterogeneously dense parenchyma with a cluster of pleomorphic microcalcifications (Fig. 1).

Ultrasonography and MRI were requested for confirmation of the mammography findings and more precise identification of the lesion. In addition, two-view tomosynthesis was performed for comparison, by using a Giotto Image 3D unit from Internazionale Medico Scientifica Srl (I.M.S. Internazionale Medico Scientifica Srl, Bologna, Italy).

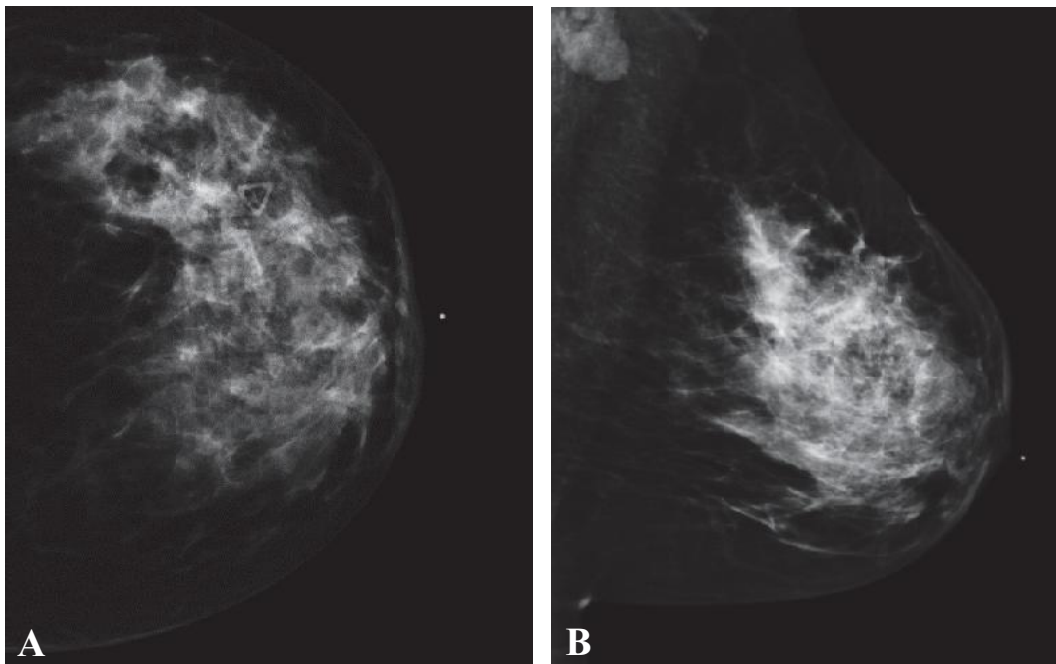


Fig. 1. Two-dimensional mammograms in the craniocaudal (A) and mediolateral oblique (B) views showing a cluster of pleomorphic microcalcifications.

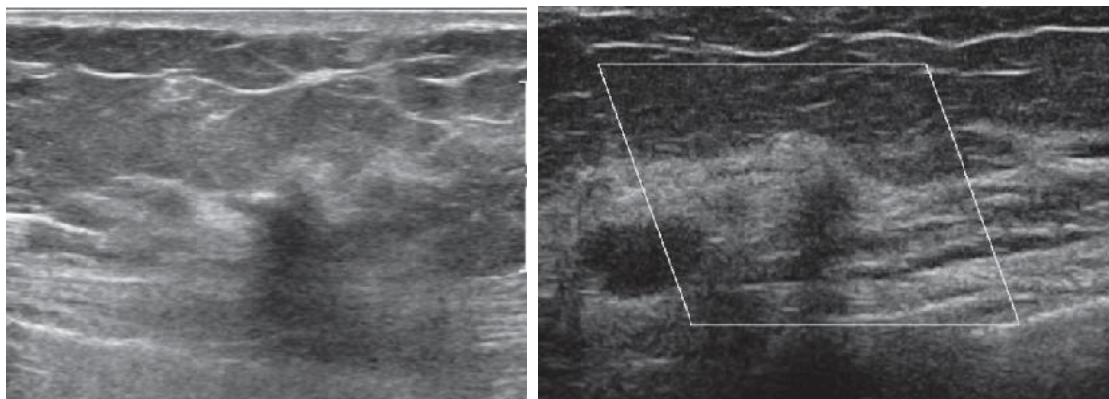


Fig. 2. Ultrasound showing suspected lesion and enlarged left axillary lymph nodes.

Ultrasonography revealed a poorly defined, difficult-to-measure lesion in the superolateral aspect of the left breast and at least two enlarged left axillary lymph nodes (Fig. 2). T1- and T2-weighted, contrast-enhanced MRI confirmed a 10.8×4.0 cm irregular lesion that showed early and persistent enhancement and extended laterally from the nipple to the posterior aspect of the left breast (Fig. 3). In addition, at least three abnormal left axillary lymph nodes were identified. An ultrasound-guided core biopsy confirmed the diagnosis of carcinoma.

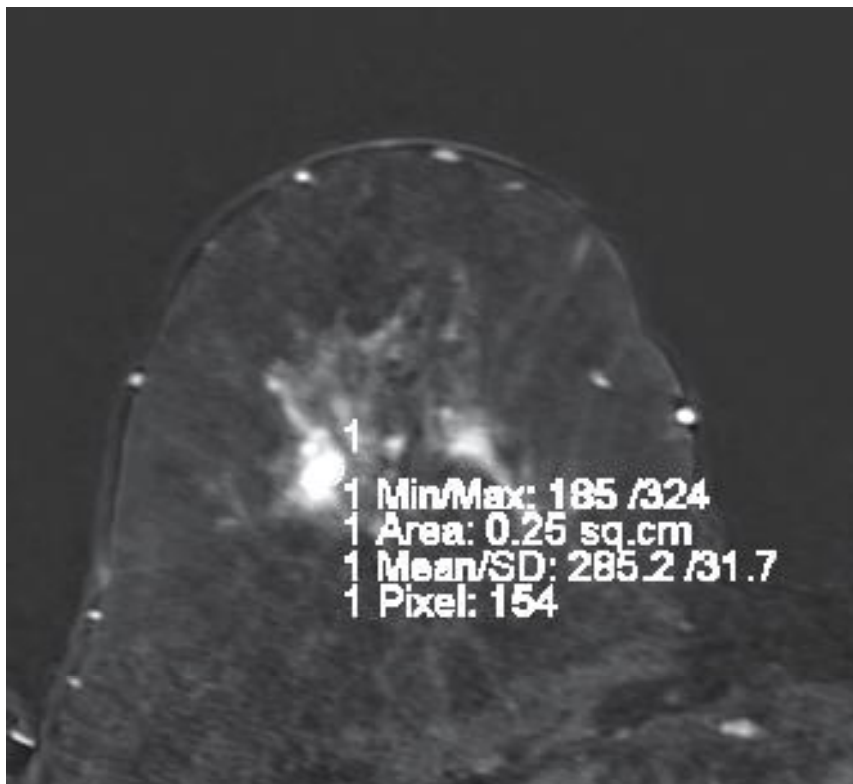


Fig. 3. MRI identification and measurement of the suspected area.

Similar to MRI, tomosynthesis confirmed the location of the calcifications and identified additional parenchymal distortion, and a spiculated density posterior and medial to the clustered calcifications (Fig. 4A).

Furthermore, the mediolateral oblique view confirmed the finding of the three abnormal lymph nodes, which appeared denser than on

two-dimensional images (Fig. 4B). Unlike two-dimensional mammography which only identified the calcifications; tomosynthesis alone, confirmed all the pathological findings detected on mammography, ultrasonography and MRI.

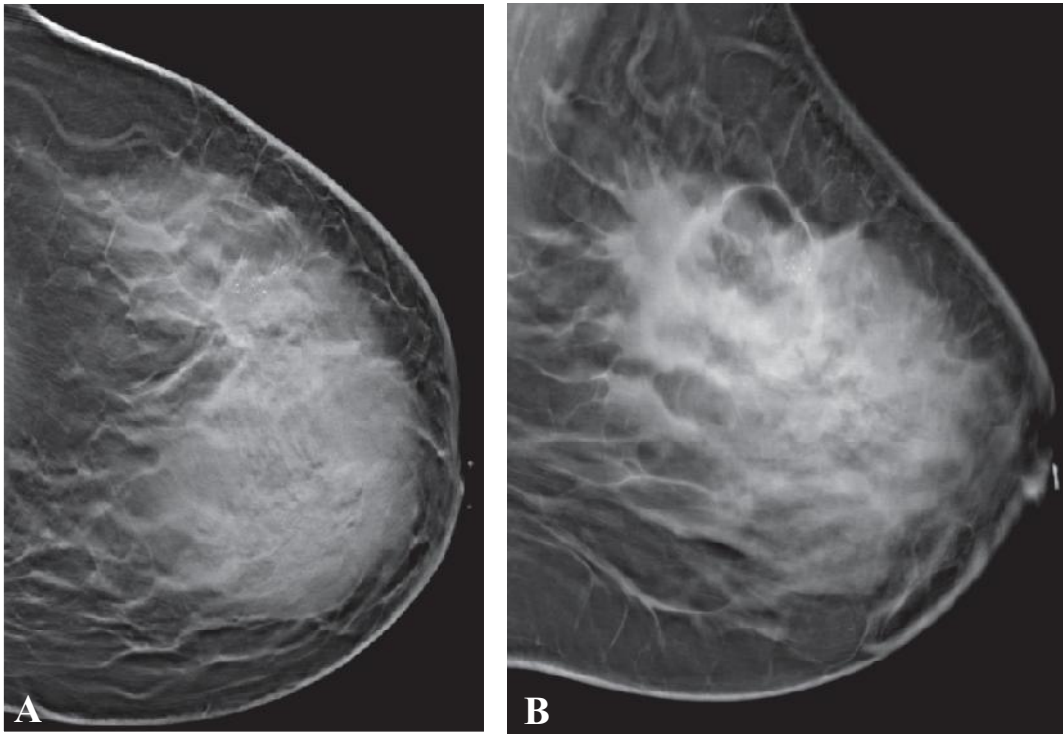


Fig. 4. Tomosynthesis showing clear calcifications in the craniocaudal view (A) and clustered calcifications and a spiculated posterior lesion in the mediolateral oblique view (B).

The patient was diagnosed with ductal carcinoma in situ of the left breast, with involvement of the left axillary lymph nodes. A lumpectomy with sentinel node dissection followed by radiation therapy is planned for this patient.

Discussion

Tomosynthesis is a revolutionary new breast imaging method that has resolved the persistent problem of overlapping tissue in two-dimensional mammography. The drawback of this technology is the fact that it is associated with a slightly higher dose than digital

mammography alone, depending on machine settings and number of views. The radiation dose from combined investigations by mammography and tomosynthesis could reach 2 times that of mammography alone^[5]. However, it can still be under the allowable dose limit set by the Food & Drug Administration (FDA) and American College of Radiology (ACR) per breast (3mSv)^[5]. Several studies have reported a reduction in recall rates and increased detection of breast cancers due to the use of tomosynthesis in addition to mammography for breast cancer screening^[1,2].

In the case of this patient, an abnormality was detected on two-dimensional mammography, but further investigations, namely, ultrasonography, MRI and biopsy, were still required to characterize and define the lesion. In the same patient, tomosynthesis alone could confirm the findings of two-dimensional mammography, ultrasonography and MRI. Thus, this case report demonstrates the clinical usefulness of tomosynthesis. Moreover, breast tomosynthesis allows for better visualization of lesions in dense breasts^[6], and could decrease the need for additional investigations like MRI, ultrasonography and biopsy, which cause emotional distress to the patient and increase healthcare costs.

Tomosynthesis is becoming an essential diagnostic tool for the detection of breast cancer, and although it has not been approved as a screening tool, its usefulness has been proven, especially in high-risk patients and those with dense breast tissue^[3,5]. Moreover, our experience suggests that the combination of tomosynthesis with mammography for breast cancer screening increases the sensitivity of screening, and provides better characterization of lesion margins, although this needs to be confirmed in a large cohort.

Clinical studies on the use of tomosynthesis for screening and diagnosis have been conducted in Europe and the United States, and several trials are ongoing^[3,5,6]. Many presentations and discussions during The European Congress of Radiology in Vienna in March 2013 foresaw breast tomosynthesis modifying the existing practice in mammography screening in the near future^[8]. However, this

technology is still relatively new in Saudi Arabia, having been introduced less than 2 years ago. The lack of a national screening program contributes to the late presentation of breast cancer in Saudi Arabia. The introduction of tomosynthesis in combination with two-dimensional mammography for breast cancer screening may enable the accurate detection of highly suspicious lesions on tomosynthesis alone without requiring additional views on conventional two-dimensional mammography or additional investigations, as illustrated by this case.

Conclusion

Tomosynthesis in combination with two-dimensional digital mammography provided equivalent diagnostic information to that provided by two-dimensional mammography, ultrasonography, and MRI all together; therefore, possibly a useful tool for the screening and diagnosis of breast cancer.

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تصوير الثدي ثلاثي الأبعاد يؤكد نتائج الموجات فوق الصوتية والتصوير بالرنين المغناطيسي معا

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المستخلص. إن للتصوير الإشعاعي للثدي ثنائي الأبعاد (الماموجرام) قيوداً منها الحساسية المنخفضة لأنواع الأنسجة المختلفة الموجودة في الثدي وكثيراً ما يحتاج إلى تصوير إضافي وأدوات تشخيصية أخرى للتأكد من الأنسجة السرطانية في الثدي من ناحية تواجدها، حجمها ومواقعها. فإن تقنية تصوير الثدي ثلاثي الأبعاد (التوموسنثز) متفوقة عليه من حيث قياسات حجم الأنسجة السرطانية وتميز وجودها ولكن الى الان لا يستخدم كالمعيار الأمثل للكشف المبكر. نستعرض في هذه المقالة حالة امرأة تبلغ من العمر ٤١ عاماً. أظهر كشف الماموجرام احتمال وجود أنسجة سرطانية. لذا إحتاجت الحالة إجراء كشف إضافي بالموجات فوق الصوتية الذي أظهر وجود غدتان لنفاويتان متضخمتان وعند إجراء تصوير بالرنين المغناطيسي أكد وجود ثلاثة غدد. كما أكدت العينة المستأصلة من الثدي وجود نسيج كثيف متجانس وتكلسات مجهية متشعبة وسرطان. قمنا بإجراء التصوير ثلاثي الأبعاد للتأكد من التشخيصات السابقة مجملة، والذي بدوره أكد التشخيص. عند استخدام التصوير ثلاثي الأبعاد، كان

التشخيص واضح فهو أكد وجود سرطان في الثدي الحالة وكذلك الغدد الليمفاوية غيرالطبيعية وعددها ثلاثة. فإن هذا النوع من التصوير قدم معلومات تشخيصية بقدر الاختبارات الأخرى مجملة. نرى أن إستخدام كل من التصوير ثنائي وثلاثي الأبعاد معاً قد يكون أفضل من الماموجرام لفحص وتشخيص سرطان الثدي.