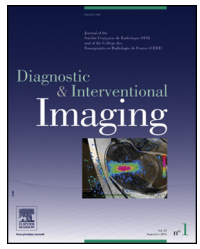
Diagnostic and Interventional Imaging (2015) **96**, 27—35



ORIGINAL ARTICLE / *Breast imaging*

The role of tomosynthesis in breast cancer staging in 75 patients

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KEYWORDS
Tomosynthesis;
Breast;
Staging;
Multifocality;
Multicentricity

Abstract
Objectives: Compare tomosynthesis to mammography, ultrasound, MRI, and histology for the detection and staging of BI-RADS 4—5 anomalies, as a function of breast composition, lesion location, size, and histology.
Patients and methods: Seventy-five patients underwent mammography, tomosynthesis, ultrasound, and MRI. The diagnostic accuracy of the different examinations was compared.
Results: The sensitivities for detection were as follows: 92.5% with MRI, 79% for ultrasound, 75% for tomosynthesis, and 59.5% for mammography. Tomosynthesis improves the sensitivity of mammography ($P = 0.00013$), but not the specificity. The detection of multifocality and multicentricity was improved, but not significantly. Tomosynthesis identified more lesions than mammography in 10% of cases and improved lesion staging irrespective of the density, but was still inferior to MRI. The detection of ductal neoplasia was superior with tomosynthesis than with mammography ($P = 0.016$), but this was not the case with lobular cancer. The visualization of masses was improved with tomosynthesis ($P = 0.00012$), but not microcalcifications. Tomosynthesis was capable of differentiating lesions of all sizes, but the smaller lesions were easier to see. Lesion sizes measured with tomosynthesis, excluding the spicules, concurred with histological dimensions. Spicules lead to an overestimation of the size.
Conclusion: In our series, tomosynthesis found more lesions than mammography in 10% of patients, resulting in an adaption of the surgical plan.

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http://dx.doi.org/10.1016/j.diii.2014.06.010

The improved prognosis [1] for breast cancers is partly linked to advances in treatment.

Optimal staging, to determine the size of the tumor and the presence of additional lesions, is essential for appropriate surgery with healthy margins. Multifocality (more than two lesions in the same quadrant), multicentricity (two or more lesions in different quadrants), or contralateral disease [2,3] may require more extensive breast surgery. Ignorance of additional lesions affects relapse and survival rates, but the literature is not consensual [4].

To detect these multiple lesions, mammography has a sensitivity of less than 50% [5—9], and mammary MRI of 94—99% [5,9—13].

Tomosynthesis, a new technique in 3D breast imaging, acquires reconstructed volume data, the data is reconstructed secondarily in mammary slices from several radiographs acquired from different angles of view (—25° to +25° for Siemens®). It theoretically improves the sensitivity of detection by enabling enhanced delimitation of the lesion margins, and the specificity by avoiding the problem of glandular superimposition [14].

The main objective of this study was to compare tomosynthesis with 2D mammography (Fig. 1a and b, Fig. 2a and b), ultrasound, and MRI (Fig. 3a and b) in cases with suspected BI-RADS 4 or 5 anomalies, to determine its potential benefit for staging, and in particular for multifocality and multicentricity. The secondary objectives were:

- the detection of contralateral tumors;
- to calculate the sensitivity, specificity, and positive and negative predictive values (PPV and NPV) of tomosynthesis in comparison with mammography for all of the lesions;
- to grade the various imaging techniques using a qualitative ''TOMOS'' score for clinical performance;
- the comparative analysis of tomosynthesis and mammography for lesion detection according to breast density, histology, signal (mass, microcalcification), breast topography, and volume;
- the comparison of lesion sizes with tomosynthesis versus histology.

Patients and methods

The study was prospective and monocentric, with 75 patients included between 2012 and 2013; it was approved by the Committee for the Protection and Privacy of persons involved in clinical trials, the ANSM, and the scientific Committee of the establishment.

The patients were addressed to senology for the staging of a BI-RADS 4 or 5 lesion. The priority for inclusion was for patients with an indication for MRI, in compliance with recommendations (neoadjuvant treatment, invasive lobular carcinomas, young women, high family risk).

The criteria for non-inclusion were contraindications for MRI, pregnancy, and cognitive disorders preventing informed consent.

Each patient underwent, for each breast, clinical examination, 2D mammography (anterior-posterior, lateral oblique, and additional views if necessary), tomosynthesis (anterior-posterior, lateral), ultrasound, biopsies of suspicious lesions, MRI, and if necessary a 2nd look ultrasound and biopsies of additional lesions.

We used mammography with tomosynthesis (Mammomat Inspiration® from Siemens®), ultrasound (Voluson 730 Expert® of General Electric®, Aixplorer of Supersonic Imaging®), and MRI (1.5 T General Electric® and 1.5 T Philips®).

These examinations were re-read by two senologists (15 and 20 years of experience), in double blind, who were aware of the clinical presentation. The first reading was prospective, the second retrospective.

The data collected for each patient were as follows: sex, age, menopausal status, previous history of breast cancer, genetic mutations, the palpable nature of the main lesion, and the size of the breast (small, medium, or large).

We recorded the following parameters for the main and satellite lesions:

- breast density;
- the type of lesion (mass, microcalcification, architectural distortion);

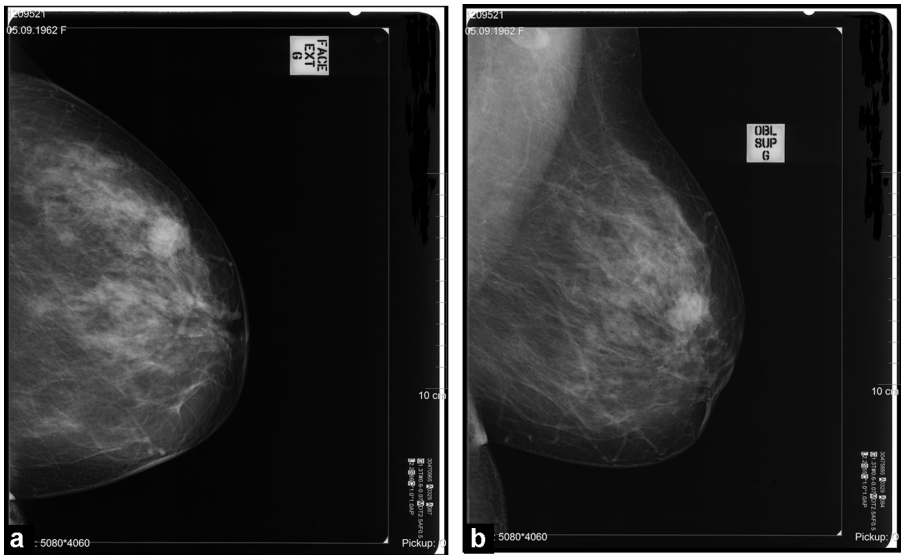

Figure 1. Left mammography: a: anteroposterior mammography; b: oblique mammography.