BI-RADS classification in breast tomosynthesis. Our experience in breast cancer cases categorized as BI-RADS 0 in digital mammography

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Aims and objectives

Digital breast tomosynthesis (DBT) is an important breakthrough in the diagnosis of breast cancer, many studies have shown the effectiveness of its application in screening programs (increasing cancer detection and reducing recall rates\(^1,2,3\)) and in the diagnostic environment (improving the classification and characterization of breast lesions\(^4,5\)) and reducing the number of BI-RADS category 3 lesions with an increased percentage of studies reported as BI-RADS 1 or 2\(^6\). The evaluation of rebuilt images (obtained from different angles from the breast in a short scanning process) allows the assessment of breast parenchyma where lesions may go unnoticed or less evident due to tissue overlap or increased breast density. Mammographic findings are seen more clearly in tomographic images with the consequent improvement of BI-RADS categorization. This fact is reflected, among other things, by the upgrade on BI-RADS classification of malignant lesions not correctly assessed by mammography\(^7\), in a better diagnostic performance in dense breasts with BI-RADS 0 findings\(^8\) and in the demonstration of suspicious lesions that are occult to digital mammography\(^9\). The aim of our study was to assess BI-RADS classification by digital breast tomosynthesis (DBT) in breast cancer cases classified as BI-RADS 0 after digital mammography as initial approach.
Methods and materials

This study is part of a retrospective review of breast cancer cases that were evaluated by digital mammography and DBT between May 2011 and December 2015. We assessed 385 patients with the diagnosis of breast cancer confirmed by percutaneous biopsy or surgical exeresis (the age range of the patients was from 30 to 89 years, 136 patients of our series were recalled from the breast cancer screening program and the remaining 249 patients had symptoms or had periodic surveillance in our centre).

After signing the informed consent, each patient underwent bilateral two view cranio-caudal and medio-lateral-oblique digital mammography and DBT with the Hologic Selenia Dimensions system (images were acquired during the same compression for each view, in some cases we obtained lateral views). Images were part of a database reviewed independently by 3 radiologists with experience varying from 2 to 15 years, BI-RADS classification of each DM and DBT was registered by the readers during the diagnostic process (as part of our protocol, since the year 2011 and before ACR recommendations, we decided not to use BI-RADS 3 category to classify screening studies).

Radiologists visualized mammographic images first followed by DBT images, BI-RADS classification was performed by each reader in the same sequence of visualization (they had to review the images in that order and classify them without the possibility of modifying BI-RADS mammographic categories after viewing DBT images). We selected and analyzed the BI-RADS classification by DBT in those cases categorized as BI-RADS 0 initially by mammography (with emphasis on the morphological features of the lesions).
Results

We found 159 lesions assessed as BI-RADS 0 in mammography, after the analysis of DBT images, 28 (17.6%) and 71 (44.7%) cases were reclassified as BI-RADS 4 and 5 respectively, the rest of them (60) were considered BI-RADS 0 at DBT Fig. 1 on page 6.

In terms of breast density, type b was the most frequent (60.4%) in our series, and the majority of mammographic BI-RADS 0 findings (masses and asymmetries) were under this category Fig. 2 on page 6.

Regarding the morphology, we found three types of lesions at mammography: Masses (49.05%), asymmetries (45.3%) and microcalcifications (5.7%). At DBT, those findings were confirmed or reclassified as follows Fig. 3 on page 7:

Masses

- There were 78 masses categorized as BI-RADS 0 at mammography Fig. 4 on page 7 Fig. 5 on page 8, 77 cases from this group were detected as nodules by DBT Fig. 6 on page 9 Fig. 7 on page 10 DBT also reclassified 66 cases that were initially categorized as asymmetries (62) and microcalcifications (4).
- There was a total of 143 masses detected by DBT, we couldn’t get additional information from DBT images in 47 cases (32.9%) and they were also classified as BI-RADS 0, the rest of the masses had another suspicious signs associated like lobulation, architectural distortion or microcalcifications Fig. 8 on page 11.

Microcalcifications

- We had 9 cases of microcalcifications in mammography, at DBT we found 4 associated masses (BI-RADS 4 - 5) Fig. 9 on page 12 Fig. 10 on page 13 and the remaining 5 cases were classified as BI-RADS 0.

Distortions

- DBT identified 2 distortions occulted at digital mammography (reported as a nodule and an asymmetry respectively). Spiculation and retraction of the parenchyma were evident at DBT Fig. 11 on page 14 Fig. 12 on page 15.
Asymmetries

- In the case of asymmetries, 72 cases were categorized as BI-RADS 0 at digital mammography. At assessing this group with DBT, we identified 62 occult masses, 1 distortion Fig. 13 on page 16 Fig. 14 on page 17 and 9 persistent asymmetries (8 of them were classified as BI-RADS 0).

Finally, invasive ductal carcinoma was the most frequent pathologic diagnosis in our group (we found 123 masses detected at DBT with this type of breast cancer) Fig. 15 on page 18.
Fig. 1: Assessment of BI-RADS 0 cases in digital mammography by DBT.

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Fig. 2: Distribution of breast density in BI-RADS 0 cases at digital mammography.
Fig. 3: BI-RADS 0 mammographic findings versus DBT findings.
**Fig. 4:** 64 year-old woman: Mass seen in the external quadrants of the breast.

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Fig. 5: 64 year-old woman: At DBT we identified a well-circumscribed mass (4 cm) without other signs of malignancy (colloid carcinoma).

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Fig. 6: 55 year-old woman: In 2D OML view we identified a non-specific nodule in the superior quadrants of the breast.

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Fig. 7: 55 year-old woman: At DBT (lateral view), we identified the same nodule with spiculated margins.

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**Fig. 8:** BI-RADS classification in masses detected at DBT.

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Fig. 9: 56 year-old woman: In 2D CC view we identified a cluster of punctate microcalcifications in the external quadrants of the breast.

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Fig. 10: 56 year-old woman: Tomosynthesis in the craniocaudal view showed an occult mass associated with microcalcifications.

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Fig. 11: 40 year-old woman: Focal asymmetry seen in the external quadrants (CC view).

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Fig. 12: 40 year-old woman: Tomosynthesis identified an architectural distorsion in the area of asymmetry.

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Fig. 13: 48 year-old woman: Patient recalled from the screening program to assess a nodule at the external quadrants of the breast. We also identified an area of fibroglandular density at the same level.

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Fig. 14: 48 year-old woman: Tomosynthesis identified an architectural distortion in the area of fibroglandular density described before. We also identified the nodule (BI-RADS 0) previously detected at mammography (it was a simple cyst).

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**Fig. 15:** Final pathologic diagnosis distributed according to DBT findings.

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Conclusion

In our experience, DBT improves morphological characterization of lesions and BI-RADS classification, reducing the number of cases assessed as BI-RADS 0 in digital mammography (more than 50% of our breast cancer cases of our series were correctly classified as suspicious abnormality or highly suggestive of malignancy). This evidence would support the idea that DBT is an indispensable requirement at the beginning of the diagnostic process for breast cancer. Moreover, breast cancer cases initially classified as BI-RADS 0 in mammography were not erroneously assessed as negative or benign findings in DBT.
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