

Contrast-Enhanced Mammography-Guided Biopsy: A Case Report and Literature Review

SIDIBE Fakourou^{1,2*}, NOUR Said¹, CLAUDIU Sucaluc², COHEN David², NASTE Nadia², MOLIERE Sebastien², AABID Mohammed¹, AHAMANA Choukry Moliere Sebastien¹, ZOUITA Ibstissam¹, BASRAOUI Dounia¹, JALAL Hicham¹

¹Department of Radiology, Mohammed VI University Hospital, Marrakech, Morocco.

²Department of Breast Imaging, Centre Paul Strauss, Strasbourg, France.

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*Corresponding author: SIDIBE Fakourou

Department of Radiology, Mohammed VI University Hospital, Marrakech, Morocco

Abstract

Case Report

Contrast-enhanced mammography (CEM) is a highly effective functional imaging technique, comparable to MRI, enabling the detection of breast lesions based on their enhancement after contrast injection. We report the case of a patient in whom a contralateral lesion, not confirmed on initial ultrasound-guided biopsy, was re-characterized by contrast-enhanced mammography, revealing a distinct suspicious abnormality. Targeted vacuum-assisted biopsy provided a precise histological diagnosis, allowing appropriate therapeutic management. This case highlights the value of contrast-enhanced mammography-guided biopsy in situations of radiologic–histologic discordance or lesions occult on conventional imaging, offering a reliable and accessible alternative to MRI-guided biopsy.

Keywords: Contrast-Enhanced Mammography, Breast Cancer, Biopsy.

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INTRODUCTION

Contrast-enhanced mammography (CEM) is a technique combining dual-energy mammography with iodinated contrast injection. Essentially, two acquisitions are performed: a low-energy image equivalent to standard mammography, used as a “mask,” and a high-energy image, which is subtracted from the mask. The resulting recombined image highlights only areas of the breast showing contrast enhancement [1].

Unlike conventional mammography or tomosynthesis, CEM allows visualization of breast vascularity, particularly tumor-related neoangiogenesis, a hallmark of malignancy. For this reason, the sensitivity of CEM for tumor detection is higher than that of mammography, tomosynthesis, ultrasound, or the combination of these modalities [1–3].

In terms of image contrast and diagnostic performance, CEM is closer to breast MRI angiography, while offering several important advantages [4]. Indeed, CEM can be performed using a modified mammography system, making it more accessible and less costly than MRI, with shorter acquisition times. Moreover, CEM

provides direct correlation with mammography, facilitating interpretation, which is also binary (presence or absence of enhancement). Finally, CEM is generally better tolerated than MRI in terms of anxiety, claustrophobia, and overall patient comfort.

CEM is associated with a slight increase in radiation dose compared with full-field digital mammography, with an average dose per view ranging from 0.43 to 2.65 mGy depending on the manufacturer, according to the meta-analysis by Zanardo *et al.*, [5].

When a suspicious lesion is identified on CEM recombined images, correlation with ultrasound, mammography, or tomosynthesis should be sought, as these modalities allow image-guided tissue sampling. More than one-third of lesions detected on CEM have an ultrasound correlate [6].

Furthermore, adding tomosynthesis acquisition during the same breast compression as CEM enables tomosynthesis-guided biopsy in nearly two-thirds of cases [7]. When no correlation is found on ultrasound,

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mammography, or tomosynthesis, biopsy is performed under MRI or CEM guidance.

Technique

The most commonly used approach is the horizontal (lateral) approach. This provides better visualization of lesion enhancement through more homogeneous compression using a non-perforated compression paddle and reduces needle-related artifacts. It also allows acquisition of a “pre-fire” image with the needle in contact with the target.

At the beginning of the procedure, skin marking is performed over the lesion site. A three-dimensional planning acquisition is then performed, centered on the sampling window, to evaluate the lesion environment and identify anatomical landmarks (calcifications, vessels, or fatty lobules).

The breast is then decompressed prior to iodinated contrast injection. The injection protocol is identical to that used for diagnostic CEM, with a contrast concentration of 350 mg iodine/cm³, administered at a dose of 1.5 cm³/kg and an injection rate of 3 cm³/s.

Two minutes after the start of injection, the breast is recompressed and repositioned. A bidimensional low- and high-energy acquisition is

performed, and a recombined image is generated to visualize lesion enhancement within the target window. Spatial coordinates of the target are then calculated using stereotactic low- and high-energy images acquired at complementary angles of +15° and -15°.

Once targeting is completed, local anesthesia is administered at the puncture site and along the needle path, followed by needle placement and tissue sampling. A marker clip is deployed at the end of the procedure to localize the sampled area.

This technique is advantageous as it is rapid, easy to organize, and already familiar to breast imaging radiologists, who routinely perform similar procedures under other guidance modalities (ultrasound, stereotaxis, tomosynthesis, MRI) [8].

CASE PRESENTATION

The patient was referred for routine breast cancer screening, with no breast-related symptoms, and a family history of breast cancer in her grandmother.

Clinical examination was unremarkable, with no palpable mass and no axillary lymphadenopathy detected.

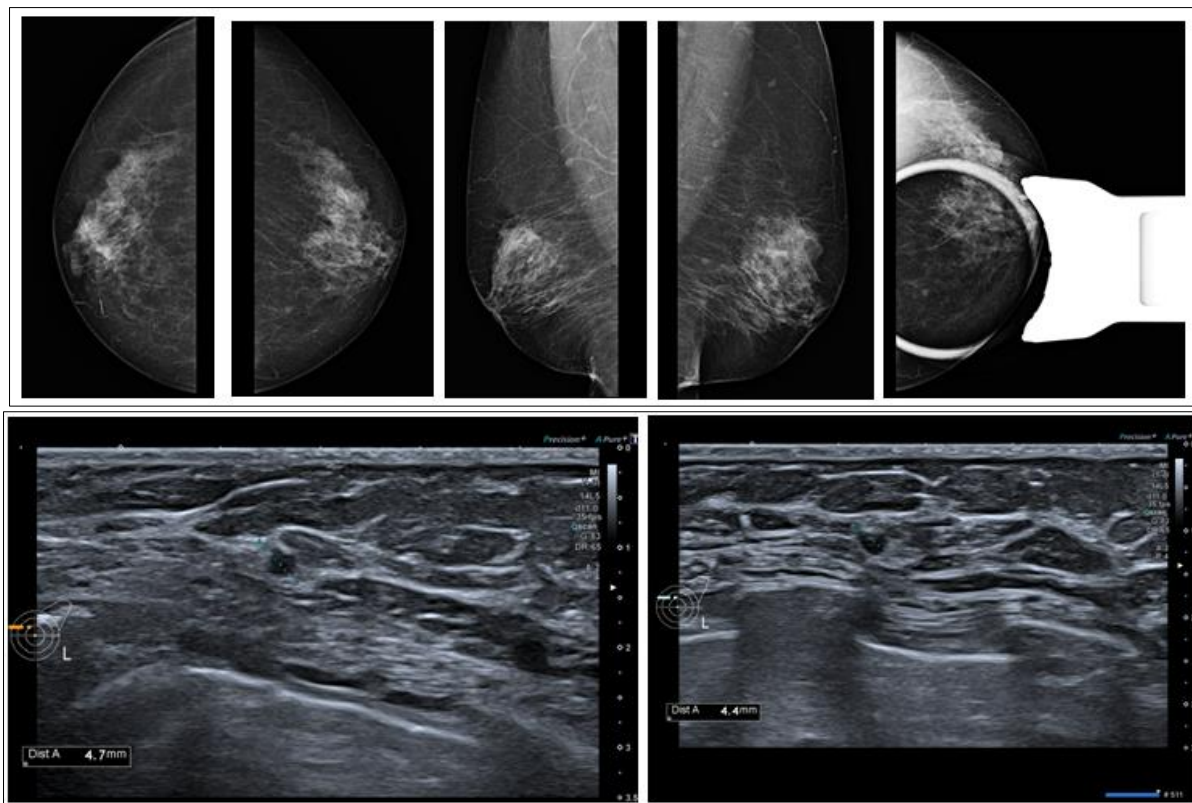


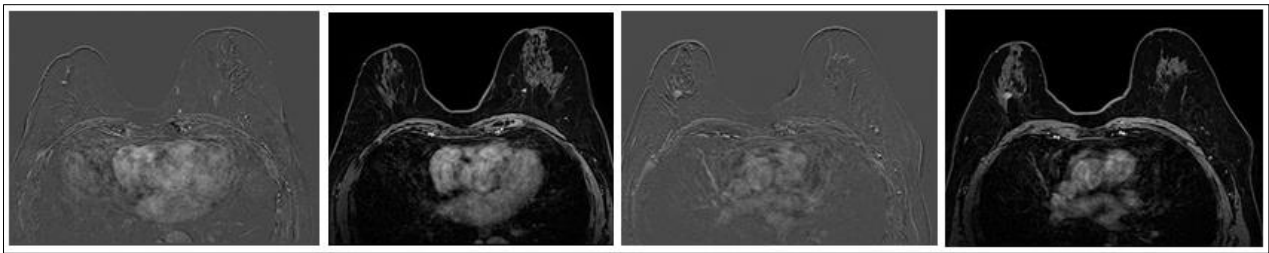
Figure Legend:

The initial mammography (density C) reveals, in the left breast, a 4–5 mm irregular opacity located in

the upper inner quadrant, classified as ACR 4. Ultrasound confirms an irregular hypoechoic nodule at

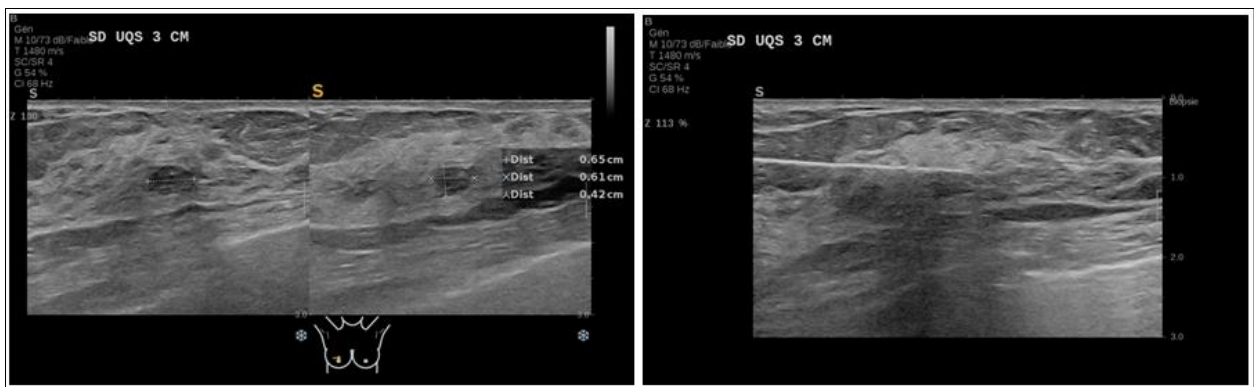
the same location. Core needle biopsy concludes to ductal carcinoma in situ.

Breast MRI demonstrates enhancement corresponding to the left-sided lesion, as well as a second contralateral right-sided lesion measuring 9 mm.



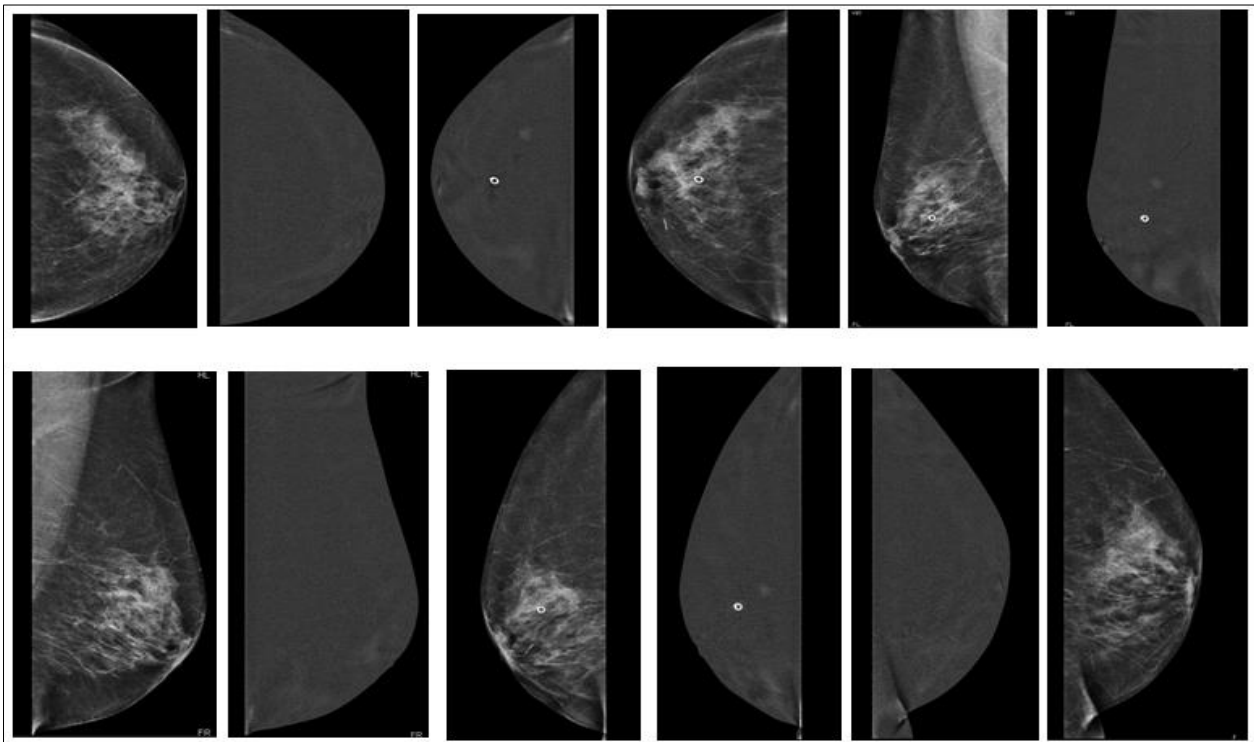
Second-look ultrasound of the right breast reveals a 7 mm hypoechoic area. A biopsy was

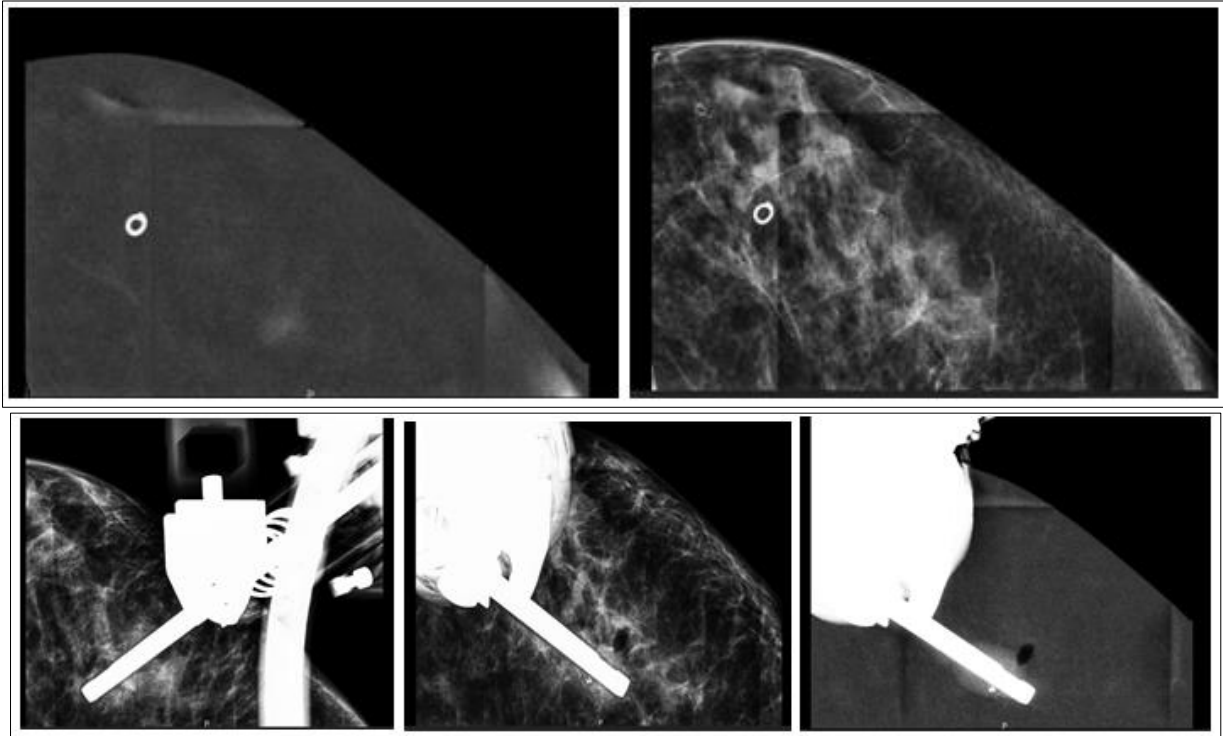
performed with clip placement, and histopathological analysis showed benign fibrous changes.



Given the radiologic-histologic discordance, contrast-enhanced mammography was performed, revealing a 7 mm right-sided nodular enhancement

located away from the initial clip. A stereotactic vacuum-assisted biopsy was subsequently carried out with clip placement.

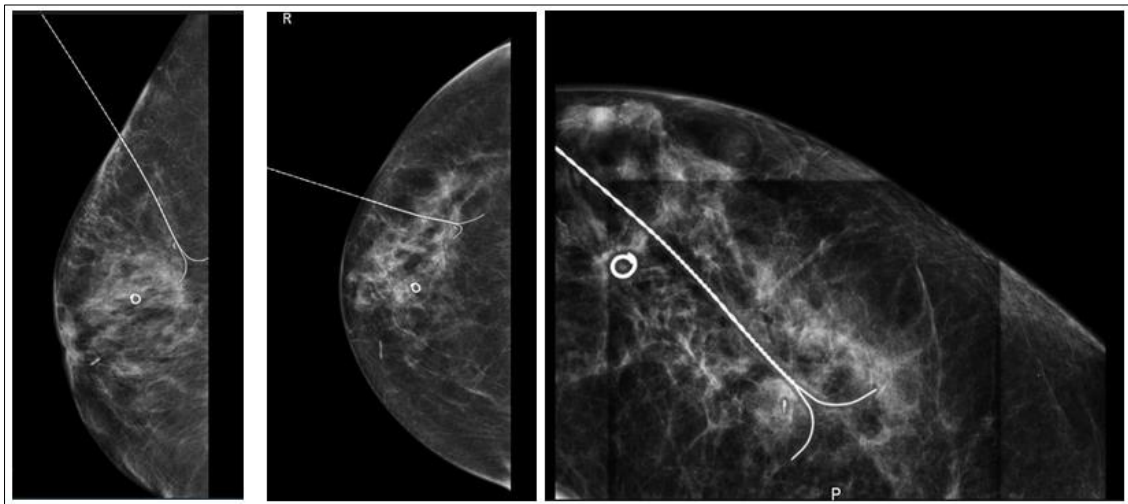




Histopathological Result

Right breast, upper quadrants junction, vacuum-assisted biopsy: invasive carcinoma of no special type (NST), presumed SBR grade II (modified SBR score: 2/5).

Preoperative localization of the right-sided lesion was performed under stereotactic guidance due to its poor visualization on ultrasound. The control image confirmed correct positioning of the localization wire in contact with the marker clip.



A partial mastectomy associated with sentinel lymph node dissection was performed in this patient.

DISCUSSION

Contrast-enhanced mammography (CEM)-guided biopsy represents a recent advancement in the management of breast lesions detected only after contrast injection. It is emerging as a promising alternative to conventional guidance techniques, particularly MRI-guided biopsy.

1. Value of CEM-Guided Biopsy

CEM-guided biopsy appears to be a relevant alternative to MRI-guided biopsy, especially in centers with limited access to MRI. Several studies have demonstrated excellent correlation between lesions enhanced on CEM and those visualized on MRI, with comparable diagnostic performance [9].

In practice, CEM offers notable logistical advantages: it is more accessible, less expensive, and

faster than MRI, while still allowing both morphological and functional evaluation of breast lesions [10].

2. Main Indications

The main indications for CEM-guided biopsy include lesions visible only after contrast injection and not detectable on standard mammography or ultrasound.

It is also particularly useful in cases of contraindications to MRI (such as claustrophobia, non-compatible pacemakers, or severe renal insufficiency in the context of gadolinium injection) or when MRI is not available within an appropriate timeframe for patient management [11].

3. Comparison with Other Techniques

Compared with MRI-guided biopsy, CEM-guided biopsy offers a simpler procedure, performed in a seated or standing position, with improved patient comfort and shorter examination time. However, MRI retains slightly higher sensitivity for certain multifocal or diffuse lesions [12].

Ultrasound-guided biopsy remains the reference technique when the lesion is visible on ultrasound, due to its simplicity, low cost, and absence of radiation. However, it is limited to sonographically visible lesions.

Stereotactic biopsy is particularly well suited for microcalcifications but cannot target lesions visible only after contrast injection, which represents a specific advantage of CEM.

4. Advantages

CEM-guided biopsy allows improved detection and localization of certain lesions occult on conventional imaging, particularly in dense breasts. It also provides a technically simpler alternative to MRI-guided biopsy, with better availability and a relatively short learning curve for trained teams [13].

5. Limitations

However, this technique has some limitations. Radiation exposure, although moderate, remains higher than that of standard mammography. The use of iodinated contrast media carries a risk of allergic reactions and requires prior assessment of renal function.

Additionally, the technique requires specific equipment and dedicated training, which may limit its widespread adoption. Finally, long-term clinical data remain limited compared with older, more established techniques [14].

6. Contribution of the Presented Case

The reported case illustrates the feasibility of CEM-guided biopsy in situations of radiologic–histologic discordance and lesions occult on ultrasound.

It highlights the diagnostic yield of this technique, enabling precise histological characterization.

Moreover, this observation underscores its direct impact on therapeutic management, allowing better selection of patients for surgery or surveillance, thus confirming the growing role of this technique in the diagnostic arsenal of breast imaging.

CONCLUSION

Contrast-enhanced mammography-guided biopsy is an innovative and promising technique for the evaluation of breast lesions, particularly those visible only after contrast injection. It represents a reliable alternative to MRI-guided biopsy, with notable advantages in terms of accessibility, speed, and patient comfort.

The presented case illustrates both the feasibility and diagnostic performance of this approach, particularly in situations of radiologic–histologic discordance or lesions occult on conventional imaging. This technique therefore contributes to optimizing both diagnostic and therapeutic management.

Despite certain limitations, particularly related to radiation exposure and the use of iodinated contrast agents, CEM-guided biopsy is emerging as a valuable complementary tool in modern breast imaging practice.

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