

## **Value of second look breast US with and without volume navigation and fusion imaging using contrast-enhanced MR as reference**

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**Authors:** A. Fausto<sup>1</sup>, L. Borghese<sup>2</sup>, G. Rizzato<sup>1</sup>; <sup>1</sup>Gorizia/IT, <sup>2</sup>Udine/IT  
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## Purpose

To investigate the value of second look breast US with and without contrast enhanced MR volume navigation and fusion imaging (VNav) as reference.

Images for this section:



**Fig. 0:** Three vitamin E pills and their corresponding skin markers represent the fiducial markers used for the coregistration of MRI volume and US scan.

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**Fig. 0:** The system is composed by a commercially available US scanner with a conventional 6-15 MHz matrix array transducer and a magnetic tracking system. The transmitter (T) is positioned near the patient. Two light sensors are mounted on a transducer' bracket (close up).

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## Methods and Materials

Twenty-four patients ( $52 \pm 18$  years, range 33-77) with additional lesions at conventional MR underwent bilateral contrast-enhanced (0.1 mmol/Kg bw Gd- BOPTA, Bracco Diagnostics) breast MR in supine position (1.5T, Achieva, Philips Healthcare) using T1-weighted high resolution isotropic examination volume and spectral attenuated inversion recovery fat suppression with body coil. Three fiducial, pills of vitamin E on the corresponding skin markers were used. US and MR coregistration was obtained by means of a magnetic transmitter positioned close to the patient and two small magnetic receivers positioned on a linear probe's bracket (LOGIQ E9, GE Healthcare). The same radiologist performed first second look US without and then with VNav. Images were reviewed by consensus by two experienced radiologist. Pathologic examination was the standard of reference. McNemar test was used.

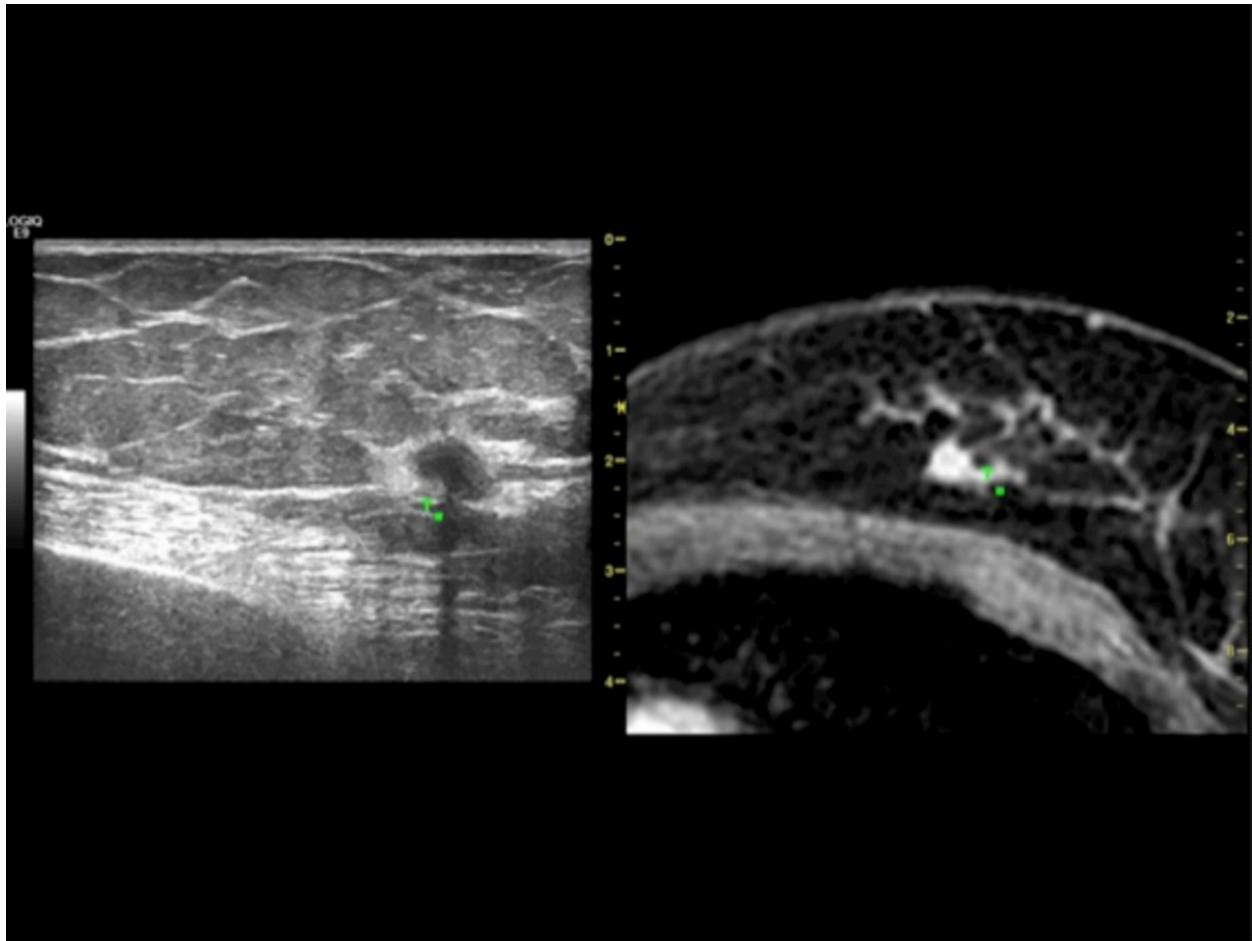


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**Fig. 0:** The system is composed by a commercially available US scanner with a conventional 6-15 MHz matrix array transducer and a magnetic tracking system. The transmitter (T) is positioned near the patient. Two light sensors are mounted on a transducer' bracket (close up).

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**Fig. 0:** Side-by-side real-time US scan and the corresponding reformatted multiplanar MRI image during volume navigation (VNav). A GPS (global positioning system) marker (squared point and T) was positioned below the MRI lesion and automatically reproduced on the US scan. Shape and dimension of GPS marker change depending lesion to probe distance allowing to easily localizing additional MRI detected finding.

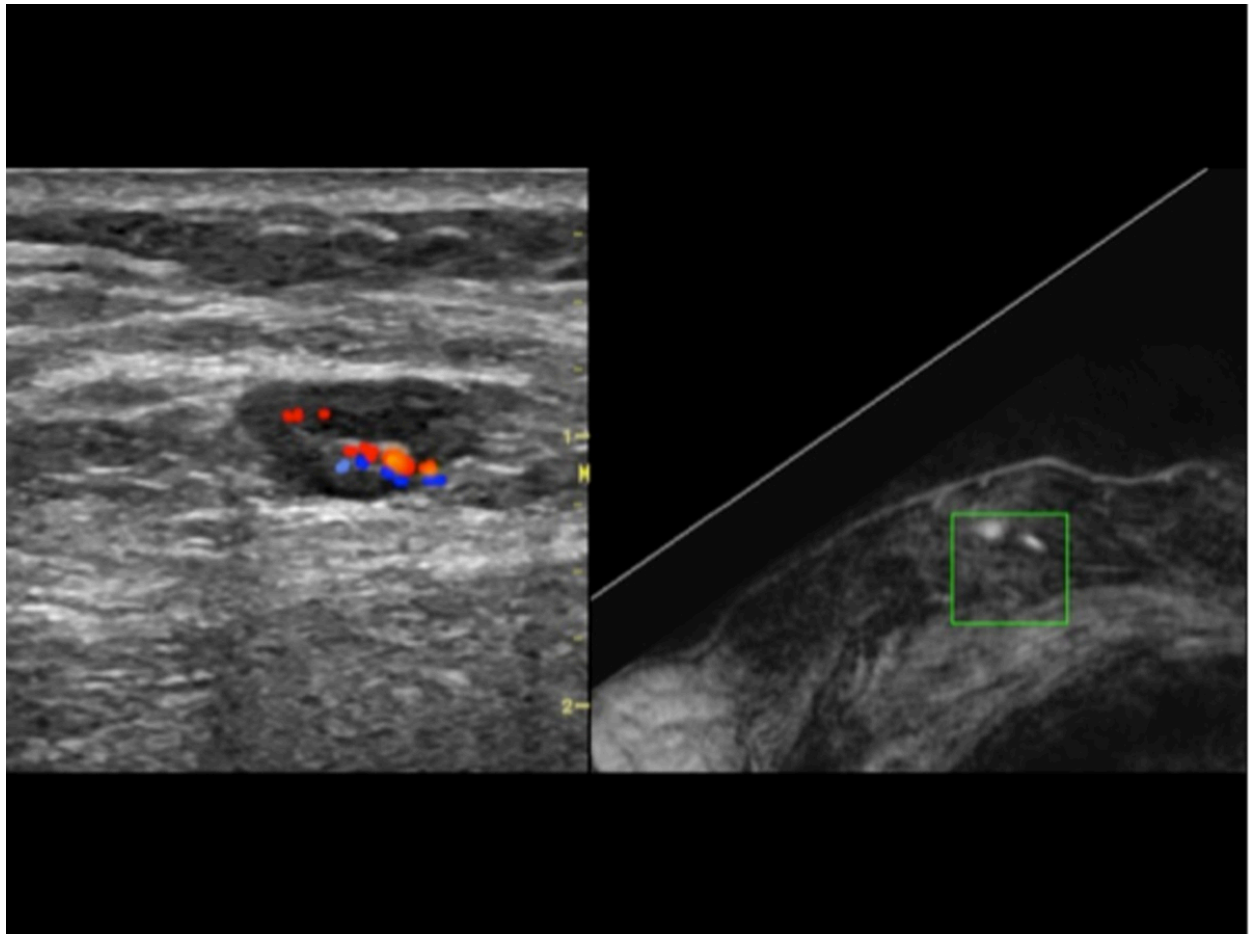
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**Fig. 0:** VNav allows precise and comparable measurements. Patient with an inflammatory fluid collection of the left breast.

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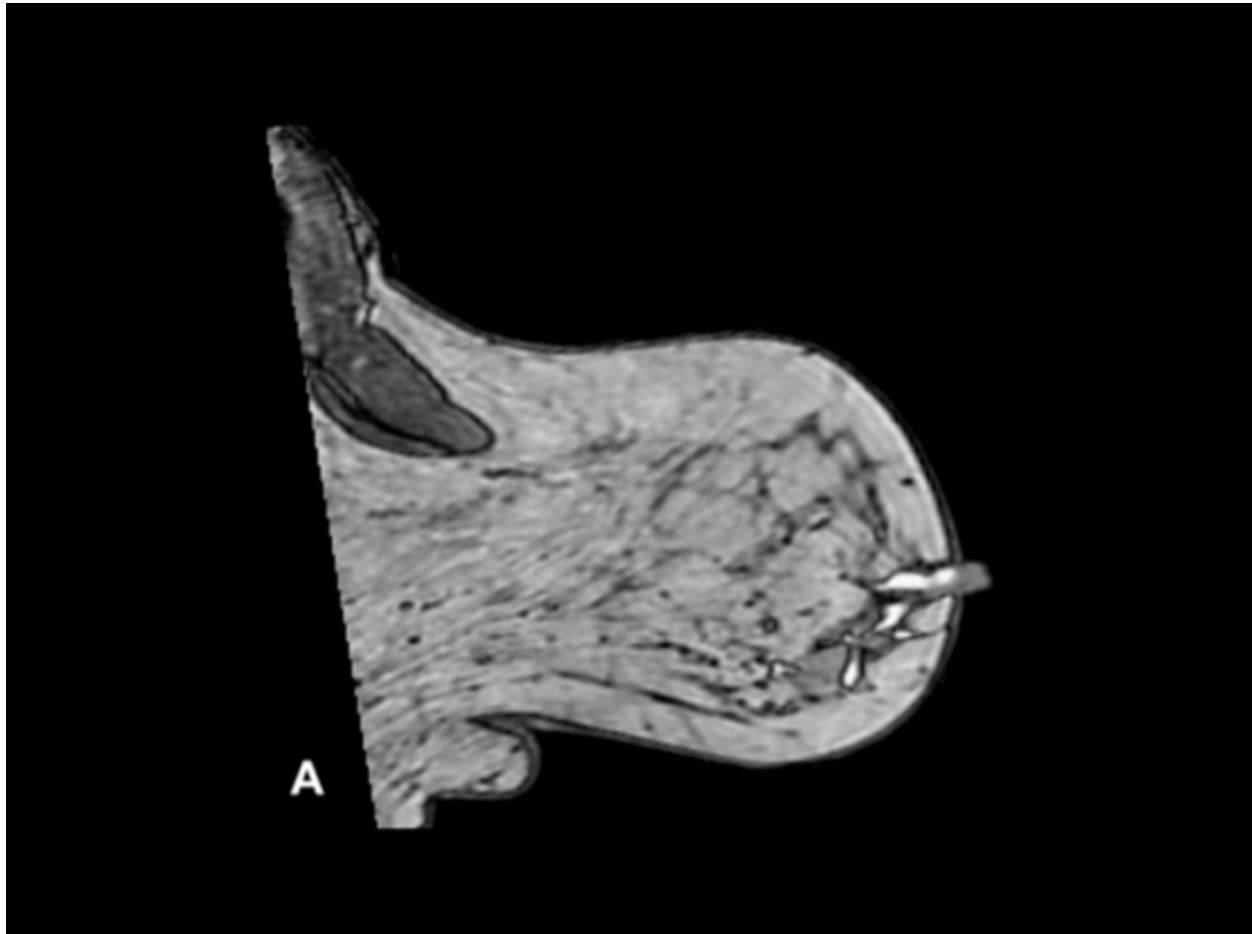
**Fig. 0:** Patient with a 14 mm invasive ductal carcinoma of the right breast and extensive ductal carcinoma in situ component. In the lower external quadrant of the left breast there is a second 9 mm contrast enhanced lesion. VNav shows very well the correlate; color Doppler identifies the typical hilar vascularity of an intramammary lymph node. No further procedure was necessary. The patient was examined only in supine position because her size did not allow a prone study with the SENSE breast coil.

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## Results

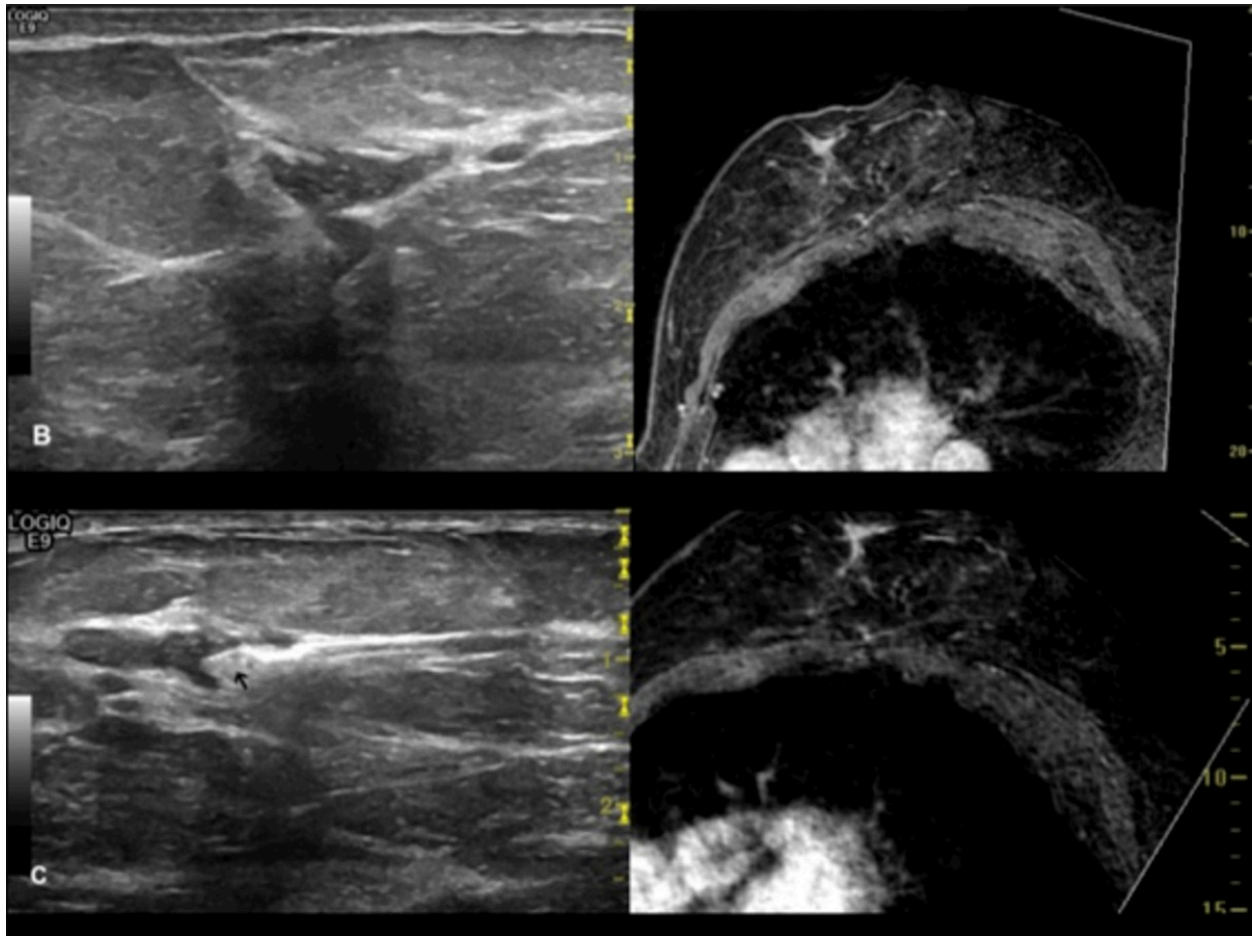
Thirty-one additional lesions were detected in both MR exams. Pathologic examination showed 21 malignant and 10 benign lesions. Lesions diameter was  $25\pm 12$  mm (mean  $\pm$ SD, range 7-43). 52% (11/21) of malignant and 60% (6/10) of benign lesions were detected only using VNav ( $p=0.0001$ ). MR-guided biopsy was performed in three cases. Pathology demonstrated a 9 mm DCIS, a 8 mm sclerosing adenosis and a 12 mm atypical ductal hyperplasia.

Images for this section:



**Fig. 0:** Sagittal oblique reconstructed second postcontrast fast field echo T1-weighted native image of the left breast acquired in prone position (A). A linear branched enhancing lesion of about 35 mm is showed in the nipple region.

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**Fig. 0:** Same case of previous image. Coregistration allowed tracing the dilated and filled ducts in their branching (B). US real-time guidance allowed very precise positioning of the needle tip (arrow) and multiple specimens were collected along the major axis of some ducts (C).

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## Conclusion

Second look US with VNav showed a significant higher detection rate for additional MR-detected lesions increasing the possibility of tissue assessment using US- guided biopsy.

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## Personal Information

### **Alfonso Fausto, M.D.**

Consultant Radiologist, Diagnostic Imaging Department

San Giovanni di Dio General Hospital

Viale Fatebenefratelli, 34

34170 Gorizia - Italy

Email: afausto@sirm.org

### **Ludovica Borghese, M.D.**

Consultant Radiologist, Diagnostic Imaging Department

Casa di Cura Città di Udine

Viale Venezia, 410

33100 Udine, Italy

Email: ludovicaborghese@yahoo.it

### **Giorgio Rizzato, M.D.**

Director, Diagnostic Imaging Department

San Giovanni di Dio General Hospital

Viale Fatebenefratelli, 34

34170 Gorizia - Italy

Email: grizzato@libero.it