Multiparametric MRI with dynamic contrast enhanced MRI and diffusion weighted imaging for the assessment of non-mass enhancing breast tumours

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Aims and objectives

To assess whether multiparametric-MRI (mpMRI) with dynamic-contrast-enhancement-MRI (DCE-MRI) and diffusion weighted imaging (DWI) improves the diagnostic accuracy in breast non-mass enhancement (NME) lesions.

Methods and materials

In this IRB-approved study, a prospectively populated database was searched for patients with a breast mpMRI and a suspicious NME lesion (BI-RADS 4/5). 95 patients were identified. 29 were excluded due to suboptimal quality/non-visibility of the lesion on DWI. Two readers (r1, r2) independently assessed the NME on DCE-MRI and DWI. For each lesion they assigned a score for DCE-MRI according to BI-RADS lexicon. A 2D ROI was manually drawn in the most hypointense/suspicious area of the NME and ADC values were measured. MpMRI with DWI was assessed using a previously published reading method that adapted ADC-thresholds to the assigned BI-RADS classification.Sensitivity (SE), specificity (SP), diagnostic accuracy (DA) and kappa agreement were calculated.

Images for this section:

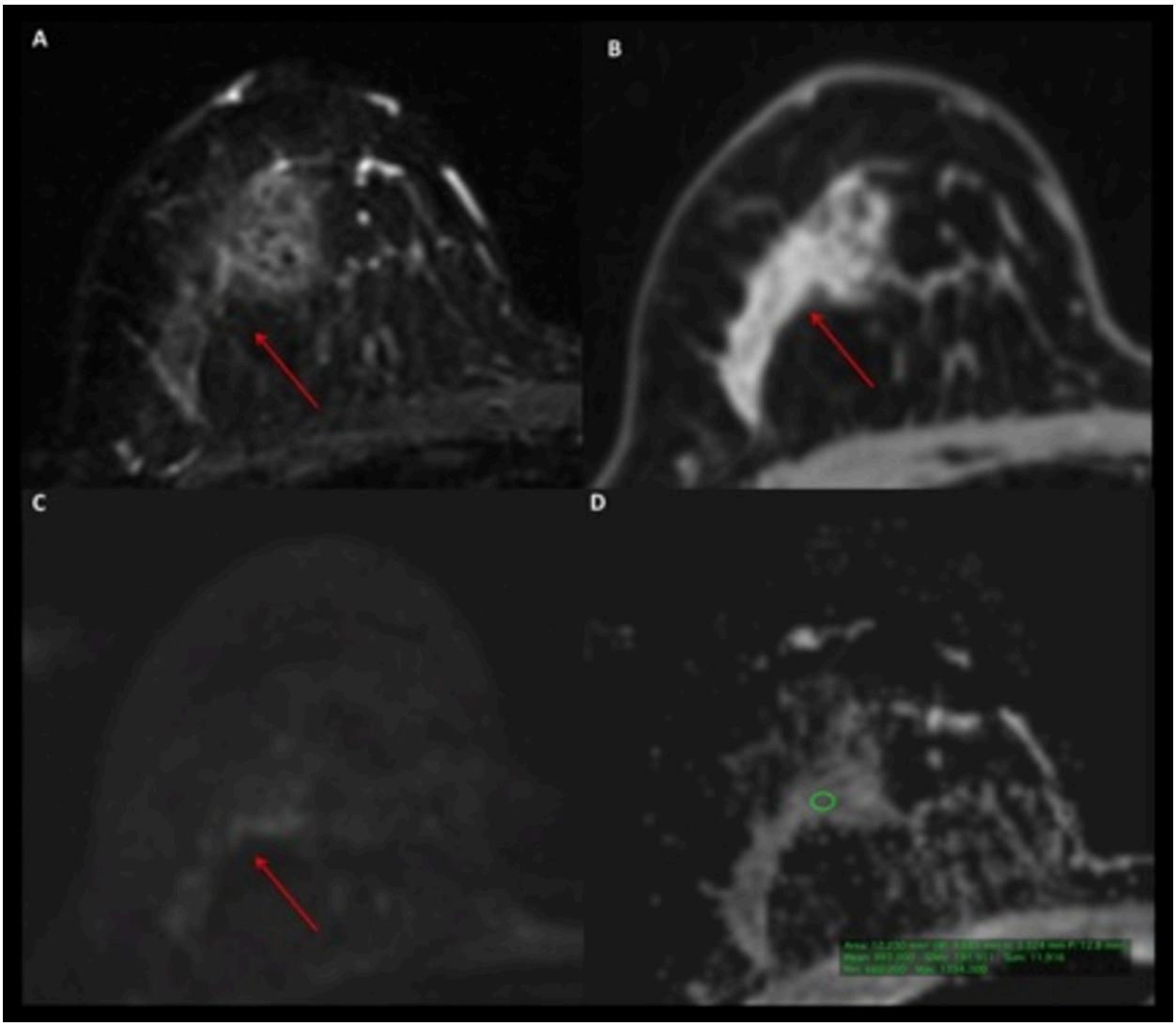

Fig. 1: 49-year-old patient with a palpable lump in the right breast. Multiparametric magnetic resonance imaging, axial plane: (A) Short-tau inversion recovery (STIR) T2 weighted image; (B) T1 weighted dynamic-contrast enhanced sequence, 2 minutes post-contrast injection; (C) Diffusion weighted image (DWI) at a b value of 800 and (D) Apparent diffusion coefficient (ADC) map. The MpMRI shows a 63 mm non-mass lesion slightly hyperintense in STIR (A) with a regional distribution, heterogenous fast enhancement. The lesion shows a ADC value of 0.9x10-3mm2/sec. Based on both dynamic-contrast enhanced images and DWI, the lesion was categorized as BI-RADS 5 and a biopsy was recommended. Final histology: Invasive lobular cancer, grade 2.

Results

There were 66 patients (mean ages 51.8 ±10.8 yo) with a mean size lesion of 40±25 mm: 37 malignant (56%) and 29 benign (44%) (Figure 2). For DCE-MRI a SE of 94.9% (r1) and 100% (r2) and a SP of 66.7% (r1) and 77.8% (r2) were achieved. For MpMRI the SE was 87.2% (r1) and 90% (r2) and the SP 85.2% for both readers (P>0.5). The reduction of false positive was ranged between 33.3% (6 vs 2)and 55.5% (9 vs 4) (Figure 3). There was substantial agreement for both DCE-MRI and MpMRI readings (k=0.610 vs k=0.719).

Images for this section:

HISTOPATHOLOGY	N	%
MALIGNANT	**39/66**	**59**
DUCTAL CARCINOMA IN SITU	4	10
INVASIVE DUCTAL CARCINOMA	24	62
INVASIVE LOBULAR CARCINOMA	9	23
IDC+DCIS	1	2.5
IDC+LCIS	1	2.5
BENIGN	**27/66**	**41**
FA/FAH	5	19
ADENOSIS, SCLEROSING ADENOSIS, FOCAL FIBROSIS, APOCRINE METAPLASIA, BREAST PARENCHYMA, FIBROCYSTIC CHANGES	12	44
PAPILLOMA	1	4
HIGH-RISK (CCC WITH ATYPIA, PAPILLOMA WITH ATYPIA)	2	7
OTHER (CHRONIC ABSCESS, GYNECOMASTIA, FAT NECROSIS, SCAR TISSUE)	7	26

Fig. 2: Histopathology characteristics of the non-mass enhancement lesions included in our investigation

	Variables	SENSITIVITY (TP/TP+FN)	95% Confidence Interval	SPECIFITY (TN/TN+FP)	95% Confidence Interval	PPV	95% Confidence Interval	NPV	95% Confidence Interval
Reader 1	BI-RADS DCE MRI	94.87 % (37/37+2)	82.7%-99.4%	66.67% (18/18+9)	46.0%-83.5%	80.43%	70.58%-87.57%	90.00 %	69.45%-97.27%
	BI-RADS MpMRI	87.17% (34/34+5)	77.24%-93.94%	85.19% (23/23+4)	70.8%-97.6%	89.47%	80.44% - 97.22%	82.14 %	72.79%-95.99%
Reader 2	BI-RADS DCE MRI	100% (39/39+0)	91%- 100%	77.78% (21/21+6)	57.7%-91.4%	86.67%	76.24%-92.94%	100%	
	BI-RADS MpMRI	89.74% (35/35+4)	75.78% to 97.13%	85.19% (23/23+4)	66.27% to 95.81%	89.74%	77.87% to 95.60%	85.19 %	69.16% to 93.65%

Fig. 3: Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for BI-RADS and MpMRI reading for the two readers with their corresponding 95 % confidence intervals

Conclusion

MpMRI enables an improved specificity and agreement compared to DCE-MRI in non-mass enhancement lesions of the breast.

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