PIXELS TO PROGNOSIS

Predicting Response to Neoadjuvant Systemic Treatment Using Multiparametric Imaging Combining Tomosynthesis, Shear Wave Elastography and Doppler

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Background

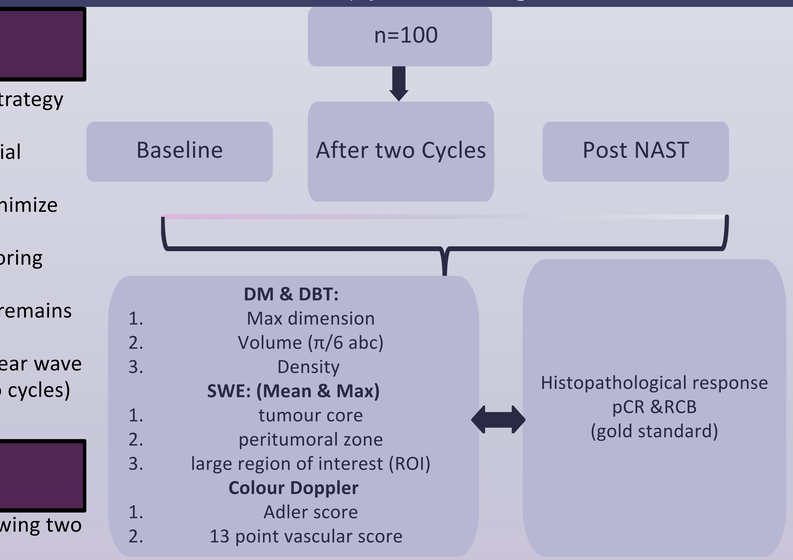
- Neoadjuvant systemic therapy (NAST) is a crucial treatment strategy for breast cancer
- Achieving pathological complete response (pCR) or good partial response to NAST makes BCS or SLNB possible.
- Primary objective of NAST in operable breast cancers is to minimize extent of surgery (BCS and/or SLNB)
- Accurate assessment of tumor response to NAST helps in tailoring subsequent surgery and rest of treatment.
- Predicting response to NAST using optimal imaging methods remains unsettled.
- We evaluated if early mammographic and ultrasound with shear wave elastography and colour Doppler response to NAST (after two cycles) can predict pCR.

Aims & Objectives

- To predict pCR based on changes in imaging parameters following two cycles of NAST.
- We assessed whether these correlate with achieving pCR and can guide further adjustments in chemotherapy for non-responders/stable disease.

Methods

- Single centre prospective study
- IEC approved (IEC 2023-204-MCh-133)
- 100 non-metastatic breast cancer patients that underwent sugery followingNAST
- Imaging was performed at baseline, after 2 NAST cycles, and after completing NAST/pre-surgery
- Tumor dimensions, volume, density, stiffness, and vascularity were evaluated each time
- All radiological parameters from baseline to post-two cycles were correlated with pCR & residual cancer burden (RCB)
- Statistical mehtod: Area under ROC analysis

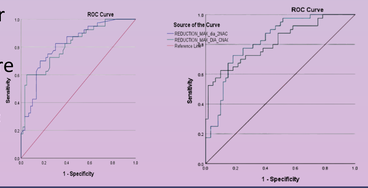


Results

100 patients - mean age - 48.5yrs
- 39 TNBC
- 31 HER2-enriched
- 28 Luminal-B-like

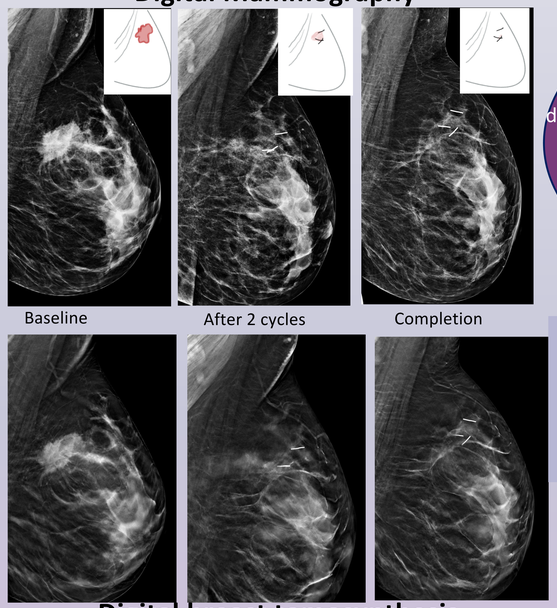
60% postmenopausal

pCR	
No	Yes
60 (60%)	40 (40%)



	Post 2 cycles of NAST	Post completion of NAST
Max extent reduction	17.6% SN 82.5% SP 70.0% AUC 0.817	37.1% SN 81.5 SP 62.5 AUC 0.841
Volume reduction	≥39.4% SN 87.5% SP 70.0% AUC – 0.824	68.6% SN 85.2 SP62.5 AUC – 0.823

Digital Mammography



Digital breast tomosynthesis

Density		pCR Yes	pCR No
DM/DBT post-2 cycles NAST	High	3(7.5%)	46(76.7%)
	Isodense	29(72.5%)	14(23.3%)
	Low	8(20%)	0
Post-Completion of NAST	High	2(5%)	26(43.3%)
	Isodense	9(22.5%)	27(45%)
	Low	29(72.5)	7(11.7%)

Density at 2nd NAST-strongly associated with pathological response:
- 87.0% of isodense/low-density tumors had good response (RCB 0–1)
- 87.8% with persistently high-density tumors had poor response (RCB 2–3)
- Yielding 87.0% Sn, 79.6% Sp

Conclusion/ Key findings

- Early imaging response after 2 cycles of NAST—especially DBT density/volume reduction and peritumoral SWE stiffness reduction—strongly predicts pCR
- Multiparametric imaging combining DBT, SWE, and Doppler vascular scores (Adler and 13-point) → non-invasive, early surrogate for treatment response

- Among 6 SWE parameters (mean & maximum from tumour core, peritumoral zone & large region of interest) only reduction in peritumoral SWE (mean & max) from baseline to 2nd scan - significantly associated with pCR (p=0.038, 0.020)
- Absolute SWE values at 2nd scan/post NAST across all regions did not distinguish responders →peritumoral SWE change more reliable predictor than static measurements

Parameter	pCR Group (n=40)	Non-pCR Group (n=60)	p-value
Peritumoral Mean Reduction	41.8 ± 41.1	20.7 ± 54.2	0.038
Peritumoral Max Reduction	43.9 ± 38.3	20.8 ± 53.5	0.02

Modality	Parameter	AUC (Area under curve)	Cut-off (%) / Value	Sensitivity	Specificity	Significance (p)
Doppler	Adler Score	–	"No flow" (Score 0)	25.00%	86.70%	0.002
Doppler	13-point Vascular Score	0.695	≤6	77.50%	60.00%	0.001

- **HER2-enriched**: greatest DBT density reduction at NAST completion (87.1%, p=0.038)
- **TNBC & HER2:** greater SWE stiffness reduction at 2nd NAST (peritumoral mean/max & large ROI; AUC = 0.70)
- **Adler score regression** (→ no flow): mainly in TNBC; subtype difference NS (p=0.750)
- **Luminal B:** least favourable imaging response across all modalities

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