

CODE: TCS/17/05

RESEARCH PROJECT BRIEFING



CONTrast Enhanced breaSt Tomosynthesis (CONTEST) in patients suspected of having breast cancer: a prospective comparison with digital mammography and breast MRI



AIMS

The aim of the CONTEST study was to assess the additional diagnostic value of Contrast Enhanced Digital Breast Tomosynthesis (CE-DBT) over Digital Mammography (DM) for diagnosing symptomatic breast cancer, and to compare it directly with breast Magnetic Resonance Imaging (MRI).

CE-DBT consists of Digital Breast Tomosynthesis (DBT) and Contrast Enhanced Mammography (CEM) performed in a combined episode.



KEY FINDINGS

87 participants were recruited, 5 withdrew/did not complete the study, and 2 participants were found to be ineligible after recruitment. 80 participants were included in the analysis, 69 had cancer, of whom 13 had multiple areas of disease, giving a total of 87 cancers.

- Diagnostic accuracy: mammography vs CE-DBT. The individual components CEM and DBT - were each more accurate than DM. The combination of CE-DBT showed reduced specificity without an increase in sensitivity, compared to CEM alone. Differences were not statistically significant.
- **Diagnostic accuracy: MRI vs CE-DBT.** MRI showed higher sensitivity than DM or DBT, but lower than CEM or CE-DBT. Specificity was lower for MRI than DBT, CEM or CE-DBT. These differences were not statistically significant.
- Accuracy for local staging: identifying additional areas of disease. CEM was more accurate than DM or DBT, identifying 8/10 cases of additional disease with no false positives. The addition of DBT to CEM did not improve accuracy.
- Accuracy of local staging: estimation of disease extent. Strong correlation (0.9) was demonstrated between pathological size and predicted size on CEM, CE-DBT and MRI, with DM and DBT demonstrating moderate correlation (0.6). These findings were statistically significant (p<0.001).
- **Patient experience** data revealed that, of those who expressed a preference (n=48), 35 (78%) preferred the CE-DBT to the MRI scan.



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WHAT DID THE STUDY INVOLVE?

Primary study objective:

• To identify and quantify any improvement in diagnostic performance of CE-DBT over standard digital mammography (DM) in the diagnosis of breast cancer.

Secondary study objectives:

- · Compare diagnostic accuracy of CE-DBT to breast MRI
- · Assess comparative accuracy of CE-DBT and MRI in local staging of breast cancer
 - Identification of additional malignant lesions: bilateral, multifocal or multicentric disease.
 - Estimation of total disease extent in unifocal, unilateral disease.
- · Assess patient experience and preference of CE-DBT and MRI.

In this paired comparison imaging study, female patients aged 18-70 years with clinical features suspicious for operable breast cancer were recruited from four centres to undergo CE-DBT. After informed consent, participants had DM and the CE-DBT procedure in the clinic, with ultrasound and biopsy according to standard clinical practice. All participants had a breast MRI scan as part of the study, during an additional hospital visit. Radiological findings from the various modalities were compared to the gold standard of histopathology.

Patient experience of the CE-DBT procedure and the MRI scan was collected on two separate patient questionnaires.



WHAT WERE THE RESULTS AND WHAT DO THEY MEAN?

Diagnostic accuracy: relative accuracy of components of CE-DBT: (Table 1)

There were increases in sensitivity with both DBT and CEM when separately compared to DM. CEM alone showed better specificity than DM but specificity was worse for DBT. When DBT was added to CEM (=CE-DBT), it reduced specificity without an increase in sensitivity. Although DBT, CEM and CE-DBT each showed descriptively higher diagnostic accuracy (which is the combination of sensitivity and specificity) than DM, none of these differences was statistically significant.

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Diagnostic accuracy: relative accuracy of MRI vs components of CE-DBT: (Table 2)

MRI showed descriptively higher sensitivity than DM or DBT, but lower than CEM or CE-DBT. Specificity was lower than the elements of CE-DBT, both separately and in the combination. These differences were not statistically significant.

Identifying additional sites of disease: (Table 3)

DM missed the most cases of additional disease (8/10). DBT was more sensitive but had lower specificity. MRI had the overall highest sensitivity, identifying all cases of additional disease, but at the cost of more false positives. Thus, CEM had the greatest accuracy, which was not improved by the addition of DBT. These differences were not statistically significant.

Accuracy of estimating disease extent: (Table 4)

Strong correlation (0.9) was demonstrated between pathological size and the predicted size on each of CEM, CE-DBT and MRI, with DM and DBT demonstrating moderate correlation (0.6). These findings were statistically significant (p < 0.001).

Patient experience and preference:

CE-DBT

MRI

34.7

40.7

12 - 85

13 - 95

Of those patients who expressed a preference (n=48), 35 (78%) preferred the CE-DBT to the MRI scan. The concerns expressed about the MRI were mostly around feeling confined/enclosed, the noise, and long duration in an uncomfortable position.

Table 1	Sens. (%)	Spec. (%)	PPV (%)	NPV (%)	Accu	Accuracy		ANOVA	
Mammogram	88.41	81.82	96.83	52.94	87.50	7.50		-	
DBT	94.20	63.64	94.20	46.67	85.71	35.71		P=0.618	
CEM	100.0	72.73	95.83	100.0	96.25	96.25		p=0.057	
CE-DBT	100.0	63.64	94.52	100.0	95.00	95.00		p=0.106	
Table 2	Sens. (%)	Spec. (%)	PPV (%)	NPV (%)	Accuracy		ANOVA		
MRI	98.53	54.55	93.06	85.71	92.41		-		
DBT	94.20	63.64	94.20	46.67	85.71	85.71		1.0000	
CEM	100.0	72.73	95.83	100.0	96.25	96.25		0.1346	
CE-DBT	100.0	63.64	94.52	100.0	95.00		0.2406		
Table 3	Sens. (%)	Spec. (%)	PPV (%)	NPV (%)	Accuracy		ANOVA		
MRI	100.0	86.2	71.4	100.0	89.7		-		
Mammogram	20.0	100.0	100.0	78.4	79.5		-		
DBT	50.0	96.6	83.3	84.9	84.6		0.50		
CEM	80.0	100.0	100.0	93.6	94.9		0.41		
CE-DBT	80.0	96.6	88.9	93.3	92.3		0.69		
Table 4	able 4 Tumour size (mm)		Difference in size			Correlat	ion	p value	
			(imaging vs pathol		ogy)	Coefficient			
	Mean	Range	Mean	95%	CI				
Pathology	36.4	10 - 100	-	-		-		-	
Mammogram	26.5	7 – 90	9.2	2.4, 1	16.0 0.585			<0.001	
DBT	9.5	6 – 84	9.5	2.4, 2	16.7 0.617			< 0.001	
CEM	33.0	12 – 85	3.3	-2.4	4.4	0.886		< 0.001	

1.7

-4.3

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-2.4, 5.8

-9.7, 1.0

0.871

0.817

< 0.001

< 0.001



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WHAT IMPACT COULD THE FINDINGS HAVE?

Our findings are consistent with published literature that shows that CEM has a similar accuracy to MRI for diagnosis and local staging of breast cancer. Unlike previous studies, we did not find that the addition of DBT to CEM increased accuracy further.

We found that if patients were imaged with CEM, MRI could have been avoided, without loss of diagnostic information, and with significant cost savings and operational benefits for relevant NHS services. Most patients preferred the CEM test, so CEM can further enhance quality of care for breast patients. Based on the findings of this study, and other existing evidence, a CEM pathway has been implemented in NHS Tayside.



HOW WILL THE OUTCOMES BE DISSEMINATED?

A full report of the research will be submitted to a peer reviewed journal for publication. We expect the manuscript to be ready for submission by the end of June 2025. We will submit an abstract of the findings for a conference presentation either at Symposium Mammographicum (July 2025) or the British Society of Breast Radiology Annual Scientific

meeting (Nov 2025). We will also disseminate via radiological networks within Scotland.

A lay summary of the findings will be offered to all participants and disseminated via patient groups and social media.

Future multi-centre contrast enhanced mammography research by one of our co-investigators in Dundee has recently been awarded funding by NIHR, examining effectiveness for monitoring response to chemotherapy. Further work on the radiomics and functional information that can be obtained is also recommended and should include development of tools to enable deployment.



CONCLUSION

- Contrast Enhanced Mammography showed similar accuracy to MRI for the diagnosis and local staging of breast cancer in this study.
- There was no incremental benefit in accuracy with the addition of DBT to CEM (CE-DBT).
- Most patients preferred the CEM (or CE-DBT) test to MRI.

RESEARCH TEAM & CONTACT

Chief Investigator: Patsy Whelehan PhD (Originally Dr Sarah Vinnicombe, then Prof Andy Evans) Co-Investigator: Dr Sarah Savaridas Project Manager: Kulsam Ali PhD University of Dundee Ninewells Hospital & Medical School

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Additional Information

The project was completed (all data entered in database) on 31st December 2023, and we received £301,053 of funding from CSO.