ISRCTN12671109 https://doi.org/10.1186/ISRCTN12671109

Is a new type of mammogram called contrast-enhanced mammography (CEM) as good as magnetic resonance imaging (MRI) scans for showing how well a cancer has responded to chemotherapy?

Submission date
05/11/2024

Recruitment status
Recruiting

Registration date
27/11/2024

Overall study status
Ongoing

Last Edited
14/05/2026

Condition category
Cancer

[X] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[_] Results
[_] Individual participant data
[X] Record updated in last year

Plain English summary of protocol

Background and study aims
When patients have chemotherapy before surgery, doctors want to know how the tumour is shrinking as a result of the treatment. This helps in planning the best surgery. This is often done with magnetic resonance imaging (MRI) scans. MRI scans give very clear images but are very expensive and the patient has to lie still in the scanner for a long time which can be difficult, especially if they don't like small spaces. Also, some patients are not able to have MRI scans if they have metal in their bodies, such as a pacemaker. These patients are monitored using breast examination, standard mammography and ultrasound.
Recently a new type of mammogram has become available called contrast-enhanced mammography (CEM) which could be used as an alternative to MRI scans. In the new technique the patient is injected with a dye which makes the cancer much easier to see than in a normal mammogram.
The aims of this study are to compare these two different types of imaging tests for breast cancer and to provide evidence for whether CEM is good enough to replace MRI scans for this purpose, and which imaging test patients prefer.

Who can participate?
Patients aged 18 years and over who are having chemotherapy followed by surgery to treat their breast cancer

What does the study involve?
Participants will be asked to have a new type of mammogram called contrast-enhanced mammography (CEM) as well as a standard MRI scan before they start chemotherapy and after they finish chemotherapy (before surgery). They will also be asked to complete a questionnaire about their experience after each imaging test.

What are the possible benefits and risks of participating?
Breast MRI is a very good test for seeing how much of the breast tissue is affected by cancer and for seeing how a tumour has responded to chemotherapy. However, some people cannot have an MRI or find having it very difficult. This can make reading the MRI pictures more difficult, if for example the person has wriggled or had to stop the MRI early.
CEM is also very good at showing the amount of breast tissue affected by cancer and may be an easier test to have done. It is possible that CEM will help to accurately identify areas of cancer not seen on MRI and this may help decide the best treatment for patients. However, the researchers cannot guarantee a direct benefit as the accuracy of CEM for monitoring response to NACT has not yet been established. Any new findings seen on the CEM images will be shared with the participant's clinical team. By taking part in this research, participants would be helping the researchers to find out if this new test should be offered to patients in the future.
The injection needed for this test is generally very safe. Many people have this injection in imaging/radiology departments every day, for example for CT scans. Sometimes the plastic cannula can be difficult to place correctly in a suitable vein. The needle may cause a bit of bruising and very occasionally some of the dye can leak into the tissues. With every injection of the dye, there is a very slight risk of a reaction. Some people may develop a rash, and a few people may get a mild asthma attack. More serious reactions are very rare. The researchers do not offer you the test if you have risk factors for allergy. The doctor and radiographers in the imaging/radiology department are trained to recognise these reactions and to treat them.
The dye used for the test can affect the kidneys. This doesn’t happen often (less than 1 in 100 people). To reduce the chances of affecting the kidneys, the researchers will not offer the test if participants have any risk factors or are known to have kidney problems. Participants should drink a bit more fluid than usual for 24 hours after the test, to “flush” the dye through (water, tea and squash are all fine).
A mammogram is an x-ray of the breasts. CEM takes a little longer than the standard mammogram, so may be a little bit more uncomfortable.
All X-rays involve radiation. The amount of radiation from a standard mammogram is small. It is similar to the amount of radiation we receive naturally from the environment over a period of a few months. The radiation dose from CEM is higher than that of a standard mammogram. The additional risk of radiation-induced breast cancer as a result of taking part in this study is 1 in 4000. A medical physics expert has assessed the additional risk of the study test as low. The ethics committee has made no objection to the study after considering all the risks and benefits.

Where is the study run from?
University of Dundee (UK)

When is the study starting and how long is it expected to run for?
March 2024 to August 2027

Who is funding the study?
National Institute for Health and Care Research (NIHR) (UK)

Who is the main contact?
Dr Sarah Savaridas, s.savaridas@dundee.ac.uk

Contact information

Type(s)
Public

Contact name
Mrs Lyn Mitchell

Contact details
University of Dundee
School of Medicine
Ninewells Hospital and Medical School
Dundee
United Kingdom
DD1 9SY
+44 (0)1382 383232
l.y.mitchell@dundee.ac.uk

Type(s)
Scientific, Principal investigator

Contact name
Dr Sarah Savaridas

ORCID ID
https://orcid.org/0000-0003-1037-1174

Contact details
University of Dundee
School of Medicine
Ninewells Hospital and Medical School
Dundee
United Kingdom
DD1 9SY
+44 (0)1382 383967
s.savaridas@dundee.ac.uk

Additional identifiers

Integrated Research Application System (IRAS)
333133

Central Portfolio Management System (CPMS)
58570

Study information

Scientific Title
Contrast Enhanced mammography versus magnetic reSonance imaging for Assessment of Response to neoadjuvant chemotherapy (CESAR)

Acronym
CESAR

Study objectives

The key aim of this study is to establish whether contrast-enhanced mammography (CEM) is non-inferior to magnetic resonance imaging (MRI) for assessing the response to neoadjuvant chemotherapy (NACT) in patients with breast cancer.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 28/11/2024, London - Bloomsbury Research Ethics Committee (Health Research Authority, 2 Redman Place, E20 1JQ, UK; +44 (0)207 104 8384; bloomsbury.rec@hra.nhs.uk), ref: 24/LO/0834

Primary study design
Interventional

Study design
Non-randomized; Interventional; Design type: Diagnosis, Imaging

Study type(s)
Diagnostic

Health condition(s) or problem(s) studied
Breast cancer

Interventions
This is a paired comparison study of a diagnostic test (CEM) i.e. all participants will receive the equivalent of standard care (MRI) plus the experimental procedure. CEM is considered to be the intervention.

This study involves the collection of images and information from patients with breast cancer undergoing neoadjuvant chemotherapy (NACT) prior to surgery. We shall not be changing the treatment of patients. Most of the information and images will be generated during standard care. All participants will receive standard care (MRI) plus the experimental imaging technique (CEM).

Potential participants will be identified at the breast multidisciplinary team (MDT) meeting where the decision to offer NACT will be made. The study will initially be discussed at a routine appointment. After an appropriate length of time women wishing to participate will be asked to sign a consent form to take part in the study. E-consent will be available so that patients can be consented from home with telephone support, or it can at a routine clinical appointment, additional visits to the hospital for consent will be avoided wherever possible.

Participants will then have extra imaging using CEM, in addition to standard of care. This will be performed at two time points during their treatment; before chemotherapy, and after finishing chemotherapy. As it may not be possible to arrange the CEM studies on the same day as the MRI, it is possible the participants will need to attend the hospital on up to two occasions in addition to standard care. They will be asked to complete questions regarding their experiences after the initial imaging and end-of-treatment imaging.

The duration is intended to be 3 years, with 1.5 years of that consisting of the recruitment period.

Intervention Type
Other

Primary outcome(s)
Absolute differences between tumour size measurements from each imaging technique and surgical pathology. Maximum imaging lesion size will be recorded on CEM (enhancement + microcalcification) and MRI, as described above. Pathological size will be defined as whole tumour size (WTS). Timepoint: Post surgery.

Key secondary outcome(s)
1. Absolute differences between tumour size measurements from each imaging technique and WTS, where CEM size is the extent of enhancement only. Timepoint: Post-surgery.
2. Absolute differences between tumour size measurements from each imaging technique and WTS, where CEM size is the extent of enhancement only. Timepoint: Post-surgery.
3. Absolute differences between tumour size measurements from each imaging technique and ITS, where CEM size is the extent of enhancement only. Timepoint: Post-surgery.
4. Signed difference between tumour size measurements from each imaging technique and surgical pathology. Timepoint: Post-surgery.
5. Absolute differences between tumour size measurements from each imaging technique and WTS and ITS, where MRI enhancement size is combined with the extent of microcalcification on the LE component of the CEM. Timepoint: Post-surgery.
6. Accuracy, specificity and sensitivity of CEM (enhancement only) and MRI for determining pCR. Timepoint: Post-surgery.
7. Accuracy, specificity and sensitivity of CEM (enhancement + microcalcifications) and MRI for determining pCR. Timepoint: Post-surgery.
8. Diagnostic accuracy of the pre-treatment imaging for identifying multifocality will be assessed by correlation with biopsy results. A true positive is defined as an additional lesion identified by CEM and/or MRI, demonstrated to be malignant on core biopsy. A true negative is unifocal disease on imaging confirmed at surgery. A false positive is an additional suspicious lesion identified on CEM and/or MRI proven benign on pathology. A false negative is when imaging indicates unifocal disease but additional foci of malignancy are proven pathologically. Timepoint: post-biopsy (pre-NACT).
9. Diagnostic accuracy of the pre-treatment imaging for identifying multifocality will be assessed by correlation with biopsy results. Timepoint: post-biopsy (pre-NACT).
10. Patient acceptability will be assessed after completion of both imaging techniques using a specially devised questionnaire, following PPI consultation. Timepoint: following baseline and end-of-treatment imaging.
11. Association between CEM dynamic enhancement characteristics (ordinal data) and MRI time intensity curves (ordinal data) will be assessed using chi-squared tests for trend. Timepoint: following baseline and end-of-treatment imaging.
12. Changes in CEM dynamic enhancement characteristics, for example from a washout pattern pre-treatment CEM to a persistent pattern post-treatment, will be assessed and compared between responders and non-responders using chi-squared tests. Timepoint: Post-surgery.

Completion date
31/08/2027

Eligibility

Key inclusion criteria

1. Individuals (aged 18 years and above) with invasive breast cancer
2. Willing and able to give informed consent
3. Requiring imaging monitoring of response to NACT
4. Undergoing standard-of-care monitoring with breast MRI
5. Symptomatic or screen-detected breast cancer

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Mixed

Lower age limit
18 Years

Upper age limit
100 Years

Sex
All

Total final enrolment
0

Key exclusion criteria
1. Contraindication to CEM contrast agent (iodine)
2. Unwilling to have CEM
3. Ipsilateral breast implant
4. Pregnant or breastfeeding
5. Radiotherapy prior to surgery

Date of first enrolment
01/03/2025

Date of final enrolment
28/02/2027

Locations

Countries of recruitment
United Kingdom

England

Scotland

Study participating centre
Ninewells Hospital and Medical School
George Pirie Way
Dundee
Scotland
DD1 9SY

Sponsor information

Organisation
University of Dundee

ROR
https://ror.org/03h2bxq36

Funder(s)

Funder type
Government

Funder Name
National Institute for Health and Care Research

Alternative Name(s)
National Institute for Health Research, NIHR Research, NIHRresearch, NIHR - National Institute for Health Research, NIHR (The National Institute for Health and Care Research), NIHR

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
United Kingdom

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary

Data sharing statement to be made available at a later date