

Contrast Enhanced Mammography (CEM)

Purpose

This procedure provides medical imaging staff a process to follow for contrast enhanced mammography (CEM).

Site Applicability

This procedure applies to all Medical Imaging departments within Lower Mainland Medical Imaging (LMMI) in Fraser Health (FH), Providence Health Care (PHC), Provincial Health Services Authority (PHSA) and Vancouver Coastal Health (VCH) where CEM studies are performed.

Practice Level

Profession	Required Competency Skills
Radiologist	<ul style="list-style-type: none"> CEM training
Medical Radiation Technologists (MRT)	<ul style="list-style-type: none"> Hand hygiene on line course Peripheral intravenous (IV) on line course, training & competency assessment Multi dosing and/or Single use Injector training and competency assessment Delegation for contrast media administration Delegation for peripheral IV insertion CEM training

Need to Know

- Contrast enhanced mammography (CEM)** is when high and low energy exposures are taken in each of the 4 mammography views to produce 2 images via dual energy subtraction technique. The 1st image is similar to a regular mammogram. The 2nd image demonstrates contrast uptake where blood flows.
- CEM indications:**
 - Magnetic Resonance Imaging (MRI) contraindications** due to claustrophobia, MRI-incompatible implants, MRI weight limitation and/or gadolinium contraindications
 - High-risk patients defined as those with greater or equal to 20% lifetime risk of breast cancer. Hereditary high-risk population or history of Mantle radiation for Hodgkin lymphoma
 - Intermediate risk patients defined as those with intermediate to high lifetime risk of breast cancer (15-20%) who may not be eligible for supplemental screening MRI
 - Personal history of breast cancer
 - Dense breast tissue (C or D)
 - Diagnosis of breast cancer under the age of 50
 - Persistent symptoms despite negative diagnostic evaluation
 - Determining extent of disease for pre-surgical planning
 - Response to neoadjuvant therapy
 - Post lumpectomy
 - Evaluation of radiologic-pathologic discordance

3. Adverse events.

- Rare unintended complications from high-pressure volume injections may occur these may include but are not limited to contrast extravasation, which may lead to compartment syndrome
- Contrast reaction, mild (urticarial) to severe (anaphylaxis)

Exceptions

Exceptions made to the procedure by a radiologist.

Equipment and Supplies

1. **Intravenous supplies:** Prepared IV infusion tubing and solution if indicated. Gloves, tourniquet, cutaneous antiseptic agent (CHG2%/Alc 70% in FHA) gauze, tape, tegaderm, IV catheter, IV tubing, normal saline flush, connectors if required.
2. Power injector syringe kit and high pressure tubing.
3. Power compatible extension set. (maximum of 300 PSI)
4. Iodinated contrast media. (non-ionic)

Procedure

Patient completes the contrast safety screening form upon arrival

The MRT will:

1. Perform a patient identification and time out as per [Patient ID and Time-Out MI Policy](#).
2. Review requisition and contrast safety screening form and assess the patient for contraindications. Review lab work for eGFR.

Communicate any concerns with radiologist to determine next steps.

3. Explain procedure, answer patient's questions, and remediate any patient questions with radiologist.
4. Set machine parameters using dual-energy subtraction with full field digital mammography. (FFDM)
5. Lay patient down or sit patient for peripheral IV insertion. Site to determine.
6. Perform hand hygiene. Gather supplies for peripheral IV insertion and contrast injector loading.
7. Insert peripheral IV using aseptic technique and assess patency using start/stop technique.
8. Select correct contrast and check expiry date, color and clarity.
9. Prepare injector for contrast loading following the single use or multi dosing injector set up.
10. Load injector with contrast and connect power compatible extension set to the patients IV.

Failure to use a power compatible extension set may cause damage and harm to the patient.

11. Set contrast injector rate and volume as per **established protocol**.
12. Administer contrast and wait 2 minutes post contrast administration prior to imaging.

Visibility Window: optimal contrast tissue enhancement occurs between 2- 7 minutes during which time image acquisition is completed. After 7 minutes, contrast washout occurs.

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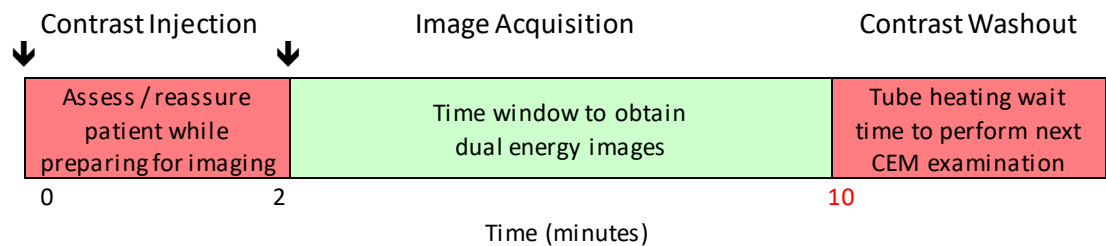


Image courtesy of Polat, D.S., Evans, W.P., Dogan, B.E., Feb 13, 2020. Contrast-Enhanced Digital Mammography: Technique, Clinical Applications, and Pitfalls

13. During the 2 minutes, assess patient for adverse reactions, reassure patient of normal contrast sensations (warm feeling all over, metallic taste, feeling need to urinate) and check PIV site for signs of contrast extravasation. Assess or evaluate injector psi chart/values.
14. At the 2 minute mark complete the following images:
 - right cranio-caudal
 - left cranio-caudal
 - right mediolateral oblique
 - left mediolateral oblique

Dual Energy Subtraction Imaging

The image-processing software algorithm subtracts two exposures generating two images

The 2 sets of images are taken:

- 1) Low-energy exposures are acquired at 26-31 kVp.
To maximize soft-tissue contrast and are analogous to a standard 2D digital mammogram.
- 2) High-energy exposures are acquired at 33.2kVp, just above **peak KVp** threshold of iodine.
The 2nd set of images are subtracted images displaying areas of contrast enhancement.

15. Check images with radiologist and perform extra additional views as per radiologist.

Post Procedure

- a. Remove patient IV and provide discharge instructions for follow up as per the radiologist.
- b. Document exam and contrast media administration in the patient's health record as per site-specific processes. Forms may be scanned into PACS.
- c. Document any allergy alerts in the patient's electronic medical record.
- d. Notify responsible radiologist and document contrast related adverse events into the Patient Safety and Learning System (PSLS).
- e. Discharge patient from medical imaging if there are no adverse reactions to contrast.

Related Documents

[Delegated Medical Act for Peripheral IV Insertion](#)

[Delegated Medical Act for Contrast Administration](#)

[Injector Pump: Multi-Dosing Set Up: Bracco EmpowerCTA+ Procedure](#)

[Injector Pump: Multi-Dosing Set Up: Bracco EmpowerCTA+ Competency Assessment Tool](#)

[Contrast Administration Intravenous Route Competency Assessment Tool](#)

[Contrast Agents: Safe Use and Storage](#)

[Contrast Safety Screening Form - CT & IR \(Adult/Pediatric\)](#)

[Allergy Assessment and Documentation by MRTs and Sonographers](#)

[Extravasation of Non-Ionic Intravascular Contrast: Patient Management Guidelines](#)

[Adverse Reactions: Reporting and Documentation in Medical Imaging Department](#)

[Management of Adverse Events in MI \(Adults\) - Poster](#)

[Patient ID and Time-Out MI Policy](#)

[Breast Implant Associated Anaplastic Large Cell Lymphoma \(BIA-ALCL\) Investigation](#)

Other

[ACR Manual on Contrast Media Version 10.3. 2020](#)

[BC Patient Safety and Learning System](#)

Definitions & Key Words

Contrast Enhanced Dual-energy mammography: Contrast enhanced mammography (CEM) is a dual energy subtraction technique. High and low energy images are acquired which straddle the K-edge of iodine, the final image is a weighted logarithmic subtraction. Contrast material is the key. Tumors require nutrients and secrete vascular growth factors which trigger tumor angiogenesis. The vessels form rapidly in a disorganized manner and are leaky. Contrast extravasates into the tumor interstitium and creates enhancement, which is what we see. CEM is a dual energy subtraction technique, high and low energy images are acquired

Power Injector: A mechanical device used to administer contrast media and normal saline at a prescribed maximum pressure, flow rate and dose for examinations.

Pressure Rated Tubing: Health Canada approved tubing approved for use with power injectors and can withstand medium to high pressure.

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