SUBJECT: ECHOCARDIOGRAM WITH CONTRAST

PURPOSE:

To optimize the quality of echocardiographic images. To reduce variability and increase accuracy of 2-dimensional echocardiography. To increase the confidence and certainty of interpreting physicians.

POLICY:

1. This policy applies to all patients in adult care areas receiving an echocardiogram that requires enhancement to obtain the optimal test result.

2. DEFINITIONS:

   a. Contrast Echocardiogram: A transthoracic or transesophageal echocardiogram done with the administration of the contrast agent

   b. Contrast Agent: Perflutren, (Definity®) is an engineered microbubble that consists of a gas coated with a permeable shell of lipids. The design characteristics allow for an echocardiographic contrast that will persist in the blood for an optimal period (contrast effect lasting 3-10 minutes) and are small enough to pass through the microcirculation and thereby reaching the left-sided heart structures.

   c. Equipment

      - Perflutren Lipid Microsphere lnjectable suspension vial Perflutren, (Definity®)-1.5 ml for single use.
      - 10 cc syringe filled with 8.7 ml of preservative free saline.
      - 18-20 gauge needle for venting
      - Vialmix® mixing device
      - EKG/ pulse oximetry available.

PROCEDURE:

Contraindications:

1) Right to left shunts: includes permanent and transient right to left shunts and bidirectional shunts

2) Hypersensivity to Perflutren, (Definity®).

3) Hypersensitivity to blood, blood products, or albumin (in the case of Optison only)

lndications: Adopted from the American Society of Echocardiography (ASE) and Intersocietal Accreditation Commission of Echocardiography (IACEL):

1. Poor endocardial border definition (defined as the inability to detect **two or more contiguous segments** in any three of the apical windows) for quantification of chamber dimensions, volumes, ejection fraction and assessment of regional wall motion.

2. When left ventricular thrombus is suspected.

3. To assess conditions such as apical hypertrophic cardiomyopathy (or to better assess septal thickness in the setting of asymmetric septal hypertrophy).

4. Should be considered in studies that are technically difficult.

5. May be used in conjunction with treadmill, bicycle, arm crank or pharmacological stress testing to optimize endocardial border definition or enhance Doppler signals.

6. For improving the evaluation of regional right ventricular wall motion.

7. For improving Doppler image quality, especially the tricuspid regurgitant jet that is used to estimate pulmonary artery systolic pressure.

DEFINITY®: Dosing and Administration:

1. A physician, physician assistant, nurse practitioner or registered nurse will prepare and administer the contrast agent

2. A 22 gauge IV access will be obtained.

3. **Activate** a vial of Definity® obtained from the pharmacy, where it has been stored in a refrigerator.

    a. Activate with VIALMIX® for the full 45-second activation cycle to ensure consistent bubble size.

    b. Activated DEFINITY® should be used within 5 minutes of VIALMIX®activation. However, once activated, the DEFINITY® vial can be carried around until it is ready to be used again (up to 12 hours) by resuspending microspheres with 10 seconds of hand agitation.

4. The **Diluted IV Bolus Technique** will be utilized to administer the contrast agent

5. **Withdrawing activated DEFINITY®** from the vial: It is important to use a venting method. Venting avoids negative pressure in the vial and allows for easier contrast withdrawal. Air should never be injected

   a) Withdraw 8.7 mL preservative-free saline into 10 cc syringe using 18 or 20 gauge needle.
   Following activation with VIALMIX®, remove DEFINITY® vial cap and insert venting needle into the vial.
   b) Insert needle attached to 10 cc syringe filled with 8.7 mL preservative-free saline.
   c) Invert vial and ensure the needle tip is positioned approximately in the middle of the suspension.
   d) Slowly withdraw 1.3 mL of activated DEFINITY®.

6) **ADMINISTRATION:**

   a) Gently hand agitate 10 cc syringe filled with 1.3 mL of activated DEFINITY® diluted with 8.7 mL of preservative-free saline to evenly distribute microspheres.
   b) Slowly inject up to 3 mL of solution.
   c) Subsequent injections of 1 to 2 mL as needed.

Key components for optimizing contrast (for echo technicians):

1. Very low mechanical index <0.2
2. Place the focus at the level of the mitral annulus
3. Visually determine whether the Definity administration is optimal by assessing the homogeneity of LV cavity opacification from the apex to the mitral annular plane in the apical views
4. Gain and compression settings should be adjusted to reduce background signals coming from myocardium or blood
5. Minimize shadowing or attenuation by lowering the infusion rate or reducing the size of the bolus injection and flush rate
6. Attenuation observed with a bolus injection will resolve with time, so image acquisition should be delayed until the attenuation disappears. Once the attenuation is minimized, and apical swirling is not present, the sonographer can begin acquisition.
7. Begin acquisition in the apical four-chamber, two-chamber, and long-axis views.
8. For evaluation of the right ventricular (RV) wall motion, contrast media must be given at lower infusion rates so as not to cause RV shadowing.
9. For improving Doppler image quality, such as CW of tricuspid valve to evaluate TR, the Doppler gain settings should be lowered for this application, to reduce background noise.

Adverse Reactions:

1. Anaphylactic or other allergic reactions are rare. With respect to anaphylaxis, respiratory distress due to bronchospasm is the most serious concern. Other reactions include shock (hypotension).

   If anaphylaxis→call rapid response team or code team

2. Allergic reactions can include: back pain (most common), urticarial, facial or laryngeal edema, seizures, and convulsions.
   a. If back pain occurs during Definity administration, discontinue injection and monitor vital signs. No further treatment is needed, and in most cases the pain resolves spontaneously within a few minutes. If contrast is needed again in patients who have experienced back pain with Definity, an alternative contrast agent such as Optison should be used.
   b. If allergic reaction→stop injecting and monitor patient's vital signs for 30 minutes.

   → life-threatening reactions are exceedingly rare (<1 in 10,000)

After the study:

1. NO MONITORING IS NECESSARY. After completion of study, if no reactions, can send patient home or back to ward.

Table 2 Common problems and artifacts encountered when using IV contrast

Typical location of artifact	Artifact/problem	Sonographer correction method	Key additional points
Apex-endocardial border	Swirling	Use real-time very low MI imaging Increase contrast infusion rate (Video 7; available at www.onlinejase.com)	Lower frame rate prevents apical destruction; also can move focus to near field.
Apex-myocardium	Reduced contrast	Increase near-field TGC under resting conditions; move focus temporarily to near field (Video 8; available at www.onlinejase.com)	If resting wall motion is normal, perfusion should be normal, so a defect in this setting is an artifact.
Basal segment–myocardium	Reduced myocardial contrast	Additional foreshortened apical windows to get basal segments in the near field (Video 9; available at www.onlinejase.com)	If resting wall motion is normal, perfusion is normal, and therefore there should be no resting contrast defects in the absence of wall motion abnormalities. Use this concept in setting up receiver gain during resting images, because during stress, perfusion alone can be abnormal.
LV cavity contrast	Inadequate using a continuous infusion	Check IV site to ensure not obstructed; increase infusion rate; ensure contrast is not too dilute and is staying adequately mixed	Could switch to a small bolus.
LV cavity contrast	Shadowing of basal/mid segments	Slow down infusion or reduce bolus size and flush rate	Infusion (compared with bolus) reduces shadowing problems and allows more rapid correction of the problem.