

Guidelines for the Cardiac Sonographer in the Performance of Contrast Echocardiography: Recommendations of the American Society of Echocardiography Council on Cardiac Sonography

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INTRODUCTION

The impact of contrast agents (transpulmonary and agitated saline) on the clinical applications of echocardiography has been dramatic over the last decade. Currently, the Food and Drug Administration–approved indications for transpulmonary agents include the enhancement of left ventricular endocardial border definition. The augmentation of Doppler signals and intracardiac shunt detection can also be enhanced with the administration of contrast agents. The use of contrast agents in each of these clinical situations is well established and has become standard practice in many echocardiography laboratories.¹ The development of newer agents promises to bring additional advances in the utility of contrast echocardiography, including the real-time assessment of myocardial perfusion²; coronary flow detection and flow reserve measurements^{3,4}; the delivery of pharmacologic or genetic therapy⁵; and in combination with continuous ultrasonography, as a therapy for discriminatingly dissolving life-threatening blood clots.⁶ As these applications continue to expand, so must the role and responsibilities of the cardiac sonographer.

Contrast echocardiography requires a high level of competence and expertise, in addition to the skills frequently required in standard cardiac sonography practice, such as assisting with transesophageal echocardiography and performing stress echocardiography, interventional and/or interoperative procedures, and fetal echocardiography.⁷ The American Society of Echocardiography (ASE) highly recommends that cardiac sonographers take the appropriate steps to become trained in the administration of the contrast agents used in echocardiography. The sonographer is often the first person to recognize the need for contrast, but the physician is ultimately responsible for ordering its use, which ideally should be done on a case-by-case basis. However, we recognize that there are situations in which the physician is not immediately available, and in such instances, another option might be the use of standing orders, with explicit indications listed as to when to use a contrast agent. This alternative would require active involvement of the laboratory medical director for the development of standing orders and specific protocols.

The cardiac sonographer's role in performing contrast echocardiography consists of 4 components:

1. A thorough understanding of microbubble physics, instrumentation, and the application of cardiac ultrasonographic scanning techniques for the acquisition of high-quality images during contrast administration.
2. Recognition of the indications for use of a contrast agent for left heart-chamber border delineation, enhancement of Doppler signals, and intracardiac/intrapulmonary shunt detection.
3. Obtainment of intravenous (IV) access or evaluation of an existing IV line for administration of a contrast agent by a sonographer.

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4. Performance of the IV injection or the infusion of the contrast agent.

It is recognized that, given the variety of practice situations, some of these components (ie, [3] and [4]), may not necessarily be a part of the sonographer's responsibilities. However, in the interest of providing a timely patient diagnosis—especially in situations in which the test results will affect the patient's clinical management—a qualified cardiac sonographer can determine the need for a contrast agent and, if necessary, establish IV access and even potentially administer a contrast agent.⁸ This may be the case if the physician or a registered nurse is not present but is available in the immediate area and can provide direct supervision for the insertion of an IV line or for the administration of the contrast agent. It is preferable that a physician and/or a nurse have direct involvement with a contrast study because the sonographer cannot administer a contrast agent (ie, bolus injections) and simultaneously perform a quality echocardiographic examination without additional support.

All persons involved in contrast echocardiography must be well trained and demonstrate competency. Cardiac sonographers need to be credentialed in their respective discipline (adult and/or pediatric). Importantly, when direct supervision by a physician or registered nurse is available and established, and when written laboratory protocols are in place, a credentialed sonographer can initiate the process,¹ obtain IV access, and have a registered nurse or physician administer the appropriate agent. In rare situations, another qualified sonographer could administer the appropriate contrast agent if the registered nurse or physician is not available at the time of the study.

WHEN TO PERFORM CONTRAST ECHOCARDIOGRAPHY

The cardiac sonographer has the responsibility to carry out the physician's order for the performance of the examination and therefore initially determines the overall technical quality of the echocardiogram. Thus this person is often in the primary position to identify the need for contrast enhancement. It is well established that in up to 20% of resting studies, the endocardial border definition of the left ventricle is suboptimal.¹ This has been defined as the inability to visualize at least 2 myocardial segments of the left ventricle. Suboptimal visualization of certain segments, such as the anterior or lateral walls, may be even worse during stress echocardiography. The enhancement of left ventricular endocardial border

definition can be facilitated by using transpulmonary contrast agents.

Other clinical situations that may require the use of contrast are the Doppler signal enhancement of tricuspid regurgitation jet velocity for estimating pulmonary artery pressure, and the improvement of aortic, pulmonic, and mitral valve spectral signals for further analysis of valvular disease severity. In addition, if 2-dimensional echocardiography identifies previously unsuspected findings suggestive of intracardiac or intrapulmonary shunt, this may necessitate the performance of a right-heart contrast study to determine the presence or absence of shunt flow. The cardiac sonographer often can identify the need for a contrast agent in these clinical situations and can improve the efficiency and accuracy of the echocardiographic examination.

To address these clinical issues, the sonographer must have a physician's order for the contrast agent and a preapproved and written procedure plan, established by the medical director, for initiation of the appropriate contrast agent indicated in the particular situation. The supervising or interpreting physician's approval for the study should be obtained whenever possible on a case-by-case basis. However, in the consideration of procedure time, patient satisfaction, or unnecessary delay, a standing order or laboratory policy directive can be considered an alternative means to accomplish timely completion of the echocardiographic examination. In some instances, the echocardiography laboratory medical director could provide standing orders, with the approval of the hospital administration and medical staff and in accordance with state laws regarding administration of pharmaceutical agents.

It is recommended that only credentialed sonographers who practice in accredited⁹ or, at least, Level II¹⁰ laboratories be granted the authority to determine the need for contrast agent usage when the supervising physician is not immediately available. The ASE's view is that these persons have achieved a standard of competency, are well experienced, and can apply independent judgment with sufficient problem-solving skills to assume the responsibility of determining when to incorporate contrast agents.

INTRAVENOUS ACCESS FOR CONTRAST INJECTIONS

The third component of the cardiac sonographer's role in performing contrast echocardiography in-

volves obtaining proper IV access for injections of the agent. This represents an opportunity for the sonographer to learn new skills, gain an enhanced role in the laboratory, and provide higher-quality patient care.⁸ Echocardiography laboratories that have registered nurses, physicians, or IV teams readily available to assist in contrast studies are at an advantage and represent the ideal situation, but they may reflect a minority of laboratory settings. The task of obtaining IV access should not be considered a role reserved only for nurses and physicians. Many allied health professionals are trained to perform venipuncture, including phlebotomists, emergency medical technicians, and radiologic and nuclear medicine technologists. Respiratory therapists perform direct radial artery cannulization to obtain blood samples for blood gases. As with any health care professional who performs IV insertion techniques, the sonographer must complete the appropriate training and certification process before assuming this skill.

The difficulty in obtaining IV training is recognized; however, it may be facilitated by the active involvement of the echocardiography laboratory medical director, or through consultation with nursing administration or perhaps with the clinical laboratory director. The hospital system might offer a program, and courses might be offered in a community college or by independent clinical laboratories. In addition, professional organizations and ultrasound contrast companies are investigating avenues for IV training. When available, local resources are the best approach for the sonographer seeking certification.

It is recommended that IV training encompass knowledge of venous anatomy and appropriate sites of access, risks to patients and the health care professional, use of sterile technique, infection control, and safety precautions. Additional components of training are the confirmation of venous access and the knowledge of proper supplies, including the selection and inspection of the various angiocatheters and needles to be used. A checklist that outlines the procedure and process may be useful. Sonographers should obtain appropriate patient consent and provide an explanation of the procedure. Other elements that must be in place are documentation of the training provided, certification, periodic skill assessment, and close supervision.

An additional consideration for cardiac sonographers are those patients with existing IV lines, whether in the arm or other sites. It is recommended that sonographers who use these sites have thorough knowledge of the catheter type, IV patency, and medications being infused and have direct con-

tact with the patient's nurse for consultation and assistance. This will ensure proper use of the existing IV line and prevent complications.

The ASE recommends that only credentialed sonographers who have had proper IV training, with verified competency, be allowed to perform this procedure, and these persons must be fully aware of the risks and benefits of IV insertion. It is strongly recommended that contrast studies be done only in settings where direct supervision by a physician or nurse is available. Patient safety remains the most important component.

INJECTION OR INFUSION OF CONTRAST AGENTS

After IV access is secured, the injection or infusion of the contrast agent is the remaining component of the contrast echocardiography examination. The recommended approach is that a registered nurse or physician performs the actual injection or infusion of the agent while the cardiac sonographer focuses on acquisition of the images. However, in situations in which the nurse or physician is not readily available and a written policy is in place, a sonographer might perform this function. Other allied health professionals perform injections or administer drugs on standing, preapproved written orders or after obtaining verbal orders from a physician. Any person who administers the contrast agent must have knowledge of the proper technique for injection or infusion, the approved indications, the agent's safety profile (ie, contraindications), the possible allergic reactions, and the potential risk to the patient. This requires carefully explaining the procedure to the patient, answering questions and addressing concerns, and obtaining consent (written, when necessary). The current contrast agents have an excellent safety profile, and complications are extremely rare. However, of particular concern are patients with intracardiac or intrapulmonary right-to-left shunts, in whom the potential for adverse events are greater.¹¹ Importantly, a nurse or physician should be available for immediate response, and the necessary emergency equipment and medications should be available in case of allergic reaction.

It is the official position of the ASE that cardiac sonographers who administer contrast agents must have demonstrable training and skills with thorough product knowledge, and laboratories must have clearly defined written policies and procedures in place, including standing orders from the laboratory

medical director. Only credentialed cardiac sonographers should be given this responsibility, and the use of contrast agents should be carried out in accredited or, at least, Level II echocardiography laboratories.

CONCLUSIONS

The ASE supports and encourages an expanded role of the credentialed cardiac sonographer in the selection of patients and the administration of contrast agents for echocardiography. Such responsibilities require a thorough understanding of microbubble characteristics and interaction with cardiac ultrasound and the indications (and contraindications) for contrast agent injections. The cardiac sonographer must comply with established policies and procedures, as outlined in specific written protocols developed by the echocardiography laboratory director. When responsible for obtaining IV access, this person must have appropriate training with certification. The injection or infusion of agents ideally should be done by a physician or registered nurse following proper techniques. The use of contrast agents should be reserved for accredited or, at least, Level II echocardiography laboratories in which direct physician supervision and registered nurse support are available.

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