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LETTERS TO THE EDITOR

Early Detection of Iatrogenic Pericardial Effusion: Importance of Intracardiac Echocardiography

In a recent issue of *JACC: Cardiovascular Interventions,* Holmes et al. (1) presented information about the incidence, diagnosis, and treatment of iatrogenic pericardial effusion (PE)/tamponade following transseptal catheterization (TSC) and during different percutaneous intracardiac interventions.

The early detection of PE can prevent it from evolving to life-threatening tamponade. Transthoracic and transesophageal echocardiography have been useful in the diagnosis of PE during percutaneous intracardiac interventions. However, difficulties encountered with transthoracic echocardiography in accurately imaging critical intracardiac structures and PE, and with transesophageal echocardiography, which requires heavy sedation and/or general anesthesia, have hindered their routine use as real-time imaging tools during percutaneous intracardiac interventions. In our experience with intracardiac echocardiography (ICE) in more than 2,000 TSC cases, ICE has proven an effective real-time monitoring tool to enhance early detection of PE. An indwelling ICE catheter in the right heart during the entire intracardiac ablation procedures is also well tolerated (2).

There were several specific viewpoints expressed by Holmes et al. (1) that should be discussed in light of the availability of ICE.

Recognition of PE and tamponade. Holmes et al. (1) suggested that "a new septal shift on 2-dimensional echocardiography" and pulse-wave Doppler showing a decrease in the initial E velocity during inspiration are important to detect early subclinical stages of tamponade. However, these are indirect indexes of tamponade with many limitations. They may not be easily applied diagnostic criteria in an emergency scenario and may only be recognized later in the evolution of a progressively enlarging PE. In contrast, ICE can typically detect <20 cc of pericardial fluid at baseline assessment and no echo-free space or less than 1 to 2 mm of echo-free space seen posteriorly only during systole. When a small amount of PE is present, estimated up to 50 to 80 cc, ICE can detect 2 to 5 mm of echo-free space posteriorly. Furthermore, if coagulation of the PE starts, ICE can easily differentiate coagulated PE (clot) from fluid (echo-free space). In contrast, on many occasions, transthoracic echocardiography cannot detect this small fluid space, which suggests that ICE with a 5.5- to 7.5-MHz transducer has a greater resolution and is more precise for identifying a new effusion. When the ICE transducer is placed in the right ventricle, it can also identify PE around the apex or right or left ventricle as the PE progresses. Also, ICE can detect invagination of the right atrial or ventricular wall during diastole and early systole as another important sign of tamponade (3).

Relative contraindications to TSC. Holmes et al. (1) and Ross (4) defined many contraindications to TSC guided mainly by fluoroscopy. These contraindications are less risky and are thus not contraindicated with ICE guidance. A markedly dilated ascending aorta can be easily imaged and the puncture needle/sheath can be guided through the interatrial septum at the fossa ovalis with ICE. In other distorted cardiac anatomy due to rotational abnormalities of the heart and great vessels, and kyphoscoliosis, ICE imaging of the transseptal needle, as it relates to the fossa ovalis and its surrounding structures, makes the TSC expeditious and safe. In anticoagulated patients undergoing left atrium catheter ablation for atrial fibrillation, TSC is safe under ICE guidance (5). Our experience has confirmed that some atrial conditions require caution during TSC even under ICE guidance. These conditions include the presence of an atrial septal aneurysm, especially with a normal left atrium size (3). During transseptal puncture, tenting and bulging of the aneurysm deep into the left atrium may be observed and penetration through the septum may be difficult. A puncture site caudal and lateral to the border of aneurysm can be safely performed under ICE guidance in selected patients. In patients with a repaired patch or an "occluder" device in the atrial septum, ICE can also provide accurate location of the occluding device and guide the TSC safely (3).

In summary, ICE provides a guide for safe TSC under a variety of what were previously considered high-risk situations and represents a powerful tool for real-time monitoring with early detection of PE, which can prevent the development of tamponade.

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Reply

We thank Drs. Ren and Marchlinski for the interest in our paper (1). The most important aspect of pericardial effusion is prompt and early recognition, which then facilitates rapid treatment. A

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number of different diagnostic modalities are available that can facilitate this process. Certainly intracardiac echocardiography can be very helpful although it is not routinely used in all laboratories. It can be used to facilitate transseptal approaches as has been mentioned and can be used for early diagnosis of effusion. We use it often in complex cases involving pulmonary vein ablation, pulmonary vein stenosis, left atrial appendage occlusion, paravalvular leaks, among other situations. It is very helpful, although not perfect.

It is important to remember that like any other technical or imaging procedure, intracardiac echocardiography is not perfect, and one should not make the mistake of thinking that it makes procedures that can be complex into very easy risk-free adventures. Careful attention to detail, knowledge about the risks and benefits of each procedure, and awareness of complications is essential to optimize outcome. As part of the armamentarium of interventional cardiologists, intracardiac echocardiography is a wonderful addition.

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