EDITORIAL

Intracardiac Echocardiography-assisted Transseptal Puncture

Wen-Chung Yu*

Division of Cardiology, Department of Medicine, Taipei Veterans General Hospital, and National Yang-Ming University School of Medicine, Taipei, Taiwan, R.O.C.

The demand for imaging techniques to guide cardiac intervention has increased because of the rapid growth of new percutaneous procedures in structural heart diseases and arrhythmia. Fluoroscopy and angiography are the traditional imaging tools to guide interventional procedures. However, they are limited because of increased radiation exposure, contrast exposure and poor soft-tissue resolution. Echocardiography has a role in imaging because it can provide invaluable real-time images for guiding interventional procedures. It ranges from noninvasive transthoracic echocardiography (TTE) to invasive transesophageal echocardiography (TEE) and intracardiac echocardiography (ICE). TTE can provide valuable information about the structure and function of the heart chamber and valves, and it can be used to guide pericardiocentesis, endomyocardial biopsy and transseptal puncture.[1] However, it is limited by the narrow acoustic window during the interventional procedure and potential compromise of the sterile field. TEE can provide better images of the interatrial septum, left atrial appendage, and mitral valve anatomy. It is frequently used to guide transseptal puncture and placement of closure devices for atrial septal defect, patent foramen ovale and ventricular septal defect.[2,3] The major limitation of TEE is that general anesthesia with or without endotracheal intubation is often required. Both TTE and TEE necessitate a second operator. The advantages of using ICE to guide interventional procedures are that it provides more accurate images than TTE and it does not require anesthesia or a second operator.

For rheumatic mitral valve stenosis, balloon mitral valvuloplasty has become the treatment of choice. The study by Liang and colleagues in the September 2010 issue of the *Journal of the Chinese Medical Association* compared mechanical ICE with phase-array ICE for guiding transseptal puncture in patients undergoing percutaneous transvenous mitral commissurotomy (PTMC).[4] The authors reported that there was no significant difference in procedure success rate and fluoroscopic time between these 2 modalities. Although the study is limited by its low case number, it demonstrated the effectiveness of an old model of ICE with a mechanical transducer in guiding transseptal puncture.

Do we need more high-technology and more expensive devices in PTMC? To answer this question, we need to readdress the fundamental requirements of imaging in PTMC. The ideal imaging techniques for PTMC should provide the capability to: (1) guide transseptal puncture; (2) assess the left atrial appendage; and (3) evaluate mitral status before and after valvuloplasty. First, mechanical ICE can provide adequate images with the advantage of near-field resolution. In addition, it is cheaper than phase-array ICE. However, mechanical ICE is usually not adequate for detecting thrombus in the left atrial appendage, and it also lacks the ability to evaluate the status of the mitral valve before and after PTMC. Conversely, phase-array ICE can provide accurate images of the interatrial septum and left atrial appendage, and has the capability to monitor the status of the mitral valve due to its superior far-field resolution, steerability, and Doppler and color flow imaging. Therefore, phase-array ICE is the better choice for assessment of the left atrial appendage and evaluation of mitral status before and after valvuloplasty. In summary, both mechanical ICE and phase-array ICE are adequate for guiding transseptal puncture. Mechanical ICE needs to be used with other modalities, usually TTE or TEE, for full monitoring of PTMC, and phase-array ICE by itself provides the

*Correspondence to: Dr Wen-Chung Yu, Division of Cardiology, Department of Medicine, Taipei Veterans General Hospital, 201, Section 2, Shih-Pai Road, Taipei 112, Taiwan, R.O.C.
E-mail: wcyu@vghtpe.gov.tw • Received: July 13, 2010 • Accepted: August 18, 2010

possibility for full monitoring of PTMC. Their clinical application should be determined according to the operator's experience and their availability.

The rapid development in catheter ablation of cardiac arrhythmia, especially atrial fibrillation, has led to a new demand for imaging modalities to assist transseptal puncture and to locate the ablation catheter in the left heart chamber. Phase-array ICE is preferred because of its image depth and steerability. Recently, the development of computer micromachined ultrasound transducers has made it possible to incorporate interventional devices with ultrasound and 3-dimensional ICE.[5,6] It is hoped that these new developments will advance the diagnostic and therapeutic application of ICE as a guide for transseptal puncture.

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