

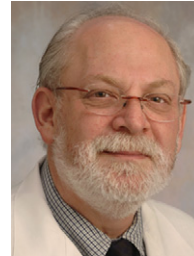
## Preface



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Three-dimensional echocardiography (3DE) has transitioned from a research tool to a methodology useful in everyday clinical practice. This transition began, in earnest, in 2002 with the release of a reasonably user-friendly version of a matrix array transducer capable of real-time 3D imaging together with software that allows rapid slicing and quantification of structures. Prior to this time, 3DE had been acquired by using a two-dimensional echocardiography (2DE) transducer, wherein the movement of the transducer was followed in space, or by moving it in a prespecified pattern, acquiring multiple 2DE images with the aid of cardiac and (in some renditions) respiratory gating, and finally assembling the 2D images into a 3D image using advanced computer software and coupled with the spatial tracking information. This approach was formidable and only undertaken by those with a major interest in the research and development of the technology. Previous ultrasound imaging systems had 256 to 512 elements. The current 3D matrix transducer has approximately 3000 imaging elements, coupled with significantly enhanced computer processing power. The major breakthrough in transducer technology was the development of a microbeam former that allowed not only the acquisition of a large volume of information but also electronic steering of the transducer.

Hence the combination of the microbeam former, improved image quality, more efficient management of the images (in terms of digital storage and transfer), improved analysis packages, and reimbursement of the service combine to make 3DE a possibility for routine use in the clinical echocardiography laboratory. Most importantly, critical research has been performed that defines the current use of the technology.

The timing of this issue of the *Cardiology Clinics* is primed by the recent release of a position paper by the American Society of Echocardiography (ASE) and a message from Dr. Michael Picard, the current ASE president. The ASE position paper summarizes the data documenting the usefulness of 3D technology. Dr. Picard encourages the use of 3DE for the following reasons:

1. *Keeping up with the competition.* Currently, CT and MRI already use 3D imaging to their advantage. We as echocardiographers need to increase awareness that this approach is feasible with echocardiography.
2. *Improved assessment of the left ventricle.* There are now many publications showing the superiority of left ventricular volume, mass, and ejection fraction measurement with 3DE compared with 2DE. Volume

and mass are important markers of prognosis in both heart failure and hypertension.

3. *Improved understanding of valve function.* As depicted in the ASE position paper, 3DE allows an “en face” view of the valve for measuring the valve area in mitral stenosis and aortic stenosis. Furthermore, in mitral regurgitation—more specifically, mitral valve prolapse—3DE can precisely define which individual scallop is involved and further delineate other mechanisms of mitral regurgitation. In addition, using 3D color Doppler, the shape and exact size of the vena contracta can be assessed, obviating assumptions made regarding its shape when using 2DE/Doppler. Thus, it provides more accurate quantitative assessment of valva regurgitation severity, unlike the proximal isovelocity surface area (PISA) method, which assumes (mostly incorrectly) the flow acceleration to be hemispherical.
4. *Improved display of congenital heart lesions.* A mainstay of 3DE is its ability to display complex spatial relationships between structures in patients with more advanced forms of congenital heart disease.
5. *Preparing for the future.* It is likely that 3DE will become a common part of all echocardiographic examinations. This will be challenging, because the technology is changing rapidly—on the positive side, it is improving rapidly as well. It is important for us as cardiologists, not just as echocardiographers, to keep up with this technology.
6. *Helping drive the technology forward.* It is our job within this issue of the *Cardiology Clinics* to challenge all cardiologists and sonographers to explore this technology and ask critical questions regarding its use and development. The more people engage from the sidelines and become part of the process, the quicker

the technology will advance and be understood. Clearly improvements are needed, particularly with regard to more advanced transducers with higher frequencies and frame rates and complete Doppler capabilities.

The reader is encouraged to explore Dr. Picard’s entire document, as well as the position paper [1,2].

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## References

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- [2] Hung J, Lang R, Flachskampf F, et al. 3D echocardiography: a review of the current status and future directions. *J Am Soc Echocardiogr* 2007;20:213–33.