GE Healthcare

4D imaging increases clinical confidence through detailed cardiac anatomy.

- Real-time, 4D imaging enables a more detailed analysis of valve morphology
- Combined with color Doppler, 4D imaging can eliminate the need to conduct Transesophageal echocardiography exams
- 4D imaging has been proven to help surgeons in their surgery preparation

"4D in real-time is very user-friendly. It gives the reader a much better concept of the heart as being the volumetric (3-dimensional) organ that it really is. We are seeing beautiful endocardial definition, and nice color Doppler in 4D mode. Our sonographers say that the 3V transducer is lightweight, easy to use, and leaves a relatively modest footprint on the chest."

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CASE 1

4D echocardiography with color Doppler identifies severe mitral valve disease.

A thirty year old woman with shortness of breath was told years earlier that she had a heart murmur, but no further investigation had been performed. She reported feeling fine until 6 months earlier when she started experiencing increased fatigue and dyspnea. She also complained of orthopnea, but denied any chest pain, palpitations, syncope or fever. Past medical history was unremarkable and she denied any drug use.

Her electrocardiogram revealed a sinus rhythm at 75bpm, with left ventricular hypertrophy and left atrial enlargement. Her chest x-ray showed cardiomegaly and mild pulmonary edema. Two-dimensional echocardiography revealed an enlarged left ventricle with preserved ejection fraction. A thickened mitral valve with reduced excursion, left atrial enlargement, and the presence of mitral regurgitation was also revealed, the severity of which was difficult to accurately assess (Figure 1).

Conclusion

The use of real-time, 4D imaging with color Doppler allowed a detailed analysis of the morphology of the mitral valve and it's abnormal function, including the cause and severity of the mitral regurgitation. 4D imaging with color Doppler provided the necessary diagnostic information on the patient's cardiac morphology and function, thus avoiding the need for additional transesophageal imaging. In addition, the 4D images were very helpful to the cardiovascular surgeons in planning her mitral valve surgery.

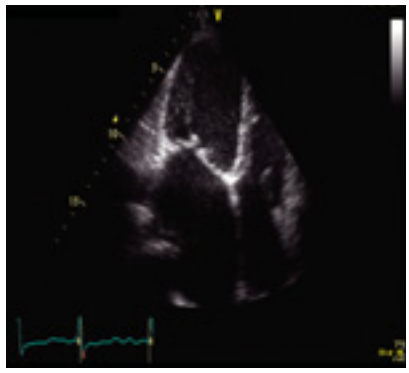


Figure 1

2D echocardiography reveals an enlarged LV and a thickened mitral valve.

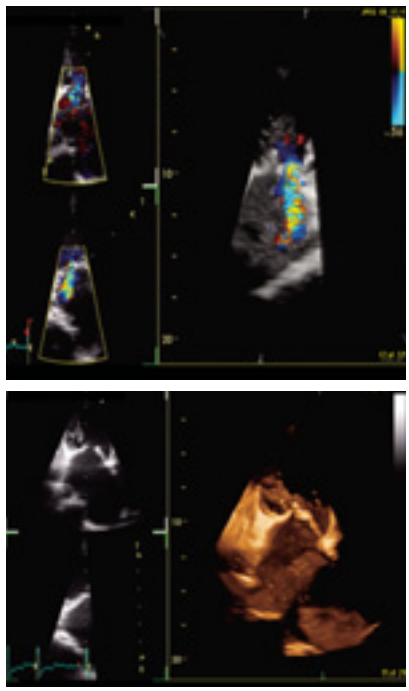


Figure 2

Real-time, 4D imaging revealed a thickened, calcified, rheumatic mitral valve with marked restriction of movement in the posterior leaflet.

Figure 3

Manipulation of the full-volume image revealed that the mitral valve was opening sufficiently in diastole, excluding the presence of significant mitral stenosis.

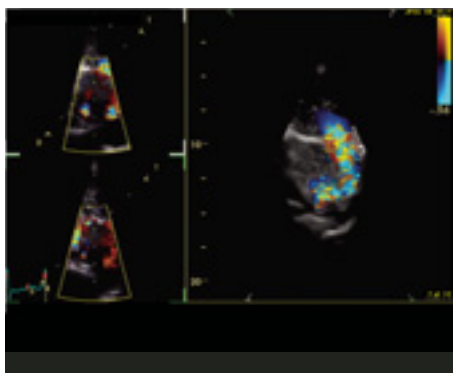


Figure 4

4D imaging with color Doppler revealed a large, very eccentric, posteriorly-directed jet of mitral regurgitation, which was graded as severe.

Figure 5

Manipulation of the color Doppler images allowed visualization of the precise point of malcoaptation of the mitral valve, as well as the origin of the severe mitral regurgitation.

CASE 2

4D imaging identifies the infected, ruptured sinus of Valsalva aneurysm with bicuspid aortic valve.

A thirty-three year old man with increasing shortness of breath, fever and weakness had previously been told he had “a hole in the heart,” but knew no other details. At admission, his blood pressure was 110/73 mmHg, heart rate was 86bpm, and his temperature was 101.6 degrees F. Blood cultures taken came back growing Strep. Viridans in 8/8 bottles.

Two-dimensional transthoracic imaging with color Doppler identified the flow at the junction of the aortic valve and interventricular septum, but could not identify the exact site of communication with the right ventricle, nor the exact source of infection. 4D imaging was then performed, revealing a ruptured left aortic sinus of Valsalva aneurysm into the right ventricular outflow track (Figures 1-4).

Conclusion

There was no Doppler evidence of aortic coarctation. The diagnosis of infected, ruptured sinus of Valsalva aneurysm was made, and the patient was treated with 6 weeks of intravenous antibiotics. Subsequent definitive surgical correction of the ruptured sinus of Valsalva aneurysm was also performed. This case illustrates how 4D imaging provided incremental information above and beyond that of 2D studies.

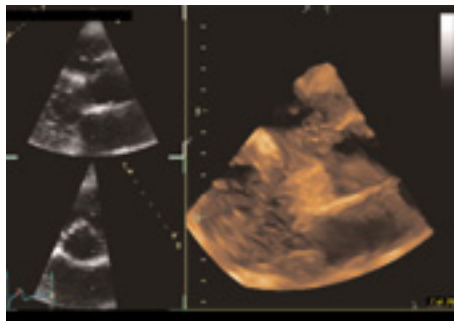


Figure 1

4D imaging revealed a ruptured left aortic sinus of Valsalva aneurysm.

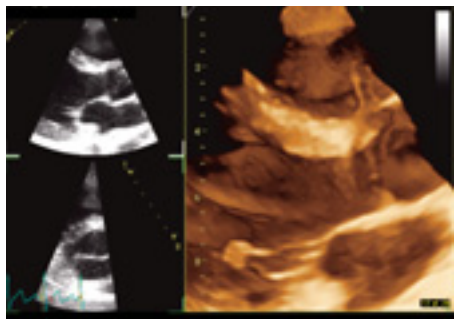
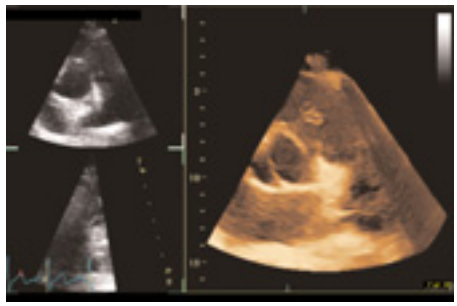


Figure 2

A discrete mass could also be seen on the windsock of the ruptured sinus, consistent with endocarditis.



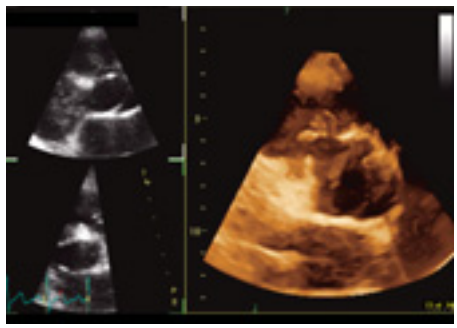


Figure 3 & 4

In addition, a bicuspid aortic valve was identified, but there was no evidence of endocarditis on any cardiac valve.

Healthcare Re-imagined

GE is dedicated to helping you transform healthcare delivery by driving critical breakthroughs in biology and technology. Our expertise in medical imaging and information technologies, medical diagnostics, patient monitoring systems, drug discovery, and biopharmaceutical manufacturing technologies is enabling healthcare professionals around the world to discover new ways to predict, diagnose and treat disease earlier. We call this model of care "Early Health." The goal: to help clinicians detect disease earlier, access more information and intervene earlier with more targeted treatments, so they can help their patients live their lives to the fullest.
Re-think, Re-discover, Re-invent, Re-imagine.

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