

Echocardiography

An **echocardiogram**, often referred to in the medical community as a **cardiac ECHO** or simply an **ECHO**, is a sonogram of the heart (it is *not* abbreviated as ECG, which in medicine usually refers to an electrocardiogram). Also known as a **cardiac ultrasound**, it uses standard ultrasound techniques to image two-dimensional slices of the heart. The latest ultrasound systems now employ 3D real-time imaging.

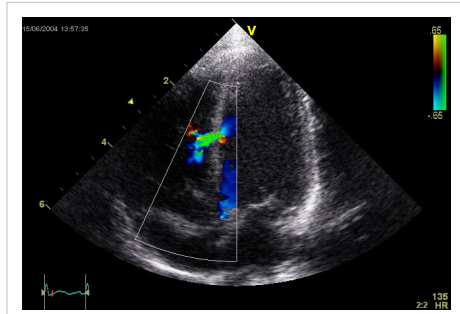
In addition to creating two-dimensional pictures of the cardiovascular system, an echocardiogram can also produce accurate assessment of the velocity of blood and cardiac tissue at any arbitrary point using pulsed or continuous wave Doppler ultrasound. This allows assessment of cardiac valve areas and function, any abnormal communications between the left and right side of the heart, any leaking of blood through the valves (valvular regurgitation), and calculation of the cardiac output as well as the ejection fraction. Other parameters measured include cardiac dimensions (luminal diameters and septal thicknesses) and E/A ratio.

Echocardiography was an early medical application of ultrasound. Echocardiography was also the first application of intravenous contrast-enhanced ultrasound. This technique injects gas-filled microbubbles into the venous system to improve tissue and blood delineation. Contrast is also currently being evaluated for its effectiveness in evaluating myocardial perfusion. It can also be used with Doppler ultrasound to improve flow-related measurements (see Doppler echocardiography).

Echocardiography is either performed by cardiac sonographers or doctors trained in cardiology.

Purpose

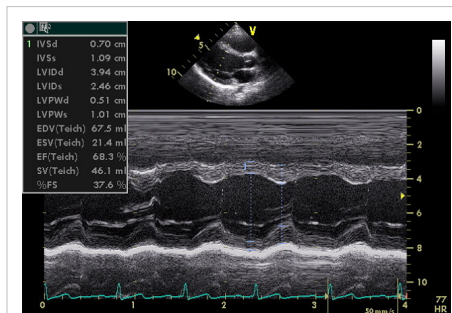
Echocardiography is used to diagnose cardiovascular diseases. In fact, it is one of the most widely used diagnostic tests for heart disease. It can provide a wealth of helpful information, including the size and shape of the heart, its pumping capacity and the location and extent of any damage to its tissues. It is especially useful for assessing diseases of the heart valves. It not only allows doctors to evaluate the heart valves, but it can detect abnormalities in the pattern of blood flow, such as the backward flow of blood through partly closed heart valves, known as regurgitation. By assessing the motion of the heart wall, echocardiography can help detect the presence and assess the severity of coronary artery disease, as well as help determine whether any chest pain is related to heart disease. Echocardiography can also help detect



An abnormal **echocardiogram**. Image shows a mid-muscular ventricular septal defect. The trace in the lower left shows the cardiac cycle and the red mark the time in the cardiac cycle that the image was captured. Colors are used to represent the velocity and direction of blood flow.



Sonographer doing pediatric echocardiography



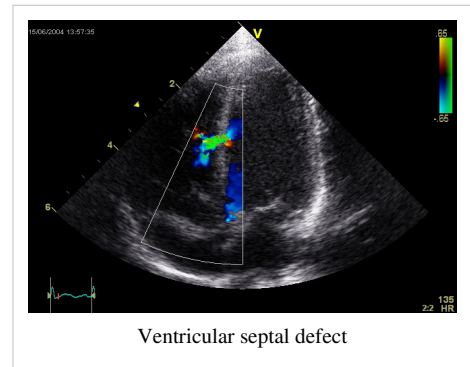
Echocardiogram in the parasternal long-axis view, showing a measurement of the heart's left ventricle

hypertrophic cardiomyopathy. The biggest advantage to echocardiography is that it is noninvasive (doesn't involve breaking the skin or entering body cavities) and has no known risks or side effects.

Transthoracic echocardiogram

A standard echocardiogram is also known as a transthoracic echocardiogram (TTE), or cardiac ultrasound. In this case, the echocardiography transducer (or probe) is placed on the chest wall (or thorax) of the subject, and images are taken through the chest wall.

This is a non-invasive, highly accurate and quick assessment of the overall health of the heart.



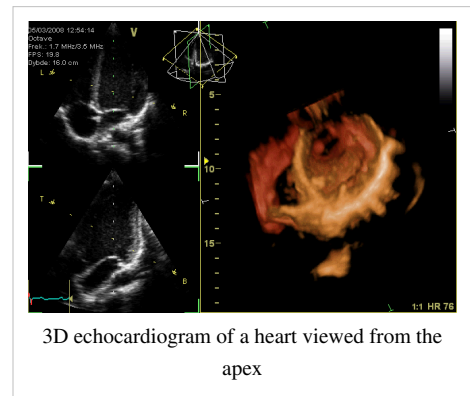
Ventricular septal defect

Transoesophageal echocardiogram

This is an alternative way to perform an echocardiogram. A specialized probe containing an ultrasound transducer at its tip is passed into the patient's oesophagus. This allows image and Doppler evaluation which can be recorded. This is known as a transoesophageal echocardiogram, or TOE (TEE in the United States).

3-dimensional echocardiography

3-D echocardiography is now possible, using an ultrasound probe with an array of transducers and an appropriate processing system. This enables detailed anatomical assessment of cardiac pathology, particularly valvular defects,^[1] and cardiomyopathies.^[2] The ability to slice the virtual heart in infinite planes in an anatomically appropriate manner and to reconstruct 3-dimensional images of anatomic structures make 3D echocardiography unique for the understanding of the congenitally malformed heart.^[3]



3D echocardiogram of a heart viewed from the apex

Accreditation

- United States: The "Intersocietal Commission for the Accreditation of Echocardiography Laboratories" (ICAEL) sets standards for the echo labs, cardiologists and technologists in the US to comply to. Once all requirements have been met, the lab will receive ICAEL certification. A lab that has received the certification may also receive higher reimbursement from insurance companies such as Medicare and United Healthcare. <http://www.icael.org/icael/index.htm>
- UK: In the UK, accreditation is done by the British Society of Echocardiography. Accredited technologists or other professionals from the echocardiography field will have completed a logbook and passed an exam^[4].
- Europe: At a European level, individual and laboratory accreditation^[5] is provided by the European Association of Echocardiography (EAE). Three subspecialties for individual accreditation: Adult Transthoracic Echocardiography (TTE), Adult Transesophageal Echocardiography (TEE) and Congenital Heart Disease Echocardiography (CHD).

See also

- Angiogram
- Aortic valve area calculation
- Electrocardiogram
- Fetal echocardiography

External links

- Mitral Valve Prolapse ^[6]
- American Society of Echocardiography ^[7]
- British Society of Echocardiography ^[4]
- International Society of Cardiovascular Ultrasound ^[8]
- European Association of Echocardiography ^[9]
- 3D Echo Box: Interpretation of 3 Dimensional Echocardiography images and derive information online ^[10]
- Basic Echocardiography Course: From physics to anatomy, and assessment of heart chambers and valvular structures ^[11]
- VIRTUAL TEE - online self-study and teaching resource ^[12]
- Echobasics - free online echocardiography tutorial ^[13]
- Algorithms and System for Digital Echocardiogram Video Indexing and Su ^[14]

References

- [1] Poh KK, Levine RA, Solis J, Shen L, Flaherty M, Kang YJ, Guerrero JL, Hung J. (2008). "Assessing aortic valve area in aortic stenosis by continuity equation: a novel approach using real-time three-dimensional echocardiography". *Eur Heart J* **29**: 2526. doi:10.1093/eurheartj/ehn022. PMID 18263866.
- [2] Goland S, Czer LS, Luthringer D, Siegel RJ. (2008). "A case of arrhythmogenic right ventricular cardiomyopathy". *Can J Cardiol* **24** (1): 61–2. PMID 18209772.
- [3] Impact of Multiplanar Review of Three-Dimensional Echocardiographic Data on Management of Congenital Heart Disease. *Ann. Thorac. Surg.*, September 2008; 86: 875 - 881)
- [4] <http://www.bsecho.org>
- [5] <http://www.escardio.org/communities/EAE/accreditation/Pages/welcome.aspx>
- [6] <http://www.youtube.com/watch?v=QztHmYLXhMA>
- [7] <http://www.asecho.org>
- [8] <http://www.iscu.org/>
- [9] <http://www.escardio.org/communities/EAE/Pages/welcome.aspx>
- [10] <http://www.escardio.org/communities/EAE/3d-echo-box/Pages/welcome.aspx>
- [11] <http://www.escardio.org/communities/EAE/education/welcome/echocardiography-course/Pages/welcome.aspx>
- [12] <http://pie.med.utoronto.ca/tee>
- [13] <http://www.echobasics.de/>
- [14] <http://www.logikbase.com/website/techprofile.cfm?licid=770>

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