Echocardiography

Doppler examination

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Principle - Echography

- $T$: time (period) = $1/F$
- $A$: amplitude
- $\lambda$: length of the wave
Piezoelectric effect

Appearance of an electric field in certain nonconducting crystals as a result of the application of mechanical pressure. Pressure polarizes some crystals, such as quartz, by slightly separating the centers of positive and negative charge. The resultant electric field is detectable as a voltage. The converse effect also occurs: an applied electric field produces mechanical deformation in the crystal. Using this effect, a high-frequency alternating electric current (see alternating current) can be converted to an ultrasonic wave of the same frequency, while a mechanical vibration, such as sound, can be converted into a corresponding electrical signal.
The scheme of an echography
The transducer - the probe

Ultrasound wave

Ultrasound beam
The transducer - the probe

**Fig. 1-21.** Various types of real-time scanners.

**Fig. 2-25.** A to D. Construction of a phased array transducer. (See text for details.)
The transducer- the probe

Scanning methods

Types of Scans:
- Sector
- Linear
- Arc
- Compound

Fig. 1-19. Various types of scanning maneuvers.
The reflection of the ultrasound waves
The refraction of the ultrasound wave
The amplitude of the electric impulse is directly proportional with the intensity of the echo.
A Mode - amplitude

Transducer
Heart
Ultrasound beam
B Mode- brightness

Mode A

Mode B
M mode - motion

Heart - anatomy  B mode brightness  M mode
Anatomy of the thorax
The principal plans of section used in echocardiography
Left parasternal long axis view
Apical two chamber view
Apical four chamber view
Short axis view of left ventricle
Subcostal view
Mitral Valve M-mode Analysis
Mitral Valve M-mode Analysis
Aortic Valve M-mode Analysis
Aortic Valve M-mode Analysis
Ventricular M-mode
Ventricular M-mode

- Ventricular Wall Thickness
- Ventricular Chamber Size
- Intraventricular Masses
Doppler echography

\[ \Delta F = \frac{2 \times f_0 \times s \times \cos \alpha}{c} \]

- \( F_0 \) = emission frequency;
- \( S \) = speed of the blood cells;
- \( C \) = speed of the ultrasound wave;
- \( \cos \alpha \) = the angle between the wave direction and blood direction.
Doppler echography
Normal aspect

- Arterial flow
  - High resistance
- Low resistance
Normal aspect

- Venous flow
  - peripheral

- central
DOPPLER COLOR

- Superficial femoral artery
Arterial occlusion

- Embolism
- Thrombosis
Heart - color Doppler

BP 130/75
Mitral valve regurgitation - color Doppler