

# Doppler Ultrasound



The background features several watercolor-style splashes in light blue, teal, and green. Scattered throughout are small, dark blue dots of varying sizes. In the bottom right corner, there are faint, stylized line drawings of fingers.

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The background features a light cream color with abstract watercolor splashes in shades of light blue and pale green. Scattered throughout are small, dark blue dots of varying sizes. A thin, dark blue line curves across the right side, ending in a small, hand-drawn loop.

# 01

## Overview

# About the device

Doppler imaging is based on the Doppler principle, which states that when a wave is transmitted from or reflected off a moving object, its frequency shifts. Because sound waves emitted from a moving source are compressed or expanded depending on the direction of movement, this occurs.



# Doppler imaging types

- **Color Flow Doppler:** it converts Doppler pulses into colors
- **Continuous Wave Doppler:** it uses continuous transmission and reception of ultrasound waves.
- **Pulsed Wave Doppler:** shows the power or amplitude of sound signals rather than a shift in frequency.
- **Other types:** Power Doppler, duplex ultrasound



# 02

## Importance

A central light blue circle with a dark blue outline is connected by six dark blue lines to six surrounding light green, brush-stroke style rounded rectangles. The background features abstract blue and green watercolor-like splatters.

**Doppler can  
be used in**

**Intracardiac pressure**

**Blood Flow**

**Musculoskeletal  
Disorders**

**Tumor Characterization**

**Distinguishing Solid from  
Fluid-Containing Structures**

**Early Detection of  
Inflammatory Arthropathy**

The background features a light blue watercolor splash in the upper center, transitioning into a light green splash at the bottom. Scattered throughout are small, dark blue dots of varying sizes. A thin, dark blue line curves from the top right, looping around the right side of the central splash, and ending in a series of three loops at the bottom right.

# 03

## Components



# Doppler imaging main components



## Transducer

a handheld device, The transducer probe makes the sound waves and receives the echoes



## CPU

It contains the microprocessor, memory and power supplies for the microprocessor and transducer probe



## Printer

used to capture a hard copy of the image from the display



## Display Screen

It's a monitor that shows the processed data from the CPU




## Disk storage

The processed data and/ or images can be stored on disk



## Keyboard/Cursor

These devices allow the operator to add notes to and take measurements from the data.



# 04

## Theory

# Wave Parameters

- ❖ Doppler echocardiography devices emit ultrasound waves (above the range that human can hear) to create a picture of organs, tissues, and other structures inside the body.



# Duration



A Doppler ultrasound test is usually done in a clinic. A special gel is rubbed on the part of the body being tested to improve sound quality. Then, a transducer is held against your skin while images of the blood vessels are recorded.



A computer takes all the sound waves and turns them into moving images that you can see live on a screen. It usually takes about 30 to 60 minutes (include scanning and results).

# Tissue interaction



## Specular reflections

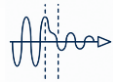
reflections form the most apparent boundaries on images are termed specular reflection



## Diffuse reflection

reflections that arise from within relatively homogeneous tissues tend to be scattered in various directions

## Attenuation



All sound waves are attenuated when they travel through tissue or fluid

## Refraction



Finally, refraction occurs when ultrasound is reflected at an angle from the original ultrasound beam

## Parameters of soft tissue

**Reflectivity**

About **99.9%**

**Impedance**

**$1.54 \times 10^6$**  kg/m<sup>2</sup>sec

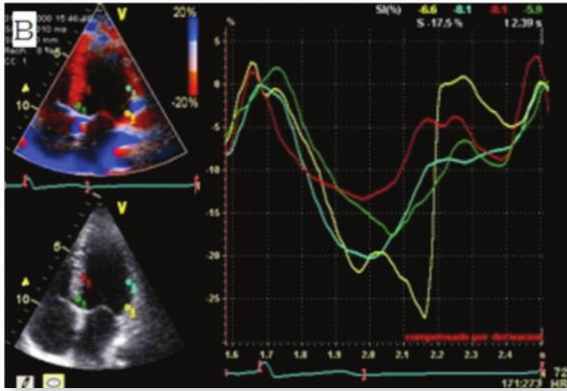
**Attenuation coefficient**

**0.75** dB/MHz cm

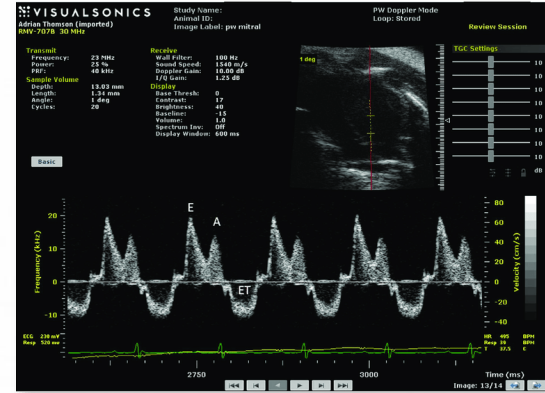
## Materials

- Plastic: some type of polymers and Teflon
- Metal: it include aluminum, steel alloys and iron

# Samples



Color Doppler



spectral Doppler



Apical three-chamber view from a subject with suboptimal endocardial visualization



The background features a light blue watercolor splash in the center, with a green watercolor splash at the bottom. Scattered around are small dark blue dots and a thin, dark blue line that curves from the top right towards the bottom right, ending in a small loop.

# 05

## Risks & precautions



# Analysis

- ❖ There are no known risks with an ultrasound, including a Doppler ultrasound and There is usually no need to restrict foods or fluids, or to make any special preparations before a Doppler ultrasound test.
- ❖ There are some Factors that can cause issues with the results include:



Cold extremities  
and open wounds  
in the area



Excessive  
movement during  
the exam



Intestinal gas or  
nearby bones



Severe obesity

# 6 References

- Echocardiographic Instrumentation and Principles of Doppler Echocardiography , Scott D. Solomon MD
- Circulation: a Clinician's Guide to Tissue Doppler Imaging
- <https://medlineplus.gov/lab-tests/doppler-ultrasound>
- Diagnostic Ultrasound Imaging: Inside Out , Tomas .L Szabo
- [thoracickey.com/physics-of-echocardiography](http://thoracickey.com/physics-of-echocardiography)



# Thanks

Do you have any questions?