# WaVelocity

## Cardiovascular Image Analysis

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http://telin.ugent.be/~dbabin/Demo_WaVelocity/

# Aortic Analysis

**WaVe**locity features:

- Validated Pulse Wave Velocity (PWV) measurement
- Validated centerline extraction
- PWV cross-sectional
- PWV para-sagittal
- Velocity curves analysis
- Aortic segmentation, diameter and distensibility
- Blood flow quantification
- Easy reporting

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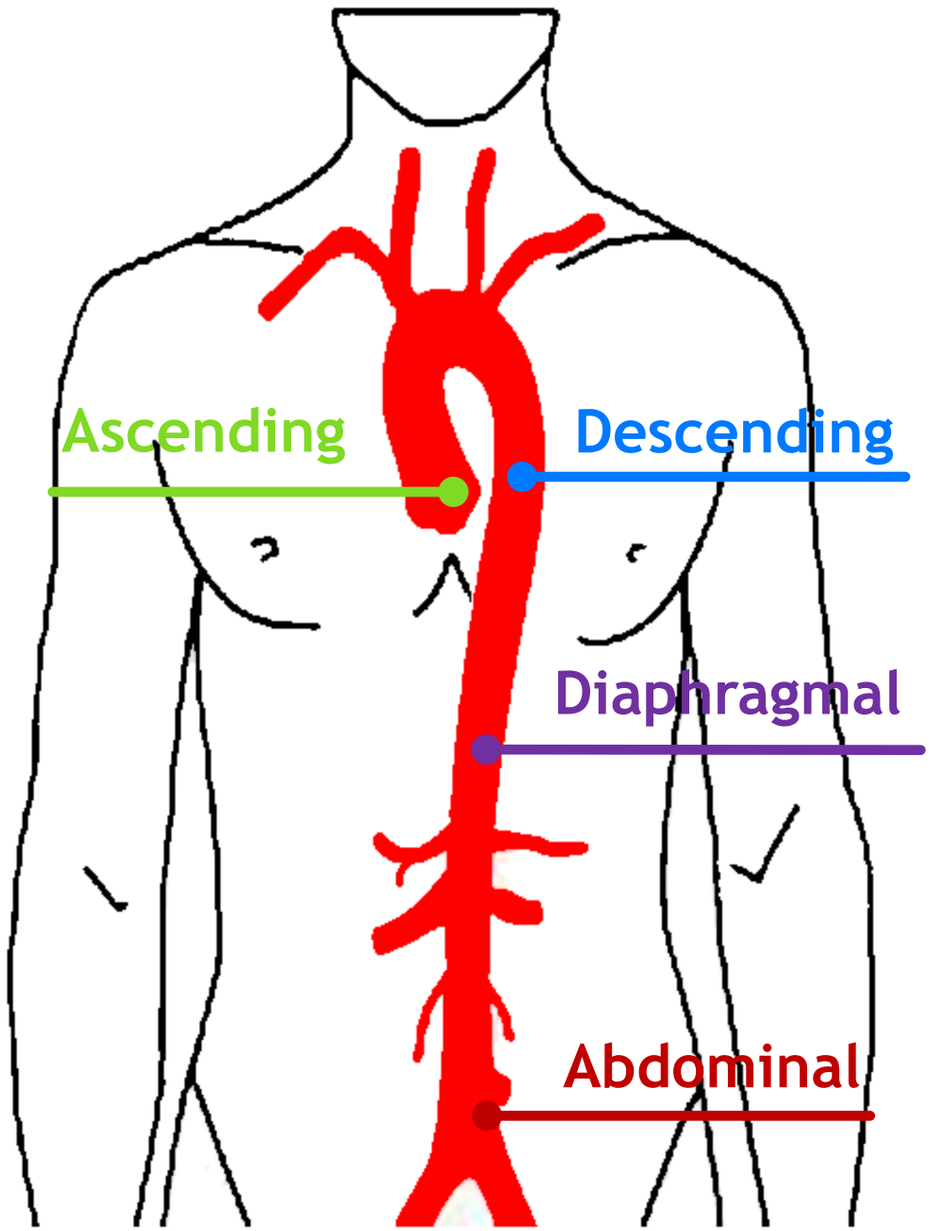
# PWV Cross-Sectional

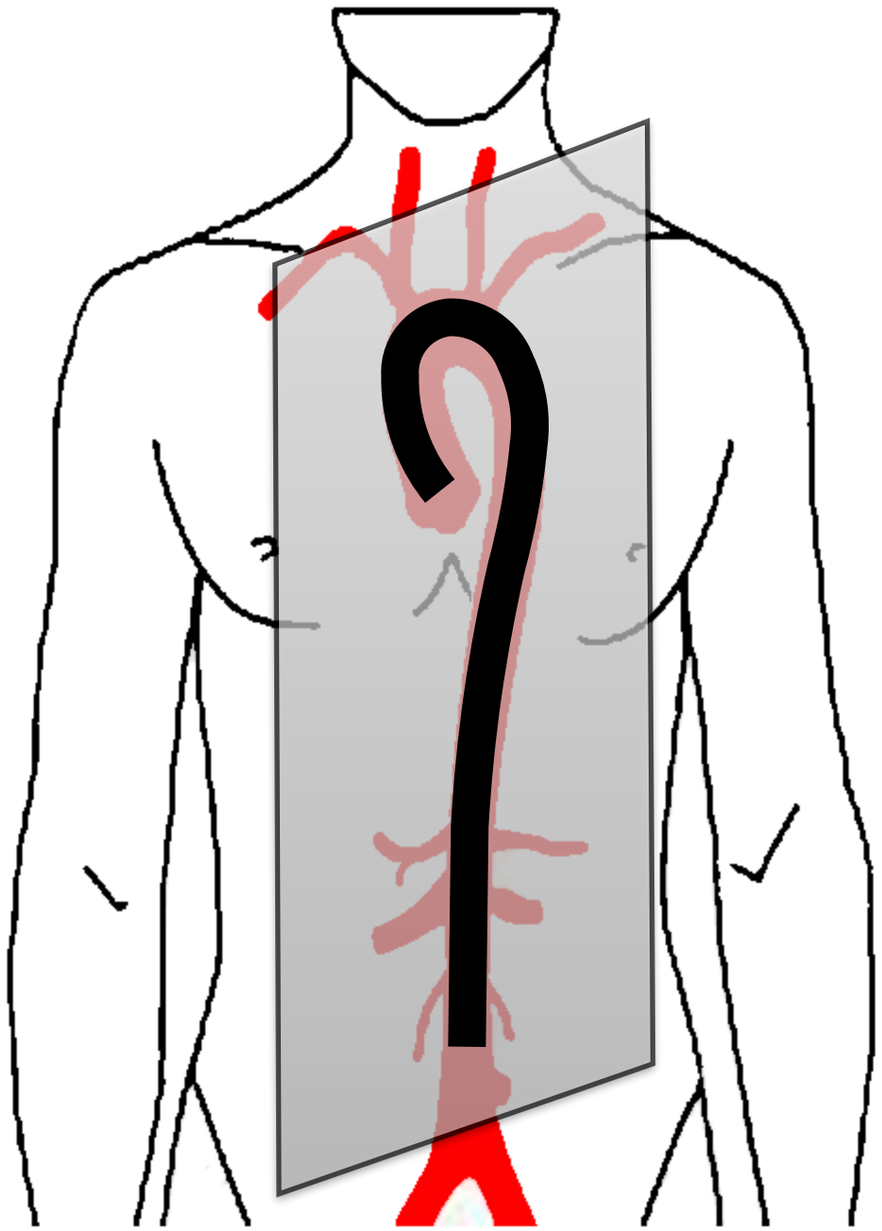



Requires:

- Anatomical 3D image for centerline extraction,
- Cross-sectional Phase-Contrast 2D+time images at **ascending**, **descending**, **diaphragmal** and **abdominal** aortic levels.

http://telin.ugent.be/~dbabin/Demo_WaVelocity/005_00_PWV_Cross_Sectional01.mp4

# PWV Para-Sagittal



Requires:

- Para-sagittal 2D+time Phase-Contrast image(s) of aorta.

http://telin.ugent.be/~dbabin/Demo_WaVelocity/005_01_PWV_ParaSagittal01.mp4

# Aortic Centerlines

Centerline extraction from:

- 3D anatomical images contrasted (trueFisp)
- 3D anatomical images non-contrasted (HASTE)
- 3D anatomical contrast-enhanced images
- 3D+time Phase-Contrast images
- 3D anatomical CT images
- easy manual centerline creation
- OsiriX

http://telin.ugent.be/~dbabin/Demo_WaVelocity/002_00_Centerline_Manual.mp4
http://telin.ugent.be/~dbabin/Demo_WaVelocity/002_01_Centerline_HASTE.mp4
http://telin.ugent.be/~dbabin/Demo_WaVelocity/002_02_Centerline_Fiesta.mp4
http://telin.ugent.be/~dbabin/Demo_WaVelocity/002_03_Centerline_PhaseContrast.mp4
http://telin.ugent.be/~dbabin/Demo_WaVelocity/002_06_Centerline_Osirix_Plugin_short.mp4

# Osirix

Connection to Osirix, the favourite viewer of radiologists and cardiologists.

Allows for image analysis not supported by Osirix (e.g. 3D centerlines).

http://telin.ugent.be/~dbabin/Demo_WaVelocity/002_06_Centerline_Osirix_Plugin_short.mp4

# Analysis of Velocity Curves

Velocity curves time shift computation methods:

- cross correlation
- foot of the curve
- steepest slope
- extreme values
- median values

# Aortic cross-section segmentation

Robust and fast segmentation of aortic cross-sections

Calculated from cross-sectional magnitude (Cine) images.

http://telin.ugent.be/~dbabin/Demo_WaVelocity/003_Segment_Cine_AorticCrossSections.mp4

# Aortic Distensibility

Extent to which the aortic wall stretches (enlarges cross-sectional area).

Calculated from cross-sectional magnitude (Cine) images.

http://telin.ugent.be/~dbabin/Demo_WaVelocity/004_Aortic_Distensibility.mp4

# Easy Reporting

Export screen shots, charts, tables, comments, segmented models (meshes), centerlines, images, positions, etc, as a web page.

Data is also exported to widely used files formats (e.g. RTF for Word, CSV for Excel).

http://telin.ugent.be/~dbabin/Demo_WaVelocity/007_Create_Report.mp4

# Validation

**Comparison study**: compared with validated software of LUMC (Leiden) on 41 healthy volunteers.

**Phantom study**: compared PWV values of pressure catheter against MR PWV measurements for aortic and straight tube phantom. Compared MR measured aortic centerline lengths against catheter measured lengths.

**Inter-scanner variability**: 6 volunteers scanned on Siemens, Philips and GE Magnetic Resonance scanners.

http://telin.ugent.be/~dbabin/aorta_52bpm_comparison.html
http://telin.ugent.be/~dbabin/tube_52bpm_200venc_comparison.html

Other

**WaVelocity**

features

# Advanced Data Analysis

- Osirix connection
- 4D (3D+time) images
- 4D (3D+time) centerlines
- 4D (3D+time) meshes
- Signals
- Tables
- Vectors (profiles)

# Images

- 4D (3D+time) images
- Loading 4D images from DICOM and VTK
- Methods:
  - segmentation
  - skeletonization
  - morphology
  - measurements on binary images
  - general image processing

# Centerlines

- 4D (3D+time) centerlines
- Loading, saving 4D centerlines
- Methods and features:
  - centerlines from images and positions
  - multiple scalars in centerlines
  - best paths
  - maximum flow paths
  - graph analysis
  - image reconstruction from centrelines
  - centerline tree separation (e.g. liver)
  - landmark extraction (e.g. AVM)

# Advanced UI

- Friendly UI - context menus, data drag&drop
- Image 3D+time, 2D+time viewers (4 pane)
- 3D+time scene viewer
- Signal charts
- Multi-sheet tables
- Report generator
- User documentation generator
- Plugin generator

# Other Medical Projects

- Embolization of Arteriovenous Malformation (AVM)

http://telin.ugent.be/~dbabin/Demo_WaVelocity/100_00_Other__AVM.mp4
http://telin.ugent.be/~dbabin/x_avm_decomposition_bcr.htm
http://telin.ugent.be/~dbabin/x_avm_decomposition_bpm.htm

- Liver segmentation (venous trees separation)

http://telin.ugent.be/~dbabin/Demo_WaVelocity/100_01_Other__Liver_Decomposition.mp4

- Lung air tubes segmentation

http://telin.ugent.be/~dbabin/Demo_WaVelocity/100_02_Other__Lungs.mp4

- EEG source localization visualization

http://telin.ugent.be/~dbabin/Demo_WaVelocity/100_03_Other__EEG_Neoguard02.mp4

- Tracking of coronary arteries