

Electrocardiogram (ECG) / Echo HAS_ECE_002

Purpose

ECG:

To provide a high throughput method to obtain Electrocardiograms in a conscious mouse.

Echo:

To assess the functionality of the heart in order to determine the presence of a mutant phenotype.

Experimental Design

- **Minimum number of animals** : 5-7M + 5-7F
- **Age at test**: Ideal age = 12 weeks $\pm$ 3 days.
- **Sex**: We would expect the results of this test to show sexual dimorphism

Procedure

ECG:

1. The lead plates are to be snapped into place onto the top of the pre-amplifier tower. The covering is removed to reveal three gel coated pads surrounded by a sticking plate. The plate will need to be covered with the extra cover in the package.
2. Turn on the combined amplifier and the pre-amplifier tower.
3. Double click the icon ECG acquisition on the acquisition computer.
4. Open the ECG set up file (for default settings).
6. Place mouse on pad, lowering the Red Acrylic Cubby to surround the mouse on 3 sides discouraging escape.
7. Press Start.
8. After the desired acquisition time, (5-10 minutes) stop the reading. There will be one long reading.
9. Save the data.
10. For additional readings create a new session using the same settings as before.
11. When saving sections with good readings, highlight the selected area and then save.

Echo:

1. Place animal in induction chamber and anesthetize the mouse and ensure sedation.
2. Once the animal is sedated, move it to a nose cone for hair removal using cream. Only apply cream to the area of the chest that will be utilized for imaging. Once the hair is removed, wipe area with wet gauze to ensure all hair is removed.

3. Move the animal to the imaging platform and tape its paws to the ECG lead plates and insert rectal probe. Body temperature should be maintained at 36-37°C. During imaging, reduce anesthesia to maintain proper heart rate. If the animal shows signs of being awake, use a higher concentration of anesthetic.

** Before imaging, decrease the Sector X so that the frame rate increases to 110 and change the orientation of the heart by clicking the dot as shown in Fig. 1.*

4. Apply gel on to the area to be imaged.

5. Lower the probe to the gel until it makes contact, making sure that all areas of the probe are covered with gel.

6. The image of the heart should be taken in the short-axis mode with papillary muscles being the point of reference. The papillary muscles should be parallel to the screen as shown on Fig. 2. Some manipulation of the platform may be necessary in order to get a clear image.

7. Once the papillary muscles are parallel in B-Mode, press the M-mode button and place the yellow line in the middle of the LV. Change the Display window to 1000ms. If image is not clear as in Fig. 3, move the yellow line to the left or right. Another option is to leave the line in the center of the LV and move the platform left or right, forward or backwards.

8. When a good clear image is obtained press the Cine store button to save the M-mode data. Save at least 4 short loops of data.

9. Once imaging is complete, remove animal from the platform and allow to recover atop a heating pad.

Figure 1.



Figure 2.

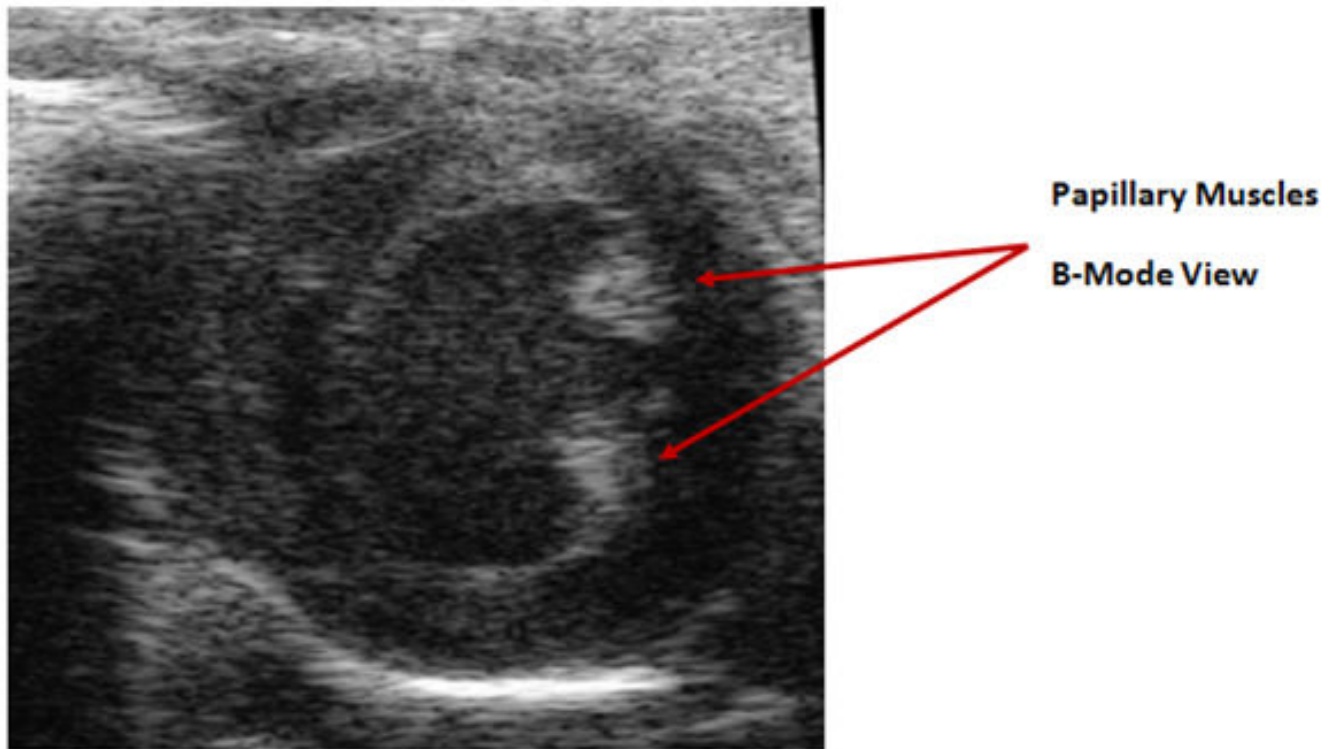
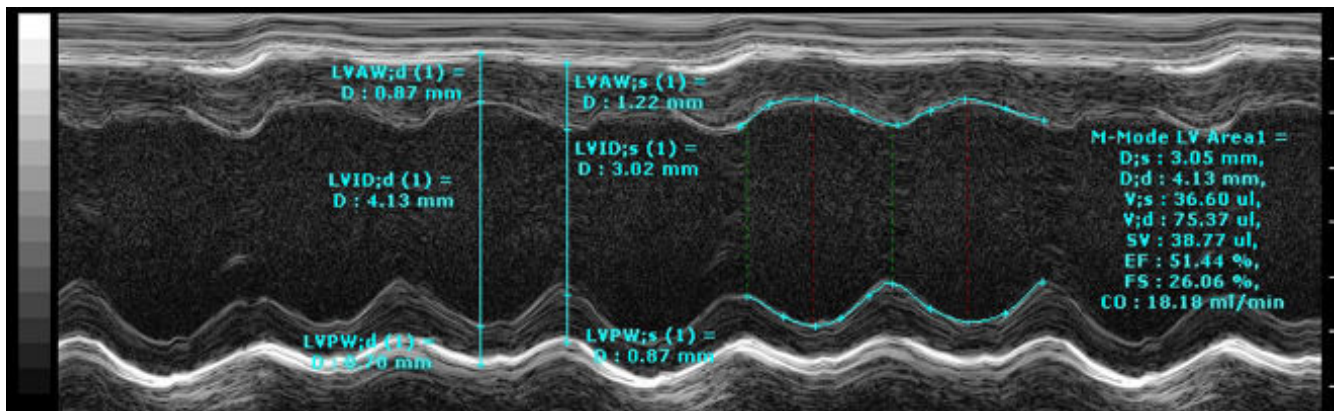


Figure 3.



Notes

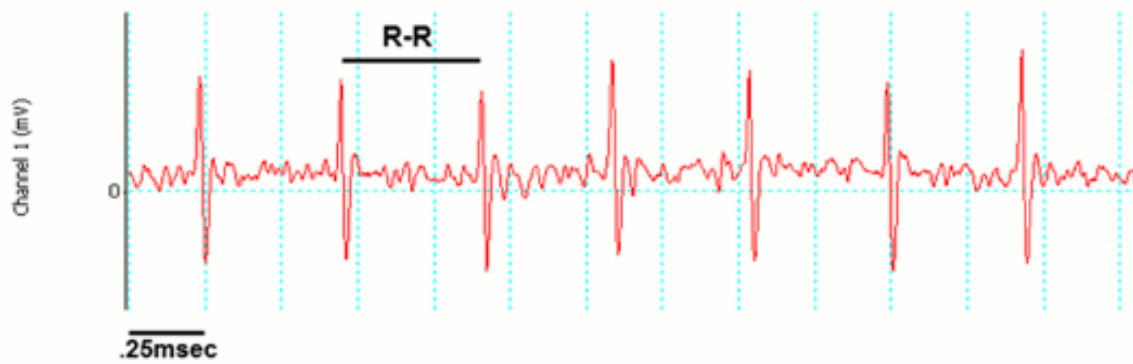
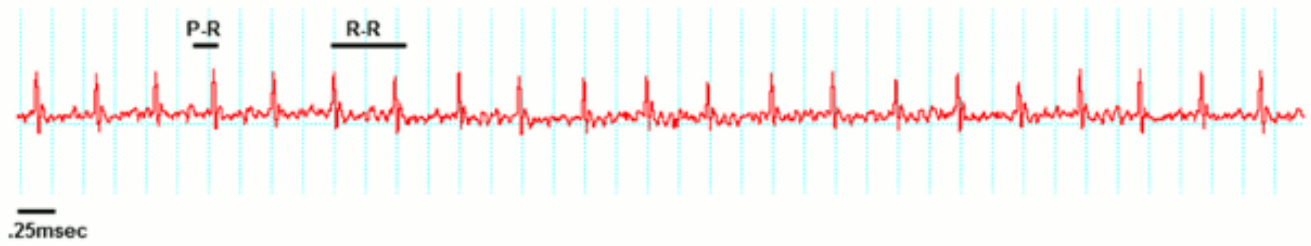
ECG:

Data Analysis

1. Open Emouse Analyses icon
2. Select ECG signals
3. Choose folder (all readings in folder will show)
4. Click PNN X (for mice: N-N> than 6 ms)
5. Choose file(s) by highlighting
6. Go
7. Bottom file is the corrected file
8. Red dots should be on peak of R waves, if image appears inverted click invert
9. Click Add, or minus if R waves are not marked with red dots or if too many are marked

- L click to zoom in
 - R click to zoom out
10. 'What if?' button to remove unwanted sections
 - L click image (zooms in)
 - L click left boundary
 - L click right boundary
 11. Options- click more if want to exclude more sections
 12. Undo available
 13. Go
 14. Here can input animal data if desired
 15. Save- For the first mouse in in group, hit save, a new results folder will be created within the folder with the mouse data. Then can click quick save or next.
 16. For the rest of the mice in the series, can hit quick save at this point- saves in last selected file – will group all files together in same excel sheet.
 17. Open Emouse Analyses icon
 18. Select ECG signals
 19. Choose folder (all readings in folder will show)
 20. Click PNN X (for mice: N-N> than 6 ms)
 21. Choose file(s) by highlighting
 22. Go
 23. Bottom file is the corrected file
 24. Red dots should be on peak of R waves, if image appears inverted click invert
 25. Click Add, or minus if R waves are not marked with red dots or if too many are marked
 - L click to zoom in
 - R click to zoom out
 26. 'What if?' button to remove unwanted sections
 - L click image (zooms in)
 - L click left boundary
 - L click right boundary
 27. Options- click more if want to exclude more sections
 28. Undo available
 29. Go
 30. Here can input animal data if desired
 31. Save- For the first mouse in in group, hit save, a new results folder will be created within the folder with the mouse data. Then can click quick save or next
 32. For the rest of the mice in the series, can hit quick save at this point- saves in last selected file - will group all files together in same excel sheet

Examples of good readings

A**B**

Data QC

Analysis room should be dim and quiet. Keep the door closed preferably while analysis is taking place.

Figure A. Taking a reading

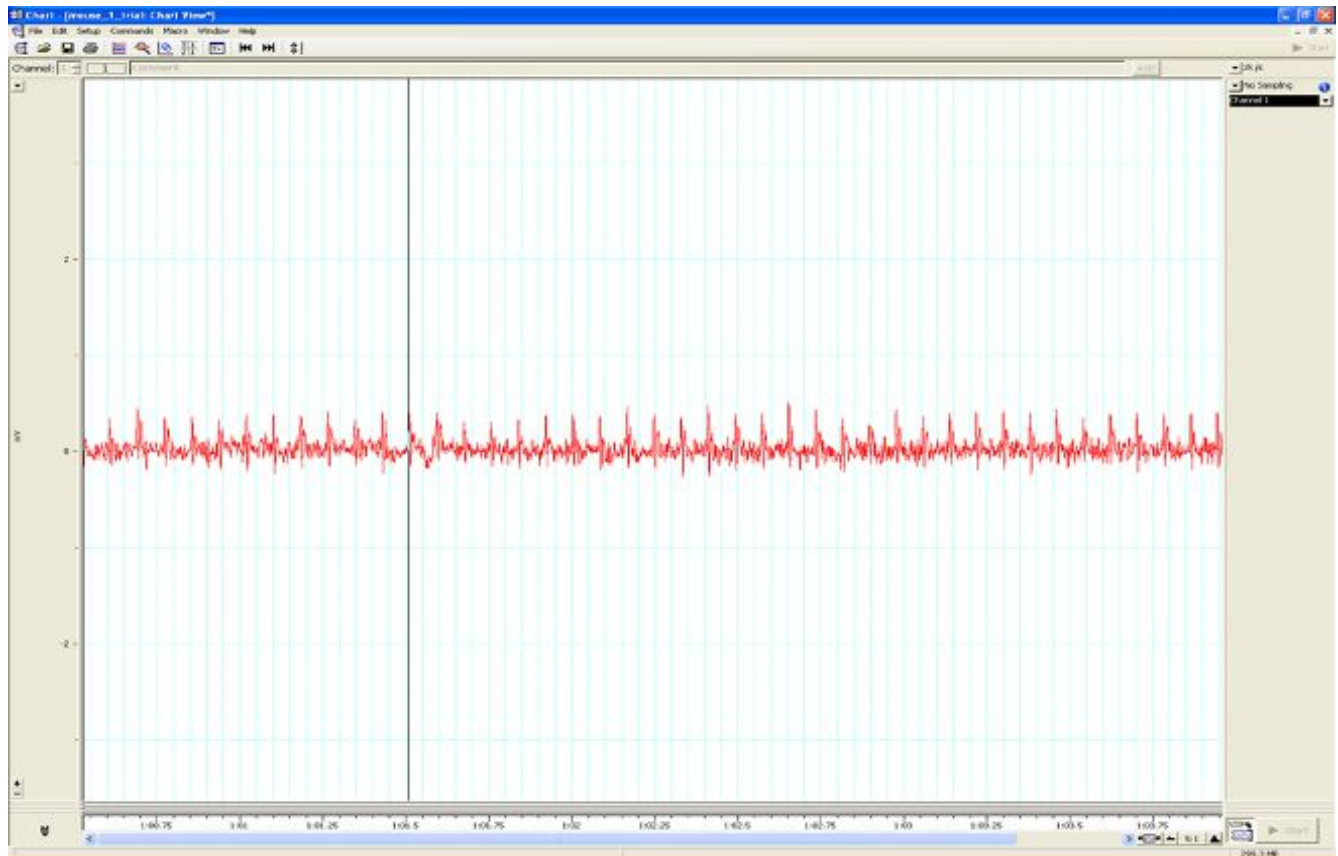


Figure B. Saving a section of the reading

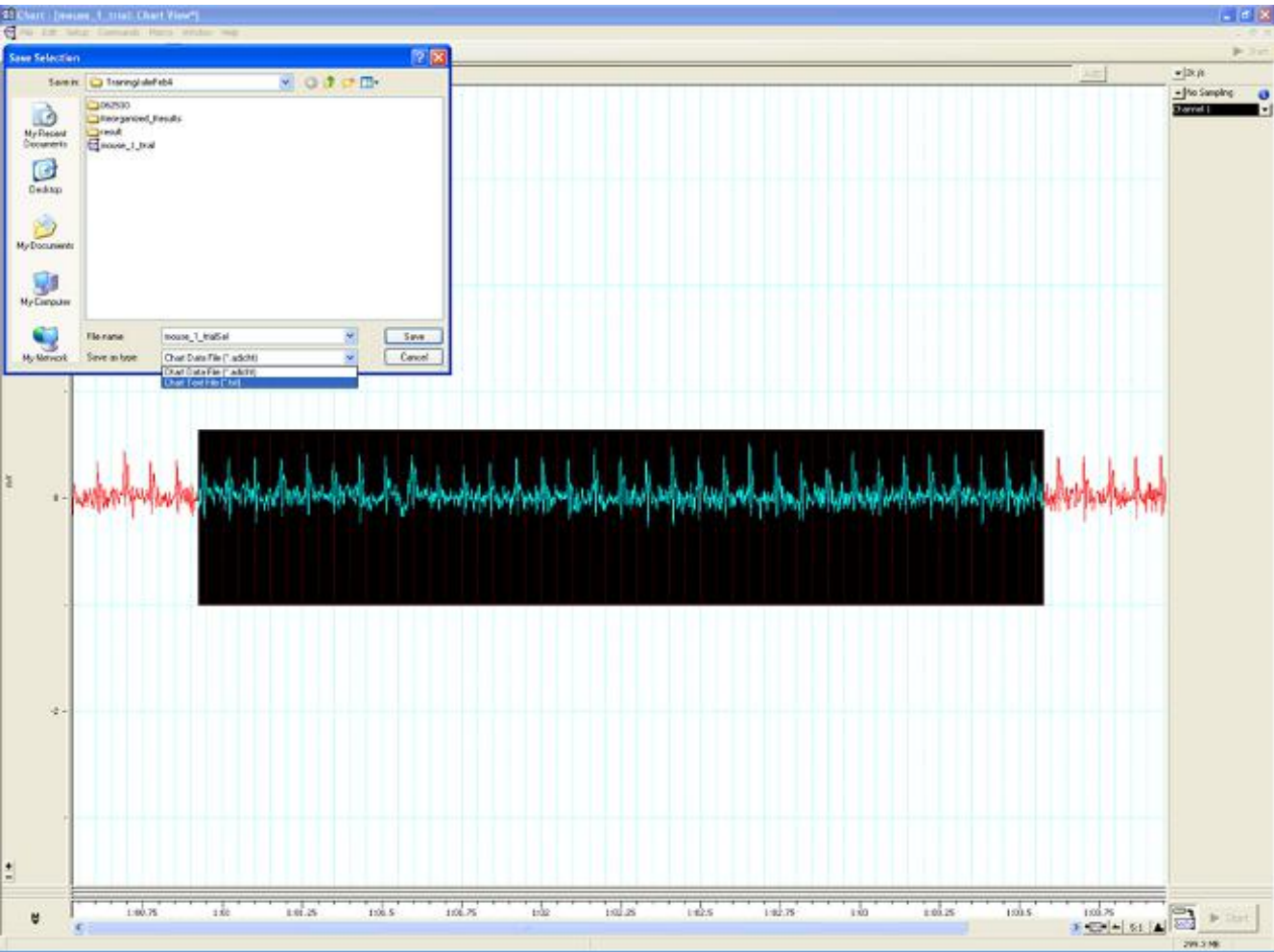
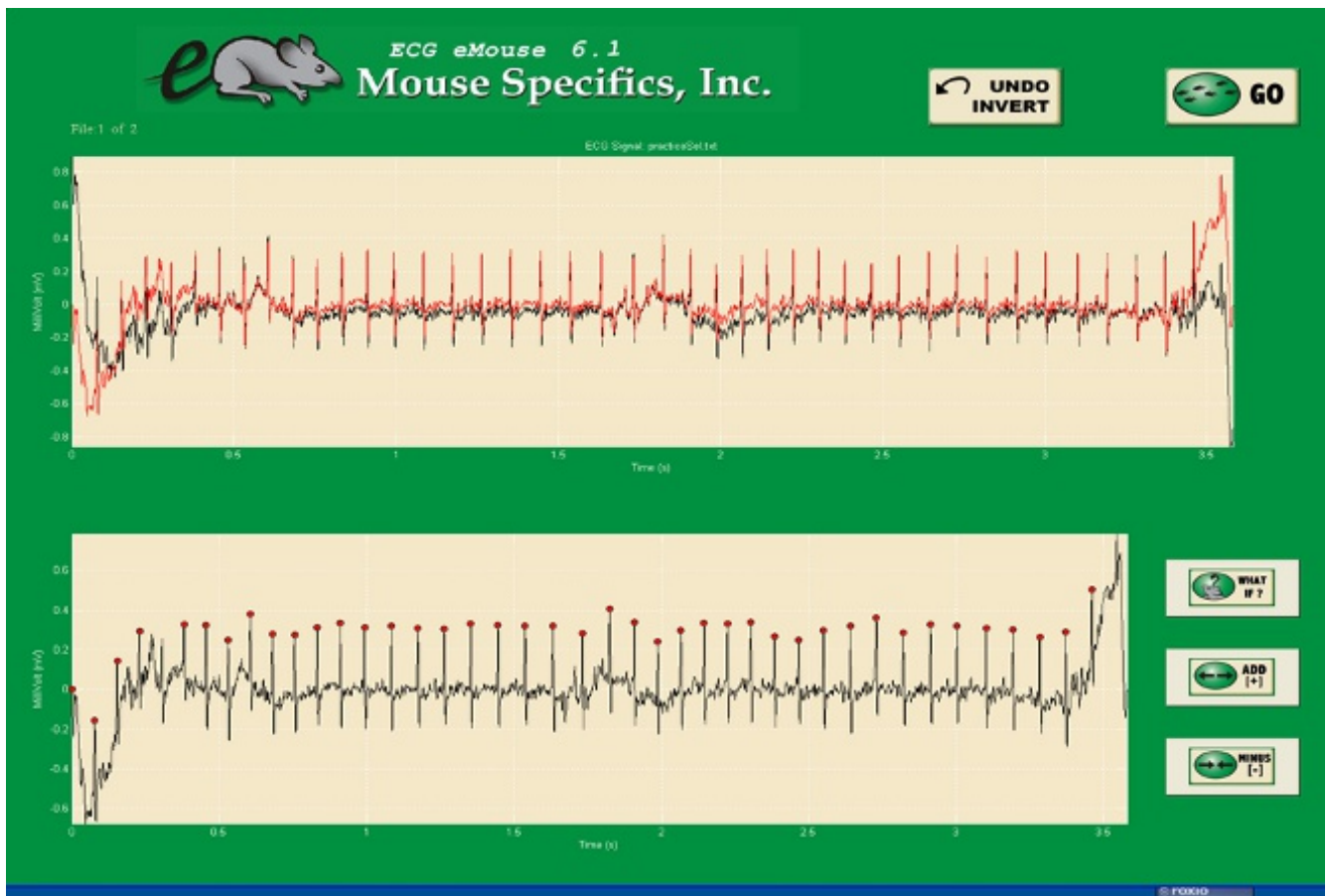


Figure C. Analysis phase, with the options to remove sections on the 'What if?' button below.



Echo:

Each animal should have at least four short M-Modes for data analysis.

In order to analyze these data files, you must use the software package provided by Visualsonics. The analysis for these files will involve performing a trace of two cardiac cycles per image as well as analyzing the wall measurements for diastole and systole as seen in Fig. 3. The parameters derived from the trace are End systolic/diastolic diameter (d ; s/d ; d), systolic/diastolic volume (V ; s/V ; d), stroke volume (SV), ejection fraction (EF), fractional shortening (FS), heart rate (HR) and body temp (temp).

These data points can be displayed in a bar graph or a line graph.

Parameters and Metadata

Number of signals HAS_ECE_001_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: count

Description: number_of_signals

HR (ECG) HAS_ECE_002_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Description: hr_ecg_

CV HAS_ECE_003_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: %

Description: cv

RR HAS_ECE_004_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: ms

Description: rr

PQ HAS_ECE_005_001 | v1.0
simpleParameter

Req. Analysis: false Req. Upload: false Is Annotated: true

Unit Measured: ms

Description: pq

PR HAS_ECE_006_001 | v1.0
simpleParameter

Req. Analysis: false Req. Upload: false Is Annotated: true

Unit Measured: ms

Description: pr

QRS HAS_ECE_007_001 | v1.1
simpleParameter

Req. Analysis: false Req. Upload: false Is Annotated: true

Unit Measured: ms

Description: qrs

ST HAS_ECE_008_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: ms

Description: st

QTc HAS_ECE_009_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: ms

Description: qtc

HRV HAS_ECE_010_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: bpm

Description: hrv

QTc Dispersion HAS_ECE_011_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: ms

Description: qtc_dispersion

Mean SR amplitude HAS_ECE_012_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: mV

Description: mean_sr_amplitude

Mean R amplitude HAS_ECE_013_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: mV

Description: mean_r_amplitude

rMSSD HAS_ECE_014_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: ms

Description: rmssd

pNN5(6>ms) HAS_ECE_015_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: %

Description: pnn5_6_ms_

End-Systolic Diameter HAS_ECE_016_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: mm

Description: end_systolic_diameter

End-Diastolic Diameter HAS_ECE_017_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: mm

Description: end_diastolic_diameter

Stroke Volume HAS_ECE_018_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: ul

Description: stroke_volume

Ejection Fraction HAS_ECE_019_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: %

Description: ejection_fraction

Fractional Shortening HAS_ECE_020_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: %

Description: fractional_shortening

Cardiac Output HAS_ECE_021_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: ml/min

Description: cardiac_output

LVAWd HAS_ECE_022_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: mm

Description: ivsdd

LVIDd HAS_ECE_023_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: mm

Description: lvidd

LVPWd HAS_ECE_024_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: mm

Description: lvpwd

LVAWs HAS_ECE_025_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: mm

Description: ivss

LVIDs HAS_ECE_026_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: mm

Description: lvids

LVPWs HAS_ECE_027_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: mm

Description: lvpws

HR (Echo) HAS_ECE_028_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Description: hr_echo_

Body Temp HAS_ECE_029_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: C

Description: body_temp

Short-axis HAS_ECE_030_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Description: short_axis

Long-Axis HAS_ECE_031_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Description: long_axis

VTI of aortic flow (Pulse wave doppler mode) HAS_ECE_032_001

| v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: cm

Description: vti_of_aortic_flow_pulse_wave_doppler_mode_

Aortic diameter (Dao) HAS_ECE_033_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: mm

Description: aortic_diameter_dao_

Tpeak Tend Interval HAS_ECE_034_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: s

Description: tpeak_tend_interval

Respiration Rate HAS_ECE_035_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: true

Unit Measured: bpm

Description: respiration_rate

Noise level HAS_ECE_036_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Description: noise_level

Light level HAS_ECE_037_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Description: light_level

ECG Equipment ID HAS_ECE_038_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Description: ecg_equipment_id

ECG Equipment Manufacturer HAS_ECE_039_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Description: ecgequipment_manufacturer

ECG Equipment Model HAS_ECE_040_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Description: ecg_model

Ultrasound Equipment ID HAS_ECE_041_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Description: ultrasound_equipment_id

Ultrasound Equipment Manufacturer HAS_ECE_042_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Description: ultrasound_equipment_manufacturer

Ultrasound Equipment Model HAS_ECE_043_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Description: ultrasound_equipment_model

Anesthetic HAS_ECE_044_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Description: anesthetic

Experimenter ID HAS_ECE_045_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Date ECG equipment last calibrated HAS_ECE_046_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Date Ultrasound equipment last calibrated HAS_ECE_047_001 | v1.0

procedureMetadata

Req. Analysis: false

Req. Upload: false

Is Annotated: false

Procedural comments HAS_ECE_048_001 | v1.0

simpleParameter

Req. Analysis: false

Req. Upload: false

Is Annotated: false
