



## **Patient Studies**

### **Maximum Venous Outflow MVO**

The Maximum Venous Outflow procedure is designed to be recorded with either a strain gauge or pneumo plethysmograph. The CVS4 uses the pneumo plethysmograph with the MD35 Procord. The Maximum Venous Outflow exam can be located in Patient Studies > Lower Venous > MVO.

Before the examination, the patient should rest supine on the examination table for 10 - 15 minutes

Follow the instructions below to perform an MVO exam using Pneumo plethysmography.

1. Elevate the legs 27 cm above the level of the patient's back using foam wedges to support the hips and thighs. Foam blocks should be used to position the patient's legs and feet. Bend the leg slightly at the hip and knee. Rotate the legs outward.
2. Apply a large CC17, or appropriately sized occlusion cuff around the proximal thigh. Connect the RD2 Rapid cuff deflator if not using the E20 Rapid cuff inflator.
3. Attach an SC10 or appropriately sized pneumo sensing cuff to the calf and attach the pneumo hose.
4. Select the pneumo plethysmograph on the MD35 Procord and select the MVO exam in NIVP3 - located in Lower Venous exams.
5. Select the appropriate predefined protocol for your test or create a new protocol in NIVP3. Click on the drop down arrow of MVO protocol. Be sure to select PN for Pneumo plethysmograph. A list of available protocols are available by instrument type.

#### Note:

To modify and or customize a protocol click Edit MVO Protocol. The column labeled Instrument Mode will change the type of plethysmograph used. MVO Reading specifications will change the test stage times (sec).

#### Note:

Selecting pneumo plethysmography will disable the strain gauge plethysmography MVO calculation methods (VO, MVO2, and VO/(T1/2)) as they are calibrated measurements that cannot be obtained using the pneumo plethysmograph.

#### Note:

Select the New button to create a custom protocol. Be sure to enter the stage times and correct instrument mode.

#### 6. Modify protocol to meet cuff inflation and deflation needs

Note:

If an E20 Rapid Cuff Inflator is being used, the following steps will be performed by the software:

- \*Balance the plethysmograph.
- \*Collect the waveform from the pneumo or strain gauge plethysmograph.
- \*Inflate the venous occlusion cuff.
- \*Deflate the venous occlusion cuff.

If another type of cuff inflator is being used, it should be used in conjunction with an RD2 Rapid Cuff Deflator to rapidly deflate the venous occlusion cuff on the thigh.

The following steps are performed by the software:

- \*Balance the plethysmograph.
- \*Collect the waveform from the pneumo or strain gauge plethysmograph.
- \*Inflation and deflation of the venous occlusion cuff is controlled by the user, according to the timer on the screen.

7. Select the button which corresponds to the limb to be tested, left or right.

8. Check the auto balance box to ensure the instrument will be automatically balanced during the recording.

9. Select Vein (DC) mode on the MD35 Procord and select the appropriate instrument range.

10. Inflate the pneumo sensing cuff on the calf to approximately 25 mmHg. Seal the connection between the cuff and the pneumo plethysmograph by pressing Record on the front panel of the MD35.

11. Select Take Reading . Adjust the waveform position close to the bottom of the waveform box, using the position slider on the front panel of the MD35 Procord.

12. Make sure the range on the instrument corresponds to the range setting in NIVP3.

Note:

To change the range in NIVP3, select the appropriate range setting from the Range menu at the top of the screen.

13. To begin taking measurements, select the Take Reading, the baseline stage timer will begin.

Note:

Each MVO measurement consists of three timed stages: baseline, inflate and deflate. The time of each stage is listed to the right of the waveform box as they have been predefined by the selected protocol.

Baseline is a period of time (10 seconds or less) after the initial zero level is set. The baseline waveform is used to measure the height of subsequent measurements.

Inflate is the amount of time the venous occlusion cuff is inflated.

Deflate is the amount of time the waveform is recorded after the venous occlusion cuff is deflated.

Up to five measurements can be taken for each leg.

14. Press the spacebar to initiate the inflation stage of the exam. Press the spacebar before the Baseline timer reaches 0. Inflate the venous occlusion cuff on the thigh to approximately 50 mmHg.

Note:

If using the E20 Rapid Cuff Inflator, the computer will prompt the E20 to inflate the cuff automatically to the preset pressure. If a different inflator is used, an RD2 Rapid Cuff Deflator should be connected to the venous occlusion cuff, so that it can be rapidly deflated.

15. Press spacebar and deflate the venous occlusion cuff when the waveform reaches a plateau. The waveform has reached a plateau when the current waveform tracing is at the same level as the previous waveform tracing. Press the space bar and deflate the occlusion cuff before the inflate timer reaches zero.

If the E20 is used, the computer will prompt cuff deflation automatically.

16. Press the Spacebar to exit the waveform screen, and/ or edit the waveform. Press Esc to delete the measurement.

17. Proceed to the next limb to be tested. Or, repeat as needed.

Editing the MVO Data

Each MVO reading should be reviewed for accurate results.

Note:

If the E20 Rapid Cuff Inflator is used, the Inflate and Deflate points are known and editing is not necessary.

If a different inflator was used, each reading should be edited to ensure that the inflate and deflate points are correct.

Each measurement can be edited immediately after it is taken, or when all measurements are complete. To edit a measurement select the measurement to be edited, then select Edit Reading.

Each completed reading has two vertical cursors on the waveform.

The cursor on the left should be on the baseline, just before the venous occlusion cuff was inflated.

The right cursor should be directly over the point where the venous occlusion cuff was deflated. To adjust the cursor, click and drag it to the appropriate position. As the cursor is moved, the intercept over the deflation waveform moves also. The end points of the tangent line represent limb volume 0.5 and 2.0 seconds after the deflation point.

Note:

The Time scale on the x-axis of the edit screen changes at the 0.0 mark (the venous occlusion cuff deflation point). The time scale is more compressed to the left of the 0.0.

The patient report will print the graph of each MVO waveform, including the statistics for each measurement, and MVO vs. Capacitance with the discriminate line - indicating normal vs. abnormal measurements.