Pulse Volume Assessments using moorVMS-PRES
Application note #107

Application

The measurement of pulse volume is a useful initial test for patients with suspected lower limb peripheral artery disease (PAD). It can also be used as a predictor for critical limb ischemia and amputation. When arterial disease is present the contour of the waveform is seen to change: the slope is seen to flatten whilst pulse width widens. The dicrotic notch is also lost (TASC II). Pulse volume recordings are often used for localising the level of arterial disease. Unlike ankle brachial pressure measurements and segmental limb systolic pressure measurements, pulse volume recordings are not affected by calcified arteries. Thus pulse volume measurements are particularly useful in diabetic patients with calcified arterial vessels.

The moorVMS-PRES enables controlled, sensitive and reproducible pulse volume measurements in just a few minutes. The system has been designed to incorporate a flexible yet user-friendly interface designed for both users new to field in addition to those with more experience. Default protocols are available for new users, whilst those with more experience can set user defined protocols to suit individual circumstances.

Progressive arterial insufficiency, resulting for example from the atherosclerotic process, has been cited as a risk factor for impaired wound healing in coronary artery bypass grafting (CABG). Screening for arterial insufficiency prior to CABG using Ankle-Brachial Index and Pulse Volume recordings could help identify patients at risk of impaired healing of saphenous vein incisions (Haraden and Jaenicke). PV recording with the moorVMS-PRES is a non-invasive, inexpensive technique ideal for such applications.

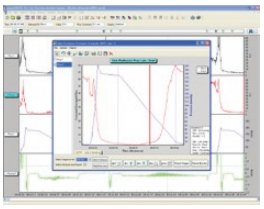
For the detection and localization of significant occlusive lesions Pulse Volume recordings have been shown to be 85% accurate, and when used in conjunction with segmental limb measurements the accuracy increases to 95%. As a result pulse volume recording and segmental limb pressures are commonly used together when evaluating PAD (Norgren et al, 2007).

Equipment Required

The following equipment is required for Pulse Volume assessments: -

moorVMS-PRES
pressure module

Easy Care Cuff
(Inflatable pressure cuff)*



moorVMS-PC Windows
software and PC

* The cuff used will depend upon patient and limb size e.g. arm, thigh, lower leg etc.

Method

- Measurements should be made with the patient in the supine position with the limb to be measured at heart level.
- The patient should remain in the resting supine position for 10 minutes prior to recording pulse volume.
- Place an appropriate sized pressure cuff around the limb (sites commonly include the high thigh, above the knee, below the knee, the ankle and the toe).

- Set the moorVMS-PC software using the settings shown in Figure 1 (adjust for preferred protocol):

Figure 1 - moorVMS-PRES Pulse Volume Simple Protocol Set-up.

- The cuff will:
    1. Inflate automatically to the pre-set pressure level (in this case 60 mmHg).
    2. Hold at pre-set pressure for the pre-set duration (in this case 30 seconds).
    3. Deflate at the maximum rate.
- Each of the above settings can be determined by the user depending upon individual user requirements

Analysis

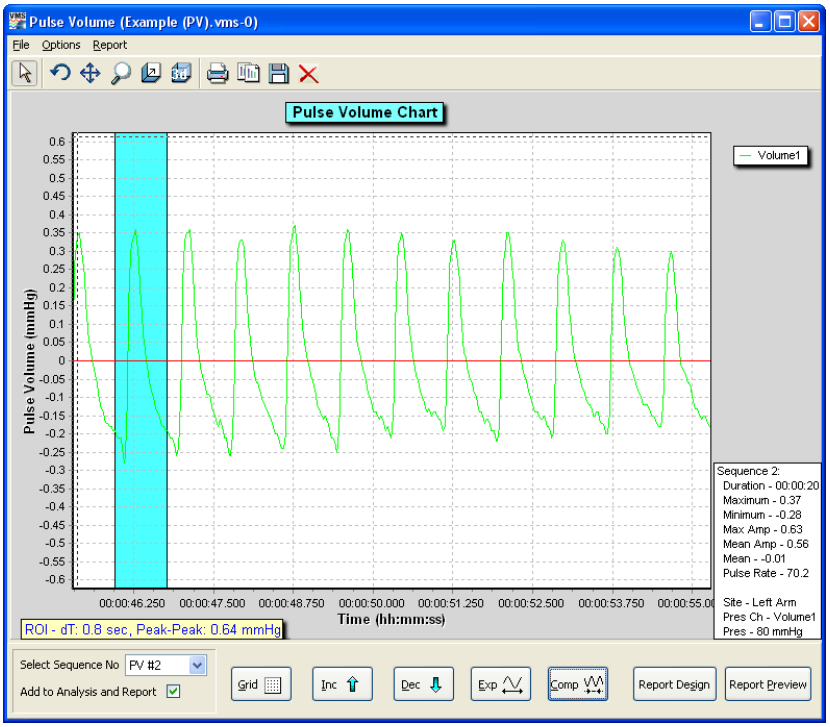


Figure 2 - Pulse Volume Chart.

A pulse volume chart can be viewed (as shown in figure 2 above)
Using the Report function the following statistics are available:

- Duration – length of sequence's hold period in hh:mm:ss
- Max amplitude: maximum individual wave's amplitude mmHg
- Min amplitude: minimum individual waves' amplitude mmHg
- RMS: Root mean square of pulse volume
- IQR: Interquartile range (i.e. range of mid 50%) of pulse volume in mmHg
- Pulse rate: mean cardiac pulse rate in CPM (Cycle's per Minute)
- Hold pressure: holding pressure in mmHg during pulse volume recording

You can also measure the peak to peak amplitude of a defined region by moving the start and end points of the blue ROI.

Practical Suggestions

Microvascular blood flow can be affected by many things. The following practical suggestions are provided as a guide and are not exhaustive:

- Commonly the cuff is inflated to 60-65 mmHg, sufficient to detect volume changes without arterial occlusion occurring (Clement, TASC-II).
- Perform measurements in a quiet room whilst maintaining a comfortable temperature (typically 22ºC). Ensure the patient is acclimatised to the room temperature for 30 minutes prior to measurements.
- Patients should avoid caffeine, high salt food, alcohol, vigorous exercise, and smoking for 24 hours prior to the study.
- During measurements ask the patient to breathe normally. Coughing, talking and yawning can all affect microvascular blood flow readings.
- The patient should be in a comfortable, relaxed position and avoid movement during all measurements.

Publications

1. Clement D. Diagnosis and evaluation of peripheral artery disease – non invasive vascular laboratory and imaging techniques. Based on the Inter-Society Consensus. www.tasc-2-pad.org.
2. Haraden, J. and Jaenicke, C. 2006 Correlation of preoperative ankle-brachial index and pulse volume recording with impaired saphenous vein incisional wound healing post coronary artery bypass surgery. Journal of Vascular Nursing, Vol XXIV, No.2, pp 35-41.
3. Norgren, L., Hiatt, W. R., Dormandy, J. L., Nehler, M. R., Harris, K. A., Fowkes, F. G. R. 2007 Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASCII). Journal of Vascular Surgery, Vol 45, No. 1., Supplement S pp S5A - S67A.

Further Reading

moorVMS-PRES and moorVMS-PC user manuals for instrument operation.
www.moor.co.uk - information about moorVMS-PRES and pressure cuffs.
Please feel free to consult sales@moor.co.uk for further advice or support with issues not covered in this application note and details of other application notes using the moorVMS-PRES.

Important Disclaimer: This information is provided to further clinical research into diagnostic capabilities of laser Doppler. The moorVMS-PRES is CE marked for human use but not specifically for clinical diagnosis of PVR assessments. Calibrated equipment with a current service record should only be used.

Notes

moor instruments
laser Doppler blood flow assessment

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