

UK Biobank

Pulse wave analysis and aortic pressure

Version 1.0

<http://www.ukbiobank.ac.uk/>

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This document details the procedure for measurement of pulse wave analysis and aortic pressure measurement performed at an Imaging assessment centre for UK Biobank.

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1. Introduction

1.1: This manual details the procedure for pulse wave analysis and aortic pressure measurement at a UK Biobank Imaging Assessment Centre.

Table 1: Sequence of assessment visit

| | Visit station | Assessments undertaken |
|---|----------------------------|---|
| 1 | Reception | <ul style="list-style-type: none"> Welcome & registration Generating a USB key for Participants |
| 2 | Eligibility Section | <ul style="list-style-type: none"> Eligibility questionnaire Consent |
| 3 | Imaging scans | <ul style="list-style-type: none"> Cardiac MRI scan (including pulse wave analysis) Body (abdominal) MRI scan Brain MRI scan Whole body DXA scan Carotid ultrasound 12-lead (at rest) ECG |
| 4 | Touchscreen | <ul style="list-style-type: none"> Touchscreen questionnaire Hearing Test Cognitive function tests |
| 5 | Interview & blood pressure | <ul style="list-style-type: none"> Interviewer questionnaire Blood pressure measurement Measurement of arterial stiffness |
| 6 | Physical measurements | <ul style="list-style-type: none"> Height (Standing and Sitting) Hip & Waist measurement Weight and Bio-impedance measurement Hand-grip strength Ultrasound Bone Densitometry Spirometry (Lung function test) |
| 7 | Sample collection & exit | <ul style="list-style-type: none"> Blood, urine and saliva sample collection |

1.2: At the start of their visit, each participant is issued with a USB key at the Reception station. This contains Participant ID, name, date of birth and gender. As the participant progresses between stations the USB key acts as an identifying token. The USB key is encrypted so can only be read by assessment centre computers. None of the participant's test data is transferred to the USB key. At the end of the assessment visit all identifying data on the USB key is removed.

1.3: This procedure is performed by a member of staff who has received suitable training and has been granted the relevant module permissions.

1.4: This procedure is performed as part of the cardiac MRI module. It is carried out using a VICORDER® device and provides pulse wave analysis and a measure of aortic distensibility.

2. Equipment Preparation

2.1: The member of staff insures the participant details are correct as displayed on the VICORDER® home page.

3. Participant Preparation

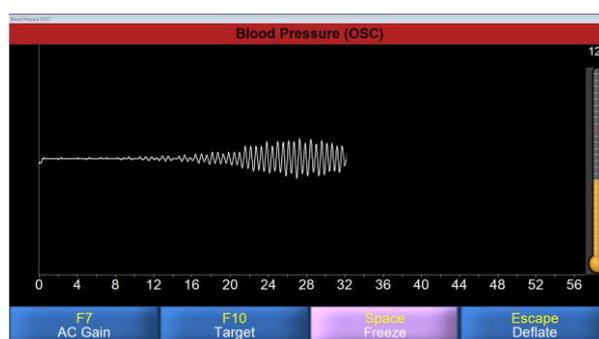
3.1: The brachial cuff is placed onto the humerus of the left arm like a blood pressure cuff. The connection should be placed towards the inside of the humerus, towards to bicep region. The arm is enclosed within the cuff and strapped into place with Velcro.

4. VICORDER® measurement

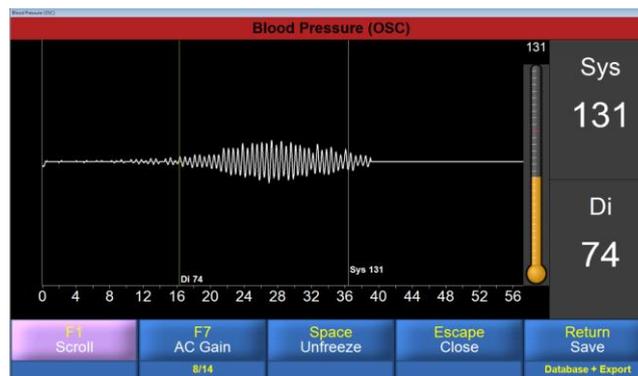
4.1: Brachial blood pressure readings are obtained using a manual sphygmomanometer. This is used to calibrate peripheral waveforms. Immediately afterwards, a brachial pressure wave trace is digitally computed by the VICORDER® device, with the cuff statically inflated to 70 mmHg using a volume displacement technique.

4.2: The VICORDER® measurement is repeated twice, once immediately prior to the aortic distensibility scan and once after.

4.3: When the cuff is 'seated' around the participant's arm, a trace appears on the screen (see below).

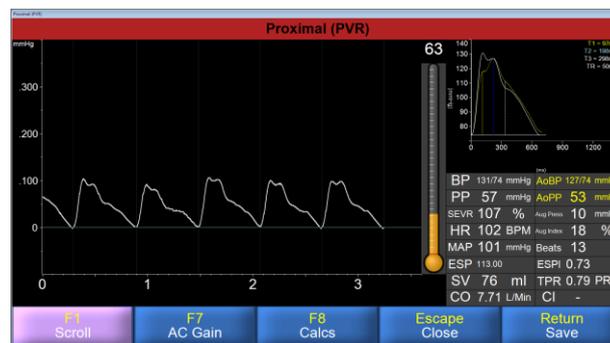


4.4: The software will automatically stop and capture the result (show below).



4.5: The cuff is inflated once more to capture the PWA measurements.

4.6: A trace appears on the screen and results are saved (shown below).



4.6: A second measure is required after the distensibility scan has been completed.

5. Aortic distensibility

The VICORDER® software calculates values for central blood pressure by applying a previously described brachial-to-aortic transfer function [2]. Aortic distensibility represents the relative change in area of the aorta per unit pressure, taken here as the central pulse pressure and is calculated according to the formula:

$$\text{aortic distensibility} = (A_{\max} - A_{\min}) / A_{\min} / (P_{\max} - P_{\min}),$$

where A_{\max} =maximal (systolic) area (mm^2), A_{\min} =minimal (diastolic) area (mm^2), P_{\max} =systolic blood pressure (mm Hg), and P_{\min} =diastolic blood pressure (mm Hg) [3].

6. Data collected

The following data were collected and are available in Showcase:

- Cardiac index and output and central augmentation
- Central pulse pressure
- Diastolic and systolic brachial blood pressure
- End systolic pressure
- Heat rate
- Mean arterial pressure
- Peripheral pulse pressure
- Stroke volume
- Total peripheral resistance