L16 - Blood Pressure (4.1.2 Jan 11 2017)

File name: DaveL16-L16

05/03/2019

12:45

First recording (starts at event labeled 'Left arm, seated 1'): Cuff on left arm, seated and relaxed.

Second recording (starts at event labeled 'Left arm, seated 2'): Cuff on left arm, seated and relaxed.

Third recording (starts at event labeled 'Right arm, seated 1'): Cuff on right arm, seated and relaxed.

Fourth recording (starts at event labeled 'Right arm, seated 2'): Cuff on right arm, seated and relaxed.

Fifth recording (starts at event labeled 'Right arm, supine 1'): Cuff on right arm, supine and relaxed.

Sixth recording (starts at event labeled 'Right arm, supine 2'): Cuff on right arm, supine and relaxed.

Seventh recording (starts at event labeled 'Right arm, after exercise'): Cuff on right arm, recovering from mild exercise.

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# L16 DATA REPORT

Student's Name: Michael Lenehan

Lab Section: 16

Date: 05/03/2019

# I. Data and Calculations

Subject Profile

Name: Height: Age: Time: Gender: Weight:

Note: This Data Report assumes that all lesson recordings were performed, which may not be the case for your lab. Please disregard any references to excluded recordings.

## A. Systolic Measurements

Complete Table 16.2 with the systolic measurements for all data recordings. Note the pressure measurement at the event marker insertion point (where Director audibly detected and marked systolic) and where the first Korotkoff sound was detected with the stethoscope microphone. Calculate the Delta difference between the trials for each condition, the trial average pressure, and the Delta difference between the event marker and stethoscope microphone average pressure measurements.

| Systolic Pressure mmHg | | | | | | |
|---|---|---|---|---|---|---|
| Condition | Trial | Audibly Detected Pressure (Event marker) | Average Pressure (Calculate) A | Microphone Detected Pressure (In data, unmarked) | Average Pressure (Calculate) B | Δ Average Pressure B Minus Average Pressure A |
| Left arm, seated | 1 | 68.67960 | 87.044 | 61.30112 | 81.086 | -5.9580 |
| | 2 | 105.40826 | | 100.87136 | | |
| | Δ | 36.729 | | 39.570 | | |
| Right arm, seated | 1 | 114.79030 | 113.17 | 109.31905 | 108.15 | -5.0200 |
| | 2 | 111.55378 | | 106.97835 | | |
| | Δ | -3.2365 | | -2.3407 | | |
| Right arm, lying down | 1 | 35.94842 | 56.138 | 33.85817 | 49.766 | -6.3720 |
| | 2 | 76.32779 | | 65.67426 | | |
| | Δ | 40.379 | | 31.816 | | |
| Right arm, after exercise* | 1 | 150.77725 | | 147.32882 | | -3.4484 |

*For 'Right arm, after exercise' recording, calculate the Delta difference between 'Audibly Detected Pressure' and 'Microphone Detected Pressure' values, and record the result in the right column.

Figure 1: (Table 16.2) Systolic Data

## B. Diastolic Measurements

Complete Table 16.3 with the Diastolic measurements for all data recordings. Note the pressure measurement at the event marker insertion point (where Director audibly detected and marked diastolic) and where the Korotkoff sound

disappeared from the stethoscope microphone. Calculate the Delta difference between the trials for each condition, the trial average pressure, and the Delta difference between the event marker and stethoscope microphone average pressure measurements.

| Diastolic Pressure mmHg | | | | | | |
|---|---|---|---|---|---|---|
| Condition | Trial | Audibly Detected Pressure (Event marker) | Average Pressure (Calculate) A | Microphone Detected Pressure (In data, unmarked) | Average Pressure (Calculate) B | Δ Average Pressure B Minus Average Pressure A |
| Left arm, seated | 1 | 9.68064 | 39.585 | 9.24681 | 34.744 | -4.8405 |
| | 2 | 69.48873 | | 60.24154 | | |
| | Δ | 59.808 | | 50.995 | | |
| Right arm, seated | 1 | NA | 62.68229 | NA | 57.08209 | -5.6062 |
| | 2 | 62.68829 | | 57.08209 | | |
| | Δ | 62.68829 | | 57.08209 | | |
| Right arm, lying down | 1 | 20.71947 | 15.147 | 15.52756 | 11.439 | -3.7085 |
| | 2 | 9.57468 | | 7.34958 | | |
| | Δ | -11.145 | | -8.1780 | | |
| Right arm, after exercise* | 1 | 53.14240 | | 36.33372 | | -16.809 |
| *For 'Right arm, after exercise' recording, calculate the Delta difference between 'Audibly Detected Pressure' and 'Microphone Detected Pressure' values, and record the result in the right column. | | | | | | |

Figure 2: (Table 16.3) Diastolic Data

## C. BPM Measurements

Complete Table 16.4 with the BPM measurements from three cycles of each of the seven data recordings and calculate the mean BPM for each recording. * Cycle measurements: If ECG was recorded, use ; if ECG was not recorded, use .

| Condition | Trial | Cycle | | | Calculate the Mean | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | Of Cycles 1-3 | Of Trial 1-2 Means |
| Left arm, seated | 1 | 68.986551 | 65.93406 | 64.93506 | 66.619 | 66.211 |
| | 2 | 64.51612 | 66.66666 | 66.22516 | 65.803 | |
| Right arm, seated | 1 | 72.63922 | 70.58823 | 69.93006 | 71.053 | 69.016 |
| | 2 | 68.48315 | 66.66666 | 65.78948 | 66.980 | |
| Right arm, lying down | 1 | 64.51612 | 62.11180 | 58.02707 | 61.552 | 62.707 |
| | 2 | 66.66666 | 63.69426 | 61.22448 | 63.862 | |
| Right arm, after exercise | 1 | 57.36137 | 59.17159 | 59.05511 | 58.529 | |

Figure 3: (Table 16.4) BPM

## D. Summary of Mean Blood Pressure Data

Complete Table 16.5 with the average from sound data from tables 16.2 and 16.3 and then calculate the pulse pressure and the mean Arterial Pressure (MAP).

Note the pressure measurements at the event marker insertion points (where Director audibly detected and marked systolic and diastolic).

$Pulse\ pressure = Systolic\ Pressures - Diastolic\ Pressure$

$MAP = \frac{pulse\ pressure}{3} + diastolic\ pressure$

OR

$MAP = \frac{(systolic\ pressure + 2(diastolic\ pressure))}{3}$

| CONDITION | SYSTOLE | DIASTOLE | BPM | Calculations: | |
|---|---|---|---|---|---|
| | Table 16.2 Sound Average | Table 16.3 Sound Average | Table 16.4 | Pulse pressure | MAP |
| Left arm, sitting up | 81.086 | 34.744 | 66.211 | 46.342 | 50.191 |
| Right arm, sitting up | 108.15 | 57.08209 | 69.016 | 51.068 | 74.105 |
| Right arm, lying down | 49.766 | 11.439 | 62.707 | 38.327 | 24.215 |
| Right arm, after exercise | 147.32882 | 36.33372 | 58.529 | 111.000 | 73.332 |

Figure 4: (Table 16.5) Average Systolic Pressure/Average Diastolic Pressure

### E. Timing of Korotkoff Sounds

NOTE—This table requires ECG data, which is not recorded on MP45 systems.

Complete Table 16.6 with the Delta T for each condition, and calculate the means.

| | Timing of Sounds | | |
|---|---|---|---|
| Condition | Trial 1 | Trial 2 | Mean (calculation) |
| Left arm, sitting up | 0.53200 | 0.21600 | 0.37400 |
| Right arm, sitting up | 0.22200 | 0.22600 | 0.22400 |
| Right arm, lying down | 0.79000 | 0.61600 | 0.70300 |
| Right arm, after exercise | 0.31600 | NA | 0.31600 |

Figure 5: (Table 16.6) Korotkoff Sounds

### F. Calculation of Pulse Speed

Complete the calculation in Table 16.7 using "Right arm, seated" data.

No available data for the completion of Table 16.7

## II. Questions:

**1. Note the difference in systolic pressure value between when the sound actually began, was detected by the stethoscope transducer, and was recorded, and the time when the observer first heard the sound and pressed the event marker keystroke. (Example: 141 mmHg – 135 mmHg = 6 mmHg). What factors could account for this difference? Would the observed difference be the same if measured by another observer? Explain your answer.**

This difference may come from a delay in the detection of the sound. With different subject, the observed difference would not be the same as there may be a difference in this sound detection delay.

## 2.

**a) Does your systolic and/or diastolic arterial pressure change as your heart rate increases?**

Systolic arterial pressure increases with an increased heart rate, as seen in Table 16.2 above. Diastolic pressure also increased, as seen in Table 16.3. There is less of an increase seen in the diastolic pressure than in the systolic pressure.

**(b) How does this change affect your pulse pressure?**

As pulse pressure is systolic pressure minus diastolic pressure, this gives ans increase in pulse pressure with an increase in heart rate.

**(c) How would you expect the systolic, diastolic and pulse pressures to change in a normal healthy individual as their heart rate increases?**

## 3. Give three sources of error in the indirect method of determining systemic arterial blood pressure.

Sources of error may be:

- Inability of the observer to correctly identify sounds.
- Incorrect placement of the cuff.
- Quality and calibration of the equipment which is being used.

## 4. Use an equation that relates flow, pressure, and resistance to define mean arterial pressure:

$F = P/R$ relates flow to pressure and resistance.

As pressure can be given by the mean arterial pressure, the mean arterial pressure in terms of the flow and resistance can be given as: $MAP = FP$

**5. Blood flow (liters per min.) through the pulmonary circuit equals blood flow through the systemic circuit, but pulmonary resistance to flow is 5 times less than the systemic resistance to flow. Using the equation in Question 4, show that mean pulmonary pressure is 5 times less than mean systemic pressure.**

**6. Define the first and second sounds of Korotkoff. Which sound is used to approximate systolic pressure and which sound is used to approximate diastolic pressure?**

The first Korotkoff sound is heard as a tapping. This sound is taken as an approximation of the systolic pressure.

The second Korotkoff sound comes as the sound which has been increasing in intensity becomes suddenly muffled. This is taken as an approximation of the diastolic pressure.

**7. Why is mean arterial pressure not equal to (systolic pressure − diastolic pressure)/2?**

In a cardia cycle, more time is spent in diastole then in systole, therefore arterial pressure cannot be taken as a simple average of the two values, and must be approximated by the given formula of $MAP = \frac{(systolicpressure+2diastolicpressure)}{3}$.

**8. Define pulse pressure. Explain, in terms of changes in systolic and diastolic pressures, why pulse pressure increases during exercise.**

$PulsePressure = SystolicPressure - DiastolicPressure$

As mentioned in Q2 part b, pulse pressure increases, as the systolic pressure has increased more than the diastolic pressure.

**9. Give one reason why blood pressure in the left arm may be different than blood pressure in the right arm of a Subject at rest.**

This may be due to a difference in resistance experienced, therefore giving a difference in the $F = P/R$ relationship.

**10. Name an artery other than the brachial that could be used for an indirect measurement of blood pressure and explain your choice.**

The femoral artery may also be used for blood pressure measurement.

End of Lesson 16 Data Report

BSL 4.1 DRL16-04092015