L05 - Electrocardiography (ECG) I (4.1.2 Jan 11 2017)

File name: NoName05-L05

19/02/2019

12:29

First recording (starts at event labelled 'Supine'): Supine and relaxed.

Second recording (starts at event labelled 'Seated'): Seated and relaxed.

Third recording (starts at event labelled 'Deep breathing'): Seated and relaxed for 5 deep breath cycles.

Fourth recording (starts at event labelled 'After exercise'): Seated and relaxed, recovering from exercise.

L05 DATA REPORT

Student's Name: Michael Lenehan

Lab Section:

Date: 26/02/2019

I. Data and Calculations

Subject Profile

Name: Michael Lenehan Height: 1.78m Weight: 88.8kg

Age: 22 Gender: Male

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. Heart Rate

Complete the following tables with the lesson data indicated, and calculate the Mean as appropriate;

Table 1: (Table 5.2)

Condition	Cardiac Cycle	1	2	3	Mean
Supine		75.28230	63.49206	59.05511	65.943
Seated		95.84664	95.23809	96.93053	96.005
Start of inhale		70.42253	83.79888	95.84664	83.356
Start of exhale		58.65102	68.64988	66.22516	64.589
After exercise		121.95121	123.96694	124.74012	123.55

B. Ventricular Systole and Diastole

Table 2: (Table 5.3)

Condition	Duration (ms)	
	Ventricular Systole	**Ventricular Diastole**
Supine	0.25500	0.58600
After exercise	0.19100	0.31600

C. Components of the ECG

Table 3: (Table 5.4) Condition: Supine Recording (Duration measurements taken from 3 cardiac cycles)

ECG Component	Duration (ms)			
Waves	Normative Value (Based on Resting Heart Rate 75bpm)	1	2	3
P	0.07-0.18	0.10400	0.09900	0.13200
QRS Complex	0.06-0.12	0.06900	0.06300	0.07000
T	0.10-0.25	0.18100	0.15300	0.17400
Intervals				
P-R	0.12-0.20	0.15000	0.1700	0.17200
Q-T	0.32-0.36	0.35900	0.36400	0.36200
R-R	0.80	0.94200	1.01600	0.99900
Segments				
P-R	0.02-0.10	0.06100	0.07100	0.06900
S-T	<0.20	0.12300	0.10300	0.10100
T-P	0.00-0.40	0.44000	0.48000	0.47200

Mean Duration Values:

Waves

- P: 0.11167ms
- QRS Complex: 0.067333ms
- T: 0.16933ms

Intervals

- P-R: 0.164ms
- Q-T: 0.36167ms
- R-R: 0.98567ms

Segments

- P-R: 0.067ms
- S-T: 0.109ms
- T-P: 0.464ms

Table 4: (Table 5.4 continued) Condition: Supine Recording (Amplitude measurements taken from 3 cardiac cycles)

ECG Component	Amplitude (mV)			
Waves	Normative Value	1	2	3
P	<20	0.109555	0.131830	0.099490
QRS Complex	0.10-1.50	1.30650	1.26281	1.263730
T	<5	0.38848	0.41748	0.40710

Mean Amplitude Values:

Waves

- P: 0.11363mV
- QRS Complex: 1.2777mV
- T: 0.40435mV

Table 5: (Table 5.5) Condition: After Exercise (measurements taken from 1 cardiac cycle)

ECG Component	Normative Values		1	
Waves	Duration (ms)	Amplitude (mV)	Duration (ms)	Amplitude (mV)
P	0.07-0.18	<.20	0.01800	0.19836
QRS Complex	0.06-0.12	0.1-1.5	0.06500	1.35108
T	0.10-0.25	<0.5	0.16600	1.35108
Intervals	Duration (ms)		Duration (ms)	
P-R	0.12-0.20		0.05700	
Q-T	0.32-0.36		0.34200	
R-R	0.80		0.48600	
Segments	Duration (ms)		Duration (ms)	
P-R	0.02-0.10		0.05900	

ECG Component	Normative Values	1
S-T	<0.20	0.09800
T-P	0.0-0.40	0.07200

Note Interpreting ECGs is a skill that requires practice to distinguish between normal variation and those arising from medical conditions. Do not be alarmed if your ECG does not match the "Normative" values and references above and in the Introduction.

II. Questions

D. Using data from table 5.2:

1. **Explain the changes in heart rate between conditions. Describe the physiological mechanisms causing these changes.**

There is an increase in average heart rate between the supine and seated conditions. This is due to the effects gravity has on blood flow when sitting, meaning pumping has to occur at a faster rate to meet the needs of the body.

There is a decrease in average heart rate between the seated and start of inhale conditions. This is an unexpected result, and likely due to the recording taking place after moving from the supine to seated position quite quickly, as usually the heart rate would increase with inhalation, as there is a decrease in systemic arterial blood pressure, reducing carotid baroreceptor firing.

There is an decrease in average heart rate between the start of inhale and start of exhale conditions. This is due to an increase in systemic arterial blood pressure and cardiac output cause an increase in carotid baroreceptor firing, which in turn causes the heart rate to decrease.

There is a large increase in average heart rate between the start of exhale and after exercise conditions. This is due to the excess of oxygen and blood flow required to be pumped to the extremities during intense physical activity.

2. **Are there differences in the cardiac cycle with the respiratory cycle (recording 3 data)?**

Yes, there are differences, as with an increase in respiration, for example in the after exercise condition, there is an increase in hear rate.

E. Using data from table 5.3:

What changes occurred in the duration of systole and diastole between resting and post exercise?

The durations of systole and diastole both decreased after exercise, with a larger decrease occurring in ventricular diastole when compared with ventricular systole.

F.Using data from tables 5.4 and 5.5:

1. **Compared to the resting state, do the durations of the ECG intervals and segments decrease during exercise? Explain:**

The durations of the ECG intervals and segments decrease during exercise when compared with the resting state. This is due to the increase in heart rate which occurs during exercise, meaning that intervals and segments are shorter in duration.

2. **Compare your ECG data to the normative values. Explain any differences.**

With the exception of the Q-T and R-R interval and T-P segment durations in the supine condition, and the T wave amplitude, P-R, and R-R interval duration in the after exercise conditions, all data was within the given normative values. The observed differences may be due to the unclear start and end point of the measurements, due to an unsteady isoelectric line.

3. **Compare ECG data with other groups in your laboratory. Do their data differ? Explain why this may not be unusual.**

Compared to other ECG data, their are differences in measurement values, however this is not unusual, as factors such as fitness and age have an impact on the heart rate of the individual being tested.

G. In order to beat, the heart needs three types of cells. Describe the cells and their function.

1. Rhythm generators generate electrical signals
2. Conductors which spread the pacemaker signal
3. Contractile cells which mechanically pump blood

H. List in proper sequence, starting with the normal pacemaker, elements of the cardiac conduction system.

1. Sinoatrial Node
2. Internodal Pathways
3. Atrial Fibers
4. Atrioventricular Node
5. Bundle of His

6. Left Bundle Branch
7. Right Bundle Branches
8. Purkinje Fibers

I. Describe three cardiac effects of increased sympathetic activity, and of increased parasympathetic activity.

Sympathetic

An increase in sympathetic activity causes:

1. An increase in automaticity and excitability of the SA Node, giving increased heart rate
2. An increase in electrical impulse conductivity through atrioventricular conduction system
3. An increase in atrioventricular contraction

Parasympathetic

An increase in parasympathetic activity causes:

1. A decrease in automaticity and excitability of the SA Node, giving a decreased heart rate
2. A decrease in electrical impulse conductivity through the atrioventricular conduction system
3. A decrease in the force of atrioventricular contraction

J. In the normal cardiac cycle, the atria contract before the ventricles. Where is this fact represented in the ECG?

This can be seen in the P-R interval, which is the time from the onset of atrial depolarization to the onset of ventricular depolarization.

K.What is meant by "AV delay" and what purpose does the delay serve?

AV delay is the approximately 0.20 seconds between the depolarization of the atria due to the SA node impulse, and the contraction of the ventricles. This is due to the non-conducting tissue found between the atria and ventricles. The purpose of this delay is to ensure the blood has been pumped from the atria to the ventricles before the ventricles contract to pump the blood around the rest of the body.

L.What is the isoelectric line of the ECG?

It is a point of departure of electrical activity if depolarization and repolarizations of the cardiac cycle, indicating periods when the ECG electrodes did not detect electrical activity.

M.Which components of the ECG are normally measured along the isoelectric line?

All waves - P, QRS complex, and T waves -, intervals - P-R, Q-T, and R-R -, and segments - P-R, S-T, and T-P - are measured along the isoelectric line.

End of Lesson 5 Data Report

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