Practicum 1: The Structure of the Heart

Introduction

In this exercise, you study the structure of the heart. The heart is located deep in the thorax between the lungs in a region known as the **mediastinum**. The mediastinum contains the heart, the coverings of the heart (the **pericardia**), and other structures such as the oesophagus and descending aorta.

If you were to open the chest cavity, the first structure you would see is the **parietal pericardium**. The parietal pericardium encloses the heart and has two layers; a tough, outer connective tissue sheath called the fibrous layer and an inner layer called the serous layer. Deep to the parietal pericardium is the **pericardial cavity**, which contains a small amount of **serous fluid.** This fluid reduces the friction between the outer surface of the heart and the parietal pericardium. The heart wall itself has an outer layer known as the **visceral pericardium** or **epicardium.**

Objectives

At the end of this exercise you should be able to:

1. describe the general structure of the heart
2. find and name the anatomical features on the models or specimen of the heart
3. describe the blood flow through the heart and the function of the internal parts of the heart
4. discuss the functioning of the artioventricular valves and the semi lunar valves and their role in circulating blood through the heart
5. describe the position of the heart in the thoracic cavity.

Materials

- Models and charts of the heart
- Preserved mammalian hearts
- Blunt probes (mall probes)
- Dissection pans
- Razor blades or scalpels
- Sharps in a container
- Disposable gloves
- Waste container
- Microscopes
- Prepared slides of cardiac muscle

Procedure

1. Examination of the heart model and specimen

   Exterior structure of the heart

- Compare the heart model with the mammalian heart specimen
- Examine the heart model and specimen. Notice that the heart has a pointed end or apex and a blunt end or base. See how the aorta curves to the left in an anterior view of the heart and posterior to the pulmonary trunk.

Use charts to fill in details

A. Locate the anterior features of the heart

Left vertical interventricular groove or salcus coronary arteries, veins, aurides.

B. Locate the posterior features of the heart

Examine the heart from the posterior side and see the following:

- Atria (right and left atria)
- Atrioventricular salcus or groove
- Coronary sinus
- Superior and inferior vena cavae
- Inferior vena cava
- Pulmonary veins

C. Locate the major vessels of the heart

Pulmonary trunk, pulmonary arteries
Ligamentum anteriosum
Ascending aorta, pulmonary veins

The heart is nourished by coronary arteries. Examine the heart for the following vessels:

- left coronary artery
- anterior interventricular artery
- circumflex artery
- right coronary artery
- posterior interventricular artery
- right marginal artery
- the great cardiac vein
- small cardiac vein

Interior Structure of the Heart

Examine the heart model and specimen and locate the following structures:

- right ventricle
- left ventricle
- interventricular septum
- right and left atria

- inner atrial septum
- fossa ovalis
- foramen ovale
- pedinate muscles
- tricuspid value
- chordae muscles
- papillary muscles
- trabeculae carneae
- pulmonary semilunar
- bicuspid valve (mitral valve)
- aortic semilunar valve.

Procedure for the Dissection of the Mammalian Heart

- Use a preserved mammalian heart specimen for dissection
- Place the heart under running water for a few minutes to rinse off the preserving fluid.
- Place the heart specimen on a dissecting board
- Following the instructions from your laboratory supervisor, cut the heart specimen open.
- Using a sharp scalpel/razor blade make an incision along the right side of heart (lateral side) from the apex of the heart to the lateral side of the right arterialise make a coronal section.
- Examine for various structures as indicated above.

REVIEW

Name: ……

1. The heart is located between the lungs in an area known as the: ……

   ……..

2. What is the outer layer superficial to the pericardial cavity?

   ……

3. What is the innermost layer of the heart wall called?

   ……

4. Is the apex of the heart superior or inferior to other parts of the heart?

……

5. What blood vessels nourish the heart tissue?

……

6. What separates the left atrium from the right atrium?

……

7. The bicuspid valve is located between what two chambers of the heart?

……

8. What is the function of the aortic semilunar valve?

……

9. What is another name for the tricuspid valve?

……

10. What is the cell type that makes up most of the myocardium?

……

11. What adaptation do you see in the walls of the left ventricle being thicker than those of the right ventricle?

……

12. How does cardiac muscle resemble skeletal muscle?

……

13. In terms of function, how is cardiac muscle different from skeletal muscle?

……

14. Label the following illustration

REFERENCE

1. Wise E (2001). Anatomy and Physiology. The Unity of Form and Function. Laboratory Manual. 2nd ed. McGraw Hill. Boston.

Practicum 2: Blood Typing

Introduction

The surfaces of red blood cells possess various antigenic molecules that have been designated by letters such as A, B, C, D, E, c, d, e, M, N, etc. Although the exact chemical composition of all these substances is undetermined, some of them appear to be carbohydrate residues (oligosaccharides).

The presence or absence of these various substances determine the type of blood possessed by an individual. Since the chemical makeup of cells is genetic, an individual's blood type is the same in old age as it is at birth. It never changes.

The only factors that we are concerned with here in this exercise are A, B, and D (Rh) antigens since they are most commonly involved in transfusion reactions.

To determine an individual's blood type, drops of blood-typing sera are added to suspensions of red blood cells to detect the presence of **agglutination** (clumping) of the cells. ABO typing may be performed at room temperature with saline suspensions of red blood cells. Rh typing for the D factor, on the other hand, requires higher temperatures (around 50^{o} C) and whole blood instead of diluted blood. For ABO typing the diluted blood procedure is preferable. For convenience, however, the warming box method may be used for combined ABO and Rh typing. Two procedures are provided here. Your instructor will indicate which method will be used.

Objectives

1. Determine the antigens (agglutinogens) present in a particular ABO blood type.
2. List the antibodies (agglutinins) present in a particular ABO blood types.
3. Relate Rh-positive or Rh-negative blood to antigens present

ABO BLOOD TYPING

(Saline Dilution Method)

Materials

- small vials (10 mm dia x 50 mm long)
- disposable lancets (*B-D Microlance, sera sharp,* etc.)
- 70% alcohol and cotton
- wax pencil and microscope slides
- typing sera (anti-A and anti-B)
- applicators or toothpicks
- saline solution (0.85%)
- 1 ml pipettes

Procedure

1. Mark a slide down the middle with a marking pencil, dividing the slide into two halves. Write ANTI-A on the left side and ANTI-B on the right side.

2. Pipette approximately 1 ml of saline solution into a small vial or test tube.

3. Scrub the middle finger with a piece of cotton saturated with 70% alcohol and pierce it with a sterile disposable lancet.

4. Allow two or three drops of blood to mix with the saline by holding the finger over the end of the vial and washing it with the saline by inverting the vial several times.

5. Place a drop of this red cell suspension on each side of the slide.

6. Add a drop of anti-A serum to the left side of the slide and a drop of anti-B serum to the right side. *Do not contaminate the tips of the serum pipettes with the material on the slide.*

7. After mixing each side of the slide with separate applicators or toothpicks, look for agglutination. The slide should be held about 6 inches above an illuminated white background and rocked gently for two or three minutes.

8. Record your results on the Laboratory Report as of three minutes.

COMBINED ABO AND RH TYPING
(Warming Box Method)

In performing this test, two factors are of considerable importance: first, only a small amount of blood must be used (a drop of about 3 mm diameter on the slide), and second, proper agitation must be executed. The agglutination that occurs in this antibody-antigen reaction results in finer clumps; therefore, closer examination is also essential. If the agitation is not properly performed, agglutination may not be as apparent as it should be.

In this combined method, we will use whole blood for the ABO typing also. Although this method works out satisfactorily as a classroom demonstration for the ABO groups, it is not as

reliable as the other method in which saline and room temperature are used. *For clinical applications, whole undiluted blood, with heat, is not recommended.*

Materials

- slide warming box with a special marked slide
- anti-A, anti-B and anti-D typing sera
- applicators or toothpicks
- 70% alcohol
- cotton
- disposable sterile lancets *(B-D Microlance, sera-sharp,* etc.)

Procedure

1. Scrub the middle finger with a piece of cotton saturated with 70% alcohol and pierce it with a sterile disposable lancet. Place a small drop in each of these squares on the marked slide on the warming box. To get the proper proportion of serum to blood, do not use a drop that is larger than 3 mm diameter on the slide.

2. Add a drop of anti-D serum to the blood in the anti-D square, mix with a toothpick and note the time. **Only two minutes should be allowed for agglutination.**

3. Add a drop of anti-B serum to the anti-B square and a drop of anti-A to the anti-A square. Mix the sera and blood in both squares with *separate fresh* toothpicks.

4. Agitate the mixtures on the slide by slowly rocking the box back and forth on its pivot. At the end of two minutes, examine the anti-D square carefully for agglutination. If no agglutination is apparent, consider the blood to be Rh negative. By this time, the ABO type can also be determined.

LABORATORY REPORT

Record your results in section B of the Laboratory Report and answer all the questions.

REFERENCE

1. Benson, H J, Gunsteram S E, Talaro, A and Talaro K P (1995). Anatomy and Physiology. 6th ed., WCB McGraw Hill, Boston.

Practicum 3: The Coagulation Time

Introduction

The coagulation of blood is a complex phenomenon involving over thirty substances. The majority of these substances inhibit coagulation and are called *anticoagulants*: the remainder, which promote coagulation, are designated as *procoagulants.* Whether or not the blood will coagulate depends of which group predominates in a given situation. Normally, the anticoagulants predominate, but when a vessel is ruptured, the procoagulants in the affected are assume control, causing a clot (*fibrin)* to form in a relatively short period of time.

Of the various methods that have been devised to determine the rate of blood coagulation, the one outlined here is very easy to perform and very reliable. Figure .

Objective

To determine the rate of blood coagulation

Materials

- lancets, cotton, alcohol
- capillary tubes (0.5 mm diameter)
- 3-cornered file

Procedure

1. Puncture the finger to expose a free flow of blood. **Record time.**

2. Place one end of the capillary tube into the drop of blood. Hold the tube so that the other end is **lower** than the drop of blood so that the force of gravity will aid the capillary action.

3. At **one-minute intervals,** break off small portions of the tubing by scratching the glass first with a file.

   Important: Separate the broken ends slowly and gently while looking for coagulation. Coagulation has occurred when threads of fibrin span the gap between the broken ends.

4. **Record the time** as that from which the blood first appeared on the finger to the formation of fibrin.

LABORATORY REPORT

Record your results on table II, section C, of Laboratory Report.

HEMATOLOGICAL TESTS

TEST RESULTS

Except for blood typing, record all test results in table II. Calculations for blood cell counts should be performed as stated below.

A. Differential White Blood Cell Count

As you move the slide in the pattern indicated in figure ….. record all the different types of cells in table I. Refer to figures …… and …… for cell identification. Use this method of tabulation: ~~1111~~ ~~1111~~ 11. Identify and tabulate 100 leukocytes. Divide the total of each kind of cell by 100 to determine percentages.

Table I Leukocyte tabulation

Neutrophils	**Lymphocytes**	**Monocytes**	**Eosinophils**	**Basophils**
Totals				
Percent				

B. Blood typing

Record your blood type here: …….

1. If you needed a blood transfusion, what types of blood could you be given?

   ……

2. If your blood were to be given to someone in need, what type should that person have?

C. Summarization of Results

Record blood cell counts and other test results in the following table:

Table II

Test	Normal Values	Test Results	Evaluation (over, under, normal)
Differential WBC Count	Neutrophils: 50% - 70%		
	Lymphocytes: 20% - 30%		
	Monocytes: 2% - 6%		
	Eosinophils: 1% - 5%		
	Basophils: 0/.5% - 1%		
Total WBC Count	5000 – 9000 per cu mm		
RBC Count	Males: 4.8-6.0 million/cu mm		
	Females: 4.1-5.1 million/cu mm		
Hemoglobin Percentage	Males: 13.4-16.4 gms/100 ml		
	Females: 12.2-15.2 gms/100ml		
Hematocrit (VPRC)	Males: 40%-54% (Av. 47%)		
	Females: 37%-47% (Av. 42%)		
Coagulation Time	2 to 6 minutes		

D. Materials

Identify the various blood tests in which the following supplies are used.

1.	Hemacytometer	
2.	Hemoglobinometer	
3.	Centrifuge	Hematocrit (VPRC) - 1
4.	Capillary tubes	clotting time - 2
5.	Wright's stain	RBC and WBC counts - 3
6.	Microscope slides	differential WBC count - 4
7.	Hemolysis applicators	haemoglobin determination - 5
8.	Seal-ease	
9.	Diluting fluid	
10.	Cover glass	

Materials
1. ……
2. ……
3. ……
4. ……
5. ……
6. ……
7. ……
8. ……
9. ……
10. ……..

REVIEW

1. What is the name of a surface membrane molecule that causes an immune reaction?

2. What ABO blood type is found in a person who is a universal donor?

3. What percentage of the blood volume are formed elements?

4. A person with blood type B had what kind of agglutinins (antibodies)?

5. A person has antibody A and antibody B in his or her blood with no Rh antibody. What specific blood type would this person have?

6. An individual with blood type "B negative" is injected with A positive blood. What would happened after the injection?

7. What is the normal hematocrit for a healthy female?

8. What might changes in the Unopette technique alter the final determined value of erythrocytes?

9. Using the following illustration, calculate the hematocrit of the individual. Determine if it falls within normal limits.

REFERENCES

1. Benson, H J, Gunsteram S E, Talaro, A and Talaro K P (1995). Anatomy and Physiology. 6th ed., WCB McGraw Hill, Boston.

2. Wise E (2001). Anatomy and Physiology. The unity of form and function. Laboratory Manual. 2nd ed. McGraw Hill. Boston.