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PHARMACOLOGY

ANA202 assignment

1. Describe the heart and its functions

   The heart is a muscular organ about the size of a fist, located just behind and slightly left of the breastbone. The heart pumps blood through the network of arteries and veins called the cardiovascular system. The heart is located between your lungs in the middle of your chest, behind and slightly to the left of your breastbone (sternum). A double-layered membrane called the pericardium surrounds your heart like a sac. The outer layer of the pericardium surrounds the roots of your heart's major blood vessels and is attached by ligaments to your spinal column, diaphragm, and other parts of your body. The inner layer of the pericardium is attached to the heart muscle. A coating of fluid separates the two layers of membrane, letting the heart move as it beats. Your heart has 4 chambers. The upper chambers are called the left and right atria, and the lower chambers are called the left and right ventricles. A wall of muscle called the septum separates the left and right atria and the left and right ventricles. The left ventricle is the largest and strongest chamber in your heart. The left ventricle's chamber walls are only about a half-inch thick, but they have enough force to push blood through the aortic valve and into your body.

### Right side of the heart

- The right atrium receives deoxygenated blood from the body through veins called the superior and inferior vena cava (the largest veins in the body)
- The right atrium contracts and blood passes to the right ventricle.
- Once the right ventricle is full, it contracts and pumps the blood through to the lungs via the pulmonary artery, where it picks up oxygen and offloads carbon dioxide.

## Left side of the heart

- ★ Newly oxygenated blood returns to the left atrium via the pulmonary vein.
- ★ The left atrium contracts, pushing blood into the left ventricle.
- ★ Once the left ventricle is full, it contracts and pushes the blood back out to the body via the aorta.
- ★ Each heartbeat can be split into two parts:

**Diastole**: the atria and ventricles relax and fill with blood.

**Systole**: the atria contract (atrial systole) and push blood into the ventricles; then, as the atria start to relax, the ventricles contract (ventricular systole) and pump blood out of the heart.When blood is sent through the pulmonary artery to the lungs, it travels through tiny capillaries on the surface of the lung's alveoli (air sacs). Oxygen travels into the capillaries, and carbon dioxide travels from the capillaries into the air sacs, where it is breathed out into the atmosphere.The muscles of the heart need to receive oxygenated blood, too. They are fed by the coronary arteries on the surface of the heart.Where blood passes near to the surface of the body, such as at the wrist or neck, it is possible to feel your pulse; this is the rush of blood as it is pumped through the body by the heart. If you would like to take your own pulse, this article explains how.

## The wall of the heart consists of three layers of titissue

Epicardium — protective layer mostly made of connective titissue.

Myocardium — the muscles of the heheart

Endocardium — lines the inside of the heart and protects the valves and chambers.

## The Heart Valves

Pumps need a set of valves to keep the fluid flowing in one direction and the heart is no exception. The heart has two types of valves that keep the blood flowing in the correct direction. The valves between the atria and ventricles are called atrioventricular valves (also called cuspid valves), while those at the bases of the large vessels leaving the ventricles are called semilunar valves.

The right atrioventricular valve is the tricuspid valve. The left atrioventricular valve is the bicuspid, or mitral, valve. The valve between the right ventricle and pulmonary trunk is the pulmonary semilunar valve. The valve between the left ventricle and the aorta is the aortic semilunar valve.

When the ventricles contract, atrioventricular valves close to prevent blood from flowing back into the atria. When the ventricles relax, semilunar valves close to prevent blood from flowing back into the ventricles.

1. The tricuspid valve regulates blood flow between the right atrium and right ventricle.
2. The pulmonary valve controls blood flow from the right ventricle into the pulmonary arteries, which carry blood to your lungs to pick up oxygen.
3. The mitral valve lets oxygen-rich blood from your lungs pass from the left atrium into the left ventricle.
4. The aortic valve opens the way for oxygen-rich blood to pass from the left ventricle into the aorta, your body's largest artery

both atria and ventricles contract at the same time. The heart works as two pumps, one on the right and one on the left, working simultaneously. Blood flows from the right atrium to the right ventricle, and then is pumped to the lungs to receive oxygen. From the lungs, the blood flows to the left atrium, then to the left ventricle. From there it is pumped to the systemic circulation.

**Electrical impulses** from your heart muscle (the myocardium) cause your heart to contract. This electrical signal begins in the sinoatrial (SA) node, located at the top of the right atrium. The SA node is sometimes called the heart's "natural pacemaker." An electrical impulse from this natural pacemaker travels through the muscle fibers of the atria and ventricles, causing them to contract. Although the SA node sends electrical impulses at a certain rate, your heart rate may still

change depending on physical demands, stress, or hormonal factors.

**The heart has four chambers:**

1. The right atrium receives blood from the veins and pumps it to the right ventricle.
2. The right ventricle receives blood from the right atrium and pumps it to the lungs, where it is loaded with oxygen.
3. The left atrium receives oxygenated blood from the lungs and pumps it to the left ventricle.
4. The left ventricle (the strongest chamber) pumps oxygen-rich blood to the rest of the body. The left ventricle's vigorous contractions create our blood pressure.

The coronary arteries run along the surface of the heart and provide oxygen-rich blood to the heart muscle. A web of nerve tissue also runs through the heart, conducting the complex signals that govern contraction and relaxation. Surrounding the heart is a sac called the pericardium.

**Function of the Heart**

The heart is the main organ in the circulatory system, the structure primarily responsible for delivering the circulation of blood and transportation of nutrients in all parts of the body. This continuous task uplifts the role of the heart as a vital organ whose normal operation is constantly required.

2. Write on 5 different congenital anomalies of the heart

1. **Ventricular septal defect**. Ventricular septal defect occurs in 2 to 7 percent of all live births and accounts for about 20 percent of all congenital heart defects, according to the American Heart Association. It's the most common congenital heart defect among newborns, according to the American Heart Association. VSDs are small- to large-sized holes between the lower chambers of the heart. They're typically diagnosed due to the presence of a heart murmur (an additional sound heard when listening to the heart with a stethoscope). Many infants and children with VSD are otherwise asymptomatic. The

larger the hole is, the greater the chance that the infant will develop congestive heart failure from excessive blood flow crossing the hole from the left ventricle back into the lungs, essentially flooding the lungs. Infants with large VSDs typically breathe fast, have high heart rates, sweat all the time (even while resting) and have difficulty gaining weight.

Treatment. Initially, doctors conservatively monitor babies with VSDs to see how the hole or holes affect the infant over time. If the child develops heart failure, physicians conduct surgery to close the hole or holes. This usually occurs within the first four to six months of life for larger holes. Surgeons typically close such holes with a patch sewn into the right ventricular side of the heart muscle. The prognosis for infants with simple VSDs is very good, Van Bergen says. Babies typically stay in the hospital for a VSD closure for one to three days. The need for additional treatment is uncommon.

2. **Tetralogy of Fallot**. Tetralogy of Fallot, or TOF, is a relatively common heart abnormality that physicians typically diagnose during the fetal period or soon after the infant is born, Van Bergen says. The hallmark feature of TOF is an abnormal position or orientation of the ventricular septum, with a hole present between the two lower heart chambers. The aortic valve overrides this hole instead of coming directly out of the left ventricular outflow tract; consequently, the blood flow coming out of the right ventricle is obstructed, Van Bergen says. This causes a thickening of the heart muscle in the right ventricle. The severity of the defect and the need for early intervention depends on the degree of the obstruction of blood going to the lungs. All cases of TOF require surgical repair; the only difference is timing, Bacha says. In most cases treated in the United States and the rest of the developed world, surgery is conducted when the infant is about six months old, he says.

Treatment. Infants with TOF must have surgery at some point. In extreme cases in early infancy, during the child's first weeks of life, if the degree of obstruction is high and oxygen levels to the heart are low, an intervention is needed. Options for this age group include a cardiac catheterization procedure that involves placing a stent in the right ventricular outflow tract as a temporary solution. This eliminates or decreases the area of obstruction. Other babies may be treated with a procedure in which a tube is surgically placed between the aorta and the right pulmonary artery. This allows the blood from the aorta to go back to the lungs to get replenished with oxygen since not enough blood flow was getting into the lungs through the narrow pulmonary artery, Van Bergen says. TOF patients need to be followed long term, as they often require additional intervention, mostly involving pulmonary valve replacements.

3. **Single ventricle defects.** This condition is characterized by a wide variety of congenital anomalies that typically result in the patient having only one functional ventricle or "pumping chamber" instead of two, says Dr. D. Byron Holt, chief of

cardiology at Dell Children's Medical Center of Central Texas in Austin. Infants with this condition typically have lower than normal oxygen levels that cause a bluish discoloration of the skin, or cyanosis.

Treatment. All children with this condition will require a series of surgeries to ultimately reroute deoxygenated blood directly to the lungs. Thanks to improvements in treatments over the last 20 years or so, the long-term prognosis of patients with this condition has drastically improved, Holt says. This condition once had an early mortality rate of nearly 100 percent, but today more than 85 percent of infants with single ventricle defects live through kindergarten and beyond, he says. "The current thought process is that most patients with single ventricles will ultimately need mechanical assistance for their heart muscle or a transplant at some point in their life," Holt says. "The goal has been to extend that timing as much as possible."

4.**Pulmonary valve stenosis**. This is the most common valve defect in newborns. Babies with severe cases often have strained right ventricles. Your doctor can usually treat it with a catheter procedure. She will use a catheter, or thin tube, with a balloon on the end to inflate and stretch open the strained valve.

In some cases, the obstruction is present in the pulmonary valve itself, either from an abnormally small structure or due to the fusion of one or two of the valve leaflets, which are flaps that allow blood to flow forward and close to prevent blood from flowing backward. The level of obstruction may be below or above the valve. Typically, infants with this congenital heart defect have a murmur that helps physicians provide a diagnosis, often with the use of an echocardiogram. However, some patients are asymptomatic. If the degree of obstruction increases, it could overload the right side of the heart with pressure, causing the ventricular muscle to work harder and become abnormally thickened, Van Bergen says.

Treatment. Intervention depends on the location of the obstruction and its severity, according to Van Bergen. This condition is often treated with balloon angioplasty procedures. When the narrowing is above or below the valve, surgery is typically needed at some point.

5.**Patent ductus arteriosus (PDA)**. Simply put, this is a hole in your baby’s aorta that doesn’t close.During pregnancy, the hole allows your baby’s blood to bypass his lungs and get oxygen from your umbilical cord. After he’s born, he starts to get oxygen from his own lungs, and the hole has to close.If it doesn’t, it’s called patent ductus arteriosus, or PDA. Small PDAs may get better on their own. A larger one could need surgery

Treatment. Cardiologists have a wide array of options to treat symptomatic PDAs. These include medications, such as special forms of IV ibuprofen and acetaminophen, cardiac surgery, which typically involves an incision between the ribs on the left side of the back, and minimally invasive catheterization procedures.