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Coagulogram Changes in the Congenital Heart Defect Tetralogy of Fallot

Xurozov Maxsud Maxmutovich
Cardiologist, Department of Therapy, Samarkand Regional Multidisciplinary Medical Center

Aripov Sohib Abduxalilovich
Therapeutist, Department of Emergency Therapy, Samarkand Branch of the Republican Emergency Medical Center

Uzoqova Oyjamol Narzullayevna
Assistant, Department of Hematology, Samarkand State Medical University

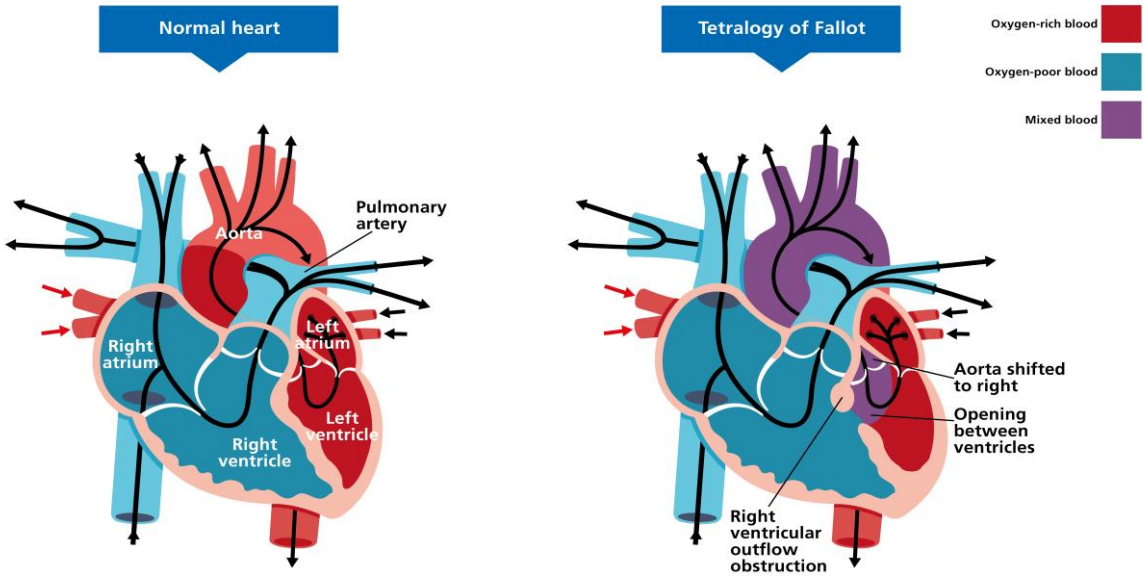
Abstract: Tetralogy of Fallot is a complex and one of the most common congenital heart defects, accounting for 8-13% of diagnosed cardiovascular diseases. It is the most common of the "blue" or cyanotic heart defects. Every year, 3-4 children are born with tetralogy of Fallot for every 10 thousand newborns. The severity of the disease can be very diverse. The main thing is not to forget - modern treatment methods are able to completely eliminate the negative consequences of this anomaly.

Keywords: Blue heart defects, Cyanotic defects, Tetralogy of Fallot, Ventricular septal defect, Dextroposition of the aorta.

Introductory part: Before we begin the direct story about tetralogy of Fallot, let's go back to the concept of cyanotic, or as they say, "blue", heart defects. With defects of this group, the following picture is observed. Venous blood, which has given its oxygen to the tissues and carried away carbon dioxide from them, enters the arterial system, where it mixes with oxygen-rich arterial blood. Doctors call this a "right-to-left" shunt - from the right chambers of the heart to the left.

Children with "blue defects" are distinguished from others by a characteristic bluish tint of the skin. Visible mucous membranes also change color. They become crimson or even purple, as if the child had eaten bird cherry or service berry. Sometimes this cyanosis is observed immediately after birth, in other cases after a few weeks or months. Moreover, the intensity of these manifestations can vary greatly. This is due to the fact that arterial blood receives an admixture of venous blood, which is deprived of oxygen due to a defect in the heart. As a result, there is a constant lack of oxygen in this mixed blood, and as a result, all organs and tissues do not receive it in sufficient quantities.

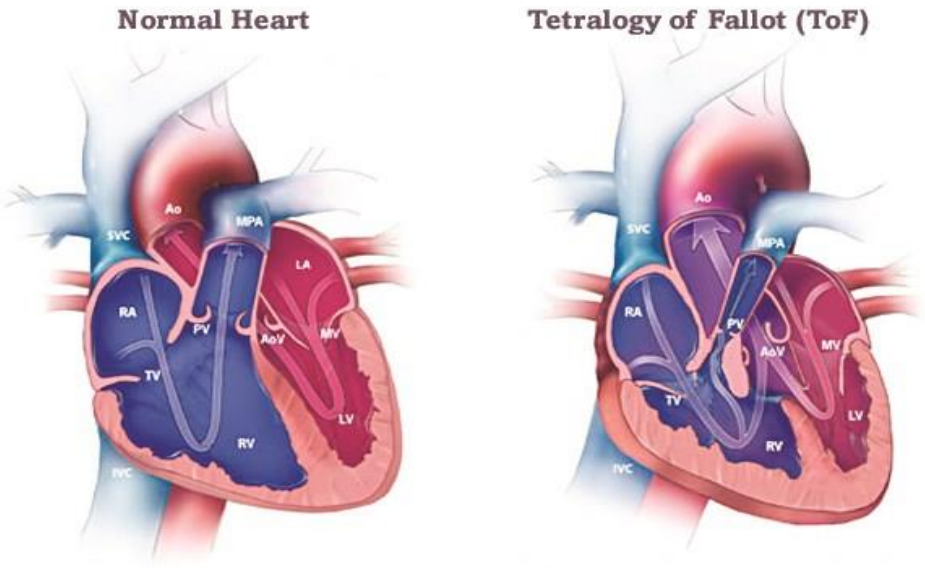
Of course, the body always tries to fight and ensure its survival. In this case, the hematopoietic organs (bone marrow and spleen) produce more intensively red blood cells that carry oxygen. So, in the blood of children with some cyanotic defects, a significant increase in the number of red blood cells is sometimes observed. In addition, we can detect an increase in the level of hemoglobin in the blood. This is a substance contained in red blood cells that can attach oxygen molecules to itself. (Such children are operated on very early, and the spleen does not always have time to work along such a compensatory path. I found out that this happens with some defects, and not so often)



Research methods and materials: Thus, the more venous blood enters the arterial system, the more red blood cells and hemoglobin there are in the blood. This is a compensatory reaction that allows organ cells to survive in conditions of oxygen deficiency. However, one should not think that such compensation occurs without consequences for the body. The blood with a changed composition becomes thicker and more viscous, blood circulation in small vessels slows down significantly. This can lead to blockage of the smallest vessels, and especially the vessels of the brain, which is accompanied by the appearance of various neurological symptoms.

Due to lack of oxygen, the parts of the body farthest from the heart - the tips of the fingers and toes - not only change color, but also turn blue. They thicken at the ends, acquire a characteristic "drumstick" shape, and the nails become convex ("hourglass").

If a child with a right-to-left shunt also has blood flow in the right ventricle, then dyspnea-cyanotic attacks may develop. In such cases, the child loses consciousness for several seconds, and sometimes longer, and cannot breathe in enough air. This is already very dangerous, as it can lead to long-term and sometimes irreversible loss of consciousness. Therefore, in most cases, it is necessary to get rid of the "blue defect" surgically.



The degree of cyanosis, that is, blueness, as we have already said, can be different. It depends on the degree of mixing of venous and arterial blood. Sometimes the whole body of the child turns blue, sometimes only the fingertips and lips. Moreover, in some cases, cyanosis becomes noticeable not immediately, but several weeks or months after birth. This does not mean that something happened to the baby. The child simply grew a little, and the discharge from right to left increased, and the “look” defect became “blue”. This happens. But the opposite is never true - “blue” can only turn into “white” as a result of surgical intervention. Now let's return to our main topic and figure out what tetralogy of Fallot is.

Tetralogy of Fallot cyanosis is one of the "blue" defects, which often develops gradually. Sometimes it is almost imperceptible, and only the number of hemoglobin and red blood cells (it is better to replace it with "saturation indicators", hemoglobin and red blood cells react very rarely) can alert the doctor. This does not change its anatomical essence in any way.

"Tetrad" means "four." The whole essence of this disorder is that the child has four different defects at the same time:

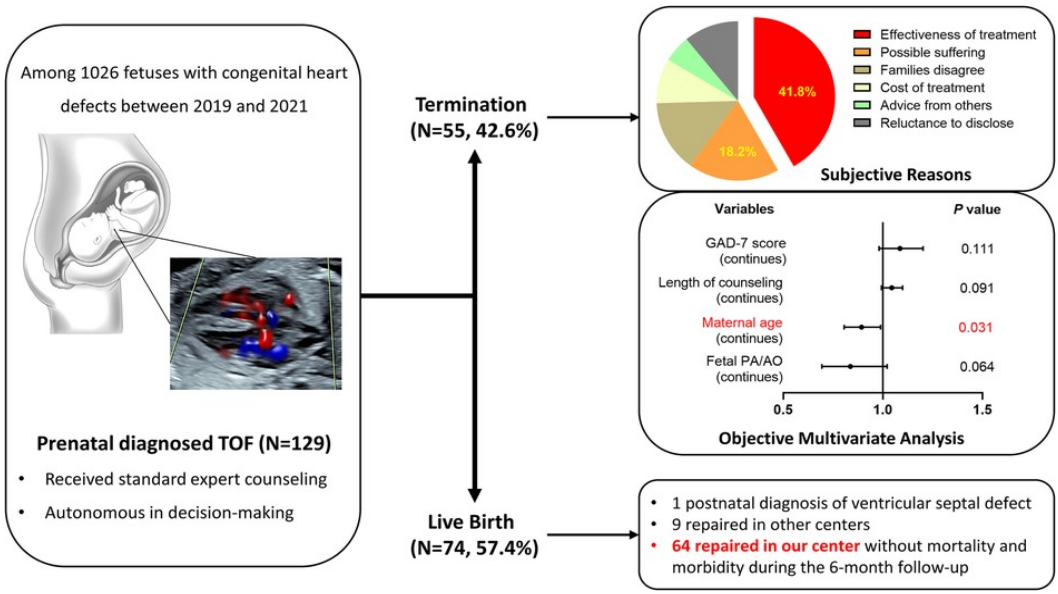
a. ventricular septal defect;

b. aortic dextrosis;

c. right ventricular outflow tract obstruction and pulmonary valve stenosis;

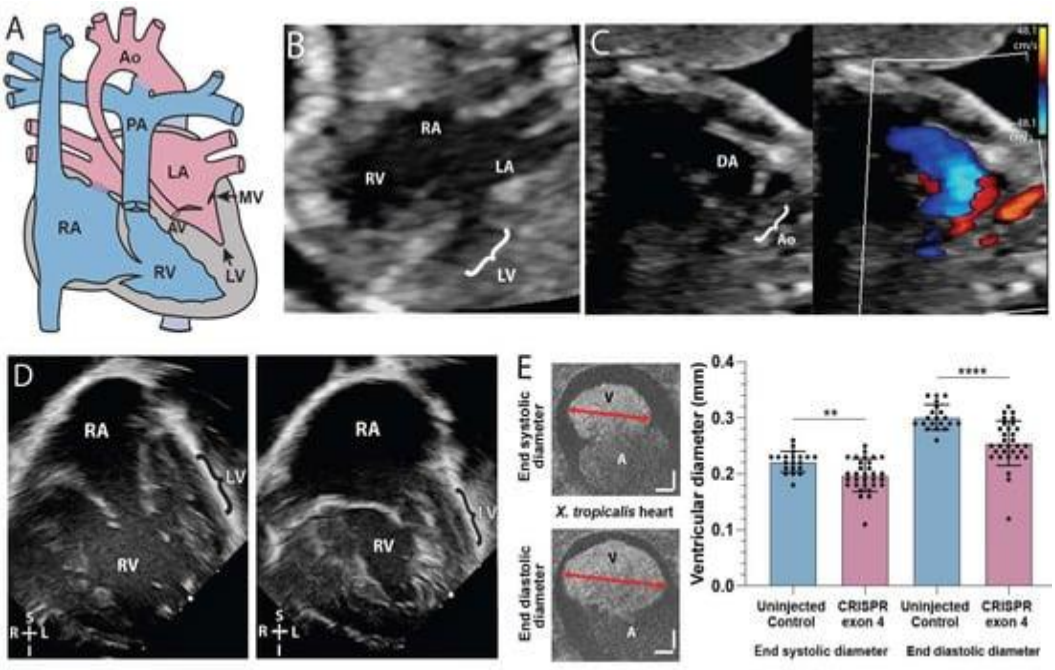
d. right ventricular hypertrophy.

In general, ventricular septal defects occur in various and different forms. The essence of the defect is the presence of a hole between the left and right ventricles of the heart. Unlike many other defects, with tetrad it is not just a hole, but the absence of an entire section of the septum between the ventricles. It simply does not exist. Thus, there is practically no obstacle to the mixing of arterial and venous blood.



The second defect is the incorrect position of the aortic orifice. Normally, the aorta originates from the left ventricle. In tetralogy of Fallot, its opening is shifted to the right and forward, as a result of which it is partially removed from the right ventricle. As a result, blood enters the arterial system from both ventricles.

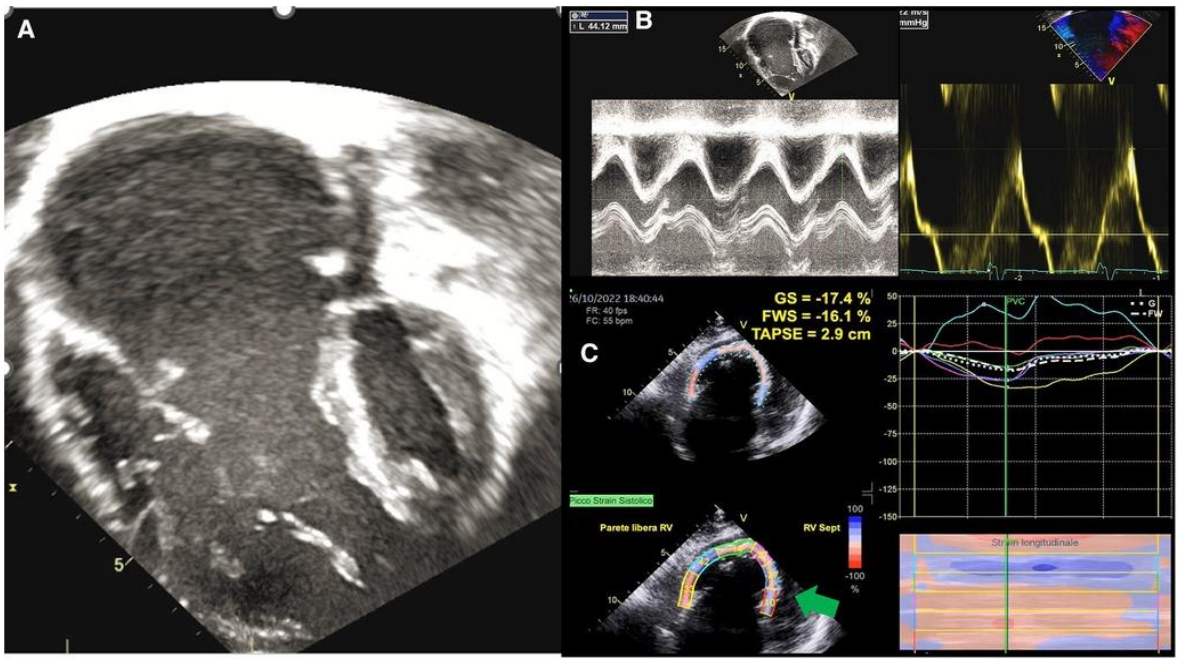
Obstruction - blockage of blood flow. In tetralogy of Fallot, a narrowing of the outflow tract of the right ventricle, which opens into the mouth of the pulmonary artery, is observed even at the muscular intraventricular level. In addition, often both the pulmonary artery itself and the arteries branching off from it are subject to stenosis, that is, narrowing. As a result, venous blood has a certain obstacle to the exit of the right ventricle.



Hypertrophy is an increase in the size and mass of an organ or part of it, which occurs under the influence of various factors. Hypertrophy develops if the organ is forced to perform work that is difficult for it. For example, the pronounced muscles of an athlete are hypertrophy of skeletal muscles. In tetralogy of Fallot, there is a pronounced thickening of all the muscles of the right ventricle, the thickness of which is several times greater than normal.

Poor heart! When nature turns out to be so cruel, how can it do its job and provide all the cells of the child with oxygen? And it tries. But before we talk about what happens to blood flow in tetralogy of Fallot, we need to briefly review the normal anatomy and physiology of the cardiovascular system.

So, the heart is a muscular organ, which consists of four parts or chambers: the right and left atrium, the right and left ventricle. The function of the heart is to pump blood through the vessels, which carry various substances, including oxygen, to all organs and tissues. The vessels that go from the heart to the tissues are called arteries, and from the tissues to the heart - veins. Blood saturated with oxygen is called arterial, and blood that has given up oxygen and received carbon dioxide in the tissues is called venous.

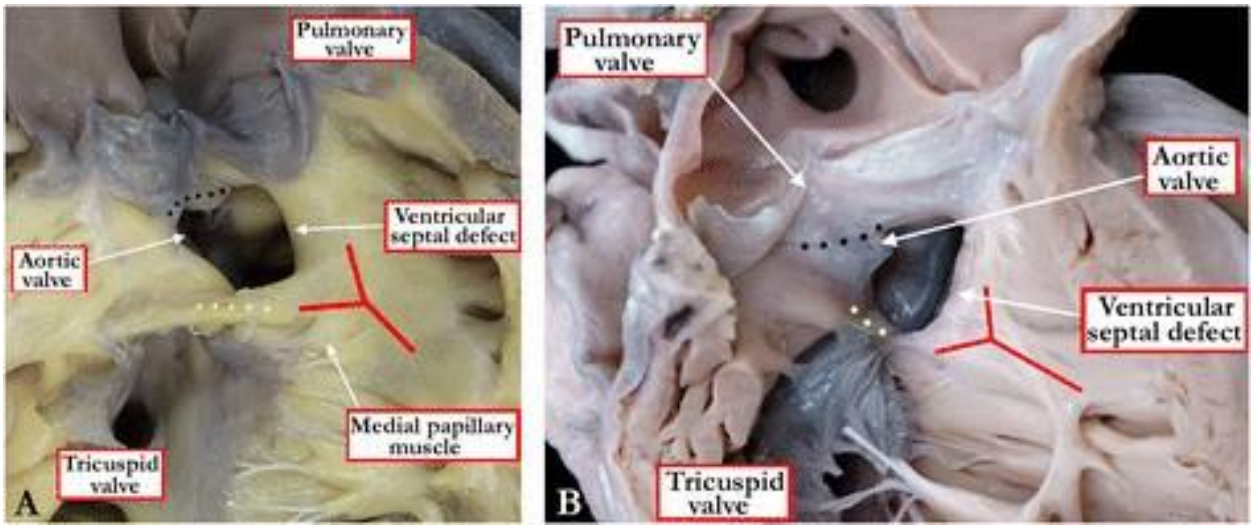


This is how normal blood circulation looks like. From the left ventricle, arterial blood enters the aorta, and from there through the arterial system to all organs and tissues. There, the blood releases oxygen, receives carbon dioxide, that is, becomes venous blood, and is directed through the ventilation system to the right atrium. From the right atrium, venous blood enters the right ventricle, and from there through the pulmonary trunk into the pulmonary arteries. Gas exchange occurs in the alveoli of the lungs: the blood is enriched with oxygen and releases carbon dioxide, that is, becomes arterial blood. Then, through the veins, the blood enters the left atrium, and then the left ventricle, after which everything starts all over again. This, of course, is a rather simplified description of the physiology of blood circulation, but for now it will be enough.

From the above description, we see that normally arterial and venous blood do not mix anywhere, but rather convert into each other at the points of gas exchange. In tetralogy of Fallot, the following occurs.

Venous blood from the body tissues, as usual, enters the right atrium through the veins, and then into the right ventricle. And here, attention, it has two paths:

The most common is in the pulmonary trunk, where there is an obstruction to blood flow due to an obstruction in tetralogy of Fallot.



Results : Any liquid goes in the direction of least resistance, and blood is no exception. Of course, in a small circle, i.e. through the lungs, blood also flows, but it is in a smaller volume than in normal physiology. At the same time, most of the venous blood from the right ventricle flows to the left, that is, into the aorta, where it mixes with arterial blood. As a result, the blood reaching the tissues is not saturated with oxygen, which is accompanied by cyanosis. The degree of cyanosis directly depends on the degree of oxygen saturation of the blood, that is, the ratio of venous blood to arterial blood, as well as on the degree of activation of various protective mechanisms, including the production of red blood cells. Since the right ventricle works under load, having to push blood into the narrowed vessels of the pulmonary trunk, its hypertrophy develops - a significant thickening of the wall.

Usually, the baby looks very healthy immediately after birth, but after a few days you may notice that the baby has shortness of breath with even slight exertion - sucking at the breast. Cyanosis may be subtle or may only appear in certain situations, such as when crying.

Discussion : In general, the cyanosis seen in tetralogy of Fallot usually appears in the second half of life, and sometimes later. Everything seems fine, the baby is growing and gaining weight well. But suddenly, against the background of complete apparent well-being, the baby suddenly chokes, begins to roll his eyes and seems to lose consciousness. It lasts from a few seconds to a few minutes and ends abruptly. This was a dyspnoea-cyanotic attack, which can occur even in the complete absence of cyanosis. Such attacks do not occur in everyone and depend on the degree of obstruction of the outflow tract of the right ventricle. Even the shortest dyspnoea-cyanotic attacks are dangerous because

they are unpredictable, and if you have the slightest suspicion that you are experiencing this condition, you should see a doctor as soon as possible.

Conclusion : The prognosis without treatment is unfavorable. Children with such a defect can live for several years, but their condition gradually worsens. Cyanosis becomes more pronounced, the child lags behind his peers in development. It becomes difficult for him to play, move and engage in daily activities. The baby's favorite position is to lie down with his legs tucked under him. The diagnosis is undoubted, and after the diagnosis is made, of course, the question of surgical treatment. How urgently this is required depends on a number of factors, but in any case it cannot be postponed. The consequences of chronic oxygen deficiency and dyspneic-cyanotic attacks, including damage to the central nervous system, can become irreversible at any time. And then the child will remain disabled forever. Even if cyanosis is practically not expressed, its probability is lower, such a negative scenario is possible.

If you have any suspicious symptoms for tetralogy of Fallot, be sure to consult a qualified cardiologist. Don't delay! The sooner you show your child to a specialist, the sooner treatment can be planned and the higher the baby's chances of survival.

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