

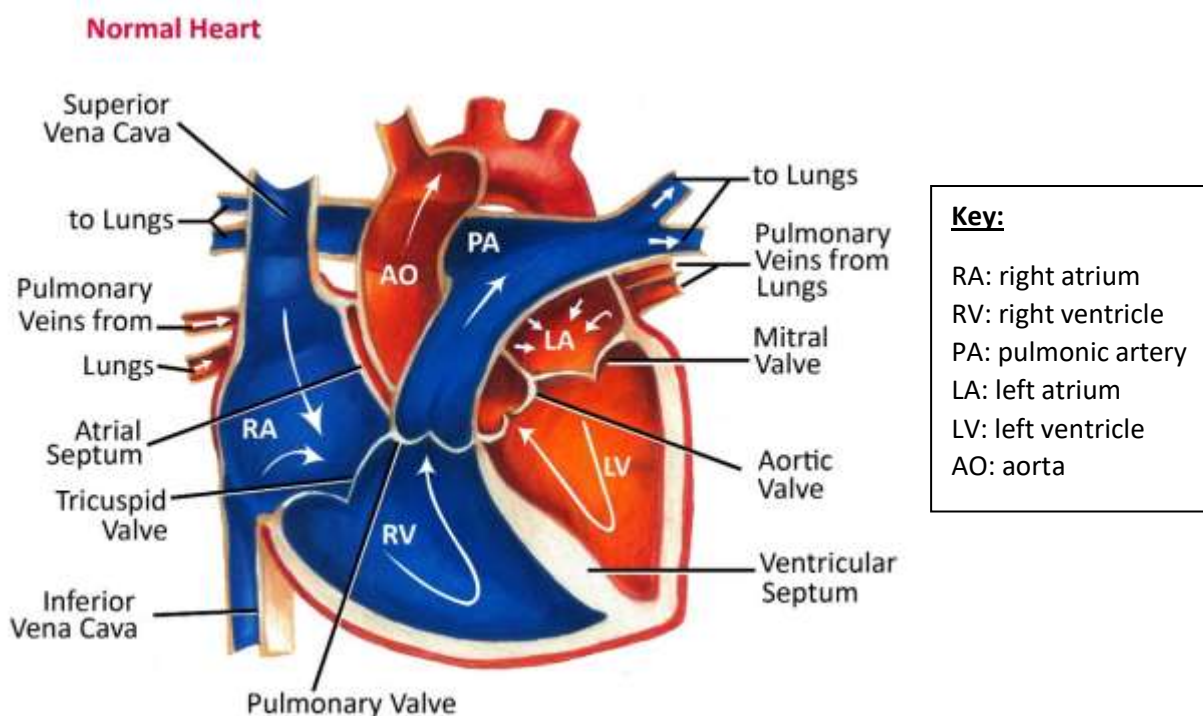


Cyanotic Heart Disease

How does the heart work?

The heart is the organ responsible for pumping blood to and from all tissues of the body. The heart is divided into right and left sides. The job of the right side is to pump oxygen-deficient blood returning from the body into the lungs where fresh oxygen is collected and carbon dioxide is removed. The oxygen-rich blood returning from the lungs enters the left side of the heart where it is pumped into the aorta then to the rest of the body via the arterial system.

Each side of the heart has two chambers, an upper atrium and a lower ventricle. Between the atrium and ventricle on each side lies a valve – the tricuspid on the right and the mitral on the left – that regulates blood flow into the chambers. As the heart pumps, these valves act as one-way gates allowing blood to flow from the atrium above to the ventricle below and preventing blood from flowing back into the atrium. From the ventricles, blood is then forced to flow out into the pulmonary artery (on the right) or the aorta (on the left) through a second series of one-way valves called the pulmonic valve and the aortic valve, respectively. The right and left ventricles are separated by a wall called the interventricular septum while the right and left atria are separated by a wall called the interatrial septum.





What is Cyanotic Heart Disease?

Cyanotic heart disease refers to a congenital (in born) heart abnormality (or abnormalities) that results in decreased blood and tissue oxygen levels. There are many different types of cyanotic heart disease, however generally it involves an abnormal communication (i.e. 'hole') between the right and left sides of the heart (or between the pulmonary artery and the aorta). With a 'hole' in the interatrial or interventricular septum there is an alternative pathway for blood to flow. Although it is much more common for blood to flow from left to right, for complicated reasons, in cyanotic heart disease the blood flow reverses (right to left). As a result, a portion of the oxygen-deficient blood returning to the right heart chambers, travels directly through the 'hole' into the left heart chambers, bypassing the lungs (and therefore not being replenished with oxygen). This oxygen-deficient blood mixes with and dilutes the oxygen-rich blood that has returned from the lungs, causing an overall decrease in blood oxygen levels (called hypoxaemia). This right to left flow of blood is often exacerbated with exercise/exertion.

Over time, chronically decreased blood oxygen, triggers the bone marrow to produce additional red blood cells. The primary function of red blood cells is to transport oxygen around the body, therefore an increase in the number of red blood cells is the body's way of increasing the oxygen-carrying capacity of the blood. Unfortunately, this increase in red blood cells is only beneficial up until a certain level. Once the number of red blood cells exceeds a critical point (this point varies from animal to animal) the blood becomes thick and viscous. This makes it difficult for blood to move through vessels, tissues and organs (called hyperviscosity syndrome). This causes a constellation of clinical problems that are not specific to any one area of the body (since blood flow is compromised on a global scale). Some reported problems include: neurological signs, renal failure and bleeding tendencies.

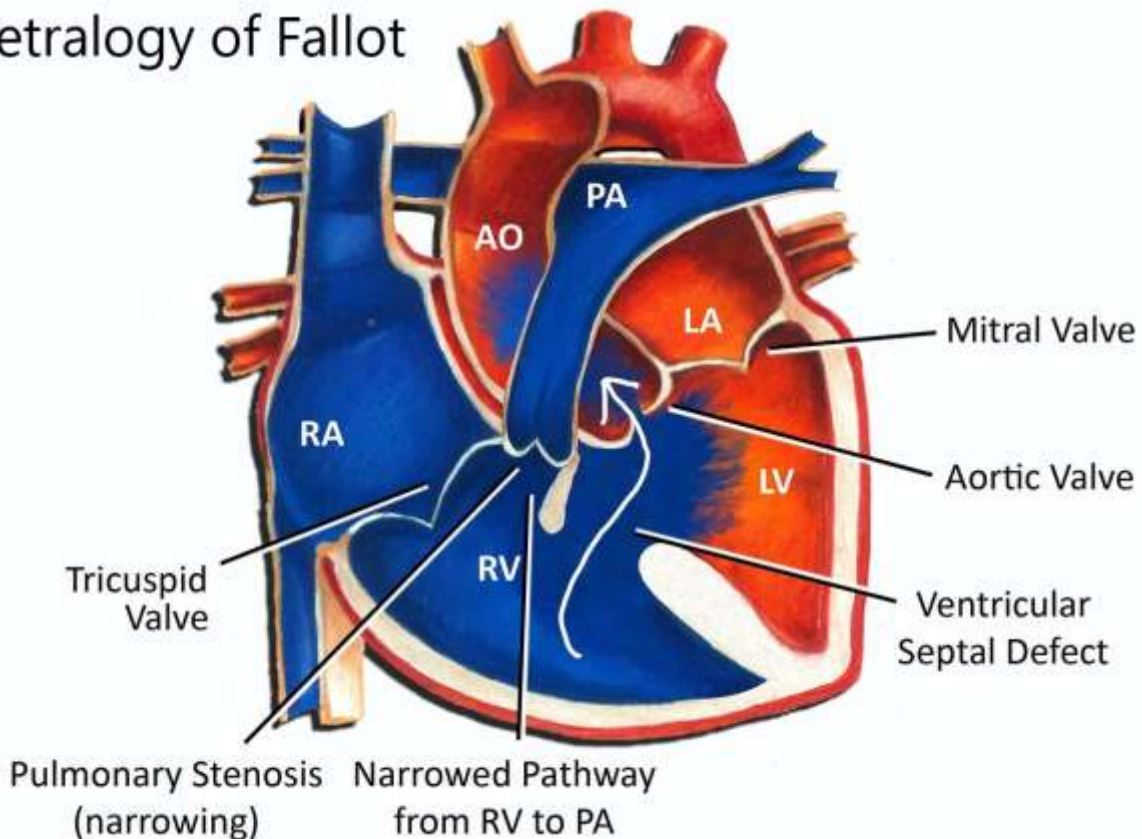
What is the most common Cyanotic Heart Disease?

The most common cyanotic heart disease is called Tetralogy of Fallot. This is a complex congenital malformation however essentially the main problem is a large hole in the interventricular septum. Blood flow through the lungs is also significantly decreased (because of a narrowed pulmonic valve). The consequences are as described above.

Other forms of cyanotic heart disease are very rare. If your pet is diagnosed with an unusual type of cyanotic heart defect, this will be explained in detail by your cardiologist.



Tetralogy of Fallot



What clinical signs are noted in the pet with Cyanotic Heart Disease?

The clinical signs reported by the owner (at least initially) are related directly to the decreased blood oxygen levels. Clinical signs include:

- Weakness, lethargy
- Failure to grow
- Failure to put on weight
- Fainting, collapse
- Intermittent breathing problems (generally made worse with exercise)
- Sudden death

How is cyanotic heart disease diagnosed?

The most important diagnostic test (and the only way to make a definitive diagnosis) is echocardiography (ultrasound). Because these conditions are considered very complex, it is essential this is only performed by experienced veterinarians (and ideally a specialist veterinary cardiologist).



Other tests are sometimes performed in addition to echocardiography however these will not lead to a definitive diagnosis. Blood oxygen content and red blood cell levels are often assessed with a simple blood test.

Are there treatments for Cyanotic Heart Disease?

Unfortunately, in veterinary medicine, definitive surgical correction of cyanotic heart defects is not feasible (in contrast to paediatric cardiology in which heart surgery is routine). Open-heart surgery is necessary which requires complex equipment and skilled personnel. Although a few veterinary centres around the world have some experience with 'open-heart' techniques, the lack of availability, lack of training and expense involved, means for most veterinary patients, surgery is not an option.

Palliative medical treatment is the only option for most small animals with cyanotic heart disease. Some of these medical treatments include:

- Periodic removal of blood (using a normal cannula/catheter) to decrease the number of red blood cells and bring them back into a more normal range. The frequency of this procedure will vary from patient to patient.
- Drugs: certain drugs can suppress the production of red blood cells by the bone marrow (this is sometimes used as an alternative to blood removal).

What about exercise?

It is important your pet continues to have quality of life, therefore completely avoiding exercise is not reasonable.

However, some degree of exercise restriction is necessary in animals with clinical signs that are exacerbated by exercise/exertion (e.g. collapse or breathing problems). Most importantly 'forcing' your pet to do exercise should be avoided. Exercise in hot weather should also be avoided.

What is the prognosis?

The long-term prognosis for animals with cyanotic heart disease is poor. Sudden cardiac death is also a possibility. However, in saying this some pets can live several years with a reasonable quality of life provided red blood cell levels are maintained within the normal range.

Most owners will eventually opt for euthanasia once complications from elevated red blood cells arise. Other owners will immediately proceed with euthanasia following diagnosis after being provided an explanation of the disease and the prognosis.