



Mitral valve repair surgery information sheet

What is Myxomatous mitral valve disease (MMVD)?

Myxomatous mitral valve disease is a chronic degenerative condition that affects the mitral valve.

The mitral valve is located on the left side of the heart, between the filling chamber (the atrium) and the pumping chamber (the ventricle). When the heart contracts, the left pumping chamber pushes oxygenated blood around the body, via the aorta. The mitral valve should act as a perfect seal to ensure none of this blood goes back into the left atrium instead. These valves open and close with every heartbeat approximately 120,000 times each day!

With MMVD, various parts of the mitral valve start to degenerate – the valve edges become thickened and uneven and the chords that act as parachute strings to stop the valve going in the wrong direction (into the atrium), become thickened, stretched and can completely break.

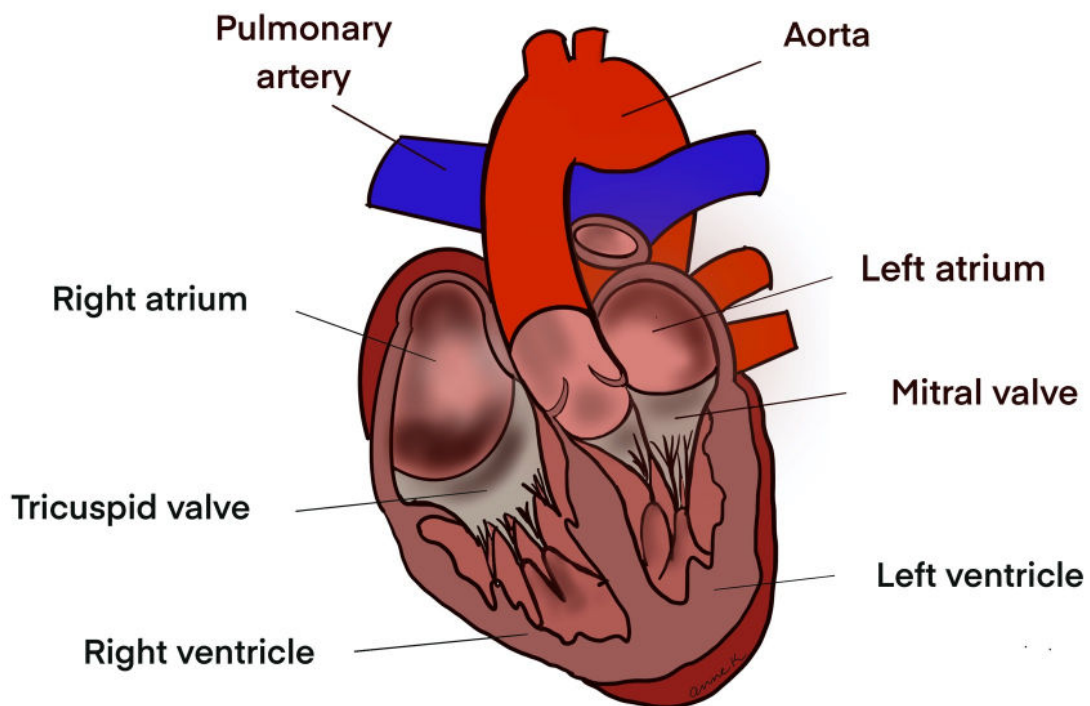


Figure 1. Schematic drawing of the heart showing the four chambers and the mitral valve



These changes result in leakage of blood back into the left atrium, resulting in increased pressure on the heart (the left atrium) and subsequently the lungs, leading to congestive heart failure. As the heart enlarges it also pulls the two sides of the mitral valve further apart. This results in further leakage of blood, further heart enlargement, further gaps between the valve and a vicious cycle.

Stages of MMVD

This disease is classed into several stages and it is important to know what stage your dog is in for management and prognosis. It is important to remember however that not all dogs will enter stage C.

Stage A: this is any dog that is deemed to be at high risk of developing myxomatous mitral valve disease but currently has no structural changes. This sadly includes every cavalier king Charles spaniel, as well as other at-risk breeds.

B1

Valve changes but minimal, minimal/no valve leakage and heart is a normal size. (No heart failure)

B2

Valve changes, some leakage of blood back into atrium, certain criteria met of heart enlargement. No heart failure

C

At least one episode of congestive heart failure has occurred

D

Congestive heart failure is now termed 'refractory' as medications needed to control it have increased beyond certain doses.

For more information on the different stages please see: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6524084/>

Medical management versus Surgical intervention

Medical management

This consists of starting a drug called pimobendan when your dog is diagnosed as being in stage B2 of MMVD (see above). This drug is a common heart medication and used by veterinary surgeons to help delay the onset of congestive heart failure. Pimobendan works by improving the hearts' ability to contract and dilates the surrounding blood vessels, reducing congestion. It is worth noting that not all dogs in stage B2 will enter stage C within their lifetime.



If your dog has reached the stage where congestion on the lungs has happened (congestive heart failure, stage C), diuretic drugs will be prescribed to get rid of the excess fluid.

Myxomatous mitral valve disease can be stabilised and managed initially by medication, but the very nature of this degenerative disease will unfortunately mean a decline once stage C has been entered, requiring more drugs to be added and doses of drugs needing to be increased overtime. Once a patient has had an episode of congestive heart failure, the average life span is around ten to twelve months after this.

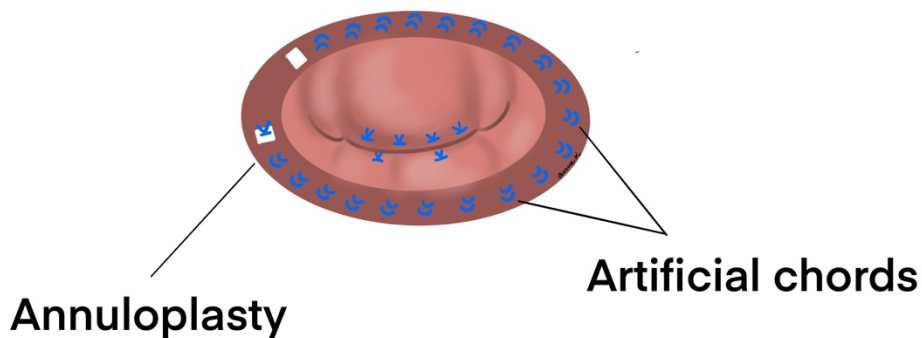
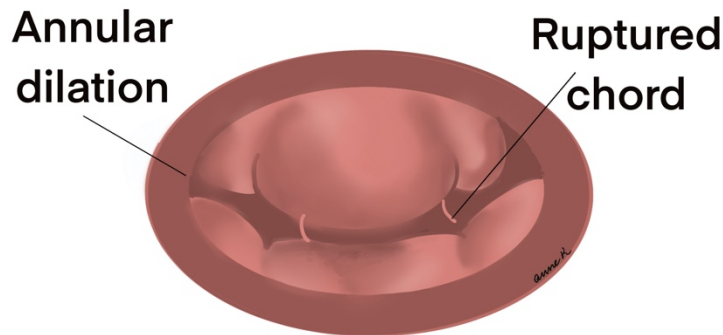
Surgical management

Surgery is the only way to halt the disease process and over time allow the heart and related vessels to remodel and return to a normal (or near normal) size.

The surgery is a repair of the mitral valve and is based on human techniques. It consists of replacing the stretched/ruptured chords that are no longer keeping the valve in its correct plane, and of a procedure called an annuloplasty. An annuloplasty counteracts the expansion of the left atrium which has caused the valve edges to be pulled apart, resulting in gaps and more leakage (regurgitation) of blood. It involves placing a continuous suture (two lines of this), around where the valve leaflets meet the atrium. It is then drawn down, just like pulling the draw string on trousers, until the valve area is back at a normal size. Both of these steps combined will improve the contact between the valve leaflets creating a much better seal, thereby reducing this regurgitation of blood back into the left atrium. This will allow the heart to start to shrink back down to a normal or near normal size.



Before



After

Figure 2. Birds eye view looking down on the mitral valve – in the top image the two valve leaflets can be seen with gaps in them where the heart has expanded due to MMVD. In the bottom image, an annuloplasty has been performed (as well as artificial chords placed), and minimal/no gaps are now present. The bottom image is smaller as the surface area has been reduced by the annuloplasty.

In order to perform the surgery, the heart must be still. Therefore, use of a heart lung machine (cardiopulmonary bypass machine), is required, just like for humans. This will stop the heart from moving during the surgery and remove the blood from the surgical field whilst maintaining perfusion of oxygenated blood to the rest of the body. The heart lung machine is operated by a perfusionist who works alongside our anaesthesia, surgical and cardiology specialists to maintain stability throughout the surgery.



As the mitral valve sits on the left of the heart, the surgical incision is made on the left side of your dog's chest, between the ribs, meaning no bones need to be cut. The ribs are gently spread to allow the surgeon access to the heart.

In order to circulate blood through the heart lung machine, we first make a small incision on the left side of the neck, around 2-3cm in length. The carotid artery is isolated and then the incision between the ribs (thoracotomy) is performed.

When blood is exposed to foreign material, such as the cannulas and tubes needed for cardiopulmonary bypass (CPB) it will form clots. If this was to happen whilst on the CPB machine then blood would stop circulating which would be fatal. Therefore, in order to go on the machine, we need to thin the blood using a drug called heparin.

Once the blood is thinned we place a cannula in the carotid artery (for the arterial system) and a cannula in the tip of the right atrium which is easily reached through our left rib incision. Blood that is unoxygenated (as it is naturally from the right side of the heart), is drained from this cannula into the CPB machine. There it is provided with oxygen, anaesthesia gas is added to it and the temperature of it is changed as needed. It is then pumped through the machine and back into the body via the carotid artery. As the arterial system has no valves in it, the blood pumped into the carotid artery will perfuse all the organs in the body.

A very small cannula is then placed into the aorta, just as it exits the heart. When we are ready to start the valve repair, we place a clamp across the aorta and the perfusionist instils a liquid through the cannula in the aorta – as the aorta is clamped downstream from the cannula, this fluid goes back towards the heart, through the coronary vessels and around the heart. This liquid is called cardioplegia and contains a high dose of potassium which stops the electrical and therefore muscular activity of the heart. This means we can then open it and operate on it to repair the valve.

Potential complications

We talk about four main steps involved in this procedure. The **first** step is getting through the surgery. Risks during surgery include failure of the heart to restart (which is rare in dogs other than those in very end stage of D), bleeding, a drug reaction, and heart rhythm problems. The chance of getting through surgery for a dog in stage C of disease is around 98%.

All being well with step 1, we move to the intensive care unit and wake patients up with additional oxygen supplied to help their lungs, either via an oxygen cage or a specialised high flow nasal oxygen machine.

The **second** step is from this point to the morning following surgery, whilst the body is adjusting and recovering from the surgery. Patients are kept in our ICU under



constant observation and monitoring. Risks include bleeding, clots, heart rhythm disturbances, lung and/or kidney inflammation from the process of the heart-lung machine and disturbances to the body's electrolytes.

The **third** step is from the morning after surgery until the time of discharge from the hospital – typically 6-8 days later. During this time we expect gradual daily improvements. Most dogs will be able to be carried out for a brief walk and some fresh air the morning after surgery and will be offered food and water. It is common to show no interest in food for the first 2-3 days, but the vast majority of patients will start eating by day 3.

During this time the main risk becomes the formation of blood clots. As suture material has been placed inside the heart for the repair, the blood will recognise it as foreign, as described above, and would try to form blood clots over it. If a clot were to form on the repair and dislodge a stroke could occur, or neurological problems to a limb for example. We therefore need to start the patients on blood thinners from the morning after surgery. This is in the form of injections of a different form of heparin which goes just under the skin at the back of the neck for the first 8-10 days. We also start tablet medication with aspirin and another blood thinner called clopidogrel.

The valve is assessed with a heart scan performed by our cardiologists every 2-3 days during the hospitalisation period, mainly to check for clots. The vast majority of dogs will have no problems; however some can form clots despite the medications – if this is the case then the doses are increased. Some, although rarely, can have a bleed due to the blood thinners which can cause neurological and brain signs too.

Heart rhythm abnormalities are also a risk in the short and longer term, although this is very rare and can usually be managed with medication.

All being well, most patients are discharged around day 6-8 after surgery. The **fourth** step is assessing the repair in the medium term to analyse how well the valve is now functioning and to ensure no clots or infections are forming on it. As this is a degenerative condition, depending on the severity of disease, further heart medications may be needed again in the future.

If all goes well, your dog should be living a longer life with importantly, a much better quality of life, than they would otherwise have had without surgical intervention.

Frequently asked questions

Is my dog a surgical candidate?

The cardiothoracic surgical team meets every two weeks to discuss each case enquiry to assess if your dog is a good candidate for surgery.



The criteria that are assessed include age, concurrent disease, full clinical history from your primary care practice and cardiologist, echocardiogram report and videos, recent blood test and current stage of mitral valve disease.

The current stage of disease is very important as we will not currently operate on your dog if they have not yet had an episode of congestive heart failure (Stage C). This is due to the high-risk nature of this procedure, and dogs that are still in the early stages on the disease process (Stage B1 or B2), managed with medication typically lead a very good quality of life and may never enter stage C of disease.

Why is a valve replacement not performed?

In human medicine, valve replacements are inferior to a valve repair for several reasons. Valve repairs preserve the heart function better, they mean the patient doesn't need life-long blood thinning medication and they have higher survival rates in both the short and longer term after surgery.

In dogs, valve replacements have historically been tried however dogs react strongly to these by forming clots over the replacement. As well as increasing the risk for complications such as a stroke, these clots also made the valve replacements stop working.

Therefore currently, valve repairs are the gold standard surgery in dogs as well.

What do I need to do to have my dog considered for surgery?

In most instances your cardiologist will contact us to discuss your dog's case and their suitability for heart surgery. They will provide us with your dog's records and heart ultrasound videos and reports. We also need your dogs medical records from your primary care (GP) vet. We would then contact yourselves if you have passed on permission for us to do so to arrange either an in-person consultation and assessment at our hospital, or a video consultation via Microsoft teams, depending on where you are based.

If you are contacting us yourself then please email us on heart.team@dwr.co.uk and provide the information you will be asked for on return email. Please ask your cardiologist to send us your dog's heart ultrasound report and videos from this, as well as any other tests done via the file system wetransfer.

We will endeavour to get back to you within 5 working days. When initial contact is made and your dog appears to be a suitable candidate based on initial information, we will hold a space for you on our waiting list so please do not worry about missing out if it takes a little time for medical records to be sent and for the consultation to be arranged.



Once the consultation has been done, if you want to go ahead with surgery then we will ask you to let us know via email once you have had time to consider everything. Once you have confirmed this, we will email you back with a provisional date and deposit information. We will also let yourself and your cardiologist know what further tests, if any are required.

This date will be provisional as the waiting list can change based on scheduled dates, staff availability and how critical cases are etc, however the date will be confirmed within plenty of time for you to make any necessary arrangements.

After this stage, whilst your dog is waiting for surgery, we ask for you to keep us updated on her/his progress. When further visits to your cardiologist/primary care vet occur, we ask that you have these records sent to us so we can make sure your dog remains a suitable candidate for surgery and so we can discuss with you any ongoing changes.

How long will my dog stay in the hospital after surgery?

Patients usually stay with us for 6-8 days. During hospitalisation, your dog will be closely monitored including by performing repeat heart scans and blood tests every couple of days. Blood thinning drugs are also transitioned from injections under the skin to tablets over this period of time too. You can visit daily during this time (other than the day of surgery) if you would like to.

What is the success rate?

Several members of our team helped to form the programme that was previously at the Royal Veterinary College and therefore we have a wealth of experience in these surgeries. We will publish success rates at our new hospital on our website every six months. Success rates with Poppy (our head of Cardiac and Soft Tissue Surgery) and Anne (our head of Cardiology), at our last hospital were 88-90% for dogs in stage C to survive to discharge from the hospital. Unfortunately, success rates when dogs have reached stage D will always be lower as the heart is much weaker at that stage, though this stage in particular is a spectrum and we will discuss prognosis with you further during the consultation.

In the long term, there is no data currently to provide you with for long term survival however we are working on this. In the first 60 dogs we operated on with this condition, only 3 that survived out of the hospital died within the first six months. Two of these were due to an infection and the other dog died of a condition unrelated to heart disease. Therefore, the main risk period is the initial 7-10 days. A further risk in the long term would be for an artificial chord to stretch or rupture, resulting in more regurgitation of blood and potentially even congestive heart failure again, though this risk is very low.



As with all procedures we sadly cannot make any guarantees other than that we will always treat your dog with the utmost care possible and as if they were one of our own (which we always feel like they are!).

What happens once my dog comes home?

Follow up visits with us or your regular cardiologist if that is not us, will be performed at 1, 3 and 6 months after surgery, and then yearly thereafter, providing your dog continues to do well. We would ask yourselves and your cardiologist to keep us updated with your dog's progress and send us the heart ultrasound images for us to assess and discuss with you both. Initially, your dog will come home on pimobendan, and two types of blood thinners – aspirin and clopidogrel. At three months after surgery these blood thinners will be able to be stopped. Most dogs stop their pimobendan within the first few weeks to months. Occasionally this is continued longer term.

Other medications are usually not necessarily but if needed could include medication(s) to manage any heart rhythm disturbances as a result of your dog's heart condition (or in rare instances as a side effect of surgery).

Therefore, at three months after surgery, the vast majority of dogs are off all their medications!

You will receive discharge instructions to help you look after your dog when at home and we will always be available for any advice and support needed. Exercise will of course need to be restricted initially with lead walks for the first few months, with the aim to get back to a normal level of exercise at month three.