

Myocarditis and Cardiomyopathy

An introduction to myocarditis

- Myocarditis is an inflammation of the heart's muscular wall.
- It can affect the function and electrical signalling of the heart.
- In some people myocarditis can lead to dilated cardiomyopathy.
- Rarely, myocarditis can also result in sudden cardiac death.
- Most cases of myocarditis are mild and self-limiting.

What is myocarditis?

The heart wall has three layers:

- **pericardium** – the fibrous 'sac' that surrounds the heart;
- **myocardium** – this is the middle muscular layer;
- **endocardium** – the inner lining of the heart.

Myocarditis is an inflammation of the heart's muscular wall (the myocardium). It can affect how well the heart works, causing problem with function but also electrical signalling. The heart may pump less effectively and there may be abnormal heart rhythms (arrhythmias).

Who gets myocarditis?

Myocarditis can affect anyone, at any age, and can happen in people with no history of illness. Most commonly however, myocarditis affects young men.

What causes myocarditis?

There are many possible causes of myocarditis, but the most common cause is a viral infection.

- **Viral infections** – including viruses that cause the common cold, flu, COVID-19, chickenpox, glandular fever and German measles.
- **Vaccination** – rarely, myocarditis can be caused by certain types of vaccine. This newly recognised cause of myocarditis is poorly understood at present.
- **Bacterial infections** – such as staphylococcus (sometimes called 'staph'), streptococcus (sometimes called 'strep') and the bacteria that causes Lyme disease (transmitted by ticks).
- **Parasitic infections** – such as toxoplasma (found in cat faeces) and Trypanosoma cruzi (in tropical countries this can cause a condition known as Chagas disease and is transmitted by insect bites).
- **Fungal infections** – including moulds, yeasts and fungi.

- **Allergic reactions** – to medication (such as some antibiotics and anti-epileptic drugs) and recreational drugs (such as cocaine).
- **Cancer treatments** – including some chemotherapy agents and radiotherapy.
- **Immune conditions** – myocarditis can be associated with autoimmune conditions (where the immune system is overactive and attacks healthy cells and organs) such as lupus. Giant cell myocarditis (a rare condition where some cells in the heart grow abnormally big) is another example.

It may not be possible to confirm the exact cause of myocarditis. When a cause can't be found, this might be referred to as 'idiopathic' (or unknown) myocarditis.

What are the symptoms of myocarditis?

Not everyone with myocarditis will have symptoms. Some people feel generally ill or under the weather, and have 'viral' symptoms such as tiredness, muscle aches, a sore throat or a headache. However, other people have more severe symptoms, which are usually the following:

- **Chest pain** – which can feel very similar to the pain of a heart attack.
- **Palpitations (feeling your heart beating too fast or too hard like it is 'fluttering')** – this is caused by abnormal heart rhythms ('arrhythmias') where the heart is beating too fast or erratically because the electrical messages which control the heart's rhythm are disrupted.

Does myocarditis get better?

Most people with myocarditis recover completely (either with or without treatment) and have no lasting symptoms or complications. For example, if it is caused by a viral infection, the myocarditis may get better as the person's immune system fights the infection and they recover from the virus. Doctors may suggest avoiding strenuous activity and exercise



for some months to avoid strain on the heart and help it to recover. This is particularly important if you play sport competitively.

However, some people will have ongoing symptoms or suffer complications, which can vary in how severe they are.

Complications

Severe myocarditis can cause permanent damage to the heart muscle and cause the following complication:

- **Stroke** – there can be an increased risk of stroke following severe myocarditis. This is because when the heart is not able to pump effectively, blood can pool in the chambers of the heart and form blood clots. These clots can leave the heart and can get trapped in other blood vessels, such as in the brain (causing a stroke).

Arrhythmias

In atrial fibrillation (AF) the electrical messages that normally cause the heart muscle to contract are disrupted. This means that the top chambers of the heart (atria) beat very quickly and are uncoordinated, making the flow of blood 'turbulent' and the heart less efficient at pumping. These uncoordinated messages can also be transferred to the lower chambers of the heart (the ventricles). This can cause a fast and irregular heart rhythm. The turbulent flow of blood can also increase the risk of blood clots forming, which can increase the risk of a stroke.

In ventricular fibrillation (VF) the contraction of the lower chambers of the heart (ventricles) is uncoordinated and they 'quiver' rather than contract normally. This means that blood is not pumped out of the heart at all. This is life-threatening (it is known as 'cardiac arrest') and needs emergency treatment (CPR and defibrillation).

Myocarditis and cardiomyopathy

Myocarditis, particularly when it is caused by a viral infection, can cause dilated cardiomyopathy. When this happens, the person usually experiences symptoms of heart failure.

Heart failure is a term used to describe when the heart isn't pumping well enough and needs support to meet the needs of the body. It can cause the following symptoms:

- **Breathlessness** – fluid builds-up in the lungs, making it harder to breathe. This might happen

when doing activities, but in more severe cases it can happen even when resting.

- **Tiredness** – as the heart function is reduced, less energy is delivered to the tissues, causing tiredness.
- **Ankle and abdominal swelling** – fluid can build up in these tissues ('oedema'), because the heart isn't pumping effectively to remove it.
- **Heart failure** – can also cause palpitations, dizziness and fainting.

See our information sheet 'about heart failure' or 'dilated cardiomyopathy'.

Myocarditis and dilated cardiomyopathy

It is not clear why in some people myocarditis leads to dilated cardiomyopathy. It may be that the immune response that usually protects the body from infection can cause damage to the heart. This may involve cells from the immune system (such as T- lymphocytes) or the proteins (cytokines) they produce. Uncontrolled viral replication (reproduction) can also lead to heart damage through cell death (necrosis) and scar formation.

How is it diagnosed?

There are several tests that can be used to diagnose myocarditis. They are not all required to make a diagnosis and some hospitals may not have direct access to all these tests. These may include:

- **Physical exam and medical history** – to see what physical symptoms are happening and what may be possible causes of these symptoms.
- **Blood tests** – these look for evidence of inflammation, infection and for damage to the heart muscle.
- **ECG (electrocardiogram)** – this looks at the electrical activity of the heart and how the spread of electrical messages pass through the heart muscle. It is also used to see whether arrhythmias are happening.
- **Chest X-ray** – this looks at the size and structure of the heart (to see if it is enlarged) and whether there is fluid in the lungs (a symptom of heart failure).
- **Echo (echocardiogram)** – this is a type of ultrasound scan that uses sound waves to create images of the heart. An echo looks at the structure of the heart and how it is working. It can be used to see if the heart is enlarged or has fluid around it.
- **MRI (Magnetic Resonance Imaging) scan** – this scan produces high quality images and is used to look at the shape and structure of the heart. It has become a very important test for myocarditis



because it can also detect inflammation and scar tissue in the heart muscle.

- **PET (Positron Emission Tomography) scan** – this scan uses radioactive dyes to create images of the body and looks for evidence of inflammation. This is usually combined with a CT or MRI scan.
- In some cases an **endomyocardial biopsy** is performed. This is where a small piece of heart muscle is removed using tubes inserted in the wrist or leg to look for the presence of immune cells or signs of infection. This is usually only done if the other tests are not able to identify the cause of your symptoms. It is an invasive test performed in a special type of operating theatre (a catheter lab). Invasive tests are associated with safety risks and so this test is less commonly used than the non-invasive tests listed above.

How is it treated?

As myocarditis often gets better on its own, not everyone will need treatment. However, what treatment might be used depends on what symptoms the person has, how unwell they are, and the cause of their myocarditis.

Treating the cause

If the cause of myocarditis is known, treatment may be given for this. For example, drugs that affect the immune system (such as steroids and immunosuppressants) may be used when there is evidence of excessive inflammation or autoimmunity.

Treating non-heart related symptoms

Symptoms such as a high temperature may be treated with over the counter medications such as paracetamol.

Treating heart failure

Treatment of myocarditis can involve therapies used for heart failure. Depending on symptoms and how weak the heart is, treatment might include the following:

- **Beta blockers** – slow down the heart rate and control arrhythmias
- **ACE inhibitors (Angiotensin-Converting Enzyme inhibitors) / ARBs (Angiotensin II Receptor Blockers)** – relax and open blood vessels, which makes pumping blood easier and takes strain off the heart. They can reduce blood pressure and control and prevent worsening of heart failure symptoms. ARBs are used when ACE inhibitors are

not suitable due to side effects.

- **ARNI (Angiotensin Receptor-Nepriysin Inhibitors)** – these are similar to ARBs but are more powerful.
- **Mineralocorticoid inhibitors** – improve pump function and help reduce water retention.
- **SGLT2 inhibitors** – these are diabetes drugs that have been shown to improve outcomes for patients with heart failure.
- **Pacemakers** – a surgically implanted device that can treat abnormal heart rhythms and improve the pump function of the heart.
- **Diuretics (water tablets)** – help to reduce water retention by encouraging the kidneys to produce more urine. They may not be needed once the other treatments (above) start to work.
- **Anticoagulants** – may be used to prevent blood clots forming. They are often used in people with atrial fibrillation – as the uneven flow of blood through the heart could cause a clot to form.

In some cases where the heart is very weak and unable to work without support, a ventricular assist device (VAD) or other types of mechanical circulatory might support might be used. VADs are artificial pumps that assist the heart to pump blood from the lower chambers (ventricles) of the heart around the body. This may be a temporary measure while the heart recovers.

In very severe cases, a heart transplant may be needed if the heart failure is so severe that it can't be treated with medication or devices. This involves removing the failing heart and replacing it with the heart from a donor. Very occasionally, myocarditis can recur in the donor heart.

We are here for you

At Cardiomyopathy UK we offer help and support for you and your family. We have information about each type of cardiomyopathy as well as diagnosis, treatment and lifestyle issues. Look on our website or call us for more information. Call our helpline to talk to our cardiomyopathy support nurses. We can put you in contact with other people affected by cardiomyopathy through our support groups, support volunteers and social media. Contact us for more about our services, or look online - www.cardiomyopathy.org

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Send your feedback to contact@cardiomyopathy.org

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