Valvular heart disease

Characteristics, diagnosis, and treatment

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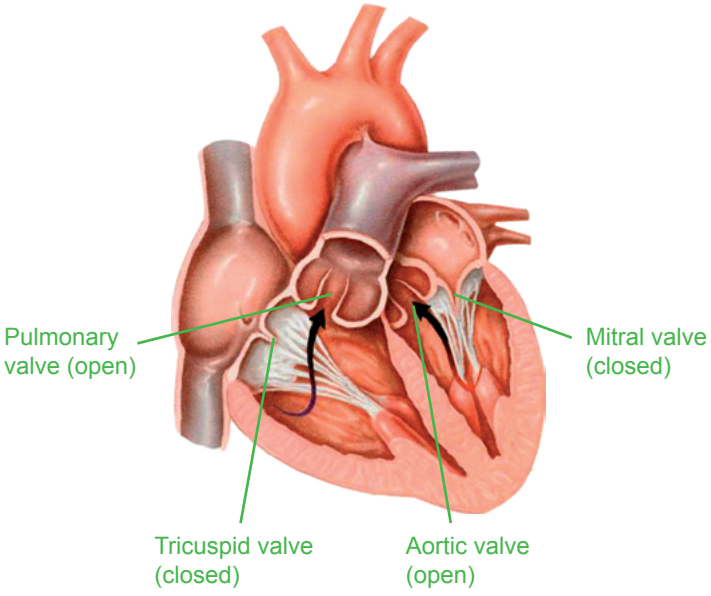
Valvular heart disease or valvulopathy

This refers to all disorders affecting the heart valves.

Heart valves are flexible structures which separate the four chambers of the heart. There are two valves on the left side of the heart (mitral and aortic) and two valves on its right side (tricuspid and pulmonary). These have the unique role of preventing blood from flowing backwards (by acting as «non-return valves»).

Sometimes one or more of these valves do not function properly. They can be affected by two types of condition:
• **narrowing (or stenosis):** where the opening is too small and slows the flow of blood;
• **leakage (or insufficiency):** incomplete closure of the valve causing leaks and back-flow of blood.
These two lesions can affect the same opening, thus constituting valvular heart disease.



The most frequent valvulopathies

To date, the most frequently encountered valvulopathies in adults are aortic valve stenosis and mitral valve insufficiency.
Other valvulopathies include aortic insufficiency, tricuspid insufficiency and mitral valve stenosis.
Pathologies affecting the pulmonary valve are rare.

What are the causes?

The causes differ depending on the type of valve affected:

- age-related degeneration (aortic stenosis, mitral insufficiency, aortic insufficiency);
- congenital abnormalities (i.e. from birth);
- Rheumatic heart disease or RHD (mitral stenosis, tricuspid stenosis), birth deformations;
- infections or inflammations (i.e. endocarditis) can involve all heart valves;
- diseases which affect the heart muscle (caused by infarction or heart failure for example) may lead to abnormal valve function.

How does a valvulopathy progress?

Left untreated, a valvulopathy will lead to dilation of the atria and/or ventricles as a consequence of the increase in heart workload. Symptoms include shortness of breath due to increased lung pressure (pulmonary oedema), light-headedness, fainting, palpitations, episodes of heart failure.

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How is a valvulopathy diagnosed?

- **Signs:** shortness of breath, initially upon exertion and subsequently at rest, angina or loss of consciousness (aortic stenosis), palpitations, pulmonary oedema, heart failure.

- **Auscultation:** detection of stenosis or regurgitation murmur, irregular heartbeat.

Sometimes, the **absence of symptoms** is not inconsistent with the severity of the disease.

- **A cardiac echocardiogram provides an accurate diagnosis.** It is either performed with a probe positioned on the thorax (transthoracic ultrasound) or introduced through the oesophagus, under local anaesthesia (transoesophageal ultrasound)

  Cardiac ultrasound :

identifies whether the valvulopathy is due to, stenosis or insufficiency,
- measures the valve surface,
- estimates the extent of the insufficiency,
- determines the impact of the valvulopathy on the capacity of the heart muscle to contract and the ability of the chambers to dilate.

The criteria to determine whether surgery is appropriate or not are extremely specific and are based on well-defined measurements.

Once the indication for surgery has been established, the assessment will be completed:

• by coronary angiography

Carried out as part of the preoperative assessment of a valvulopathy, coronary angiography is an invasive examination enabling,visualisation of all the coronary arteries, detection of areas of narrowing caused by atheroma plaque and if necessary, a decision to be made regarding the need for therapeutic action.
The examination takes place in a specifically equipped radiology room, and necessitates the injection of a contrast agent, which is opaque to X-rays, and makes it possible to visualise all the coronary arteries.

As with any invasive procedure, coronary angiography comprises some risks, albeit very low, of which the patient should be aware:

- allergic complications;
- complications at the needle puncture site.
- heart and vascular complications.

As an indication, a study on a large series of patients, published in a medical journal
determined a risk of death of 0.8/1000, a prevalence of neurological disturbances (including paralysis) of 0.6/1000 and a frequency of myocardial infarction of 0.3/1000. Other, less severe complications have been reported with frequencies of less than 1%.

Refer to the "coronary artery diseases" information sheet for more details.

• in some cases, by coronary CT-scan

In young patients, coronary arteries can be visualised with a CT-scan, thereby circumventing the need for angiography, but only if the coronary arteries are strictly normal.

The scan also enables us to visualise the shape and size of the aorta as it exits the heart, in cases of associated aortic valve damage (aortic aneurysm).

Refer to the "CT-scan" information sheet for more details.

• by cardiac magnetic resonance imaging

This imaging method has been in operation at the Cardio-Thoracic Centre of Monaco since 2002, and provide an accurate analysis of the cardiac muscle to detect fibrosis or evidence of a previous infarction.

Refer to the "MRI" information sheet for more details.

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What are the current treatment options for valvulopathies?

Depending on the extent of valve degradation, the impact on the heart muscle and the signs after medical treatment, a more invasive treatment option may be necessary:
• surgery (to repair or replace the valve),
• or, in some cases percutaneous treatments (mitral valvuloplasty, Transcatheter Aortic Valve Implantation or TAVI).
Surgery remains the standard treatment for valvular heart disease.

1 - Surgical treatment

If surgery is feasible, it may include:
• valve repair (of the mitral, tricuspid and in some cases the aortic valve);
• or the replacement of the valve either with a mechanical or a tissue-based prosthesis.

Valve repair

Valve repair is the preferred treatment option for mitral insufficiency, whenever feasible.

• **Mitral valvuloplasty** can be used to treat **mitral insufficiency:** it repairs valve anomalies whilst preserving the native valve (i.e. plastic surgery inside the heart). It can correct abnormalities of the papillary muscle, the leaflet, the annulus and is always accompanied by the placement of a prosthetic ring to correct deformation of the mitral orifice.
• **Commissurotomy** (incision at the base of the Fused commissures) this repair is performed exclusively to correct **mitral stenosis resulting from rheumatic heart disease (RHD)**, when the valve is flexible, heart rate regular (sinus rhythm), and preferentially in children or women of childbearing age.
• **Repair of the tricuspid valve** to correct **functional tricuspid insufficiency** caused by dilation of the right ventricle.
• In some **cases of isolated tricuspid insufficiency** where the repair surgery is a genuine **plastic surgery procedure to enlarge one of the valves.**
• Finally, the **aortic valve**, in the context of an aneurysm in the ascending aorta, can in some cases also be **repaired**.

Valve replacement

Prosthetic valves can be fitted to the aortic, mitral and more rarely tricuspid apertures. It is possible to replace two or even three heart valves.

Treatment option and valve choice (mechanical or tissue-based) are dependent on a number of criteria and decided upon in consultation with the patient:
• patient's age,
• the presence or absence of an irregular heartbeat requiring anticoagulation therapy
• the feasibility and risks associated with long-term vitamin K antagonist based anticoagulation therapy,
• the condition of the heart muscle,
• the patient's lifestyle.

Mechanical valves are made of pyrolytic carbon with two discs that swivel on an axis.

They have the advantage of being durable, but **disadvantage of requiring an anticoagulation treatment for life,** with the associated risks of haemorrhage when treatment is too effective, or of thromboembolism (formation of a clot) when it is ineffective.

Tissue-based or bio-prosthetic valves consist of a Dacron® coated framework, which either holds in place a pig's aortic valve or a valve made from calf pericardium. A ring lined with silicone padding allows the bio-prosthetic valve to be fitted to the patient's valvular annulus.

The main advantage of bio-prosthetic valves is that they do not require long-term anticoagulation therapy, in the absence of total cardiac arrhythmia.

Bio-prosthetic

These valves do however deteriorate over time and need to be replaced, on average, every fifteen years.

Bio-prosthetic valves are favoured in individuals aged 60 to 65 or older, in women wishing to conceive and in particular in cases where a contraindication exists or effective and correctly monitored long-term anticoagulation treatment is not feasible.

However, they can be fitted to individuals under 50, who are active, with a heart in good condition and who refuse long-term anticoagulation treatment, but who agree to the high likelihood of repeat surgery within 15 years of the first operation..
Bio-prosthetic valves degrade more slowly in older patients.

Bio-prosthetic Magna-Ease Carpentier Edwards®

Before the procedure

On admission, you will provide your doctors and nurses with all the medical documentation relating to your condition (X-rays, electrocardiogram, stress test and laboratory test results...).

A full laboratory test will be carried out and our **healthcare team will explain the preoperative preparation protocol** to be followed, (showers and oral care), **to prevent infection**. Body hair will be carefully removed from the incision area before disinfection.

What does the operation entail?

It is performed under general anaesthesia.

Several techniques and access routes can be used depending on the patient's pathology and state of health:
Most frequently, an incision is made in the middle of the sternum (sternotomy) or a mini sternotomy (aortic valve).
Finally, endoscopic minimally invasive surgery: this is a method whereby an incision is made to insert trocars in order to facilitate viewing, aspiration and the passage of instruments.

These various techniques are carried out under extracorporeal circulation making it possible to isolate the heart and facilitates cardiac surgery in a "dry" operative field. During the operation, the heart muscle is protected by local and systemic hypothermia and stopped by cardioplegia.
The surgical procedure lasts several hours, depending on the complexity of the case.

Your stay in the intensive care unit

Following surgery, **patients are admitted to the intensive care unit, for approximately 48 hours.**
Assisted breathing by way of a ventilator is maintained for the first few hours and then gradually removed, by withdrawing the tube from the trachea.
Medications are prescribed to relieve pain and intravenous fluids are administered to maintain hydration.
Temporary drainage tubes (chest drains) are left in place for a few days, to divert serous fluids and blood from the wound. A small percentage of patients may require a blood transfusion.

Eating can generally be resumed the day after the operation.

Returning to your room

Most patients will obtain consent from the medical staff to get up and stroll around 48 hours post-surgery. Regular physiotherapy sessions will help you regain functional autonomy and recover respiratory functions. Patients are continuously monitored by ECG (telemetry).

What are the risks of heart valva surgery ?

Heart valve surgery is a procedure which, like all other surgical procedures, is associated
with an inherent risk of morbidity/mortality, which is taken into account by the medical team (cardiologist, surgeon and anaesthetist) and very much depends on the patient's heart condition and general state of health. Such complications may be of an intra- or peri-operative nature.
Some complications, such as heart rhythm disorders (arrhythmia, bradycardia) may require the fitting of a pace-maker; other, less frequent complications include post-operative infections (less than 2% in the Cardio-Thoracic Centre of Monaco's experience) or neurological complications (less than 1.5%).
These risks, about which the patient and their family are advised, are specific to each patient
and every pathology. These risks are however, significantly lower than the risks involved in letting the disease run its natural course, resulting in surgery needing to be proposed.

What happens once you have been discharged ?

Upon discharge, you will either return home or most often be admitted to a specialised rehabilitation centre, depending on your condition and/or your personal preference.
Generally speaking, physical recovery is fast. Driving and sexual activity can be resumed within 4 weeks.

The main limiting factor to resuming normal activities is the healing of the sternum. Like any bone fracture, this can take between 6 and 12 weeks to consolidate. Any activity likely to put pressure on the chest during this period of time is prohibited.

Returning to work

This depends on the speed of your recovery and the physical and stressful nature of your profession. Your surgeon and referring cardiologist will help you determine when you will be fit to enough to return to work.

Do you need to follow a rehabilitation program ?

A cardiac rehabilitation program can help monitor progress and expedite the resumption of a normal active life. General guidance and, recommendations will be given to you regarding beneficial lifestyle changes : diet, weight loss and level of physical exercise or sports activity to attain.
During this period, you will be taught about your anticoagulation treatment and how to live with a prosthesis.
Depending on the condition of your heart and your overall health, the cardiologist and surgeon will help you implement this rehabilitation program.

Long term follow up of patients fitted with valve prostheses

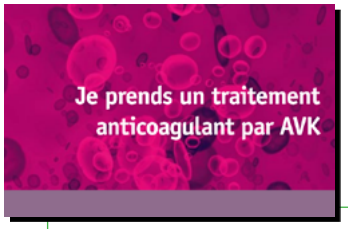
In most cases, replacement of the damaged valve leads to significant improvement, in particular reduced or eradicated breathlessness upon exertion.

Regular check-ups are crucial, by:
- **your general practitioner,**
- **your cardiologist,**
- **your dental surgeon.**

> Your GP should be consulted every two to three months to check:
- auscultation of your prosthetic valve,
- the absence of anaemia,
- the absence of an infected site,
- the effectiveness of the anticoagulation treatment.

> Your cardiologist should be consulted every six months to complete your GP's assessment with an electrocardiogram and echocardiogram. Should a potential prosthesis dysfunction be suspected, further tests may be required (cardiac MRI, echocardiography…).

> You should get your teeth checked every six months, as a matter of routine, and ensure that antibiotic treatments are prescribed for any dental care associated with an increased risk of infection. Mention your anticoagulation treatment to your dental surgeon.



Inform your health professionals about your anti-coagulation treatment !

Anticoagulation treatment

Anticoagulation treatment consists of a vitamin K antagonist (Sintrom®, Previscan®, Coumadin® …):

- It is systematic and for life in patients fitted with mechanical valves;
- it is also taken for the first three months, following placement of a valve bio-prosthesis or mitral valvuloplasty;
- in the event of arrhythmia, the treatment will only be discontinued once the arrhythmia has been treated.

In cases of mechanical valve replacements, anticoagulation treatment should not be interrupted under any circumstances.

> It is monitored by measuring INR *(International Normalised Ratio) and maintained*:

- between 2 and 3 in cases of arrhythmia, tissue valve replacements or valvuloplasty,
- between 3 and 4 for a mechanical mitral valve.

Initially, **INR is checked every 8 days**, then every 15 days at the beginning of treatment, and subsequently every month, if the treatment appears to be stable. If INR results are unstable, more frequent tests are necessary. Similarly, if the vitamin K antagonist dose is adjusted a repeat test is required a few days later. **The dosage schedule and the test results are recorded in a diary to monitor** the effectiveness of the anticoagulation therapy.

> Overdosing may cause signs of haemorrhage: prolonged bleeding after shaving or after brushing your teeth or if you bruise easily. A repeat blood test is necessary to determine if the current dose of medication should potentially be reduced.

> Some medications should not be taken concomitantly, as they increase the potency of anticoagulation drugs (e.g. tetracyclines, aspirin, anti-inflammatories); while others may decrease it (barbiturates).

> No intramuscular injection should be administered to a patient on anticoagulation therapy.

> Some foods can affect your anticoagulation treatment. In practice:

- do not consume more than one portion of foods rich in vitamin K per day (tomatoes, lettuce, spinach, cabbage, broccoli,…);
- avoid alcohol.

Prevention of infectious endocarditis

Infectious endocarditis is a potential complication which occurs when bacteria colonise the prosthetic valve.
This may produce a fever (not necessarily a very high temperature) which is sustained over an extended period of time. This type of complication should **always be taken very seriously, as it can lead to heart valve deterioration.**

A previous **dental infection** is often the precursor of this type of infection.

To minimise the danger of infectious endocarditis:

> be aware of and inform your physician if you have any episode of fever;

> treat all types of infections appropriately, however small: tooth, lung, rhino pharyngeal, urinary tract or skin infections;

> take **preventive antibiotic treatment subsequent to any invasive procedure, specifically any dental procedure, which is at risk of infection.** Inform your dentist about your heart disease;

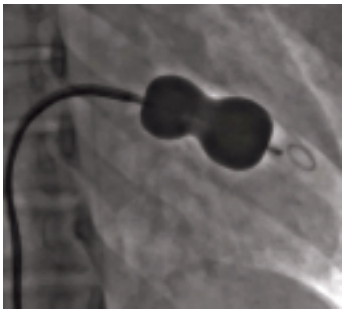
> be rigorous about your oral hygiene and **maintain your teeth in perfect condition.**

Valve protheses are not entirely perfect and require regular check-ups, most often permanent and appropriate anticoagulation treatment as well as a range of measures to prevent infectious endocarditis. Valvular protheses do however facilitate the resumption of a normal life and completely normal socio-professional activities, for patients who undergo surgery in time before the cardiac muscle has incurred irreversible damage.

2 - Specific cases

Percutaneous mitral valvuloplasty

In cases of **mitral stenosis** following acute rheumatic heart disease (RHD) in young patients, with a flexible valve and with regular sinus rhythms a percutaneous mitral valvuloplasty can sometimes postpone surgery for several years. **Conditions treated with this approach must fulfil very specific and limited criteria.**



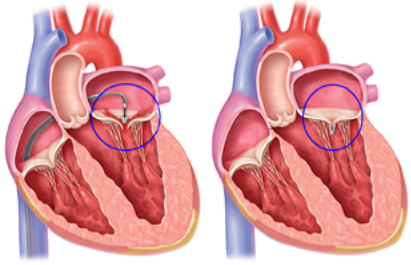
Mitral valve dilatation

Treatment of certain mitral regurgitations using a percutaneous approach with the Mitraclip® system in high risk surgical or inoperable patients.

This technique is designed for patients unable to undergo mitral valve surgery, which is the standard treatment, who suffer from severe mitral valve leakage (grades 3 and 4). It involves the placement of a clip introduced through the femoral vein, which approximates the mitral valve leaflets so that the defect closure can be reduced.

In order to validate its indication and feasibility, a preoperative assessment is carried out. This includes a transoesophageal echocardiogram during which various anatomical measurements of the heart are recorded. This may be completed by a thoracoabdominal CT scan and a coronary angiography.

The procedure is carried out under general anaesthesia in a hybrid operating theatre in the presence of interventional cardiologists, an anaesthetist, the heart surgeon, and a sonographer, who guides the cardiologists throughout the procedure.



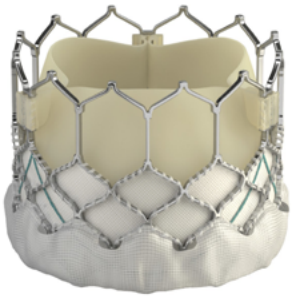
Setting up the clip

Once the clip has been positioned, residual leakage is assessed by ultrasound. If necessary, conventional surgery may be carried out at any time without the need to move the patient.

Transcatheter aortic valve implantation (TAVI)

This technique is an alternative for patients at high surgical risk or inoperable, suffering from severe aortic stenosis. These patients are often elderly or have already undergone surgery.

Preliminary tests are carried out before the procedure, including an electrocardiogram, a chest x-ray, and a CT coronary angiogram, the aim of which is to ascertain the feasibility of this technique, as well as determine the best approach and the size of valve to be implanted. This alternative to valve surgery enables us to replace the damaged valve with a bio-prosthesis under sedation or general anaesthesia.



The Edwards-Sapien 3 valve

Two techniques are possible:

- **by cardiac catheterisation,** during which the valve is inserted into the heart through the femoral artery,
- **or** through **trans-apical** access via a minimal incision underneath the left breast at the level of the apical tip of the heart.

The procedure is performed in what is known as a “hybrid” angiography room/operating theatre where, if necessary, conventional surgery can be carried out at any moment with no need to move the patient.

For more information, refer to the “Implantation of a percutaneous artificial aortic valve” information sheet.

References
French Society of Cardiology
French Federation of Cardiology