

Information for Patients & Families

Ross procedure for aortic valve replacement

This information leaflet has been written to help you understand more about the Ross procedure to replace the aortic valve. It will give you general information about the operation, its benefits and how it compares to alternative procedures. We hope this answers some of the questions or concerns you may have. It is not intended to replace talking with medical or nursing staff. Further details, including the risks and benefits involved in the surgery will be discussed in full during the consent process.

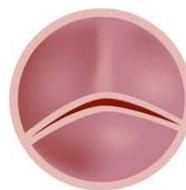
What is the aortic valve?

The heart is divided into a left and a right side with two heart valves on each side. Their purpose is to prevent the backflow of blood through the heart as it pumps the blood forward through the circulation. The aortic valve sits on the left side of the heart and guards the outlet of the main pumping chamber of the heart, which is the left ventricle. When the heart pumps, blood flows out through the aortic valve into the main blood vessel in the body, the aorta, which supplies blood to all the organs. On the right side of the heart, sits the pulmonary valve which guards the flow between the right pumping chamber of the heart and the artery to the lungs.

The aortic valve is made up of three leaflets that meet in the centre of the valve when the valve closes. Although the majority of the population will have an aortic valve with three leaflets (a trileaflet valve), approximately 2% of people will have two leaflets that close together otherwise known as a bicuspid aortic valve (see diagram below). This is a congenital variation which means people with this sort of valve will have been born with it. People with a bicuspid aortic valve may develop problems with their aortic valve at a younger age than people with a trileaflet valve, however, this is highly variable.



Normal tricuspid valve



Bicuspid aortic valve

The aortic valve sits within the first part of the aorta called the aortic root. This provides structural support to the valve leaflets as they open and close. The two coronary arteries (the blood supply to the heart) arise from bulging areas in the aortic root called the aortic sinuses very close to the valve.

Problems related to the function of the aortic valve may arise from irregularities involving the leaflet tissue, the aortic root that supports the valve leaflets or a combination of both. These problems can result in either valve narrowing (stenosis) or a valve leak (regurgitation). The Ross procedure is usually offered to valves with predominant narrowing.

Why might the aortic valve need intervention/surgery?

If the valve narrowing or leak becomes severe enough to cause symptoms or have an impact on the strength or the size of the heart muscle, then intervention/surgery on the aortic valve may be necessary. People may be monitored for many years with malfunctioning valves before they reach the verge at which corrective surgery becomes beneficial. The commonest procedure currently is valve replacement with an artificial prosthesis.

What are the commonest prosthetic valve types?

Prosthetic aortic valve replacements are an excellent solution in many patients with aortic valve disease. The procedure is done under general anaesthetic and with the aid of a heart-lung bypass machine (open heart surgery). The aorta above the root is opened, the valve leaflets are cut out, and the new prosthetic valve is sutured in place. The majority of cases do not need the aortic root to be replaced as well.

There are two main sorts of replacement heart valve; mechanical and tissue but there is a degree of compromise associated with each. These include the requirement for a lifetime of blood thinning medication (warfarin) for *mechanical valves* versus the life-span or amount of time the valve lasts for with *tissue valves* and as a result of this the potential for further operations down the line.



Tissue valve and mechanical valve

Tissue aortic valve replacements are made of animal tissue (usually cow or pig tissue) and are also known as bioprosthetic valves. These valves have a limited durability especially in individuals younger than 60 years. Whereas a bioprosthetic valve would be expected to last for 15 years or more in patients older than 60 years of age, it would wear out faster in younger patients. This process is called 'valve degeneration' and is quicker the younger the patient's age is. This would require a repeat operation to extract the old valve and implant a new one in its place, or a procedure to implant a catheter delivered valve within the old valve in patients who cannot withstand a second operation. The risk of a repeat operation in a 40 year old is around 80%.

Although these valves are natural, but blood clots can sometimes still form on these valves which can lead to distant blood vessel occlusion such as stroke. (1%/year)

Mechanical valves are made of metal and carbon and because blood clots form more easily on these valves that could potentially block the metal mechanism or cause a stroke, these valve replacements require lifelong warfarin. They also produce a clicking noise with every heartbeat.

However, mechanical valves do not wear out like tissue valves do. They are therefore more durable. To avoid repeated operations in younger patients mechanical valves have traditionally been the preferred option in this age group. However, the warfarin requirement in this instance may conflict with plans for pregnancy in women and cause lifestyle or

occupational adjustments in all patients. There is also an increased risk of bleeding episodes with Warfarin (1%/year).

Despite their robust construction mechanical valves are not entirely without a risk of reoperation either. This can be due to infection of the valve (which can happen to any artificial medical device), tissue growth around the valve or clot formation. The likelihood of this within a person's lifespan is around 10%.

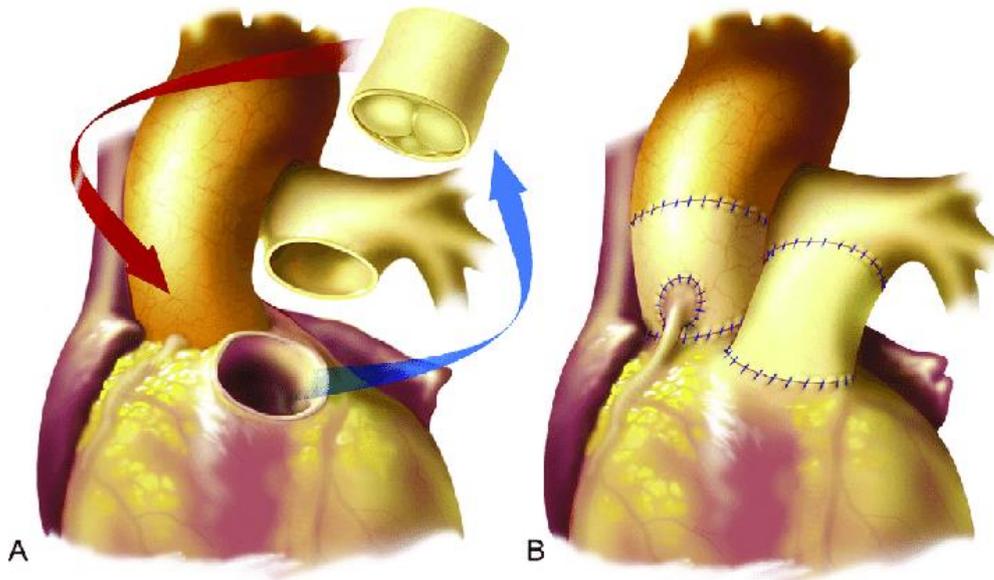
Both valves carry a small risk of infection on the long run called endocarditis.

On the whole, prosthetic valve replacements are technically easier to implant and are a good option but come with long-term complications which are more pronounced the younger the patient.

What is the Ross procedure?

The Ross procedure is an alternative operation for aortic valve replacement using the patient's own pulmonary valve and root to replace the aortic valve and root. This pulmonary valve and root is called the 'autograft'. The pulmonary valve is then replaced with either a donor pulmonary valve and root from a cadaver (called a homograft or allograft) or a conjoined bioprosthetic vascular conduit to restore continuity on the right side of the heart.

Therefore it is a procedure which addresses 2 valves to treat 1 valve. It is more technically challenging and takes longer to do than conventional prosthetic replacement, and it involves doing a root replacement and re-implanting the coronary artery origins rather than just a valve replacement.



What are the advantages of the Ross procedure?

There are many advantages to the Ross procedure over conventional prosthetic valve replacement especially in younger patients:

- There is no need for blood thinning medication (anticoagulation). There is no requirement for long term anticoagulation unless it is for a co-existing condition.

- In this younger age group, although there is a risk of requiring a reoperation for either the autograft or the pulmonary homograft, this risk is lower compared to a bioprosthetic valve replacement.
- There is a lower risk of clots forming on the valves, lower risk of bleeding, and a lower risk of infection when compared to either prosthetic valve replacements.
- There is no clicking noise and patients report a better quality of life compared to mechanical valves.
- It is the only aortic valve replacement procedure which restores young patients' lifespan to that of the normal age matched population due to a better haemodynamic valve performance.

Is the Ross procedure safe?

In spite of its technical complexity, the Ross procedure is safe and all large international studies quote an early mortality rate equal to prosthetic valve replacement (0.3-1.1%). This does depend on the experience of the centre and the surgeons performing the procedure.

What are its drawbacks?

- It is technically more complex and does require a longer anaesthetic and heart bypass time which may not be suitable for some patients.
- It entails replacing the aortic root which otherwise would not have needed replacement.
- There is also the long term need for reoperations on either the autograft or the pulmonary homograft (20 year freedom from autograft reoperation 80-90% and homograft reoperation 90%).

Can all patients have a Ross?

Not all diseased aortic valves are suitable for the Ross procedure for technical reasons. Valves that have a very dilated attachment ring (annulus) may not be suitable or may not produce the same durable long term results. Patients who have pulmonary valve or root abnormalities may also be unsuitable. Equally pulmonary valves or roots that are very thin and fragile may also be unsuitable for repair.

For these reasons it is sometimes difficult to completely predict whether a valve will be suitable until the surgeon is able to review by the naked eye in the operating theatre. If the valve is unsuitable then the surgeon will proceed directly with a valve replacement. This is why it is important for us to discuss with you before your operation, what your preferred prosthetic valve replacement would be in the event that we are unable to perform the Ross procedure.

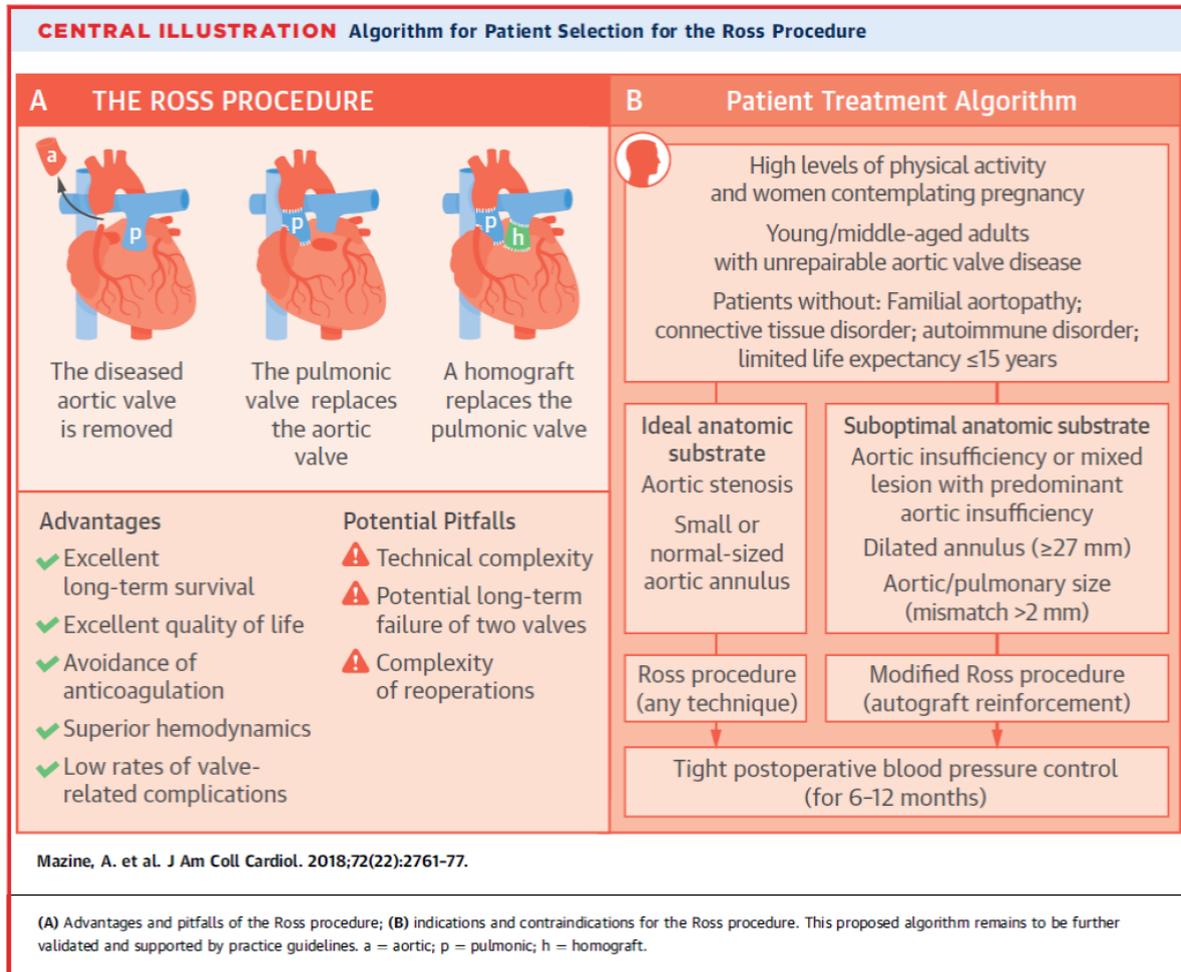
As mentioned earlier, this procedure takes longer than prosthetic replacement and therefore patients need to have reasonable heart function and good health otherwise to ensure a good outcome. Also patients with generally weak vascular tissues (connective tissue disorders) are excluded.

So finally, how do I choose?

Shared decision making is very important when considering which valve to go for. With careful consideration and discussion with your surgeon of which valve type is suitable for you, this decision should be made easier.

Summary

Below is a diagram which summarises the key points described in this leaflet and to assist you in decision-making:



If you have any further questions, please do not hesitate in asking your doctor or nurse specialist.