

AORTIC VALVE REPLACEMENT OPTIONS

Patient Education Leaflet

Introduction

This information leaflet explains the currently available options for replacing the aortic valve, including advantages, disadvantages, risks, and age range applicability for each prosthesis. It is by no means an exhaustive document, and references can be provided for further detailed knowledge of each valve substitute used.

1. MECHANICAL (PROSTHETIC VALVE)

There are a number of different brands (St. Jude, ATS, Carbomedics, Medtronic, etc.), although all have in common at least one artificial valve leaflet that opens and closes passively with the flow of blood across the prosthesis. Most fit into the category of bileaflet (two artificial leaflets) valves housed within a circular stent, and associated sewing ring, which is used to secure the prosthesis to the aortic valve ring at the time of valve replacement. The durability with all available mechanical prosthesis is very good with very few valves requiring replacement later. Because the artificial valve leaflets act as a foreign prosthetic surface inside the circulation, it is mandatory that recipients are placed on anti-coagulants (Warfarin, Coumadin), in order to prevent blood clots forming on the valve prosthesis, which could prevent the leaflets from opening, or break off and travel to other sites in the body, eg. the brain (by which they would cause a stroke or localised damage to the brain). Patients with mechanical valves must remain on Warfarin life long, and have blood tests performed every two to four weeks, to ensure their blood is prevented from clotting "to the correct degree". Certain other factors can interact with the Warfarin dosage, and these include dietary factors, administration of other medications or drugs, and other intercurrent illness. Whilst taking Warfarin or Coumadin, there is a small ongoing risk of blood clot migration problems (embolisation), as well as bleeding risks associated with being on Warfarin. Other major operations which may need to be performed at a later date (non-cardiac operations), can be performed, although there is a documented increase in risk of complications, because patients are on Warfarin.

Applicable Age Range (20 – 100)

Advantages

- (a) Durability - These valves are the most durable of all available prostheses, with 20 year freedom from re-operation of 90%.
- (b) Easy Insertion - These valves can be inserted easily in a reasonably straightforward manner.
- (c) Availability – "on shelf".

Disadvantages

- (a) Warfarin necessity lifelong.
- (b) Ongoing hazard of Warfarin and other valve-related complications.
- (c) Increased risk for subsequent non-cardiac surgery.

2. XENOGRAFT TISSUE VALVES (BIOPROSTHESES)

These valves are constructed from either the aortic valve or other tissue from various animals, e.g. porcine, calf pericardium. They are manufactured commercially and are widely available "on the shelf" of operating theatres in a similar way to mechanical valves. They do not require long term Warfarin (after the initial six

weeks or so), although they are limited by durability, which is worse in younger patients. For instance, in a 40 year old patient, durability is estimated at eight to 10 years, in a 60 year old patient at 10 to 12 years, and over the age of 70 years, 13 to 15 years can be anticipated. Thus, they are really most suitable for patients over the age of 65, and in particular, those over the age of 70, in whom the durability is better, and the chance of a re-operation being necessary are reduced, because of the patient's older age.

Applicable Age Range Greater Than 65 Years

Advantages

- (a) Do not require Warfarin after the first six weeks.
- (b) Easy insertion – relatively straightforward.
- (c) Availability.

Disadvantages

- (a) Limited durability in younger age groups, e.g. less than 60 years.

3. AORTIC ALLOGRAFT (HOMOGRAFT)

Rather than being of animal origin, these valves are of human origin, and in the State of Victoria, are available from the Donor Tissue Bank of Victoria, a subsidiary of the Victorian Institute of Forensic Pathology (Police Coroner's Court). These valves are taken from people who have died, and are subject to a coroner's autopsy for various reasons, e.g. Suicide, homicide, other deaths reported to the coroner. Consent is obtained from the relatives within 24 hours of death, so that the valves can be taken at the time of the autopsy. They are processed and stored in liquid nitrogen, and the donors are tested for all communicable diseases including Hepatitis, HIV, syphilis, etc., before the valves are available for use. They are stored in liquid nitrogen, and can be kept this way for five years. These valves are a little bit more difficult to obtain, because they are not kept on the shelf in the operating theatre, and the correct size has to be ordered in advance. Also, insertion methods are slightly more difficult than standard mechanical and xenograft valves. However, they do not need Warfarin treatment at any stage, and their durability is better than xenograft in young patients. Between the age of 20 to 70, they are useful, with an anticipated average life span of 15 years. They have proven very resistant to infection, and are used often when operating for endocarditis (valve infection).

Applicable Age Groups 20 – 70

Durability is reduced in patients under the age of 20.

Advantages

- (a) Patients do not require Warfarin at any stage.
- (b) Valves are not rejected acutely, and patients do not require immunosuppressive treatment.
- (c) Most useful when operating for infection of the aortic valve.

Disadvantages

- (a) All these valves will degenerate at an average of 15 years (some longer, some shorter), and will thus require replacement.
- (b) Ease of insertion – more difficult than standard mechanical and xenograft valves.
- (c) Reduced availability – have to be ordered on a case-by-case basis.

4. ROSS PROCEDURE

With this operation, the aortic valve is replaced with the patient's own pulmonary valve, which is in turn replaced with a human pulmonary valve (allograft or homograft). The advantage of this procedure is that the aortic valve replacement is the patient's own tissue, which is viable, and has the potential to last 40 years plus, i.e. a life time for many patients.

The major advantage is that the patient has a durable tissue valve substitute, and does not need to take Warfarin at all, with all its attendant complications. It is a longer and more complicated procedure than a mechanical or xenograft valve replacement, although this does not appear to increase the risk at all, providing an experienced operator is performing the procedure. Estimated durability is 85% at 20 years (compared to 90% with mechanical valve). The only potential disadvantage is that patients require follow up of both aortic and pulmonary valves. However earlier concerns that the pulmonary valve allograft replacement could be a drawback to the procedure, have proven unfounded, with an extremely low incidence of late problems (including re-operations) with the pulmonary valve substitute. This operation is most suited to younger patients (less than 60 years). The risk does increase with older patients, those with other comorbidities (e.g. lung and kidney disease), and if other cardiac procedures are required simultaneously (e.g. coronary artery bypass surgery).

Applicable Age Range 15 – 60

Advantages

- (a) Warfarin not required at any stage: excellent quality of life without blood tests or anticoagulation related complications.
- (b) Best durability of any tissue (non-mechanical valve).
- (c) "Viable" valve substitute.

Disadvantages

- (a) Longer, more complex operation (five hours -v- three hours for a mechanical valve).
- (b) Should be performed by experienced operator.
- (c) Follow up of both aortic and pulmonary valves required, although pulmonary valve re-operation rate extremely low.

Surgical Risks

In patients under the age of 70 years, operative risk is 1% regardless of procedure. The major post-operative risk is that of cerebro-vascular accident (CVA, stroke) which occurs in an additional 1%. Other complications include necessity for permanent pacemaker (1%), sternal wound infection (0.5%).